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NUCLEAR SAFETY AND RADIATION PROTECTION ACT, (CAP N142 LAWS OF THE FEDERATION OF NIGERIA)

NIGERIA BASIC IONIZING RADIATION REGULATIONS, 2023

ARRANGEMENT OF REGULATIONS

Regulation:

S. I. No. 3 of 2026

NUCLEAR SAFETY AND RADIATION PROTECTION ACT, (CAP N142 LAWS OF THE FEDERATION OF NIGERIA)

NIGERIA BASIC IONIZING RADIATION REGULATIONS, 2023

[23*rd November*, 2023] Commencement

In exercise of the powers conferred on it by section 47 of the Nuclear Safety and Radiation Protection Act, CAP N142, Laws of the Federation of Nigeria, 2004 and of all other powers enabling it in that behalf, the Nigerian Nuclear Regulatory Authority, with the approval of the President, hereby makes the following Regulations —

PART I — GENERAL PROVISIONS

1.—(1) These Regulations specify the basic requirements — Objectives

(*a*) for protection of people against undue exposure to ionizing radiation, the safety of radiation sources, the safety of radioactive waste management, and protection of the environment (protection and safety) ;

(*b*) to prevent unauthorised access or damage to, and loss, theft or unauthorised transfer of, radioactive sources, so as to reduce the likelihood of accidental harmful exposure to such sources ; and

(*c*) to implement the Country's international commitments relevant to radiation safety.

(2). These Regulations shall not relieve an authorised legal person from the duty to take any additional actions as may be appropriate and necessary to protect the health and safety of people.

(3). These Regulations establish the requirements that shall be fulfilled in any facility and activity which gives rise to radiation risks.

2.—(1) These Regulations shall apply to — Application

(*a*) protection against ionizing radiation, which includes gamma rays, x-rays and particles such as beta particles, neutrons, protons, alpha particles and heavier ions or as may be applicable ;

(*b*) any situation involving radiation exposure that is amenable to control ;

(*c*) the three categories of exposure, which are occupational exposure, public exposure and medical exposure ;

(*d*) the adoption, introduction, conduct, discontinuance, or cessation of a

practice in a planned exposure situation and to the design, manufacture, construction or assembly, acquisition, import or export, distribution, selling, locating, commissioning, processing, possession, use and operation, maintenance or repair, transfer or decommissioning, disassembly, transport, storage and recycling or disposal of a radiation source within a practice ;

(*e*) the following practices in any planned exposure situation —

(*i*) the production, supply and transport of radioactive material and of any device that contain radioactive material, including sealed source and unsealed source, and of any consumer product,

(*ii*) the production and supply of any device that generate radiation, including linear accelerator, cyclotron, and fixed and mobile radiography equipment,

(*iii*) the use of radiation or radioactive material for medical, industrial, veterinary, agricultural, legal or security purposes, and the use of associated equipment, software or devices where such use may affect exposure to radiation,

(*iv*) the use of radiation or radioactive material for education, training or research, including any activity relating to such use that involve or may involve exposure to radiation or exposure due to radioactive material, and

(*v*) any other practice related to radiation safety as specified by the Authority; and

(*f*) intervention by any legal person authorised to possess radiation source in the event of radiological emergency involving their sources.

(2) Any other safety requirement, complementary to these Regulations shall apply for certain facilities and activities, such as nuclear installation, radioactive waste management facility and the transport of radioactive material.

(3) The source within any practice to which the requirement for any practice of these Regulations shall apply include —

(*a*) any facility that contain radioactive material and radiation generators, including medical radiation facility and irradiation facility ;

(*b*) individual source of radiation, including any source within the types of facility mentioned in paragraph (a) of this sub-regulation, as appropriate, in accordance with the requirements of the regulatory body ;

(*c*) exposure due to material in any practice where the activity concentration in the material of any radionuclide in the uranium decay chain or thorium decay chain is greater than 1Bq/g or the activity concentration of ^{40}K is greater than 10 Bq/g ;

(*d*) radioactive waste resulting from any application and to any radioactive

waste management facility and activity including —

(*i*) effluent discharge,

(*ii*) waste that contains naturally occurring material, whatever the origin of the waste, and

(*iii*) disused radioactive source ; and

(*e*) any other radiation source specified by the regulatory body, including source in the environment such as radon.

(4) The specific radioactive waste provisions shall apply to waste arising from medical, agricultural, industrial, research and education applications, mining and milling activity, including associated radioactive waste management activity such as collection, segregation, characterization, classification, treatment, conditioning, and storage.

Application of the principles of rediation protection

3.—(1) Any party with responsibility for protection and safety shall ensure that the principles of radiation protection is applied for any exposure situation.

(2) For any planned exposure situation, a party with responsibility for protection and safety shall ensure that no practice is undertaken unless it is justified.

(3) For any emergency exposure situation and existing exposure situation, a party with responsibility for protection and safety shall ensure that any protective or remedial action is justified and undertaken to achieve the objectives set out in a protection strategy.

(4) For any exposure situation, a party with responsibility for protection and safety shall ensure that protection and safety is optimized.

(5) For any planned exposure situation other than for medical exposure, a party with responsibility for protection and safety shall ensure that, specified dose limits is not exceeded.

(6) The application of the regulation for the system of protection and safety shall be commensurate with the radiation risks associated with the exposure situation.

Responsibility of the reponsible party

4.—(1) The person or organisation responsible for any facility and activity that gives rise to radiation risks shall have the prime responsibility for protection and safety, which shall not be delegated.

(2) Any other party shall have specified responsibility for protection and safety.

(3) The principal party responsible for protection and safety are —

(*a*) registrant or licensee, or any person or organisation responsible for

notified or authorised practice or source within a practice ;

(*b*) any employer, in relation to occupational exposure ;

(*c*) any radiological medical practitioner, in relation to medical exposure ; and

(*d*) any person or organisation designated to deal with emergency exposure situations or existing exposure situations.

(4) Any other party shall have specified responsibility in relation to protection and safety and the other party includes —

(*a*) supplier of source, provider of equipment and software, and provider of consumer products ;

(*b*) radiation safety officer ;

(*c*) referring medical practitioner ;

(*d*) medical physicist ;

(*e*) radiographer ;

(*f*) qualified expert or any other party to whom a principal party has assigned specific responsibility ;

(*g*) any worker dealing with any radiation matter other than those listed in paragraphs (a) - (f) of this sub-regulation ; and

(*h*) ethics committees.

(5) The legal person in collaboration with the radiation safety officer shall establish and implement a protection and safety programme that is appropriate for the exposure situation, which shall —

(*a*) adopt objectives for protection and safety in accordance with the requirements of these Regulations ; and

(*b*) apply measures for protection and safety that are commensurate with the radiation risks associated with the exposure situation in accordance with a graded approach which is adequate to ensure compliance with the requirements of these Regulations.

(6) The legal person shall ensure that —

(*a*) radioactive source is managed in accordance with the authorisation ;

(*b*) any radioactive source not in use is promptly stored ;

(*c*) a radiation generator or radioactive source is not transferred if the recipient does not possesses the necessary authorisation ;

(*d*) arrangements are made for the safe management of radioactive sources where they are disused, such as minimum category 1, 2 and 3, including financial provisions where appropriate ;

(*e*) the import and export of category 1 and 2 radioactive sources is done

in accordance with these Regulations ;

(*f*) any source is shipped and received in accordance with regulatory requirements ; and

(*g*) assistance is provided to the State authority or local law enforcement authority in recovering any lost or stolen source.

(7) The legal person in implementing the protection and safety programme shall ensure that —

(*a*) measures and resources necessary to achieve the objectives of protection and safety programme is determined and duly provided ;

(*b*) the programme is periodically reviewed to assess its effectiveness and its continued fitness for purpose ;

(*c*) any failure or shortcoming in protection and safety is identified, corrected, documented and measures are taken to prevent the reoccurrence ;

(*d*) any interested party is consulted where the needs arise ;

(*e*) appropriate records are maintained ;

(*f*) any personnel engaged in any activity relevant to protection and safety have appropriate education, training and qualification to carry out the responsibility effectively with appropriate judgement and in accordance with the procedure ; and

(*g*) qualified experts, such as Radiation Safety Adviser (RSA), Engineering Service provider, Environmental Monitors, Waste Management Consultant, Dosimetry Service Providers (DSP) and other authorised service providers, accredited by the Authority are identified and consulted where necessary on the implementation of these Regulations.

(8) The qualified expert shall —

(*a*) develop a management system manual for technical services in radiation safety in line with the Authority's Management System Guide, and submit to the Authority for approval ; and

(*b*) provide service to any person or organisation in accordance with sub-regulation (7)(g) of this regulation.

(9) For the purpose of sub-regulation (7) (f) and (g) of this regulation and subject to paragraph (c) of this sub-regulation —

(*a*) a registrant and licensee shall consult such suitable qualified expert necessary to advise the registrant and licensee with respect to compliance with these Regulations and shall, where necessary, consult one or more suitable qualified expert on any matter provided in the Sixth Schedule to these Regulations ;

(*b*) where a qualified expert is consulted pursuant to the requirements of

paragraph (a) of this sub-regulation, the registrant and licensee shall appoint the qualified expert in writing and include in the appointment the scope of the advice that the qualified expert is required to give ; and

(*c*) nothing in paragraph (a) of this sub-regulation shall be construed as requiring the registrant and licensee to consult a qualified expert where the work with ionizing radiation undertaken by the registrant and licensee is work specified in the First Schedule to these Regulations.

Regulatory inspection of premises and information

5. The relevant principal party shall permit access to any appointed inspector of the Authority to carry out inspection of the facility and activity including the protection and safety records, and shall cooperate in the conduct of inspection.

Non-compliance and accident

6.—(1) Where there is a contravention of any applicable requirement of these Regulations, a principal party shall —

(*a*) notify the Authority within 24 hours ;

(*b*) investigate the breach, its cause, circumstance and consequence ;

(*c*) take appropriate action to remedy the circumstance and prevent a recurrence of any similar situation ;

(*d*) report to the Authority as required on the cause of the breach, its circumstance, consequence, and on the corrective or any preventive action taken or to be taken ; and

(*e*) take any other necessary action required by these Regulations.

(2) The Authority shall be immediately informed, where an emergency exposure situation has developed or is developing.

(3) Where a situation involving the loss of control such as loss or theft of a radioactive source has occurred, or is occurring, the Authority shall be informed as soon as practicable.

(4) Failure to take corrective or preventive action within a reasonable time in accordance with these Regulations is grounds for enforcement in accordance with these Regulations.

Enforcement

7.—(1) An authorisation to use a radiation source may be revoked, suspended or modified, or the possession of a radiation source may be prohibited where there is an undue threat to health and safety or non-compliance with applicable regulatory requirements.

(2) Any legal person responsible for notified or authorized practice or source within practice is subject to fines for noncompliance with applicable regulations and regulatory requirements commensurate with the nature of the infraction.

(3) Willful violation or attempted violation of these Regulations or requirements may be referred to Federal Ministry of Justice for prosecution under the relevant law.

(4) The enforcement of the provisions of these Regulations shall be in accordance with a graded approach.

Part II — Administrative Requirements

General obligations

8. A person or organisation shall not —

(*a*) operate any facility or conduct any activity, and adopt, introduce, conduct, discontinue or cease a practice ; or

(*b*) mine, extract, process, design, manufacture, construct, assemble, install, import, export, supply, provide site, locate, commission, possess, use, operate, maintain, repair, transfer, decommission, disassemble, transport, store or dispose of a source within a practice, other than in accordance with these Regulations and with an authorisation issued by the Authority.

Graded approach

9.—(1) The application of the requirements of these Regulations in any planned exposure situation shall commensurate with the characteristics of the practice or the source within a practice, and with the likelihood and magnitude of exposures.

(2) The application of these Regulations shall be in accordance with the graded approach and conform to any regulations specified by the Authority.

Notification and authorisation

10.—(1) Any person or organisation that intends to operate a facility or conduct any activity specified in regulations 2 (1)(e) and (3) and 8 of these Regulations shall submit to the Authority a notification and, as appropriate, an application for authorisation.

(2) Notwithstanding the provisions of regulations 10(4) - (9) and 11(1) of these Regulations, where an employer has notified work in accordance with paragraph (1)(a) of this regulation and subsequently makes a material change in the work which may affect the particulars so notified, he shall immediately notify the Authority of such changes.

(3) Nothing in sub-regulation (2) of this regulation shall be construed as requiring the cessation of the work to be notified except where the site or any part of the site in which the work is carried on has been or is to be vacated.

(4) Notification is sufficient in any activity referred to in regulation 2 (1) (e) and (3) of these Regulations provided that the exposures expected to be associated with the practice or action is unlikely to exceed the relevant limits specified by the Authority, and that the likelihood and magnitude of potential exposures and any other potential detrimental consequences are negligible.

(5) Notification is required for consumer products where it relates to manufacture, maintenance, import, export, provision, distribution and, in some cases, disposal.

(6) Without prejudice to the provisions of sub-regulations (1), (4) and (5) of this regulation, notification shall not be required for any work exempted from these Regulations as specified in the First Schedule to these Regulations.

(7) Where a person or organisation has notified the Authority of work referred to in sub-regulation (5) of this regulation and subsequently makes a material change in the work which may affect the particulars so notified, the person or organisation shall immediately notify the Authority of the change.

(8) Nothing in sub-regulation (7) of this regulation shall require the cessation of the work before issuing the notification except where the site or any part of the site in which the work is carried out has been or is to be vacated.

(9) Where the work involves clinical treatment of a person with the use of a radioactive medicinal product, it is sufficient compliance with sub-regulation (1) of this regulation if the notification required is given as soon as practicable before the work is carried out.

Authorisation for registration or licensing

11.—(1) Any person or organisation that intends to carry out any of the actions specified in regulation 8 of these Regulations shall, unless where notification is sufficient, apply to the Authority for authorisation, which shall take the form of either registration or licensing or both and the person or organisation shall —

(*a*) submit a duly completed authorisation application form to the Authority for the specific practice ;

(*b*) submit to the Authority the relevant requirement, which shall be practice specific, and other relevant information necessary to support the application ;

(*c*) not carry out any action specified in regulation 8 of these Regulations until the registration or licence is issued ;

(*d*) assess the nature, likelihood and magnitude of the expected exposure due to the source and take all necessary measures for protection and safety ;

(*e*) have a safety assessment made and submitted to the Authority as part of the application, if there is a possibility for an exposure to be greater than a level specified by the Authority ;

(*f*) as required by the Authority, have an appropriate prospective assessment made for radiological environmental impacts, commensurate with the radiation risks associated with the facility or activity ; and

(*g*) submit to the Authority information related to facility emergency plan, discharge to the environment, final fate at the end of the useful life of the source, and any other applicable information.

(2) The authorisation referred to in sub-regulation (1) of this regulation may be —

(*a*) refused due to non-compliance with the relevant requirement in respect to the specific practice ;

(*b*) granted subject to such terms and conditions as the Authority may, from time to time, determine ; or

(*c*) revoked in writing at any time.

(3) Where any person or organisation granted authorisation under sub-regulation (2) of this regulation subsequently makes a material change to the circumstances relating to the authorisation, the person or organisation shall immediately notify the Authority of the changes.

(4) Any employer who is aggrieved by the decision of the Authority under sub-regulation (2) of this regulation may appeal to the Governing Board of the Authority.

Exemption of practice and source

12.—(1) Without prejudice to the provisions of regulation 11 (1) of these Regulations—

(*a*) practice or source for any work specified in the First Schedule to these Regulations shall be exempted from some or all the requirement of these Regulations as the Authority shall deem appropriate ; and

(*b*) the legal person for practice or source for any work specified in the First Schedule to these Regulations shall apply for exemption certificate to be issued by the Authority.

(2) The Authority shall not grant exemption for any practice that is not justified.

(3) The following practice and source within a practice shall be considered exempted from the specific safety requirements of these Regulations —

(*a*) any radioactive material in a moderate amount for which the total activity of a given nuclide present on the premises at any time or its activity concentration does not exceed the applicable exemption levels ;

(*b*) radioactive material in bulk amount for which the activity concentration of a given radionuclide of artificial origin used in the practice does not exceed the relevant value given in Table 1.2 provided in the First Schedule to these Regulations ;

(*c*) equipment containing radioactive material exceeding the quantity or

concentration specified in paragraphs (a) and (b) of this sub-regulation, where —

(*i*) the equipment containing radioactive material is of a type approved by the Authority,

(*ii*) it is in the form of a sealed source that effectively prevents any contact with the radioactive material and prevents its leakage,

(*iii*) it is in the form of an unsealed source in a small amount such as sources used for radioimmunoassay,

(*iv*) in normal operating conditions, the equipment does not cause a n ambient dose equivalent rate or a directional dose equivalent rate, as appropriate, exceeding 1μSv/h at a distance of 0.1m from any accessible surface of the apparatus, or

(*v*) necessary conditions for disposal of the equipment have been specified in these Regulations ; and

(*d*) radiation generators of a type approved by the Authority, or in the form of an electronic tube, such as a cathode ray tube for the display of visual images, where —

(*i*) they do not in normal operating conditions cause an ambient dose equivalent rate or a directional dose equivalent rate, as appropriate, exceeding 1μSv/h at a distance of 0.1m from any accessible surface of the equipment, or

(*ii*) the maximum energy of the radiation generated is no greater than 5keV.

Responsibility of the registrant and licensee in planned exposure situation

13.—(1) The registrant and licensee shall be responsible for protection and safety in any planned exposure situation.

(2) The registrant and licensee —

(*a*) shall be responsible for setting up, and implementing the technical and organisational measures that are necessary for protection and safety for the practices and sources for which they are authorised ;

(*b*) may designate any suitably qualified person to carry out tasks which relates to these responsibilities, but shall be responsible for protection and safety ; and

(*c*) shall document the names and responsibilities of any person designated to ensure compliance with the requirements of these Regulations.

(3) The registrant and licensee shall —

(*a*) notify the Authority of any intention to introduce modification to any practice or source for which they are authorised and shall not carry out any such modification unless it is specifically authorised by the Authority ;

(*b*) establish clear lines of responsibility and accountability for protection and safety for the source for which they are authorised, and shall establish organisational arrangements for protection and safety ;

(*c*) ensure that any delegation of responsibility by a principal party is documented ;

(*d*) conduct a safety assessment for the source for which they are authorised and for which a safety assessment is required in regulation 11(1)(e) of these Regulations, and keep it up to date in accordance with regulation 27 of these Regulations ;

(*e*) conduct assessment for the source for which they are authorised and for which the Authority requires a prospective assessment to be made for radiological environmental impacts, and keep it up to date ;

(*f*) assess the likelihood and magnitude of potential exposures, their likely consequences and the number of individuals who may be affected by it ;

(*g*) have in place operating procedure and arrangement for protection and safety that are subject to periodic review and update under a management system ;

(*h*) establish the procedure for reporting on and learning from accidents and other incidents ;

(*i*) establish the arrangement for the periodic review of the overall effectiveness of the measures for protection and safety ;

(*j*) ensure that adequate maintenance, test and service are carried out as necessary so that sources remain capable of fulfilling their design requirements for protection and safety throughout their lifetime ; and

(*k*) ensure safe management and control of all radioactive waste that are generated, and dispose of such waste in accordance with the regulatory requirements.

(3) The licensee shall ensure that —

(*a*) appropriate safety measures are implemented throughout the lifecycle of radiation sources, from manufacture to their final disposal (cradle to grave) ;

(*b*) a multilevel defence-in-depth is in place as provided in regulation 26(3) of these Regulations ;

(*c*) the structure, system and component, including software, that are related to protection and safety for any facility and activity are designed, constructed, commissioned, operated and maintained to prevent any accident as may be reasonably practicable and in this regards, the licensee shall make suitable arrangements as provided in regulation 26(5) of these Regulations ; and

(*d*) the safety of the facility or the waste is not jeopardized by any provision made for the purpose of complying with national or international requirements concerning safeguards of the material.

Reporting to the Authority

14.—(1) The registrant and licensee shall —

(*a*) notify the Authority immediately of any event in which the dose limit specified in the Third Schedule to these Regulations is exceeded either by phone, e-mail or any other means ;

(*b*) notify the Authority by phone, email or any other means promptly not later than 24 hours after occurrence, of any unintended or accidental medical, public or occupational exposure ;

(*c*) submit to the Authority, within 30 days after occurrence of any unintended or accidental medical, public or occupational exposure, a written report which states the cause of accidental exposure to include information on the dose, corrective measure and any other relevant information ;

(*d*) report a summary of the public exposure monitoring results to the Authority at approved intervals and promptly inform the Authority of any abnormal result which led to, or may lead to an increase of public exposure ;

(*e*) report at intervals to the Authority of any discharge of radioactive waste to the environment as specified in the licence and relevant regulations and promptly report any discharge exceeding the authorised limit ; and

(*f*) report promptly to the Authority, any release of radioactive material to the environment above the clearance criteria established by the Authority, and submit a written report within 30 days.

(2) In addition to sub-regulation (1) of this regulation, the licensee shall submit the following reports to the Authority —

(*a*) radioactive source inventory data and any subsequent change to the data, except for routine movements of the source allowed in the authorisation ;

(*b*) any unusual event or incident, such as —

(*i*) loss of control over a radioactive source,

(*ii*) unauthorised access to, or unauthorised use of, a source, and

(*iii*) discovery of any orphan sources ;

(*c*) any intention to introduce modification to any practice with a radioactive source where the modification may have significant implication for safety ; and

(*d*) the relevant part of any contract or acceptance document relating to the return of radioactive source intended to be imported.

Investigation and feedback of information on the facility operation experience

15.—(1) The registrant and licensee shall —

(*a*) conduct formal investigation of abnormal conditions arising in the operation of any facility or the conduct of any activity, and shall disseminate information that is significant for protection and safety ;

(*b*) ensure that information on both normal operation and abnormal conditions that are significant for protection and safety is disseminated or made available, to the Authority and the relevant party, which includes —

(*i*) details of dose associated with any given activity,

(*ii*) data on maintenance,

(*iii*) description of any event and information on corrective action, and

(*iv*) operating experience from any other relevant facility and activity ;

(*c*) conduct investigations as specified by the Authority where —

(*i*) a quantity or operating parameter which relates to protection and safety exceeds an investigation level or is outside the stipulated range of operating conditions, or

(*ii*) any equipment failure, accident, error, mishap or other unusual event or condition occurs that has the potential to cause a quantity to exceed any relevant limit or operating restriction ;

(*d*) conduct an investigation as soon as possible after an event and prepare a written record of its causes, or suspected causes, including a verification or determination of any dose received or committed and recommendations for preventing the reoccurrence of the event and the occurrence of similar events ; and

(*e*) communicate to the Authority and any other relevant party, a written report of any formal investigation relating to any event prescribed by the Authority, including exposures giving rise to doses exceeding a dose limit and immediately report, within 48 hours, to the Authority any event in which a dose limit is exceeded.

(2) The licensee shall where applicable make suitable arrangements with any supplier of source to establish and maintain mechanisms for transfer of information to the supplier on the use, maintenance, disposal and malfunctioning that may be relevant for future improvements in the design and fabrication of the source they have supplied.

Clearance

16. Radiation source, including substance, material, radioactive waste and object within authorised practice may be released from further compliance with the radiation protection and safety requirements of these Regulations provided that they comply with —

(*a*) criteria for clearance or clearance levels established in the First Schedule to these Regulations ; and

(*b*) the extant radioactive waste management regulations issued by the Authority.

PART III — REQUIREMENTS FOR RADIATION PROTECTION

Justification of practice

17.—(1) The following practice is deemed not justified —

(*a*) practice, that result in an increase in activity, by the deliberate addition of radioactive substance or activation in food, feed, beverage, cosmetic or any other commodity or product intended for ingestion, inhalation or percutaneous intake by, or application to a person, except for justified practice involving medical exposure ;

(*b*) practice involving the frivolous use of radiation or radioactive substance in any commodity or consumer product such as toys and personal jewellery or adornment, which result in an increase in radioactivity, by the deliberate addition of radioactive substance or activation ;

(*c*) human imaging using radiation that is performed as a form of art or for publicity purposes ; and

(*d*) any other practice determined by the Authority, from time to time, as unjustified.

(2) Human imaging using radiation that is performed for occupational, legal or health insurance purpose, and undertaken without reference to clinical indication, is deemed not justified except where the Authority decides that the justification of such human imaging for any specific practice is to be considered, and the requirements as established by the Authority shall apply.

(3) Human imaging using radiation for theft detection purpose and the detection of concealed any object for anti-smuggling purpose is deemed not justified except where the Authority decides that the justification of such human imaging is to be considered, and the requirements of regulations 30 - 31 of these Regulations shall apply.

(4) Human imaging using radiation for the detection of any concealed object that may be used for criminal acts which pose a national security threat shall be justified by the government and if the government decides that the justification of such human imaging is to be considered, the requirements of regulations 30 - 31 of these Regulations shall apply.

Optimization of protection and safety

18.—(1) The registrant and licensee shall ensure that protection and safety is optimized.

(2) For occupational exposure and public exposure, the registrant and

licensee shall ensure that the relevant factors are taken into account in a coherent way in the optimization of protection and safety, in order to achieve the following objectives —

(*a*) determine measures for protection and safety that are optimized for the prevailing circumstances, with account taken of the available options for protection and safety as well as the nature, likelihood and magnitude of exposures ; and

(*b*) establish criteria, on the basis of the results of the optimization, for the restriction of the likelihood and magnitudes of exposures by means of measures to prevent accident and mitigate the consequences where it occurs.

(3) For occupational exposure and public exposure, the registrant and licensee shall ensure, as appropriate, that the relevant constraint on dose and risk are used in the optimization of protection and safety for any particular source within a practice.

(4) In case of any source that may release radioactive material to the environment, the dose constraints shall be established so that the prospective annual dose to any member of the public, including people distant from the source and people of future generations, summed over all exposure pathways, including contributions by any other practice and source, are unlikely to exceed the dose limits specified in the Third Schedule to these Regulations or any lower value established by the Authority.

(5) For the optimization of protection and safety in medical exposure, regulation 49 of these Regulations shall apply.

Dose limit

19.—(1) The registrant and licensee shall ensure that the exposures of any individual due to the practices for which the registrant and licensee is authorised is restricted, so that the effective dose or equivalent dose to the tissue or organ does not exceed the relevant dose limit specified in the Third Schedule to these Regulations.

(2) The dose limit shall not apply to medical exposure.

Management for protection and safety

20.—(1) The licensee shall establish a management system, commensurate with the size and nature of the authorised activity, which ensures that —

(*a*) the policy and procedure that identify safety as being of the highest priority are established ;

(*b*) problems affecting protection and safety are promptly identified and corrected in a manner commensurate with their importance ;

(*c*) the responsibility of any individual for safety is clearly identified and the individual is suitably trained and qualified ;

(*d*) clear lines of authority for any decision on safety is defined ; and

(*e*) organisational arrangements and lines of communications are established which results in an appropriate flow of information on safety at and between the various levels in the entire organisation of the licensee.

(2) The principal party shall ensure that protection and safety are effectively integrated into the overall management system of the organisations for which they are responsible.

Protection and safety elements of the management system

21. The principal party shall —

(*a*) demonstrate commitment to protection and safety at the highest levels within the organisations for which they are responsible ;

(*b*) ensure that the management system is designed and applied to enhance protection and safety by —

(*i*) application of the requirements for protection and safety coherently with guidelines for security and other requirements, including requirements for operational performance,

(*ii*) description of the planned and systematic actions necessary to provide adequate confidence that the requirements for protection and safety are fulfilled,

(*iii*) application of measures which ensures that protection and safety are not compromised by any other requirement,

(*iv*) provision of regular assessment of performance for protection and safety, and the application of lessons learned from the experience, and

(*v*) promotion of safety culture ;

(*c*) ensure that protection and safety elements of the management system are commensurate with the complexity of and the radiation risks associated with the activity ;

(*d*) demonstrate the effective fulfillment of the requirements for protection and safety in the management system ; and

(*e*) demonstrate commitment to protection and safety at the highest levels within the organisations for which they are responsible.

Safety Culture

22. The principal party shall promote and maintain safety culture by —

(*a*) promotion of individual and collective commitment to protection and safety at all levels of the organisation ;

(*b*) application of measures to ensure a common understanding of the key aspects of safety culture within the organisation ;

(*c*) provision of the means by which the organisation supports individuals and teams to carry out their tasks safely and successfully, while taking account of the interactions between individuals, technology and the organisation ;

(*d*) encouraging the participation of the worker and their representatives and any other relevant person in the development and implementation of policies, rules and procedures dealing with protection and safety ;

(*e*) application of measures to ensure accountability of the organisation and individuals at all levels for protection and safety ;

(*f*) encouraging open communication with regard to protection and safety within the organisation and with the relevant party, as appropriate ;

(*g*) encouraging a questioning and learning attitude, and discouraging complacency, with regard to protection and safety ; and

(*h*) provision of means by which the organisation continually seeks to develop and strengthen its safety culture.

Human factors

23. The principal party and any other party with specified responsibility in relation to protection and safety shall take into account human factors, and support good performance and good practice to prevent human and organisational failure by ensuring factors which include —

(*a*) sound ergonomic principles are followed in the design of equipment and the development of operating procedures ;

(*b*) the employees are informed at least annually of the importance of effective measures for protection and safety and trained in their implementation as appropriate ; and

(*c*) training programmes are routinely evaluated and updated as necessary.

Confidentiality of information

24. The employer, registrant and licensee shall establish information management systems, commensurate with the size and nature of the authorised activity, which ensures that —

(*a*) the confidentiality of information that it receives in confidence from another party is protected; and

(*b*) information received in confidence from another party is provided to a third party with the consent of the first party.

Qualified expert and radiation safety officer

25.—(1) The licensee shall arrange for qualified expert as required under regulation 4 (7)(f) and (g), (8) and (9) of these Regulations.

(2) A qualified expert in radiation safety shall possess a level of academic knowledge and professional experience compatible with the levels of risks associated with the authorised practices or sources within a practice.

(3) The licensee shall designate a radiation safety officer.

(4) A radiation safety officer shall be technically competent in radiation protection matters relevant to a given type of practice.

(5) An applicant may propose to use a radiation safety officer in place of a qualified expert in radiation safety on the basis of the relatively low risk of the practice.

(6) The radiation safety officer shall oversee the application of the requirements of these Regulations to the practice.

(7) The licensee shall provide the Authority with the letter of engagement and qualification of the qualified expert and radiation safety officer.

Prevention of accident

26.—(1) The registrant and licensee shall apply good engineering practice and take the practicable measures to prevent accident and mitigate the consequence of such accident.

(2) The registrant or licensee shall cooperate with any other responsible party, to ensure that the siting, location, design, manufacture, construction, assembly, commissioning, operation, maintenance and decommissioning or closure of any facility or part of it are based on good engineering practice which shall —

(*a*) take account of international and national standards ;

(*b*) be supported by managerial and organisational features, to ensure protection and safety throughout the lifetime of the facility ;

(*c*) include adequate safety margins in the design and construction of the facility, and in operations involving the facility, so as to ensure reliable performance in normal operation, and take account of the necessary quality, redundancy and capability for inspection, with emphasis on preventing any accident, mitigating the consequence of the accident and restricting any possible future exposure ; and

(*d*) take account of relevant developments concerning technical criteria, the result of any relevant research on protection and safety and feedback of information on lessons learned from experience.

(3) The registrant and licensee shall ensure that a multilevel (defence-in-depth) system of sequential, independent provisions for protection and safety that is commensurate with the likelihood and the magnitude of the potential exposures is applied to any source for which the licensee is authorized.

(4) The licensee shall ensure that if one level of protection fails, the subsequent independent level of protection shall be available and such defence-in-depth shall be applied to —

(*a*) prevent accident ;

(*b*) mitigate the consequence of any accident that may occur ; and

(*c*) restore the source to safe condition after such accident.

(5) The registrant or licensee for any facility or activity shall make suitable arrangements to —

(*a*) prevent any reasonably foreseeable accident in the facility or the activity ;

(*b*) mitigate the consequence of the accident that may occur ;

(*c*) provide the worker with the information, instruction, training and equipment necessary to restrict any potential exposure ;

(*d*) ensure that there are adequate procedures for the control of the facility and for the management of any reasonably foreseeable accident ;

(*e*) ensure that significant safety structures, systems and components, including software, and any other equipment is inspected and tested regularly for any degradation that may lead to any abnormal condition or inadequate performance ;

(*f*) ensure that maintenance, inspection and testing are carried out without undue occupational exposure ;

(*g*) provide, where appropriate, automatic systems to safely shut off or reduce the release of radiation from any facility where the operating condition is outside the stipulated range ;

(*h*) ensure that there is a system for detection and response to allow for corrective action in a timely manner, to any abnormal operating condition that may significantly affect protection and safety ; and

(*i*) ensure that the relevant safety documentation is available in the appropriate languages understandable to the users.

Part IV — Verification Of Safety

Safety assessment

27.—(1) The person or organisation, as required under regulation 11 (1)(e) of these Regulations, or the registrant and licensee, shall conduct a safety assessment that is generic or specific to the practice or source, as required by the Authority, for which they are responsible.

(2) Safety assessments shall be conducted at different stages, including siting, design, manufacture, construction, assembly, commissioning, operation, maintenance and decommissioning or closure of facilities or parts of it as appropriate, to —

(*a*) identify the ways in which exposures may be incurred, taking account

of the effects of any external event and event directly involving the source and associated equipment ;

(*b*) determine the expected likelihood and magnitudes of exposure in normal operation and, to the extent reasonable and practicable, make an assessment of potential exposures ; and

(*c*) assess the adequacy of the provisions for protection and safety.

(3) The safety assessment shall include, a systematic critical review of the —

(*a*) operational limit and condition for the operation of the facility ;

(*b*) ways in which the structure, system and component, including software, and procedures relating to protection and safety may fail, singly or in combination, or may otherwise give rise to any exposure, and the consequences of such event ;

(*c*) ways in which external factor may affect protection and safety ;

(*d*) ways in which operating procedures relating to protection and safety may be erroneous, and the consequences of such errors ;

(*e*) implication for protection and safety of any modification ;

(*f*) implication for protection and safety of any security measure or modification to security measure ; and

(*g*) uncertainty or assumption and their implications for protection and safety.

(4) The registrant or licensee in carrying out the safety assessment shall take into account factors that —

(*a*) may give rise to a substantial release of radioactive material, the measures available to prevent or control such a release, and the maximum activity of radioactive material that, in the event of a major failure of the containment, may be released to the environment ;

(*b*) may give rise to a smaller but continuing release of radioactive material, and the measures available to detect and prevent or control such a release ;

(*c*) may give rise to unintended operation of any radiation generator or a loss of shielding, and the measures available to detect and prevent or control such occurrences ; and

(*d*) is appropriate to restrict the likelihood and magnitude of potential exposures, the extent to which the use of redundant and diverse safety features are independent of each other, so that failure of one does not result in failure of any other.

(5) The registrant and licensee shall ensure that the safety assessment is documented and, where appropriate, independently reviewed under the relevant management system.

(6) The registrant and licensee shall perform additional reviews of the safety assessment where necessary to ensure that the technical specifications or conditions of use is met where —

(*a*) significant modifications to the facility or to its operating procedures or maintenance procedures are envisaged ;

(*b*) significant change occur on the site that may affect the safety of the facility or activity on the site ;

(*c*) information on operating experience, or information about any accident and other incident that may result in exposure, indicates that the current assessment may be invalid ;

(*d*) any significant change in activity is envisaged ; or

(*e*) any relevant change in guidelines or standards is made or are envisaged.

(7) If as a result of a safety assessment, or for any other reason, an opportunity to improve protection and safety is available and improvement seems desirable, any consequential modification shall be made cautiously after favourable assessment of the implication for protection and safety.

(8)The implementation of all improvement shall be prioritized to optimize protection and safety.

Monitoring for verfication of compliance

28.—(1) The registrant, licensee and employer shall conduct monitoring to verify compliance with these Regulations.

(2) The registrant, licensee and employer shall ensure that —

(*a*) monitoring and measurements of parameters are performed where necessary for verification of compliance with the requirements of these Regulations ;

(*b*) suitable equipment is provided and procedures for verification are implemented ;

(*c*) equipment is properly maintained, tested and calibrated at appropriate intervals with reference traceable to Secondary Standard Dosimetry Laboratory (SSDL) ;

(*d*) records of the results of monitoring, a verification of compliance, tests and calibrations are maintained in accordance with these Regulations ; and

(*e*) results of monitoring and verification of compliance are submitted to the Authority.

Inventory and records

29.—(1) The registrant and licensee shall establish, maintain and retrieve records relating to —

(*a*) inventory of any sealed source and radiation generator ;

(*b*) dose from occupational exposure ;

(*c*) any facility and activity ;

(*d*) inventory of radioactive waste ;

(*e*) environmental radiological monitoring ;

(*f*) any event including non-routine release of radioactive material to the environment ;

(*g*) decommissioning or closure of any facility ;

(*h*) transfer of any radioactive source ;

(*i*) testing of instruments and safety systems, and calibrations carried out in accordance with the requirements of these Regulations ; and

(*j*) any other record required by the Authority.

(2) Individual sealed source records shall include the —

(*a*) location of the source ;

(*b*) radionuclide ;

(*c*) radioactivity on a specified date ;

(*d*) serial number or unique identifier ;

(*e*) chemical and physical form ;

(*f*) source use history, including recording all movements into and out of the storage location ;

(*g*) receipt, transfer or disposal of the source ; and

(*h*) other information, as appropriate, to enable the source to be identifiable and traceable.

(3) The licensee shall check inventory periodically to confirm that radioactive sources and radiation generators are in their assigned locations and under control.

(4) The licensee shall provide appropriate information from their inventory records to the Authority.

Part V — Human Imaging Using Radiation for Purposes Other than Medical Diagnosis, Medical Treatment or Biomedical Research

Justification of practice of any type of human imaging using radiation

30.—(1) The justification process applied to the practice of any type of human imaging procedure in which radiation is used for any purpose other than medical diagnosis, medical treatment or as part of a programme of biomedical research shall include the consideration of—

(*a*) the benefit and detriment of implementing the type of human imaging procedure ;

(*b*) the benefit and detriment of not implementing the type of human imaging procedure ;

(*c*) any legal or ethical issue associated with the introduction of the type of human imaging procedure ;

(*d*) the effectiveness and suitability of the type of human imaging procedure, including the appropriateness of the radiation equipment for the intended use ; and

(*e*) the availability of sufficient resources to conduct the human imaging procedure safely throughout the intended period of the practice.

(2) Human imaging that is determined to be justified through the process specified in sub-regulation (1) of this regulation shall be subject to regulatory control, including authorisation or approval from the Authority.

Optimizatoin of protection and safety

31.—(1) Where any person may be exposed to radiation for employment, legal, education or health insurance related purpose and without medical referrals, the registrant or licensee shall ensure that the appropriate optimization requirements for medical exposure in regulation 49 of these Regulations is applied and performed by medical personnel using medical radiological equipment.

(2) The provisions of sub-regulation (1) of this regulation shall be subject to the dose constraint established by the Authority in consultation with the relevant professional body instead of diagnostic reference levels.

(3) The registrant and licensee shall apply the requirements for public exposure in any planned exposure situation for procedures with inspection imaging devices in which radiation is used to expose any person for the purpose of detection of any concealed weapon, contraband or other object on or within the body considered to give rise to public exposure, and ensure that optimization of protection and safety is subject to any dose constraint for public exposure set by the Authority.

(4) The registrant and licensee shall ensure that —

(*a*) any person who is to undergo a procedure with inspection imaging device in which ionizing radiation is used is informed of the possibility of requesting the use of an alternative inspection technique that does not use ionizing radiation ; and

(*b*) any inspection imaging device used for the detection of any concealed object on or within the body, conforms to the standards of the International Organisation for Standardization or Standards Organisation of Nigeria.

Part VI — Occupational Exposure

Responsibility of the employer, registrant and licensee for protection of the worker

32.—(1) The employer, registrant and licensee shall be responsible for the protection of any worker who is engaged in any activity in which is or may be subject to occupational exposure in any planned exposure situation and ensure compliance with relevant requirements of these Regulations.

(2) The employer, registrant and licensee shall ensure that —

(*a*) occupational exposure is controlled such that the relevant dose limit for occupational exposure specified in the Third Schedule to these Regulations is not exceeded ;

(*b*) protection and safety is optimized in accordance with the requirements of these Regulations ;

(*c*) any decision with regard to measures for protection and safety is recorded and made available to the relevant party, through their representatives where appropriate, as specified by the Authority ;

(*d*) the policy, procedure and organisational arrangement for protection and safety are established for implementing the relevant requirements of these Regulations, with priority given to design and technical measures for controlling occupational exposure ;

(*e*) suitable and adequate facility, equipment and services for protection and safety are provided, the type and extent of which are commensurate with the expected likelihood and magnitude of occupational exposure ;

(*f*) necessary workers' health surveillance and health services for workers are provided ;

(*g*) appropriate monitoring equipment and Personal Protective Equipment (PPE) is provided and arrangements are made for its proper use, calibration, testing and maintenance ;

(*h*) suitable and adequate human resources and appropriate training in protection and safety are provided, as well as periodic retraining as required to ensure the necessary level of competence ;

(*i*) adequate records are maintained in accordance with the requirements of these Regulations ;

(*j*) arrangements are made to facilitate consultation of and cooperation with the worker, through their representatives where appropriate, with regard to protection and safety on the measure necessary to achieve the effective application of these Regulations ;

(*k*) necessary conditions for promoting safety culture are provided ; and

(*l*) any worker exposed to radiation from a source within a practice that is not required by or directly related to their work have the same level of protection against such exposure as any member of the public.

(3) The employer, registrant and licensee shall —

(*a*) involve the worker in optimization of protection and safety ;

(*b*) establish and use constraints as part of optimization of protection and safety ;

(*c*) take the necessary administrative action to ensure that the worker is informed that ensuring protection and safety is an integral part of a general occupational health and safety programme, in which the worker has specific obligation and responsibility for his protection, and the protection of others against radiation exposure and for the safety of sources ;

(*d*) record any report received from a worker that identifies circumstances that may affect compliance with the requirements of these Regulations, and shall take appropriate action ;

(*e*) comply with applicable national and local laws and regulations governing hazards in the workplace to ensure protection and safety; and

(*f*) facilitate compliance with the requirements of these Regulations by workers.

Compliance by the worker

33.—(1) The worker shall fulfill their obligations and carry out their duties for protection and safety by —

(*a*) following any applicable rules and procedures for protection and safety as specified by the employer, registrant or licensee ;

(*b*) proper use of the monitoring equipment and PPE provided ;

(*c*) cooperating with the employer, registrant or licensee with regard to protection and safety, and programmes for workers' health surveillance and programmes for dose assessment ;

(*d*) providing to the employer, registrant or licensee such information on their past and present work that is relevant to ensure their effective and comprehensive protection and safety and that of others ;

(*e*) abstaining from any willful action that may endanger them or others and that is in contravention of these Regulations ; and

(*f*) accepting such information, instruction and training in protection and safety as may facilitate their work in accordance with the requirements of these Regulations.

(2) A worker who identifies circumstances that may adversely affect protection and safety shall report such circumstances to the radiation safety officer, employer, registrant or licensee as soon as possible.

Cooperation between the employer, registrant and licensee

34.—(1) The employer, registrant and licensee shall cooperate to the extent necessary for compliance by the responsible party with the requirements of these Regulations for protection and safety.

(2) The registrant or licensee responsible for the source and the employer shall cooperate to the extent necessary for compliance by both parties with the requirements of these Regulations, if workers are engaged in work that involves or may involve a source that is not under the control of their employer.

(3) An employer shall cooperate with the registrant or licensee in —

(*a*) the development and use of specific restrictions on exposure and other means of ensuring that the measures for protection and safety for the worker who is engaged in work which involves or may involve a source that is not under the control of the employer is at least as good as those for the employee of the registrant or licensee ;

(*b*) specific assessment of the dose received by the worker as specified in paragraph (a) of this sub-regulation ; and

(*c*) a clear allocation and documentation of the responsibility of the employer and registrant or licensee for protection and safety.

(4) The registrant or licensee responsible for the source or for the exposure shall —

(*a*) obtain from the employer, including self-employed persons, the previous occupational exposure history of the worker as specified in regulation 42(1) of these Regulations, and any other necessary information ;

(*b*) provide appropriate information to the employer, including any available information relevant for compliance with the requirements of these Regulations that the employer requests ; and

(*c*) provide the worker and employer with the relevant exposure records.

Classification of area

35. The employer, registrant and licensee shall establish and maintain organisational, procedural and technical arrangements for the designation of

any controlled and supervised area, for local rules and for monitoring of the workplace, to ensure adequate arrangements under the radiation protection programme.

Controlled area

36.—(1) The registrant and licensee shall designate as a controlled area, any area in which specific measures for protection and safety are or may be required to —

(*a*) control exposure or prevent the spread of contamination in normal operation ; or

(*b*) prevent or limit the likelihood and magnitude of exposure in anticipated operational occurrences and accident conditions.

(2) The registrant and licensee shall —

(*a*) take account of the magnitude of the exposure expected in normal operation, the likelihood and magnitude of exposure in anticipated operational occurrence and in any accident condition ; and the type and extent of the procedure required for protection and safety in defining the boundary of any controlled area ;

(*b*) delineate any controlled area by physical means or, where this is not reasonably practicable, by any other suitable means ;

(*c*) where a source is intermittently brought into operation, energized, or is moved from place to place, delineate an appropriate controlled area by means that are appropriate under the prevailing circumstances and shall specify the exposure times ;

(*d*) ensure that suitable and sufficient signs are displayed in suitable positions which indicates that the area is a controlled area, the nature of the radiation source in the area and the risks arising from such source ;

(*e*) establish measures for protection and safety, including, as appropriate, physical measures to control the spread of contamination and local rules and procedures for the controlled area ;

(*f*) restrict access to any controlled area by means of administrative procedures such as the use of work permit, and by any physical barrier, which may include lock or interlock, the degree of restriction being commensurate with the likelihood and magnitude of exposures ;

(*g*) provide at the entrance to any controlled area —

(*i*) PPE,

(*ii*) equipment for individual monitoring and workplace monitoring, and

(*iii*) suitable storage for personal clothing ;

(*h*) provide at the exit from any controlled area shall

(*i*) equipment for monitoring for contamination of skin and clothing,

(*ii*) equipment for monitoring for contamination of any object or material being removed from the area,

(*iii*) washing or showering facility and any other personal decontamination facility, and

(*iv*) suitable storage for contaminated PPE ;

(*i*) periodically review conditions to assess whether there is any need to modify the measures for protection and safety or the boundaries of controlled areas ; and

(*j*) provide appropriate information, instruction and training for any person working in a controlled area.

Supervised area

37.— (1) The registrant and licensee shall designate as a supervised area any area not designated as a controlled area but for which occupational exposure conditions needs to be kept under review, where specific measures for protection and safety are not normally needed.

(2) The registrant and licensee, taking into account the nature, likelihood and magnitude of any exposure or contamination in the supervised area, shall —

(*a*) delineate the supervised areas by appropriate means ;

(*b*) display approved signs, as appropriate, at access point to any supervised area where appropriate, in suitable positions which indicates the nature of the radiation source and the risk arising from such source ; and

(*c*) periodically review conditions to assess whether there is any need for further measures for protection and safety or any need for change to the boundary of any supervised area.

Local rules, procedures and personal protective equipment

38. —(1) The employer, registrant and licensee shall minimize the need to rely on administrative controls and PPE for protection and safety by providing well engineered controls and satisfactory working conditions, in accordance with the following hierarchy of preventive measures —

(*a*) engineered control ;

(*b*) administrative control ; and

(*c*) PPE.

(2) The employer, registrant and licensee, in consultation with the worker, or through their representatives shall —

(*a*) establish in writing local rules and procedures necessary for protection and safety of the worker and any other person ;

(*b*) include in the local rules and procedures any relevant investigation level or authorised level, and the procedure to be followed where such level

is exceeded ;

(*c*) ensure that the local rule, procedure, the measures for protection and safety is known to the worker to whom it applies and to any other person who may be affected ;

(*d*) ensure that any work in which the worker is or may be subject to occupational exposure is adequately supervised and shall take the reasonable steps to ensure that the rules, procedures, and measures for protection and safety are observed ; and

(*e*) designate a radiation safety officer in accordance with the criteria established by the Authority.

(3) The employer, registrant and licensee shall ensure that —

(*a*) the worker is provided with suitable and adequate PPE that meets relevant standards or specifications as appropriate, including —

(*i*) protective clothing,

(*ii*) respiratory protective equipment, the characteristics of which is made known to the user, and

(*iii*)protective apron, glove and organ shield ;

(*b*) the worker receives adequate instruction in the proper use of respiratory protective equipment as appropriate ;

(*c*) the task which require the use of certain personal protective equipment are assigned to the worker who on the basis of medical advice is capable of safely sustaining the extra effort necessary ;

(*d*) where the use of PPE is considered for any given task, account is taken of any additional exposure that may result owing to the additional time taken or the inconvenience, and of any non-radiological risk that may be associated with using PPE while performing the task ; and

(*e*) the PPE, including equipment for use in an emergency, is maintained in proper condition and, is tested at regular intervals.

Monitoring of the workplace

39.—(1) The registrant and licensee shall, in cooperation with the employer establish, maintain and keep under review a programme for workplace monitoring under the supervision of a radiation safety officer and a qualified expert authorised by the Authority.

(2) The registrant and licensee shall institute the appropriate type and frequency of workplace monitoring which shall —

(*a*) enable —

(*i*) evaluation of the radiological conditions in the workplace,

(*ii*) assessment of exposures in any controlled and supervised area, and

(*iii*) review of the classification of any controlled and supervised area ; and

(*b*) be based on dose rate, activity concentration in air, surface contamination, and the expected fluctuation; and on the likelihood and magnitude of any exposure in anticipated operational occurrence and accident condition.

(3) The registrant and licensee shall —

(*a*) generate and maintain record of the result of the workplace monitoring carried out and of the test monitoring equipment ;

(*b*) ensure that the record of the test is authorized by a qualified person ; and

(*c*) keep the record for at least two years from the respective dates on which it is made.

(4) The registrant and licensee shall cooperate with the employer to maintain such records and make it available to the worker through their representatives where appropriate.

Classification of the worker

40.—(1) An employer, self-employed person, registrant and licensee shall designate as classified person, any employee who is subject to occupational exposure as a result of their work in controlled or supervised areas, and such employee shall be informed of their designations —

(*a*) Category A - classified person who works in a controlled area, or who occasionally works in a controlled area and may receive a significant dose from occupational exposure ; and

(*b*) Category B - classified person who works in a supervised area, or who occasionally enters a controlled area, and is likely to receive an effective dose greater than 1mSv a year.

(2) An employer, registrant or licensee shall not designate an employee as a classified person unless the employee is —

(*a*) 18 years or above ; and

(*b*) certified medically fit for the work by an appointed doctor or employment medical adviser.

(3) An employer, registrant or licensee shall treat an employee as a classified person until the end of a calendar year and except where —

(*a*) an appointed doctor or employed medical adviser so requires ; or

(*b*) the employee is no longer employed by the same employer in the capacity, which is likely to result in significant exposure to ionizing radiation during the remainder of the relevant calendar year.

Assessment of occupational exposure

41.—(1) An employer, self-employed person, registrant and licensee shall with an authorised Dosimetry Service Providers (DSP) who operates a quality management system for assessment of occupational exposure of the worker, and on the basis of individual monitoring where appropriate, make arrangements for —

(*a*) systematic assessment of dose by the use of suitable individual monitoring for appropriate periods or, where individual measurement is inappropriate, by means of other suitable measurement approved by the Authority ; and

(*b*) generation and maintenance of the dose record relating to each classified person.

(2) Occupational exposure for any category A classified worker, shall be assessed on the basis of individual monitoring where appropriate, adequate and feasible.

(3) Where individual monitoring of the worker is inappropriate, inadequate or not feasible, the occupational exposure shall be assessed on the basis of the result of the workplace monitoring and information on the location and duration of exposure of the worker.

(2) Occupational exposure for any category B classified worker, shall be assessed on the basis of the result of the workplace monitoring or individual monitoring, as appropriate.

(3) An employer, registrant and licensee shall ensure that any worker who may be subject to exposure due to contamination is identified, including workers who use respiratory protective equipment, arrange for appropriate monitoring to the extent necessary to demonstrate the effectiveness of the measures for protection and safety, and assess intakes of radionuclides and the committed effective doses.

(4) Where a dosimeter or other device used to make any individual measurement is lost, damaged or destroyed or it is not practicable to assess the dose received by a classified person over any period, the employer shall —

(*a*) make an adequate investigation of the circumstance of the case with a view to estimating the dose received by the person during the period and —

(*i*) where there is adequate information to estimate the dose received by the classified person, the employer shall arrange for the authorised DSP to enter a notional dose in the dose record of the person which shall be the proportion of the total annual dose limit for the relevant period, and

(*ii*) in any other case, the employer shall take reasonable steps to inform the classified person of the entry and arrange for the authorised DSP to identify the person of such entry and arrange for the authorised DSP to identify the entry in the dose records as an estimated dose or a notional dose as the case may be ; and

(*b*) at the request of the classified person or a person formerly employed by the employer as a classified person to whom the investigation made under this sub-regulation relates and upon reasonable notice, make available to such person a copy of the summary sent to the authorised DSP under paragraph (a)(i) of this sub-regulation.

(5) Subject to sub-regulations (7) and (10) of this regulation, where an employer has reasonable cause to believe that the dose received by a classified person is greater or much lesser than that shown in the relevant entry of the dose records, he shall conduct adequate investigation of the circumstances of the exposure of such person to ionizing radiation and, if the investigation confirms his belief, the employer shall where there is adequate information to estimate the dose received by the employee —

(*a*) send to the authorised DSP, the adequate summary of the information used to estimate such dose ;

(*b*) arrange for the authorised DSP to enter such estimated dose in the dose record of such person and for the authorised DSP to identify the estimated dose in records as a special entry ; and

(*c*) notify the classified person accordingly.

(6) The employer shall make a report of any investigation carried out under sub-regulation (5) of this regulation, send the report to the Authority and preserve a copy of the report for a period of five years from the date it is made.

(7) The provisions of regulation 40 (1) of these Regulations shall not apply —

(*a*) in respect of a classified person subject to an annual dose limit, more than 12 months after the original entry is made in the record ; and

(*b*) in any other case, more than 5 years after the original entry is made in the record.

(8) Where a classified person is aggrieved by a decision to replace a recorded dose by an estimated dose pursuant to sub-regulation (6) of this regulation, he may, by an application in writing to the Authority made within 3 months of the date on which he is notified of the decision, apply for the decision to be reviewed.

(9) Where the Authority concludes whether as a result of a review carried out pursuant to sub-regulation (8) of this regulation or otherwise that —

(*a*) there is reasonable cause to believe that the investigation carried out pursuant to sub-regulation (5) of this regulation is inadequate ; or

(*b*) a reasonable estimated dose is not established, the employer shall, if so directed by the Authority, re-instate the original entry in the dose record.

(10) The employer shall not, without the consent of the Authority, require the authorised DSP to enter an estimated dose in the dose record in any case where —

(*a*) the cumulative recorded effective dose is 20mSv or more in one calendar year ; or

(*b*) the cumulative recorded equivalent dose for the calendar year exceeds a relevant dose limit.

Record of occupational exposure

42.— (1) An employer, registrant and licensee shall maintain dose records for any worker for whom assessment of occupational exposure is required in regulations 40 and 41 of these Regulations.

(2) An employer, registrant and licensee shall —

(*a*) ensure that an outside worker is provided with separate or individual radiation dose records ; and

(*b*) make suitable arrangements to ensure that the particulars entered in the radiation record is up-to-date, during the continuance of the employment of the outside worker, and submitted to the Authority at such intervals as may be determined, from time to time, by the Authority.

(3) The radiation dose records shall include particulars provided in the Fifth Schedule to these Regulations.

(4) Records of occupational exposure for each worker shall be maintained during and after the worker's working life, at least until the former worker attains or may have attained the age of 75 years, and for not less than 50 years after cessation of the work in which the worker is subject to occupational exposure.

(5) Record of occupational exposure shall include —

(*a*) information on the general nature of the work in which the worker is subject to occupational exposure ;

(*b*) information on dose assessment, exposure and intake at or above the relevant recording levels specified by the Authority and the data upon which the dose assessments is based ;

(*c*) information on the date of employment, dose, exposure and intake

for each employment where the worker is employed by more than one employer ; and

(*d*) record of any assessment made of dose, exposure and intake due to any action taken in an emergency or due to any accident or other incident, which shall be distinguished from assessment of dose, exposure and intake due to normal conditions of work and shall include references to the report of any relevant investigation.

(6) An employer, registrant and licensee shall —

(*a*) provide the worker with access to records of their occupational exposure ;

(*b*) provide workers' health surveillance, to the supervisor of the programme, the Authority and the relevant employer with access to workers' dose record ;

(*c*) facilitate the provision of copies of the workers dose records to new employers where workers change employment ;

(*d*) make arrangements for the retention of dose record for the former worker ; and

(*e*) in complying with paragraphs (a)-(d) of this sub-regulation, maintain the confidentiality of records.

(7) For the purposes of regulation 41 (1) of these Regulations the employer, registrant or licensee shall make arrangements with the authorised DSP to include requirements to —

(*a*) keep and submit to the Authority, quarterly records made and maintained pursuant to the arrangements or a copy of it until the person to whom the record relates has or may have attained the age of 75 years or for at least 50 years from when made, whichever is earlier ;

(*b*) provide the employer, registrant or licensee —

(*i*)at appropriate intervals with suitable summaries of the dose record maintained in accordance with paragraph (a) of this sub-regulation,

(*ii*) such copies of the dose record relating to any of the employees as may be required from time to time,

(*iii*) where necessary, the termination record which is a record of the information concerning the dose assessment relating to a classified person who ceases to be an employee and send such record to the Authority and send a copy to the employer, registrant and licensee, and

(*iv*) with summary of the current dose record relating to the preceding year to the Authority on or before 31st March of the following year ;

(*c*) where a dose is estimated pursuant to regulation 41 (3) of these

Regulations, make an entry in a dose record and retain the summary of the information used to estimate the dose ; and

(*d*) where the employer, registrant or licensee engages an outside worker, provide the dose records in respect of the outside worker to the Authority.

(8) An employer, registrant and licensee who ceases to conduct any activity in which the worker is subject to occupational exposure, shall make arrangements for the retention of the workers' dose record by the Authority or by a relevant employer, registrant or licensee, as appropriate.

Workers health surveillance

43.—(1) Programmes and arrangement for workers' health surveillance required in regulation 32 (2)(f) of these Regulations and in accordance with rules established by the Authority shall be—

(*a*) based on the general principles of occupational health ; and

(*b*) designed to assess the initial and continuing fitness of workers for their intended tasks.

(2) If the worker is to be engaged in work, in which there may be exposure to radiation from a source that is not under the control of the employer, the registrant or licensee responsible for the source shall, as a precondition for the engagement of such worker, make with the employer any special arrangements for workers' health surveillance necessary to comply with the regulatory requirements and any other rule established by the Authority.

Information, instruction and training

44. The employer, in cooperation with the licensee shall —

(*a*) provide the worker with adequate information on health risks due to occupational exposure in normal operation, anticipated operational occurrence and accident condition, adequate instruction and training, periodic retraining in protection and safety, and adequate information on the significance of their actions for protection and safety ;

(*b*) provide the worker who may be involved in or affected by the response to an emergency with appropriate information, adequate instruction and training and periodic retraining, for protection and safety ; and

(*c*) maintain records of the training provided to the individual worker.

Conditions of service

45.—(1) The conditions of service offered by any employer, registrant and licensee to the worker shall be independent of whether they are or may be subject to occupational exposure.

(2) Special compensatory arrangements, or preferential consideration with respect to salary, special insurance coverage, working hours, length of vacation, additional holidays or retirement benefits, shall not be granted or used as substitutes for measures for protection and safety in accordance with the requirements of these Regulations.

(3) The employer shall make reasonable effort to provide the worker with suitable alternative employment in circumstances for which it is determined, by the Authority or in the framework of the programme for workers' health surveillance in accordance with the requirements of these Regulations, that workers, for health reasons, may no longe—ue in employment in which they are or may be subject to occupational exposure.

Special arrangements for protection and safety for the worker and person under 18 years of age undergoing training

46.—(1) An employer, registrant and licensee shall make special arrangements for the female worker, where necessary, for protection of the embryo or fetus and breastfed infants ; and for protection and safety for any person under 18 years of age undergoing training.

(2) An employer, registrant and licensee, shall provide any female worker who is liable to enter any controlled or supervised area or who may undertake any emergency duty with appropriate information on the —

(*a*) risk to the embryo or fetus due to exposure of a pregnant woman ;

(*b*) importance for a female worker to notify her employer as soon as possible if she suspects that she is pregnant or if she is breast-feeding ; and

(*c*) risk of health effects for a breastfed infant due to ingestion of any radioactive substance.

(3) For female worker —

(*a*) notification of the employer by the female worker if she suspects that she is pregnant or if she is breast-feeding shall not be considered a reason to exclude the female worker from work ;

(*b*) it is obligatory for such employee pursuant to paragraph (a) of this sub-regulation to inform the employer in writing as soon as possible after being aware of her pregnancy; or if she is breast feeding ; and

(*c*) the employer of a female worker, who is notified of her condition pursuant to this sub-regulation, shall adapt the working conditions in respect of occupational exposure to ensure that the embryo, fetus or the breastfed infant is afforded the same broad level of protection as is required for any member of the public.

(4) An employer, registrant and licensee shall ensure that no person under the age of 16 years is or may be subject to occupational exposure.

(5) An employer, registrant and licensee shall ensure that any person under the age of 18 years is allowed access to a controlled area under supervision and for the purpose of training for employment in which they are or may be subject to occupational exposure or for the purpose of studies in which sources are used.

PART VII — MEDICAL EXPOSURE

Responsibility of the registrant and licensee

47.— (1) A registrant and licensee shall ensure that no person incurs a medical exposure unless there has been an appropriate referral from a medical practitioner, responsibility has been assumed for ensuring protection and safety; and the person subject to exposure is informed of the expected benefit and risk.

(2) A registrant and licensee shall ensure that no patient, whether symptomatic or asymptomatic, undergoes a medical exposure unless—

(*a*) it is a radiological procedure that is requested by a referring medical practitioner and information on the clinical context is provided, or it is part of an approved health screening programme ;

(*b*) the medical exposure is justified by means of consultation between the radiological medical practitioner and the referring medical practitioner, as appropriate, or it is part of an approved health screening programme ;

(*c*) a radiological medical practitioner has assumed responsibility for protection and safety in the planning and delivery of the medical exposure as specified in sub-regulation (4)(c) of this regulation ; and

(*d*) the patient or the patient's legal authorised representative is informed as appropriate of the expected diagnostic or therapeutic benefit of the radiological procedure and radiation risk.

(3) A registrant and licensee shall ensure that —

(*a*) no individual incurs a medical exposure as part of a programme of biomedical research unless the exposure is approved by an ethics committee or any other institutional body that is assigned functions similar to those of an ethics committee by the relevant authority, as required in regulation 48 (8) of these Regulations and a radiological medical practitioner has assumed responsibility as specified in sub-regulation (4)(c) of this regulation; and

(*b*) the requirements specified in regulation 49 (12)(b) of these Regulations are fulfilled for the optimization of protection and safety for any person subject to exposure as part of a programme of biomedical research.

(4) A registrant and licensee shall ensure that —

(*a*) no individual incurs a medical exposure as a carer or comforter unless he has received relevant information on radiation protection and has indicated an understanding of the associated radiation risk prior to providing care and comfort to any individual undergoing a radiological procedure ;

(*b*) the requirements specified in regulation 49 (12)(a) of these Regulations are fulfilled for the optimization of protection and safety for any radiological procedure in which an individual acts as a carer or comforter ;

(*c*) the radiological medical practitioner who performs or oversees the radiological procedure has assumed responsibility to ensure overall protection and safety for any patient in the planning and delivery of the medical exposure, including the justification of the radiological procedure as required in regulation 48 (2) - (8) of these Regulations and the optimization of protection and safety, in cooperation with the medical physicist and the radiographer as required in regulation 49 (2) - (4) of these Regulations ;

(*d*) the radiological medical practitioner, medical physicist, radiographers and any other health professional with specific duty in relation to protection and safety for the patient in a given radiological procedure is specialized in the appropriate area ;

(*e*) sufficient medical personnel and paramedical personnel are available as specified by the health authority and meet the necessary requirements, specified by the Authority, for education, training and competence in radiation protection ;

(*f*) for therapeutic radiological procedure, the requirements of these Regulations for calibration, dosimetry and quality assurance, including the acceptance and commissioning of medical radiological equipment, as specified in regulation 49 (6), (7), (9) and (10) of these Regulations, is fulfilled by or under the supervision of a medical physicist ;

(*g*) for diagnostic radiological procedure and image guided interventional procedure, the requirements of these Regulations for medical imaging, calibration, dosimetry and quality assurance, including the acceptance and commissioning of medical radiological equipment, as specified in regulation 49 (6), (7)(a) - (b), (8), (9) and (11) of these Regulations is fulfilled by or under the oversight of or with the documented advice of a medical physicist, whose degree of involvement is determined by the complexity of the radiological procedures and the associated radiation risks; and

(*h*) any delegation of responsibility by a principal party is documented.

Justification of medical exposure

48.—(1) A registrant and licensee shall ensure that any medical exposure is justified.

(2) A medical exposure shall be justified by weighing the diagnostic or therapeutic benefit it is expected to yield against the radiation detriment it may cause, taking account of the benefit and risk of available alternative techniques that do not involve medical exposure.

(3) Generic justification of a radiological procedure shall be carried out by the health authority in colaboration with the appropriate professional body, and shall be reviewed from time to time, taking account of advance in knowledge and technological development.

(4) The justification of medical exposure for an individual patient shall be carried out by the radiological medical practitioner in consultation with the referring medical practitioner as appropriate, and particularly taking account of the patient who is pregnant, breast-feeding and paeadiatric to establish the —

(*a*) appropriateness of the request ;

(*b*) urgency of the radiological procedure ;

(*c*) characteristics of the medical exposure ;

(*d*) characteristics of the individual patient ; and

(*e*) relevant information from the patient's previous radiological procedures.

(5) Relevant national or international referral guidelines shall be taken into account for the justification of the medical exposure of an individual patient in a radiological procedure.

(6) The health authority shall in colaboration with appropriate professional body carry out, justification for radiological procedures to be performed as part of a health screening programme for asymptomatic populations.

(7) Any radiological procedure on an asymptomatic individual that is intended to be performed for the early detection of disease, but not as part of an approved health screening programme, shall require specific justification for the individual by the radiological medical practitioner and the referring medical practitioner, in accordance with the guidelines of relevant professional bodies or the health authority and as part of this process, the individual shall be informed in advance of the expected benefit, risk and limitation of the radiological procedure.

(8) The medical exposure of volunteers as part of a programme of biomedical research is not justified unless it is in accordance with the provisions of the Helsinki Declaration and is subject to approval by an ethics committee or any other institutional body that is assigned functions similar to those of an ethics committee by the relevant authority, board or council, and subject to the dose constraint as established by the Authority in collaboration with relevant institutional body.

Optimization of protection and safety

49.—(1) A registrant, licensee and radiological medical practitioner shall ensure that protection and safety is optimized for each medical exposure.

(2) A registrant and licensee, in cooperation with the supplier, shall ensure that medical radiological equipment and software that may influence the delivery of medical exposure are used if they conform to the applicable standards of the International Organisation for Standardization (ISO), International Electro-technical Commission (IEC) and the Standards

Organisation of Nigeria (SON), in addition to ensuring that the responsibility stated in regulation 58 (1) of these Regulations is discharged.

(3) For diagnostic radiological procedures and image guided interventional procedures, the radiological medical practitioner, in cooperation with the medical radiation technologist, the medical physicist, and if appropriate the radiopharmacist or radiochemist, shall ensure the use of —

(*a*) an appropriate medical radiological equipment and software ; and appropriate radiopharmaceuticals for nuclear medicine; and

(*b*) appropriate techniques and parameters to deliver the minimum necessary medical exposure that is required to fulfill the clinical purpose of the radiological procedure, taking account of relevant norms of acceptable image quality established by relevant professional body and of relevant diagnostic reference level established by the Authority.

(4) For therapeutic radiological procedures —

(*a*) the radiological medical practitioner, in cooperation with the medical physicist and the radiographer, shall ensure that for each patient, the exposure of volumes other than the planning target volume is kept as low as reasonably achievable consistent with delivery of the prescribed dose to the planning target volume within the required tolerances ; or

(*b*) in which radiopharmaceuticals are administered, the radiological medical practitioner, in cooperation with the medical physicist, and the radiographer and if appropriate with the radio-pharmacist or radiochemist, shall ensure that for each patient, the appropriate radiopharmaceutical with the appropriate activity is selected and administered, so that the radioactivity is primarily localized in the organ of interest, while the radioactivity in the rest of the body is kept as low as reasonably achievable.

(5) A registrant and licensee shall ensure that the particular aspects of medical exposure is considered in the optimization process for —

(*a*) any peadiatric patient subject to medical exposure ;

(*b*) any individual subject to medical exposure as part of an approved health screening programme ;

(*c*) any volunteer subject to medical exposure as part of a programme of biomedical research ;

(*d*) relatively high dose to the patient ;

(*e*) exposure of the embryo or fetus, in particular for radiological procedures in which the abdomen or pelvis of the pregnant patient is exposed to the useful radiation beam or may otherwise receive a significant dose ; and

(*f*) exposure of a breastfed infant as a result of a breastfeeding patient having undergone a radiological procedure with radiopharmaceuticals.

(6) In accordance with regulation 47 (4)(f) and (g) of these Regulations the medical physicist shall ensure that —

(*a*) any source which gives rise to medical exposure is calibrated in terms of appropriate quantity using internationally accepted or nationally accepted protocols ;

(*b*) calibration is carried out at the time of commissioning a unit prior to clinical use, after any maintenance procedure that may affect the dosimetry and at the interval approved by the Authority ;

(*c*) calibration of radiation therapy unit is subject to independent verification prior to clinical use ; and

(*d*) calibration of any dosimeter used for dosimetry of any patient and for the calibration of any source is traceable to a Secondary Standards Dosimetry Laboratory (SSDL).

(7) The registrant and licensee shall ensure that dosimetry of any patient is performed and documented by or under the supervision of a medical physicist using calibrated dosimeter and following internationally accepted or nationally accepted protocols, including dosimetry to determine the following —

(*a*) typical dose to any patient for diagnostic radiological procedure ;

(*b*) typical dose to any patient for image guided interventional procedures ;

(*c*) absorbed dose to the planning target volume for each patient treated with external beam therapy or brachytherapy and absorbed dose to the relevant tissue or organ as determined by the radiological medical practitioner, for therapeutic radiological procedure ; and

(*d*) typical absorbed dose to any patient for therapeutic radiological procedure with unsealed source.

(8) The registrant and licensee shall ensure that —

(*a*) local assessment, on the basis of the measurement required in this regulation is made at the approved interval for the radiological procedure for which diagnostic reference level is established ; and

(*b*) a review is conducted to determine whether the optimization of protection and safety for any patient is adequate, or whether corrective action is required if, for a given radiological procedure —

(*i*) typical dose or activity exceed the relevant diagnostic reference level, or

(*ii*) typical dose or activity fall substantially below the relevant diagnostic reference level and the exposures do not provide useful diagnostic information or do not yield the expected medical benefit to the patient.

(9) The registrant and licensee shall establish a comprehensive programme of quality assurance for medical exposure with the active participation of the medical physicists, radiological medical practitioner, radiographer and, for complex nuclear medicine facility, radio-pharmacists and radiochemists; and in conjunction with any other health professional as appropriate in applying the requirements of these Regulations in respect of management systems.

(10) The registrant and licensee shall ensure that the programme of quality assurance for medical exposure include, as appropriate to the medical radiation facility—

(a) measurements of the physical parameter of medical radiological equipment made by, or under the supervision of, a medical physicist—

(*i*) at the time of acceptance and commissioning of the equipment prior to its clinical use on any patient,

(*ii*) periodically thereafter,

(*iii*) after any major maintenance procedure that may affect protection and safety of any patient, and

(*iv*) after any installation of new software or modification of existing software that may affect protection and safety of any patient ;

(*b*) implementation of the corrective action if measured values of the physical parameters mentioned in paragraph (a) of this sub-regulation are outside the established tolerance limit ;

(*c*) verification of the appropriate physical and clinical factors used in the radiological procedure ;

(*d*) maintenance of the record of relevant procedure and result ; and

(*e*) periodic checks of the calibration and conditions of operation of dosimetry equipment and monitoring equipment.

(11) The registrant and licensee shall ensure that regular and independent audit is made of the programme of quality assurance for the medical exposure, and that the frequency is in accordance with the complexity of the radiological procedure being performed and the associated risk.

(12) The registrant and licensee shall ensure that the relevant dose constraint—

(*a*) established by the Authority in consultation with the health Authority and relevant professional body is used in the optimization of protection and

safety in any radiological procedure in which an individual acts as a carer or comforter ; and

(*b*) specified or approved by the ethics committee or any other institutional body that is assigned functions similar to those of an ethics committee, by the relevant authority, on a case by case basis as part of a proposal for biomedical research is used in the optimization of protection and safety for any person subject to exposure as part of a programme of biomedical research.

Pregnant or breast-feeding patient

50.—(1) The registrant and licensee shall ensure that —

(*a*) arrangement is in place for appropriate radiation protection in a case where a female patient may be pregnant or is breast-feeding ;

(*b*) signs in English and appropriate local languages are placed in any public area, waiting room for patient, cubicle and any other appropriate place, and that other means of communication are used as appropriate, to request any female patient who is to undergo a radiological procedure to notify the radiological medical practitioner, radiographer or any other personnel where she is —

(*i*) or may be pregnant, and

(*ii*) breast-feeding and that the scheduled radiological procedure includes the administration of a radiopharmaceutical ;

(*c*) there is a procedure in place to ascertain the pregnancy status of a female patient of reproductive capacity before the performance of any radiological procedure that may result in a significant dose to the embryo or fetus, so that this information shall be considered in the justification for the radiological procedure and in the optimization of protection and safety ; and

(*d*) arrangement is in place to establish that a female patient is not currently breast-feeding before the performance of any radiological procedure involving the administration of a radiopharmaceutical that may result in a significant dose to a breastfed infant, so that this information shall be considered in the justification for the radiological procedure and in the optimization of protection and safety.

Release of the patient after radionuclide therapy

51.—(1) The registrant and licensee shall ensure that arrangement is in place to ensure appropriate radiation protection for any member of the public and family member before a patient is released following radionuclide therapy.

(2) The radiological medical practitioner shall ensure that no patient who has undergone a therapeutic radiological procedure with a sealed source or an unsealed source is discharged from a medical radiation facility until it is established by either a medical physicist or the facility's radiation safety officer that the —

(*a*) activity of radionuclides in the patient is such that the dose that may be received by any family member and the public may be in compliance with the criteria and guidelines established by the Authority for the release of any patient who have undergone any therapeutic radiological procedure using unsealed source or implanted sealed source ; and

(*b*) patient, carer, comforter or the legal guardian of the patient is provided with —

(*i*) written instructions to keep the dose to any person in contact with or in the vicinity of the patient as low as reasonably achievable and avoid the spread of contamination, and

(*ii*) information on the radiation risk.

Unintended and accidental medical exposures

52.—(1) The registrant and licensee shall ensure that the practicable measures are taken to minimize the likelihood of any unintended or accidental medical exposure ; and promptly investigate any unintended or accidental medical exposure and, if appropriate, shall implement the corrective action.

(2) The registrant and licensee, in accordance with the relevant requirements of regulations 22, 26(5), 57 and 50 of these Regulations, shall ensure that the practicable measures are taken to minimize the likelihood of any unintended or accidental medical exposure arising from any flaw in design and operational failure of medical radiological equipment, from any failure of and error in software, or as a result of human error.

(3) The registrant and licensee shall promptly investigate any of the following unintended or accidental medical exposures —

(*a*) medical treatment delivered to the wrong individual or to the wrong tissue or organ of a patient, using the wrong radiopharmaceutical, or with an activity, a dose or dose fractionation differing substantially from the values, over or under, prescribed by the radiological medical practitioner, or that may lead to unduly severe secondary effects ;

(*b*) diagnostic radiological procedure or image guided interventional procedure in which the wrong individual or the wrong tissue or organ of the patient is subject to exposure ;

(*c*) exposure for diagnostic purpose is substantially greater than is intended ;

(*d*) any exposure arising from an image guided interventional procedure is substantially greater than is intended ;

(*e*) there is inadvertent exposure of the embryo or fetus in the course of performing a radiological procedure ; and

(*f*) there is failure of medical radiological equipment, failure of software

or system failure, or accident, error, mishap or other unusual occurrence with the potential to subject the patient to a medical exposure that is substantially different from what is intended.

(4) The registrant and licensee shall, with regard to any unintended or accidental medical exposure investigated as required in sub-regulation (3) of this regulation—

(*a*) calculate or estimate the dose received and the dose distribution within the patient ;

(*b*) indicate the corrective action required to prevent the reoccurrence of such an unintended or accidental medical exposure ;

(*c*) implement the corrective actions under their responsibility ;

(*d*) produce and keep, as soon as possible after the investigation or as otherwise required by the Authority, a written record that states the cause of the unintended or accidental medical exposure and includes the information specified in paragraphs (a) - (c) of this sub-regulation, or any other information as required by the Authority ;

(*e*) submit such written record to the Authority as soon as possible for any significant unintended or accidental medical exposure and to the relevant health authority; and

(*f*) ensure that the appropriate radiological medical practitioner informs the referring medical practitioner and the patient, or the patient's carer, comforter, legal guardian of the unintended or accidental medical exposure.

Review and record

53.—(1) The registrant and licensee shall ensure that radiological review is performed periodically at any medical radiation facility and record is maintained.

(2) The registrant and licensee shall ensure that radiological review is performed periodically by the radiological medical practitioner at the medical radiation facility, in cooperation with the radiographer and the medical physicists.

(3) The radiological review shall include an investigation and critical review of the current practical application of the radiation protection principles of justification and optimization for the radiological procedure that is performed in the medical radiation.

(4) The registrant and licensee shall maintain the personnel record during the period of employment and make available to the authority, as required —

(*a*) record of any delegation of responsibility by a principal party as required in regulation 47 (4)(h) of these Regulations; and

(*b*) record for education, training and competence of personnel in radiation protection.

(5) The registrant and licensee shall maintain for a period as specified by the Authority and shall make available, as required —

(*a*) record of the result of the calibration and periodic checks of the relevant physical and clinical parameters selected during treatment of any patient ;

(*b*) record of dosimetry of any patient, as required in regulation 49 (7) of these Regulations ;

(*c*) record of local assessments and reviews made with regard to diagnostic reference level, as required in regulation 49 (8) of these Regulations ; and

(*d*) record associated with the quality assurance programme, as required in regulation 49 (10)(d) of these Regulations.

(6) The registrant and licensee shall maintain for a period as specified by the Authority and shall make available, as required, the following record for medical exposure —

(*a*) information necessary for retrospective assessment of the dose, including the number of exposure and the duration of fluoroscopic radiological procedure for diagnostic radiology ;

(*b*) information necessary for retrospective assessment of the dose, including the duration of the fluoroscopic component and the number of image acquired for image guided interventional procedures ;

(*c*) the type of radiopharmaceutical administered and their activity for nuclear medicine ;

(*d*) a description of the planning target volume, the absorbed dose to the centre of the planning target volume, and the maximum and minimum absorbed dose delivered to the planning target volume, or equivalent alternative information on absorbed dose to the planning target volume, and the absorbed dose to the relevant tissue or organ as determined by the radiological medical practitioner; and in addition, for external beam radiation therapy, the dose fractionation and the overall treatment time for external beam radiation therapy or brachytherapy ;

(*e*) exposure record for the volunteer subject to medical exposure as part of a programme of biomedical research ; and

(*f*) report on the investigation of any unintended and accidental medical exposure, as required in regulation 52 (4) (d) of these Regulations.

PART VIII — PUBLIC EXPOSURE

Responsibility of the relevant party specific to public exposure

54.—(1) The registrant and licensee, in cooperation with the supplier and provider of consumer product, shall apply the requirements of these Regulations, verify and demonstrate compliance as specified by the Authority, in relation to any public exposure for which they have responsibility.

(2) The registrant and licensee, in cooperation with the supplier, in applying the principle of optimization of protection and safety in the design, planning, operation and decommissioning of a source or for closure and the post-closure period for any waste disposal facility, shall take into account the following —

(*a*) possible change in any condition that are likely to affect exposure of any member of the public, such as change in the characteristics and use of the source, change in environmental dispersion condition, change in exposure pathway or change in the value of parameter used for the determination of the representative person ;

(*b*) good practice in the operation of similar source or the conduct of similar practice ;

(*c*) buildup and accumulation of any radioactive substance from discharge during the lifetime of the source ; and

(*d*) uncertainties in the assessment of the dose, especially in contributions to the dose where the source and the representative person are separated in space and time.

(3) The registrant and licensee shall establish, implement and maintain —

(*a*) the policy, procedure and organisational arrangement for protection and safety in relation to public exposure, in accordance with the requirements of these Regulations ;

(*b*) the measure to ensure —

(*i*) optimization of protection and safety, and

(*ii*) limitation of exposure of any member of the public from such source, in accordance with the authorisation ;

(*c*) the measure to ensure the safety of such source ;

(*d*) programmes for appropriate training of personnel with functions relevant to protection and safety of any member of the public, and periodic retraining as required, to ensure the necessary level of competence ;

(*e*) adequate record of monitoring programme ; and

(*f*) emergency plan, procedure and arrangement, in accordance with the nature and magnitude of the radiation risk associated with the sources.

(4) The registrant and licensee shall provide for —

(*a*) suitable and adequate resources including facility, equipment and services, for the protection and safety of any member of the public, commensurate with the likelihood and magnitude of exposure ; and

(*b*) appropriate monitoring equipment, monitoring programmes and methods for assessing public exposure.

(5) The registrant and licensee, in cooperation with the employer shall —

(*a*) apply the relevant requirements of these Regulations in respect of public exposure for any visitor to a controlled or supervised area ;

(*b*) ensure that a visitor is accompanied in any controlled area by a person who knows the measures for protection and safety for the controlled area ;

(*c*) provide adequate information and instructions to a visitor before they enter a controlled or supervised area, so as to provide for protection and safety of the visitor and any other individual who may be affected by their actions ; and

(*d*) ensure that adequate control is maintained over the entry of a visitors to a controlled or supervised area, including the use of signs for such areas.

(6) The registrant and licensee who possess a source that gives rise to external exposure of any member of the public shall ensure that —

(*a*) the floor plans and arrangements of equipment for any new installation utilizing such source, and any significant modification to any existing installation, is subject, to review and approval by the Authority prior to commissioning ; and

(*b*) shielding and any other measure for protection and safety, including access control, is provided to restrict public exposure, at open sites such as for any application of industrial radiography.

(7) The registrants and licensee shall ensure that—

(*a*) specific provision for confinement is established for the design and operation of a source that may cause the spread of contamination in any area that is accessible to any member of the public ; and

(*b*) measures for protection and safety are implemented to restrict public exposure due to contamination in any area within a facility that is accessible to any member of the public.

Consumer product

55.—(1) The provider of any consumer product shall ensure that —

(*a*) the product is not available to the public unless the use is justified ; and

(*b*) the use is exempted on the basis of the criteria specified in the First Schedule to these Regulations or the provision to the public is authorised.

(2) The provider of any consumer product shall —

(*a*) comply with the conditions of the authorization to provide a consumer products to the public ;

(*b*) ensure that the consumer product comply with the requirements of these Regulations ; and

(*c*) plan for appropriate arrangements for the service, maintenance, recycle or disposal of consumer products.

(3) The designer, manufacturer and provider of any consumer product shall ensure that the concept of optimization of protection and safety is applied on the design and manufacture of the consumer product, with features that is likely to affect exposure during normal handling, transport and use, in the event of mishandling, misuse, accident or disposal, taken into consideration —

(*a*) the various radionuclides that may be used in the consumer product and the radiation type, energy, activity and half-live ;

(*b*) the chemical and physical form of the radionuclide that may be used in the consumer product and the significance for protection and safety in normal and abnormal condition ;

(*c*) the containment and shielding of the radioactive substance in the consumer product and access to the radioactive substance in normal and abnormal condition ;

(*d*) the need for service or repair of the consumer product and ways in which this may be done ; and

(*e*) relevant experience with similar consumer product.

(4) The provider of any consumer product shall ensure that —

(*a*) a legible label is firmly affixed to a visible surface of each consumer product that states —

(*i*) that the consumer product contains radioactive substance and identifies the radionuclide and the activity,

(*ii*) that the provision of the consumer product to the public is authorised by the Authority, and

(*iii*) information on the required or recommended option for recycling or disposal ; and

(*b*) information specified in paragraph (a) of this sub-regulation is also printed legibly on the retail packaging of the consumer product.

(5) The provider of any consumer product shall provide clear and appropriate information and instructions for each consumer product on —

(*a*) correct installation, use and maintenance of the consumer product ;

(*b*) service and repair ;

(*c*) the radionuclide and the activity at a specified date ;

(*d*) dose rate in normal operation and during service and repair ; and

(*e*) required or recommended option for recycling or disposal.

(6) The provider of any consumer product —

(*a*) shall provide to the product retailer clear and appropriate information on safety and instruction on the transport and storage; and

(*b*) who imports any consumer product, as exempt product, for subsequent sale and distribution shall include in the application to the Authority, a copy of authorization issued by the regulatory body in the country of manufacture or origin which authorizes distribution to any member of the public in the country.

Monitoring and reporting of public exposure

56.—(1) The registrant and licensee shall ensure that the programme for source monitoring and environmental radiological monitoring is in place and that the results from the monitoring is recorded and made available.

(2) The registrant and licensee shall —

(*a*) establish and implement source and environmental radiological monitoring programmes to ensure that public exposure due to a source under their responsibility is adequately assessed to verify and demonstrate compliance with the authorisation which shall include monitoring of the following, as appropriate —

(*i*) external exposure due to such source,

(*ii*) discharge,

(*iii*) radioactivity in the environment, and

(*iv*) any other parameter important for the assessment of public exposure ;

(*b*) maintain appropriate record of the result of the radiological monitoring programmes and estimated dose to any member of the public ;

(*c*) report and make available to the Authority —

(*i*) the result of the radiological monitoring programme at approved intervals, including, as applicable, the level and composition of discharge, dose rate at the site boundary and in premises open to any member of the public, result of environmental radiological monitoring and retrospective assessment of dose to the representative person,

(*ii*) any level exceeding the operational limit and condition relating to public exposure, including authorised limit on discharge, in accordance with reporting criteria established by the Authority, and

(*iii*) any significant increase in dose rate or concentration of radionuclide in the environment that may be attributed to the authorised practice, in accordance with reporting criteria established by the Authority ;

(*d*) establish and maintain a capability to conduct monitoring in an emergency in the event of unexpected increase in radiation level or in concentration of radionuclide in the environment due to an accident or other unusual event attributed to the authorised source or facility ;

(*e*) verify the adequacy of the assumptions made for the assessment of public exposure and the assessment for radiological environmental impacts ; and

(*f*) publish and make available on request, the result from source and environmental radiological monitoring programmes and assessments of dose from public exposure.

PART IX — RADIATION GENERATOR AND RADIOACTIVE SOURCE

General responsibility

57.—(1) The registrant and licensee, in cooperation with any other responsible party, shall ensure that the siting, location, design, construction, assembly, commissioning, operation, maintenance and decommissioning or closure of any facility or part of it is based on good engineering practice, which shall —

(*a*) take account of national and international standards ;

(*b*) be supported by managerial and organisational feature, to ensure protection and safety throughout the lifetime of the facility ;

(*c*) include adequate safety margins in the design, construction of the facility, and in operations involving the facility, to ensure reliable performance in normal operation, and take account of the necessary quality, redundancy and capability for inspection, with emphasis on preventing accidents, mitigating the consequences of the accident and also restricting any possible future exposure ; and

(*d*) take account of relevant developments concerning technical criteria, including the results of any relevant research on protection and safety and feedback of information on lessons learned from experience.

(2) The registrant and licensee shall make suitable arrangements with the supplier of the radiation generator and radioactive source, the Authority and any other relevant party to —

(*a*) obtain information on conditions of use and operating experience that may be important for protection and safety ; and

(*b*) provide feedback and information that is likely to have implications

for protection and safety for any other user and possibility for improvement in protection and safety for the radiation generator and radioactive source.

(3) The registrant and licensee in choosing a location to use or to store a radiation generator or radioactive source shall consider —

(*a*) factors that may affect the safe management of and control over the radiation generator or radioactive source ;

(*b*) factors that may affect occupational and public exposure due to the radiation generator or radioactive source ; and

(*c*) the feasibility of paragraphs (a) and (b) of this sub-regulation in engineering design.

(4) In selecting a site for a facility that may contain large amount of radioactive material and with potential for the release of significant amounts of radioactive material, the registrant and licensee shall take into account—

(*a*) features that may affect protection and safety ;

(*b*) features that may affect the integrity or functioning of the facility; and

(*c*) the feasibility of carrying out any off-site protective action where necessary.

(5) The registrant and licensee shall —

(*a*) maintain an inventory that includes records of the —

(*i*) location and description of each radiation generator or radioactive source for which they are responsible, and

(*ii*) activity, form and other description specified in regulation 29 (2) of these Regulations of each radioactive source for which they are responsible ;

(*b*) provide appropriate information from their inventory records of the radiation generator and radioactive source to the Authority bi-annually ; and

(*c*) keep the radiation generator and radioactive source under control to prevent loss, damage and any unauthorised person from carrying out any of the activities in regulation 8 of these Regulations, by ensuring that—

(*i*) control over a radiation generator or radioactive source is not relinquished except in compliance with the relevant requirements specified in the registration or licence,

(*ii*) the Authority is promptly provided with information regarding a radiation generator or radioactive source that is lost, missing or not under control,

(*iii*) a radiation generator or radioactive source is not transferred unless the recipient possesses the necessary authorisation, and

(*iv*) an inventory, of the radiation generator or radioactive source is checked periodically in line with sub-regulation (5)(b) of this regulation, to confirm that they are in their assigned locations and are under control.

Design of radiation generator and radioactive source

58.—(1) The registrant and licensee who are manufacturers or suppliers of radiation generator and radioactive source shall —

(*a*) supply a well designed, manufactured and constructed radiation generator or radioactive source and device that —

(*i*) provides for protection and safety in accordance with the requirements of these Regulations,

(*ii*) meets engineering, performance and functional specifications,

(*iii*) meets quality standards commensurate with the significance for protection and safety of systems and components, including software, and

(*iv*) provides clear displays, gauges and instructions on operating consoles in clear English language to users ;

(*b*) ensure that radiation generators and radioactive sources are tested to demonstrate compliance with the relevant specifications ;

(*c*) make available, in English or appropriate local language understandable to users, information on the proper installation and use of the radiation generator or radioactive source and its associated radiation risk, including performance specification, instruction for operating and maintenance ; and instructions for protection and safety ; and

(*d*) ensure that the protection provided by shielding and by any other protective device is optimized.

(2) The registrant and licensee shall ensure that sealed sources are categorized in accordance with the categorization scheme set out in the Second Schedule to these Regulations and in accordance with the requirements of the Authority.

(3) The manufacturer of a radioactive source or a device containing a radioactive source shall ensure that, the source and its container is marked with the symbol recommended by the International Organisation for Standardization (ISO) or Standard Organisation of Nigeria (SON).

(4) The registrant and licensee, in cooperation with the manufacturer, shall ensure that, where practicable, sealed sources are identifiable and traceable.

(5) The registrant and licensee shall ensure that —

(*a*) any radioactive source not in use is stored in an appropriate manner for protection and safety ;

(*b*) arrangement for safe management and control is made before any purchase, or acquisition of radiation generator and radioactive source, including adequate financial provisions for its management where appropriate, once it is disused or out of its useful life ; and

(*c*) details of the arrangements in paragraph (b) of this sub-regulation, including copies of any contractual arrangements is submitted to the Authority.

Supply and procurement of radioactive source

59.—(1) Licensee who supplies and distributes of radioactive source shall supply and distribute to authorized recipients.

(2) Licensees who supplies radioactive source or device incorporating radioactive sources shall provide the recipient with the relevant technical information to permit the safe management.

Part X — Import and Export of Category 1 and 2 Radioactive Source

Export of category 1 or 2 radioacitve source

60.—(1) Any registrant and licensee who intends to export Category 1 or 2 radioactive sources shall apply to the Authority for an export authorisation.

(2) The application for authorisation to export a source shall include a copy of the recipient authorisation to receive and possess the source to be exported that includes at least the following information —

(*a*) name of the recipient ;

(*b*) recipient location and legal address or principal place of business ;

(*c*) relevant radionuclides and radioactivity ;

(*d*) uses of the source, if appropriate ; and

(e) recipient authorisation expiration date (if any).

(3) Other information to be submitted as part of the application for authorisation to export may include, copies of relevant parts of any contractual agreements to re-import the source.

(4) After receiving authorisation to export the source, licensees shall ensure that —

(*a*) the export of the source is conducted in compliance with all applicable transport requirements of the International Atomic Energy Agency Regulations (IAEA) for the safe transport of radioactive material; and

(*b*) the importing State is notified in advance, at least seven days to the extent practicable, of each shipment with the following information in writing —

(*i*) the estimated date of export,

(*ii*) exporting facility,

(*iii*) recipient,

(*iv*) radionuclide and radioactivity,

(*v*) aggregate activity level, and

(*vi*) the number of radioactive sources and, if available, their unique identifiers ; and

(*c*) for category 1 sources, the notification described in this regulation shall be accompanied by a copy of the importing States consent to import the sources, if applicable.

Import of category 1 and 2 radioactive source

61.—(1) Any licensee who intends to import Category 1 or 2 radioactive source shall apply to the Authority for an import authorisation.

(2) The application for authorisation to import a source shall include the following information—

(*a*) name of the exporter ;

(*b*) exporter location and legal address or principal place of business ;

(*c*) name of the recipient ;

(*d*) recipient location and legal address or principal place of business ;

(*e*) relevant radionuclides and radioactivity ;

(*f*) uses of the sources, if appropriate ; and

(*g*) details of the arrangements for the safe management of the sources, including financial provisions where appropriate, where it is disused, including copies of any contractual agreements.

(3) The licensee shall, after receiving authorisation to import the sources, to the extent possible, ensure that the import of the sources is in compliance with all applicable transport —requirements of any extant regulation on transport of radioactive materials issued by the Authority and IAEA Regulations for the safe transport of radioactive material.

Part XI — Radioactive Waste and Discharge

Radioactive waste and discharge

62.—(1) Radioactive materials not in use shall be managed in compliance with the extant radioactive waste and spent nuclear fuel management regulations issued by the Authority.

(2) The registrant and licensee shall ensure that any radioactive waste and discharge to the environment is managed in accordance with the terms and conditions of the authorisation and any other relevant regulations.

(3) The registrant and licensee who intends to import a sealed source containing any radioactive material for any practice shall —

(*a*) require the supplier, to receive the source back within six months after its useful lifetime, as a condition of any contract for the purchase or transfer ; and

(*b*) submit to the Authority a copy of relevant parts of the purchase or transfer document and obtain its authorisation prior to entering the contract in force or accepting the source.

Radioactive waste

63. The registrant and licensee, in cooperation with the supplier shall —

(*a*) have the primary responsibility for the safe management of radioactive waste and shall take all necessary actions to ensure the safety of radioactive waste unless such responsibility has been transferred to another person or organisation with the approval of the Authority ;

(*b*) be responsible for on-site segregation, collection, characterization, and temporary storage of the radioactive waste arising from activities and discharge of exempt waste; and shall notify the Authority of all radioactive wastes that are not expected to decay to clearance levels within one year from the time of their generation ;

(*c*) ensure that there is separate processing of radioactive waste of different types, where necessary by differences in factors such as radionuclide content, half-life, activity concentration, volume, and physical and chemical properties, taking into account the available options for storage and disposal of radioactive waste, without precluding the mixing of radioactive waste for protection and safety ;

(*d*) ensure that activities for the predisposal management of and for the disposal of radioactive waste are conducted in accordance with the terms and condition of the authorisation ;

(*e*) not dispose of any radioactive waste unless the disposal facility designed and constructed specifically for this purpose is available and licensed by the Authority ;

(*f*) ensure that any radioactive waste generated is kept to the minimum practicable in terms of both activity and volume ;

(*g*) maintain an inventory of all radioactive waste that is generated, stored, transferred or disposed of ; and

(*h*) develop and implement a strategy for radioactive waste management which shall include appropriate evidence for optimization of protection and safety.

Discharge

64.—(1) The registrant and licensee, in cooperation with suppliers, in applying for an authorisation for discharges shall —

(*a*) determine the characteristics and activity of the material to be discharged, and the possible points and methods of discharge ;

(*b*) determine by an appropriate pre-operational study all significant exposure pathways by which discharged radionuclides may give rise to exposure of members of the public ;

(*c*) assess the doses to the representative person due to the planned discharges ;

(*d*) consider the environmental radiological impacts in an integrated manner with features of the system of protection and safety, as required by the Authority; and

(*e*) submit to the Authority the findings of paragraphs (a) - (d) of this regulation in accordance with, authorised limits on discharges and conditions for implementation as contained in any extant radioactive waste and spent nuclear fuel management regulations issued by the Authority.

(2) Registrants and licensees in relation to operational limits and conditions relating to public exposure outside the territory or other area under the jurisdiction or control of Nigeria shall—

(*a*) ensure that the assessment for radiological impacts includes the impacts outside the territory or other area under the jurisdiction or control of Nigeria ;

(*b*) comply with the Authority's established requirements for the control of discharges ; and

(*c*) arrange with the affected State the means for the exchange of information and consultations, with the Authority's approval.

(3) Registrants and licensees shall review and modify their discharge control measures, in agreement with the Authority, taking into account —

(*a*) operating experience ; and

(*b*) any changes in exposure pathways or in the characteristics of the representative person that may affect the assessment of doses due to the discharges.

Part XII — Decommissioning of Facility and Activity

Decommissioning of facility and activity

65.— (1) A graded approach shall be applied to the planning, conduct and completion of decommissioning.

(2) The registrant and licensee shall —

(*a*) prepare and maintain a decommissioning plan throughout the lifetime of the facility, unless otherwise approved by the Authority, in order to show that the decommissioning shall be accomplished safely to meet the defined end state and in this regard, the registrant and licensee shall—

(*i*)prepare and submit an initial decommissioning plan in support of the licence application for the construction of the facility or at the time of applying for an authorisation to operate the facility,

(*ii*) review and update periodically the initial decommissioning plan

during operation, as prescribed by the Authority, and

(*iii*) prepare without undue delay the initial decommissioning plan for facilities with none ;

(*b*) retain the necessary resources, expertise and knowledge for decommissioning and shall keep records and documentation relevant to the design, construction, operation and decommissioning process during transition from operation to decommissioning ;

(*c*) prepare and submit a final decommissioning plan to the Authority for approval prior to the conduct of decommissioning phase and shall ensure that the —

(*i*) facility is maintained in a safe configuration until approval of the decommissioning plan, and

(*ii*) decommissioning plan states the methodology and criteria to demonstrate that the proposed end state is achieved which includes unrestricted use for most medical, industrial and research facilities ; and

(*d*) ensure adequate financial provisions are available to decommissioning the facility including the management of the resulting waste when needed, and cases of premature shutdown in accordance with the national regulatory framework.

(3) The responsibility for the facility after shutdown may be transferred to a different organisation.

(4) Knowledge of the operational history of the facility shall be maintained and passed to the new operating organisation and for such transfer of responsibility, the new operating organisation shall have the necessary resources, expertise and knowledge.

(5) Financial assurance for decommissioning shall be included as part of the license application, and shall be priority to initiation of construction or operation of the facility.

(6) If financial assurance for decommissioning an existing facility is not obtained, appropriate funding provisions shall be put in place as soon as possible and financial assurance is priority to approval of license renewal or license extension.

(7) Decontamination and dismantling techniques shall be chosen such that the protection of workers, the public and the environment is optimized and the generation of waste is minimized.

(8) Prior to using any new or untried methods for decommissioning, it shall be demonstrated that the use of such methods is justified and is addressed within the optimization analysis supporting the decommissioning plan and such analyses shall be subject to review and approval by the Authority.

(9) On completion of decommissioning, the registrant and licensee shall demonstrate that the end state criteria as defined in the decommissioning plan and any additional regulatory requirements is met and in this regards the registrant and licensee shall take into consideration —

(*a*) the facilty shall be relieved of further responsibility after approval by the Authority ;

(*b*) the facility shall not be released from regulatory control, or its authorisation terminated, until the registrant and licensee has demonstrated that the end state in the decommissioning plan is reached and that any additional regulatory requirements is met ;

(*c*) on completion of decommissioning, appropriate records shall be retained as specified by the Authority ;

(*d*) a system shall be established to ensure that all records are maintained in accordance with the records retention requirements of the management system and the regulatory requirements ; and

(*e*) if waste is stored on the site, a revised or new, separate authorisation, including requirements for decommissioning, is required for the facility.

(10) The registrant and licensee shall prepare and submit to the Authority a final decommissioning report which shall document, in particular, the end state of the facility or site.

(11) If a facility cannot be released for unrestricted use, appropriate controls shall be maintained to ensure the protection of human health and the environment and the registrant and licensee shall —

(*a*) specify the controls which shall be subject to approval by the Authority and clear responsibility shall be assigned to implement and maintain the controls ; and

(*b*) ensure that in the case of restricted release of the facility or site from the regulatory control, appropriate arrangements for continuous controls are established to guarantee the protection of the workers, the public and the environment.

Part XIII — Transport of Radioactive Material

Transport of radioactive material

66. The registrant and licensee who transports radioactive sources, radioactive waste or any other radioactive material, either domestically or internationally shall comply with all applicable transport requirements of any extant regulations on transport of radioactive materials issued by the Authority.

Part XIV — Emergency Preparedness and Response

Responsibility of the licensee

67.—(1) If an authorised practice or source including radioactive waste within a practice has a potential for an emergency affecting either workers or

members of the public, the licensee shall prepare an emergency plan for the protection of people and the environment.

(2) The licensee shall as part of the emergency plan, include arrangements for the prompt identification of an emergency, and to determine the appropriate level of the emergency response and in relation to the arrangements for the emergency response at the scene by the licensee, the emergency plan shall include —

(*a*) provision for individual monitoring, area monitoring, and arrangements for medical treatment ; and

(*b*) arrangements to assess and mitigate any consequences of an emergency.

(3) The licensee shall be responsible for the implementation of their emergency plans and shall be prepared to take any necessary action for effective response.

(4) To prevent the occurrence of any condition that may lead to a loss of control over a source or to the escalation of such conditions, the licensee shall —

(*a*) develop, maintain and implement procedures to provide the means to prevent loss of control over the source and regain control over the source as necessary ;

(*b*) make available equipment, instrumentation and diagnostic aids that may be needed ; and

(*c*) train and periodically retrain personnel in the procedures to be followed and exercise the procedures.

Emergency preparedness and response

68. Each licensee responsible for sources, including radioactive waste, for which prompt intervention may be required, shall ensure that the responsibilities at the scene of the emergency is defined in the emergency plan and takes account of off-site responsibilities of response organisations appropriate for implementation of the emergency plan and such emergency plans shall —

(*a*) characterize the content, features and extent of a potential emergency taking into account the results of any hazard assessment and any lessons learned from operating experience and accidents that have occurred with sources of a similar type ;

(*b*) identify the various operating and other conditions of the source which may lead to the need for intervention ;

(*c*) describe the methods and instruments to assess the accident and its consequences on and off the site ;

(*d*) provide for protective and mitigation actions and assignment of

responsibilities to initiate and discharge such actions ;

(*e*) provide for rapid and continuous assessment of the accident as it proceeds and determine the need for protective actions ;

(*f*) allocate responsibilities to notify the relevant authorities and initiate intervention ;

(*g*) provide procedures, including communication arrangements to contact and obtain assistance from any relevant response organisation such as, civil defence, fire service, medical, police and other relevant organisations ;

(*h*) provide for training personnel involved in implementing emergency plans which shall be rehearsed at suitable intervals based on requirements defined in regulation 23 of these Regulations in conjunction with designated authorities ; and

(*i*) provide for periodic review and update of the plan.

Implement-ation of intervention

69.—(1) The Licensee shall ensure that the protective or remedial action to reduce or avert accidental exposures are undertaken when they are justified, taking into account health, social and economic factors.

(2) The form, scale and duration of any justified intervention shall be optimized to produce the maximum net benefit under the prevailing social and economic circumstances.

(3) The licensee shall promptly notify the Authority when an accidental situation which requires intervention arises or is expected to arise and shall keep the Authority informed of the —

(*a*) current situation and its expected evolution ;

(*b*) measures taken to terminate the accident and protect workers and members of the public ; and

(*c*) exposures that are incurred and that are expected to be incurred.

Protection of the emergency worker in an emergency exposure situation

70.—(1) The response organisation and employers responsible to ensure compliance with the requirements in sub-regulations (2) - (8) of this regulation shall be specified in the emergency plan.

(2) In an emergency exposure situation, the relevant requirements for occupational exposure in planned exposure situations shall be applied for emergency workers, in accordance with a graded approach, except as required in sub-regulation (3) of this regulation.

(3) Response organisations and employers shall ensure that no emergency worker is subject to exposure in excess of 50mSv other than —

(*a*) to save life or prevent serious injury ;

(*b*) when undertaking actions to avert a large collective dose ; or

(*c*) when undertaking actions to prevent severe deterministic effects and the development of catastrophic conditions that may significantly affect people and the environment.

(4) In the exceptional circumstances of sub-regulation (3) of this regulation, response organisations and employers shall make all reasonable efforts to keep doses to emergency workers below the values set out in Table 4.2 of the Fourth Schedule to these Regulations and emergency workers who undertake actions with doses that may approach or exceed the values set out in Table 4.2 of the Fourth Schedule to these Regulations shall act where the expected benefits to others clearly outweigh the risks to the emergency workers.

(5) Response organisations and employers shall ensure that emergency workers who undertake actions in which the doses received may exceed 50mSv —

(*a*) act voluntarily ;

(*b*) are clearly and comprehensively informed of the associated health risks in advance and are provided with available measures for protectionand safety ; and

(*c*) are to the extent possible, trained in the actions that they may be required to take.

(6) Any worker who undertakes work such as repairs to plant and buildings or activities for radioactive waste management or remedial work for the decontamination of the site and surrounding areas shall be subject to the relevant requirements for occupational exposure specified in these Regulations.

(7) Response organisations and employers shall take all reasonable steps to assess and record the doses received by emergency workers and information of the doses received and information concerning the associated health risks shall be communicated to the workers involved.

(8) Workers who receive doses in an emergency exposure situation shall not normally be precluded from incurring further occupational exposure, however, qualified medical advice shall be obtained before any further occupational exposure if a worker has received a dose exceeding 200 mSv or at the request of the worker.

Part XV — Existing Exposure Situations

Responsibilities for remediation of areas with residual radioactive material

71.—(1) The person or organisation responsible to plan, implement and verify of remedial actions shall, ensure that —

(*a*) a remedial action plan, supported by a safety assessment, is prepared and submitted to the Authority for approval ;

(*b*) the remedial action plan is aimed at the timely and progressive reduction of the radiation risks and possible eventual removal of restrictions on the use or access to the area ;

(*c*) any additional dose received by members of the public as a result of the remedial actions are justified on the basis of the resulting net benefit, including consideration of the consequent reduction of the annual dose ;

(*d*) in the choice of the optimized remediation option —

(*i*) radiological impacts on people and the environment are considered with non-radiological impacts on people and the environment, and with technical, societal and economic factors, and

(*ii*) the costs of the transport and management of radioactive waste, the radiation exposure of and health risks to the workers who manage the radioactive waste, and any subsequent public exposure associated with its disposal are all taken into account ;

(*e*) a mechanism for public information is in place and interested parties are involved to plan, implement and verify of the remedial actions, including any monitoring following remediation ;

(*f*) a monitoring programme is established and implemented ;

(*g*) a system to maintain adequate records which relates to the existing exposure situation and actions taken for protection and safety is in place; and

(*h*) procedures are in place to report to the Authority on any abnormal conditions relevant to protection and safety.

(2) The person or organisation responsible to carry out the remedial actions shall—

(*a*) ensure that the work, including management of the radioactive waste which arises, is conducted in accordance with the remedial action plan ;

(*b*) take responsibility for all aspects of protection and safety, including the conduct of a safety assessment ;

(*c*) monitor the area regularly during the remediation to verify levels of contamination, compliance with the requirements for radioactive waste management, and to enable the detection of any unexpected levels of radiation and the need for modification of the remedial action plan subject to the Authority's approval ;

(*d*) perform a radiological monitoring after completion of remedial actions to demonstrate that the end point conditions, as established in the remedial action plan, is met ; and

(*e*) prepare and retain a final remediation report and submit a copy to

the Authority.

(3) The person or organisation responsible for post-remediation control measures shall establish and maintain, for as long as required by the Authority, an appropriate programme, including any necessary provision for monitoring, to verify the long term effectiveness of the completed remedial actions for areas in which controls are required after remediation.

(4) The conditions which prevail after the completion of remedial actions, if the Authority has imposed no restrictions or controls, shall be considered as background conditions for any new facilities and activities or for habitation on the land.

Exposure in the workplace

72.—(1) The requirements in respect of public exposure stated in regulation 71 of these Regulations shall be applied for protection and safety for workers in existing exposure situations, other than in those specific situations identified in sub-regulations (2) - (6) of this regulation.

(2) The employer shall ensure that the exposure of workers who undertake remedial actions is controlled in accordance with the relevant requirements on occupational exposure in planned exposure situations as established in Part VI of these Regulations.

(3) The employer shall ensure that —

(*a*) activity concentrations of ^{222}Rn in workplaces are as low as reasonably achievable below the reference level established by the Authority, and protection is optimized ; and

(*b*) relevant requirements for occupational exposure in planned exposure situations as stated in Part II of these Regulations apply, where activity concentration of ^{222}Rn in workplaces remains above the reference level established by the Authority despite all reasonable efforts to reduce it.

(4) Where assessment of the exposure of aircrew due to cosmic radiation is necessary, the doses received by aircrew from occupational exposure to cosmic radiation shall not exceed the dose limits for occupational exposures given in the Third Schedule to these Regulations.

(5) In accordance to the framework established by the Authority for assessment of occupational exposure to cosmic radiation —

(*a*) where the doses of aircrew are likely to exceed the reference level, as established by the Authority, employers of aircrew shall —

(*i*) implement a personnel monitoring pursuant to regulation 32 of these Regulations,

(*ii*) assess and keep records of doses,

(*iii*) make records of doses available to aircrew, and

(*iv*) make records of doses available to the Authority ; and

(*b*) employers shall —

(*i*) inform female aircrew of the risk to the embryo or fetus due to exposure to cosmic radiation and of the need for early notification of pregnancy, and

(*ii*) apply the requirements of regulation 47(1)-(3) of these Regulations in respect of notification of pregnancy.

Part XVI — Offences and Penalties

Offences and penalties

73.—(1) A person who contravenes any of the provision of these Regulations commits an offence and is liable on conviction to the penalties stipulated under the Act and any other extant law or guidelines made pursuant to the Act.

(2) Notwithstanding the provisions of sub regulation (1) of this regulation, the Authority may impose penalties such as administrative fine, suspension, revocation of authorisation, sealing of facility or any combination of these.

Enforcement procedure

74. —(1) Any legal person responsible for notified or authorised practice or source within practice is subject to administrative fine for non-compliance with any applicable regulations and regulatory requirements commensurate with the nature of the infraction, in line with the Enforcement Policy of the Authority.

(2) Where the infractions referred to in subregulation (1) of this regulation persists, the violator shall be referred to the Nuclear Security Committee established by the Authority for appropriate sanction.

Appeal

75. Any person or organisation may appeal to the Governing Board of the Authority against any decision made by the Authority pursuant to these Regulations.

Part XVII — Miscellaneous Provisions

Applicability of any other regulations, requirement, and resolution of conflict

76.—(1) The requirement of these Regulations are in addition to, and not in place of, any other applicable national and local law and regulation.

(2) Nothing in these Regulations shall be construed as relieving employers, registrants or licensees from complying with applicable national and local laws and regulations governing safety.

(3) If a conflict exists between requirements contained in these Regulations and any other law or regulation, the Authority shall be notified of such conflict in order to initiate steps towards resolution.

(4) Nothing in these Regulations shall be construed to restrict any action that may be necessary for protection and safety.

Additional requirement

77. The employers, registrants and licensee shall comply with additional requirements imposed by the Authority by other regulations, order, or conditions of an authorisation, in addition to these Regulations, as deemed appropriate or necessary to —

(*a*) protect health ;

(*b*) protect the environment ; or

(*c*) minimize risk from radiation hazards.

Authorisation fees

78. The Authority may, with the approval of the Board, prescribe —

(*a*) the fees payable in respect of any licence ;

(*b*) the classification of licences ;

(*c*) the inspection, at any interval deemed necessary, of any irradiating device or radioactive materials and the fees to be paid in respect of such inspections ; and

(*d*) any other actions, including changes to fees charged, that may be deemed necessary in order to meet the needs of the time, to carry out the provisions of these Regulations.

Revocation of the Nigerian basic ionizing radiation Regulations, 2003

79. The Nigerian Basic Ionizing Radiation Regulations, 2003 is revoked.

Transitional and savings provisions

80. The revocation of the Nigerian Basic Ionizing Radiation Regulations, 2003 shall not invalidate or otherwise prejudicially affect anything done or purported to be done under the revoked Regulations.

Interpretation

81. In these Regulations —

"*the Act*" means the Nuclear Safety and Radiological Protection Act No. 19, 1995 ;

"*absorbed dose, D*" means the fundamental dosimetric quantity D, defined as —

$$\mathrm{D} = \frac{d\varepsilon}{dm}$$

where dε is the mean energy imparted by ionizing radiation to matter in a volume element and dm is the mass of matter in the volume element ;

"*accident*" means any unintended event, including operating errors, equipment failures and other mishaps, the consequences or potential consequences of which are not negligible from the point of view of protection and safety ;

"*activation*" means the process of inducing radioactivity in matter by irradiation of that matter ;

"*activity*" means the quantity A for an amount of radionuclide in a given energy state at a given time, defined as—

$$A(t) = \frac{dN}{dt}$$

where *dN* is the expectation value of the number of spontaneous nuclear transformations from the given energy state in the time interval d*t* ;

"*ambient dose equivalent, H*(d)*" means the dose equivalent that may be produced by the corresponding aligned and expanded field in the International Commission on Radiation Units and Measurements (ICRU) sphere at a depth *d* on the radius vector opposing the direction of the aligned field ;

"*annual dose*" means the dose from external exposure in a year plus the committed dose from intakes of radionuclides in the year ;

"*approval*" means the grant of consent by the Authority ;

"*area monitoring*" means a form of workplace monitoring in which an area is monitored by taking measurements at different points in the area ;

"*assessment*" means the process, and the result, of analyzing systematically and evaluating the hazards associated with sources and practices, and associated protection and safety measures ;

"*the Authority*" means the Nigerian Nuclear Regulatory Authority established under section 1 of the Act ;

"*authorised limit*" means a limit on a measurable quantity, established or formally accepted by a Authority ;

"*authorisation*" means the grant of written permission by an Authority or other governmental body for a person or organisation (the operator) to conduct specified activities ;

"*carers and comforters*" means persons who willingly and voluntarily help, other than in their occupation, in the care, support and comfort of patients undergoing radiological procedures for medical diagnosis or medical treatment ;

"*clearance*" means the removal of regulatory control by the Authority from radioactive material or radioactive objects within notified or authorised practices ;

"*clearance level*" means a value, established by the Authority and

expressed in terms of activity concentration, at or below which regulatory control may be removed from a source of radiation within a notified or authorised practice ;

"*committed dose*" means—

(*i*) the lifetime dose expected to result from an intake, and

(*ii*) committed equivalent dose or committed effective dose;

"*committed effective dose, E*(τ)" means the quantity $E(\tau)$, defined as —

$$E(\tau) = \sum_T w_T H_T(\tau)$$

Where $H_T(\tau)$ is the committed equivalent dose to tissue or organ T over the integration time τ elapsed after an intake of radioactive substances and w_T is the tissue weighting factor for tissue or organ T; when τ is not specified, it shall be 50 years for adults and the time to age 70 years for intakes by children ;

"*committed equivalent dose,* $\boldsymbol{H_T(\tau)}$" means the quantity $H_T(\tau)$ defined as —

$$\boldsymbol{H_T(\tau)} = \int_{t_0}^{t_0+\tau} H_T(t).dt$$

Where t_0 is the time of intake, $H_T(t)$ is the equivalent dose rate at time t in tissue or organ T and τ is the integration time elapsed after an intake of radioactive substances ; where τ is not specified, it shall be 50 years for adults and the time to age 70 years for intakes by children ;

"*confinement*" means prevention or control of releases of radioactive material to the environment in operation or accidents ;

"*constraint*" means a prospective and source related value of individual dose (dose constraint) or of individual risk (risk constraint) that is used in planned exposure situations as a parameter for the optimization of protection and safety for the source, and that serves as a boundary in defining the range of options in optimization ;

"*consumer product*" means a device or manufactured item into which radionuclides have deliberately been incorporated or produced by activation, or which generates ionizing radiation, and which may be sold or made available to members of the public without special surveillance or regulatory control after sale ;

"*containment*" means methods or physical structures designed to prevent or control the release and the dispersion of radioactive substances ;

"*contamination*" means radioactive substances on surfaces, or within solids, liquids or gases, including the human body, where their presence or the process giving rise to their presence in such places is unintended or undesirable ;

"*control*" means the function, power or means of directing, regulating or

restraining ;

"*controlled area*" means a defined area in which specific protection measures and safety provisions are or may be required to control exposures or prevent the spread of contamination in normal working conditions, and prevent or limit the extent of potential exposures ;

"*decontamination*" means the complete or partial removal of contamination by a deliberate physical, chemical or biological process ;

"*decorporation*" means the biological processes, facilitated by a chemical or biological agent, by which incorporated radionuclides are removed from the human body ;

"*defence in depth*" means a multilevel system of sequential, independent provisions for protection and safety that is commensurate with the likelihood and magnitude of potential exposures is applied to sources for which the Registrants and Licensees are authorised ;

"*deterministic effect*" means a radiation induced health effect for which generally a threshold level of dose exists above which the severity of the effect is greater for a higher dose ;

"*severe deterministic effect*" means a deterministic effect that is fatal or life threatening or results in a permanent injury that reduces quality of life ;

"*diagnostic reference level*" means a level used in medical imaging to indicate whether, in routine conditions, the dose to the patient or the amount of radiopharmaceuticals administered in a specified radiological procedure for medical imaging is unusually high or unusually low for the procedure ;

"*directional dose equivalent, $H'(d,\Omega)$*" means the dose equivalent produced by the corresponding expanded field in the International Commission on Radiation Units and Measurements (ICRU) sphere at a depth d on a radius in a specified direction Ω ;

"*disposal*" means emplacement of waste in an appropriate facility without the intention of retrieval ;

"*disused radioactive source*" means a source that is no longer used, and is not intended to be used, for the practice for which an authorisation has been granted, radioactive source —

(*i*) may still represent a significant radiological hazard,

(*ii*) differs from a spent source in that, it may still be capable of performing its function, and

(*iii*) may be disused because it is no longer needed ;

"*dose*" means a measure of the energy deposited by radiation in a target, including absorbed dose, committed equivalent dose, committed effective dose,

effective dose, equivalent dose or organ dose, as indicated by the context ;

"*dose assessment*" means assessment of the doses to an individual or group of people ;

"*dose constrain*" means a prospective and source related value of individual dose that is used in planned exposure situations as a parameter for the optimization of protection and safety for the source, and that serves as a boundary in defining the range of options in optimization ;

"*dose limit*" means the value of the effective dose or the equivalent dose to individuals in planned exposure situations that is not to be exceeded ;

"*effective dose, E*" means the quantity E, defined as a summation of the tissue or organ equivalent doses, each multiplied by the appropriate tissue weighting factor —

$$E = \sum_T w_T H_T$$

Where H_T is the equivalent dose in tissue or organ T and W_T is the tissue weighting factor for tissue or organ T. From the definition of equivalent dose, it follows that —

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

Where W_R is the radiation weighting factor for radiation type R and $D_{T,R}$ is the average absorbed dose in the tissue or organ T delivered by radiation type R ;

"*emergency*" means a non-routine situation that necessitates prompt action, primarily to mitigate a hazard or adverse consequences for human health and safety, quality of life, property or the environment and includes—

(*i*) nuclear or radiological emergencies and conventional emergencies such as fires, release of hazardous chemicals, storms or earthquakes, and

(*ii*) situations for which prompt action is warranted to mitigate the effects of a perceived hazard;

"*emergency action level (EAL)*" means a specific, predetermined, observable criterion used to detect, recognize and determine the emergency class ;

"*emergency arrangements*" means the integrated set of infrastructural elements necessary to provide the capability to perform a specified function or task required in response to a nuclear or radiological emergency, these elements may include authorities and responsibilities, organisation, coordination, personnel, plans, procedures, facilities, equipment or training ;

"*emergency class*" means a set of conditions that warrant a similar immediate emergency response ;

"*emergency exposure situation*" means a situation of exposure that arises as a result of an accident, a malicious act or other unexpected event,

and requires prompt action in order to avoid or reduce adverse consequences ;

"*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, it serves as the basis for the development of other plans, procedures and checklists ;

"*emergency preparedness*" means the capability to take actions that shall effectively mitigate the consequences of an emergency for human health and safety, quality of life, property and the environment ;

"*emergency procedures*" means a set of instructions which describes in detail the actions to be taken by response personnel in an emergency ;

"*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 provide a basis for the resumption of normal social and economic activity ;

"*emergency worker*" means a person with specified duties as a worker in response to an emergency ;

"*employer*" means a person or organisation with recognized responsibilities, commitments and duties towards a worker in the employment of the person or organisation by virtue of a mutually agreed relationship ;

"*environment*" means the conditions under which people, animals and plants live or develop and which sustain all life and development; especially such conditions as affected by human activities ;

"*environmental monitoring*" means the measurement of external dose rates due to sources in the environment or of radionuclide concentrations in environmental media ;

"*equilibrium equivalent concentration (EEC)*" means the activity concentration of Rn^{222} or Rn^{220} in radioactive equilibrium with its short lived progeny that may have the same potential alpha energy concentration as the actual (non-equilibrium) mixture ;

"*equilibrium factor*" means the ratio of the equilibrium equivalent activity concentration of ^{222}Rn to the actual ^{222}Rn activity concentration ;

"*equivalent dose, H_T*" means the quantity $H_{T,R}$, defined as —

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

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 —

$H_T = \sum_R w_R D_{T,R}$;

"*event*" in the context of the reporting and analysis of events, means an event is any occurrence unintended by the operator, including operating error, equipment failure or other mishap, and deliberate action on the part of others, the consequences or potential consequences of which are not negligible from the point of view of protection and safety ;

"*exemption*" means the determination by the Authority that a source or practice need not be subject to some or all aspects of regulatory control on the basis that the exposure and the potential exposure due to the source or practice are too small to warrant the application of those aspects or that it is the optimum option for protection irrespective of the actual level of the doses or risks ;

"*exemption level*" means a value, established by the Authority and expressed in terms of activity concentration, total activity, dose rate or radiation energy, at or below which a source of radiation need not be subject to some or all aspects of regulatory control ;

"*existing exposure situation*" means a situation of exposure that exists when a decision on the need for control needs to be taken ;

"*export*" means the activity of sending goods to another country ;

"*exposure*" means the state of being subject to irradiation ;

"*external exposure*" means exposure to radiation from a source outside the body ;

"*exposure pathway*" means a route by which radiation or radionuclides may reach humans and cause exposure ;

"*facilities and activities*" means a general term encompassing nuclear facilities, uses of all sources of ionizing radiation, all radioactive waste management activities, transport of radioactive material and any other practice or circumstances in which people may be subject to exposure to radiation from naturally occurring or artificial sources ;

"*feed*" means any single material or multiple materials, whether processed, semi-processed or raw, that is or are intended to be fed directly to food producing animal ;

"*food*" means any substance, whether processed, semi-processed or raw, that is intended for human consumption ;

"*graded approach*" for a system of control, such as a regulatory system or a safety system, means a process or method in which the stringency of the control measures and conditions to be applied is commensurate, to the extent practicable, with the likelihood and possible consequences of, and the level of risk associated with, a loss of control ;

"*hazard assessment*" means assessment of hazards associated with facilities, activities or sources within or beyond the borders of a State in order to identify —

(*i*) events and the associated areas for which protective actions may be required within the State, and

(*ii*)the actions that may be effective to mitigate the consequences of such events ;

"*health authority*" means a governmental authority at the national, regional or local level that is responsible for policies and interventions, including the development of standards and provision of guidance, to maintain or improve human health which has the legal power to enforce such policies and interventions ;

"*health professional*" means an individual who is formally recognized through appropriate national procedures to practice a profession related to health such as medicine, dentistry, chiropractic, podiatry, nursing, medical physics, medical radiation technology, radiopharmacy or occupational health ;

"*health screening programme*" means a programme in which health tests or medical examinations are performed for early detection of disease ;

"*health surveillance*" has the same meaning with workers' health surveillance ;

"*hereditary effect*" means a radiation induced health effect that occurs in a descendant of the exposed person ;

"*International Commission on Radiation Units sphere (ICRU sphere)*" is used as a reference phantom to define dose equivalent quantities, a sphere of 30 cm diameter made of tissue equivalent material with a density of 1 g/ cm3 and a mass composition of 76.2% oxygen, 11.1% carbon, 10.1% hydrogen and 2.6% nitrogen ;

"*import*" means the activity or business of bringing goods into a country from another country ;

"*incident*" means any unintended event, including operating errors, equipment failures, initiating events, accident precursors, near misses or other mishaps, or unauthorised act, malicious or non-malicious, the consequences or potential consequences of which are not negligible from the point of view of protection and safety ;

"*individual monitoring*" means monitoring using measurements by equipment worn by individuals, or measurements of quantities of radioactive substances in or on, or taken into, the bodies of individuals, or measurements of quantities of radioactive substances excreted from the body by individuals; "inspection imaging device" means an imaging device designed specifically for imaging persons or cargo conveyances to detect concealed objects on or within the human body, cargo or a vehicle ;

"*intake*" means the act or process of taking radionuclides into the body

by inhalation or ingestion or through the skin and the activity of a radionuclide taken into the body in a given time period or as a result of a given event;

"*interested party*" means a person or company with a concern or interest in the activities and performance of an organisation, business, system or as may be applicable ;

"*internal exposure*" means exposure to radiation from a source within the body ;

"*investigation level*" means the value of a quantity such as effective dose, intake or contamination per unit area or volume at or above which an investigation may be conducted ;

"*ionizing radiation*" for the purposes of radiation protection, means radiation capable of producing ion pairs in any biological material ;

"*justification*" means the process of determining for —

(*i*) a planned exposure situation whether a practice is, overall, beneficial ; that is whether the expected benefits to individuals and to society from introducing or continuing the practice outweigh the harm including radiation detriment, resulting from the practice, and

(*ii*) an emergency exposure situation or an existing exposure situation whether a proposed protective action or remedial action is likely, overall, to be beneficial; which is whether the expected benefits to individuals and to society, including the reduction in radiation detriment, from introducing or continuing the protective action or remedial action outweighs the cost of such action and any harm or damage caused by the action ;

"*kerma, K*" means the quantity K, defined as —

$$K = \frac{dE_{tr}}{dm}$$

Where d*E*tr is the sum of the initial kinetic energies of all charged ionizing particles liberated by uncharged ionizing particles in a material of mass d*m* ;

"*legal person*" means any person , organisation, corporation, partnership, firm, association, trust, public or private estate, or other persons designated in accordance with national legislation who or which has responsibility as authority for any action with implications for protection and safety ;

"*licence*" means a legal document issued by the Authority which grants authorisation to perform specified activities relating to a facility or activity ;

"licensee" means the holder of a current licence, a person or organisation with overall responsibility for a facility or activity ;

"*limit*" means the value of a quantity used in certain specified activities or circumstances that shall not be exceeded ;

"*linear-no threshold (LNT) hypothesis*" means the hypothesis that the risk of stochastic effects is directly proportional to the dose for all levels of dose and dose rate below the levels at which deterministic effects occur ;

"*lung absorption type*" means a classification used to distinguish between the different rates at which inhaled radionuclides are transferred from the respiratory tract to the blood ;

"*management system*" means a set of interrelated or interacting elements (system) to establish policies and objectives and enable the objectives to be achieved in an efficient and effective manner ;

"*medical exposure*" means exposure incurred by patients for medical or dental diagnosis or treatment ; by carers and comforters ; and by volunteers subject to exposure as part of a programme of biomedical research ;

"*medical physicist*" means a health professional with specialist education and training in the concepts and techniques of applying physics in medicine and competent to practice independently in one or more of the subfields (specialties) of medical physics ;

"*medical radiation facility*" means a medical facility in which radiological procedures are performed ;

"*medical radiation technologist*" means a health professional, with specialist education and training in medical radiation technology, competent to perform radiological procedures, on delegation from the radiological medical practitioner, in one or more of the specialties of medical radiation technology ;

"*medical radiological equipment*" means radiological equipment used in medical radiation facilities to perform radiological procedures that either delivers an exposure to an individual or directly controls or influences the extent of such exposure, the term applies to —

(*i*) radiation generators, such as X ray machines or medical linear accelerators,

(*ii*) devices which contains sealed sources, such as ^{60}Co teletherapy units,

(*iii*) devices used in medical imaging, to capture images, such as gamma cameras, image intensifiers or flat panel detectors, and

(*iv*) hybrid systems such as positron emission tomography-computed tomography scanners ;

"*member of the public*" for the purposes of protection and safety, in a general sense, means any individual in the population except when subject to occupational exposure or medical exposure and for the purpose of verifying compliance with the annual dose limit for public exposure, means the representative person ;

"*monitoring*" means the measurement of dose, dose rate or activity for reasons relating to the assessment or control of exposure to radiation or exposure due to radioactive substances, and the interpretation of the results ;

"*natural background*" means the doses, dose rates or activity concentrations associated with natural sources, or any other sources in the environment that are not amenable to control ;

"*natural source*" means a naturally occurring source of radiation, such as the, sun and stars (sources of cosmic radiation) and rocks and soil (terrestrial sources of radiation), or any other material whose radioactivity is for all intents and purposes due only to radionuclides of natural origin, such as products or residues from the processing of minerals; but excluding radioactive material for use in a nuclear installation and radioactive waste generated in a nuclear installation ;

"*notification*" means a document submitted to the Authority by a person or organisation to notify an intention to carry out a practice or other use of a source ;

"*nuclear fuel cycle*" means all operations associated with the production of nuclear energy ;

"*nuclear installation*" means any nuclear facility subject to authorisation that is part of the nuclear fuel cycle, except facilities for the mining or processing of uranium ores or thorium ores and radioactive waste disposal facilities ;

"*nuclear or radiological emergency*" means an emergency in which there is, or is perceived to be, a hazard due—

(*i*) to the energy resulting from a nuclear chain reaction,

(*ii*) from the decay of the products of a chain reaction, or

(*iii*) from radiation exposure ;

"*nuclear safety*" means the achievement of proper operating conditions, prevention of accidents or mitigation of accident consequences, which result in protection of workers, the public and the environment from undue radiation hazards ;

"*nuclear security*" means the prevention of, detection of, and response to, criminal or intentional unauthorised acts involving or directed at nuclear material, radioactive material, associated facilities, or associated activities ;

"*occupancy factor*" means a typical fraction of the time for which a location is occupied by an individual or group ;

"*occupational exposure*" means exposure of workers incurred in the course of their work ;

"*operator*" means any person or organization that applies for authorization, authorised or responsible for safety when undertaking activities or in relation to any nuclear facilities or sources of ionizing radiation ;

"*operational intervention level (OIL)*" means set level of a measurable quantity that corresponds to a generic criterion ;

"*operational limits and conditions*" means a set of rules which provides parameter limits, the functional capability and the performance levels of equipment and personnel approved by the Authority for safe operation of an authorised facility ;

"*optimization of protection and safety*" means the process to determine what level of protection and safety may result in the magnitude of individual doses, the number of individuals (workers and members of the public) subject to exposure and the likelihood of exposure being "as low as reasonably achievable, economic and social factors being taken into account" (ALARA); for medical exposures of patients, the optimization of protection and safety is the management of the radiation dose to the patient commensurate with the medical purpose ;

"*orphan source*" means a radioactive source which is not under regulatory control, either because it has never been under regulatory control or because it has been abandoned, lost, misplaced, stolen or otherwise transferred without proper authorisation ;

"*outside worker*" means any exposed worker who is not employed by the undertaken responsible for the supervised and controlled areas, but performs activities in those areas including apprehentices, students, trainees and cleaners ;

"*personal dose equivalent, Hp(d)*" means the dose equivalent in soft tissue below a specified point on the body at an appropriate depth d ;

"*planned exposure situation*" means the situation of exposure that arises from the planned operation of a source or from a planned activity that results in an exposure due to a source ;

"*planning target volume*" a geometrical concept used in radiation therapy to plan medical treatment with consideration of the net effect of movements of the patient and of the tissues to be irradiated, variations in size and shape of the tissues, and variations in beam geometry such as beam size and beam direction ;

"*potential exposure*" means prospectively considered exposure that is not expected to be delivered with certainty but that may result from an anticipated operational occurrence or accident at a source or owing to an event or sequence of events of a probabilistic nature, including equipment failures and operating errors ;

"*practice*" means any human activity that introduces additional sources of exposure or additional exposure pathways, 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 ;

"*principal parties*" means the person with the main responsibilities to apply these Regulations and includes registrants, licensees, and employers ;

"*projected dose*" means the dose that may be expected to be received if planned protective actions is not taken ;

"*protection (against radiation)*" means the protection of people from harmful effects of exposure to ionizing radiation, and the means to achieve it ;

"*protection and safety*" means the protection of people against exposure to ionizing radiation or exposure due to radioactive material and the safety of sources, including the means to achieve this, and the means to prevent accidents and mitigate the consequences of accidents if it occurs ;

"*protective action*" means an action to avoid or reduce doses that may otherwise be received in an emergency exposure situation or an existing exposure situation ;

"*protective task*" means the generation of at least the protective actions necessary to ensure that the safety task required by a given initiating event is accomplished ;

"*public exposure*" means exposure incurred by members of the public due to sources in planned exposure situations, emergency exposure situations and existing exposure situations, excluding any occupational exposure or medical exposure ;

"*qualified expert*" means an individual who, by virtue of certification by appropriate boards or societies, professional licence or academic qualifications and experience, is duly recognised to possess the expertise in a relevant field of specialization, such as medical physics, radiation protection, occupational health, fire safety, quality management or any relevant engineering or safety specialty ;

"*quality assurance*" means the function of a management system that provides confidence that specified requirements shall be fulfilled ;

"*radiation*" means energy that moves from one place to another in a form that may be described as waves or particles, it refers to ionizing radiation unless otherwise stated ;

"*radiation detriment*" means the total harm that shall eventually be incurred by a group that is subject to exposure and by its descendants as a result of the group's exposure to radiation from a source ;

"*radiation generator*" means a device capable of generating ionizing radiation, such as X rays, neutrons, electrons or other charged particles, that may be used for scientific, industrial or medical purposes ;

"*radiation protection*" has the same meaning with protection ;

"*radiation safety officer*" means a person technically competent in radiation protection matters relevant for a given type of practice who is designated by the registrant, licensee or employer to oversee the application of regulatory requirements ;

"*radiation risks*" means detrimental health effects of exposure to radiation including the likelihood of such effects occurring, and any other safety related risks including those to the environment, that may arise as a direct consequence of —

(*i*) exposure to radiation,

(*ii*) the presence of radioactive material including radioactive waste or its release to the environment, and

(*iii*) a loss of control over a nuclear reactor core, nuclear chain reaction, radioactive source or any other source of radiation ;

"*radiation weighting factor*, w_R" means a number by which the absorbed dose in a tissue or organ is multiplied to reflect the relative biological effectiveness of the radiation in inducing stochastic effects at low doses, the result being the equivalent dose ;

"*radioactive (adjective)*" means —

(*i*) exhibiting radioactivity ; which emits or relates to the emission of ionizing radiation or particles, and

(*ii*) designated in national law or by the Authority as being subject to regulatory control because of its radioactivity ;

"*radioactive discharges*" means radioactive substances which arises from sources within facilities and activities which are discharged as gases, aerosols, liquids or solids to the environment, generally with the purpose of dilution and dispersion ;

"*radioactive material*" means material designated in national law or by a Authority as being subject to regulatory control because of its radioactivity; "radioactive source" means a source which contains radioactive material that is used as a source of radiation, it is radiation generator, or a radioactive source or other radioactive materials outside the nuclear fuel cycle of research and power reactors and includes—

(*i*) radiation generator which means a device capable of generating ionizing radiation, such as X rays, neutrons, electrons or other charged

particles, that may be used for scientific, industrial or medical purposes,

(*ii*) radioactive material which means material designated in national law or by a regulatory body as being subject to regulatory control because of its radioactivity,

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

(*iv*) disused radioactive source which means radioactive source which is no longer used, and is not intended to be used, for the practice for which an authorisation has been granted,

(*v*) orphan radioactive source means a radioactive source which is not under regulatory control because it has never been under regulatory control, or because it has been abandoned, lost, misplaced, stolen, or transferred without proper authorisation,

(*vi*) spent radioactive source means a radioactive source that is no longer suitable for its intended purpose as a result of radioactive decay, and

(*vii*) vulnerable radioactive source which means a radioactive source for which the control is inadequate to provide assurance of long term safety and security, such that it may relatively easily be acquired by unauthorised persons or may relatively easily be orphaned;

"*radioactive substance*" means any substance, which contains one or more radionuclides whose activity cannot be disregarded for the purposes of radiation protection ;

"*radioactive waste*" for legal and regulatory purposes, means material for which no further use is foreseen that contains, or is contaminated with, radionuclides at activity concentrations greater than clearance levels as established by the Authority ;

"*radioactive waste management*" means all administrative and operational activities involved in the handling, pretreatment, treatment, conditioning, transport, storage and disposal of radioactive waste ;

"*radioactive waste management facility*" means a facility specifically designed to handle, treat, condition, store or permanently dispose of radioactive waste ;

"*radiological medical practitioner*" means a health professional with specialist education and training in the medical uses of radiation, who is competent to perform independently or to oversee radiological procedures in a given specialty ;

"*radiological procedure*" means a medical imaging procedure or therapeutic procedure that involves ionizing radiation, such as a procedure in diagnostic radiology, nuclear medicine or radiation therapy, or a planning procedure, image guided interventional procedure or other interventional procedure involving radiation, delivered by a radiation generator, a device containing a sealed source or an unsealed source, or by means of a radiopharmaceutical administered to a patient ;

"*radionuclides of natural origin*" means radionuclides that occur naturally on earth in significant quantities ;

"*radiopharmacist*" means a health professional, with specialist education and training in radiopharmacy, who is competent to prepare and dispense radiopharmaceuticals used for the purposes of medical diagnosis and radionuclide therapy ;

"*radon*" means any combination of isotopes of the element radon ;

"*radon progeny*" means the short lived radioactive decay products of ^{220}Rn and of ^{222}Rn ;

"*reference level*" for an emergency exposure situation or an existing exposure situation, means the level of dose, risk or activity concentration above which it is not appropriate to plan to allow exposures to occur and below which optimization of protection and safety shall be implemented ;

"*referring medical practitioner*" means a health professional who, in accordance with national requirements, may refer individuals to a radiological medical practitioner for medical exposure ;

"*registrant*" means the holder of a current registration ;

"*registration*" means a form of authorisation for practices of low or moderate risks whereby the person or organisation responsible for the practice has, as appropriate, prepared and submitted a safety assessment of the facilities and equipment to the Authority, the practice or use is authorised with conditions or limitations as appropriate ;

"*regulatory control*" means any form of control or regulation applied to facilities and activities by a Authority for reasons relating to nuclear safety and radiation protection or to nuclear security ;

"*relative biological effectiveness (RBE)*" means a relative measure of the effectiveness of different radiation types at inducing a specified health effect, expressed as the inverse ratio of the absorbed doses of two different radiation types that may produce the same degree of a defined biological end point ;

"*relative biological effectiveness (RBE) weighted absorbed dose, AD_T*" means the quantity $AD_{T,R}$, defined as —

$$\mathrm{AD}_{\mathrm{T,R}} = D_{\mathrm{T,R}} \times \mathrm{RBE}_{\mathrm{T,R}}$$

Where $D_{T,R}$ is the absorbed dose delivered by radiation of type R averaged over a tissue or organ T and $RBE_{T,R}$ is the relative biological effectiveness for radiation of type R in the production of severe deterministic effects in a tissue or organ T and where the radiation field is composed of different radiation types with different values of $RBE_{T,R}$, the RBE weighted absorbed dose is given by —

$$AD_T = \sum_R D_{T,R} \; X \; RBE_{T,R};$$

"*remedial action*" means the removal of a source or the reduction of its magnitude in terms of activity or amount to prevent or reduce exposures that may otherwise occur in an existing exposure situation ;

"*remediation*" means any measures that may be carried out to reduce the radiation exposure due to existing contamination of land areas through actions applied to the contamination itself (the source) or to the exposure pathways to humans ;

"*representative person*" means an individual receiving a dose that is representative of the doses to the more highly exposed individuals in the population ;

"*residual dose*" means the dose expected to be incurred after protective actions is terminated or after a decision is taken not to take protective actions ;

"response organisation" means an organisation designated or otherwise recognized by a State as being responsible for managing or implementing any aspect of an emergency response ;

"*risk*" means a multiattribute quantity expressing hazard, danger or chance of harmful or injurious consequences associated with exposures or potential exposure; it relates to quantities such as the probability that specific deleterious consequences may arise and the magnitude and character of such consequences ;

"*risk constraint*" means a prospective and source related value of individual dose (dose constraint) or of individual risk (risk constraint) that is used in planned exposure situations as a parameter for the optimization of protection and safety for the source, and that serves as a boundary in defining the range of options in optimization ;

"*safety*" means the protection of people and the environment against radiation risks, and the safety of facilities and activities that give rise to radiation risks ;

"*safety assessment*" means assessment of all aspects of a practice that are relevant to protection and safety; for an authorised facility, this includes siting, design and operation of the facility ;

"safety culture" means the assembly of characteristics and attitudes in organisations and individuals which establishes that, as an overriding priority, protection and safety issues receive the attention warranted by their significance ;

"safety measure" means any action that may be taken, condition that may be applied or procedure that may be followed to fulfill the requirements of safety requirements ;

"*scenario*" means a postulated or assumed set of conditions or events ;

"*security*" means the achievement of proper operating conditions, prevention of accidents or mitigation of accident consequences, which result in protection of workers, the public and the environment from undue radiation hazards ;

"*somatic effect*" means a radiation induced health effect that occurs in the exposed person ;

"*source*" means anything that may cause radiation exposure such as by emitting ionizing radiation or releasing radioactive substances or radioactive material, and may be treated as a single entity for the purpose of protection and safety ;

"*dangerous source*" means a source that may, if not under control, give rise to exposure sufficient to cause severe deterministic effects ; this categorization is used to determine the need for emergency arrangements and is not to be confused with categorizations of sources for other purposes ;

"*radioactive source*" means a source which contains radioactive material that is used as a source of radiation ;

"*sealed source*" means a radioactive source in which the radioactive material is —

(*i*) permanently sealed in a capsule, or

(*ii*) closely bonded,

and in a solid form ;

"*spent source*" means a source that is no longer suitable for its intended purpose as a result of radioactive decay ;

"*unsealed source*" means a radioactive source in which the radioactive material is neither —

(*i*) permanently sealed in a capsule, or

(*ii*) closely bonded,

and in a solid form ;

"*source monitoring*" means the measurement of activity in radioactive material being released to the environment or of external dose rates due to sources within a facility or activity ;

"*spent fuel*" means nuclear fuel removed from a reactor following irradiation that is no longer usable in its present form because of depletion of fissile material, poison buildup or radiation damage ;

"*standards dosimetry laboratory*" means a laboratory, designated by the relevant national authority, that possesses certification or accreditation necessary to develop, maintain or improve primary or secondary standards for radiation dosimetry ;

"*stochastic effect*" 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 ;

"*storage*" means the holding of radioactive sources, radioactive material, spent fuel or radioactive waste in a facility that provides for their or its containment, with the intention of retrieval ;

"*structures, systems and components*" means a general term encompassing all of the elements (items) of a facility or activity that contribute to protection and safety, except human factors ;

"*supervised area*" means a defined area not designated as a controlled area but for which occupational exposure conditions are kept under review, even though specific protection measures or safety provisions are not normally needed ;

"*supplier (of a source)*" means any person or organisation to whom a registrant or licensee assigns duties, totally or partially, in relation to the design, manufacture, production or construction of a source ;

"*tissue weighting factor, wT*" means multiplier of the equivalent dose to a tissue or organ used for purposes of radiation protection to account for the different sensitivities of different tissues or organs to the induction of stochastic effects of radiation ;

"*transboundary exposure*" means exposure of members of the public in one State due to radioactive material released via accidents, discharges or waste disposal in another State ;

"*transport*" means the deliberate physical movement of radioactive material, other than that forming part of the means of propulsion, from one place to another ;

"*worker*" means any person who works, whether full time, part time or temporarily, for an employer and who has recognised rights and duties in relation to occupational radiation protection ;

"*workers health surveillance*" means medical supervision intended to ensure the initial and continuing fitness of workers for their intended tasks ; and

"*workplace monitoring*" means monitoring using measurements made in the working environment.

82. These Regulations may be cited as the Nigeria Basic Ionizing Radiation Regulations, 2023. Citation

SCHEDULES

First Schedule

[regulations 4(9)(c) and 12(1)]

EXEMPTION AND CLEARANCE

1. *Criteria for exemption*

(1) The general criteria for exemption of a practice or a source within a practice from the requirements of these Regulations are where —

(*a*) radiation risks which arises from the practice or from a source within the practice are sufficiently low as not to warrant regulatory control, with no appreciable likelihood of situations arising that may lead to a failure to meet the general criterion for exemption ; or

(*b*) regulatory control of the practice or the source shall yield no net benefit, in that reasonable measures for regulatory control shall not achieve a worthwhile return in terms of reduction of individual doses or of health risks.

(2) A practice or a source within a practice may be exempted without further consideration from the requirements of these Regulations under the terms of sub-paragraph (1)(a) of this paragraph where under all reasonably foreseeable circumstances the effective dose expected to be incurred by any individual, normally evaluated on the basis of a safety assessment, owing to the exempt practice or the exempt source within the practice is of the order of 10μSv or less in a year.

(3) Where low probability scenarios is taken into consideration in a practice within a practice referred to in sub-paragraph (2) of this paragraph, a different criterion may be used, such that the effective dose expected to be incurred by any individual for such low probability scenarios shall not exceed 1mSv in a year.

(4) Under the criteria set out in sub-paragraphs (1), (2) and (3) of this paragraph, the following sources within justified practices are exempted without further consideration from the requirements of these Regulations, including requirements for notification, registration or licensing —

(*a*)material in a moderate amount for which either the total activity of an individual radionuclide present on the premises at one time or the activity concentration as used in the practice does not exceed the applicable exemption level given in Table 1.1 of this Schedule ;

(*b*) material in bulk amount for which the activity concentration of a given radionuclide of artificial origin used in the practice does not exceed the relevant value given in Table 1.2 of this Schedule ;

(*c*) radiation generators of a type approved by the Authority, or in the form of an electronic tube, such as a cathode ray tube for the display of visual images ; and

(*d*) radiation generators referred to in sub-paragraph (4)(c) of this paragraph shall not —

(*i*) in normal operating conditions cause an ambient dose equivalent rate or a directional dose equivalent rate, as appropriate, exceeding 1μSv/h at a distance of 0.1 m from any accessible surface of the equipment, or

(*ii*) generate energy of the radiation which is greater than 5keV.

(5) For radionuclides of natural origin, exemption of bulk amounts of material shall be considered on a case by case basis by using a dose criterion of the order of 1 mSv in a year, commensurate with typical doses due to natural background levels of radiation.

(6) Exemptions may be granted subject to conditions specified by the Authority, such as conditions relating to the physical or chemical form of the radioactive material, and to its use or the means of its disposal, in particular, such an exemption may be granted for equipment containing radioactive material that is not otherwise exempted without further consideration from the requirements of these Regulations under sub-paragraph (4)(a) of this paragraph where —

(*a*) the equipment containing radioactive material is of a type approved by the Authority ;

(*b*) the radioactive material is in the form of —

(*i*) a sealed source that effectively prevents any contact with the radioactive material and prevents its leakage, or

(*ii*) an unsealed source in a small amount such as sources used for radioimmunoassay ;

(*c*) in normal operating conditions, the equipment does not cause an ambient dose equivalent rate or a directional dose equivalent rate, as appropriate, exceeding 1 μSv/h at a distance of 0.1 m from any accessible surface of the equipment ; and

(*d*) necessary conditions for disposal of the equipment conforms with the provisions of the regulations on radioactive waste and spent nuclear fuel management.

(7) For exemption of radioactive material containing more than one radionuclide, on the basis of the levels given in Tables 1.1 and 1.2 of this Schedule, the condition for exemption from some or all of the requirements of

these Regulations is that the sum of the individual radionuclide activities or activity concentrations, as appropriate, is less than the derived exemption level for the mixture (X_m), determined as follows —

$$Xm = \frac{1}{\sum_{n} \frac{f(i)}{X(i)}} \qquad (1.1)$$

Where f(i) is the fraction of activity or activity concentration, as appropriate, of radionuclide i in the mixture ;

X(i) is the applicable level for radionuclide i as given in Table 1.1 or Table 1.2 of this Schedule and n is the number of radionuclides present.

(8) Radioactive material arising from authorized discharges is exempt from any requirements for notification, registration or licensing unless otherwise specified by the Authority.

(9) The values provided in Tables 1.1 and 1.2 of this Schedule shall not be applied to the control of discharges or to the control of residual radioactive material in the environment.

2. *Criteria for clearance*

(1) The general criteria for clearance are where —

(*a*) radiation risks arising from the cleared material are sufficiently low as not to warrant regulatory control, and there is no appreciable likelihood of occurrence for scenarios that may lead to a failure to meet the general criterion for clearance ; or

(*b*) continued regulatory control of the material shall yield no net benefit, in that reasonable control measures shall not achieve a worthwhile return in terms of reduction of individual doses or reduction of health risks.

(2) Material may be cleared without further consideration under the terms of sub-paragraph (1)(a) of this paragraph provided that in reasonably foreseeable circumstances the effective dose expected to be incurred by any individual owing to the cleared material is of the order of 10 μSv or less in a year.

(3) Where low probability scenarios is taken into consideration with regards to materials referred to under sub-paragraph (2) of this paragraph, a different criterion may be used, such that the effective dose expected to be incurred by any individual for such low probability scenarios shall not exceed 1 mSv in a year.

(4) Radioactive material within a notified practice or an authorised practice may be cleared without further consideration where —

(*a*) the activity concentration of an individual radionuclide of artificial origin in solid form does not exceed the relevant level given in Table 1.2 of this Schedule ;

(*b*) the activity concentrations of radionuclides of natural origin does not exceed the relevant level given in Table 1.3 of this Schedule ; or

(*c*) for radionuclides of natural origin in residues that may be recycled into construction materials, or the disposal of which is liable to cause the contamination of drinking water supplies, the activity concentration in the residues does not exceed specific values derived so as to meet a dose criterion of the order of 1 mSv in a year, which is commensurate with typical doses due to natural background levels of radiation.

(5) Clearance may be granted by the Authority for specific situations, on the basis of the criteria of Tables 1.1 and 1.2 of these Schedule, with account taken of the physical or chemical form of the radioactive material, and its use or the means of its disposal and such clearance levels may be specified in terms of activity concentration per unit mass or activity concentration per unit surface area.

(6) For clearance of radioactive material containing more than one radionuclide of artificial origin, on the basis of the levels given in Table 1.2 of this Schedule, the condition for clearance is that the sum of the activity concentrations for individual radionuclides is less than the derived clearance level for the mixture (Xm), determined as follows —

$$Xm = \frac{1}{\sum_{1=1}^{n} \frac{f(i)}{X(i)}} \qquad (1.2)$$

Where $f(i)$ is the fraction of activity concentration of radionuclide i in the mixture ; or

$X(i)$ is the applicable level for radionuclide i as given in Table 1.2 ;

and n is the number of radionuclides present.

(7) For clearance of bulk quantities of material containing a mixture of radionuclides of natural origin and radionuclides of artificial origin, the conditions given in sub-paragraphs (4)(b) and (6) of this paragraph shall be satisfied.

TABLE 1.1 LEVELS FOR EXEMPTION OF MODERATE AMOUNTS OF MATERIAL WITHOUT FURTHER CONSIDERATION : EXEMPT ACTIVITY CONCENTRATIONS AND EXEMPT ACTIVITIES OF RADIONUCLIDES

Radionuclide	Activity concentration (Bq/g)	Activity (Bq)	Radionuclide	Activity concentration (Bq/g)	Activity (Bq)
H-3	1×10^6	1×10^9	Sc-45	1×10^2	1×10^7
Be-7	1×10^3	1×10^7	Sc-46	1×10^1	1×10^6
Be-10	1×10^4	1×10^6	Sc-47	1×10^2	1×10^6
C-11	1×10^1	1×10^6	Sc-48	1×10^1	1×10^5
C-14	1×10^4	1×10^7	Sc-49	1×10^3	1×10^5
N-13	1×10^2	1×10^9	Ti-44	1×10^1	1×10^5
Ne-19	1×10^2	1×10^9	Ti-45	1×10^1	1×10^6
O-15	1×10^2	1×10^9	V-47	1×10^1	1×10^5
F-18	1×10^1	1×10^6	V-48	1×10^1	1×10^5
Na-22	1×10^1	1×10^6	V-49	1×10^4	1×10^7
Na-24	1×10^1	1×10^5	Cr-48	1×10^2	1×10^6
Mg-28	1×10^1	1×10^5	Cr-49	1×10^1	1×10^6
Al-26	1×10^1	1×10^5	Cr-51	1×10^3	1×10^7
Si-31	1×10^3	1×10^6	Mn-51	1×10^1	1×10^5
Si-32	1×10^3	1×10^6	Mn-52	1×10^1	1×10^5
P-32	1×10^3	1×10^5	Mn-52m	1×10^1	1×10^5
P-33	1×10^5	1×10^8	Mn-53	1×10^4	1×10^9
S-35	1×10^5	1×10^8	Mn-54	1×10^1	1×10^6
Cl-36	1×10^4	1×10^6	Mn-56	1×10^1	1×10^5
Cl-38	1×10^1	1×10^5	Fe-52	1×10^1	1×10^6
Cl-39	1×10^1	1×10^5	Fe-55	1×10^4	1×10^6
Ar-37	1×10^6	1×10^8	Fe-59	1×10^1	1×10^6
Ar-39	1×10^7	1×10^4	Fe-60	1×10^2	1×10^5
Ar-41	1×10^2	1×10^9	Co-55	1×10^1	1×10^6
K-40	1×10^2	1×10^6	Co-56	1×10^1	1×10^5
K-42	1×10^2	1×10^6	Co-57	1×10^2	1×10^6
K-43	1×10^1	1×10^6	Co-58	1×10^1	1×10^6
K-44	1×10^1	1×10^5	Co-58m	1×10^4	1×10^7
K-45	1×10^1	1×10^5	Co-60	1×10^1	1×10^5
Ca-41	1×10^5	1×10^7	Co-60m	1×10^3	1×10^6
Ca-45	1×10^4	1×10^7	Co-61	1×10^2	1×10^6
Ca-47	1×10^1	1×10^6	Co-62m	1×10^1	1×10^5
Sc-43	1×10^1	1×10^6	Ni-56	1×10^1	1×10^6
Sc-44	1×10^1	1×10^5	Ni-57	1×10^1	1×10^6

TABLE 1.1 LEVELS FOR EXEMPTION OF MODERATE AMOUNTS OF MATERIAL WITHOUT FURTHER CONSIDERATION : EXEMPT ACTIVITY CONCENTRATIONS AND EXEMPT ACTIVITIES OF RADIONUCLIDES (*Continued*)

Radionuclide	Activity concentration (Bq/g)	Activity (Bq)	Radionuclide	Activity concentration (Bq/g)	Activity (Bq)
Ni-59	1×10^4	1×10^8	As-72	1×10^1	1×10^5
Ni-63	1×10^5	1×10^8	As-73	1×10^3	1×10^7
Ni-65	1×10^1	1×10^6	As-74	1×10^1	1×10^6
Ni-66	1×10^4	1×10^7	As-76	1×10^2	1×10^5
Cu-60	1×10^1	1×10^5	As-77	1×10^3	1×10^6
Cu-61	1×10^1	1×10^6	As-78	1×10^1	1×10^5
Cu-64	1×10^2	1×10^6	Se-70	1×10^1	1×10^6
Cu-67	1×10^2	1×10^6	Se-73	1×10^1	1×10^6
Zn-62	1×10^2	1×10^6	Se-73m	1×10^2	1×10^6
Zn-63	1×10^1	1×10^5	Se-75	1×10^2	1×10^6
Zn-65	1×10^1	1×10^6	Se-79	1×10^4	1×10^7
Zn-69	1×10^4	1×10^6	Se-81	1×10^3	1×10^6
Zn-69m	1×10^2	1×10^6	Se-81m	1×10^3	1×10^7
Zn-71m	1×10^1	1×10^6	Se-83	1×10^1	1×10^5
Zn-72	1×10^2	1×10^6	Br-74	1×10^1	1×10^5
Ga-65	1×10^1	1×10^5	Br-74m	1×10^1	1×10^5
Ga-66	1×10^1	1×10^5	Br-75	1×10^1	1×10^6
Ga-67	1×10^2	1×10^6	Br-76	1×10^1	1×10^5
Ga-68	1×10^1	1×10^5	Br-77	1×10^2	1×10^6
Ga-70	1×10^2	1×10^6	Br-80	1×10^2	1×10^5
Ga-72	1×10^1	1×10^5	Br-80m	1×10^3	1×10^7
Ga-73	1×10^2	1×10^6	Br-82	1×10^1	1×10^6
Ge-66	1×10^1	1×10^6	Br-83	1×10^3	1×10^6
Ge-67	1×10^1	1×10^5	Br-84	1×10^1	1×10^5
Ge-68[b]	1×10^1	1×10^5	Kr-74	1×10^2	1×10^9
Ge-69	1×10^1	1×10^6	Kr-76	1×10^2	1×10^9
Ge-71	1×10^4	1×10^8	Kr-77	1×10^2	1×10^9
Ge-75	1×10^3	1×10^6	Kr-79	1×10^3	1×10^5
Ge-77	1×10^1	1×10^5	Kr-81	1×10^4	1×10^7
Ge-78	1×10^2	1×10^6	Kr-81m	1×10^3	1×10^{10}
As-69	1×10^1	1×10^5	Kr-83m	1×10^5	1×10^{12}
As-70	1×10^1	1×10^5	Kr-85	1×10^5	1×10^4
As-71	1×10^1	1×10^6	Kr-85m	1×10^3	1×10^{10}

TABLE 1.1 LEVELS FOR EXEMPTION OF MODERATE AMOUNTS OF MATERIAL WITHOUT FURTHER CONSIDERATION : EXEMPT ACTIVITY CONCENTRATIONS AND EXEMPT ACTIVITIES OF RADIONUCLIDES (*Continued*)

Radionuclide	Activity concentration (Bq/g)	Activity (Bq)	Radionuclide	Activity concentration (Bq/g)	Activity (Bq)
Kr-87	1×10^{2}	1×10^{9}	Y-94	1×10^{1}	1×10^{5}
Kr-88	1×10^{2}	1×10^{9}	Y-95	1×10^{1}	1×10^{5}
Rb-79	1×10^{1}	1×10^{5}	Zr-86	1×10^{2}	1×10^{7}
Rb-81	1×10^{1}	1×10^{6}	Zr-88	1×10^{2}	1×10^{6}
Rb-81m	1×10^{3}	1×10^{7}	Zr-89	1×10^{1}	1×10^{6}
Rb-82m	1×10^{1}	1×10^{6}	Zr-93[b]	1×10^{3}	1×10^{7}
Rb-83[b]	1×10^{2}	1×10^{6}	Zr-95	1×10^{1}	1×10^{6}
Rb-84	1×10^{1}	1×10^{6}	Zr-97[b]	1×10^{1}	1×10^{5}
Rb-86	1×10^{2}	1×10^{5}	Nb-88	1×10^{1}	1×10^{5}
Rb-87	1×10^{3}	1×10^{7}	Nb-89	1×10^{1}	1×10^{5}
Rb-88	1×10^{2}	1×10^{5}	Nb-89m	1×10^{1}	1×10^{5}
Rb-89	1×10^{2}	1×10^{5}	Nb-90	1×10^{1}	1×10^{5}
Sr-80	1×10^{3}	1×10^{7}	Nb-93m	1×10^{4}	1×10^{7}
Sr-81	1×10^{1}	1×10^{5}	Nb-94	1×10^{1}	1×10^{6}
Sr-82[b]	1×10^{1}	1×10^{5}	Nb-95	1×10^{1}	1×10^{6}
Sr-83	1×10^{1}	1×10^{6}	Nb-95m	1×10^{2}	1×10^{7}
Sr-85	1×10^{2}	1×10^{6}	Nb-96	1×10^{1}	1×10^{5}
Sr-85m	1×10^{2}	1×10^{7}	Nb-97	1×10^{1}	1×10^{6}
Sr-87m	1×10^{2}	1×10^{6}	Nb-98	1×10^{1}	1×10^{5}
Sr-89	1×10^{3}	1×10^{6}	Mo-90	1×10^{1}	1×10^{6}
Sr-90[b]	1×10^{2}	1×10^{4}	Mo-93	1×10^{3}	1×10^{8}
Sr-91	1×10^{1}	1×10^{5}	Mo-93m	1×10^{1}	1×10^{6}
Sr-92	1×10^{1}	1×10^{6}	Mo-99	1×10^{2}	1×10^{6}
Y-86	1×10^{1}	1×10^{5}	Mo-101	1×10^{1}	1×10^{6}
Y-86m	1×10^{2}	1×10^{7}	Tc-93	1×10^{1}	1×10^{6}
Y-87[b]	1×10^{1}	1×10^{6}	Tc-93m	1×10^{1}	1×10^{6}
Y-88	$1 \times 10^{1/}$	1×10^{6}	Tc-94	1×10^{1}	1×10^{6}
Y-90	1×10^{3}	1×10^{5}	Tc-94m	1×10^{1}	1×10^{5}
Y-90m	1×10^{1}	1×10^{6}	Tc-95	1×10^{1}	1×10^{6}
Y-91	1×10^{3}	1×10^{6}	Tc-95m	1×10^{1}	1×10^{6}
Y-91m	1×10^{2}	1×10^{6}	Tc-96	1×10^{1}	1×10^{6}
Y-92	1×10^{2}	1×10^{5}	Tc-96m	1×10^{3}	1×10^{7}
Y-93	1×10^{2}	1×10^{5}	Tc-97	1×10^{3}	1×10^{8}

TABLE 1.1 LEVELS FOR EXEMPTION OF MODERATE AMOUNTS OF MATERIAL WITHOUT FURTHER CONSIDERATION : EXEMPT ACTIVITY CONCENTRATIONS AND EXEMPT ACTIVITIES OF RADIONUCLIDES (*Continued*)

Radionuclide	Activity concentration (Bq/g)	Activity (Bq)	Radionuclide	Activity concentration (Bq/g)	Activity (Bq)
Tc-97m	1×10^3	1×10^7	Ag-106m	1×10^1	1×10^6
Tc-98	1×10^1	1×10^6	Ag-108m	1×10^1	1×10^6
Tc-99	1×10^4	1×10^7	Ag-110m	1×10^1	1×10^6
Tc-99m	1×10^2	1×10^7	Ag-111	1×10^3	1×10^6
Tc-101	1×10^2	1×10^6	Ag-112	1×10^1	1×10^5
Tc-104	1×10^1	1×10^5	Ag-115	1×10^1	1×10^5
Ru-94	1×10^2	1×10^6	Cd-104	1×10^2	1×10^7
Ru-97	1×10^2	1×10^7	Cd-107	1×10^3	1×10^7
Ru-103	1×10^2	1×10^6	Cd-109	1×10^4	1×10^6
Ru-105	1×10^1	1×10^6	Cd-113	1×10^3	1×10^6
Ru-106[b]	1×10^2	1×10^5	Cd-113m	1×10^3	1×10^6
Rh-99	1×10^1	1×10^6	Cd-115	1×10^2	1×10^6
Rh-99m	1×10^1	1×10^6	Cd-115m	1×10^3	1×10^6
Rh-100	1×10^1	1×10^6	Cd-117	1×10^1	1×10^6
Rh-101	1×10^2	1×10^7	Cd-117m	1×10^1	1×10^6
Rh-101m	1×10^2	1×10^7	In-109	1×10^1	1×10^6
Rh-102	1×10^1	1×10^6	In-110	1×10^1	1×10^6
Rh-102m	1×10^2	1×10^6	In-110m	1×10^1	1×10^5
Rh-103m	1×10^4	1×10^8	In-111	1×10^2	1×10^6
Rh-105	1×10^2	1×10^7	In-112	1×10^2	1×10^6
Rh-106m	1×10^1	1×10^5	In-113m	1×10^2	1×10^6
Rh-107	1×10^2	1×10^6	In-114	1×10^3	1×10^5
Pd-100	1×10^2	1×10^7	In-114m	1×10^2	1×10^6
Pd-101	1×10^2	1×10^6	In-115	1×10^3	1×10^5
Pd-103	1×10^3	1×10^8	In-115m	1×10^2	1×10^6
Pd-107	1×10^5	1×10^8	In-116m	1×10^1	1×10^5
Pd-109	1×10^3	1×10^6	In-117	1×10^1	1×10^6
Ag-102	1×10^1	1×10^5	In-117m	1×10^2	1×10^6
Ag-103	1×10^1	1×10^6	In-119m	1×10^2	1×10^5
Ag-104	1×10^1	1×10^6	Sn-110	1×10^2	1×10^7
Ag-104m	1×10^1	1×10^6	Sn-111	1×10^2	1×10^6
Ag-105	1×10^2	1×10^6	Sn-113	1×10^3	1×10^7
Ag-106	1×10^1	1×10^6	Sn-117m	1×10^2	1×10^6

TABLE 1.1 LEVELS FOR EXEMPTION OF MODERATE AMOUNTS OF MATERIAL WITHOUT FURTHER CONSIDERATION : EXEMPT ACTIVITY CONCENTRATIONS AND EXEMPT ACTIVITIES OF RADIONUCLIDES (*Continued*)

Radionuclide	Activity concentration (Bq/g)	Activity (Bq)	Radionuclide	Activity concentration (Bq/g)	Activity (Bq)
Sn-119m	1×10^3	1×10^7	Te-123m	1×10^2	1×10^7
Sn-121	1×10^5	1×10^7	Te-125m	1×10^3	1×10^7
Sn-121m[b]	1×10^3	1×10^7	Te-127	1×10^3	1×10^6
Sn-123	1×10^3	1×10^6	Te-127m	1×10^3	1×10^7
Sn-123m	1×10^2	1×10^6	Te-129	1×10^2	1×10^6
Sn-125	1×10^2	1×10^5	Te-129m	1×10^3	1×10^6
Sn-126[b]	1×10^1	1×10^5	Te-131	1×10^2	1×10^5
Sn-127	1×10^1	1×10^6	Te-131m	1×10^1	1×10^6
Sn-128	1×10^1	1×10^6	Te-132	1×10^2	1×10^7
Sb-115	1×10^1	1×10^6	Te-133	1×10^1	1×10^5
Sb-116	1×10^1	1×10^6	Te-133m	1×10^1	1×10^5
Sb-116m	1×10^1	1×10^5	Te-134	1×10^1	1×10^6
Sb-117	1×10^2	1×10^7	I-120	1×10^1	1×10^5
Sb-118m	1×10^1	1×10^6	I-120m	1×10^1	1×10^5
Sb-119	1×10^3	1×10^7	I-121	1×10^2	1×10^6
Sb-120	1×10^2	1×10^6	I-123	1×10^2	1×10^7
Sb-120m	1×10^1	1×10^6	I-124	1×10^1	1×10^6
Sb-122	1×10^2	1×10^4	I-125	1×10^3	1×10^6
Sb-124	1×10^1	1×10^6	I-126	1×10^2	1×10^6
Sb-124m	1×10^2	1×10^6	I-128	1×10^2	1×10^5
Sb-125	1×10^2	1×10^6	I-129	1×10^2	1×10^5
Sb-126	1×10^1	1×10^5	I-130	1×10^1	1×10^6
Sb-126m	1×10^1	1×10^5	I-131	1×10^2	1×10^6
Sb-127	1×10^1	1×10^6	I-132	1×10^1	1×10^5
Sb-128	1×10^1	1×10^5	I-132m	1×10^2	1×10^6
Sb-128m	1×10^1	1×10^5	I-133	1×10^1	1×10^6
Sb-129	1×10^1	1×10^6	I-134	1×10^1	1×10^5
Sb-130	1×10^1	1×10^5	I-135	1×10^1	1×10^6
Sb-131	1×10^1	1×10^6	Xe-120	1×10^2	1×10^9
Te-116	1×10^2	1×10^7	Xe-121	1×10^2	1×10^9
Te-121	1×10^1	1×10^6	Xe-122[b]	1×10^2	1×10^9
Te-121m	1×10^2	1×10^6	Xe-123	1×10^2	1×10^9
Te-123	1×10^3	1×10^6	Xe-125	1×10^3	1×10^9

TABLE 1.1 LEVELS FOR EXEMPTION OF MODERATE AMOUNTS OF MATERIAL WITHOUT FURTHER CONSIDERATION : EXEMPT ACTIVITY CONCENTRATIONS AND EXEMPT ACTIVITIES OF RADIONUCLIDES (*Continued*)

Radionuclide	Activity concentration (Bq/g)	Activity (Bq)	Radionuclide	Activity concentration (Bq/g)	Activity (Bq)
Xe-127	1×10^3	1×10^5	La-131	1×10^1	1×10^6
Xe-129m	1×10^3	1×10^4	La-132	1×10^1	1×10^6
Xe-131m	1×10^4	1×10^4	La-135	1×10^3	1×10^7
Xe-133m	1×10^3	1×10^4	La-137	1×10^3	1×10^7
Xe-133	1×10^3	1×10^4	La-138	1×10^1	1×10^6
Xe-135	1×10^3	1×10^{10}	La-140	1×10^1	1×10^5
Xe-135m	1×10^2	1×10^9	La-141	1×10^2	1×10^5
Xe-138	1×10^2	1×10^9	La-142	1×10^1	1×10^5
Cs-125	1×10^1	1×10^4	La-143	1×10^2	1×10^5
Cs-127	1×10^2	1×10^5	Ce-134	1×10^3	1×10^7
Cs-129	1×10^2	1×10^5	Ce-135	1×10^1	1×10^6
Cs-130	1×10^2	1×10^6	Ce-137	1×10^3	1×10^7
Cs-131	1×10^3	1×10^6	Ce-137m	1×10^3	1×10^6
Cs-132	1×10^1	1×10^5	Ce-139	1×10^2	1×10^6
Cs-134m	1×10^3	1×10^5	Ce-141	1×10^2	1×10^7
Cs-134	1×10^1	1×10^4	Ce-143	1×10^2	1×10^6
Cs-135	1×10^4	1×10^7	Ce-144[b]	1×10^2	1×10^5
Cs-135m	1×10^1	1×10^6	Pr-136	1×10^1	1×10^5
Cs-136	1×10^1	1×10^5	Pr-137	1×10^2	1×10^6
Cs-137[b]	1×10^1	1×10^4	Pr-138m	1×10^1	1×10^6
Cs-138	1×10^1	1×10^4	Pr-139	1×10^2	1×10^7
Ba-126	1×10^2	1×10^7	Pr-142	1×10^2	1×10^5
Ba-128	1×10^2	1×10^7	Pr-142m	1×10^7	1×10^9
Ba-131	1×10^2	1×10^6	Pr-143	1×10^4	1×10^6
Ba-131m	1×10^2	1×10^7	Pr-144	1×10^2	1×10^5
Ba-133	1×10^2	1×10^6	Pr-145	1×10^3	1×10^5
Ba-133m	1×10^2	1×10^6	Pr-147	1×10^1	1×10^5
Ba-135m	1×10^2	1×10^6	Nd-136	1×10^2	1×10^6
Ba-137m	1×10^1	1×10^6	Nd-138	1×10^3	1×10^7
Ba-139	1×10^2	1×10^5	Nd-139	1×10^2	1×10^6
Ba-140[b]	1×10^1	1×10^5	Nd-139m	1×10^1	1×10^6
Ba-141	1×10^2	1×10^5	Nd-141	1×10^2	1×10^7
Ba-142	1×10^2	1×10^6	Nd-147	1×10^2	1×10^6

TABLE 1.1 LEVELS FOR EXEMPTION OF MODERATE AMOUNTS OF MATERIAL WITHOUT FURTHER CONSIDERATION : EXEMPT ACTIVITY CONCENTRATIONS AND EXEMPT ACTIVITIES OF RADIONUCLIDES (*Continued*)

Radionuclide	Activity concentration (Bq/g)	Activity (Bq)	Radionuclide	Activity concentration (Bq/g)	Activity (Bq)
Nd-149	1×10^2	1×10^6	Eu-155	1×10^2	1×10^7
Nd-151	1×10^1	1×10^5	Eu-156	1×10^1	1×10^6
Pm-141	1×10^1	1×10^5	Eu-157	1×10^2	1×10^6
Pm-143	1×10^2	1×10^6	Eu-158	1×10^1	1×10^5
Pm-144	1×10^1	1×10^6	Gd-145	1×10^1	1×10^5
Pm-145	1×10^3	1×10^7	Gd-146[b]	1×10^1	1×10^6
Pm-146	1×10^1	1×10^6	Gd-147	1×10^1	1×10^6
Pm-147	1×10^4	1×10^7	Gd-148	1×10^1	1×10^4
Pm-148	1×10^1	1×10^5	Gd-149	1×10^2	1×10^6
Pm-148m	1×10^1	1×10^6	Gd-151	1×10^2	1×10^7
Pm-149	1×10^3	1×10^6	Gd-152	1×10^1	1×10^4
Pm-150	1×10^1	1×10^5	Gd-153	1×10^2	1×10^7
Pm-151	1×10^2	1×10^6	Gd-159	1×10^3	1×10^6
Sm-141	1×10^1	1×10^5	Tb-147	1×10^1	1×10^6
Sm-141m	1×10^1	1×10^6	Tb-149	1×10^1	1×10^6
Sm-142	1×10^2	1×10^7	Tb-150	1×10^1	1×10^6
Sm-145	1×10^2	1×10^7	Tb-151	1×10^1	1×10^6
Sm-146	1×10^1	1×10^5	Tb-153	1×10^2	1×10^7
Sm-147	1×10^1	1×10^4	Tb-154	1×10^1	1×10^6
Sm-151	1×10^4	1×10^8	Tb-155	1×10^2	1×10^7
Sm-153	1×10^2	1×10^6	Tb-156	1×10^1	1×10^6
Sm-155	1×10^2	1×10^6	Tb-156m (24.4 h)	1×10^3	1×10^7
Sm-156	1×10^2	1×10^6	Tb-156m[1] (5 h)	1×10^4	1×10^7
Eu-145	1×10^1	1×10^6	Tb-157	1×10^4	1×10^7
Eu-146	1×10^1	1×10^6	Tb-158	1×10^1	1×10^6
Eu-147	1×10^2	1×10^6	Tb-160	1×10^1	1×10^6
Eu-148	1×10^1	1×10^6	Tb-161	1×10^3	1×10^6
Eu-149	1×10^2	1×10^7	Dy-155	1×10^1	1×10^6
Eu-150	1×10^1	1×10^6	Dy-157	1×10^2	1×10^6
Eu-150m	1×10^3	1×10^6	Dy-159	1×10^3	1×10^7
Eu-152	1×10^1	1×10^6	Dy-165	1×10^3	1×10^6
Eu-152m	1×10^2	1×10^6	Dy-166	1×10^3	1×10^6
Eu-154	1×10^1	1×10^6	Ho-155	1×10^2	1×10^6

TABLE 1.1 LEVELS FOR EXEMPTION OF MODERATE AMOUNTS OF MATERIAL WITHOUT FURTHER CONSIDERATION : EXEMPT ACTIVITY CONCENTRATIONS AND EXEMPT ACTIVITIES OF RADIONUCLIDES (*Continued*)

Radionuclide	Activity concentration (Bq/g)	Activity (Bq)	Radionuclide	Activity concentration (Bq/g)	Activity (Bq)
Ho-157	1×10^{2}	1×10^{6}	Lu-172	1×10^{1}	1×10^{6}
Ho-159	1×10^{2}	1×10^{6}	Lu-173	1×10^{2}	1×10^{7}
Ho-161	1×10^{2}	1×10^{7}	Lu-174	1×10^{2}	1×10^{7}
Ho-162	1×10^{2}	1×10^{7}	Lu-174m	1×10^{2}	1×10^{7}
Ho-162m	1×10^{1}	1×10^{6}	Lu-176	1×10^{2}	1×10^{6}
Ho-164	1×10^{3}	1×10^{6}	Lu-176m	1×10^{3}	1×10^{6}
Ho-164m	1×10^{3}	1×10^{7}	Lu-177	1×10^{3}	1×10^{7}
Ho-166	1×10^{3}	1×10^{5}	Lu-177m	1×10^{1}	1×10^{6}
Ho-166m	1×10^{1}	1×10^{6}	Lu-178	1×10^{2}	1×10^{5}
Ho-167	1×10^{2}	1×10^{6}	Lu-178m	1×10^{1}	1×10^{5}
Er-161	1×10^{1}	1×10^{6}	Lu-179	1×10^{3}	1×10^{6}
Er-165	1×10^{3}	1×10^{7}	Hf-170	1×10^{2}	1×10^{6}
Er-169	1×10^{4}	1×10^{7}	Hf-172[b]	1×10^{1}	1×10^{6}
Er-171	1×10^{2}	1×10^{6}	Hf-173	1×10^{2}	1×10^{6}
Er-172	1×10^{2}	1×10^{6}	Hf-175	1×10^{2}	1×10^{6}
Tm-162	1×10^{1}	1×10^{6}	Hf-177m	1×10^{1}	1×10^{5}
Tm-166	1×10^{1}	1×10^{6}	Hf-178m	1×10^{1}	1×10^{6}
Tm-167	1×10^{2}	1×10^{6}	Hf-179m	1×10^{1}	1×10^{6}
Tm-170	1×10^{3}	1×10^{6}	Hf-180m	1×10^{1}	1×10^{6}
Tm-171	1×10^{4}	1×10^{8}	Hf-181	1×10^{1}	1×10^{6}
Tm-172	1×10^{2}	1×10^{6}	Hf-182	1×10^{2}	1×10^{6}
Tm-173	1×10^{2}	1×10^{6}	Hf-182m	1×10^{1}	1×10^{6}
Tm-175	1×10^{1}	1×10^{6}	Hf-183	1×10^{1}	1×10^{6}
Yb-162	1×10^{2}	1×10^{7}	Hf-184	1×10^{2}	1×10^{6}
Yb-166	1×10^{2}	1×10^{7}	Ta-172	1×10^{1}	1×10^{6}
Yb-167	1×10^{2}	1×10^{6}	Ta-173	1×10^{1}	1×10^{6}
Yb-169	1×10^{2}	1×10^{7}	Ta-174	1×10^{1}	1×10^{6}
Yb-175	1×10^{3}	1×10^{7}	Ta-175	1×10^{1}	1×10^{6}
Yb-177	1×10^{2}	1×10^{6}	Ta-176	1×10^{1}	1×10^{6}
Yb-178	1×10^{3}	1×10^{6}	Ta-177	1×10^{2}	1×10^{7}
Lu-169	1×10^{1}	1×10^{6}	Ta-178	1×10^{1}	1×10^{6}
Lu-170	1×10^{1}	1×10^{6}	Ta-179	1×10^{3}	1×10^{7}
Lu-171	1×10^{1}	1×10^{6}	Ta-180	1×10^{1}	1×10^{6}

TABLE 1.1 LEVELS FOR EXEMPTION OF MODERATE AMOUNTS OF MATERIAL WITHOUT FURTHER CONSIDERATION : EXEMPT ACTIVITY CONCENTRATIONS AND EXEMPT ACTIVITIES OF RADIONUCLIDES (*Continued*)

Radionuclide	Activity concentration (Bq/g)	Activity (Bq)	Radionuclide	Activity concentration (Bq/g)	Activity (Bq)
Ta-180m	1×10^3	1×10^7	Os-191	1×10^2	1×10^7
Ta-182	1×10^1	1×10^4	Os-191m	1×10^3	1×10^7
Ta-182m	1×10^2	1×10^6	Os-193	1×10^2	1×10^6
Ta-183	1×10^2	1×10^6	Os-194[b]	1×10^2	1×10^5
Ta-184	1×10^1	1×10^6	Ir-182	1×10^1	1×10^5
Ta-185	1×10^2	1×10^5	Ir-184	1×10^1	1×10^6
Ta-186	1×10^1	1×10^5	Ir-185	1×10^1	1×10^6
W-176	1×10^2	1×10^6	Ir-186	1×10^1	1×10^6
W-177	1×10^1	1×10^6	Ir-186m	1×10^1	1×10^6
W-178[b]	1×10^1	1×10^6	Ir-187	1×10^2	1×10^6
W-179	1×10^2	1×10^7	Ir-188	1×10^1	1×10^6
W-181	1×10^3	1×10^7	Ir-189[b]	1×10^2	1×10^7
W-185	1×10^4	1×10^7	Ir-190	1×10^1	1×10^6
W-187	1×10^2	1×10^6	Ir-190m (3.1 h)	1×10^1	1×10^6
W-188[b]	1×10^2	1×10^5	Ir 190m[1] (1.2 h)	1×10^4	1×10^7
Re-177	1×10^1	1×10^6	Ir-192	1×10^1	1×10^4
Re-178	1×10^1	1×10^6	Ir-192m	1×10^2	1×10^7
Re-181	1×10^1	1×10^6	Ir-193m	1×10^4	1×10^7
Re-182	1×10^1	1×10^6	Ir-194	1×10^2	1×10^5
Re-182m	1×10^1	1×10^6	Ir-194m	1×10^1	1×10^6
Re-184	1×10^1	1×10^6	Ir-195	1×10^2	1×10^6
Re-184m	1×10^2	1×10^6	Ir-195m	1×10^2	1×10^6
Re-186	1×10^3	1×10^6	Pt-186	1×10^1	1×10^6
Re-186m	1×10^3	1×10^7	Pt-188[b]	1×10^1	1×10^6
Re-187	1×10^6	1×10^9	Pt-189	1×10^2	1×10^6
Re-188	1×10^2	1×10^5	Pt-191	1×10^2	1×10^6
Re-188m	1×10^2	1×10^7	Pt-193	1×10^4	1×10^7
Re-189[b]	1×10^2	1×10^6	Pt-193m	1×10^3	1×10^7
Os-180	1×10^2	1×10^7	Pt-195m	1×10^2	1×10^6
Os-181	1×10^1	1×10^6	Pt-197	1×10^3	1×10^6
Os-182	1×10^2	1×10^6	Pt-197m	1×10^2	1×10^6
Os-185	1×10^1	1×10^6	Pt-199	1×10^2	1×10^6
Os-189m	1×10^4	1×10^7	Pt-200	1×10^2	1×10^6

TABLE 1.1 LEVELS FOR EXEMPTION OF MODERATE AMOUNTS OF MATERIAL WITHOUT FURTHER CONSIDERATION : EXEMPT ACTIVITY CONCENTRATIONS AND EXEMPT ACTIVITIES OF RADIONUCLIDES (*Continued*)

Radionuclide	Activity concentration (Bq/g)	Activity (Bq)
Au-193	1×10^2	1×10^7
Au-194	1×10^1	1×10^6
Au-195	1×10^2	1×10^7
Au-198	1×10^2	1×10^6
Au-198m	1×10^1	1×10^6
Au-199	1×10^2	1×10^6
Au-200	1×10^2	1×10^5
Au-200m	1×10^1	1×10^6
Au-201	1×10^2	1×10^6
Hg-193	1×10^2	1×10^6
Hg-193m	1×10^1	1×10^6
Hg-194[b]	1×10^1	1×10^6
Hg-195	1×10^2	1×10^6
Hg-195m[b]	1×10^2	1×10^6
Hg-197	1×10^2	1×10^7
Hg-197m	1×10^2	1×10^6
Hg-199m	1×10^2	1×10^6
Hg-203	1×10^2	1×10^5
Tl-194	1×10^1	1×10^6
Tl-194m	1×10^1	1×10^6
Tl-195	1×10^1	1×10^6
Tl-197	1×10^2	1×10^6
Tl-198	1×10^1	1×10^6
Tl-198m	1×10^1	1×10^6
Tl-199	1×10^2	1×10^6
Tl-200	1×10^1	1×10^6
Tl-201	1×10^2	1×10^6
Tl-202	1×10^2	1×10^6
Tl-204	1×10^4	1×10^4
Pb-195m	1×10^1	1×10^6
Pb-198	1×10^2	1×10^6
Pb-199	1×10^1	1×10^6
Pb-200	1×10^2	1×10^6
Pb-201	1×10^1	1×10^6
Pb-202	1×10^3	1×10^6
Pb-202m	1×10^1	1×10^6
Pb-203	1×10^2	1×10^6
Pb-205	1×10^4	1×10^7
Pb-209	1×10^5	1×10^6
Pb-210[b]	1×10^1	1×10^4
Pb-211	1×10^2	1×10^6
Pb-212[b]	1×10^1	1×10^5
Pb-214	1×10^2	1×10^6
Bi-200	1×10^1	1×10^6
Bi-201	1×10^1	1×10^6
Bi-202	1×10^1	1×10^6
Bi-203	1×10^1	1×10^6
Bi-205	1×10^1	1×10^6
Bi-206	1×10^1	1×10^5
Bi-207	1×10^1	1×10^6
Bi-210	1×10^3	1×10^6
Bi-210m[b]	1×10^1	1×10^5
Bi-212[b]	1×10^1	1×10^5
Bi-213	1×10^2	1×10^6
Bi-214	1×10^1	1×10^5
Po-203	1×10^1	1×10^6
Po-205	1×10^1	1×10^6
Po-206	1×10^1	1×10^6
Po-207	1×10^1	1×10^6
Po-208	1×10^1	1×10^4
Po-209	1×10^1	1×10^4
Po-210	1×10^1	1×10^4
At-207	1×10^1	1×10^6
At-211	1×10^3	1×10^7
Fr-222	1×10^3	1×10^5
Fr-223	1×10^2	1×10^6

TABLE 1.1 LEVELS FOR EXEMPTION OF MODERATE AMOUNTS OF MATERIAL WITHOUT FURTHER CONSIDERATION : EXEMPT ACTIVITY CONCENTRATIONS AND EXEMPT ACTIVITIES OF RADIONUCLIDES (*Continued*)

Radionuclide	Activity concentration (Bq/g)	Activity (Bq)	Radionuclide	Activity concentration (Bq/g)	Activity (Bq)
Rn-220[b]	1×10^{4}	1×10^{7}	U-235[b]	1×10^{1}	1×10^{4}
Rn-222[b]	1×10^{1}	1×10^{8}	U-236	1×10^{1}	1×10^{4}
Ra-223[b]	1×10^{2}	1×10^{5}	U-237	1×10^{2}	1×10^{6}
Ra-224[b]	1×10^{1}	1×10^{5}	U-238[b]	1×10^{1}	1×10^{4}
Ra-225	1×10^{2}	1×10^{5}	U-239	1×10^{2}	1×10^{6}
Ra-226[b]	1×10^{1}	1×10^{4}	U-240	1×10^{3}	1×10^{7}
Ra-227	1×10^{2}	1×10^{6}	U-240[b]	1×10^{1}	1×10^{6}
Ra-228[b]	1×10^{1}	1×10^{5}	Np-232	1×10^{1}	1×10^{6}
Ac-224	1×10^{2}	1×10^{6}	Np-233	1×10^{2}	1×10^{7}
Ac-225[b]	1×10^{1}	1×10^{4}	Np-234	1×10^{1}	1×10^{6}
Ac-226	1×10^{2}	1×10^{5}	Np-235	1×10^{3}	1×10^{7}
Ac-227[b]	1×10^{-1}	1×10^{3}	Np-236	1×10^{2}	1×10^{5}
Ac-228	1×10^{1}	1×10^{6}	Np-236m	1×10^{3}	1×10^{7}
Th-226[b]	1×10^{3}	1×10^{7}	Np-237[b]	1×10^{0}	1×10^{3}
Th-227	1×10^{1}	1×10^{4}	Np-238	1×10^{2}	1×10^{6}
Th-228[b]	1×10^{0}	1×10^{4}	Np-239	1×10^{2}	1×10^{7}
Th-229[b]	1×10^{0}	1×10^{3}	Np-240	1×10^{1}	1×10^{6}
Th-230	1×10^{0}	1×10^{4}	Pu-234	1×10^{2}	1×10^{7}
Th-231	1×10^{3}	1×10^{7}	Pu-235	1×10^{2}	1×10^{7}
Th-232	1×10^{1}	1×10^{4}	Pu-236	1×10^{1}	1×10^{4}
Th-234[b]	1×10^{3}	1×10^{5}	Pu-237	1×10^{3}	1×10^{7}
Pa-227	1×10^{1}	1×10^{6}	Pu-238	1×10^{0}	1×10^{4}
Pa-228	1×10^{1}	1×10^{6}	Pu-239	1×10^{0}	1×10^{4}
Pa-230	1×10^{1}	1×10^{6}	Pu-240	1×10^{0}	1×10^{3}
Pa-231	1×10^{0}	1×10^{3}	Pu-241	1×10^{2}	1×10^{5}
Pa-232	1×10^{1}	1×10^{6}	Pu-242	1×10^{0}	1×10^{4}
Pa-233	1×10^{2}	1×10^{7}	Pu-243	1×10^{3}	1×10^{7}
Pa-234	1×10^{1}	1×10^{6}	Pu-244	1×10^{0}	1×10^{4}
U-230[b]	1×10^{1}	1×10^{5}	Pu-245	1×10^{2}	1×10^{6}
U-231	1×10^{2}	1×10^{7}	Pu-246	1×10^{2}	1×10^{6}
U-232[b]	1×10^{0}	1×10^{3}	Am-237	1×10^{2}	1×10^{6}
U-233	1×10^{1}	1×10^{4}	Am-238	1×10^{1}	1×10^{6}
U-234	1×10^{1}	1×10^{4}	Am-239	1×10^{2}	1×10^{6}

TABLE 1.1. LEVELS FOR EXEMPTION OF MODERATE AMOUNTS OF MATERIAL WITHOUT FURTHER CONSIDERATION : EXEMPT ACTIVITY CONCENTRATIONS AND EXEMPT ACTIVITIES OF RADIONUCLIDES (*Continued*)

Radionuclide	Activity concentration (Bq/g)	Activity (Bq)	Radionuclide	Activity concentration (Bq/g)	Activity (Bq)
Am-240	1×10^{1}	1×10^{6}	Bk-247	1×10^{0}	1×10^{4}
Am-241	1×10^{0}	1×10^{4}	Bk-249	1×10^{3}	1×10^{6}
Am-242	1×10^{3}	1×10^{6}	Bk-250	1×10^{1}	1×10^{6}
Am-242m[b]	1×10^{0}	1×10^{4}	Cf-244	1×10^{4}	1×10^{7}
Am-243[b]	1×10^{0}	1×10^{3}	Cf-246	1×10^{3}	1×10^{6}
Am-244	1×10^{1}	1×10^{6}	Cf-248	1×10^{1}	1×10^{4}
Am-244m	1×10^{4}	1×10^{7}	Cf-249	1×10^{0}	1×10^{3}
Am-245	1×10^{3}	1×10^{6}	Cf-250	1×10^{1}	1×10^{4}
Am-246	1×10^{1}	1×10^{5}	Cf-251	1×10^{0}	1×10^{3}
Am-246m	1×10^{1}	1×10^{6}	Cf-252	1×10^{1}	1×10^{4}
Cm-238	1×10^{2}	1×10^{7}	Cf-253	1×10^{2}	1×10^{5}
Cm-240	1×10^{2}	1×10^{5}	Cf-254	1×10^{0}	1×10^{3}
Cm-241	1×10^{2}	1×10^{6}	Es-250	1×10^{2}	1×10^{6}
Cm-242	1×10^{2}	1×10^{5}	Es-251	1×10^{2}	1×10^{7}
Cm-243	1×10^{0}	1×10^{4}	Es-253	1×10^{2}	1×10^{5}
Cm-244	1×10^{1}	1×10^{4}	Es-254	1×10^{1}	1×10^{4}
Cm-245	1×10^{0}	1×10^{3}	Es-254m	1×10^{2}	1×10^{6}
Cm-246	1×10^{0}	1×10^{3}	Fm-252	1×10^{3}	1×10^{6}
Cm-247	1×10^{0}	1×10^{4}	Fm-253	1×10^{2}	1×10^{6}
Cm-248	1×10^{0}	1×10^{3}	Fm-254	1×10^{4}	1×10^{7}
Cm-249	1×10^{3}	1×10^{6}	Fm-255	1×10^{3}	1×10^{6}
Cm-250	1×10^{-1}	1×10^{3}	Fm-257	1×10^{1}	1×10^{5}
Bk-245	1×10^{2}	1×10^{6}	Md-257	1×10^{2}	1×10^{7}
Bk-246	1×10	1×10^{6}	Md-258	1×10^{2}	1×10^{5}

TABLE 1.2 LEVELS FOR EXEMPTION OF BULK AMOUNTS OF SOLID MATERIAL WITHOUT FURTHER CONSIDERATION AND FOR CLEARNACE OF SOLID MATERIAL WITHOUT FURTHER CONSIDERATION : ACTIVITY CONCENTRATIONS OF RADIONUCLIDES OF ARTIFICIAL ORIGIN

Radionuclide	Activity concentration (Bq/g)	Radionuclide	Activity concentration (Bq/g)
H-3	100	Co-58	1
Be-7	10	Co-58m	10 000
C-14	1	Co-60	0.1
F-18	10	Co-60m	1 000
Na-22	0.1	Co-61	100
Na-24	1	Co-62m	10
Si-31	1000	Ni-59	100
P-32	1000	Ni-63	100
P-33	1000	Ni-65	10
S-35	100	Cu-64	100
Cl-36	1	Zn-65	0.1
Cl-38	10	Zn-69	1 000
K-42	100	Zn-69m[a]	10
K-43	10	Ga-72	10
Ca-45	100	Ge-71	10 000
Ca-47	10	As-73	1 000
Sc-46	0.1	As-74	10
Sc-47	100	As-76	10
Sc-48	1	As-77	1 000
V-48	1	Se-75	1
Cr-51	100	Br-82	1
Mn-51	10	Rb-86	100
Mn-52	1	Sr-85	1
Mn-52m	10	Sr-85m	100
Mn-53	100	Sr-87m	100
Mn-54	0.1	Sr-89	1 000
Mn-56	10	Sr-90[a]	1
Fe-52[a]	10	Sr-91[a]	10
Fe-55	1000	Sr-92	10
Fe-59	1	Y-90	1 000
Co-55	10	Y-91	100
Co-56	0.1	Y-91m	100
Co-57	1	Y-92	100

TABLE 1.2 LEVELS FOR EXEMPTION OF BULK AMOUNTS OF SOLID MATERIAL WITHOUT FURTHER CONSIDERATION AND FOR CLEARNACE OF SOLID MATERIAL WITHOUT FURTHER CONSIDERATION : ACTIVITY CONCENTRATIONS OF RADIONUCLIDES OF ARTIFICIAL ORIGIN (*Continued*)

Radionuclide	Activity concentration (Bq/g)	Radionuclide	Activity concentration (Bq/g)
Y-93	100	In-111	10
Zr-93	10	In-113m	100
Zr-95[a]	1	In-114m[a]	10
Zr-97[a]	10	In-115m	100
Nb-93m	10	Sn-113[a]	1
Nb-94	0.1	Sn-125	10
Nb-95	1	Sb-122	10
Nb-97[a]	10	Sb-124	1
Nb-98	10	Sb-125[a]	0.1
Mo-90	10	Te-123m	1
Mo-93	10	Te-125m	1000
Mo-99[a]	10	Te-127	1000
Mo-101[a]	10	Te-127m[a]	10
Tc-96	1	Te-129	100
Tc-96m	1 000	Te-129m[a]	10
Tc-97	10	Te-131	100
Tc-97m	100	Te-131m[a]	10
Tc-99	1	Te-132[a]	1
Tc-99m	100	Te-133	10
Ru-97	10	Te-133m	10
Ru-103[a]	1	Te-134	10
Ru-105[a]	10	I-123	100
Ru-106[a]	0.1	I-125	100
Rh-103m	10 000	I-126	10
Rh-105	100	I-129	0.01
Pd-103[a]	1 000	I-130	10
Pd-109[a]	100	I-131	10
Ag-105	1	I-132	10
Ag-110m[a]	0.1	I-133	10
Ag-111	100	I-134	10
Cd-109[a]	1	I-135	10
Cd-115[a]	10	Cs-129	10
Cd-115m[a]	100	Cs-131	1000

TABLE 1.2 LEVELS FOR EXEMPTION OF BULK AMOUNTS OF SOLID MATERIAL WITHOUT FURTHER CONSIDERATION AND FOR CLEARNACE OF SOLID MATERIAL WITHOUT FURTHER CONSIDERATION : ACTIVITY CONCENTRATIONS OF RADIONUCLIDES OF ARTIFICIAL ORIGIN (*Continued*)

Radionuclide	Activity concentration (Bq/g)	Radionuclide	Activity concentration (Bq/g)
Cs-132	10	Er-171	100
Cs-134	0.1	Tm-170	100
Cs-134m	1000	Tm-171	1000
Cs-135	100	Yb-175	100
Cs-136	1	Lu-177	100
Cs-137[a]	0.1	Hf-181	1
Cs-138	10	Ta-182	0.1
Ba-131	10	W-181	10
Ba-140	1	W-185	1000
La-140	1	W-187	10
Ce-139	1	Re-186	1000
Ce-141	100	Re-188	100
Ce-143	10	Os-185	1
Ce-144[a]	10	Os-191	100
Pr-142	100	Os-191m	1000
Pr-143	1000	Os-193	100
Nd-147	100	Ir-190	1
Nd-149	100	Ir-192	1
Pm-147	1000	Ir-194	100
Pm-149	1000	Pt-191	10
Sm-151	1000	Pt-193m	1000
Sm-153	100	Pt-197	1000
Eu-152	0.1	Pt-197m	100
Eu-152m	100	Au-198	10
Eu-154	0.1	Au-199	100
Eu-155	1	Hg-197	100
Gd-153	10	Hg-197m	100
Gd-159	100	Hg-203	10
Tb-160	1	Tl-200	10
Dy-165	1000	Tl-201	100
Dy-166	100	Tl-202	10
Ho-166	100	Tl-204	1
Er-169	1000	Pb-203	10

TABLE 1.2 LEVELS FOR EXEMPTION OF BULK AMOUNTS OF SOLID MATERIAL WITHOUT FURTHER CONSIDERATION AND FOR CLEARNACE OF SOLID MATERIAL WITHOUT FURTHER CONSIDERATION : ACTIVITY CONCENTRATIONS OF RADIONUCLIDES OF ARTIFICIAL ORIGIN (*Continued*)

Radionuclide	Activity concentration (Bq/g)
Bi-206	1
Bi-207	0.1
Po-203	10
Po-205	10
Po-207	10
At-211	1000
Ra-225	10
Ra-227	100
Th-226	1000
Th-229	0.1
Pa-230	10
Pa-233	10
U-230	10
U-231	100
U-232[a]	0.1
U-233	1
U-236	10
U-237	100
U-239	100
U-240[a]	100
Np-237[a]	1
Np-239	100
Np-240	10
Pu-234	100
Pu-235	100
Pu-236	1
Pu-237	100
Pu-238	0.1
Pu-239	0.1
Pu-240	0.1
Pu-241	10
Pu-242	0.1
Pu-243	1 000
Pu-244[a]	0.1
Am-241	0.1
Am-242	1 000
Am-242m[a]	0.1
Am-243[a]	0.1
Cm-242	10
Cm-243	1
Cm-244	1
Cm-245	0.1
Cm-246	0.1
Cm-247[a]	0.1
Cm-248	0.1
Bk-249	100
Cf-246	1 000
Cf-248	1
Cf-249	0.1
Cf-250	1
Cf-251	0.1
Cf-252	1
Cf-253	100
Cf-254	1
Es-253	100
Es-254[a]	0.1
Es-254m[a]	10
Fm-254	10 000
Fm-255	100

B 250

Table 1.3 Levels For Clearnace of Material : Activity Concentrations of Radionuclides of Natural Origin

Radionuclide	**Activity concentration (Bq/g)**
K-40	10
Each radionuclide in the uranium decay chain or the thorium decay chain	1

SECOND SCHEDULE

[regulation 58(2)]

CATEGORIES FOR SEALED SOURCES USED IN COMMON PRACTICES

Table 2.1 provides categories for sealed sources used in common practices and the activity corresponding to a dangerous source (D value) for selected radionuclides.

TABLE 2.1 CATEGORIES FOR SEALED SOURCES USED IN COMMON PRACTICES (*Continued*)

Category	**Ratio of activity in the source to activity that is considered dangerous (*A*/D)**	**Example of sources and practices**
1	*A*/D≥1000	Radioisotope thermoelectric generators ; Irradiators ; Teletherapy sources ; Fixed, multibeam teletherapy ('gamma knife') sources
2	1000>*A*/D≥10	Industrial gamma radiography sources ; High/medium dose rate brachytherapy sources
3	10>*A*/D≥1	Fixed industrial gauges incorporating high activity sources ; Well logging gauges
4	1>*A*/D≥0.01	Low dose rate brachytherapy sources (except eye plaques and permanent implants) ; Industrial gauges not incorporating high activity sources ; Bone densitometers ; Static eliminators

TABLE 2.1 CATEGORIES FOR SEALED SOURCES USED IN COMMON PRACTICES (*Continued*)

Ratio of activity in the source to activity that is considered dangerous (*A*/D)	**Example of sources and practices**
0.01>*A*/D and *A*>level for exemption	Low dose rate brachytherapy eye plagues and permanent implant sources ; X ray fluorescence devices ; Electron capture devices ; Mossbauer spectrometry sources ; Positron emission tomography check sources

THIRD SCHEDULE

[regulations 14(1)(a) and 18(4)]

DOSE LIMITS AND CONSTRAINTS FOR PLANNED EXPOSURE SITUATIONS

1. *Occupational exposure*

(1) For occupational exposure of workers over the age of 18 years, the dose limits are an —

(*a*) effective dose of 20 mSv per year averaged over five consecutive years (100 mSv in five years) and of 50 mSv in any single year ;

(*b*) equivalent dose to the lens of the eye of 20 mSv per year averaged over five consecutive years (100 mSv in 5 years) and of 50 mSv in any single year ; and

(*c*) equivalent dose to the extremities, hands and feet, or to the skin of 500 mSv in a year, additional restrictions apply to occupational exposure for a female worker who has notified pregnancy or is breast-feeding.

(2) For occupational exposure of apprentices of 16 to 18 years of age who are trained for employment involving radiation and for exposure of students of age 16 to 18 who use sources in the course of their studies, the dose limits are —

(*a*) an effective dose of 6 mSv in a year ;

(*b*) an equivalent dose to the lens of the eye of 20 mSv in a year ; and

(*c*) an equivalent dose to the extremities (hands and feet) or to the skin of 150mSv in a year.

2. *Public exposure*

For public exposure —

(*a*) the dose limit for members of the public for doses from all planned exposure situations is an effective dose of 1 mSv in a year ;

(*b*) sub-paragraph (a) of this paragraph and its risk equivalent are criteria that shall not be exceeded while the dose constraint for an individual facility is 0.3 mSv in a year ;

(*c*) in special circumstances, a higher value of effective dose in a single year may apply, where the average effective dose over five consecutive years does not exceed 1 mSv per year ;

(*d*) an equivalent dose to the lens of the eye of 15 mSv in a year ; and

(*e*) an equivalent dose to the skin of 50 mSv in a year.

3. *Verification of compliance with dose limits*

(1) The effective dose limits specified in this Schedule shall apply to the sum of the relevant doses from external exposure in the specified period and the relevant committed doses from intakes in the same period, the period for calculating the committed dose shall normally be 50 years for intakes by adults and shall be up to age 70 years for intakes by children.

(2) For occupational exposure, the personal dose equivalent $H_p(10)$ may be used as an approximation of the effective dose from external exposure to penetrating radiation.

FOURTH SCHEDULE

[regulation 79(4)]

CRITERIA FOR USE IN EMERGENCY PREPAREDNESS AND RESPONSE

1. Table 4.1 of this Schedule provides generic criteria for any dose received within a short period of time for which any protective action and other response action is expected to be undertaken under any circumstance to avoid or minimize severe deterministic effect.

2. Table 4.2 of this Schedule provides guidance values for restricting exposure of any emergency worker.

TABLE 4.1 GENERIC CRITERIA FOR DOSES RECEIVED WITHIN A SHORT PERIOD OF TIME FOR WHICH PROTECTIVE ANY ACTION AND OTHER RESPONSE ACTION IS EXPECTED TO BE UNDERTAKEN UNDER ANY CIRCUMSTANCE TO AVOID OR MINIMIZE SEVERE DETERMINISTIC EFFECT

Acute external exposure (<10 h)		If the dose is projected :
$AD_{red\ marrow}$		- Take precautionary urgent protective actions immediately (even under difficult conditions) to keep doses below the generic criteria
	AD_{fetus} 0.1 Gy	- Provide public information and warnings
AD_{tissue}	25 Gy at 0.5 cm	- Carry out urgent decontamination
AD_{skin}	10 Gy to 100 cm^2	
Acute internal exposure due to an Intake (Δ = 30 d)		
$AD(\Delta)_{red\ marrow}$	0.2 Gy for radionuclides with atomic number Z ≥ 90 2 Gy for radionuclides with an atomic number Z ≥ 89	If the dose has been received : - Perform immediate medical examination, consultation and indicated medical treatment
$AD(\Delta)_{thyroid}$	2 Gy	- Carry out contamination control
$AD(\Delta)_{lung}$	30 Gy	- Carry out immediate decorporation (if applicable)
$AD(\Delta)_{colon}$	20 Gy	- Carry out registration for longer term medical follow-up
$AD(\Delta)_{fetus}$	0.1 Gy	- Provide comprehensive psychological Counseling

a. $AD_{red\ marrow}$ Represents the average relative biological effectiveness (RBE) weighted absorbed dose to internal tissues or organs (such as red marrow, lung, small

intestine, gonads or thyroid) and to the lens of the eye from exposure in a uniform field of strongly penetrating radiation.

b. Dose delivered to 100 cm^2 at a depth of 0.5 cm under the body surface in tissue due to close contact with a radioactive source (such as source carried in the hand or pocket) and the dose is to the 100 cm^2 dermis (skin structures at a depth of 40 mg/cm^2 (or 0.4 mm) below the surface).

c. AD(**Δ**) is the RBE weighted absorbed dose delivered over a period of time **Δ** by the intake (I_{05}) that shall result in a severe deterministic effect in 5% of exposed individuals.

d. Different generic criteria are used to take account of the significant difference in RBE weighted absorbed dose from exposure at the intake threshold values specific for these two groups of radionuclides.

e. Decorporation is the action of the biological processes, facilitated by chemical or biological agents, by means of which incorporated radionuclides are removed from the human body and the generic criterion for decorporation is based on the projected dose without decorporation.

f. For the purposes of these generic criteria, 'lung' means the alveolar-interstitial region of the respiratory tract.

g. For this particular case, '**Δ**' means the period of in utero development of the embryo and fetus.

TABLE 4.2 GUIDANCE VALUES FOR RESTRICTING EXPOSURE OF ANY EMERGENCY WORKER

Tasks	Guidance value
	$H_p(10)^b$ < 500 mSv
Life saving actions	This value may be exceeded under circumstances in which the expected benefits to others clearly outweigh the emergency worker's own health risks, and the emergency worker volunteers to take the action and understands and accepts these health risks
Actions to prevent severe deterministic effects and actions to prevent the development of catastrophic conditions that may significantly affect people and the environment	$H_p(10)$< 500 mSv
Actions to avert a large collective dose	$H_p(10)$< 100 mSv

FIFTH SCHEDULE

[regulation 42(3)]

PARTICULARS TO BE ENTERED IN RADIATION DOSE RECORD

1. Individual serial number of the dose record.

2. A statement that the dose record has been authorised by the Authority for the purposes of these Regulations.

3. Date of issue of the dose record by the authorised dosimetry service provider.

4. The name, telephone number and mark of endorsement of the employer.

5. The name, address, telephone and telex or fax number of the employer.

6. The Full name (surname, forenames), date of birth, gender and national insurance number of the outside worker to whom the dose record has been issued.

7. The Date of the last medical review of the outside worker and the relevant classification in the health record maintained under regulation 23 of these Regulations as fit, fit subject to conditions, which shall be specified, or unfit.

8. The relevant dose limits applicable to the outside worker to whom the dose record has been issued.

9. The cumulative dose assessment in mSv for the year to date for the outside worker, external (whole body, organ or tissue) or internal as appropriate and the date of the end of the last assessment period.

10. In respect of services performed by the outside worker —

(*a*) the name and address of the employer responsible for the controlled area ;

(*b*) the period covered by the performance of the services ; and

(*c*) estimated dose information, which shall be, as appropriate —

(*i*) an estimate of any whole body effective dose in mSv received by the outside worker,

(*ii*) in the event of non-uniform exposure, an estimate of the equivalent dose in mSv to organs and tissues as appropriate, and

(*iii*) in the event of internal contamination, an estimate of the activity taken in or the committed dose.

SIXTH SCHEDULE

[regulation 4(9)(a)]

MATTERS IN RESPECT OF WHICH A RADIATION SAFETY ADVISER SHALL BE CONSULTED BY A RADIATION EMPLOYER

1. The implementation of requirements as to controlled and supervised areas.
2. The prior examination of plans for installation and the acceptance into service of new or modified sources of ionizing radiation in relation to any engineering controls, design features, safety features and warning devices provided to restrict exposure to ionizing radiation.
3. The regular calibration of equipment provided for monitoring levels of ionizing radiation and the regular checking that such equipment is serviceable and correctly used.
4. The periodic examination and testing of engineering controls, design features, safety features and warning devices and regular checking of systems of work provided to restrict exposure to ionizing radiation.

MADE at Abuja this 23*rd day of November*, 2023

BOLA AHMED TINUBU, GCFR
President, Federal Republic of Nigeria