



Federal Republic of Nigeria

Official Gazette

No. 58

Lagos - 6th November, 2006

Vol. 93

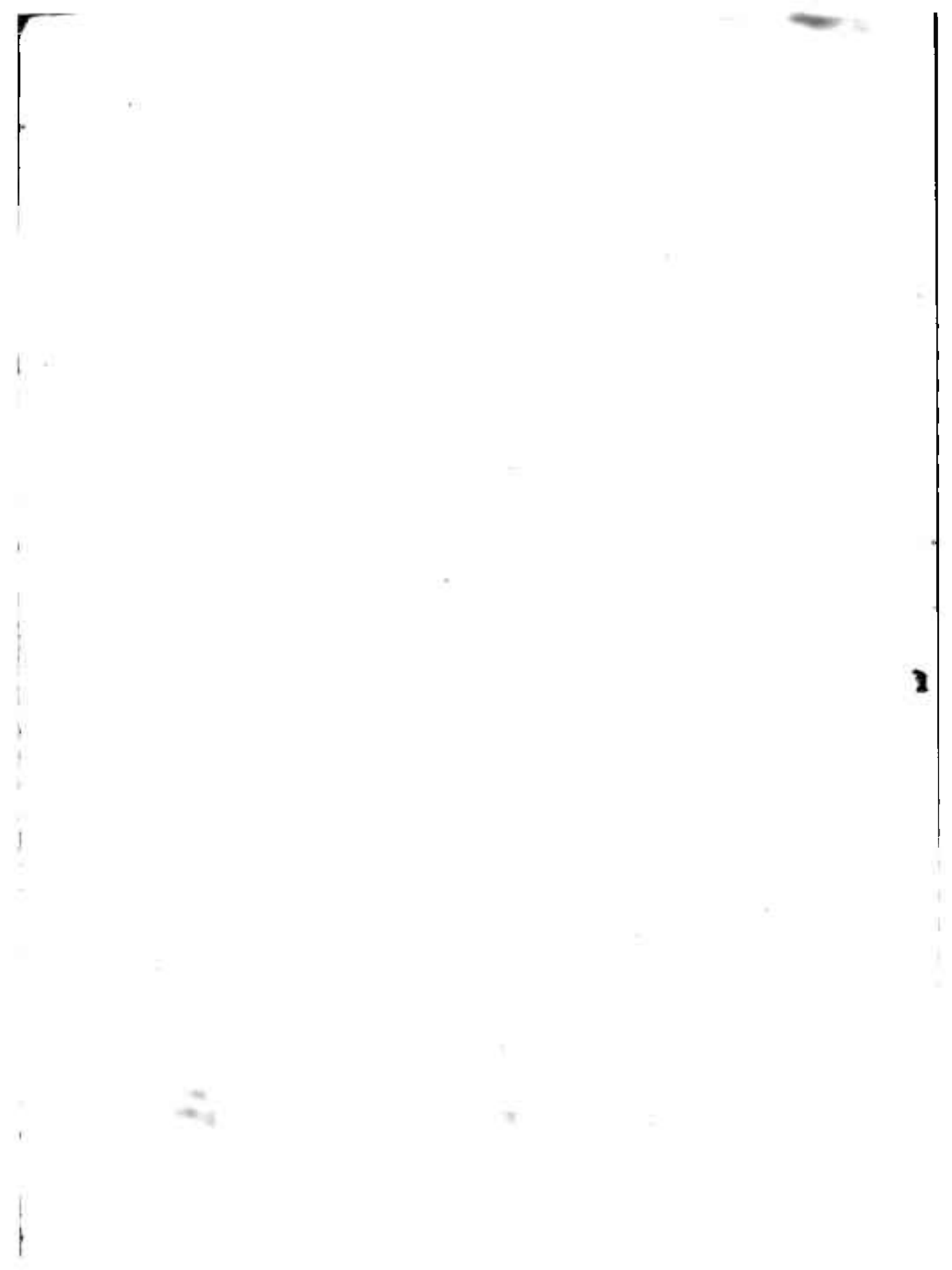
Government Notice No. 42

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Printed and Published by the Federal Government Printer, Lagos, Nigeria
FGP 183/112006/1000 (OL 63)

Annual Subscription from 1st January, 2006 is Local : ₦15,000.00 Overseas : ₦21,500.00 [Surface Mail]
₦24,500.00 [Second Class Air Mail]. Present issue ₦5,000.00 per copy. Subscribers who wish to obtain *Gazette*
after 1st January should apply to the Federal Government Printer, Lagos for amended Subscriptions.



NUCLEAR SAFETY AND RADIATION PROTECTION ACT

(1995 No. 19)

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DOSE LIMITS

1948

1949

S.I. 57 of 2006

NUCLEAR SAFETY AND RADIATION PROTECTION ACT

(1995 No. 19)

NIGERIAN RADIATION SAFETY IN INDUSTRIAL RADIOGRAPHY
REGULATIONS, 2006

[5th October, 2006]

Commence-
ment.

In exercise of the powers conferred on it by Section 47 of the Nuclear Safety and Radiation Protection Act 1995 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

1. For the purpose of these Regulations, unless the context otherwise requires—

Interpretation.

“*Absorbed Dose*” means the quotient $\frac{dE}{dm}$ (in Gy) where dE 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 ;

“*Activity*” means the quotient $\frac{dN}{dt}$ (in Bq or Ci) where dN is the expectation value of the number of spontaneous nuclear transformations from the given energy state in the time interval dt ;

“*Applicant*” means any legal person who applies to the Nigerian Nuclear Regulatory Authority for authorization to undertake any of the actions covered by the scope of the regulations ;

“*Approved*” means approval by the Authority ;

“*Authority*” means the Nigerian Nuclear Regulatory Authority established under Section 1 of Act 19 of 1995 ;

“*Authorization*” means permission granted in a document by the Authority to a legal person who has submitted an application to carry out a practice within the scope of the regulations. The authorization can take the form of a registration or a licence ;

“*Collective Dose*” means an expression for the total radiation dose incurred by a population, defined as the product of the number of individuals exposed to a source and their average radiation dose (man.Sv) ;

“*Chronic Exposure*” means exposure persisting in time ;

“*Disused Source*” means a radioactive source no longer intended to be used for its original purpose ;

“*Decontamination*” means the removal or reduction of contamination by a physical or chemical process ;

“*Dose Limit*” means the value of the effective dose or the equivalent dose to individuals from controlled practices that shall not be exceeded ;

“*Dosimeter*” means an instrument used for measuring the absorbed dose of radiation ;

"Employer" means a legal person with recognized responsibility, commitment and duties towards a worker in his or her employment by virtue of a mutually agreed relationship. A self-employed person is regarded as being both an employer and a worker ;

"Effective Dose" means the quantity E , defined as a summation of the tissue equivalent doses, each multiplied by the appropriate tissue weighting factor :

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

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

$$E = \sum_T w_T \cdot \sum_R w_R D_{TR}$$

where w_R is the radiation weighting factor for radiation R and D_{TR} the average absorbed dose in the organ or tissue T . The unit of effective dose is $J.kg^{-1}$, termed the sievert (Sv).

"Health Professional" means an individual who has been accredited through appropriate national procedures to practice a profession related to health (e.g. medicine, dentistry, chiropractic, pediatrics, nursing, medical physics, radiation and nuclear medical technology, radio-pharmacy, occupational health) ;

"Ionizing Radiation" means radiation capable of producing ion pairs in biological materials ;

"Licence" means an authorization granted by the Authority on the basis of a safety assessment and accompanied by specific requirements and conditions to be complied with by the licensee ;

"Licensee" means the holder of a current licence granted for a practice or source who has recognized rights and duties for the practice or source, particularly in relation to protection and safety ;

"Limit" means the value of a quantity used in certain specified activities or circumstances that must not be exceeded ;

"Management" means all activities, administrative or operational, that are involved in the manufacture, supply, receipt, storage, use, transfer, import, export, transport, maintenance or disposal of radioactive sources ;

"Monitoring" means the measurement of dose or contamination for reasons related to the assessment or control of exposure to radiation or radioactive substances, and the interpretation of the results ;

"Notification" means a document submitted to the Authority by a legal person to notify an intention to carry out a practice or any other action within the scope of the regulations ;

"Occupational Exposure" means all exposures of workers incurred in the course of their work, with the exception of exposures from practices or sources exempted by the scope of the regulations ;

"Operating Organization" means an operator of industrial radiography equipment and facilities in Nigeria

"Public Exposure" means exposure incurred by members of the public from radiation sources, excluding any occupational or medical exposure and the normal

local natural background radiation but including exposure from authorized sources and practices and from intervention situations ;

"Practice" means any human activity that introduces additional sources of exposure or exposure pathways or extends exposure to additional people or modifies the network of exposure pathways from existing sources, so as to increase the exposure or the likelihood of exposure of people or the number of people exposed ;

"Qualified Expert" means an individual who, by virtue of certification by appropriate boards, societies, professional licensees, academic qualifications and experience, duly recognized as having expertise in any specialized field e.g. medical physics, radiation protection, occupational health, fire safety, quality assurance or any relevant engineering or safety specialty ;

"Radiation Generator" means a device capable of generating radiation, such as X rays, neutrons, electrons or other charged particles, which may be used for practices within the scope of the regulation ;

"Radiation Safety Officer" means an individual technically competent in radiation protection and safety matters relevant for a given type of practice who is designated by the registrant or licensee to oversee the application of the requirements of the Regulations ;

"Radiation Source" means anything that may cause radiation exposure, such as by emitting ionizing radiation or releasing radioactive substances or materials. A complex or multiple installations situated at one location or site may, as appropriate, be considered a single source for the purposes of application of the regulations ;

"Radioactive Waste" means a material, whatever its physical form, remaining from practices or interventions and for which no further use is foreseen (i) that contains or is contaminated, with radioactive substances and has an activity or activity concentration higher than the level from regulatory requirements, and (ii) exposure to which is not excluded from the regulations ;

"Regulatory Control" means any form of control applied to facilities or activities by the Authority for reasons related to radiation protection, safety and security of radioactive sources ;

"Risk" means a multi-attribute quantity expressing hazard, danger or chance of harmful or injurious consequences associated with actual or potential exposures. It relates to quantities such as the probability that specific deleterious consequences may arise and the magnitude and character of such consequences ;

"Safety" means any measures intended to minimize the likelihood of accidents with radiation sources and, should such an accident occur, to mitigate its consequences ;

"Sealed Source" means a radioactive material that is (a) permanently sealed in a capsule or (b) closely bounded and in a solid form. The capsule or material of a sealed source shall be strong enough to maintain leak tightness under the condition of use and wear for which the source was designed, and also for under foreseeable mishaps ;

"Supervised Area" means any area not designated as a controlled area but for which occupational exposure conditions are kept under review even though specific protective measures and safety provisions are not normally needed ;

"Supplier" means any legal person to whom a registrant or licensee delegates duties, totally or partially, in relation to the design, manufacture, production or construction of a source. An importer of a source is considered a supplier of the source ;

"Unsealed Source" means a source that does not meet the definition of a sealed source ;

"Worker" means any person who works, whether full time, part time or temporarily, for an employer and who has recognized rights and duties in relation to occupational radiation protection. A self-employed person is regarded as having the duties of both an employer and a worker.

Objective. 2. The regulations shall set up the basic technical and organizational requirements to be complied with by all operators of industrial radiography equipment and facilities in Nigeria, in order to ensure the protection of human health and the environment from the hazards associated with ionizing radiation.

Scope. 3. The regulations shall specify the minimum requirements for radiation protection and safety for all users of ionizing radiation in industrial radiography, these shall include; non-destructive testing, either with fixed assemblies x-rays generators or gamma emitting sealed sources where industrial radiography is carried out inside shielded facilities with engineering controls or with mobile assemblies for site radiography outside shielded facilities.

Application. 4.—(1) The application of these Regulations shall be in addition to the Nigeria Basic Ionizing Radiation Regulations 2003 (NiBIRR) and any other existing ionizing radiation and nuclear regulations e.g. safety and security of radioactive sources regulations, transport of radioactive sources regulations in force.

(2) These Regulations shall apply to :

(a) all sources of ionizing radiation used for industrial radiography purposes, with possible exemption prior to authorization by the authority ;

(b) facilities where sources of ionizing radiation are installed, used or stored ;

(c) the operation of sources of ionizing radiation ;

(d) the duties and responsibilities of the users, their internal safety organization and working procedures related to radiation protection ;

(e) the monitoring of persons occupationally exposed and of work places ;

(f) medical examinations of persons occupationally exposed ;

(g) radioactive sources or materials in storage or in transit ;

(h) handling of wastes from the above uses ; and

(i) handling of radiological emergencies or accidents ;

(j) import or export requirements ;

(k) quality control of equipment and calibration of instruments, etc ;

(l) program for education, training and development ; and

(m) handling of radiation injuries and medical preparedness.

PART II—GENERAL REQUIREMENTS

5. The principal radiation safety requirements related to justification of the practice, dose limitation, optimization of protection, and dose constraints, as specified in Nigeria Basic Ionizing Radiation Regulations shall be applied to industrial radiography.

Radiation
safety
requirements.

6.—(1) A legal person intending to carry out industrial radiography or any of the following associated activities shall notify the Authority of his intention and obtain an authorization for :

Authorization
of the
practice.

(a) importation, purchase, sale, manufacture, repair of or modification to, radiation generators and sealed sources used for industrial radiography including ancillary equipment, which incorporates radioactive materials such as depleted uranium source containers etc ;

(b) transportation, storage, use of radiation generators and sealed sources for industrial radiography including ancillary equipment, which incorporates radioactive materials ;

(c) construction of facilities for industrial radiography and any temporary or permanent decommissioning of these facilities ;

(d) disposal of any sealed sources including ancillary equipment, which incorporate radioactive materials ; and

(e) transfer of ownership of any radiation generator or sealed source including ancillary equipment which incorporates radioactive materials or any facility used for industrial radiography.

(2) When applying for a license, the legal person shall provide documentary evidence to the Authority which demonstrates an adequate level of radiation safety provided and maintained.

7.—(1) Legal persons shall provide all relevant information in their request for authorization to the Authority which shall include the following :

Requirement
for
authorizations.

(a) design and construction of facilities, equipment and radiation sources ;

(b) systems for managing radiation safety, radiation safety programme, results of safety assessments, quality assurance procedures ; and

(c) procedures for the safe operation of radiation sources including local rules and record-keeping.

8.—(1) Authorization granted by the Authority shall be for a period as may be determined by the Authority and shall be renewable.

Duration of
authorization.

(2) The Authority may suspend or revoke the authorization where the licensee is in breach of the licence conditions, NiBIRR or these regulations.

(3) In order to be able to resume operation, the licensee shall reapply for authorization in case of revocation and reconsideration in case of suspension.

9.—(1) The Licensee shall be responsible for setting up and implementing the technical and organizational measures that are needed for ensuring the protection and safety of sources for which they are authorized.

Responsibilities
of the
Licensee.

(2) The Licensee shall—

- (a) notify the Authority of all the activities stated in these regulations ;
- (b) notify the Authority of any intentions to introduce modifications to any practice or source for which they are authorized ;
- (c) prepare and implement an operational radiation protection and safety programme, which includes, the establishment of policies, procedures and standards for the safe keeping and use of radiation sources and the protection of workers and other persons ;
- (d) appoint one or more Radiation Safety Officers to oversee the implementation of the radiation safety programme and provide such Radiation Safety Officers with appropriate authority and adequate resources ;
- (e) consult and appoint Radiation Safety Adviser where necessary ;
- (f) perform the required Safety Assessments as contained in these regulations ;
- (g) ensure that workers are adequately trained in :
 - (i) radiation protection and safety ;
 - (ii) the operating procedures, local rules and emergency plans appropriate to the specific types of equipment used within the organization ; and
 - (iii) provide workers with personal dosimeter and appropriate health surveillance ;
- (h) ensure that all equipment used for the practice is suitable for its intended and actual uses and is properly maintained ;
- (i) provide workers with appropriate survey meters that are maintained in good working order and tested regularly ;
- (j) ensure that adequate radiation monitoring is carried out and that records are kept ;
- (k) provide emergency plans (contingency plans) for all reasonably foreseeable radiation accidents and incidents ;
- (l) make provisions for the safe disposal or return to the supplier of existing radioactive sources that are no longer required ;
- (m) when applying for a new authorization for the importation, use or storage of any radioactive source including ancillary equipment that incorporates depleted uranium shielding, provide for a program for the safe disposal or return of radioactive sources to the supplier when they are no longer required ; and
- (n) ensure that any provider of radiation protection and safety related services (e.g. dosimeter laboratories) are authorized or approved by the Authority.

Management
and
organizational
requirements.

10.—(1) The Management of the operating organization shall provide the human and material resources necessary to ensure safe working conditions and compliance with License conditions.

(2) Every operating organization shall develop and promote a safety culture to encourage a questioning and learning attitude to protection, safety and to discourage complacency. This includes establishing and maintaining a radiation safety programme which objectives shall include the following elements :

(a) taking all practicable steps to ensure that the exposure of all persons is kept as low as reasonably achievable and below the dose limits set in the Regulations as in Schedule 1;

(b) taking all necessary steps to ensure the physical safety and security of radiation sources to minimize risk to persons not connected with the practice ; and

(c) compliance with the Regulations and License requirements, ensuring that all necessary tests, inspections and records are maintained to enable the operating organization to demonstrate compliance with these requirements.

11.—(1) The Licensee shall appoint at least one Radiation Safety Officer whose functions and duties are clearly defined and documented.

Appointment
of Radiation
Safety
Officer.

(2) The minimum requirements and qualities for a Radiation Safety Officer shall include :

(a) theoretical knowledge and practical training in radiation protection and safety related to industrial radiography ;

(b) sufficient management authority within the operating organization to effectively supervise and control the radiography work to ensure that the license conditions are met ; and

(c) the Radiation Safety Officers shall have the authority to stop work that is not being undertaken in a safe manner.

12.—(1) The Radiation Safety Officer's responsibilities shall include :

Responsibilities
of the
Radiation
Safety
Officer.

(a) supervising the work to the extent necessary to ensure that procedures including local rules and all License terms and conditions are complied with ;

(b) preparing and reviewing written administrative procedures that define the means of complying with regulatory or license requirements ;

(c) preparing and reviewing operational procedures including local rules to ensure that exposures to radiation are kept as low as reasonably achievable ;

(d) ensuring that operation manuals for the radiography equipment are provided and are understood by the radiographers ;

(e) ensuring that safety assessments and emergency plans are prepared ;

(f) ensuring that engineering controls and other equipment designed to protect persons against ionizing radiation are maintained ;

(g) identifying designated areas and establishing necessary safeguards for controlling access to such areas ;

(h) arranging for and supervising the use of personnel dosimeter and ensuring that that appropriate dose records are maintained ;

(i) ensuring that there is adequate monitoring of workplaces in order to prevent unnecessary exposure and to demonstrate compliance with the Regulations and Licence conditions ;

(j) investigation of accidents including abnormal high exposures in routine work and overexposures, proposing, implementing remedial actions and accident preventive measures ;

(k) to determine the additional requirements for protection of any female staff engaged in the work with ionizing radiation who may be pregnant;

(l) carry out a prior examination from a radiation safety standpoint of any plans for new fixed radiography facilities or modifications to existing ones ;

(m) maintain inventories of radioactive sources ;

(n) perform regular safety inspections of all radiography work ; and

(o) identify situations where a Radiation Safety Adviser should be consulted.

(2) In cases where more Radiation Safety Officers are appointed, i.e. multiple job sites, the reporting structure and individual duties of each shall be well defined, with one Radiation Safety Officer having general oversight and the Authority shall be notified of these appointments.

Responsibilities
of the
Radiation
Safety
Officer.

13.—(1) Daily responsibility for safe working with industrial radiography sources shall rest with the radiographer and in addition to protecting himself, the radiographer shall be vigilant to ensure the safety of his colleagues, other workers not directly connected with the work and the public.

(2) In this regard, the radiographer shall—

(a) appreciate the hazards associated with radiography and take all necessary steps to protect themselves and others ;

(b) adequately supervise assistant radiographers ;

(c) undertake only work they are trained and qualified for, and to seek assistance from the Radiation Safety Officers if unsure about the safety implications of any work ;

(d) use the radiographic and ancillary equipment including safety equipment and sources for the purposes for which they were designed ;

(e) follow the written procedures and local rules provided, without exception ;

(f) wear personal dosimeter(s) at all times when handling or using radiographic equipment ;

(g) never undertake work with radiation sources if the equipment is defective or has not been adequately maintained according to standard procedures ;

(h) promptly report all equipment defect to the Radiation Safety Officers ; and

(i) respond promptly and correctly in the event of emergencies, according to the documented contingency plans.

The
responsibilities
of the
Assistant
Radiographer.

14. Assistant Radiographers shall always be directly supervised by a qualified Radiographer and the duties and responsibilities of the assistant Radiographer shall :

(a) work only under the personal supervision of a qualified radiographer ;

(b) respect the hazards associated with radiography and taking all necessary steps to protect themselves and others ;

(c) undertake only work they are trained and qualified for and to seek assistance from the qualified radiographer if he is unsure of the safety implications of any work ;

- (d) understand radiographic and ancillary equipment including safety equipment ;
- (e) follow the procedures and local rules provided by the radiation employer ;
- (f) wear a personal dosimeter at all times when handling or using radiographic equipment ;
- (g) never undertake work with radiation sources if equipment is defective ;
- (h) report all defects with equipment to the qualified radiographer and Radiation Safety Officers ; and
- (i) inform the qualified radiographer immediately in the event of an emergency and to assist in dealing with such situations as directed.

15.—(1) Licensee shall appoint an authorized Radiation Safety Adviser, to advise in many areas, such as design of new facilities, maintenance of safety systems etc. to ensure compliance with regulatory and license requirements.

Appointment
of Radiation
Safety
Adviser.

(2) The scope of advice and the services provided by an authorized Radiation Safety Adviser shall be agreed with the Licensee and clearly documented.

(3) Licensee shall provide the Radiation Safety Adviser with appropriate information and access to facilities in order for the Adviser carry out the agreed services.

16.—(1) Licensees shall ensure that radiography is carried out only by qualified radiographers.

Training and
Education.

(2) Formal training of industrial radiographers shall be carried out in a systematic manner and shall involve accreditation to a recognized local, national or international standard and periodical training is essential to maintain the required level of competence.

(3) Licensees shall only employ qualified radiographers who have received formal training which include :

- (a) sufficient educational background ;
- (b) specialized formal training in the techniques required to obtain a radiograph, as appropriate to the duties ;
- (c) specialized formal training in radiation protection and safety ;
- (d) familiarity with the organization's local rules and License requirements ; and
- (e) practical training in techniques and radiation protection and safety requirements including emergency procedures specific to the equipment used within the organization.

17. The Licensee shall also ensure that Radiation Safety Officers and all workers know and understand the following—

Obligations
of the
Licensee.

- (a) the conditions and limitations of the License held by the operating organization ;
- (b) the organization's radiation protection and safety programme ;
- (c) the operation and maintenance of the equipment used by the licensee ;
- (d) hazards identified by the Safety Assessment ;
- (e) local rules and other operating procedures ; and

(f) the detailed procedures to be followed in the event of emergencies, training for which shall include training exercises carried under realistic condition.

Record of Training.

18.—(1) The licensee shall prepare and maintain a record of training of all the personnel involved in industrial radiography and these records shall include the following information :

- (a) name of the person who received the instruction or training ;
- (b) name of the institution or person who delivered the training ;
- (c) dates and duration of the instruction or training ;
- (d) a summary or list of the topics addressed ;
- (e) copy of any training certificates ; and
- (f) the result of any professional examination taken.

(2) The licensee shall provide copies of the training records to individual workers especially if they change their employers.

Safety Assessments.

19.—(1) Licensees shall ensure that a safety assessment is carried out at the following stages :

- (a) when applying for a new licence or for modification to an existing license ;
- (b) at the design stage, prior to the construction of a fixed industrial radiography facility ;
- (c) upon commissioning of the facility and before any routine radiography begins in the facility ;
- (d) when making significant changes to working practices or modifications to permanent radiography enclosures ; and
- (e) when operating experience, or other information about accidents, failures, errors or other events that could lead to potential exposures indicates that the current assessment might be invalid.

(2) Licensee shall ensure that the safety assessment is fully documented and is prepared in consultation with the Radiation Safety Officer and Radiation Safety Adviser.

- (3) The safety assessment shall include a systematic and critical review of—
 - (a) the nature and magnitude of potential exposures and the likelihood of their occurrence ;
 - (b) the limits and technical conditions for operation of radiation sources ;
 - (c) the ways in which structures, systems, components and procedures related to radiation protection or safety might fail, singly or in combination, or otherwise lead to potential exposures, and the consequences of such failures ; and
 - (d) factors which could give rise to the unintended operation of any radiation source and the measures available to prevent, identify and control such occurrences.

(4) Where the safety assessment shows there is a risk of a radiation accident, Licensees shall take all practicable steps to :

- (a) prevent such accident ;

- (b) limit the consequences of such accident, should the accident occur ; and
- (c) provide workers with training in emergency procedures.

20. Licensees shall carry out regular audits of normal radiography operations to ensure that a satisfactory standard of radiation safety is being maintained.

Verification
of Safety

21.—(1) Licensees shall develop a policy statement that specifies the following :

Policy
Statement.

- (a) person responsible for organizing and carrying out the safety audits ;
- (b) the time interval between audits ;
- (c) person responsible for preparing the audit report and making recommendations ;
- (d) person to whom the audit report is to be sent ; and
- (e) person responsible for implementing any corrective measures that are identified during the audit.

(2) Each audit shall be done according to a structured plan and the time scale set for implementing corrective measures and shall ensure that any deficiencies which present a significant radiological hazard are dealt with promptly and the agreed corrective measures shall be followed-up to ensure that the audit process is completed.

PART III—INDIVIDUAL MONITORING OF WORKERS

22.—(1) Employers shall assess the occupational exposure of all workers, Radiographers, Assistant Radiographers and any other persons who may regularly work in controlled areas or may receive significant occupational exposure which shall be provided with appropriate individual dosimeters to assess their cumulative occupational radiation exposure.

Statutory
(Legal)
Dosimeters
and Dose
Record.

(2) The dosimeters coverage is subject to the following :

- (a) the dosimeter shall be a film badge or a thermo-luminescent dosimeter ;
- (b) the supplying laboratory shall be subject to the approval of the Authority ;
- (c) the period for the use of a dosimeter shall be, for a maximum period of 3 months ;
- (d) workers shall be required to wear additional dosimeters such as extremity thermo-luminescent dosimeter during source changes or additional dosimeters if neutron radiography is undertaken ;
- (e) the statutory personal dosimeter shall only be used by the person to whom it is assigned ;
- (f) the Licensee shall maintain a dose record for each individual in the manner specified in the regulations ;
- (g) before a radiographer starts work, the licensee shall obtain a copy of the workers' dose record from previous occupational exposure ;
- (h) the licensee shall also supply relevant information of their record of service to radiographers on termination of their employment ;
- (i) licensee shall draw up a procedure to describe the way individual dosimeters are administered and this shall include persons who ;
- (j) order and receive the dosimeters from the dosimeter laboratory ;

- (k) distributes them to the radiographers and Radiation Safety Officer ;
- (l) collects them and dispatches them to the dosimeter processing laboratory ; and
- (m) reviews and maintains the dose records.

Protection of
personnel
Dosimeters
during use.

23. In order to ensure the protection of the personnel dosimeters, the Radiographers shall :

- (a) take good care of their dosimeter; protect them from loss, theft or damage ;
- (b) return them at the end of every specified period of usage ; and
- (c) inform the Radiation Safety Officer without delay, if their dosimeter is missing, damaged or if it has been accidentally exposed to radiation when not in use.

Storage of
personnel
Dosimeters.

24. To ensure accurate reading of the dosimeters when not in use, the storage of individual dosimeters shall include the following elements :

- (a) dosimeters shall be stored in a suitable environmental condition, which will not damage or affect the properties of the dosimeter ;
- (b) individual dosimeters shall not be stored in source stores, inside radiography enclosures, near exposure containers, near radioactive luminous items or in any other area where there are raised dose rates ; and
- (c) they shall not go through x-ray mail inspection systems.

Loss of
Personnel
Dosimeters.

25.—(1) For the loss of any dosimeter, the operating organization shall take all reasonable steps to recover it.

(2) If the dosimeter cannot be located, the operating organization shall carry out an investigation and prepare a report which includes an estimate of the dose received by the worker for the relevant period.

Investigation
of Doses.

26.—(1) Results of personal dosimeters shall be reported to the Radiation Safety Officer who shall inspect them to determine whether any unexpectedly high doses have been received and to determine whether individuals are keeping their doses within the dose limits.

(2) In addition, the Radiation Safety Officer shall set investigation levels of doses above which a formal investigation and written report shall be prepared.

Reading of
Dosimeter.

27.—(1) Direct reading dosimeters (e.g. quartz fibre electroscopes) shall be used to supplement the TLD or film badge, whenever it is important to have an immediate indication of exposure, for example during site radiography in a confined space or during emergency recovery of a source.

(2) Such uses shall be subject to the following conditions :

- (a) direct reading dosimeters shall be read or reset, at the start of each work shift and then read at regular intervals with accurate records kept ;
- (b) if the direct reading dosimeter exceeds a level set by the Radiation Safety Officer, the radiographer shall stop work and discuss the situation with the Radiation Safety Officer to establish how procedures might be improved ; and
- (c) licensees shall ensure that direct reading dosimeters and personal alarm monitors are kept in good working condition and subject to regular operational checks.

28. All radiographers shall wear a personal alarm monitor that emits an audible and sometimes visible alarm when exposed to dose rates above a preset level as determined by the Radiation Safety Officer

Personal
alarm
Monitor.

PART IV—WORKPLACE MONITORING.

29. Licensees shall develop and maintain a programme for workplace monitoring in order to :

Maintenance
of workplace
Monitoring.

- (a) evaluate radiological conditions ;
- (b) assess exposures in controlled and supervised areas ; and
- (c) review the classification of controlled and supervised areas.

30.—(1) The licensee shall ensure that a sufficient number of suitable radiation survey meters are available for the radiographers and Radiation Safety Officer.

Survey
Meters.

(2) A survey meter shall be used before and after every exposure of a radioactive source to confirm that the source is in its fully shielded position. For it to be suitable for the work environment, radiation survey meters shall satisfy the following conditions :

- (a) survey meters shall be robust, waterproof if likely to be used in the rain and have an illuminated display if likely to be used in the dark ;
- (b) batteries shall be readily available ;
- (c) they shall be scaled in units of dose rate and shall be able to indicate radiation levels from about 1 mSv/h-1 up to about 10mSv/h-1 ; and
- (d) licensees shall ensure that equipment obtained for this purpose is of a type approved by the Authority and that it comes with an operating manual and with an initial certificate of testing by the manufacturer or supplier.

31.—(1) The radiographer shall inspect the operation of the radiation survey meter at the start of each working shift.

Maintenance
and
Calibration

(2) This inspection shall include :

- (a) battery condition ;
- (b) any other instrument checks (e.g. high voltage setting) ;
- (c) background radiation level is as expected ; and
- (d) response against a gamma exposure container or other suitable check source.

(3) Every radiation survey meter used during radiography shall be checked regularly :

- (a) normal tests as in proceeding paragraph ;
- (b) any specific inspection of instrument specified by the manufacturer ;
- (c) inspection of indicated gamma dose rate versus actual dose rate at a range of dose rates to establish linearity of response ;
- (d) inspection of indicated dose rate versus actual dose rate at a range of dose rates to establish linearity of response ; and
- (e) over-load check to confirm that the survey meter indicator remains at maximum, under condition of a very high dose rate.

32.—(1) Radiation survey meters shall be used to evaluate the radiological conditions in all workplaces, in particular at the following locations :

- (a) around controlled and supervised areas to review classification and assess exposures ;
- (b) around a transport container when a new gamma source is received ;
- (c) around a gamma source container when collecting it from a store ;
- (d) around a gamma source container when returning it to a store to confirm the source is present and is fully shielded ; and
- (e) around a gamma source container when loading and offloading it into a vehicle used for transport.

(2) In the following situations :

- (a) after every exposure of a gamma source to confirm that it has fully returned to the shielded position in its exposure container ;
- (b) to check the dose rates at the controlled area barriers during site radiography ;
- (c) when transferring gamma sources between containers ; and
- (d) when dealing with emergencies involving gamma sources.

(3) The results of radiation surveys shall be recorded in the following instances :

- (a) when commissioning a new fixed radiography compound or one that has been significantly modified;
- (b) when commissioning a new radiation source store ;
- (c) when checking the dose rate around a gamma radiography exposure container prior to transporting it so that the transportation index can be recorded on the consignment document ;
- (d) routine surveys around fixed radiographic facilities at least once every year ;
- (e) during site radiography with mobile sources to confirm that barrier distances are set correctly ; and
- (f) during emergencies and investigations so that dose estimates can be performed.

(4) Records of radiation surveys should include the following details :

- (a) location ;
- (b) date ;
- (c) name of person performing survey ;
- (d) survey meter type and serial number ;
- (e) radiation source details, e.g. type of source, activity, beam direction, x-ray tube settings, etc ;
- (f) locations of measuring points ; and
- (g) dose rate in mSv h^{-1} .

(5) The licensee shall ensure that records of radiation surveys are kept in a manner specified in any License conditions or the Regulations.

PART V—SECURITY OF RADIOACTIVE SOURCES

33.—(1) The licensee shall establish physical controls and administrative procedures to prevent damage to, theft, loss or unauthorized removal of radioactive sources.

Security and
Control of
Radiation
Sources.

(2) In order to ensure this, the licensee shall take into consideration the following :

(a) controls and procedures to prevent entry by unauthorized persons into radioactive source stores, fixed radiography facilities and controlled areas during site radiography procedures ;

(b) control of source is not relinquished without prior notification of the Authority ;

(c) a radioactive source shall not be transferred, unless the receiver possesses a valid authorization ;

(d) that all workers shall be informed of the need and importance of radioactive source security ;

(e) permanent and purpose designed radioactive source stores are to be made available ;

(f) temporary stores are established where necessary at sites where radiography with mobile sources is undertaken ;

(g) identification of the potential ways in which sources can be lost or stolen, in particular the risks of theft during temporary storage and transporting radioactive sources ; and

(h) an effective system for accounting radioactive sources shall be implemented and to be fully complied with by all workers and the system shall be capable of detecting losses quickly.

34. Sealed sources used in industrial radiography shall be stored in secured exposure containers or source changers and these in turn shall be kept in suitable stores that will meet the following minimum requirements :

Storage of
Industrial
Radiography
Sources.

(a) it shall be designated as a controlled area ;

(b) it shall be properly secured, to prevent removal or tampering with the radioactive sources ;

(c) the keys shall be made available to a qualified radiographer only and key holding shall be properly documented ;

(d) it shall protect the equipment from any mechanical damage and harsh environmental conditions ;

(e) it shall provide protection against fire and shall not contain or be located in proximity to flammable, corrosive or oxidizing materials, or explosives ;

(f) it shall provide adequate shielding against gamma radiation ;

(g) the entrance door to the store shall be labeled clearly and durably with a radiation trefoil symbol, the words: "*Danger Radioactive Material*" in an understandable language ; and

(h) if the store is located at a place not on the operating organizations site, the name, address and telephone number of the licensee shall be displayed so that he can be contacted in an emergency situation.

Accounting
for
Radioactive
Sources.

35.—(1) Licensee shall ensure that the location of their sources is known at all times and a formal accountability system shall be established that records the location of the following radioactive sources :

- (a) sealed sources used in gamma radiography ;
- (b) pipeline crawler sources ;
- (c) other sources such as those used to test radiation survey instruments ; and
- (d) exposure containers incorporating depleted uranium shielding, even when these containers do not contain a gamma radiography source.

(2) The accountancy procedures shall be documented and consist of a number of elements which together provide defence in depth to ensure that records are complete and accurate.

Central
records of
Radioactive
Sources.

36.—(1) Licenses shall maintain a central and definitive record of all their radioactive sources.

(2) This shall be established for each source as soon as it is delivered to the organization and shall contain the following documents and details, which shall be updated when the sources are moved between storage locations or exposure containers, for each sealed source :

- (a) details of the source supplier ;
- (b) date of receipt into the operating organization ;
- (c) manufacturers' serial number ;
- (d) radionuclide and activity on a stated date ;
- (e) normal storage location ;
- (f) type and serial number of the exposure container in which source is located ;
- (g) local identifier ;
- (h) original manufacturers' leak test certificate ;
- (i) copy of any subsequent leak test certificate ;
- (j) original suppliers' special form certificate if one is issued and any updated certificates ; and
- (k) date, method and destination for final disposal or transfer to another party as authorized by the Authority.

(3) For each exposure container or source changer incorporating depleted uranium—the following records shall be made :

- (a) details of the container supplier ;

- (b) date of receipt into the operating organization ;
- (c) manufacturers' serial number ;
- (d) container type or model number or other descriptor ;
- (e) transport code (e.g. Type A, Type B, etc) ;
- (f) maximum activity of source allowed to be used in the container ;
- (g) the quantity of depleted uranium in kg (if used as shielding material) ; and
- (h) date, method and destination for final disposal or transfer to another party as authorized by the Authority.

(4) These records shall be securely kept by the licensee and copies of the records shall be transported with each mobile source in a suitable file or other document holder so that they can be readily inspected by the Authority or internal auditor.

(5) When sources or exposure containers are finally disposed of, the central records for each source or container shall be stored in a secured place for such period as may be specified in the License conditions or Regulations.

37.—(1) Source movement records shall be maintained for every mobile radioactive sources, exposure container or source changer that incorporates depleted uranium of the sources and the records shall be recorded as follows :

Source
Movement
Records

- (a) an identifier that is sufficient to allow the exposure container to be related to the central records which also contain the records of the sealed source inside the container ;
- (b) the radionuclide (e.g. cobalt-60, iridium-192) ;
- (c) date and time the exposure container or source is removed from the store ;
- (d) name and signature of the radiographer removing the source ;
- (e) the place where it will be taken ;
- (f) date and time shall be returned to the source store ; and
- (g) name and signature of the radiographer returning the source.

(2) The source movement shall be recorded every time the source is moved and the Radiation Safety Officer shall regularly inspect them, to ensure that these records are accurately completed and the licensee shall retain the source movement records for a period specified by the Authority.

38.—(1) Licensees shall ensure that monthly audits are made of the source accounts and movement records.

Radioactive
Source
Audits.

(2) The physical location of each source and any exposure containers incorporating depleted uranium shall be verified.

(3) The audit shall include the following :

- (a) identification from the central record of which sources are currently held by the licensee ;
- (b) preparation of a checklist of these sources ;

(c) confirmation by physical inspection that every source and depleted uranium source container is accounted for using a radiation survey meter if there is any doubt whether the source is present ;

(d) confirmation that source movement records are accurately completed ; and

(e) a written record that the audit results are satisfactory, this might take the form of the signature of the Radiation Safety Officer in the record or a separate record sheet retained by the Radiation Safety Officer.

PART VI—REQUIREMENTS FOR INDUSTRIAL RADIOGRAPHY EQUIPMENT

General Requirements.

39. X-ray and gamma ray equipment shall be used for industrial radiography subject to the following general requirements :

(a) any modification of an exposure container, sealed source, X-ray source, or any ancillary equipment used in industrial radiography shall be undertaken only by a qualified expert who is satisfied that the modification does not adversely effect the safety of the equipment and significant modifications shall only be carried out following authorization from the Authority ; and

(b) radiography equipment shall not be used in conditions or environments for which it was not designed and such equipment shall be stored in a suitable manner.

Gamma Radiography Equipment.

40. To ensure adequate protection of persons during gamma radiography the sealed source shall be housed in a shielded container (the "exposure container") and the source exposed only for the minimum time necessary to carry out the required radiographic inspections.

Requirements for Sealed Sources.

41.—(1) Sealed sources used for industrial radiography shall be designed, manufactured and tested to meet the requirements of the International Standard Organization or Standard Organization of Nigeria.

(2) In addition :

(a) they shall be certified as meeting the requirements of 'special form' radioactive material according to the International Atomic Energy Agency transport regulations, TS-R-1 ;

(b) each radioactive source shall have demonstrated its integrity by completion of a satisfactory leak test in accordance with the international standard organization ;

(c) any new source shall be supplied with a leak test certificate and to ensure the ongoing integrity of the source capsule ;

(d) leak tests shall be carried out at intervals prescribed by the Authority or license conditions or the regulations ;

(e) operating organizations shall require that source suppliers provide certification with all new sources ;

(f) source assemblies shall be designed, fabricated and tested to meet the requirements of the International Standard Organization (ISO) ;

(g) source assemblies shall be compatible with the exposure container, ancillary equipment such as guide tubes and any source changer ;

(h) source assemblies shall be marked with the radiation trefoil sign and a "radioactive" ; and

(i) they shall also be durably marked with the manufacturer's serial number.

42. The radiographer shall have a good understanding of the type and safe use of the exposure containers, which includes the shutter type, projection container type or any other container authorized by the Authority shall be used and further requirements shall include :

Requirements
for Exposure
Container.

(a) containers that incorporate depleted uranium shall be treated as radioactive sources even when empty and they shall be properly stored, accounted for and disposed of only in a manner authorized by the Authority ;

(b) operating organizations shall ensure that they know which of their exposure containers incorporate depleted uranium and check that the containers are durably marked to identify this ;

(c) whichever type of exposure container is used, it shall meet the minimum requirements of the International Standard Organization or equivalent to the requirements of the Standard Organization of Nigeria ;

(d) any exposure container shall bear a durable and clear label with the following details :

(i) the ionizing radiation trefoil symbol,

(ii) a cautionary warning e.g. "DANGER - RADIOACTIVE MATERIALS"

(iii) chemical and mass number of radionuclide (e.g. "Ir-192", "Co-60"),

(iv) maximum source activity permitted for the container,

(v) model and serial number of the container, and

(vi) licensee name and address ;

(e) the exposure container shall be supplied with an operational and maintenance manual ; and

(f) licensee shall request that suppliers of exposure containers and ancillary equipment to provide these manuals in English language.

43. The following requirements shall be met in the case of projection type containers :

Projection
Type
Containers.

(a) the coupling between the source assembly (the detachable element which is stored inside the exposure container when not in use) and the control (or "wind-out") cable shall be designed in such a manner that the source assembly cannot become disconnected if cranked outside of the guide tube ;

(b) the container shall automatically secure the source in the shielded position, when it is cranked back into the fully shielded position, such that it is not possible to release the source again without the deliberate operation of a release mechanism ;

(c) all connecting fittings shall have protective covers or safety plugs installed during storage and transportation, to prevent the ingress of dirt or other foreign matter ;

(d) guide tubes shall be used at all times when cranking the source out of a projection type container and such guide tubes shall have source terminal point on them (i.e. a closed end) and drive (wind-out) cables shall be of sufficient length to allow the source to be projected all the way to the end of the guide tube ;

(e) when the source is in the shielded position, dose rates on the outside of an exposure container shall not exceed 2 mSv h^{-1} at the surface or 0.1 mSv h^{-1} one meter from the surface ;

(f) all ancillary equipment shall have its compatibility tested with the exposure container before use ; and

(g) additional shielding, such as purposely made collimators or lead sheet, shall be used when practicable and compatible with the radiography technique.

Requirements
for Ancillary
Equipment
and Source
Changers.

44. All ancillary equipment used for gamma radiography shall meet the requirements of the International Standard Organization or equivalent to Standard Organization of Nigeria's standard and also :

(a) the equipment shall be tested by the licensee and must be genuine for its intended purpose before its first usage in industrial radiography ;

(b) the licensee shall carry out a pre-use test on equipment not covered under a recognized standard (e.g. collimators and positioning devices for pipeline radiography) ;

(c) source changers used in industrial radiography shall have a system for ensuring that the source will not be accidentally withdrawn from the changer when connecting or disconnecting and the source changer shall meet all applicable transportation requirements ; and

(d) depleted uranium shielding shall be taken into account in relation to storage, use, transport and disposal of source changers that incorporate such.

Requirements
for Radiation
Generators.

45. Any radiation generating equipment, including X-ray tubes, Linear Accelerators, Betatrons or Neutron generators shall meet the following minimum criteria :

(a) cable lengths shall not be less than 20 metres for x-ray generators and the capacity shall be the maximum of 300kV longer for higher energy equipment and cables, which shall be properly laid ;

(b) directional x-ray tube assemblies shall wherever practicable be fitted with suitable collimators (i.e. "cones" or "diaphragms") ;

(c) x-ray equipment shall conform with the National and International Electrical requirements and also metallic items including casings, interconnecting cables, transformers, generators, X ray control equipment, tube assembly, warning signals, other safety devices, and the work-piece shall be electrically bonded together ("earth bonding") and grounded (connected to earth) ;

(d) the x-ray tube assembly shall, wherever practicable, be supported in a suitable stand or clamped in position to prevent it from inadvertently moving during the operation ; and

(e) the control panel shall be fitted with the following features :

(i) a label incorporating the radiation (trefoil) symbol and a legend indicating that hazardous x-rays are emitted when the equipment is operating and a worded warning prohibiting unauthorized use ;

(ii) a key switch to prevent unauthorized use. The key should be removable only when the switch is in the 'off' or 'standby' position. the key positions shall be clearly marked,

(iii) a labeled warning light (preferably fail-safe), which indicates when the x-ray equipment is enabled,

(iv) a separate labeled warning light (preferable fail-safe), which indicates when the x-ray equipment is actually emitting x-rays,

(v) a timer that controls the exposure duration, or an x-ray ON/OFF switch that requires continuous pressure by the radiographer to maintain x-ray production,

(vi) indicators that show the x-ray tube potential in kilovolts (kV) and the current in milliamperes (mA) when the x-ray beam is ON, and

(vii) a clearly labeled way to terminate the generation of radiation.

46.—(1) The standards specified for conventional equipment, that is used for underwater radiography shall be designed, manufactured and tested to ensure that it is able to withstand pressures and conditions encountered in underwater environments.

Requirements
for
Underwater
Radiography
Equipment.

(2) This shall include appropriate watertight seals, use of waterproof ancillary equipment and radiation survey meters or other radiation detectors (e.g. personal alarm devices).

(3) The equipment shall indicate the maximum depth rating at which it can be used safely and additional restrictions shall be described in an operation and maintenance manual.

(4) Licensees shall ensure that radiographers are aware of all such restrictions and that these are clearly stated in the local rules.

47.—(1) Pipeline crawler equipment used for industrial radiography shall meet the applicable minimum standards for gamma sources or x-ray tubes as specified in these regulations.

Requirements
for Pipeline
Crawler
Equipment.

(2) The sealed source used in the positioning device must meet the standard requirements for a sealed source as contained in these regulations.

48.—(1) The licensee shall ensure that exposure devices, radiation generators, ancillary equipment, and safety systems are regularly inspected and maintained in good working order and this will require a formal programme of inspection and maintenance that shall take into account the recommendations of the equipment manufacturer and supplier.

Maintenance
Programme.

(2) This program as a medium shall incorporate—

(a) routine checks to be carried out at the beginning of each radiography session and which all radiographers are trained ;

(b) periodic inspection and servicing of equipment that can be done by the Licensee ;

(c) periodic inspection and servicing of equipment that shall only be done by a qualified expert either from the equipment supplier or agents approved by the equipment supplier ;

(d) any service arrangements made between the operating organization and the equipment supplier or approved agent shall be specified in writing and the operating organization shall monitor these arrangements to ensure that the agreed work is actually carried out ; and

(e) any equipment found to be defective shall be marked unserviceable, and cannot be used until repaired. Any such defect shall be promptly notified to the Radiation Safety Officer.

Maintenance
of Source
Exposure
Containers.

49.—(1) The routine daily pre-operational safety checks done by radiographers or Radiation Safety Officer shall include :

(a) verifying that the source locking mechanism functions properly ;

(b) verifying that accessible screws and nuts are tight and the threads are not damaged ;

(c) verifying that the source assembly connection to the drive cable is secured using a non interrupted gauge as supplied by the manufacturer to check for excessive wear ;

(d) inspecting the connections of the guide tubes and control mechanism to the exposure containers are properly secure ; and

(e) monitor the radiation levels to be normal ; and

(f) ensure that all labels are legible and securely fastened to the device.

(2) The periodic inspections and servicing of exposure containers shall be done by the supplier, their agents, or trained staff within the operating organization and shall include :

(a) inspecting the security of source assembly connections ;

(b) monitoring free source movement ;

(c) inspecting the locking mechanisms; damaged or worn out parts replaced ;

(d) lubrication as described by the manufacturer ;

(e) operational check after re-assembly ;

(f) measurement of the exposure levels on the outside of the exposure containers ;

(g) checking the structural integrity of the device, e.g. no cracks in welds, other obvious damage, or missing parts ;

(h) ensuring that all fasteners are in good condition and are secured to the proper torque ; and

(i) checking the condition and legibility of the identification and radiation labeling on the exposure device.

50.—(1) The routine pre-operational safety checks done by radiographers or Radiation Safety Officer shall include :

Maintenance
of Ancillary
Equipment.

- (a) drive cable, checked for free movement ;
- (b) check for excessive leakages or damages to the guide tubes ; and
- (c) collimators or specialized guide tubes shall be clear of obstructions and all fittings shall be secured.

(2) The periodic inspections and servicing of ancillary equipment by the supplier, their agents, or trained staff within the operating organization shall include:

- (a) removal and cleaning of the drive cable, inspect for corrosion, fraying and bends or leakages ;
- (b) application of proper lubrication to the drive cable as described by the manufacturer ;
- (c) all source stops and fittings shall be securely fastened with no visible damage, cracking, or excessive wear ; and
- (d) all threaded fittings are not damaged.

51.—(1) The routine pre-operational safety checks by radiographers or Radiation Safety Officer shall include :

Maintenance
of Source
Changers

- (a) lock assemblies to function properly ;
- (b) guide tube connections are properly secured ; and
- (c) there are no obstructions in the transfer tubes.

(2) If a source changer is to remain with the operating organization at the radiography facility, periodic inspection and servicing shall be retained and which shall include :

- (a) lock assemblies to function properly ;
- (b) threaded fittings are not damaged ;
- (c) any source guides are not bent or damaged ;
- (d) all lids and protective covers are properly fixed and not damaged ; and
- (e) all labels are legible and securely fastened to the source changer.

52.—(1) Licensees shall ensure that the following pre-operational safety checks are carried out :

Maintenance
of X-Ray
Equipment
and other
Radiation
Generator.

- (a) no visible damages to the equipment ;
- (b) cables have no cuts, links or broken fittings ;
- (c) no leakages on the cooling system (water or oil) ;
- (d) all interlocks are operational ;
- (e) required warning signs are legible ;
- (f) all warning indicators are functioning with no light bulbs, etc. broken ; and
- (g) all fastenings are tight and no threaded connectors are undamaged.

(2) The periodic inspection and servicing done by the supplier, their agents, or specially trained staff within the operating organization shall include the items listed in sub-paragraph (1) and the following :

- (a) inspecting the electrical safety including earth bonding ;
- (b) cleaning or replacing any filters in cooling systems ;
- (c) other servicing as recommended by the supplier ;
- (d) check for any X- ray leakage from the tube ;
- (e) inspection to ensure that all cables are in good condition, with no fraying or exposed wires ;
- (f) tests on electrical insulation of cables ;
- (g) tests on all interlocks and emergency cut-out switches ;
- (h) tests on all permanently installed radiation detectors in radiography enclosures ; and
- (i) tests on all warning signals installed inside radiography enclosures and this shall be done in a safe manner and on a regular basis without exposure of persons inside the enclosure.

PART VII—REQUIREMENTS FOR SHIELDED ENCLOSURES

Shielded
Radiography
Enclosure.

53. Whenever practicable, industrial radiography shall be undertaken in a shielded radiography enclosure and where this is not practicable (e.g. for large or in-situ objects), radiography shall be carried out under 'Site Radiography' conditions.

Design of
Shielded
Enclosure.

54.—(1) The design of a shielded enclosure shall be based on 'Defence-In-Depth' as described in Regulation 55.

(2) The design shall be submitted by the licensee to the Authority for authorization and work shall not commence until authorization is granted.

(3) Any significant modification relevant to radiation safety to be proposed to the design that has been authorized, the licensee shall not implement that modification until it has been authorized by the Authority.

Defence-in-
Depth.

55.—(1) Licensees shall ensure that defence in depth is achieved by providing multiple layers of safety and such safety features shall be independent of each other so that failure of one does not result in failure of any other, and they shall be appropriate to the probability and magnitude of potential exposures.

(2) The following shall be provided as a minimum requirement :

- (a) adequate shielding for all persons in the vicinity ;
- (b) safety system interlock that is free from any failure ;
- (c) radiation warning system, free from any failure ;
- (d) administrative procedures ;
- (e) clear and well enforced operating procedures ; and
- (f) a qualified expert shall be consulted at the design stage of an enclosure and at the commissioning stage.

Adequate
Shielding.

56.—(1) Licensees shall ensure that enclosures used for fixed radiography are adequately shielded.

(2) In order to assess the adequacy of shielding, the licensees shall ensure that the following factors are taken into consideration :

- (a) the source of radiation output and energy ;
- (b) direction of the main radiation beam (panoramic, collimated, restricted direction) ;
- (c) setting of primary and secondary barriers and the calculation of adequate barrier thickness, including walls, doors, roofs and floors as applicable ;
- (d) personnel access to areas in the vicinity of the shielded enclosure ;
- (e) occupancy of relevant adjacent areas and an assessment of potential doses ;
- (f) access into the enclosure for personnel or work pieces ; and
- (g) accessible instantaneous dose rates outside shall not be exceeded.

(3) Design calculations shall take into account the following aspects :

- (a) possible use of different radiation sources at a later stage ;
- (b) all likely radiation beam directions ;
- (c) leakage of radiation through the roof of the enclosure and the proximity of persons above the roof or at raised heights around the enclosure ;
- (d) scattering of radiation over the walls of the enclosure ;
- (e) design of cable penetrations and door seals to prevent leakage paths for scattered or direct beam radiation ; and
- (f) determination of dose rates in adjacent areas.

57.—(1) Licensees shall ensure that for enclosures in which radiation generators and high output sealed sources (i.e. $>10\text{mSv h}^{-1}$ at 1 m) are used.

Safety and
Warning
Systems.

(2) The following safety systems are required:

- (a) effective devices (interlocks) that prevent exposure unless the door(s) is closed and that terminate the exposure if the door is opened and such devices shall be installed so that the mere act of closing a door does not initiate an exposure ; and
- (b) emergency stop switches or other means of terminating the exposure, in case a person is inadvertently inside the enclosure.

58.—(1) Licensees shall ensure that the following warning systems are installed and maintained :

Warning
System.

- (a) warning shall be given before the commencement of an exposure normally an audible signal, such as a siren to warn persons both inside and outside the enclosure ;
- (b) a separate and distinguishable warning throughout the duration of the exposure normally visual, such as rotating and flashing beacons both inside and outside the enclosure ;
- (c) notices giving instructions at every access points as well as inside the enclosure and also, an explanation of the meaning of various warning systems and instructions on what to do in an emergency situation ;
- (d) notices inside the enclosure shall clearly state any working restrictions that must be observed (e.g. limitations on beam directions) ; and

(e) the warning signals described above shall operate automatically.

(2) With very high dose rates, consideration shall be given to installing a fixed radiation monitor inside the enclosure to provide one of the following features:

(a) a visible indication of whether radiation levels are normal or elevated above a pre-determined level (i.e. when a source may not be shielded or an x-ray generator may not have terminated correctly); and

(b) a signal to a door actuator to prevent the door being opened unless the dose rate is below a pre-determined level.

Designation
of Shielded
Enclosures.

59. Licensees shall designate the shielded enclosures as controlled areas and there shall be warning signs at access points to clearly indicate the designation and a description and the basis for designating shall be included in the local rules.

Local Rules.

60.—(1) The Licensee shall establish local rules which shall describe how the practical aspects of industrial radiography will be carried out in compliance with the Regulations and License conditions.

(2) The local rules shall include:

(a) a description of controlled and supervised areas around fixed facilities;

(b) designation of controlled and supervised areas during site radiography, including procedures for setting up barriers and erecting warning signs;

(c) control of access to designated areas;

(d) operating instructions for the radiographic equipment and safety systems;

(e) requirements for individual and area monitoring;

(f) name of the Radiation Safety Officer and the radiographers;

(g) transportation and storage of radioactive sources;

(h) co-operation with clients and other employees during site radiography; and

(i) emergency plans for dealing with foreseeable emergencies.

Com-
missioning.

61. The Licensee shall carry out a detailed commissioning safety assessment and radiation survey before an industrial radiography facility is brought into routine operation and for the purpose of the commissioning, the following are to be considered:

(a) the facility has been constructed in accordance with the design specification, as authorized;

(b) the design specifications have resulted in accessible dose rates outside the facility being no greater than planned, under the most critical conditions of operation;

(c) the safety and warning systems have been properly installed and confirmed to be operating in accordance with the design specifications; and

(d) administrative systems, local rules and operating procedures are in place.

Decom-
missioning
process.

62.—(1) At the end of the useful life of a radioactive source, a radiation generator or a radiography facility, the decommissioning process shall pay due regard to safety.

(2) Licensees shall notify the Authority, and ensure the following items are implemented as appropriate to the circumstances:

- (a) authorized disposal or transfer of sealed radioactive sources ;
- (b) checks for any residual radioactive contamination and the authorized disposal of any contaminated material that is found or is created during decontamination ;
- (c) authorized disposal of sealed source containers that incorporate depleted uranium ;
- (d) exposure containers shall be labeled as "empty" if they do not contain a radioactive source ;
- (e) safe disposal of radiation generators rendered inoperative ;
- (f) removal of all warning notices that are no longer applicable ;
- (g) documentary evidence that the decommissioning work is completed ; and
- (h) on completion of decommissioning, no residual radiological hazard shall remain and there shall be no indications that might create unnecessary concern in the future.

PART VIII—REQUIREMENTS FOR SITE RADIOGRAPHY

63.—(1) Work pieces shall, where practicable be radiographed inside shielded facilities and where this is not practicable, such as radiography of in-situ plant or very large work pieces, radiography shall be undertaken under "site radiography" conditions.

Preparation
for site
radiography.

(2) site radiography shall be confined to a controlled area where specific protective measures and safety provision are rigidly enforced before commencing radiography under site radiography conditions.

(3) The licensee shall :

- (a) obtain a license as required by the authority ;
- (b) carry out a site-specific safety assessment ;
- (c) provide a secure store for sealed sources and radiation generators ;
- (d) ensure that a suitable, tested and functioning radiation monitor is available at the site ;
- (e) exchange necessary information and co-operate with the site operator in so far as it is necessary to ensure the safety of all persons on the site in respect of the radiography ; and
- (f) evaluate the most appropriate radiation source to use, such that its output is not significantly greater than required to produce the required radiograph (i.e. lowest operating voltage and beam parameters for radiation generators and lowest activity for gamma sources) and this is particularly so for gamma sources, where there is a chance of a jammed or disconnected source that may need to be recovered.

64.—(1) A controlled area shall be designated, without exception, during site radiography.

Designation
of a
controlled
area.

(2) In order to determine the extent of the controlled area, Licensees shall take account of the nature and frequency of site radiography at a specific site as well as occupancy.

(3) The boundary of the controlled area shall be physically demarcated at all positions where access is possible.

Defence-in-depth during site radiography.

65. During site radiography, licensees shall ensure that defence in depth is achieved by providing multiple layers of safety that include -

- (a) carrying out a prior site-specific safety assessment ;
- (b) establishment and demarcation of a controlled area ;
- (c) restriction of access to the controlled area ;
- (d) patrolling the controlled area by the radiographers ;
- (e) use of survey meters before and after every exposure ;
- (f) use of personal alarming dosimeters ;
- (g) use of warning signals before and after the exposure ; and
- (h) properly and well implemented operating procedures.

Shielding and restriction of dose rates.

66. Restriction of dose rates shall be achieved by the following measures

- (a) use of a radiation source of output not significantly greater than required to produce the required radiograph ;
- (b) use of natural boundaries around the work piece where necessary (e.g. walls and other structures in the area) ;
- (c) purpose designed shielding such as collimators ;
- (d) additional local shielding such as "beam stops", flexible lead sheet, bags of lead shot, etc ; and
- (e) control of beam direction to minimize spread (downward beam directions are usually preferable).

Boundary of controlled area.

67.—(1) A controlled area shall be designated, without exception, during all site radiography procedures and the contour demarcating the area of safe dose shall be set at a value ensuring that outside the controlled area the annual dose limits for the public is not exceeded.

(2) The controlled area shall include the complete periphery of the contour and where necessary demarcate areas above and below the working level.

Warning notices.

68.—(1) Warning notices shall be displayed around the controlled area boundary at suitable positions, and shall bear the international radiation trefoil symbol, warnings and appropriate instructions in English language and local language (e.g. Danger Radiation, Controlled Area and Keep Out) and the meaning of the warning signals shall be clearly stated.

(2) A notice shall also include a phone number for use in case of emergencies.

69. Visible and audible signals shall be used when a radiographic source is exposed or an X-ray machine is energized and the warning signals shall be in the form of :

Warning
signals.

- (a) audible pre-warning that an exposure is about to take place ;
- (b) visual warning throughout the duration of an exposure in the form of a rotating, flashing beacon ;
- (c) these shall operate automatically and be designed to fail-to-safe in the case of radiation generators and in the case of sealed sources it is preferable that the warnings be arranged to operate automatically (e.g., actuated by a signal from a radiation monitor).

70. Before the commencement of any radiographic work :

- (a) the area shall be cleared of all people except for authorized personnel ;
- (b) the boundary shall be clearly visible, well illuminated and continuously patrolled to ensure that unauthorized people do not enter the controlled area ;
- (c) prior to carrying out the first exposure, the radiographers shall perform a test exposure to ensure that dose rates at the boundary do not exceed authorized limits ; and
- (d) dose rates at representative points at the boundary shall be checked during operations to ensure that the barriers are correctly positioned, particularly if the position of the equipment or direction of the radiation beam is changed.

Patrolling
and
monitoring
of controlled
area

71.—(1) The Licensee shall provide appropriate local rules that are followed by all persons involved in the site radiography.

Local Rules
at the
radiography
site.

- (2) Some key elements of the rules shall include the following :
 - (a) site radiography shall not be undertaken unless at least two trained radiography staff (one of who may be an assistant radiographer) is in attendance for each radiation source in use ;
 - (b) the boundary of the controlled area shall be determined in accordance and as contained in this regulations and it shall be effectively delineated with appropriate warning notices displayed ;
 - (c) warning notices and warning signals shall be clearly visible at the boundary of the controlled area ;
 - (d) a survey meter shall be used after every exposure to ensure that it is safe for persons to enter the controlled area ;
 - (e) any person who enters the controlled area shall wear a personal dosimeter and a functioning personal alarm monitor ;
 - (f) radiographic techniques shall be chosen with a view to minimizing doses received by radiography staff and other persons ;
 - (g) physical control shall be exercised over the radiation beam in so far as this will assist in restricting the size of the controlled area ;
 - (h) the wind-out crank or radiation generator control panel shall normally be set up outside the controlled area and where this is not possible it shall be positioned

such that the authorized radiographer, who enters the controlled area in order to initiate or terminate an exposure, shall not be exposed to a dose rate in excess of 2 mSv/h¹;

(i) only the Radiation Safety Officer, radiographers and trained radiography assistants shall be permitted into the controlled area ;

(j) dose rates at the boundary of the controlled area shall be checked during the first exposure and re-checked whenever exposure conditions are materially altered. The results shall be recorded ;

(k) the boundary of the controlled area shall be kept under continual surveillance throughout all exposures. This may require additional personnel if the area is large or complex ;

(l) when the controlled area is entered on the conclusion of an exposure, a survey meter shall be used to confirm that the exposure has ceased and, in the case of the use of sealed source, that the source is fully shielded ;

(m) on completion of an exposure using a sealed source, the operator shall ensure that the source is secured in the container or that the container is securely closed, as appropriate to the type of container in use ; and

(n) on completion of an exposure using a radiation generator, the operator shall remove the key from the console and take it with him when leaving the controlled area.

De-
designating
the
controlled
area.

72. On completion of site radiography work or at the end of a working period if the work is long-term the controlled area shall be de-designated and the following steps shall be taken :

(a) confirmation that all radioactive sources are fully shielded and in their exposure container ;

(b) after all exposure containers have been removed, a final check shall be made with a survey meter to ensure that no radioactive sources have been inadvertently left behind ; and

(c) check that all warning notices have been removed.

PART IX—TRANSPORTATION OF RADIOACTIVE SOURCES

General
requirements.

73.—(1) The transportation of sealed sources shall comply with International Atomic Energy Agency Safe Transport of Radioactive Materials, TS-R-1 and Nigeria Safe Transportation of Radioactive Sources Regulations 2006 and proper packaging shall be used for all transportation, and the manufacturers instructions followed for proper preparation of exposure containers before transportation.

(2) The following steps shall be taken :

(a) the package shall be suitable for its intended use and the modes of transportation involved ;

(b) gamma radiography sources are transported only in Type B packages that must have a valid certificate. The licensee shall have a valid copy of the certification ;

(c) gamma radiography sources are locked in their shielded position and any key removed ;

(d) all shipping plugs or caps are fitted correctly and, where possible, locked in place ;

(e) the package is in good condition, is fit for transport and is labeled correctly ;

(f) radiation levels are measured at the surface of the package and at one meter from it to ensure that the levels are within allowed limits and to ensure that appropriate shipping labels are displayed ;

(g) applicable shipping labels shall be applied to the outer surface of the package based on the radiation levels obtained ;

(h) a radioactive source for transportation shall have a valid leak test certificate and if not, a leak or wipe test shall be performed on the outer surface of the source container and the shipping package before shipment ;

(i) the package shall be properly secured and braced in the transport vehicle ;

(j) the vehicle carrying the package shall be placarded on both sides of the vehicle and on the rear of the vehicle with radioactive placards as defined in the Nigerian Transportation of Radioactive Sources Regulations 2006 and in the International Atomic Energy Agency (TS-R-1) ; and

(k) appropriate transportation papers must accompany the shipment (e.g.: consignor's statement and information for the carrier, such as emergency contact details).

74.—(1) Prior to each shipment of radioactive, the licensee shall make necessary arrangements with the source supplier, to receive all relevant information. This information shall include the following for each package or container :

Receipt of
radioactive
materials.

(a) the nuclide, number and activity of sources ;

(b) a description of the source construction and performance tests, including leakage tests ;

(c) special form approval certificate ;

(d) a description of the package ;

(e) approval certificate for Type B packages, or Statement of compliance with International Atomic Energy Agency (TS-R-1) for other packages ;

(f) details of any special arrangements required, including multilateral approvals, where necessary ; and

(g) a copy of the transportation documents to be sent to the licensee by fax or e-mail before dispatch if possible.

(2) The licensee shall not agree to the dispatch of the consignment by the supplier, unless all the above items are complied with. The supplier and licensee shall agree on the transportation route and responsibility for each stage of the journey.

(3) Arrangements shall also be made for the following where necessary :

(a) checking of radiation dose rates from the package or container ;

(b) checking that the correct transport labels are attached to the package or container, and replacing any that is damaged or illegible ;

(c) ensuring that the package or container is securely attached to the vehicle and that the vehicle is correctly labeled ;

(d) dealing with border controls ; and

(e) security of the consignment during transportation, particularly during delays.

Dispatch of
radioactive
materials.

75. The licensee shall return packages or containers to the source supplier after receipt of a consignment of radioactive material. All requirements in the Nigeria Transportation of Radioactive Sources Regulations, 2006 and International Atomic Energy Agency (TS-R-1) concerning packaging, labeling, placarding where necessary, consignor responsibilities and all authorizations and approvals must be met before dispatching radioactive materials.

Empty
packages.

76. With regard to returning empty packages the licensee shall :

(a) carry out dose rate and contamination monitoring of both the inside and outside of the package or container to ensure that there is no residual radioactive material present and it can therefore be treated as an empty package or container ;

(b) remove or cover all transport labels relating to the sources contained in the package or container when received ;

(c) examine the package or container to ensure that it is in good condition, and then close it securely, referring to any procedures provided by the source supplier ;

(d) attach a label to the outside of the package or container stating "UN 2908 RADIOACTIVE MATERIAL EXCEPTED PACKAGE — EMPTY PACKAGING" ;

(e) complete a transportation document ; and

(f) contact the source supplier and agree on the transportation route and responsibility for each stage of the journey. Inform the source supplier of the proposed date of dispatch .

Unused
sources.

77. With regard to returning unused sources, the licensee shall provide the following information to the consignee for each package or container :

(a) the nuclide, number and activity of sources ;

(b) a description of the source construction including leakage tests ;

(c) special form approval certificate ;

(d) a description of the packaging in which the source is to be transported ;

(e) approval certificate for Type B package, or statement of compliance with International Atomic Energy Agency (TS-R-1) for other packages ;

(f) details of any special arrangements required, including multilateral approvals, where necessary ; and

(g) a copy of the transportation documents to be sent to the consignee by fax or e-mail before dispatch if possible.

78. The licensee shall not dispatch the consignment, unless he or she has received confirmation from the consignee that they are prepared to accept it.

Dispatch of consignment.

79.—(1) The licensee and consignee shall agree on the transportation route and the responsibility for each stage of the journey.

Transportation routes.

(2) The Licensee shall be responsible from dispatch until the consignment reaches the consignee's premises and other arrangements are satisfactorily provided and are agreed in advance by both parties and are also acceptable to the Authority.

80. In order to prepare the consignment for dispatch, the licensee shall :

Details of consignment.

(a) load the sources into the package, verifying the details to be provided to the consignee e.g., serial numbers and comparable information to be entered on the transport document ;

(b) close it securely and then examine the package or container to ensure that it is in good condition, referring to any procedures provided by the source supplier ;

(c) carry out contamination monitoring of the outside of the package or container to ensure that there is no residual radioactive material present and it is therefore suitable for transportation ;

(d) carry out dose rate monitoring of the package or container and attach appropriate transport labels ;

(e) refrain from using the transport labels relating to the sources contained in the package or container when received ; and

(f) complete a transportation document.

81. Arrangements shall also be made for the following :

Security for the consignment.

(a) ensuring that the package is securely attached to the vehicle and that the vehicle is correctly labeled ;

(b) dealing with border controls ; and

(c) providing security for the consignment during transportation, particularly during delays.

PART X—EMERGENCY PLANNING AND PREPAREDNESS

82. Where a safety assessment identifies that an accident is likely to affect workers or members of the public, the licensee shall prepare emergency plans which are designed to secure the protection and safety of anyone who may be affected by such accident.

Programme for emergency planning and preparedness.

83.—(1) A Radiation Safety Adviser shall be consulted when drawing up emergency plans.

Consultation for emergency plan.

(2) Emergency planning and preparedness shall be regarded as comprising the following stages :

(a) identification of potential accidents and other unplanned events during industrial radiography and an evaluation of the risks associated with these ;

(b) development of emergency plans to deal with the identified hazards ;

(c) specification and acquisition of emergency equipment ;

(d) training to implement the emergency plan, including necessary training in the use of the emergency equipment ;

(e) exercises at appropriate intervals to test the implementation of the emergency plan ; and

(f) periodic reviews and necessary updates of the emergency plans.

Implementation
of emergency
plan.

84.—(1) The responsibility for adequately implementing each of the six stages contained under Regulation 83(2) lies with the licensee of the industrial radiography organization and the resulting emergency plans and associated arrangements shall form a part of the license application to the Authority.

(2) Implementation of the emergency plan may involve participation by external organizations and specialized consultants and the plan shall clearly address such external participation, ensuring that the participators are fully aware of and accept their various responsibilities.

Initial Safety
assessment.

85. At this stage, reasonable foreseeable accident and incident situations shall be identified, likely consequences evaluated and potential doses estimated for all persons who may be involved including members of the public if applicable and local circumstances shall be taken into account.

Sealed
sources.

86. Each of the following events involving sealed sources shall be recognized as constituting a potential event necessitating implementation of an emergency plan :

(a) failure to fully retract a source ;

(b) a source struck outside the shielded container, whether within the collimator, the guide tube or close to entrance to the container ;

(c) disconnection of the source from the wind-out cable ;

(d) a theft or loss of a source, container or exposure ;

(e) damage to a source or a container, e.g. mechanical or fire damage, including during transport ;

(f) radioactive contamination resulting from a damaged or faulty source ; and

(g) malfunction or deliberate defeat of the safety and warning system.

Radiation
generators

87. The identifiable potential events involving radiation generators shall be recognized to include the following :

(a) an automatic exposure timer fails to terminate an exposure ;

(b) unintentional energizing of an X-ray tube ;

(c) an operator fails to terminate a manually controlled exposure ;

(d) a malfunction of any critical safety or warning system, including deliberate action to override ;

(e) physical damage causing an equipment malfunction or damage to shielding ; and

(f) a failure of the associated safety and warning system, or the operator fails to heed a warning that is being given.

88. Emergency plans shall address each of the reasonably foreseeable accident situations identified during safety assessment and shall aim to restrict, so far as is reasonably possible, any exposures that may result from them.

Development of emergency plans.

89. The emergency plans shall consist of the following components :

Features of emergency plan.

(a) identification of persons authorized to implement the various stages of the plans ;

(b) identification of persons or organizations that may need to be notified at the various stages of the plans, including all necessary telephone, fax, e-mail numbers and addresses ;

(c) advice on when to implement the emergency plans ; and

(d) procedures specific to each identified emergency situation, to be followed at various stages, as applicable—

(i) initial stage, to contain the situation ;

(ii) planning stage, to plan and practice the recovery stage ;

(iii) recovery stage ;

(iv) post accident stage, to return working situation to normal ;

(v) preparation of accident report ;

(e) special procedures to follow in life threatening situations ;

(f) availability of emergency response equipment ; and

(g) notification to the Authority¹.

90. Licensees shall ensure that all necessary equipment is available to deal with emergency situations. Emergency equipment shall include :

Emergency equipment.

(a) appropriate and functioning survey meters, personal alarming dosimeters and direct reading dosimeters (QFE or electronic) ;

(b) additional personal dosimeters, thermo luminescent dosimeters or film badges ;

(c) barrier materials and warning notices ;

(d) bags of lead shot, spare lead sheet and lead tunnel ;

(e) suitable tool kit and source recovery equipment long handling tongs, pliers, screwdrivers, bolt cutters, adjustable spanner, hacksaw and torch light ;

(f) emergency shielded storage container, spare source container and communication equipment (e.g. mobile phones, walkie-talkies) ;

(g) spare batteries for survey meters, personal alarms and torch ;

(h) stationery supplies and incident logbook ; and

(i) equipment manuals.

Inspection and maintenance of emergency equipment.

91. Licensees shall carry out regular audits to ensure that all emergency equipment is available and is functioning correctly.

Training.

92.—(1) All persons nominated to participate in the emergency plans shall be adequately trained to ensure efficient and effective implementation of their roles and this shall include familiarization and understanding of the plans together with training in the use of the emergency equipment.

(2) Training provisions shall be audited at intervals, not exceeding 12 months.

Emergency exercises.

93. Emergency exercises shall be held to test critical components of the emergency plans at intervals and lessons learned shall form part of future reviews of emergency plans.

Periodic reviews of emergency plans.

94. Formal reviews of emergency plans shall be undertaken annually to ensure :

(a) names of persons, contact details, telephone and fax numbers shall be up to date ; and

(b) emergency equipment is available and is maintained.

Accident report.

95. In order to learn from the accident situations that have occurred within the organization or elsewhere, and to report back the lessons learned so as to improve equipment, operating procedures and emergency plans, reports of any accidents shall be prepared by Radiation Safety Officer with the assistance of a Radiation Safety Adviser and the reports shall be submitted to the Authority.

Details of the accident report.

96. The accident report shall include the following :

(a) a description of the accident, giving as much details as possible concerning the specific equipment involved including model and serial numbers ;

(b) names and designations of all persons affected by the accident ;

(c) environmental conditions at the time of the accident ;

(d) the specific cause of the accident, where known ;

(e) details of actions taken to stabilize the accident situation and restore conditions back to normal ;

(f) evaluation of doses received by all persons affected by the accident ; and

(g) recommendations made with the aim of preventing a similar accident occurring in the future.

PART XI —OFFENCES AND PENALTIES

Offences and penalties.

97.—(1) Any person who contravenes any of the provisions of these regulations commits an offence.

(2) Any person who commits an offence under these regulations shall be liable to the penalties as established in the enforcement policy issued by the Authority.

(3) The Authority shall impose penalties such as suspension, revocation of authorization, imposing administrative fine, closure of facility or any combination of these.

(4) Any person or body corporate who, being a holder of authorization under these regulations, who commits an offence shall be liable to prosecution in the court of law and upon conviction be liable to pay fines not exceeding ₦1,000,000 for an individual and not exceeding ₦10,000,000 for a corporate body or be given a jail term not exceeding ten years or both.

98. Any person may appeal to the Board of the Authority if he is not satisfied with the decision made against him pursuant to these Regulations. Appeal.

99. These Regulations may be cited as the Nigerian Radiation Safety in Industrial Radiography Regulations, 2006. Citation.

SCHEDULE

DOSE LIMITS

1. The occupational exposure of any worker shall be so controlled that the following limits are not exceeded :

- (a) an effective dose of 20 mSv per year averaged over five consecutive years ,
- (b) an effective dose of 50 mSv in any single year ;
- (c) an equivalent dose to the lens of the eye of 150 mSv in a year ; and
- (d) an equivalent dose to the extremities (hands and feet) or the skin of 500 mSv in a year.

2. For apprentices of 16 to 18 years of age who are training for employment involving exposure to radiation and for students of age 16 to 18 who are required to use sources in the course of their studies, the occupational exposure shall be so controlled that the following limits be not exceeded :

- (a) an effective dose of 6 mSv in a year ;
- (b) an equivalent dose to the lens of the eye of 50 mSv in a year ; and
- (c) an equivalent dose to the extremities or the skin of 150 mSv in a year.

3. For members of the public, the practice shall be so controlled that the exposure limit of 1 mSv per year is not exceeded.

MADE at Abuja this 5th day of October, 2006.

PROFESSOR SHAMSIDEEN BABATUNDE ELEGBA,
Director-General/Chief Executive Officer
Nigerian Nuclear Regulatory Authority

EXPLANATORY NOTE

(This note does not form part of the regulations but it is intended to explain its purport)

1. This set of regulations is practice-specific elaborations of the Nigeria Basic Ionizing Radiation Regulations which is derived from, but not a substitute to, the International Basic Safety Standards for Protection against Ionizing Radiation Sources (the BSS) published as International Atomic Energy Agency Safety Series No. 115 in 1996.

2. The Regulations provide, among other things, for the protection of workers and the public from the harmful effects of exposure to ionizing radiation.

NUCLEAR SAFETY AND RADIATION PROTECTION ACT
(1995 No. 19)

**NIGERIAN SAFETY AND SECURITY OF RADIOACTIVE SOURCES
REGULATIONS, 2006**



ARRANGEMENT OF REGULATIONS

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SCHEDULE

S. I. 58 of 2006

NUCLEAR SAFETY AND RADIATION PROTECTION ACT
(1995 No. 19)

**NIGERIAN SAFETY AND SECURITY OF RADIOACTIVE SOURCES
REGULATIONS, 2006**

[5th October, 2006]

Commence-
ment.

In exercise of the powers conferred on it by Section 47 of the Nuclear Safety and Radiation Protection Act 1995 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

1. In these Regulations, unless the context otherwise requires—

Interpreta-
tion.

"the Act" means the Nuclear Safety and Radiation Protection Act 1995;

"the Authority" means the Nigerian Nuclear Regulatory Authority established under Section 1 of the Act;

"authorization" means a permission granted in a document by the Authority to a legal person who has submitted an application to possess, produce, process, manufacture, purchase, sell, import, export, handle, use, transform, transfer, trade, assign, transport, store or dispose of radioactive material, nuclear material, radioactive waste, prescribed substances or any apparatus emitting ionizing radiation and the authorization may take the form of a registration or a licence;

"calendar year" means a period of 12 calendar months beginning from the 1st of January of the year;

"contamination" means the contamination by any radioactive substance of any surface including any of the body or clothing or any part of the absorbent objects or materials or the contamination of liquids or gases by any radioactive substances;

"disposal" means the emplacement of waste in an approved, specified facility including near surface or geological repository without the intention of retrieval and includes the approved direct discharge of airborne or liquid effluents into the environment with subsequent dispersion;

"disused source" means radioactive source no longer intended to be used, and is not intended to be used for the practice of which an authorization has been granted;

"dose assessment" means the dose assessment made and recorded by an authorized dosimetry service provider;

"dose limit" means in relation to persons of a specified class, the limit on effective dose or equivalent dose as specified in NiBIRR;

"dose rate" means, in relation to a place, the rate at which a person or part of a person would receive a dose of ionizing radiation from external radiation if he were at that place being a dose rate at that place averaged over one minute;

"dose record" means in relation to a person, the record of the doses received by that person as a result of his exposure to ionizing radiation, being the record made and maintained on behalf of the employer by an authorized dosimetry service provider ;

"effective dose" means the quantity E, defined as a summation of the tissue equivalent doses, each multiplied by the appropriate tissue weighting factor :

$$E = \sum_T W_T H_T$$

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

$$E = \sum_T W_T \cdot \sum_R W_R \cdot D_{T,R}$$

where W_R is the radiation weighting factor for radiation R and $D_{T,R}$ the average absorbed dose in the organ or tissue T. The unit of effective dose is J. kg⁻¹, termed the Sievert (Sv) ;

"excluded" means any exposure whose magnitude or likelihood is essentially, unamenable to control through the requirements of NiBIRR (e.g. exposure from K-40 in the body, from cosmic radiation at the surface of the earth and from unmodified concentrations of radionuclides in most raw materials) ;

"export" means the physical transfer, originating from an exporting state, into an importing state or to a recipient in an importing state, of one or more radioactive source(s) covered by these Regulations ;

"exporting facility" means the natural or legal person in an exporting state, from which one or more radioactive source(s) are exported to an importing state or to a recipient in an importing state ;

"exporting state" means the state of origin of an export of one or more radioactive source(s) to an importing state or a recipient in an importing state ;

"hazardous substance" or "hazardous waste" means a substance or waste, other than a nuclear substance, that is used or produced in the course of carrying on a licenced activity and which may pose a risk to the environment or the health and safety of persons ;

"import" means the physical transfer into an importing state or to a recipient in an importing state, originating from an exporting state, of one or more radioactive source(s) covered by these Regulations ;

"importing state" means the state of final destination for a physical transfer of one or more radioactive source(s) from an exporting state or an exporting facility ;

"industrial gamma radiography" means a non-destructive method of inspecting materials for hidden flaws by utilising the ability of gamma radiation to penetrate various materials ;

"ionizing radiation" means energy in the form of particles or electromagnetic waves of a wavelength of 100 nanometers or less or a frequency of 3×10^{15} hertz or more capable of producing ions directly or indirectly ;

"legal person" means any organisation, corporation, partnerships, firm, association, trust, estate, public or private institution, group, political or administrative entity or other persons designated in accordance with the Act, who or which has responsibility and authority for actions taken under these regulations ;

"licence" means an authorization granted by the Authority on the basis of a safety assessment and accompanied by specific requirements and conditions to be complied with by the licensee ;

"licensee" means the holder of a current licence granted by the Authority for a practice or source who has recognized rights and duties for the practice or source, particularly in relation to radiation protection, safety and security ;

"limit" means the value of a quantity used in certain specified activities or circumstances that must not be exceeded ;

"management" means the administrative and operational activities that are involved in practices entailing radioactive sources ;

"monitoring" means the measurement of radiation or radionuclides for reasons related to the assessment or control of exposure and the interpretation of such measurements. Monitoring can be continuous or non-continuous ;

"nationally tracked source" means a sealed source containing a quantity equal or greater than Category 1 or 2 levels of any radioactive material listed in Schedule I of these regulations ;

"NiBIRR" means the Nigeria Basic Ionizing Radiation Regulations 2003 ;

"notification" means a document submitted to the Authority by a legal person to notify an intention to carry out a practice or any other action described in the general obligations for practices ;

"operating Organization" any organization licenced by the Authority to carry out a practice ;

"orphan source" means a radioactive source which poses sufficient radiological hazard to warrant regulatory control but is not under regulatory control, either because it has never been under regulatory control, or because it has been abandoned, lost, misplaced, stolen or transferred without prior authorization ;

"practice" means work involving—

(a) the production, processing, handling, use, holding, storage, transport or disposal of radioactive substances ; or

(b) the operation of any electrical equipment emitting ionizing radiation and containing components operating at a potential difference of more than 5kV ;

which can increase the exposure of individuals to radiation from an artificial source, or from a radioactive substance containing naturally occurring radionuclides, which are processed for their radioactive, fissile or fertile properties ;

"quality assurance" means all those planned and systematic actions necessary to provide adequate confidence that an item, process or service will satisfy given requirements for quality, for example, those specified in the licence ;

"radiation accident" means an accident where immediate action would be required to prevent or reduce the exposure to ionizing radiation of employees or any other persons ;

"radioactive discharges" means radioactive substances arising from a source within a practice which are discharged as gases, aerosols, liquids or solids to the environment, generally with the purpose of dilution and dispersion ;

"radioactive source" means 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 ;

"radioactive substance" means any substance, which contains one or more radionuclides whose activity cannot be disregarded for the purposes of radiation protection ;

"radioactive waste" means material, whatever its physical form, remaining from practices or interventions and for which no further use is foreseen,

(i) that contains or is contaminated with radioactive substances and has an activity or activity concentration higher than the level for exemption or clearance from regulatory requirements, and

(ii) exposure to which is not excluded from these regulations ;

"radionuclide" means a nucleus (of an atom) that possesses properties of spontaneous disintegration (radioactivity). Nucleus are distinguished by their mass and atomic number ;

"recipient" means the natural or legal person in an importing state that receives one or more radioactive source(s) exported by an exporting state or a facility in the exporting state ;

"regulatory control" means any form of control applied to facilities or activities by the Authority for reasons related to radiation protection or the safety or security of radioactive sources ;

"safety" means measures intended to minimise the likelihood of accidents with radioactive sources and, should such an accident occur, to mitigate its consequences ;

"safety assessment" means a review of the aspects of design and operation of a source that are relevant to the protection of persons or the safety of the source, including the analysis of the provisions for safety and protection established in the design and operation of the source and the analysis of risks associated with normal conditions and accident situations ;

"safety culture" means the assembly of characteristics and attitudes in organizations and individuals, which establishes that, as an overriding priority, protection and safety issues receive the attention warranted by their significance ;

"sealed source" means a source containing any radioactive substance whose structure is such as to prevent, under normal conditions of use, any dispersion of

radioactive substances into the environment, but it does not include any radioactive substance inside a nuclear reactor or any nuclear fuel element ;

"security" means measures to prevent unauthorized access or damage to, and loss, theft or unauthorized transfer of, radioactive sources ;

"security culture" means characteristics and attitudes in organizations and of individuals, which establish that security issues receive the attention warranted by their significance ;

"storage" means the placement of radioactive sources in a suitable facility where isolation, environmental protection and human control (e.g monitoring unauthorized access, etc) are provided ;

"transport" means, in relation to a radioactive substance, carriage of substance on a road within the meaning of, or through another public place, whether on a conveyance or not, or by rail, inland waterway, sea or air and, in the case of transport on a conveyance a substance shall be deemed as being transported from the time that it is loaded onto the conveyance for the purpose of transporting it until it is unloaded from that conveyance, but a substance shall not be considered as being transported if—

(a) it is transported by means of a pipeline or similar means ; or

(b) it forms an integral part of a conveyance and is used in connection with the operation of that conveyance ;

"treatment" means the operations intended to benefit safety and/or economy by changing the characteristics of waste. Three basic treatment objectives are :

(a) volume reduction ;

(b) removal of radionuclides from the waste ;

(c) change of composition,

after treatment, the waste may or may not be immobilised to achieve an appropriate waste form ;

"waste inventory" means a detailed, itemised record maintained by the operator or Authority in accordance with these regulations, and may contain data such as physical quantity, the activity of the waste, the radionuclide content, and other characteristics ;

"waste management" means all activities, administrative and operational, that are involved in the handling, treatment, conditioning, storage and disposal of waste. Transportation is taken into account ;

"waste package" means the product of conditioning that includes the waste form and any container(s) and internal barriers (e.g. absorbing materials and liner), as prepared in accordance with requirements for handling, transportation, storage and /or disposal ;

"waste form" means the waste in its physical and chemical form after treatment and/or conditioning (resulting in a solid product) prior to packaging. The waste form is a component of waste package ;

"worker" means any person who works, whether full time or temporarily, for an employer and who has recognized rights and duties in relation to occupational radiation protection (a self employed person is regarded as having the duties of both an employer and a worker) ;

Objective.

2. To achieve and maintain high level safety and security of radioactive sources by preventing unauthorized access, damage, loss, theft and or unauthorized transfer of radioactive sources so as to reduce the likelihood of accidental harmful exposure or the malicious use or act to cause harm to individual, society or the environment and to prevent intentional or inadvertent recycling of radioactive metals for other uses.

Scope.

3. These regulations shall apply to all radioactive sources that may pose a significant risk to individuals, society and the environment, that is the sources referred to in Schedule 1 or any other potentially harmful radioactive sources so determined by the Authority.

Application.

4.—(1) The application of these Regulations shall be in addition to the Nigeria Basic Ionizing Radiation Regulations 2003 (NiBIRR) and any other existing ionizing radiation and nuclear regulations as well as any transport regulations in force at the commencement of these regulations.

(2) These Regulations shall apply to further the promotion of safety and security of radioactive sources and of the protection of individuals, society and the environment from the harmful effects of possible accidents and malicious acts involving radioactive sources.

PART II—RESPONSIBILITIES AND ADMINISTRATIVE MEASURES

Responsibilities.

5.—(1) The Authority :

(a) shall maintain records of holders of authorizations to possess or use radiation sources, with clear indication of the types of sources and records for transfer and disposal of the sources on termination of the authorization ;

(b) shall implement an inspection programme to verify that facilities and programmes are maintained to adequately manage the radiation sources ;

(c) shall establish and maintain a National Radioactive Source Tracking System with database of registry of sources belonging to Category 1 and 2 as described in Schedule 1 ; and

(d) shall have in place strategies including rapid response for gaining or regaining control over orphan sources, provide for measures to reduce likelihood of malicious acts, mitigate or minimize the radiological consequences of accidents or malicious acts involving radioactive sources and provide for continuous improvement of the strategies.

(2) The Licencee :

(a) shall have the prime responsibility for the safe management of, and the security of radioactive sources involved for which the licensee is authorized ;

(b) shall emplace and implement programs and procedures for security of radioactive sources within his practice and for the administration of radiation safety ;

(c) shall ensure that any transfer of sources to another person is documented and that the person is authorized and that sources are imported and received in accordance with regulatory requirements ; and

(d) shall ensure that there is a procedure for communicating routinely to the Authority on status of source and reports promptly of unusual events that may affect safety and security of sources. (Unusual events include loss of control over a radioactive source, unplanned exposures, unauthorized access or use of a source, failures of equipment containing sources and discovery of an unaccounted source).

(3) The radiation worker assigned responsibility by the licensee shall ensure that the requirements for safety and security of sources given in these regulations are implemented. ↘

6.—(1) No person or organisation shall import, transport, use, transfer ownership, dispose or export a radioactive source without an appropriate licence from the Authority.

Licence
Applications.

(2) All proposals from applicants to import, transport, use, transfer ownership, dispose or export a radioactive source shall specify the following in a written application to the Authority :

- (a) the applicant's name, address and telephone number ;
- (b) the description of the source or source containing equipment, including its quantity and unique identifiers, radionuclide and aggregate activity ;
- (c) the name and address of the supplier ;
- (d) the country of origin of the source or source containing equipment ;
- (e) the name and address and telephone number of the consignee ;
- (f) a safety assessment ;
- (g) a security plan for the source and/or the facility in which the source is to be managed ; and
- (h) such other details as the Authority may consider necessary.

(3) An applicant shall be prepared to pay the fee or fees prescribed by the Authority to cover the cost of the licensing procedures.

(4) The licensee shall comply with all limits and conditions specified in the licence, and any specific radiation protection and physical security measures.

(5) Any licence issued pursuant to sub regulations (2) and (3) of these regulations shall be :

- (a) valid for such a period as the Authority may determine ;
- (b) renewable by the Authority if the licensee complies with the licence conditions ; and

(c) subject to supervision or revocation as notified in writing if in the view of the Authority, the licensee has failed to comply with licence conditions.

Exemptions.

7.—(1) These regulations do not apply to nuclear materials as defined in the convention on the Physical Protection of Nuclear Material, except for sources incorporating plutonium—239.

(2) These regulations do not apply to radioactive sources within military or defence programmes.

Safety and security requirements for radioactive sources.

8.—(1) A licensee who possesses sealed sources, shall conduct a physical inventory of all such sealed sources semi-annually, unless another interval is specified in the licence.

(2) The records shall be kept appropriately secured and shall be retained for 3 years.

(3) Inventory records shall contain the following :

- (a) the model and serial number of each sealed source ;
- (b) the identity of each sealed source ;
- (c) radionuclide and its activity on a specified date ;
- (d) the location of each sealed source ;
- (e) receipt or transfer or disposal of the source ;
- (f) the date of the inventory ; and
- (g) the signature of the radiation safety officer or designee.

(4) The storage and transportation of sources shall comply with the Nigerian Transportation of Radioactive Sources Regulations, 2006 and the IAEA -TS-R-1.

(5) Each sealed radioactive source shall be provided with a storage or transport container which shall be equipped with a lock or tamper seal to prevent unauthorized removal of or exposure to the source of radiation.

(6) Sealed sources shall have a minimum of two locks between the device and the public when being transported or stored.

(7) Transport containers shall be physically secured in the transporting vehicle to prevent accidental loss, tampering, or unauthorized removal and the sealed source shall be located as far away from occupied areas of the vehicle as possible.

(8) Sealed sources not in storage or being transported shall be under the constant surveillance and immediate control of the licensee.

(9) Transportation of sources shall be between 6.00 am and 6.00 pm and local transportation should be accompanied by policemen.

(10) The Authority shall be notified within 24 hours by the licensee for loss of control of sources, unauthorized access to, or unauthorized use of a source, malevolent acts threatening authorized activities, failures of equipment containing sources which may have security implications and discovery of unaccounted source.

9.—(1) Radioactive materials shall be used by individuals who are qualified by training and experience to protect public, health, property and the environment.

Training requirements for authorized users.

(2) A radiation safety program for the training of workers shall be submitted for approval by the authority for its content and the trainer, person or organization.

(3) For licencees who propose to train their own personnel, detailed training program with course content, duration, instructor qualification and method of assessment shall be submitted to the Authority for approval.

(4) Records of training shall be maintained during the period of employment of the individual.

10.—(1) The licencee shall appoint a radiation safety officer with the authority to fulfill the duties and responsibilities listed in this part.

Training requirements, duties and responsibilities of the Radiation Safety Officer.

(2) The radiation safety officer shall have sufficient training and experience with radioactive materials to be a user of the requested licenced materials, unless otherwise specified in the licence, the training under paragraph (b) shall include practical experience in the safe use of radioactive materials and knowledge of procedures, facilities and equipment.

(3) The duties and responsibilities of the radiation safety officer shall include the following :

(a) ensure that all terms and conditions of the licence and these regulations are complied with ;

(b) ensure that the sealed sources are leak tested timely and as prescribed by the manufacturer or by the licence ;

(c) ensure that radioactive materials are used only by individuals who are authorized by the licence and that all individuals wear required personnel monitoring equipment ;

(d) maintain all records required by the licence and these regulations. (These records shall include personnel monitoring records, leak test records, inventory records, training records for users and receipt, transfer and disposal records) ;

(e) ensure that radioactive materials are properly secured against unauthorized access or removal ;

(f) serve as a contact with the Authority for events such as the loss, theft or damage of radioactive material ; and

(g) ensure that all users read and understand the licencee's emergency, operating and radiation safety procedures.

11.—(1) For licencees using radioactive sources of categories 1 and 2, the employer shall appoint a Radiation Safety Committee.

Radiation Safety Committee.

(2) The Radiation Safety Committee whose membership shall be drawn from the management of the operating organizations including the Radiation Safety Adviser and the Radiation Safety Officer shall have the following responsibilities :

- (a) ensure the safe use and security of radioactive sources ;
- (b) develop and recommend policies for the control and safe use of radioactive sources ;
- (c) provide technical oversight, advice, and assistance on matters concerning security, safety and radiation protection ;
- (d) determine that all activities involving radioactive sources are being conducted safely and in accordance with the provisions of the Act, Nigeria Basic Ionizing Radiation Regulations and these regulations ;
- (e) receive and review periodic reports from the RSO on incidents, personnel, monitoring, inspections and other security, safety and radiation protection matters ; and
- (f) investigate all instances of alleged infractions of safety rules and security regulations and violations of the Authority's requirements and decide the course of corrective action to be taken.

Personnel monitoring.

12.—(1) No licensee shall permit any individual to use or to assist in the use of sealed sources of radiation in portable devices unless such individual wears a personal dosimeter.

(2) No licensee shall permit any individual to perform installations, maintenance or service, initial radiation surveys, relocations or removal from service of sealed sources in fixed devices unless such individual wears a personal dosimeter.

(3) Licensees who use iodine 125, iodine 131, hydrogen 3, uranium 234, uranium 235 or uranium 238 and similar radionuclides shall have a bioassay program and shall submit a description of same for approval by the Authority.

(4) A personal dosimeter shall be worn by any individual using or assisting in the use of unsealed sources of any gamma-emitting isotope with a gamma ray energy greater than 50 kiloelectron volts or the use of any beta-emitting isotope with a maximum beta energy of 300 kiloelectron volts or more.

(5) A personal dosimeter shall be worn by any individual using or assisting in the use of unsealed sources of 1,000 microcuries (37 MBq) or more of beta-emitting isotopes with maximum beta energy of 1,000 kiloelectron volts.

(6) Each personal dosimeter shall be assigned to and worn by only one individual.

(7) Personal dosimeter shall be replaced at a specified interval and after replacement, it must be promptly processed.

Leak test requirements for possession of sealed sources.

13.—(1) A licensee in possession of a sealed source shall ensure that :

(a) (i) the sealed source is tested for leakage before its first use, unless the licensee has a certificate from the supplier indicating that the sealed source was tested before transfer to the licensee ; and

(b) (ii) the sealed source shall be tested for leakage periodically, using an approved procedure determined by the Authority.

(2) A licensee shall retain leak test records for 3 years and the records shall contain the manufacturer's name, the model and serial numbers of each sealed source tested, the identity of each sealed source, radionuclide and its estimated activity, the measured activity of each test sample expressed in microcuries (becquerels), the date of the test, and the signature of the radiation safety officer or designee.

(3) If the leak test reveals the presence of 0.005 microcurie (185 Bq) or more of removable contamination, the licensee shall :

(a) immediately withdraw the sealed source from use and cause it to be decontaminated and repaired or to be disposed of in accordance with these regulations ; and

(b) file a report with the Authority within 5 days of receiving the leak test results describing the equipment involved, the test results and the action taken.

(4) The licensee shall not open sealed sources under any circumstances.

14.—(1) The licensee's operating and emergency procedures shall be pasted within the area of operations and shall accompany portable devices at all times.

Operating
and
emergency
procedures.

(2) The procedures shall include instructions in the following as applicable to the type of use :

(a) the keeping radiation doses as low as reasonably achievable such that no individual is likely to be exposed to radiation doses in excess of those prescribed in NBIRR ;

(b) methods and occasions for conducting radiation surveys ;

(c) methods and occasions for locking and securing sources of radiation ;

(d) personnel monitoring and the use of personnel monitoring equipment ;

(e) minimizing exposure of individuals in the event of an accident ;

(f) notifying proper personnel in the event of damage, loss, theft, or accident involving sources of radiation ;

(g) general guidelines for the safe handling and use of unsealed sources ;

(h) maintenance of records ;

(i) procedures for picking up, receiving and opening packages containing radioactive materials ; and

(j) the transportation of radioactive sources to temporary job sites, including the packaging, marking, labeling and placing of such sources in vehicles, placarding of vehicles, securing the sources during transportation and possessing proper shipping papers and emergency response information.

15.—(1) For a sealed source considered irretrievable after reasonable efforts at recovery have been expended, the Authority shall be immediately notified before abandonment, giving details of the incidence and detail information on the source identification including licence and serial numbers, circumstances that resulted in the inability to retrieve the source and obtain approval to implement abandonment procedures.

Abandon-
ment.

(2) With the approval of abandonment from the Authority, the licensee shall within 30 days immobilize the source and seal the place with a cement plug, provide means to prevent inadvertent intrusion on the source, install a permanent identification plaque at the surface of the well and submit a full report of the abandonment procedures to the Authority.

Additional requirements for sealed sources in fixed devices.

16.—(1) A licensee authorized to perform installations, maintenance or service, initial radiation surveys, relocations or removal from service of sealed sources in fixed devices shall possess portable radiation survey instruments. The instruments shall be operable and calibrated. The calibration shall be traceable to a standard laboratory.

(2) A licensee shall post and provide to personnel lock-out procedures that prevent employees from entering the radiation beam during maintenance, repairs, or other work in, on, or around a bin, tank, hopper or pipe on which a device is mounted.

Import and export of radioactive source.

17. All licensees prospective of importing or exporting radioactive sources shall in addition to other requirements for the appropriate authorizations in cases of Categories 1 and 2 of Schedule 1 to these regulations provide

(a) an export licence from the regulatory body of the country of origin in the case of application for authorization to import the source ;

(b) a written agreement from the source manufacturer or an authorized handler that the source shall be accepted back when in a state of disuse or spent ;

(c) an import licence from the regulatory body of the country of origin in the case of application for authorization to export a source.

Screening of scrap metal.

18.—(1) The export of scrap metal shall only be done through designated ports where portal monitors are provided.

(2) A certified document indicating that the consignment does not contain high level of radioactivity arising from incorporation of radioactive source shall be part of the documents to be provided to the customs services before export.

(3) For industries that are using scrap metal as raw materials for products to be used in the country, provision of radiation monitors for screening of radioactivity shall be provided and screening procedures shall be approved by the Authority.

Transfer of Radioactive Source.

19.—(1) No licence issued or granted pursuant to the regulations or any right under a licence shall be transferred, assigned, or in any manner disposed of, either voluntarily or involuntarily, directly or indirectly through transfer of control of any licence to any person unless the authority after screening full information, find that the transfer is in accordance with the provisions of the Act and shall licence the transfer.

(2) The licensee shall provide to the Authority description of the transaction, changes of personnel, changes of location, equipment, procedures, surveillance records, decommissioning processes and related records of transfers, transferee's commitment to abide by the transferor's commitments.

20.—(1) For the purposes of the National Radioactive Source Tracking System (Regulatory Authority Information System), a licensee shall report to the Authority on all information of manufacture, transfer, receipt, export or disposal of sources.

Radioactive
Source
Tracking
System.

(2) The information in 20 (1) shall include manufacturer's name and address, radioactive material activity, activity and transaction dates.

(3) The licensee shall provide also the facility name, licence number, address, name of individual that prepared the report and any other information the Authority may consider necessary.

(4) Each licensee shall reconcile and verify the inventory of nationally tracked sources possessed by the licensee against the licensee's data in the National Source Tracking System.

(5) The verification shall be conducted during the month of January in each year. The reconciliation process must include resolving discrepancies in filed reports.

PART III—OFFENCES, PENALTIES AND APPEAL

21.—(1) Any person who contravenes any of the provisions of these regulations has committed an offence.

Offences and
Penalties.

(2) Any person who commits an offence under these regulations shall be liable to the penalties as established in the enforcement policy issued by the Authority.

(3) The Authority shall impose penalties such as suspension, revocation of authorization, imposing administrative fine, closure of facility or any combination of these.

(4) Any person or body corporate who, being a holder of authorization under these regulations, commits an offence, and shall be liable to prosecution in the court of law and upon conviction be liable to pay fines not exceeding ₦1,000,000 for an individual and not exceeding ₦10,000,000 for a corporate body or be given a jail term not exceeding ten years or both.

22. Any person or organisation may appeal to the Board of the Authority against any decision made by the Authority pursuant to these Regulations.

Appeal.

23. These Regulations may be cited as the Nigerian Safety and Security of Radioactive Sources Regulations, 2006.

Citation.

SCHEDULE .

CATEGORY 1 SOURCES

If not safely managed or securely protected would be likely to cause permanent injury to a person who handled them, or were otherwise in contact with them, for more than a few minutes. It would probably be fatal to be close to this amount of unshielded material for a period of a few minutes to an hour. These sources are typically used in practices such as radiothermal generators, irradiators and radiation teletherapy.

CATEGORY 2 SOURCES

If not safely managed or securely protected, could cause permanent injury to a person who handled them, or were otherwise in contact with them, for a short time (minutes to hours). It could possibly be fatal to be close to this amount of unshielded radioactive material for a period of hours to days. These sources are typically used in practices such as industrial gamma radiography, high dose rate brachytherapy and medium dose rate brachytherapy.

CATEGORY 3 SOURCES

Category 3 sources, if not safely managed or securely protected, could cause permanent injury to a person who handled them, or were otherwise in contact with them, for some hours. It could possibly — although it is unlikely — be fatal to be close to this amount of unshielded radioactive material for a period of days to weeks. These sources are typically used in practices such as fixed industrial gauges involving high activity sources (for example, level gauges, dredger gauges, conveyor gauges and spinning pipe gauges) and well logging.

TABLE 1

Provides a categorization by activity levels for radionuclides that are commonly used. These are based on D-values, which define a dangerous source i.e. a source that could, if not under control, gives rise to exposure sufficient to cause severe deterministic effects. A more complete listing of radionuclides and associated activity levels corresponding to each category, and a fuller explanation of the derivation of the D-values, may be found in eighth schedule of Nigeria Basic Ionizing Radiation Regulations, which also provides the underlying methodology that could be applied to radionuclides not listed. Typical source uses are noted above for illustrative purposes only.

ACTIVITIES CORRESPONDING TO THRESHOLDS OF CATEGORIES

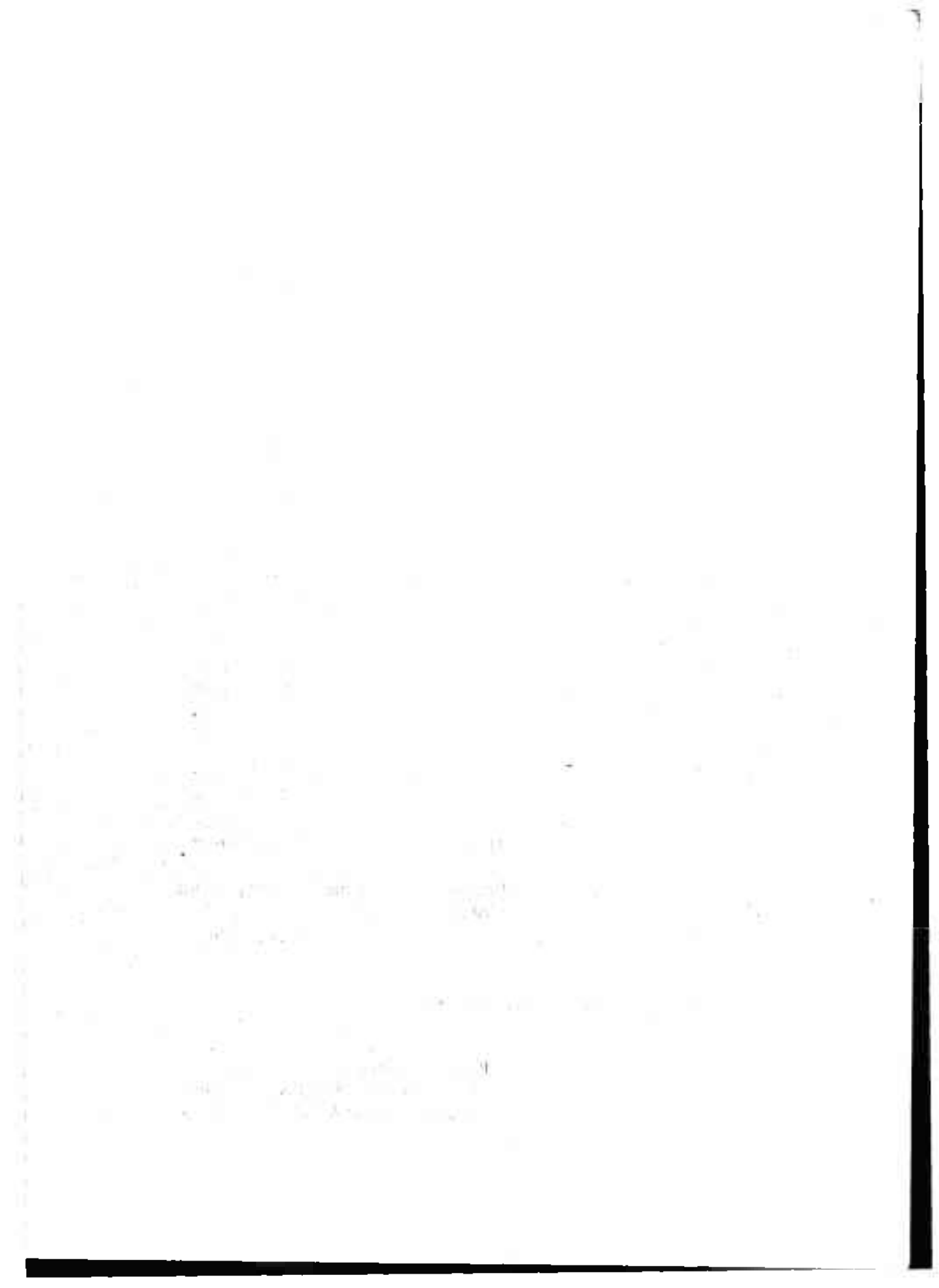
Radionuclide	Category 1		Category 2		Category 3	
	1000 x D		10 x D		D	
	(TBq)	(Ci)*	(TBq)	(Ci)*	(TBq)	(Ci)*
Am-241	6.E+01	2.E+03	6.E-01	2.E+01	6.E-02	2.E+00
Am-241/Be	6.E+01	2.E+03	6.E-01	2.E+01	6.E-02	2.E+00
Cf-252	2.E+01	5.E+02	2.E-01	5.E+00	2.E-02	5.E-01
Cm-244	5.E+01	1.E+03	5.E-01	1.E+01	5.E-02	1.E+00
Co-60	3.E+01	8.E+02	3.E-01	8.E+00	3.E-02	8.E-01
Cs-137	1.E+02	3.E+03	1.E+00	3.E+01	1.E-01	3.E+00
Gd-153	1.E+03	3.E+04	1.E+01	3.E+02	1.E+00	3.E+01
Ir-192	8.E+01	2.E+03	8.E-01	2.E+01	8.E-02	2.E+00
Pm-147	4.E+04	1.E+06	4.E+02	1.E+04	4.E+01	1.E+03
Pu-238	6.E+01	2.E+03	6.E-01	2.E+01	6.E-02	2.E+00
Pu-239b/Be	6.E+01	2.E+03	6.E-01	2.E+01	6.E-02	2.E+00
Ra-226	4.E+01	1.E+03	4.E-01	1.E+01	4.E-02	1.E+00
Se-75	2.E+02	5.E+03	2.E+00	5.E+01	2.E-01	5.E+00
Sr-90 (Y-90)	1.E+03	3.E+04	1.E+01	3.E+02	1.E+00	3.E+01
Tm-170	2.E+04	5.E+05	2.E+02	5.E+03	2.E+01	5.E+02
Yb-169	3.E+02	8.E+03	3.E+00	8.E+01	3.E-01	8.E+00
Au-198*	2.E+02	5.E+03	2.E+00	5.E+01	2.E-01	5.E+00
Cd-109*	2.E+04	5.E+05	2.E+02	5.E+03	2.E+01	5.E+02
Co-57*	7.E+02	2.E+04	7.E+00	2.E+02	7.E-01	2.E+01
Fe-55*	8.E+05	2.E+07	8.E+03	2.E+05	8.E+02	2.E+04
Ge-68*	7.E+02	2.E+04	7.E+00	2.E+02	7.E-01	2.E+01
Ni-63*	6.E+04	2.E+06	6.E+02	2.E+04	6.E+01	2.E+03
Pd-103*	9.E+04	2.E+06	9.E+02	2.E+04	9.E+01	2.E+03
Po-210*	6.E+01	2.E+03	6.E-01	2.E+01	6.E-02	2.E+00
Ru-106 (Rh-106)*	3.E+02	8.E+03	3.E+00	8.E+01	3.E-01	8.E+00
Tl-204*	2.E+04	5.E+05	2.E+02	5.E+03	2.E+01	5.E+02

(a) The primary values to be used are given in TBq. Curie values are provided for practical usefulness and are rounded after conversion.

(b) Criticality and safeguard issues will need to be considered for multiples of D.

MADE at Abuja this 5th day of October, 2006.

PROFESSOR SHAMSIDEEN BABATUNDE ELEGBA,
 Director-General/Chief Executive Officer
 Nigerian Nuclear Regulatory Authority



NUCLEAR SAFETY AND RADIATION PROTECTION ACT

(1995 No. 19)

**NIGERIAN TRANSPORTATION OF RADIOACTIVE SOURCES
REGULATIONS, 2006****ARRANGEMENT OF REGULATIONS****REGULATION**

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NUCLEAR SAFETY AND RADIATION PROTECTION ACT

(1995 No. 19)

NIGERIAN TRANSPORTATION OF RADIOACTIVE SOURCES REGULATIONS, 2006

[5th October, 2006]

Commence-
ment

In exercise of the powers conferred on it by Section 47 of the Nuclear Safety and Radiation Protection Act 1995 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:

1. The following definitions shall apply for the purposes of these Regulations :

Interpre-
tation.

"*A₁ and A₂*" means the activity value of special form radioactive material which is listed in Table I and is used to determine the activity limits for the requirements of these Regulations. *A₂* shall mean the activity value of radioactive material, other than special form radioactive material, which is listed in Table I and is used to determine the activity limits for the requirements of these Regulations,

"*Approval*"—(a) multilateral approval means approval by the relevant competent authority both of the country of origin of the design or shipment and of each country through or into which the consignment is to be transported. The term "through or into" specifically excludes "over", i.e. the approval and notification requirements shall not apply to a country over which radioactive material is carried in an aircraft, provided that there is no scheduled stop in that country ;

(b) unilateral approval means an approval of a design which is required to be given by the competent authority of the country of origin of the design only ;

"*The Authority*" means the Nigerian Nuclear Regulatory Authority established under Section 1 of the Act

"*The Act*" means the Nuclear Safety and Radiation Protection Act 1995 ,

"*Authorization*" means a permission granted in a document by the Authority to a legal person who has submitted an application to transport radioactive material. The authorization can take the form of a license, registration, permit or an exemption ;

"*Carrier*" means any person, organization or government undertaking the carriage of radioactive material by any means of transportation. The term includes both carriers for hire or reward and carriers on own account ;

"*Competent Authority*" means any national or international regulatory body or authority designated or otherwise recognized as such for any purpose in connection with these Regulations ;

"*Compliance Assurance*" means a systematic programme of measures applied by the Authority which is aimed at ensuring that the provisions of these Regulations are met in practice ;

"*Confinement System*" means the assembly of fissile material and packaging components specified by the designer and agreed to by the Authority as intended to preserve criticality safety ;

"*Containment System*" means the assembly of components of the packaging specified by the designer as intended to retain the radioactive material during transport ;

"*Consignee*" means any person, organization or government which receives a consignment ;

"*Consignment*" means any package or packages, or load of radioactive material, presented by a consignor for transport ;

"*Consignor*" means any person, organization or government which prepares a consignment for transport, and is named as consignor in the transport documents.

"*Contamination*" means the presence of a radioactive substance on a surface in quantities in excess of 0.4 Bq/cm^2 for beta and gamma emitters and low toxicity alpha emitters, 0.04 Bq/cm^2 for all other alpha emitters. Contamination shall be in one of the four groups ;

(a) non-fixed contamination means contamination that can be removed from a surface during routine conditions of transport ;

(b) fixed contamination means contamination other than non-fixed contamination ;

(c) non-fixed contamination on the external surfaces of packages and on the internal and external surfaces of overpacks, freight containers, tanks and intermediate bulk containers shall be kept as low as practicable and shall not exceed the following limits :

(i) beta, gamma and low toxicity alpha emitters 4 Bq/cm^2

(ii) all other alpha emitters 0.4 Bq/cm^2

(d) fixed contamination levels are limited by radiation level limits for packages and conveyances and by requirements for decontamination as specified in Regulation 34

"*Conveyance*" means

(a) for transport by road, rail ; or any vehicle,

(b) for transport by water, any vessel, or any hold, compartment, or defined deck area of a vessel ; and

(c) for transport by air or any aircraft.

"*Committed Effective Dose*" has the meaning assigned to it in the IAEA Safety Series No. 115 ;

"*Committed Equivalent Dose*" has the meaning assigned to it in the IAEA Safety Series No. 115 ;

"*Defined Deck Area*" means the area, of the weather deck of a vessel, or of a vehicle deck of a roll-on and roll-off ship or a ferry, which is allocated for the stowage of radioactive material ;

"*Design*" means the description of special form radioactive material, low dispersible radioactive material, package or packaging which enables such an item to be fully identified. The description may include specifications, engineering drawings, reports demonstrating compliance with regulatory requirements, and other relevant documentation

"Effective Dose" has the meaning assigned to it by Regulation 1 of NiBIRR

"Equivalent Dose" has the meaning assigned to it by Regulation 1 of NiBIRR

"Excluded" means beyond the scope of these Regulations

"Exclusive Use" means the sole use, by a single consignor, of a conveyance or of a large freight container, in respect of which all initial, intermediate and final loading and unloading is carried out in accordance with the directions of the consignor or consignee ;

"Fissile Material" means uranium-233, uranium-235, plutonium-239, plutonium-241, or any combination of these radionuclides, excepted from this definition is :

(a) natural uranium or depleted uranium which is unirradiated, and

(b) natural uranium or depleted uranium which has been irradiated in thermal reactors only ;

"Freight Container" means an article of transport equipment designed to facilitate the transport of goods, either packaged or unpackaged, by one or more modes of transport without intermediate reloading. It shall be of a permanent enclosed character, rigid and strong enough for repeated use, and must be fitted with devices facilitating its handling, particularly in transfer between conveyances and from one mode of transport to another. A small freight container is that which has either any overall outer dimension less than 1.5m, or an internal volume of not more than 3m³. Any other freight container is considered to be a large freight container ;

"IAEA" means International Atomic Energy Agency :

"Intermediate Bulk Container (IBC)" means a portable packaging that :

(a) has a capacity of not more than 3 m³ ;

(b) is designed for mechanical handling ;

(c) is resistant to the stresses produced in handling and transport, as determined by performance tests ; and

(d) is designed to conform to the standards in the chapter on Recommendations on Intermediate Bulk Containers (IBC's) of the United Nations Recommendations on the Transport of Dangerous Goods

"Licence" means an authorisation granted by the Authority on the basis of a safety assessment and accompanied by specific requirements and conditions to be complied with by the licensee ;

"licensee" means the holder of a current license granted by the Authority for transport of radioactive material who has recognized rights and duties for the practice or source, particularly in relation to radiation protection, safety, security and emergency response ;

"Low Dispersible Radioactive Material" means either a solid radioactive material or a solid radioactive material in a sealed capsule, that has limited dispersibility and is not in powder form ;

LSA material shall be in one of three groups :

(a) LSA—I :

(i) uranium and thorium ores and concentrates of such ores, and other ores containing naturally occurring radionuclides which are intended to be processed for the use of these radionuclides ;

(ii) solid unirradiated natural uranium or depleted uranium or natural thorium or their solid or liquid compounds or mixtures ;

(iii) radioactive material for which the A_2 value is unlimited ; or

(iv) other radioactive material in which the activity is distributed throughout and the estimated average specific activity does not exceed 30 times the values for exempt activity concentration specified in Regulation 16.

(b) LSA—II

(i) water with tritium concentration up to 0.8TBq/L ; or

(ii) other material in which the activity is distributed throughout and the estimated average specific activity does not exceed $10^{-4} A_2/g$ for solids and gases, and $10^{-5} A_2/g$ for liquids.

(c) LSA—III

Solids (e.g. consolidated wastes, activated materials), excluding powders, in which ;

(i) the radioactive material is distributed throughout a solid or a collection of solid objects, or is essentially uniformly distributed in a solid compact binding agent (such as concrete, bitumen, ceramic, etc.) ;

(ii) the radioactive material is relatively insoluble, or it is intrinsically contained in a relatively insoluble matrix, so that, even under loss of packaging, the loss of radioactive material per package by leaching when placed in water for seven days would not exceed $0.1 A_2$; and

(iii) the estimated average specific activity of the solid : excluding any shielding material, does not exceed $2 \times 10^{-4} A_2/g$;

"Low Specific Activity (LSA) Material" means radioactive material which by its nature has a limited specific activity, or radioactive material for which limits of estimated average specific activity apply. External shielding materials surrounding the LSA material shall not be considered in determining the estimated average activity ;

"Low Toxicity Alpha Emitter" means natural uranium, depleted uranium, natural thorium ; uranium-235 or uranium-238, thorium-232, thorium-228 and thorium-230 when contained in ores or physical and chemical concentrates, or alpha emitters with a half-life of less than 10 days ;

"Maximum Normal Operating Pressure" means the maximum pressure above atmospheric pressure at mean sea-level that would develop in the containment system in a period of one year under the conditions of temperature and solar radiation corresponding to environmental conditions in the absence of venting, external cooling by an ancillary system, or operational controls during transport.

"NiBIRR" means Nigeria Basic Ionizing Radiation Regulations 2003.

"Overpack" means an enclosure such as a box or bag which is used by a single consignor to facilitate as a handling unit a consignment of a more packages for convenience of handling, stowage and carriage ;

"Package" means the packaging with its radioactive contents as presented for transport. The types of packages covered by these Regulations, which are subject to the activity limits and material restrictions shown in Regulation 18 and meet the corresponding requirements, are :

- (a) Excepted package ;
- (b) Industrial package Type 1 (Type IP-1) ;
- (c) Industrial package Type 2 (Type IP-2) ;
- (d) Industrial package Type 3 (Type IP-3) ;
- (e) Type A package ;
- (f) Type B(U) package ;
- (g) Type B(M) package ;

packages containing fissile material or uranium hexafluoride are subject to additional requirements not addressed in these Regulations ;

"Packaging" means the assembly of components necessary to enclose the radioactive contents completely. It may, in particular, consist of one or more receptacles, absorbent materials, spacing structures, radiation shielding and service equipment for filling, emptying, venting, and pressure relief ; devices for cooling, absorbing mechanical shocks, handling and tie-down, thermal insulation ; and service devices integral to the package. The packaging may be a box, drum or similar receptacle, or may also be a freight container, tank or intermediate bulk container ;

"Quality Assurance" means a systematic programme of controls and inspections applied by any organization or body involved in the transportation of radioactive material which is aimed at providing adequate confidence that the standard of safety prescribed in these Regulations is achieved in practice.

"Radiation Level" means the corresponding dose rate expressed in millisieverts per hour ;

"Radiation Protection Programme" means systematic arrangements which are aimed at providing adequate consideration of radiation protection measures ;

"Radioactive Contents" means the radioactive material together with any contaminated or activated solids, liquids and gases within the packaging ;

"Radioactive Material" means any material containing radionuclides where both the activity concentration and the total activity in the consignment exceed the values specified in Table 1 ;

"Shipment" means the specific movement of a consignment from origin to destination ;

"Special Arrangement" means those provisions, approved by the competent authority, under which consignments which do not satisfy all the applicable requirements of these Regulations may be transported ;

"Special form Radioactive Material" means either an indispersible solid radioactive material or a sealed capsule containing radioactive material

"Specific Activity" of a radionuclide means the activity per unit mass of that nuclide. The specific activity of a material shall mean the activity per unit mass or volume of the material in which the radionuclides are essentially uniformly distributed ;

"Surface Contaminated Object (SCO)" means a solid object which is not itself radioactive but which has radioactive material distributed on its surfaces. SCO shall be in one two groups :

(a) SCO-I: A solid object on which ;

(i) the non-fixed contamination on the accessible surface averaged over 300cm^2 (or the area of the surface is less than 300cm^2) does not exceed 4Bq/cm^2 for beta and gamma emitters and low toxicity alpha emitters, or 0.4Bq/cm^2 for all other alpha emitters ; and

(ii) the fixed contamination on the accessible surface averaged over 300cm^2 (or the area of the surface if less than 300cm^2) does not exceed $4 \times 10^4 \text{Bq/cm}^2$ for beta and gamma emitters and low toxicity alpha emitters, or $4 \times 10^3 \text{Bq/cm}^2$ for all other alpha emitters ; and

(iii) the non-contamination plus the fixed contamination on the inaccessible surface averaged over 300cm^2 (or the area of the surface if less than 300cm^2) does not exceed $4 \times 10^4 \text{Bq/cm}^2$ for beta and gamma emitters and low toxicity alpha emitters, or $4 \times 10^3 \text{Bq/cm}^2$ for all other alpha emitters.

(b) SCO—II: A solid object on which either the fixed or non-fixed contamination on the surface exceeds the applicable limits specified for SCO-I in (a) above and on which :

(i) the non-fixed contamination on the accessible surface averaged over 300cm^2 (or the area of the surface if less than 300cm^2) does not exceed 400Bq/cm^2 for beta and gamma emitters and low toxicity alpha emitters, or 40Bq/cm^2 for all other alpha emitters ; and

(ii) the fixed contamination on the accessible surface, averaged over 300cm^2 (or the area of the surface if less than 300cm^2) does not exceed $8 \times 10^5 \text{Bq/cm}^2$ for beta and gamma emitters and low toxicity alpha emitters, or $8 \times 10^4 \text{Bq/cm}^2$ for all other alpha emitters ; and

(iii) the non-fixed contamination plus the fixed contamination on the inaccessible surface averaged over 300cm^2 (or the area of the surface if less than 300cm^2) does not exceed $8 \times 10^5 \text{Bq/cm}^2$ for beta and gamma emitters and low toxicity alpha emitters, or $8 \times 10^4 \text{Bq/cm}^2$ for all other alpha emitters

"Tank" means a tank container, a portable tank, a road tank vehicle, a rail tank wagon or a receptacle with a capacity of not less than 450 litres to contain liquids, powders, granules, slurries or solids which are loaded as gas or liquid and subsequently solidified, and of not less than 1000 litres to contain gases. A tank container shall be capable of being carried on land or on sea and of being loaded and discharged without the need of removal of its structural equipment, shall possess stabilizing members and tie-down attachments external to the shell, and shall be capable of being lifted when full ;

"*Transport Index (TI)*" assigned to a package, overpack or freight container, or to unpackaged LSA-I or SCO-I, means a number which is used to provide control over radiation exposure ;

"TS-R-1" means IAEA Safety Standard Series on Regulations for the Safe Transport of Radioactive Material (TS-R-1) ;

"*Unirradiated Thorium*" means thorium containing not more than 10^{-7} g of uranium-233 per gram of thorium-232 ;

"*Unirradiated Uranium*" means uranium containing not more than 2×10^3 Bq of plutonium per gram of uranium-235, not more than 9×10^6 Bq of fission products per gram of uranium-235 and not more than 9×10^{-3} g of uranium-236 per gram of uranium-235 ;

"*Uranium — Natural, Depleted, Enriched*": Natural uranium means chemically separated uranium containing the naturally occurring distribution of uranium isotopes (approximately 99.28% uranium-238, and 0.72% uranium-235 by mass). Depleted uranium means uranium containing a lesser mass percentage of uranium-235 than in natural uranium. Enriched uranium means uranium containing a greater mass percentage of uranium-235 than 0.72%. In all cases, a very small mass percentage of uranium-234 is present ;

"*Vehicle*" means a road vehicle (including an articulated vehicle, i.e a tractor and semi-trailer combination) or railroad car or railway wagon. Each trailer shall be considered as a separate vehicle ;

"*Vessel*" means any seagoing vessel or inland waterway craft used for carrying cargo ;

2. These Regulations apply in respect of the packaging and transportation of radioactive material and nuclear materials, including the design, production, use, inspection, maintenance and repair of packaging and packages, consigning, handling, loading, carriage, storage during transportation, receipt at final destination and unloading of packages.

Application.

3.—(1) These Regulations shall apply to transportation of radioactive material by all modes on land, water or in the air within Nigeria including transport which is incidental to the use of the radioactive material.

Scope.

(2) Transportation comprises all operations and conditions associated with and involved in the movement of radioactive material, these include the designing, loading, manufacturing, maintaining and repairing of packaging, and the preparation, consigning, loading, carriage including in-transit storage, unloading and receipt at final destination of loads of radioactive material and packages.

4. The Regulations provide for the protection of persons, property and the environment from the effects of radiation during the transportation of radioactive materials within Nigeria and shall further strengthen the provisions of the Act and NIBIRR on safe transportation of radioactive materials.

Objectives.

**LICENCE TO TRANSPORT RADIOACTIVE MATERIAL
AND NUCLEAR MATERIAL**

**Licence
application.**

5. An application for licence to transport radioactive material or nuclear material shall contain :

(a) the date, time and location of any scheduled stop or trans-shipment in Nigeria ;

(b) where the radioactive or nuclear material is required to be transported in a package of a certified design or in a package that has been approved as Type B(U)-96, Type C-96 or H(U)-96 by a foreign competent authority in accordance with the applicable process specified in the IAEA TS-R-1, the number of the certificate or approval applicable to the package ;

(c) the number of packages that are to be transported ;

(d) the types of conveyance to be used during transit ;

(e) where a vessel is to be used as a conveyance during transit, the name of the vessel and its flag state ; and for a special use vessel to be used as a conveyance during transit, a document issued by the competent authority of the vessel's flag state approving a radiation protection programme.

(f) where the nuclear material is to be transported by sea, the International Maritime Dangerous Goods Code transport schedule number for the radioactive or nuclear material ;

(g) the United Nations number for the radioactive or nuclear material ; and

(h) the identification number of the emergency response assistance plan approved under section 7 of the Transportation of Dangerous Goods Act, 1992.

**Licence to
Package or
Transport
under Special
Arrangement.**

6. An application for a licence to package or transport a nuclear material under special arrangement shall contain information required under the provisions of the Second Schedule of NIBIRR and the information specified in paragraph 807 of the IAEA Regulations for safe transport of radioactive materials (TS-R-1).

**Certification
of Packages.**

7.—(1) The Authority may certify a package design, a design for special form radioactive material or a design for low dispersible radioactive material after receiving an application that includes the following information :

(a) detailed description of the radioactive material or if a capsule : particular reference shall be made to both physical and chemical forms ;

(b) a detailed statement of the design of any capsule to be used ;

(c) a statement of the tests which have been done and their results, or evidence based on the calculative methods to show that the radioactive material is capable of meeting the performance standards, or other evidence that the special form radioactive material or low dispersible radioactive materials meet the applicable requirement of this regulation ;

(d) information necessary to satisfy the Authority that the design meets the requirements for packages containing uranium hexafluoride (TS-R-1, paragraph 629) and a specification of the applicable quality assurance programme as required in paragraph 310 of TS-R-1 ;

(e) evidence that for a Type B(U) and Type C packages, the regulations in paragraph 806 of TS-R-1 are met ;

(f) evidence that for a Type B(M) package, the requirements in paragraph 809-810 of the TS-R-1 are met ;

(g) evidence that for packages containing fissile materials, the design requirements of paragraph 671 of TS-R-1 and the quality assurance requirements of paragraph 310 of the TS-R-1 are met ;

(h) the number of any approval issued by a foreign competent authority in accordance with the applicable process specified in these Regulations ;

(i) in respect of a package design, the recommended inspection and servicing program ;

(j) the instructions for packaging, transporting, receiving, maintaining and unpackaging ; and

(k) at the request of the Authority, any other information that is necessary to determine if the application for certification meets the requirements of these Regulations.

(2) An applicant shall give the Authority an opportunity to observe any test that the applicant conducts to demonstrate compliance of a package design, a design for special form radioactive material or a design for low dispersible radioactive material with these Regulations, including notice of the date and time of the test.

(3) The Authority may recertify a design certified under regulation 7 if its technical specifications have not changed and the Authority or designated officer receives an application from the certificate holder no later than 60 days after the expiry date of the certificate.

(4) A statement confirming that the drawings and procedures previously submitted have not changed or if they have changed, a copy of the revised drawings and procedures and a statement confirming that the changes are without technical significance and do not affect the safety of the design. The application shall include the following information.

(a) a statement confirming that each package has been maintained in compliance with the drawings and procedures previously submitted ;

(b) in respect of a package design, a statement confirming that the instructions previously submitted have not changed ;

(c) unless previously submitted, the model number and drawings of any capsule containing radioactive material ;

(d) in respect of a certified package design, other than one referred to in paragraph (4), a list of the serial numbers of packages manufactured and maintained in accordance with the certified package design ;

(e) in respect of a certified package design that was certified after approval by a foreign competent authority, a list of the serial numbers of all packages currently in use or intended to be used in Nigeria :

(f) a list of the known users of the latest certified package design :

(g) a summary of the maintenance performed and any operational or maintenance problems encountered with the package, including the date, nature of the maintenance or problem and any action taken :

(h) in respect of a design originating in a foreign country, a copy of each package design approval document or low dispersible radioactive material approval document issued by the foreign competent authority since the last certification :

(i) a copy of the documents submitted to the foreign competent authority in order to obtain a package design approval document referred to in paragraph (5) and (10) at the request of the Authority, any other information that is necessary to enable the Authority to determine if the application meets the applicable requirements of these Regulations.

**Refusal to
certify.**

8. The Authority shall notify a person who has applied for the certification of a package design, a design for special form radioactive material or a design for low dispersible radioactive material of a proposed decision not to certify the design, as well as the basis for the proposed decision, at least 30 days before refusing to certify it.

**Decertification
of package
design.**

9. The Authority shall notify a person to whom a certificate for a package design, a design for special form radioactive material or a design for low dispersible radioactive material has been issued and, in the case of a certificate for a package design, any registered user of a package of that design, of a proposed decision to decertify the design, as well as the basis for the proposed decision, at least 30 days before decertifying it.

**Powers of
the issuing
Authority.**

10. The Authority shall review, approve, reject applications, and issue, amend, modify, suspend, cancel licences or other authorizations in respect of transportation of radioactive material.

Authorization.

11. The Authority shall make available copies of authorizations for the transportation of radioactive materials to the law enforcement agents and other relevant government agencies for their information and other necessary actions.

Licensing.

12. Any licence issued under these regulations shall be :

(a) valid for such a period as the Authority may determine ; and

(b) renewable by the Authority if the licensee complies with the license terms and conditions.

**Terms and
conditions
for licensing**

13. Any authorization so issued shall carry terms and conditions which shall be binding on the licensee and shall include :

(a) the designated ports of entry or exit of radioactive materials :

(b) requirements for the notification of the Authority of shipment and receipt of radioactive materials :

- (c) safety and security responsibilities ;
- (d) radiation protection programme ;
- (e) emergency response programme ; and
- (f) any other such terms and conditions so imposed by the Authority.

14.—(1) A consignor, carrier and consignee of radioactive materials within Nigeria shall have a valid licence from the Authority and shall notify the Authority well in advance and prior to the delivery, transport and receipt of any such materials.

Responsibilities
of the
consignors,
carriers and
consignees.

(2) Carriers of radioactive materials within Nigeria must obtain security clearance from the Department of State Service.

(3) For shipment by road, the vehicle must be dedicated for the purpose of transportation of radioactive materials only and all relevant particulars of the vehicle must be submitted to the Authority.

(4) All proposals from applicants for the transport of radioactive materials shall be supplied in writing to the Authority as required under the Second Schedule of NIBRR.

(5) A person who intends to dispatch radioactive materials shall carry out the packaging of the radioactive materials in compliance with the packaging and testing requirements under the IAEA TS-R-1 and these Regulations and as laid down in the code of practice.

(6) Consignors, consignees and carriers shall establish a procedure for routinely communicating with the Authority.

(7) An applicant shall pay the appropriate fees prescribed by the Authority.

15. The underlisted provisions shall not be affected by these Regulations:

Exclusion.

(a) where radioactive material is an integral part of the means of transport :

(b) where the radioactive material is moved within an establishment that is subject to appropriate safety regulations and where movement does not involve public roads or railways :

(c) where the radioactive material is implanted or incorporated into a person or live animal for diagnosis and treatment :

(d) where the radioactive material is in consumer products which have received the Authority's approval following their sale to the end user :

(e) natural materials and ores containing naturally occurring radionuclides that are either in their natural state, or have been processed only for the purposes other than for extraction of radionuclides, and that are not intended to be processed for use of these radionuclides, provided that the activity concentration of the material does not exceed 10 times the activity limits and material restriction as specified in paragraph 410-416 of TS-R-1 :

(f) non-radioactive solid objects with radioactive materials on the materials not in excess of 0.4 Bq/cm² for beta, gamma or low toxicity alpha emitters and 0.04 Bq/cm² for other alpha emitters.

Exempt
consignment.

16.—(1) The exempt limits for individual radionuclides that shall be contained in a package is given in Table 1.

(2) For materials containing mixtures of radionuclides, the activity concentration for exempt consignment may be derived from the expression:

$$X_m = \frac{1}{\sum_i \frac{f(i)}{X(i)}}$$

where,

(a) $f(i)$ is the fraction of activity or activity concentration of radionuclide in the mixture :

(b) $X(i)$ is the appropriate value of the activity or exempt per consignment as appropriate for the radionuclide i ; and

(c) X_m is the derived value of the activity concentration for exempt material or the activity limit for an exempt consignment in the case of a mixture.

(2) The basic activity limits for individual radionuclides, A_1 and A_2 , that must not be exceeded in a package is given in Table 1.

(3) For a mixture of radionuclides, the activity and exempt limits shall be derived using the following formula :

$$A_m = \frac{1}{\sum_i \frac{g(i)}{A(i)}}$$

where,

(a) $g(i)$ is the fraction of activity or activity concentration of radionuclide in the mixture :

(b) $A(i)$ is the appropriate value of the activity limit per consignment, A_1 or A_2 , for the radionuclide i ; and

(c) A_m is the derived value of the activity or activity concentration limit A_1 or A_2 , for individual radionuclide per consignment in mixture.

(4) For unknown radionuclides or mixtures the more restrictive values of activity concentration for exempt material or activity limits for exempt consignments specified in Table II shall be used.

(5) Radioactive material or items to be transported shall be classified, using A_1 or A_2 values, as one of the following :

(a) material or instruments or articles not exceeding the limits for an excepted package (activity limits are specified in Table III, in addition, the radiation level at 10cm from any point on the external surface of any unpackaged instrument or article shall not be greater than 0.1mSv/h) :

(b) low specific activity material (defined in these regulations as LSA-I, LSA-II or LSA-III) :

(c) surface contaminated objects (defined in these regulations as SCO-I or SCO-II):

(d) Type A package quantity (provided the activity of the material does not exceed the A_1 or A_2 values in Table I or II or the A_1 or A_2 values as derived for material containing a mixture of known radionuclides); or

(e) Type B package quantity (when the activity of the material exceeds the limits for a Type A package but not any limit specified in the competent authority certificate for the type B(U) or Type B(M) package in which it is to be transported.

(f) The complete and proper shipping names to be used for the transport of radioactive material are provided in Table VIII.

17. Some radioactive materials may be transported unpackaged under the following conditions:

Unpacked
shipment/
exclusive use.

(a) LSA-1 and SCO-1 may be transported unpackaged under exclusive use provided that all unpackaged material other than ores containing only naturally occurring radionuclides shall be transported in such a manner that under routine conditions of transport there will be no escape of the radioactive contents from the conveyance nor will there be any loss of shielding;

(b) exclusive use is not required for SCO-1 shipments where contamination on the accessible and the inaccessible surfaces is not greater than ten times the levels specified in Regulation 1. For SCO-1 shipments where it is suspected that non-fixed contamination exists on inaccessible surfaces in excess of ten times the levels specified in Regulation 1, measures shall be taken to ensure that radioactive material is not released into the conveyance.

18.—(1) Radioactive material or items which require packaging for transport shall be packaged in any of the following packages (in order of increasing risk) which are designed, manufactured, tested, documented, used, maintained, and inspected in accordance with the requirements of TS-R-1:

Packaging/
packages.

(a) Excepted package:

(b) Industrial package (IP-1, IP-2 or IP-3):

(c) Type A package:

(d) Type B(M) package:

(e) Type B(U) package

(2) Industrial packages (IP-1, IP-2 or IP-3) may be used for the transport of low specific activity material or surface contaminated objects as specified in Table IV provided that the external radiation level at 3m from the unshielded material or object or objects does not exceed 10mSv/h.

(3) Radioactive material or items may be transported in packages which provide more protection than required for the material.

(4) Empty packages, which previously contained radioactive material, may be shipped as excepted packages provided that:

(a) they are in a well maintained condition and securely closed:

(b) the outer surface of any uranium or thorium in its structure is covered with an inactive sheath made of metal or some other substantial material ;

(c) the level of internal non-fixed contamination does not exceed one hundred times the levels specified in Regulation 1 in these Regulations ;

(d) any labels required for its previous use are no longer visible ; and

(e) all other requirements for excepted packages in these Regulations are met.

Mixed
contents.

19. A package shall not contain any other items except such articles and documents as are necessary for the use of the radioactive material.

Maximum
radiation
levels.

20.—(1) Radiation level limits apply to the following items and materials to be packaged for transport :

(a) the radiation level at 10cm from any point on the external surface of any unpackaged instrument or article which has activity levels below the limits for an excepted packages, shall not be greater than 0.1mSv/h ; and

(b) the quantity of LSA material or SCO in a single industrial package (Type IP-1, IP-2 or IP-3) shall be so restricted that the external radiation level at 3m from the unshielded material or object or objects does not exceed 10mSv/h.

(2) Radiation level limits apply to packages or overpacks as follow :

(a) the radiation level limit for excepted packages is 5 μ Sv/h at the surface of an excepted package :

(b) the radiation levels for all other packages and overpacks, except for consignments under exclusive use, shall not exceed 2mSv/h at any point on any external surface of the package or overpack and, in addition, shall not exceed 0.1mSv/h at 1m from the external surfaces of the package or overpack :

(c) for consignment to be transported by road or rail under exclusive use the radiation levels on the external surface of any package or overpack shall not exceed 10mSv/h and may only exceed 2mSv/h provided that specific vehicle and shipment condition are met as specified in these Regulations :

(d) for exclusive use shipments by air or by vessel the radiation levels on the external surface of any package or overpack greater than 2mSv/h may be allowed only under special arrangement or conditions which are not covered in these regulations.

(3) Radiation levels for conveyances are limited as follows :

(a) loading of freight containers and the accumulation of packages, overpacks and freight containers aboard a single conveyance shall be such that the radiation level under routine conditions of transport shall not exceed 2mSv/h at any point on, and 0.1mSv/h at 2m from, the external surface of the conveyance :

(b) further control over radiation exposure during transport is provided with limits on the transport index as specified in Regulation 21.

Transport
index.

21.—(1) To provide control over radiation exposure during transport a transport index (TI), based on radiation levels, shall be assigned to package, overpack or freight container or to unpackaged LSA-1 or SCO-1 as follows :

(a) determine the maximum radiation level in units of milli-sieverts per hour (mSv/h) at a distance of 1m from the external surfaces of the package, overpack, freight container, or unpackaged LSA-1 and SCO-1. The value determined shall be multiplied by 100 and the resulting number is the transport index. For uranium and thorium ores and their concentrates, the maximum radiation level at any point 1m from the external surface of the load may be taken as :

(i) 0.4mSv/h for ores and physical concentrates of uranium and thorium,

(ii) 0.3mSv/h for chemical concentrates of thorium,

(iii) 0.02mSv/h for chemical concentrates of uranium, other than uranium hexafluoride :

(b) for tanks, freight containers and unpacked LSA-1 and SCO-1, the value determined in step (a) above shall be multiplied by the appropriate factor from Table VI :

(c) the value obtained in steps (a) and (b) above shall be rounded up to the first decimal place (e.g. 1.15 becomes 1.2), except that a value of 0.05 or less may be considered as zero.

(2) The transport index for each overpack, freight container or conveyance shall be determined as either the sum of the TIs of all the packages contained, or by direct measurement of radiation level, except in the case of non-rigid overpacks for which the transport index shall be determined only as the sum of the TIs of all the packages.

(3) Any package or overpack having a TI greater than 10 shall be transported only under exclusive use.

(4) The TI limits for freight containers and conveyances not under exclusive use are provided in Table IX.

(5) There is no limit on the sum of transport indexes for consignments of LSA-1 material.

(6) Where a consignment is transported under exclusive use, there is no limit on the sum of the transport indexes abroad a single conveyance:

22.—(1) Where unpackaged LSA-1 or SCO-1 material is contained in receptacles or packaging material and shipped under conditions specified in Regulation 17, the outer surface of these receptacles or wrapping materials may bear the marking "Radioactive LSA-1" or "Radioactive SCO-1" as appropriate.

Markings.

(2) All packages shall be legibly and durably marked on the outside of the packaging with an identification of either the consignor or consignee, or both.

(3) Each package of gross mass exceeding 50kg shall have its permissible gross mass legibly and durably marked on the outside of the packaging.

(4) All packages shall be legibly and durably marked on the outside of the packaging with the appropriate United Nations number from Table VIII preceded by the letters "UN". For each package other than excepted packages the proper shipping name as identified in Table VIII must also be included with this marking.

(5) Industrial packages shall be legibly and durably marked on the outside of the packaging with "TYPE IP-1" "TYPE IP-2" or TYPE IP-3" as appropriate.

(6) Type A packages shall be legibly and durably marked on the outside of the packaging with "TYPE A".

(7) Each package which conforms to an approved Type B(U) and Type B(M) design shall be legibly and durably marked on the outside of the packaging with:

(a) the identification mark allocated by the Authority to the design of that package ;

(b) a serial number to uniquely identify each packaging which conforms to that design ;

(c) in the case of a Type B(U) or Type B(M) package design, with "TYPE B(U)" or "TYPE B(M)".

(8) In addition, each package which conforms to a Type B(U) or Type B(M) design shall have the outside of the outermost receptacle which is resistant to the effects of fire and water plainly marked by embossing, stamping or other means resistant to the effects of fire and water with the trefoil symbol.

Labeling.

23. Labeling is required in accordance with the assigned category for packages and overpacks. Packages and overpacks shall be assigned to either category I- WHITE, II- YELLOW or III- YELLOW in accordance with the conditions specified in Table VII and with the following requirements :

(a) for a package or overpack, both the transport index and the surface radiation level conditions shall be taken into account in determining the appropriate category. Where the transport index satisfies the condition for one category but the surface radiation level satisfies the condition for a different category, the package or overpack shall be assigned to the higher category. For this purpose, category I- WHITE shall be regarded as the lowest category :

(b) the transport index shall be determined following the procedures specified in Regulation 21.

Effects of labeling.

24.—(1) The labels for these categories are shown in Figures 2, 3 and 4 of TS-R-1.

(2) For all packages, any labels which do not relate to the contents shall be removed or covered.

(3) Excepted packages do not require any labeling. All other packages, overpacks and freight containers shall bear labels which conform to the models in Figures 2, 3 or 4 of TS-R-1. These labels shall be affixed to two opposite sides of the outside of a package or overpack or on the outside of all four sides of a freight containers or tank. On large freight containers and tanks enlarged labels may be used, in accordance with dimensions specified in Figure 6 of TS-R-1., in which case the following information shall be required.

(a) contents :

(i) except for LSA-I material, the name(s) of the radionuclide(s) as taken from Table I, using the symbols prescribed therein. For mixtures of radionuclides, the most restrictive nuclides must be listed to the extent the space on the line

permits. The group of LSA or SCO shall be shown following the name(s) of the radionuclide(s). The terms "LSA-II", "LSA-III", "SCO-I", and "SCO-II" shall be used for this purpose,

(ii) for LSA-I material, the term "LSA-I is all that is necessary : the name of the radionuclide is not necessary.

(b) activity: The maximum activity of the radioactive contents during transport expressed in units of becquerels (Bq) with the appropriate SI prefix (see Annex II) ;

(c) for overpack and freight containers the "contents" entries on the label shall bear the information required in subparagraphs (a) and (b), respectively, totaled together for the entire contents of the overpack or freight container except that on labels for overpacks or freight containers containing mixed loads of packages containing different radionuclides, such entries may read "See Transport Documents" ;

(d) "transport index" (See Regulation 21). (No transport index entry is required for category I-WHITE.).

25.—(1) The following conditions for loading and segregation apply to all consignments.

Loading and
segregation.

(2) Consignments shall be segregated from other dangerous goods during transport in compliance with the relevant transport regulations

(3) Radioactive material shall be segregated from undeveloped photographic film so that the radiation exposure of film due to the transport of radioactive material is limited to 0.1 mSv per consignment of such film.

(4) Where a consignment is to be transported, not under exclusive use, the following conditions apply:

(a) the consignment shall not include any package or overpack having a transport index greater than 10 ;

(b) loading of freight containers and the accumulation of packages, overpacks and freight containers aboard a single conveyance shall be so limited that the total sum of the transport indexes aboard a single conveyance shall be such that the radiation level under routine conditions of transport shall not exceed 2mSv/h at any point on, and 0.1 mSv/h at 2m from, the external surface of the conveyance.

26.—(1) Where a consignment is to be transported under exclusive use there is no limit on the sum of transport indexes but radiation levels are controlled as follows:

Control of
radiations.

(a) for road and rail consignments under exclusive use the radiation level shall not exceed 10 mSv at any point on the external surface of any *package* or *overpack*, and may only exceed 2 mSv/h provided that :

(i) the *vehicle* is equipped with an enclosure which, during routine conditions of transport, prevents the access of unauthorized persons to the interior of the enclosure,

(ii) provisions are made to secure the *package* or *overpack* so that its position within the *vehicle* remains fixed during routine conditions of transport, and

(iii) there is no loading or unloading during shipment ;

(b) 2 mSv/h at any point on the outer surfaces of the *vehicle*, including the upper and lower surfaces, or, in the case of an open *vehicle*, at any point on the vertical planes projected from the outer edges of the *vehicle*, on the upper surface of the load, and on the lower external surface of the *vehicle* : and

(c) 0.1 mSv/h at any point 2m from the vertical planes represented by the outer lateral surfaces of the *vehicle*, or, if the load is transported in an open *vehicle*, at any point 2 m from the vertical planes projected from the outer edges of the *vehicle*.

(2) The conditions for exclusive use air shipments and shipments by vessel are not addressed because they are also subject to special arrangement conditions which are beyond the scope of these regulations.

Placarding.

27.—(1) Consignments consisting solely of excepted packages do not require placarding. Where other packages are involved the following requirements for placarding apply.

(2) Large freight containers carrying packages or other excepted packages, and tanks shall bear four placards which conform with the model given in Figure 6 of TS-R-1. The placards shall be affixed in a vertical orientation to each side wall and each end wall of the large freight container or tank. Any placards which do not relate to the contents shall be removed. Instead of using both labels and placards, it is permitted as an alternative to use large labels only, as shown in Figures 2, 3 and 4 of TS-R-1 where appropriate, with dimensions of the minimum size shown in Figure 6 of TS-R-1.

(3) Where the *consignment* in the freight container or tank is unpackaged LSA-I or SCO-I or where an *exclusive use consignment* in a freight container is packaged radioactive material with a single United Nations number, the appropriate United Nations number for the *consignment* (see Table VIII) shall also be displayed, in black digits not less than 65 mm high, either :

(a) in the lower half of the placard shown in Figure 6 of TS-R-1, preceded by the letters "UN" and against the white background : or

(b) on the placard shown in Figure 7 of TS-R-1.

(3) When the alternative given in (b) above is used, the subsidiary placard shall be affixed immediately adjacent to the main placard, on all four sides of the freight container or tank.

(4) Rail and road vehicles carrying packages, overpacks or freight containers labeled with any of the labels shown in Figures 2, 3 or 4 of TS-R-1, or carrying consignments under exclusive use, shall display the placard shown in Figure 6 of TS-R-1 on each of:

(a) the two external lateral walls in the case of a rail vehicle :

(b) the two external lateral walls and the external rear wall in the case of a road vehicle.

(5) In the case of a vehicle without sided walls, the placards may be affixed directly on the cargo-carrying unit provided that they are readily visible : in the case

of physically large tanks or freight containers, the placards on the tanks or freight containers shall suffice. In the case of vehicles which have insufficient area to allow the fixing of large placards, the dimensions of the placard as described in Figure 6 may be reduced to 100 mm. Any placards which do not relate to the contents shall be removed.

(6) Where the *consignment* is or on the *vehicle* is unpackaged *LSA-I material* or *SCO-I* or where an *exclusive use consignment* is packaged *radioactive material* with a single United Nations number, the appropriate United Nations number (see Table VIII) shall also be displayed, in black digits not less than 65 mm high, either :

(a) in the lower half of the placard shown in Figure 6 of TS-R-1, preceded by the letters "UN" and against the white background : or

(b) on the placard shown in Figure 7 of TS-R-1.

(7) When the alternative given in 6(b) above is used, the subsidiary placard shall be affixed immediately adjacent to the main placard, either on the two external lateral walls in the case of a rail vehicle or the two external lateral walls and the external rear wall in the case of a road vehicle.

28. The Consignor shall provide transport documentation to accompany the consignment and shall include particulars of the consignment, a consignor's declaration and information for carriers.

Transport document.

29.—(1) The *consignor* shall include in the transport documents of each *consignment*, the following information as applicable in the order given below :

Particulars of consignment.

(a) the proper shipping name, as specified in Table VIII of the Schedule ;

(b) the United Nations Class number "7";

(c) the United Nations number assigned to the material as specified in Table VIII, preceded by the letters "UN" ;

(d) the name or symbol of each radionuclide or, for mixtures of radionuclides, an appropriate general description or a list of the most restrictive nuclides ;

(e) a description of the physical and chemical form of the material, or a notation that the material is *specified form radioactive material*. A generic chemical description is acceptable for chemical form ;

(f) the maximum activity of the *radioactive contents* during transport expressed in units of becquerels (Bq) with an appropriate SI prefix (see Annex II) ;

(g) the category of the *package*, i.e. I-WHITE, II-YELLOW, III-YELLOW ;

(h) the *transport index* (categories II-YELLOW and III-YELLOW only) ;

(i) (reserved) ;

(j) the identification mark for each *Authority* approved certificate (*special form radioactive material, package design or shipment*) applicable to the *consignments* ;

(k) for *consignments* or *packages* in an *overpack* or *freight container*, a detailed statement of the contents of each *package* within the *overpack* or *freight container* and, where appropriate, of each *overpack* or *freight container* in the *consignment*.

If *packages* are to be removed from the *overpack* or *freight container* at a point of intermediate unloading, appropriate transport documents shall be made available :

(l) where a *consignment* is required to be shipped under *exclusive use*, the statement 'EXCLUSIVE USE SHIPMENT' : and

(m) for *LSA-II*, *LSA-III*, *SCO-I* and *SCO-II*, the total activity of the *consignment* as a multiple of A_7 .

Consignors
declaration.

(2) (a) The *consignor* shall include in the transport documents a declaration in the following terms or in terms having an equivalent meaning :

"I hereby declare that the contents of this *consignment* are accurately described, classified, packed, marked and labeled, and are in all respects in proper condition for transport by (insert mode(s) of transport involved) according to the applicable Authority's and international Regulations."

(b) The declaration shall be signed and dated by the *consignor*. Facsimile signatures are acceptable where applicable laws and regulations recognize the legal validity of facsimile signatures.

(c) The declaration shall be made on the same transport document which contains the particulars of *consignment* listed above.

Information
for carriers.

(3.) The *consignor* shall provide in the transport documents a statement regarding actions, if any, that are required to be taken by the *carrier*. The statement shall be in English and shall include at least the following points:

(i) supplementary requirements for loading, stowage, carriage, handling and unloading of the *package*, *overpack* or *freight container* including any special stowage provisions for the safe dissipation of heat, or a statement that no such requirements are necessary :

(ii) restrictions on the mode of transport or *conveyance* and any necessary routing instructions :

(iii) emergency arrangements appropriate to the *consignment*.

(iv) The *consignor* shall make all the relevant Authority's authorizations available to the *carrier(s)* before loading and unloading.

Storage and
dispatch.

30.—(1) *Consignments* of radioactive material shall be stored and dispatched as follows :

(a) segregation during storage in transit is required from other dangerous goods : and

(b) from persons and undeveloped photographic films and plates :

Provided that its average surface heat flux does not exceed 15 W/m^2 and that the immediate surrounding cargo is not in sacks or bags, a package or overpack may be stored among packaged general cargo without any special stowage provisions except as may be specified required by the Authority in an applicable approval certificate.

(2) Any provisions in the Authority approval certificates and any relevant pre-use and pre-shipment requirements shall be observed.

31.—(1) Category II-YELLOW or III-YELLOW packages or overpacks shall not be carried in compartments occupied by passengers, except those exclusively reserved for couriers specially authorized to accompany such packages or overpacks ;

Carriage.

(2) For transport by road, no persons other than the driver assistant, and the Radiation Protection Officer shall be permitted in vehicles carrying packages, overpacks or freight containers bearing category II-YELLOW or III-YELLOW labels.

32.—(1) Every consignor, carrier and consignee of radioactive materials and ; or nuclear material shall establish and implement a radiation protection programme and shall as part of that programme :

Radiation
protection
programme.

(a) keep the effective dose and equivalent dose received by and committed to persons as low as reasonably achievable, through the implementation of management control over practices, personnel qualification and training, control of occupational and public or persons to radiation and planning for emergency :

(b) prevent persons from receiving doses of radiation higher than the radiation dose limits prescribed in the Forth Schedule of NIBIRR ; and

(c) train persons referred to in the programme on the application of the programme.

(2) Every consignor, carrier and consignee shall :

(a) keep a record of its radiation protection programme and of any information collected under the programme ; and

(b) maintain the record of information collected and the programme for the period ending two years after the date on which it is collected.

33.—(1) The nature of the radiation protection programme shall be related to the magnitude and likelihood of radiation exposures expected during the transportation, and all programme documents must be made available to the Authority.

Radiation
exposure
magnitude.

(2) Radiation protection must be optimized in order that the magnitude of individual doses, the number of persons exposed and the likelihood of exposure shall be kept as low as is reasonably achievable.

(3) Workers shall receive appropriate training concerning the radiation hazards involved and the precautions to be taken in order to restrict their exposures and the exposure to other persons who might be affected by their actions.

(4) Occupational exposures arising from transport activities that the effective dose is most unlikely to exceed 1 mSv in a year where neither dose assessment or individual records keeping is required and is likely to be between 1 and 6 mSv in a year where only workplace monitoring are in place and not more than 6 mSv in a year where individual monitoring is in place (para 301-306 of TS-R-1).

34.—(1) Conveyances and equipment used regularly for the transport of radioactive materials shall be periodically checked to determine the level of

Decontami-
nation.

contamination. The frequency of such checks shall be related to the likelihood of contamination and the extent to which radioactive material is transported.

(2) Conveyances and equipment which have, in the course of transport of radioactive material, become contaminated above the previously stated contamination limits or which show a radiation level in excess of 5 $\mu\text{Sv/h}$ at the surface shall be decontaminated as soon as possible by a qualified person and shall not be reused unless the non-fixed contamination does not exceed the previously stated contamination limits. In addition, the radiation levels resulting from the fixed contamination on surfaces after decontamination shall be less than 5 $\mu\text{Sv/h}$.

Emergency response.

35.—(1) In the event of accidents or incident during the transport of radioactive material, provisions as established in the National Nuclear and Radiological Emergency Plan and international organizations shall be observed to protect persons, property and the environment. Guidelines contained in the IAEA Safety Series No. 87 shall also be observed.

(2) Emergency procedures shall take into account the formation of other dangerous substances that may result from the reaction between the contents of a consignment and the environment in the event of an accident

Other provisions.

36.—(1) For radioactive material having subsidiary risks and for transport of radioactive material with other dangerous goods, the relevant transport regulation for dangerous goods shall apply in addition to these regulations.

(2) Emergency response provisions, including provisions for damaged and leaking packages, shall be established.

(3) Quality assurance programmes, which are acceptable to the Authority, based on provisions of NiBIRR, international, or other standards shall be established.

(4) A compliance assurance programmes, which are acceptable to the Authority shall be established.

(5) Customs operations involving the inspection of the radioactive contents of a package shall be carried out only in a place where adequate means of controlling radiation exposure are provided and in the presence of qualified persons. Any package opened on customs instructions shall, before being forwarded to the consignee, be restored to its original condition.

(6) Where a consignment is undeliverable, the consignment shall be placed in a safe location and the Authority shall be informed as soon as possible and a request made for instructions on further action.

Penalties.

37.—(1) Any person who contravenes any of the provisions of these Regulations has committed an offence.

(2) Any person who commits an offence under these regulations shall be liable to the penalties as established in the enforcement policy issued by the Authority.

(3). The Authority shall impose penalties such as suspension, revocation of authorization, imposing administrative fine, closure of facility or any combination of these.

(4). Any person or body corporate, being a holder of authorization under these regulations, who commits an offence shall be liable to prosecution in the court of law and upon conviction shall pay fines up to ₦1,000,000 for an individual and up to ₦10,000,000 for a corporate body or be given a jail term of up to ten years or both

38. These Regulations may be cited as the Nigerian Transportation of Radioactive Sources Regulations, 2006. Citation.

SCHEDULE

TABLE 1: BASIC RADIONUCLIDE VALUES

<i>Radionuclide (Atomic number)</i>	<i>A₁ (TBq)</i>	<i>A₂ (TBq)</i>	<i>Activity concen- tration for exempt material (Bq/g)</i>	<i>Activity limit for an exempt consignment (Bq)</i>
Actinium (89)				
Ac-225 (a)	8×10^{-1}	6×10^{-3}	1×10^1	1×10^4
Ac-227 (a)	9×10^{-1}	9×10^{-5}	1×10^{-1}	1×10^3
Ac-228	6×10^{-1}	5×10^{-1}	1×10^1	1×10^6
Silver (47)				
Ag-105	2×10^0	2×10^0	1×10^2	1×10^6
Ag-108m (a)	7×10^{-1}	7×10^{-1}	1×10^1 (b)	1×10^6 (b)
Ag-110m (a)	4×10^{-1}	4×10^{-1}	1×10^1	1×10^6
Ag-111	2×10^0	6×10^{-1}	1×10^1	1×10^6
Aluminum (13)				
Al-26	1×10^{-1}	1×10^{-1}	1×10^1	1×10^5
Americium (95)				
Am-241	1×10^1	1×10^{-3}	1×10^0	1×10^4
Am-242m (a)	1×10^1	1×10^{-3}	1×10^0 (b)	1×10^4 (b)
Am-243 (a)	5×10^0	1×10^{-3}	1×10^0 (b)	1×10^3 (b)
Argon (18)				
Ar-37	4×10^1	4×10^1	1×10^6	1×10^8
Ar-39	4×10^1	2×10^1	1×10^7	1×10^4
Ar-41	3×10^{-1}	3×10^{-1}	1×10^2	1×10^9
Arsenic (33)				
As-72	3×10^{-1}	3×10^{-1}	1×10^1	1×10^3
As-73	4×10^1	4×10^1	1×10^3	1×10^7
As-74	1×10^0	9×10^{-1}	1×10^1	1×10^6
As-76	3×10^{-1}	3×10^{-1}	1×10^2	1×10^5
As-77	2×10^1	7×10^{-1}	1×10^1	1×10^6
Astatine (85)				
At-211 (a)	2×10^1	5×10^{-1}	1×10^1	1×10^2
Gold (79)				
Au-193	7×10^0	2×10^0	1×10^2	1×10^7
Au-194	1×10^0	1×10^0	1×10^1	1×10^6
Au-195	1×10^1	6×10^0	1×10^2	1×10^7
Au-198	1×10^0	6×10^{-1}	1×10^2	1×10^6
Au-199	1×10^1	6×10^{-1}	1×10^2	1×10^6
Barium (56)				
Ba-131 (a)	2×10^0	2×10^0	1×10^2	1×10^6
Ba-133	3×10^0	3×10^0	1×10^2	1×10^6
Ba-133m	2×10^1	6×10^{-1}	1×10^2	1×10^6
Ba-140 (a)	5×10^{-1}	3×10^{-1}	1×10^1 (b)	1×10^3 (b)

<i>Radionuclide (Atomic number)</i>	<i>A₁ (TBq)</i>	<i>A₂ (TBq)</i>	<i>Activity concen- tration for exempt material (Bq/g)</i>	<i>Activity limit for an exempt consignment (Bq)</i>
Beryllium(4)				
Be-7	2×10^1	2×10^1	1×10^3	1×10^7
Be-10	4×10^1	6×10^1	1×10^3	1×10^6
Bismuth(83)				
Bi-205	7×10^1	7×10^1	1×10^1	1×10^6
Bi-206	3×10^1	3×10^1	1×10^1	1×10^5
Bi-207	7×10^1	7×10^1	1×10^1	1×10^6
Bi-210	1×10^0	6×10^1	1×10^3	1×10^6
Bi-210m(a)	6×10^1	2×10^2	1×10^1	1×10^5
Bi-212(a)	7×10^1	6×10^1	1×10^1 (b)	1×10^5 (b)
Berkelium(97)				
Bk-247	8×10^0	8×10^0	1×10^0	1×10^4
Bk-249(a)	4×10^1	3×10^1	1×10^3	1×10^6
Bromine(35)				
Br-76	4×10^1	4×10^1	1×10^1	1×10^5
Br-77	3×10^0	3×10^0	1×10^2	1×10^6
Br-82	4×10^1	4×10^1	1×10^1	1×10^6
Carbon(6)				
C-11	1×10^0	6×10^1	1×10^1	1×10^6
C-14	4×10^1	3×10^0	1×10^4	1×10^7
Calcium-20				
Ca-41	Unlimited	Unlimited	1×10^5	1×10^7
Ca-45	4×10^1	1×10^0	1×10^4	1×10^7
Ca-47(a)	3×10^0	3×10^1	1×10^1	1×10^6
Cadmium(48)				
Cd-109	3×10^1	2×10^0	1×10^4	1×10^6
Cd-113	4×10^1	5×10^1	1×10^3	1×10^6
Cd-115(a)	3×10^0	4×10^1	1×10^2	1×10^6
Cd-115m	5×10^1	5×10^1	1×10^3	1×10^6
Cerium(58)				
Ce-139	7×10^0	2×10^0	1×10^2	1×10^6
Ce-141	2×10^1	6×10^1	1×10^2	1×10^7
Ce-143	9×10^1	6×10^1	1×10^2	1×10^6
Ce-144(a)	2×10^1	2×10^1	1×10^2 (b)	1×10^5 (b)
Californium(98)				
Cf-248	4×10^1	6×10^1	1×10^1	1×10^4
Cf-249	3×10^0	8×10^0	1×10^0	1×10^3
Cf-250	2×10^1	2×10^3	1×10^1	1×10^4
Cf-251	7×10^0	7×10^1	1×10^0	1×10^3
Cf-252	5×10^2	3×10^3	1×10^1	1×10^4
Cf-253(a)	4×10^1	4×10^2	1×10^2	1×10^5

<i>Radionuclide (Atomic number)</i>	<i>A (TBq)</i>	<i>A₂ (TBq)</i>	<i>Activity concen- tration for exempt material (Bq/g)</i>	<i>Activity limit for an exempt consignment (Bq)</i>
Cf-254	1×10^{-3}	1×10^{-3}	1×10^0	1×10^3
Chlorine (17)				
Cl-36	1×10^1	6×10^{-1}	1×10^4	1×10^6
Cl-38	2×10^{-1}	2×10^{-1}	1×10^1	1×10^3
Curium (96)				
Cm-240	4×10^1	2×10^{-1}	1×10^2	1×10^5
Cm-241	2×10^0	1×10^0	1×10^2	1×10^6
Cm-242	4×10^1	1×10^{-2}	1×10^2	1×10^5
Cm-243	9×10^0	1×10^{-3}	1×10^0	1×10^4
Cm-244	2×10^1	2×10^{-3}	1×10^1	1×10^4
Cm-245	9×10^0	9×10^{-4}	1×10^0	1×10^3
Cm-246	9×10^0	9×10^{-4}	1×10^0	1×10^3
Cm-247 (a)	3×10^0	1×10^{-3}	1×10^0	1×10^4
Cm-248	2×10^{-3}	3×10^{-4}	1×10^0	1×10^3
Cobalt (27)				
Co-55	5×10^{-1}	5×10^{-1}	1×10^1	1×10^6
Co-56	3×10^{-1}	3×10^{-1}	1×10^1	1×10^5
Co-57	1×10^1	1×10^1	1×10^2	1×10^6
Co-58	1×10^0	1×10^0	1×10^1	1×10^6
Co-58m	4×10^1	4×10^1	1×10^4	1×10^7
Co-60	4×10^{-1}	4×10^{-1}	1×10^1	1×10^5
Chromium (24)				
Cr-51	3×10^1	3×10^1	1×10^3	1×10^7
Caesium (55)				
Cs-129	4×10^0	4×10^0	1×10^2	1×10^5
Cs-131	3×10^1	3×10^1	1×10^3	1×10^6
Cs-132	1×10^0	1×10^0	1×10^1	1×10^5
Cs-134	7×10^{-1}	7×10^{-1}	1×10^1	1×10^4
Cs-134m	4×10^1	6×10^{-1}	1×10^3	1×10^5
Cs-135	4×10^1	1×10^0	1×10^4	1×10^7
Cs-136	5×10^{-1}	5×10^{-1}	1×10^1	1×10^5
Cs-137 (a)	2×10^0	6×10^{-1}	$1 \times 10^1(b)$	$1 \times 10^4(b)$
Copper (29)				
Cu-64	6×10^0	1×10^0	1×10^2	1×10^6
Cu-67	1×10^1	7×10^{-1}	1×10^2	1×10^6
Dysprosium (66)				
Dy-159	2×10^1	2×10^1	1×10^3	1×10^7
Dy-165	9×10^{-1}	6×10^{-1}	1×10^3	1×10^6
Dy-166	9×10^{-1}	3×10^{-1}	1×10^3	1×10^6
Erbium (68)				
Er-169	4×10^1	1×10^0	1×10^4	1×10^7
Er-171	8×10^{-1}	5×10^{-1}	1×10^2	1×10^6

Radionuclide (Atomic number)	A_1 (TBq)	A_2 (TBq)	Activity concen- tration for exempt material (Bq/g)	Activity limit for an exempt consignment (Bq)
Europium (63)				
Eu-147	2×10^0	2×10^0	1×10^1	1×10^2
Eu-148	5×10^{-1}	5×10^{-1}	1×10^1	1×10^0
Eu-149	2×10^1	2×10^1	1×10^2	1×10^2
Eu-150 (short-lived)	2×10^0	7×10^{-1}	1×10^1	1×10^0
Eu-150 (long-lived)	7×10^{-1}	7×10^{-1}	1×10^1	1×10^0
Eu-152	1×10^0	1×10^0	1×10^1	1×10^0
Eu-152m	8×10^{-1}	8×10^{-1}	1×10^2	1×10^0
Eu-154	9×10^{-1}	6×10^{-1}	1×10^1	1×10^0
Eu-155	2×10^1	3×10^0	1×10^2	1×10^2
Eu-156	7×10^{-1}	7×10^{-1}	1×10^1	1×10^0
Fluorine (9)				
F-18	1×10^0	6×10^{-1}	1×10^1	1×10^0
Iron (26)				
Fe-52	3×10^{-1}	3×10^{-1}	1×10^1	1×10^0
Fe-55	4×10^1	4×10^1	1×10^4	1×10^0
Fe-59	9×10^{-1}	9×10^{-1}	1×10^1	1×10^0
Fe-60 (a)	4×10^1	2×10^{-1}	1×10^2	1×10^2
Gallium (31)				
Ga-67	7×10^0	3×10^0	1×10^2	1×10^0
Ga-68	5×10^{-1}	5×10^{-1}	1×10^1	1×10^2
Ga-72	4×10^{-1}	4×10^{-1}	1×10^1	1×10^2
Gadolinium (64)				
Gd-146 (a)	5×10^{-1}	5×10^{-1}	1×10^1	1×10^0
Gd-148	2×10^1	2×10^{-3}	1×10^1	1×10^0
Gd-153	1×10^1	9×10^0	1×10^2	1×10^2
Gd-159	2×10^0	6×10^{-1}	1×10^2	1×10^0
Germanium (32)				
Ge-68 (a)	5×10^{-1}	$5 \times 10^{-1}^*$	1×10^1	1×10^2
Ge-71	4×10^1	4×10^1	1×10^0	1×10^0
Ge-77	3×10^{-1}	3×10^{-1}	1×10^1	1×10^2
Hafnium (72)				
Hf-172 (a)	6×10^{-1}	6×10^{-1}	1×10^1	1×10^0
Hf-175	3×10^0	3×10^0	1×10^2	1×10^0
Hf-181	2×10^0	5×10^{-1}	1×10^1	1×10^0
Hf-182	Unlimited	Unlimited	1×10^2	1×10^0
Mercury (80)				
Hg-194 (a)	1×10^0	1×10^0	1×10^1	1×10^0
Hg-195m (a)	3×10^0	7×10^{-1}	1×10^2	1×10^0
Hg-197	2×10^1	1×10^1	1×10^2	1×10^2
Hg-197m	1×10^1	4×10^{-1}	1×10^2	1×10^0
Hg-203	5×10^0	1×10^0	1×10^2	1×10^2

Radionuclide (Atomic number)	A_1 (TBq)	A_2 (TBq)	Activity concentration for exempt material (Bq/g)	Activity limit for an exempt consignment (Bq)
Holmium (67)				
Ho-166	4×10^{-1}	4×10^{-1}	1×10^3	1×10^5
Ho-166m	6×10^{-1}	5×10^{-1}	1×10^4	1×10^6
Iodine (53)				
I-123	6×10^0	3×10^0	1×10^2	1×10^7
I-124	1×10^0	1×10^0	1×10^1	1×10^6
I-125	2×10^1	3×10^0	1×10^3	1×10^6
I-126	2×10^0	1×10^0	1×10^2	1×10^6
I-129	Unlimited	Unlimited	1×10^2	1×10^5
I-131	3×10^0	7×10^{-1}	1×10^2	1×10^6
I-132	4×10^{-1}	4×10^{-1}	1×10^1	1×10^5
I-133	7×10^{-1}	6×10^{-1}	1×10^1	1×10^6
I-134	3×10^{-1}	3×10^{-1}	1×10^1	1×10^5
I-135 (a)	6×10^{-1}	6×10^{-1}	1×10^1	1×10^6
Indium (49)				
In-111	3×10^0	3×10^0	1×10^2	1×10^6
In-113m	4×10^0	2×10^0	1×10^2	1×10^6
In-114m (a)	1×10^1	5×10^{-1}	1×10^2	1×10^6
In-115m	7×10^0	1×10^0	1×10^2	1×10^6
Iridium (77)				
Ir-189 (a)	1×10^1	1×10^1	1×10^2	1×10^7
Ir-190	7×10^{-1}	7×10^{-1}	1×10^1	1×10^6
Ir-192	1×10^0 (c)	6×10^{-1}	1×10^1	1×10^4
Ir-194	3×10^{-1}	3×10^{-1}	1×10^2	1×10^5
Potassium (19)				
K-40	9×10^{-1}	9×10^{-1}	1×10^2	1×10^6
K-42	2×10^{-1}	2×10^{-1}	1×10^2	1×10^6
K-43	7×10^{-1}	6×10^{-1}	1×10^1	1×10^6
Krypton (36)				
Kr-81	4×10^1	4×10^1	1×10^4	1×10^7
Kr-85	1×10^1	1×10^1	1×10^5	1×10^6
Kr-85m	8×10^0	3×10^0	1×10^3	1×10^{10}
Kr-87	2×10^{-1}	2×10^{-1}	1×10^2	1×10^6
Lanthanum (57)				
La-137	3×10^1	6×10^0	1×10^3	1×10^7
La-140	4×10^{-1}	4×10^{-1}	1×10^1	1×10^5
Lutetium (71)				
Lu-172	6×10^{-1}	6×10^{-1}	1×10^1	1×10^6
Lu-173	8×10^0	8×10^0	1×10^2	1×10^7
Lu-174	9×10^0	9×10^0	1×10^2	1×10^7
Lu-174m	2×10^1	1×10^1	1×10^2	1×10^7
Lu-177	3×10^1	7×10^{-1}	1×10^3	1×10^7

<i>Radionuclide (Atomic number)</i>	<i>A₁ (TBq)</i>	<i>A₂ (TBq)</i>	<i>Activity concen- tration for exempt material (Bq/g)</i>	<i>Activity limit for an exempt consignment (Bq)</i>
Magnesium (12)				
Mg-28 (a)	3×10^{-1}	3×10^{-1}	1×10^4	1×10^5
Manganese (25)				
Mn-52	3×10^{-1}	3×10^{-1}	1×10^1	1×10^5
Mn-53	Unlimited	Unlimited	1×10^4	1×10^9
Mn-54	1×10^0	3×10^0	1×10^1	1×10^6
Mn-56	3×10^{-1}	3×10^{-1}	1×10^1	1×10^5
Molybdenum (42)				
Mo-93	2×10^{-1}	4×10^{-1}	1×10^1	1×10^6
Mo-99 (a)	6×10^{-1}	1×10^0	1×10^2	1×10^6
Nitrogen (7)				
N-13	6×10^{-1}	9×10^{-1}	1×10^2	1×10^9
Sodium (11)				
Na-22	5×10^{-1}	5×10^{-1}	1×10^1	1×10^6
Na-24	2×10^{-1}	2×10^{-1}	1×10^1	1×10^5
Niobium (41)				
Nb-93m	3×10^{-1}	4×10^{-1}	1×10^4	1×10^7
Nb-94	7×10^{-1}	7×10^{-1}	1×10^1	1×10^6
Nb-95	1×10^0	1×10^0	1×10^1	1×10^6
Nb-97	6×10^{-1}	9×10^{-1}	1×10^1	1×10^6
Neodymium (60)				
Nd-147	6×10^{-1}	6×10^0	1×10^2	1×10^6
Nd-149	5×10^{-1}	6×10^{-1}	1×10^2	1×10^6
Nickel (28)				
Ni-59	Unlimited	Unlimited	1×10^4	1×10^8
Ni-63	3×10^{-1}	4×10^{-1}	1×10^5	1×10^8
Ni-65	4×10^{-1}	4×10^{-1}	1×10^1	1×10^6
Neptunium (93)				
Np-235	4×10^{-1}	4×10^{-1}	1×10^3	1×10^7
Np-236 (short-lived)	2×10^{-1}	2×10^{-1}	1×10^5	1×10^7
Np-236 (long-lived)	2×10^{-2}	9×10^0	1×10^2	1×10^5
Np-237	2×10^{-3}	2×10^{-1}	1×10^0 (b)	1×10^2 (b)
Np-239	4×10^{-1}	7×10^0	1×10^2	1×10^7
Osmium (76)				
Os-185	1×10^0	1×10^0	1×10^1	1×10^6
Os-191	2×10^0	1×10^1	1×10^2	1×10^7
Os-191m	3×10^1	4×10^1	1×10^3	1×10^7
Os-193	6×10^{-1}	2×10^0	1×10^2	1×10^6
Os-194 (a)	3×10^{-1}	3×10^{-1}	1×10^2	1×10^5
Phosphorus (15)				
P-32	5×10^{-1}	5×10^{-1}	1×10^3	1×10^5
P-33	1×10^0	4×10^1	1×10^5	1×10^8
Protactinium (91)				

<i>Radionuclide (Atomic number)</i>	<i>A₁ (TBq)</i>	<i>A₂ (TBq)</i>	<i>Activity concen- tration for exempt material (Bq/g)</i>	<i>Activity limit for an exempt consignment (Bq)</i>
Pa-230 (a)	2×10^0	7×10^{-2}	1×10^1	1×10^6
Pa-231	4×10^0	4×10^{-4}	1×10^0	1×10^3
Pa-233	5×10^0	7×10^{-1}	1×10^2	1×10^7
Lead (82)				
Pb-201	1×10^0	1×10^0	1×10^1	1×10^6
Pb-202	4×10^1	2×10^1	1×10^3	1×10^6
Pb-203	4×10^0	3×10^0	1×10^2	1×10^6
Pb-205	Unlimited	Unlimited	1×10^4	1×10^7
Pb-210 (a)	1×10^0	5×10^{-2}	1×10^1 (b)	1×10^4 (b)
Pb-212 (a)	7×10^{-1}	2×10^{-1}	1×10^1 (b)	1×10^5 (b)
Palladium (46)				
Pd-103 (a)	4×10^1	4×10^1	1×10^3	1×10^6
Pd-107	Unlimited	Unlimited	1×10^5	1×10^8
Pd-109	2×10^0	5×10^{-1}	1×10^3	1×10^6
Promethium (61)				
Pm-143	3×10^0	3×10^0	1×10^2	1×10^6
Pm-144	7×10^{-1}	7×10^{-1}	1×10^1	1×10^6
Pm-145	3×10^1	1×10^1	1×10^3	1×10^7
Pm-147	4×10^1	2×10^0	1×10^4	1×10^7
Pm-148m (a)	8×10^{-1}	7×10^{-1}	1×10^1	1×10^6
Pm-149	2×10^0	6×10^{-1}	1×10^3	1×10^6
Pm-151	2×10^0	6×10^{-1}	1×10^2	1×10^6
Polonium (84)				
Po-210	4×10^1	2×10^{-2}	1×10^1	1×10^4
Praseodymium (59)				
Pr-142	4×10^{-1}	4×10^{-1}	1×10^2	1×10^5
Pr-143	3×10^0	6×10^{-1}	1×10^4	1×10^6
Platinum (78)				
Pt-188 (a)	1×10^0	8×10^1	1×10^1	1×10^6
Pt-191	4×10^0	3×10^0	1×10^2	1×10^6
Pt-193	4×10^1	4×10^{-1}	1×10^4	1×10^7
Pt-193m	4×10^1	5×10^{-1}	1×10^3	1×10^7
Pt-195m	1×10^1	5×10^1	1×10^2	1×10^6
Pt-197	2×10^1	6×10^{-1}	1×10^3	1×10^6
Pt-197m	1×10^1	6×10^{-1}	1×10^2	1×10^6
Plutonium (94)				
Pu-236	3×10^1	3×10^{-3}	1×10^1	1×10^4
Pu-237	2×10^1	2×10^1	1×10^3	1×10^7
Pu-238	1×10^1	1×10^{-3}	1×10^0	1×10^4
Pu-239	1×10^1	1×10^{-3}	1×10^0	1×10^4
Pu-240	1×10^1	1×10^{-3}	1×10^0	1×10^3
Pu-241 (a)	4×10^1	6×10^{-2}	1×10^2	1×10^5

<i>Radionuclide (Atomic number)</i>	<i>A₁ (TBq)</i>	<i>A₂ (TBq)</i>	<i>Activity concen- tration for exempt material (Bq/g)</i>	<i>Activity limit for an exempt consignment (Bq)</i>
Pu-242	1×10^1	1×10^3	1×10^0	1×10^4
Pu-244 (a)	4×10^1	1×10^3	1×10^0	1×10^4
Radium (88)				
Ra-223 (a)	4×10^1	7×10^3	1×10^2 (b)	1×10^5 (b)
Ra-224 (a)	4×10^1	2×10^2	1×10^1 (b)	1×10^5 (b)
Ra-225 (a)	2×10^1	4×10^3	1×10^2	1×10^5
Ra-226 (a)	2×10^1	3×10^3	1×10^1 (b)	1×10^4 (b)
Ra-223 (a)	6×10^1	2×10^2	1×10^1 (b)	1×10^5 (b)
Rubidium (37)				
Rb-81	2×10^0	8×10^1	1×10^1	1×10^6
Rb-83 (a)	2×10^0	2×10^0	1×10^2	1×10^6
Rb-84	1×10^0	1×10^0	1×10^1	1×10^6
Rb-86	5×10^1	5×10^1	1×10^2	1×10^5
Rb-87	Unlimited	Unlimited	1×10^4	1×10^7
Rb(nat)	Unlimited	Unlimited	1×10^4	1×10^7
Rhenium (75)				
Re-184	1×10^0	1×10^0	1×10^1	1×10^6
Re-184m	3×10^0	1×10^0	1×10^2	1×10^6
Re-186	2×10^0	6×10^1	1×10^3	1×10^6
Re-187	Unlimited	Unlimited	1×10^6	1×10^9
Re-188	4×10^1	4×10^1	1×10^2	1×10^5
Re-189 (a)	3×10^0	6×10^1	1×10^2	1×10^6
Re(nat)	Unlimited	Unlimited	1×10^6	1×10^9
Rhodium (45)				
Rh-99	2×10^0	2×10^0	1×10^1	1×10^6
Rh-101	4×10^0	3×10^0	1×10^2	1×10^7
Rh-102	5×10^1	5×10^1	1×10^1	1×10^6
Rh-102m	2×10^0	2×10^0	1×10^2	1×10^6
Rh-103m	4×10^1	4×10^1	1×10^4	1×10^8
Rh-105	1×10^1	8×10^1	1×10^2	1×10^7
Radon (86)				
Rn-222 (a)	3×10^3	4×10^3	1×10^1 (b)	1×10^8 (b)
Ruthenium (44)				
Ru-97	5×10^0	5×10^0	1×10^2	1×10^7
Ru-103 (a)	2×10^0	2×10^0	1×10^2	1×10^6
Ru-105	1×10^0	6×10^1	1×10^1	1×10^6
Ru-106 (a)	2×10^1	2×10^1	1×10^2 (b)	1×10^5 (b)
Sulphur (16)				
S-35	4×10^1	3×10^0	1×10^5	1×10^8
Antimony (51)				
Sb-122	4×10^1	4×10^1	1×10^2	1×10^4

Radionuclide (Atomic number)	A_1 (TBq)	A_2 (TBq)	Activity concen- tration for exempt material (Bq/g)	Activity limit for an exempt consignment (Bq)
Sb-124	6×10^{-1}	6×10^{-1}	1×10^1	1×10^6
Sb-125	2×10^0	1×10^0	1×10^2	1×10^6
Sb-126	4×10^{-1}	4×10^{-1}	1×10^0	1×10^5
Scandium (21)				
Sc-44	5×10^{-1}	5×10^{-1}	1×10^1	1×10^5
Sc-46	5×10^{-1}	5×10^{-1}	1×10^1	1×10^6
Sc-47	1×10^1	7×10^{-1}	1×10^2	1×10^6
Sc-48	3×10^{-1}	3×10^{-1}	1×10^1	1×10^5
Selenium (34)				
Se-75	3×10^0	3×10^0	1×10^2	1×10^6
Se-79	4×10^1	2×10^0	1×10^6	1×10^7
Silicon (14)				
Si-31	6×10^{-1}	6×10^{-1}	1×10^3	1×10^6
Si-32	4×10^1	5×10^{-1}	1×10^3	1×10^6
Samarium (62)				
Sm-145	1×10^1	1×10^1	1×10^2	1×10^7
Sm-147	Unlimited	Unlimited	1×10^1	1×10^4
Sm-151	4×10^1	1×10^1	1×10^6	1×10^6
Sm-153	9×10^0	6×10^{-1}	1×10^2	1×10^6
Tin (50)				
Sn-113 (a)	4×10^0	2×10^0	1×10^1	1×10^7
Sn-117m	7×10^0	4×10^{-1}	1×10^2	1×10^6
Sn-119m	4×10^1	3×10^1	1×10^3	1×10^7
Sn-121m (a)	4×10^1	9×10^{-1}	1×10^3	1×10^7
Sn-123	8×10^{-1}	6×10^{-1}	1×10^3	1×10^6
Sn-125	4×10^{-1}	4×10^{-1}	1×10^2	1×10^5
Sn-126 (a)	6×10^{-1}	4×10^{-1}	1×10^1	1×10^5
Strontium (38)				
Sr-82 (a)	2×10^{-1}	2×10^{-1}	1×10^1	1×10^5
Sr-85	2×10^0	2×10^0	1×10^2	1×10^6
Sr-85m	5×10^0	5×10^0	1×10^2	1×10^7
Sr-87m	3×10^0	3×10^0	1×10^2	1×10^6
Sr-89	6×10^{-1}	6×10^{-1}	1×10^3	1×10^6
Sr-90 (a)	3×10^{-1}	3×10^{-1}	1×10^2 (b)	1×10^4 (b)
Sr-91 (a)	3×10^{-1}	3×10^{-1}	1×10^1	1×10^5
Sr-92 (a)	1×10^0	3×10^{-1}	1×10^1	1×10^6
Tritium (1)				
T (H-3)	4×10^1	4×10^1	1×10^6	1×10^9
Tantalum (73)				
Ta-178 (long-lived)	1×10^0	8×10^{-1}	1×10^1	1×10^6
Ta-179	3×10^1	3×10^1	1×10^3	1×10^7
Ta-182	9×10^{-1}	5×10^{-1}	1×10^1	1×10^6

<i>Radionuclide (Atomic number)</i>	<i>A₁ (TBq)</i>	<i>A₂ (TBq)</i>	<i>Activity concentration for exempt material (Bq/g)</i>	<i>Activity limit for an exempt consignment (Bq)</i>
Terbium (65)				
Tb-157	4×10^1	4×10^1	1×10^4	1×10^7
Tb-158	1×10^0	1×10^0	1×10^1	1×10^6
Tb-160	1×10^0	6×10^{-1}	1×10^1	1×10^6
Technetium (43)				
Tc-95m(a)	2×10^0	2×10^0	1×10^1	1×10^6
Tc-96	4×10^{-1}	4×10^{-1}	1×10^1	1×10^6
Tc-96m(a)	4×10^{-1}	4×10^{-1}	1×10^3	1×10^7
Tc-97	Unlimited	Unlimited	1×10^3	1×10^6
Tc-97m	4×10^1	1×10^0	1×10^3	1×10^7
Tc-98	8×10^{-1}	7×10^{-1}	1×10^1	1×10^6
Tc-99	4×10^1	9×10^{-1}	1×10^4	1×10^7
Tc-99m	1×10^1	4×10^0	1×10^2	1×10^7
Tellurium (52)				
Te-121	2×10^0	2×10^0	1×10^1	1×10^6
Te-121m	5×10^0	3×10^0	1×10^2	1×10^5
Te-123m	8×10^0	1×10^0	1×10^2	1×10^7
Te-125m	2×10^1	9×10^{-1}	1×10^3	1×10^7
Te-127	2×10^1	7×10^{-1}	1×10^3	1×10^6
Te-127m(a)	2×10^1	5×10^{-1}	1×10^3	1×10^7
Te-129	7×10^{-1}	6×10^{-1}	1×10^2	1×10^6
Te-129m(a)	8×10^{-1}	4×10^{-1}	1×10^3	1×10^6
Te-131m(a)	7×10^{-1}	5×10^{-1}	1×10^1	1×10^6
Te-132(a)	5×10^{-1}	4×10^{-1}	1×10^2	1×10^7
Thorium (90)				
Th-227	1×10^1	5×10^{-3}	1×10^1	1×10^4
Th-228(a)	5×10^{-1}	1×10^{-3}	$1 \times 10^2(b)$	$1 \times 10^4(b)$
Th-229	5×10^0	5×10^{-4}	$1 \times 10^2(b)$	$1 \times 10^4(b)$
Th-230	1×10^1	1×10^{-3}	1×10^0	1×10^4
Th-231	4×10^1	2×10^{-2}	1×10^3	1×10^7
Th-232	Unlimited	Unlimited	1×10^1	1×10^6
Th-234(a)	3×10^{-1}	3×10^{-1}	$1 \times 10^2(b)$	$1 \times 10^4(b)$
Th(nat)	Unlimited	Unlimited	$1 \times 10^2(b)$	$1 \times 10^4(b)$
Titanium (22)				
Ti-44(a)	5×10^{-1}	4×10^{-1}	1×10^1	1×10^5
Thallium (81)				
Tl-200	9×10^{-1}	9×10^{-1}	1×10^1	1×10^6
Tl-201	1×10^1	4×10^0	1×10^2	1×10^6
Tl-202	2×10^0	2×10^0	1×10^2	1×10^6
Tl-204	1×10^1	7×10^{-1}	1×10^4	1×10^6
Thulium (69)				
Tm-167	7×10^0	8×10^{-1}	1×10^2	1×10^6

Radionuclide (Atomic number)	A_1 (TBq)	A_2 (TBq)	Activity concentration for exempt consignment material (Bq/g)	Activity limit *for an exempt (Bq)
Tm-170	3×10^0	6×10^{-1}	1×10^3	1×10^6
Tm-171	4×10^1	4×10^1	1×10^4	1×10^6
Uranium(92)				
U-230 (fast lung absorption)(a)(d)	4×10^1	1×10^{-1}	1×10^1 (b)	1×10^5 (b)
U-230 (medium lung absorption) (a)(e)	4×10^1	4×10^{-3}	1×10^1	1×10^6
U-230 (slow lung absorption)(a)(f)	3×10^1	3×10^{-3}	1×10^1	1×10^6
U-232 (fast lung absorption)(d)	4×10^1	1×10^{-2}	1×10^0 (b)	1×10^5 (b)
U-232 (medium lung absorption)(e)	4×10^1	7×10^{-3}	1×10^1	1×10^6
U-232 (slow lung absorption)(f)	1×10^1	1×10^{-3}	1×10^1	1×10^6
U-233 (fast lung absorption)(d)	4×10^1	9×10^{-2}	1×10^1	1×10^6
U-233 (medium lung absorption)(e)	4×10^1	2×10^{-2}	1×10^2	1×10^5
U-233 (slow lung absorption)(f)	4×10^1	6×10^{-3}	1×10^1	1×10^6
U-234 (fast lung absorption)(d)	4×10^1	9×10^{-2}	1×10^1	1×10^6
U-234 (medium lung absorption)(e)	4×10^1	2×10^{-2}	1×10^2	1×10^5
U-234 (slow lung absorption)(f)	4×10^1	6×10^{-3}	1×10^1	1×10^6
U-235 (all lung absorption types) (a),(d),(e),(f)	Unlimited	Unlimited	1×10^1 (b)	1×10^4 (b)
U-236 (fast lung absorption)(d)	Unlimited	Unlimited	1×10^1	1×10^6
U-236 (medium lung absorption)(e)	4×10^1	2×10^{-2}	1×10^2	1×10^5
U-236 (slow lung absorption)(f)	4×10^1	6×10^{-3}	1×10^1	1×10^6
U-238 (all lung absorption types) (d),(e),(f)	Unlimited	Unlimited	1×10^1 (b)	1×10^4 (b)
U (nat)	Unlimited	Unlimited	1×10^0 (b)	1×10^5 (b)

<i>Radionuclide (Atomic number)</i>	<i>A₁ (TBq)</i>	<i>A₂ (TBq)</i>	<i>Activity concen- tration for exempt material (Bq/g)</i>	<i>Activity limit for an exempt consignment (Bq)</i>
U (enriched to 20% or less)(g)	Unlimited	Unlimited	1×10^0	1×10^3
U (dep)	Unlimited	Unlimited	1×10^0	1×10^3
Vanadium(23)				
V-48	4×10^{-1}	4×10^{-1}	1×10^1	1×10^5
V-49	4×10^1	4×10^1	1×10^4	1×10^7
Tungsten (74)				
W-178 (a)	9×10^0	5×10^0	1×10^1	1×10^6
W-181	3×10^1	3×10^1	1×10^3	1×10^7
W-185	4×10^1	8×10^{-1}	1×10^4	1×10^7
W-187	2×10^0	6×10^{-1}	1×10^2	1×10^6
W-188 (a)	4×10^{-1}	3×10^{-1}	1×10^2	1×10^5
Pm-149	2×10^0	6×10^{-1}	1×10^3	1×10^6
Pm-151	2×10^0	6×10^{-1}	1×10^2	1×10^6
Polonium(84)				
Po-210	4×10^1	2×10^{-2}	1×10^1	1×10^4
Praseodymium(59)				
Pr-142	4×10^{-1}	4×10^{-1}	1×10^2	1×10^5
Pr-143	3×10^0	6×10^{-1}	1×10^4	1×10^6
Platinum(78)				
Pt-188 (a)	1×10^0	8×10^1	1×10^1	1×10^6
Pt-191	4×10^0	3×10^0	1×10^2	1×10^6
Pt-193	4×10^1	4×10^{-1}	1×10^4	1×10^7
Pt-193m	4×10^1	5×10^{-1}	1×10^3	1×10^7
Pt-195m	1×10^1	5×10^1	1×10^2	1×10^6
Pt-197	2×10^1	6×10^{-1}	1×10^3	1×10^6
Pt-197m	1×10^1	6×10^{-1}	1×10^2	1×10^6
Plutonium(94)				
Pu-236	3×10^1	3×10^{-3}	1×10^1	1×10^4
Pu-237	2×10^1	2×10^1	1×10^3	1×10^7
Pu-238	1×10^1	1×10^{-3}	1×10^0	1×10^4
Pu-239	1×10^1	1×10^{-3}	1×10^0	1×10^4
Pu-240	1×10^1	1×10^{-3}	1×10^0	1×10^3
Pu-241 (a)	4×10^1	6×10^{-2}	1×10^2	1×10^5
Pu-242	1×10^1	1×10^{-3}	1×10^0	1×10^4
Pu-244 (a)	4×10^1	1×10^{-3}	1×10^0	1×10^4
Radium(88)				
Ra-223 (a)	4×10^{-1}	7×10^{-3}	$1 \times 10^2(b)$	$1 \times 10^5(b)$
Ra-224(a)	4×10^{-1}	2×10^{-2}	$1 \times 10^1(b)$	$1 \times 10^5(b)$
Ra-225 (a)	2×10^{-1}	4×10^{-3}	1×10^2	1×10^5
Ra-226 (a)	2×10^{-1}	3×10^{-3}	$1 \times 10^1(b)$	$1 \times 10^5(b)$
Ra-228 (a)	6×10^{-1}	2×10^{-2}	$1 \times 10^1(b)$	$1 \times 10^5(b)$

<i>Radionuclide (Atomic number)</i>	<i>A₁ (TBq)</i>	<i>A₂ (TBq)</i>	<i>Activity concen- tration for exempt material (Bq/g)</i>	<i>Activity limit for an exempt consignment (Bq)</i>
Rubidium (37)				
Rb-81	2×10^0	8×10^{-1}	1×10^1	1×10^6
Rb-83 (a)	2×10^0	2×10^0	1×10^2	1×10^6
Rb-84	1×10^0	1×10^0	1×10^1	1×10^6
Rb-86	5×10^{-1}	5×10^{-1}	1×10^2	1×10^5
Rb-87	Unlimited	Unlimited	1×10^4	1×10^7
Rb(nat)	Unlimited	Unlimited	1×10^4	1×10^7
Rhenium (75)				
Re-184	1×10^0	1×10^0	1×10^1	1×10^6
Re-184m	3×10^0	1×10^0	1×10^2	1×10^6
Re-186	2×10^0	6×10^{-1}	1×10^3	1×10^6
Re-187	Unlimited	Unlimited	1×10^6	1×10^9
Re-188	4×10^{-1}	4×10^{-1}	1×10^2	1×10^5
Re-189 (a)	3×10^0	6×10^{-1}	1×10^2	1×10^6
Re(nat)	Unlimited	Unlimited	1×10^6	1×10^9
Rhodium (45)				
Rh-99	2×10^0	2×10^0	1×10^1	1×10^6
Rh-101	4×10^0	3×10^0	1×10^2	1×10^7
Rh-102	5×10^{-1}	5×10^{-1}	1×10^1	1×10^6
Rh-102m	2×10^0	2×10^0	1×10^2	1×10^6
Rh-103m	4×10^1	4×10^1	1×10^4	1×10^8
Rh-105	1×10^1	8×10^{-1}	1×10^2	1×10^7
Radon (86)				
Rn-222 (a)	3×10^{-1}	4×10^{-3}	1×10^1 (b)	1×10^4 (b)
Ruthenium (44)				
Ru-97	5×10^0	5×10^0	1×10^2	1×10^7
Ru-103 (a)	2×10^0	2×10^0	1×10^2	1×10^6
Ru-105	1×10^0	6×10^{-1}	1×10^1	1×10^6
Ru-106 (a)	2×10^{-1}	2×10^{-1}	1×10^2 (b)	1×10^5 (b)
Sulphur (16)				
S-35	4×10^1	3×10^0	1×10^5	1×10^8
Antimony (51)				
Sb-122	4×10^{-1}	4×10^{-1}	1×10^2	1×10^4
Sb-124	6×10^{-1}	6×10^{-1}	1×10^1	1×10^6
Sb-125	2×10^0	1×10^0	1×10^2	1×10^6
Sb-126	4×10^{-1}	4×10^{-1}	1×10^4	1×10^5
Scandium (21)				
Sc-44	5×10^{-1}	5×10^{-1}	1×10^1	1×10^5
Sc-46	5×10^{-1}	5×10^{-1}	1×10^1	1×10^6
Sc-47	1×10^1	7×10^{-1}	1×10^2	1×10^6
Sc-48	3×10^{-1}	3×10^{-1}	1×10^1	1×10^5

Radionuclide (Atomic number)	A_1 (TBq)	A_2 (TBq)	Activity concen- tration for exempt material (Bq/g)	Activity limit for an exempt consignment (Bq)
Selenium (34)				
Se-75	3×10^0	3×10^0	1×10^2	1×10^6
Se-79	4×10^1	2×10^0	1×10^4	1×10^7
Silicon (14)				
Si-31	6×10^{-1}	6×10^{-1}	1×10^3	1×10^6
Si-32	4×10^1	5×10^{-1}	1×10^3	1×10^6
Samarium (62)				
Sm-145	1×10^1	1×10^1	1×10^2	1×10^7
Sm-147	Unlimited	Unlimited	1×10^1	1×10^6
Sm-151	4×10^1	1×10^1	1×10^4	1×10^6
Sm-153	9×10^0	6×10^{-1}	1×10^2	1×10^6
Tin (50)				
Sn-113 (a)	4×10^0	2×10^0	1×10^3	1×10^7
Sn-117m	7×10^0	4×10^{-1}	1×10^2	1×10^6
Sn-119m	4×10^1	3×10^1	1×10^3	1×10^7
Sn-121m (a)	4×10^1	9×10^{-1}	1×10^2	1×10^7
Sn-123	8×10^{-1}	6×10^{-1}	1×10^3	1×10^6
Sn-125	4×10^{-1}	4×10^{-1}	1×10^2	1×10^5
Sn-126 (a)	6×10^{-1}	4×10^{-1}	1×10^1	1×10^5
Xenon (54)				
Xe-122 (a)	4×10^{-1}	4×10^{-1}	1×10^2	1×10^6
Xe-123	2×10^0	7×10^{-1}	1×10^2	1×10^6
Xe-127	4×10^0	2×10^0	1×10^3	1×10^5
Xe-131m	4×10^1	4×10^1	1×10^4	1×10^6
Xe-133	2×10^1	1×10^1	1×10^3	1×10^6
Xe-135	3×10^0	2×10^0	1×10^3	1×10^{10}
Yttrium (39)				
Y-87 (a)	1×10^0	1×10^0	1×10^1	1×10^6
Y-88	4×10^{-1}	4×10^{-1}	1×10^1	1×10^6
Y-90	3×10^{-1}	3×10^{-1}	1×10^3	1×10^5
Y-91	6×10^{-1}	6×10^{-1}	1×10^3	1×10^6
Y-91m	2×10^0	2×10^0	1×10^2	1×10^6
Y-92	2×10^{-1}	2×10^{-1}	1×10^2	1×10^5
Y-93	3×10^{-1}	3×10^{-1}	1×10^3	1×10^5
Ytterbium (79)				
Yb-169	4×10^0	1×10^0	1×10^2	1×10^7
Yb-175	3×10^1	9×10^{-1}	1×10^3	1×10^7
Zinc (30)				
Zn-65	2×10^0	2×10^0	1×10^1	1×10^6
Zn-69	3×10^0	6×10^{-1}	1×10^4	1×10^6
Zn-69m (a)	3×10^0	6×10^{-1}	1×10^2	1×10^6

Radionuclide (Atomic number)	A_1 (TBq)	A_2 (TBq)	Activity concentration for exempt material (Bq/g)	Activity limit for an exempt consignment (Bq)
Zirconium(40)				
Zr-88	3×10^0	3×10^0	1×10^2	1×10^6
Zr-93	Unlimited	Unlimited	1×10^1 (b)	1×10^7 (b)
Zr-95 (a)	2×10^0	8×10^1	1×10^1	1×10^6
Zr-97 (a)	4×10^1	4×10^1	1×10^1 (b)	1×10^5 (b)

(a) A_1 and/or A_2 values include contributions from daughter nuclides with half-lives less than 10 days.

(b) Parent nuclides and their progeny included in secular equilibrium are listed in the following :

Sr-90	Y-90
Zr-93	Nb-93m
Zr-97	Nb-97
Ru-106	Rh-106
Cs-137	Ba-137m
Ce-134	La-134
Ce-144	Pr-144
Ba-140	La-140
Bi-212	Tl-208 (0.36), Po-212 (0.64)
Pb-210	Bi-210, Po-210
Pb-212	Bi-212, Tl-208 (0.36), Po-212 (0.64)
Rn-220	Po-216
Rn-222	Po-218, Pb-214, Bi-214, Po-214
Ra-223	Rn-219, Po-215, Pb-211, Bi-211, Tl-207
Ra-224	Rn-220, Po-216, Pb-212, Bi-212, Tl-208, (0.36), Po-212 (0.64)
Ra-226	Rn-222, Po-218, Pb-214, Bi-214, Po-214, Pb-210, Bi-210, Po-210
Ra-228	Ac-228
Th-226	Ra-222, Rn-218, Po-214
Th-228	Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0.36), Po-212 (0.64)
Th-229	Ra-225, Ac-225, Fr-221, At-217, Bi-213, Po-213, Pb-209
Th-nat	Ra-228, Ac-228, Th-228, Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0.36), Po-212 (0.64)
Th-234	Pa-234m
U-230	Th-226, Ra-222, Rn-218, Po-214
U-232	Th-228, Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0.36), Po-212 (0.64)
U-235	Th-231
U-238	Th-234, Pa-234m

U-nat Th-234, Pa-234m, U-234, Th-230, Ra-226, Rn-222, Po-218, Pb-214, Bi-214,
 Po-214 Pb-210, Bi-210, Po-210
 U-240 Np-240m
 Np-237 Pa-233
 Am-242m Am-242
 Am-243 Np-239

(c) the quantity may be determined from a measurement of the rate of decay or a measurement of the radiation level at a prescribed distance from the source :

(d) these values apply only to compounds of uranium that take the chemical form of UF_6 , UO_2F_2 and $UO_2(NO_3)_2$ in both normal and accident conditions of transport :

(e) these values apply only to compounds of uranium that take the chemical form of UO_3 , UF_6 , UCl_4 and hexavalent compounds in both normal and accident conditions of transport :

(f) these values apply to all compounds of uranium other than those specified in (d) and (e) above :

(g) these values apply to unirradiated uranium only.

TABLE II : BASIC RADIONUCLIDE VALUES FOR UNKNOWN
 RADIONUCLIDES OR MIXTURES

Radioactive contents	A_1	A_2	Activity concentration for exempt material	Activity limit for an exempt consignment
	TBq	TBq	Bq/g	Bq
Only beta or gamma emitting nuclides are known to be present	0.1	0.02	1×10^1	1×10^4
Only alpha emitting nuclides are known to be present	0.2	9×10^{-5}	1×10^{-1}	1×10^4
No relevant data are available	0.001	9×10^{-5}	1×10^{-1}	1×10^3

TABLE III : ACTIVITY LIMITS FOR EXCEPTED PACKAGES

Physical state of contents	Instrument of article		Materials
	Item limits	Package limits	Package limits
Solids :			
Special form			
Other forms	$10^{-2}A_1, 10^{-2}A_2$	A_1, A_2	$10^3A_1, 10^3A_2$
Liquids	$10^{-3}A_2$	$10^{-1}A_2$	$10^{-4}A_2$
Gases :			
Tritium	$2 \times 10^{-2}A_2$	$2 \times 10^{-1}A_2$	$2 \times 10^{-2}A_2$
Special form	$10^{-3}A_1$	$10^{-2}A_1$	$10^{-3}A_1$
Other forms	$10^{-3}A_2$	$10^{-2}A_2$	$10^{-3}A_2$

TABLE IV : INDUSTRIAL PACKAGE REQUIREMENTS
FOR LSA MATERIAL AND SCO

Radioactive Contents	Industrial Package type	
	Exclusive use	Not under exclusive use
LSA-I		
Solid*	Type IP-1	Type IP-1
Liquid	Type IP-1	Type IP-2
LSA-II		
Solid	Type IP-2	Type IP-2
Liquid and gas	Type IP-2	Type IP-3
LSA-III	Type IP-2	Type IP-3
SCO-I*	Type IP-1	Type IP-1
SCO-II	Type IP-2	Type IP-2

* LSA-I material and SCO-I may be transported unpackaged.

TABLE V : CONVEYANCE ACTIVITY LIMITS FOR LSA MATERIAL AND SCO IN INDUSTRIAL PACKAGES OR UNPACKAGED

<i>Nature of material</i>	<i>Activity limit for conveyances other than by inland waterway</i>	<i>Activity limit for a hold or compartment of an inland water craft</i>
LSA-I	No limit	No limit
LSA-II and LSA-III non-combustible solids	No limit	$100 A_1$
LSA-II and LSA-III combustible solids, and all liquids and gases	$100 A_1$	$10 A_1$
SCO	$100 A_1$	$10 A_1$

TABLE VI : MULTIPLICATION FACTORS FOR LARGE DIMENSION LOADS

<i>Size of load^a</i>	<i>Multiplication factor</i>
Size of load d" 1m ²	1
1m ² < size of load d" 5m ²	2
5m ² < size of load d" 20m ²	3
20m ² < size of load	10

^a Largest cross-sectional area of the load being measured.

TABLE VII : CATEGORIES OF PACKAGES AND OVERPACKS

<i>Transport index</i>	<i>Conditions</i>	<i>Category</i>
	Maximum radiation level at any point on external surface	
0 ^a	Not more than 0.005mSv/h	I-WHITE
More than 0 but not more than 1 ^a	More than 0.005mSv/h but not more than 0.5mSv/h	II-YELLOW
More than 1 but not more than 10	More than 0.5mSv/h but not more than 2mSv/h	III-YELLOW
More than 10	More than 2mSv/h but not more than 10mSv/h	III-YELLOW ^b

a. If the measured TI is not greater than 0.05, the value quoted may be zero.

b. Shall also be transported under exclusive use.

TABLE VIII : EXCERPTS FROM LIST OF UNITED NATIONS NUMBERS, PROPER SHIPPING NAMES AND DESCRIPTIONS

<i>Un No.</i>	<i>Proper Shipping Name ^a And Description</i>
2910	RADIOACTIVE MATERIAL, EXCEPTED PACKAGE - LIMITED QUANTITY OF MATERIAL
2911	RADIOACTIVE MATERIAL, EXCEPTED PACKAGE - INSTRUMENTS or ARTICLES
2909	RADIOACTIVE MATERIAL, EXCEPTED PACKAGE - ARTICLES MANUFACTURED FROM NATURAL URANIUM or DEPLETED URANIUM or NATURAL THORIUM
2908	RADIOACTIVE MATERIAL, EXCEPTED PACKAGE - EMPTY PACKAGING
2912	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-I)
3321	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II)
3322	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-III)
2913	RADIOACTIVE MATERIAL, SURFACE CONTAMINATED OBJECTS (SCO-I or SCO-II)
2915	RADIOACTIVE MATERIAL, TYPE A PACKAGE
2916	RADIOACTIVE MATERIAL, TYPE B(U) PACKAGE
2917	RADIOACTIVE MATERIAL, TYPE B(M) PACKAGE

^a The "PROPER SHIPPING NAME" is found in the column "PROPER SHIPPING NAME and description". In the case of UN 2909 and UN 2911 where alternative PROPER SHIPPING NAMES are separated by the word "or", only the relevant PROPER SHIPPING NAME shall be used.

TABLE IX: T_i LIMITS FOR FREIGHT CONTAINERS AND CONVEYANCES
NOT UNDER EXCLUSIVE USE

Type of freight container or conveyance	Limit on total sum of transport indexes in a freight container or aboard a conveyance
Freight container - Small	50
Freight container - Large	50
Vehicle	50
Aircraft	
Passenger	50
Cargo	200
Inland water-way vessel	50
Seagoing vessel ^a	
1. Hold, compartment or defined deck area	
Packages, overpacks, small freight containers	50
Large freight Containers	
2. Total vessel:	200
Packages, overpacks, small freight containers	
Large freight containers	No limit

MADE at Abuja this 5th day of October, 2006

PROFESSOR SHAMSIDEEN BABATUNDE ELEGBA
Director-General/Chief Executive Officer
Nigerian Nuclear Regulatory Authority

EXPLANATORY NOTE

*(This note does not form part of the regulations, but it is
intended to explain its purport)*

1. These set of regulations is derived from, but not a substitute to, the International Basic Safety Standards Series Regulations for the Safe Transport of Radioactive Material 1996 No. TS-R-1 (ST-1, Revised).

2. The Regulation provide, among other things, for the protection of workers and the public from the harmful effects of exposure to ionizing radiation.

Made at Abuja this 11th day of October 1998

Witnessed by

Chief Executive Officer

Secretary of the Regulatory Commission

Examiner: _____

(This page does not form part of the document but it is
extended to the end of the document)

1. These regulations are made in pursuance of the provisions of the
Health and Safety Standards (Enforcement) Act, 1998 (Act No. 60 of 1998).
2. The Regulations provide for the enforcement of the provisions of the
Health and Safety Standards (Enforcement) Act, 1998.

NUCLEAR SAFETY AND RADIATION PROTECTION ACT

(1995 No. 19)

NIGERIAN RADIOACTIVE WASTE MANAGEMENT REGULATIONS, 2006



ARRANGEMENT OF REGULATIONS

REGULATION

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2. Objective.
3. Scope.
4. Application.
5. Radioactive waste classification.

PART II—RESPONSIBILITIES AND ADMINISTRATIVE MEASURES

6. Responsibilities.
7. Licence applications.
8. Radioactive Waste Co-ordinator.
9. Return of sealed radioactive source to supplier.
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11. Prohibition of importation of radioactive waste.
12. Public involvement.
13. Licence for manufacture, import and distribution of consumer products containing radioactive substance.

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15. Container labelling.
16. Discharge of radioactive substances to the environment.
17. Discharge record and report.
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21. Preparation for transportation of waste.
22. Transportation.
23. Treatment.
24. Conditioning.

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- 31. Right of entry and inspection.
- 32. Offences and penalties.
- 33. Appeals.
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SCHEDULES

SCHEDULE 1

WASTE CLEARANCE

SCHEDULE 2

VALUES OF ALIMIN FOR CERTAIN COMMON RADIONUCLIDES

NUCLEAR SAFETY AND RADIATION PROTECTION ACT

(1995 No. 19)

NIGERIAN RADIOACTIVE WASTE MANAGEMENT REGULATIONS, 2006

[5th October, 2006]

Commence-
ment.

In exercise of the powers conferred on it by Section 47 of the Nuclear Safety and Radiation Protection Act 1995 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

1. In these Regulations, unless the context indicates otherwise :

Interpre-
tation.

"*The Act*" means the Nuclear Safety and Radiation Protection Act 1995 ;

"*The Authority*" means the Nigerian Nuclear Regulatory Authority established under Section 1 of the Act ;

"*Annual Limit on Intake*" (ALI) means the intake of a given radionuclide in a year by reference which would result in a committed dose equal to the relevant dose limit. The ALI is expressed in units of activity. (According to NiBIRR an effective dose of 20 mSv shall not be exceeded for occupationally exposed workers and of 1 mSv for members of the public) ;

"*Authorization*" means permission granted in a document by the Authority to a legal person who has submitted an application to possess, produce, process, manufacture, purchase, sell, import, export, handle, use, transform, transfer, trade, assign, transport, store or dispose of radioactive material, nuclear material, radioactive waste, prescribed substances or any apparatus emitting ionizing radiation and the authorization may take the form of a registration or a licence ;

"*Characterization*" means the determination of the physical, chemical and radiological properties of the waste to establish the need for further adjustment, treatment, conditioning, or its suitability for further handling, processing, storage or disposal ;

"*Clearance levels*" means a set of values, established by the Authority and expressed in terms of activity concentrations and total activities, at or below which sources of radiation can be released from regulatory control ;

"*Conditioning*" means those operations that produce a waste package suitable for handling, transportation, storage or disposal and shall include the conversion of waste to a solid waste form, enclosure of the waste in containers and if necessary, providing an over pack ;

"*Consumer Product*" means an appliance or device, produced, made, manufactured, refined or improved in which a small amount of radioactive substance

has been deliberately incorporated or induced, and which can be supplied to members of the public ;

"Container" means the vessel into which the waste form is placed for handling, transportation, storage and eventual disposal. The waste container is a component of the waste package ;

"Critical Group" means a group of persons which is reasonably homogeneous and susceptible to exposure to a given radiation source and exposure pathway which includes the group of persons receiving the highest effective dose or equivalent dose, as applicable by the given exposure pathway from the given source ;

"Designated Radioactive Waste Management Facilities" (DRWMF) means facilities for collection and transportation of all radioactive waste from the waste generator's establishments for treating, conditioning and storing the radioactive waste requiring more than one year decay period to bring down the activity level to below clearance levels ;

"Disposal" means the placement of waste in an approved, specified facility including near surface or geological repository without the intention of retrieval and includes the approved direct discharge of airborne or liquid effluents into the environment with subsequent dispersion ;

"Dose Rate" means in relation to a place, the rate at which a person or part of a person would receive a dose of ionizing radiation from external radiation, if he were at that place being a dose rate at that place averaged over one minute ;

"Effective Dose" means the quantity E , defined as a summation of the tissue equivalent doses, each multiplied by the appropriate tissue Weighting factor :

$$E = \sum_T W_T H_T$$

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

$$E = \sum_T W_T \cdot \sum_R W_R \cdot D_{T,R}$$

Where W_R is the radiation weighting factor for radiation R and $D_{T,R}$ the average absorbed dose in the organ or tissue T . The unit of effective dose is $J \cdot kg^{-1}$, termed the Sievert (Sv) ;

"Exempt Waste" means any waste that is released from regulatory control in accordance with clearance levels because the associated radiological hazards are negligible. The designation should be in terms of activity concentration and total

activity and may include a specification of the type, chemical or physical form, mass or volume of waste, and its potential use ;

"Ionizing Radiation" means energy in the form of particles or electromagnetic waves of a wavelength of 100 nanometers or less or a frequency of 3×10^{13} hertz or more capable of producing ions directly or indirectly ;

"Legal Person" means any organization, corporation, partnerships, firm, association, trust, estate, public or private institution, group, political or administrative entity or other persons designated in accordance with the Act, who or which has responsibility and authority for actions taken under these regulations ;

"Licence" means an authorization granted by the Authority on the basis of a safety assessment and accompanied by specific requirements and conditions to be complied with by the licensee ;

"Licensee" means a person granted an authorization by the Authority on the basis safety assessment and complied with specific requirements and conditions ;

"Limit" means the value of a quantity used in certain specified activities or circumstances that must not be exceeded ;

"Monitoring" means the measurement of radiation or radionuclides for reasons related to the assessment or control of exposure and the interpretation of such measurements. Monitoring can be continuous or non-continuous ;

"NiBIRR" means Nigeria Basic Ionizing Radiation Regulations, 2003 ;

"Notification" means a document submitted to the Authority by a legal person to notify an intention to carry out a practice or any other action described in the general obligations for practices ;

"Practice" means work involving

(a) the production, processing, handling, use, holding, storage, transport or disposal of radioactive substances ; or

(b) the operation of any electrical equipment emitting ionizing radiation and containing components operating at a potential difference of more than 5 kilovolts,

which can increase the exposure of individuals to radiation from an artificial source, or from a radioactive substance containing naturally occurring radionuclides, which are processed for their radioactive, fissile or fertile properties ;

"Quality Assurance" means all those planned and systematic actions necessary to provide adequate confidence that an item, process or service will satisfy given requirements for quality, for example, those specified in the licence ;

"Radiation Accident" means an accident where immediate action would be required to prevent or reduce the exposure to ionizing radiation to employees, the environment or any other persons ;

"Radioactive Discharges" means radioactive substances discharged as gases, aerosols, liquids or solids to the environment, from a source within any activity generally with the purpose of dilution and dispersion ;

"Radioactive Substance" means any substance, which contains one or more radionuclides whose activity cannot be disregarded for the purposes of radiation protection ;

"Radioactive Waste" means material, whatever its physical form, remaining from practices or interventions and for which no further use is foreseen :

(a) that contains or is contaminated with radioactive substances and has an activity or activity concentration higher than the level for exemption or clearance from regulatory requirements, and

(b) exposure which is not excluded from these regulations ;

"Radioactive Waste Management Fund" means the fund established by government with contributions from waste generator to make provisions for long-term management options of the various waste forms ;

"Radionuclide" means a nucleus (of an atom) that possesses properties of spontaneous disintegration (radioactivity). Nucleus are distinguished by their mass and atomic number ;

"Regulatory Control" means any form of control applied to facilities or activities by the Authority for reasons related to radiation protection or the safety or security of radioactive sources ;

"Repository" means a nuclear facility where waste is placed for disposal and future retrieval of waste from the repository is not intended ;

"Safety" means measures intended to minimise the likelihood of accidents with radioactive sources and, should such an accident occur, to mitigate its consequences ;

"Safety Assessment" means a review of the aspects of design and operation of a source which are relevant to the protection of persons, environment or the safety of the source, including the analysis of the provisions for safety and protection established in the design, operation of the source, the analysis of risks associated with normal conditions and accident situations ;

"Sealed Source" means a source containing any radioactive substance whose structure is such as to prevent, under normal conditions of use, any dispersion of radioactive substances into the environment, but it does not include any radioactive substance inside a nuclear reactor or any nuclear fuel element ;

"Security" means measures to prevent unauthorized access or damage to, loss, theft or unauthorized transfer of radioactive sources ;

"Storage" means the placement of radioactive waste in a suitable facility where isolation, environmental protection and human control (e.g. monitoring) are provided with the intent that the waste will be retrieved for clearance, treatment, conditioning and disposal at a later time.

(a) the radioactive source is not contained in any food, beverage, cosmetic, drug, or other commodity designed for ingestion or inhalation by, or application to, a human being ; and

(b) the applicant submits sufficient information relating to the design, manufacture, prototype testing, quality control procedures, labelling or marking, and conditions of handling, storage, use, and disposal of the material or consumer product to demonstrate that the material or product will meet the safety criteria set forth by the Authority.

(3) The information to be submitted to the Authority for the purpose of processing the application for the licence shall include :

(a) a description of the material or consumer product and its intended use or uses ;

(b) the type, quantity, and concentration of the radioactive substance in each material or product ;

(c) the chemical and physical form of the radioactive substance in the material or product, and changes in chemical and physical form that may occur during the useful life of the material or product ;

(d) analysis of the solubility in water and body fluids of the radioactive substance in the material or product ;

(e) the details of manufacture and design of the material or product relating to containment and shielding of the radioactive source and other safety features under normal and severe conditions of handling, storage, use, reuse, and disposal of the material or product ;

(f) the degree of access of human beings to the material or product during normal handling, use, and disposal ;

(g) the total quantity of radioactive substance expected to be distributed annually in the material or product ;

(h) the expected useful life of the material or product ;

(i) the proposed method of labelling or marking each unit of the material or product with identification of the manufacturer and/or initial transferor of the product and the radionuclides and quantity of radioactive substance in the material or product ;

(j) the procedures for prototype testing of the material or product to demonstrate the effectiveness of the containment, shielding, and other safety features under both normal and severe conditions of handling, storage, use, reuse, and disposal ;

(k) the results of the prototype testing of the material or product, including any change in the form of the radioactive substance contained in it, the extent to which the radioactive substance may be released to the environment, any change in radiation levels, and any other changes in safety features ;

(l) the estimated external radiation doses and dose commitments relevant to the safety and the basis for such estimates ;

(m) the quality control procedures to be followed in the production of lots of the material or product, and the quality control standards the material or product will be required to meet ; and

(n) any additional information, including experimental studies and tests, required by the Authority to facilitate a determination of the radiation safety of the material or product.

PART III—WASTE MANAGEMENT OPERATIONS

Segregation,
collection
and
characterisation.

14.—(1) The waste generator shall keep control on waste generation to the minimum practicable.

(2) The waste generator shall segregate, collect and characterise waste as far as practicable at the point of origin in accordance with the categories specified in regulation 5 in order to facilitate subsequent treatment, conditioning, storage and disposal.

(3) Each waste category after segregation shall be kept separately in a suitable container.

(4) Sufficient number of containers shall be made available where radioactive wastes are generated which shall :

- (a) be easy to handle ;
- (b) be strong enough to withstand normal handling ; and
- (c) not be affected by the waste content.

(5) Waste requiring treatment and conditioning shall be further segregated by the waste generator as stipulated in the licence depending on the availability of treatment and conditioning facilities at the Designated Radioactive Waste Management Facilities.

Container
Labelling.

15.—(1) A licensee shall ensure that each container containing radioactive waste bears a durable, clearly visible label bearing the radiation symbol which shall be legible for the whole period of storage and must provide the following information :

- (a) nature of the waste generated ;
- (b) date of waste generation ;
- (c) commencement date of storage ;
- (d) content of major radiologically significant radionuclides ;
- (e) external surface dose rate ;
- (f) waste category ;
- (g) biological, chemical or other hazardous materials if they exist ;
- (h) name of a person responsible for the waste generation ;
- (i) identification ; and
- (j) any particular information that may be required by the Authority.

(2) Each licensee shall, prior to removal of empty containers to unrestricted areas, which after measuring have proved to be uncontaminated, remove or deface the label or otherwise clearly indicate that the container no longer contains radioactive waste.

(3) A licensee shall remove labels from containers holding waste if the concentration is below the clearance levels specified in Schedule 1 of these Regulations prior to their disposal.

(a) the waste activity or concentration were confirmed to be below clearance levels as prescribed by the Authority ; and

(b) discharge of liquid or gaseous effluents is within the limits authorized by the Authority.

16.—(1) A licensee shall ensure that radioactive waste shall not be discharged or released into the environment unless :

Discharge of
Radioactive
Substances to
the
environment.

(a) the waste activity or concentration are confirmed to be below clearance levels as prescribed by the Authority ; and

(b) discharge of liquid or gaseous effluents is within the limits authorized by the Authority.

(2) A licensee, before initiating the discharge to the environment of any solid, liquid or gaseous radioactive waste considered to be within discharge limits, shall as appropriate :

(a) determine the characteristics and activity of the material to be discharged, and the potential points and method of discharge ;

(b) determine by an appropriate pre-operational model study, all significant exposure pathways by which discharged radionuclide can deliver public exposure ;

(c) assess the doses to the critical groups due to the planned discharges ; and

(d) submit this information to the Authority as an input to the establishment of authorized limits and conditions for their implementation.

17. A licensee, during the operational stages of radioactive waste management shall :

Discharge
Record and
Report.

(a) keep all radioactive discharges below authorized discharge limits ;

(b) monitor the discharges of radionuclide with sufficient detail and accuracy to demonstrate compliance with the authorized discharge limits and to permit estimation of the exposure of critical groups ;

(c) record and keep records of the monitoring results ;

(d) report the monitoring results to the Authority at approved intervals ; and

(e) report promptly to the Authority any discharges exceeding the authorized discharge limits in accordance with reporting criteria established by the Authority.

18.—(1) The waste of Category I that is expected to decay below clearance levels within one year from its generation, shall be safely stored on-site and after confirmation by measuring or other means that the clearance levels specified in Schedule 1 of these regulations have been reached, shall be appropriately discharged or released by the waste generator or the Designated Radioactive Waste Management Facility Operator.

Discharge of
exempt
waste.

(2) A licensee may discharge the exempt liquid effluents into sanitary sewage only if the material is readily soluble or is readily dispersible in water ;

(3) A licensee may release the exempt solid into a municipal waste incinerator or landfill.

(4) A licensee may discharge exempt solid waste into the atmosphere.

(5) Hazardous waste, contaminated with toxic compounds or infectious agents which are covered by regulations dealing specifically with these hazardous characteristics shall be discharged in consonance with the provisions of such regulations as well.

Release of
specific
waste.

19.—(1) A licensee may release the following material as if it were not radioactive :

(a) 0.05 μ Ci (1.85kBq), or less of hydrogen-3 or carbon-14 per gram of medium used for liquid scintillation counting ; and

(b) 0.05 μ Ci (1.85kBq) or less of hydrogen-3 or carbon - 14 per gram of animal tissue, averaged over the weight of the entire animal.

(2) A licensee shall not dispose of tissue under regulation 19 (1) (b) of this section in a manner that would permit its use either as food humans or as animal feed.

Waste
Storage.

20.—(1) A licensee shall provide for interim storage of radioactive waste prior to its clearance, discharge or disposal.

(2) The interim storage facility shall be properly designed and constructed with at least one physical barrier between the radioactive waste and other material in the store.

(3) The store shall be large enough to hold all generated and anticipated waste in an orderly manner and keep different categories separated. In addition, the store designed shall provide for :

- (a) adequate shielding of the radioactive waste ;
- (b) prevention of deterioration of waste packages ;
- (c) handling and ability to retrieve of waste packages ;
- (d) adequate ventilation of waste packages ;
- (e) conventional safety ; and
- (f) physical protection.

(4) The radioactive waste store shall not be located close to any corrosive, exposure or flammable material and shall be clearly and legibly marked with the radiation symbol.

Preparation
for
Transportation
of Waste.

21.—(1) The Designated Radioactive Waste Management Facility shall provide full information on the radioactive waste sent to it prior to delivery.

(2) If incomplete or incorrect information is given, the Designated Radioactive Waste Management Facility may, at the expense of the waste generator, make the

SCHEDULE 2

VALUES OF ALI_{min} FOR CERTAIN COMMON RADIONUCLIDES

Nuclides	ALI_{min} (Bq)	Nuclides	ALI_{min} (Bq)
Nuclides	3×10^9	^{85m}Sr	8×10^9
3H eau	3×10^8	^{85m}Sr	6×10^7
^{14}C	2×10^9	^{87m}Sr	1×10^9
^{18}F	2×10^7	^{89}Sr	5×10^6
^{22}Na	1×10^8	^{90}Sr	1×10^5
^{24}Na	1×10^7	^{90}Y	2×10^7
^{32}P	9×10^6	^{90m}Tc	3×10^9
^{36}Cl	6×10^8	^{99}Mo	2×10^8
^{38}Cl	2×10^8	^{113}In	2×10^9
^{42}K	2×10^8	^{124}Sb	1×10^9
^{43}K	3×10^7	^{123}I	1×10^8
^{45}Ca	7×10^8	^{125}I	1×10^6
^{47}Ca	3×10^7	^{129}I	2×10^5
^{51}Cr	1×10^9	^{130}I	1×10^9
^{52}Mn	3×10^7	^{131}I	1×10^6
^{52m}Mn	2×10^8	^{132}I	1×10^6
^{54}Mn	3×10	^{109}Cd	1×10^6
^{56}Mn	7×10^7	^{115}Cd	3×10^7
^{52}Fe	1×10^7	^{111}In	2×10^8
^{55}Fe	7×10^6	^{129}Cs	9×10^7
^{59}Fe	2×10^7	^{130}Cs	2×10^9
^{56}Co	3×10^7	^{131}Cs	8×10^8
^{57}Co	1×10^6	^{134}Cs	3×10^6
^{58}Co	1×10^8	^{134m}Cs	4×10^9
^{60}Co	4×10^8	^{137}Cs	4×10^6
^{63}Ni	2×10^8	^{131}Ba	1×10^6
^{64}Cu	5×10^7	^{133m}Ba	9×10^7
^{67}Cu	1×10^7	^{135m}Ba	1×10^6
^{62}Zn	2×10^8	^{140}La	2×10^7
^{65}Zn	3×10^7	^{169}Yb	2×10^7
^{69m}Zn	6×10^8	^{192}Ir	8×10^6
^{67}Ga	8×10^8	^{198}Au	4×10^7
^{68}Ga	8×10^7	^{197}Hg	2×10^8
^{73}As	6×10^7	^{203}Hg	2×10^7
^{74}As	1×10^8	^{201}Tl	2×10^6
^{75}Se	6×10^8	^{204}Tl	7×10^7
^{76}Br	1×10^8	^{210}Pb	9×10^3
^{77}Br	9×10^9	^{212}Pb	1×10^6
^{82}Br	1×10^9	^{210}Po	2×10^4
^{81m}Rb	2×10^7	^{226}Ra	2×10^4
^{81}Rb	7×10^8	^{232}Th	4×10^1
^{86}Rb	1×10^9	^{238}U	2×10^3
^{88}Rb	4×10^2	^{241}Am	2×10^2
^{89}Rb		^{252}Cf	1×10^3
^{244}Cm			

		1871	1872
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		1987	1988
		1989	1990
		1991	1992
		1993	1994
		1995	1996
		1997	1998
		1999	2000

A.3.2. If the waste contains more than one radionuclide the highest activity shall be calculated in accordance with equation (1). For the activity in one individual package, equation (3) shall apply :

$$\sum \frac{A_k}{ALI_{mn}} < 0,1 \dots \dots \dots (3)$$

A.3.3. The dose rate at the surface of the package to be sent to a municipal incinerator or landfill shall not exceed 5µGy/h.

A.3.4. When a waste package is sent to a municipal incinerator or landfill, it shall carry the following marking :

- (a) "this waste package is exempted from nuclear control according to the Radiation Waste Management Regulations" ;
- (b) name and address of sender ;
- (c) signature of sender.

A.3.5. Records of discharged exempt waste shall be established by the waste generator and kept for at least 3 years. The records shall be available for inspection by the Authority.

EXPLANATORY NOTE

(This note does not form part of the Regulations but it is intended to explain its purport)

The Regulations provide, among other things, for the protection of workers, public and the environment from the harmful effects of exposure to ionizing radiation.

MADE at Abuja this 5th day of October, 2006.

PROFESSOR SHAMSIDEEN BABATUNDE ELEGBA,
Director-General/Chief Executive Officer
Nigerian Nuclear Regulatory Authority

SCHEDULES

SCHEDULE I

WASTE CLEARANCE

Waste may be released into the atmosphere, discharged into public sewer system, incinerated in a municipal incinerator or sent for municipal landfill provided that the conditions given in the paragraphs below are satisfied.

A.1. GASEOUS WASTE

A.1.1. Each waste generator or the Designated Radioactive Waste Management Facility may discharge gaseous waste in quantities not exceeding 10 ALI_{min} per year directly into the atmosphere. Table A1 give the numerical values of ALI_{min} for the most frequently used radionuclides.

A.1.2 If the waste contains more than one radionuclide, the highest permitted activity shall be calculated in accordance with the equation (1) :

$$\sum \frac{A_k}{ALI_{min,k}} < 10 \dots \dots \dots (1)$$

Where A_k is the activity of radionuclide. ALI_{min} values are in Table A1 for radionuclide k

A.2. LIQUID WASTE

A.2.1. Each waste generator or the Designated Radioactive Waste Management Facility may discharge liquid waste into a local sewer if the total activity does not exceed 1 ALI_{min} per month and 0.1 ALI_{min} or 5MBq, which ever is less, per individual discharge.

A.2.2. If the waste contains more than one radionuclide the highest permitted activity shall be calculated in accordance with equation (1)

$$\sum \frac{A_k}{ALI_{min,k}} < 1 \dots \dots \dots (2)$$

The total activity, however, must not exceed 100MBq per month.

A.3. SOLID WASTE

A.3.1 Each waste generator or the Designated Radioactive Waste Management Facility may dispose in a local landfill the waste containing a total activity not greater than 1 ALI_{min} per month. The maximum activity in waste package shall not exceed 0.1 ALI_{min} or 5MBq.

PART V—FINANCES

Finance. 30.—(1) The waste generator shall secure proper financing of management of radioactive waste.

(2) The waste generator dispatching a radioactive waste to a Designated Radioactive Waste Management Facility for treatment, conditioning and storage services and further disposal may be charged for such services as determined by the management of the Designated Radioactive Waste Management Facility.

(3) The waste generator shall pay all prescribed contributions to the Radioactive Waste Management Fund as may be determined from time to time.

PART VI—VERIFICATION AND ENFORCEMENT

Right of
Entry and
Inspection.

31.—(1) Any person appointed by the Authority to be Inspector to control the safety of radioactive waste management may enter at any time the premises of any licensee, or any other premises where he has reason to suspect that radioactive waste is present. Inspections, tests, and samples and photographs may be taken, equipment or other experts brought in if there is reason to believe that the waste may endanger human health or environment.

(2) The inspector may recommend to the Authority and/or to the management of the facility that generates or process radioactive waste to shut down if he believes that the safety is jeopardised.

(3) Each licensee shall assist the inspector in his duties by granting him access to his facilities and records.

Offences and
penalties.

32.—(1) Any person who contravenes any of the provisions of these Regulations has committed an offence.

(2) Any one who commits an offence under these regulations shall be liable to the penalties as established in the enforcement policy issued by the Authority.

(3) The Authority shall impose penalties such as suspension or revocation of authorization, imposing administrative fine or closure of facility or any combination of these.

(4) The person or body corporate who, being a holder of authorization under these regulations, who commits an offence shall be liable to prosecution in the court of law and upon conviction be liable to pay fines up to ₦1,000,000 for an individual and up to ₦10,000,000 for a corporate body or be given a jail term of up to ten years or both.

Appeal.

33. Any person or organization may appeal to the Board of the Authority against any decision made by the Authority pursuant to these regulations.

Citation.

34. These Regulations may be cited as the Nigerian Radioactive Waste Management Regulations 2006.

PART IV—REPORTING TO THE AUTHORITY

28.—(1) A licensee shall prepare and maintain an inventory of existing and anticipated radioactive waste containing radionuclide with half-lives above 50 days and an activity greater than 10MBq.

Reporting to
the
Authority.

(2) A record of the inventory shall be submitted to the Authority with a copy to the Designated Radioactive Waste Management Facility annually and whenever any significant changes in radioactive waste amount or characteristics occur.

(3) The inventory shall be based on the classification system specified in Regulation 5, including information on important physical, chemical and radiological characteristics in addition to the quantity of radioactive waste, and the radioactive waste inventory shall be submitted in the format stipulated by the Authority.

(4) Each licensee shall report to the Authority forthwith after its occurrence becomes known to him, any loss, stolen or missing radioactive waste and the circumstances under which such an occurrence took place and within 30 days after such occurrence, the licensee shall make a written report with a description of the radioactive material involved, its probable disposition, the circumstance under which the loss occurred, and actions that have been taken.

(5) Each licensee shall immediately report to the Authority any event involving radioactive waste possessed by the licensee that may have caused or threatens to cause the release of radioactive material, inside or outside of a restricted area, where an individual could have received an intake in excess of one occupational annual limit on intake as specified in Schedule 2 of these regulations.

(6) The Designated Radioactive Waste Management Facility shall submit to the Authority by the end of each year a report that specifies details of quantities and type of :

(a) the exempt waste disposal at a municipal landfill, discharged into the public sewage system or to the atmosphere ;

(b) the effluents discharge into the environment within authorized release limits ;

(c) the conditioned radioactive waste in storage ;

(d) the conditioned radioactive waste dispatched to a disposal facility ; and

(e) the spent radiation sources sent to supplier.

29.—(1) A licensee shall establish written procedure and have equipment to :

Emergency
preparedness.

(a) deal with any emergency involving radioactive waste at their facilities ; and

(b) inform the Authority without delay of any emergency in relation to radioactive waste.

(2) The Designated Radioactive Waste Management Facility shall establish written procedures and have equipment available to deal with emergencies, and the Authority may advise and assist with any emergency at a waste generators facility whether on request or not.

(4) Radium sources shall be conditioned for storage by encapsulating the source in a welded stainless tube, placing the tube in a lead shielding container followed by emplacement of the container inside a 200 litre mild steel drum filled with the concrete.

(5) Provision for the retrieval of the encapsulated radium sources from drums and transportation to the disposal facility shall be made.

Disposal of
radioactive
waste

25.—(1) Where the radioactive waste does not qualify for discharge or release to the environment or for clearance in a reasonable period of time, it shall be disposed of in a near surface repository to be established by government and licenced by the Authority.

(2) No person or organization shall dispose of radioactive waste in a repository unless the requirements for acceptance of radioactive waste for disposal approved by the Authority are satisfied.

(3) The responsibility for verification of compliance of radioactive waste packages with the acceptance criteria rest with the disposing organization.

Quality
assurance.

26.—(1) All licencees shall ensure that all radioactive waste management operations are carried out in accordance with a suitable quality assurance programme commensurate with the scope of activity and approved by the Authority.

(2) The quality assurance programme shall be designed to ensure that the facilities and equipment are designed, constructed and operated in accordance with specified requirements for safe operation, all regulations and conditions in a licence are complied with, and the radioactive waste, packages produced meet the waste package acceptance requirements.

(3) Each licencee shall develop and maintain an accurate documentation system to cover all stages of radioactive waste management from its generation to disposal, and quality assurance programme shall provide for controlled approval, receipts, retention, distribution and disposition of all records important for safety in accordance with the Authority requirements.

(4) Records, such as letters, drawings, specification, etc must include all pertinent information, such as stamps, initials, and signatures, and licencee shall retain the records until the Authority terminates each pertinent licence requiring the record.

(5) The licencee shall maintain adequate safeguard against tempering with and loss of records.

(6) The effectiveness of the quality assurance programme shall be verified by the independent audits to ensure that a radioactive waste management programme meets specific requirements, is covered by procedures, and that implementation is adequate.

Physical
protection.

27. Waste generators and the Designated Radioactive Waste Management Facilities shall ensure adequate physical protection measures to prevent any unauthorized access to the radioactive waste, and the Authority shall approve of such physical security arrangements.

necessary investigation and report to the Authority for instructions regarding receiving such waste and its further management.

(3) The radioactive waste to be transported to a Designated Radioactive Waste Management Facility shall be prepared by the waste generator in accordance with the requirements developed by the Designated Radioactive Waste Management Facility and approved by the Authority.

(4) The Radioactive Waste Coordinator shall supervise the preparation of the radioactive waste for transportation and in particular check the adequacy of shielding, labelling and documentation.

22.—(1) Transportation of radioactive waste within any installation shall be performed by a licensee under separate operating instructions issued by the management and approved by the Authority.

Transportation.

(2) The off-site transportation of radioactive waste shall be in accordance with the Nigerian Transportation of Radioactive Sources Regulation, 2006.

(3) The Designated Radioactive Waste Management Facility shall secure a licence for transportation of radioactive waste from the Authority in addition to the licence from any other appropriate authority.

(4) The Authority shall be notified at least 14 days in advance of any off-site transfer of radioactive waste, and waste generator shall ensure that he receives an acknowledgement receipt of the dispatched radioactive waste within 14 days.

(5) Any shipment, of which acknowledgement is not received within the specified time shall be investigated by the sender and a report shall be prepared and submitted to the Authority within one (1) week after completion of the investigation but not later than twenty eight (28) days after the date of shipment.

23.—(1) The Designated Radioactive Waste Management Facility shall treat the radioactive waste received from the waste generator in order to reduce its volume and to facilitate further conditioning.

Treatment.

(2) The treatment method shall be suitably selected for the radioactive waste received depending on such factor as volume and type of the radioactive waste, the discharge requirement for liquid effluent and additional conditioning requirements.

24.—(1) The radioactive waste to be accepted for long term storage, transportation and disposal shall be properly conditioned by the Designated Radioactive Waste Management Facility.

Conditioning.

(2) Waste packages produced by a conditioning process shall be fully characterised with regard to important physical chemical, radiological, mechanical and biological properties specified by the Authority.

(3) The waste packages to be transported off-site shall comply with the Nigerian Transportation of Radioactive Sources Regulation, 2006 and shall meet waste acceptance requirements for disposal.

(2) These regulations shall not apply to Technologically Enhanced Naturally Occurring Radioactive Materials (TE-NORM).

Application.

4.—(1) The application of these Regulations shall be in addition to the Nigeria Basic Ionizing Radiation Regulations 2003 (NiBIRR) and the Nigeria Technologically Enhanced Naturally Occurring Radioactive Materials Regulations and any other existing ionizing radiation and nuclear regulations as well as any transport regulations in force.

(2) These Regulations shall apply to :

(a) all solid, liquid and gaseous waste with activity levels above the clearance levels specified in Schedule I ;

(b) all users of sources of ionizing radiation in medicine, industry, teaching, research, agriculture, hydrology, geology and other field of human activity whenever such uses are subject to registration or licensing under these Radioactive Waste Management Regulations ; and

(c) operators of radioactive waste management facilities.

**Radioactive
waste
classification.**

5. Radioactive waste shall be classified using the following categories :

(a) according to its physical form and composition :

(i) solid waste,

(ii) liquid aqueous waste,

(iii) liquid organic waste,

(iv) gaseous waste,

(v) sealed radioactive sources,

(vi) biological waste (e.g. animal carcasses which might undergo decomposition if not properly treated and stored), and

(vii) medical waste (e.g. syringes, bed linen and contaminated clothing from a hospital environment) ;

(b) according to the activity concentration and half lives of radionuclides contained in the following category of radioactive waste :

Category I—Low level radioactive waste (e.g. the activity is less than 10 MBq), containing short lived radionuclides only (e.g. with half life less than 50 days) that will decay to clearance levels within one year after the time of its generation.

Category II—Low and intermediate level radioactive waste, containing the radionuclides with half life <30 y and restricted long-lived radionuclide concentrations and that is not expected to decay to clearance levels within one year from the time of its generation (limitation of longer lived alpha emitting radionuclides to 400 Bq/g individual waste packages and to an overall average of 400 Bq/g per waste package).

Category III—Low and intermediate level radioactive waste, containing the radionuclides with half life >30 y, and concentration of alpha emitters exceeding the limitations for Category II. This waste needs to be disposed of in deep geologic facilities only.

"Transport" means, in relation to radioactive substances, carriage by road or through any public place whether on a conveyance or not, by rail, inland waterway, sea or air. In the case of transport on a conveyance, a substance shall be deemed as being transported from the time that it is loaded onto the conveyance for the purpose of transporting it until it is unloaded from that conveyance, but a substance will not be considered as being transported if—

(a) it is transported by means of a pipeline or similar means ; or

(b) it forms an integral part of a conveyance and is used in connection with the operation of that conveyance ;

"Treatment" means the operations intended to benefit safety and economy by changing the characteristics of waste. Three basic treatment objectives are :

(a) volume reduction ;

(b) removal of radionuclides from the waste ;

(c) change of composition,

after treatment, the waste may or may not be immobilised to achieve an appropriate waste form.

"Waste Inventory" means a detailed, itemised record maintained by the operator or Authority in accordance with these regulations, and may contain data such as physical quantity, the activity of the waste, the radionuclide content, and other characteristics.

"Waste Generator" means any person or organization engaged in activities which generate radioactive waste.

"Waste Management" means all activities, administrative and operational, that are involved in the handling, treatment, conditioning, storage, disposal and transportation of waste.

"Waste Package" means the product of conditioning that includes the waste form and any container(s) and internal barriers (e.g. absorbing materials and liner) as prepared in accordance with requirements for handling, transportation, storage and /or disposal.

"Waste Form" means the waste in its physical and chemical form after treatment and/or conditioning (resulting in a solid product) prior to packaging. The waste form is a component of waste package.

2. These Regulations set up the basic technical and organizational requirements to be complied with by waste generators and operators of waste management facilities in order to ensure the protection of human health and the environment from the hazards associated with radioactive waste within and beyond Nigeria's borders. Objective.

3.—(1) The scope of these Regulations covers the requirements associated with such steps in waste management as collection, segregation, characterisation, treatment, conditioning, storage and preparation for transport of radioactive waste arising from medical, industrial and research facilities where radioactive materials and sources of ionizing radiation are produced, used or handled. Scope.

Category IV—High level radioactive waste, with thermal power above 2 kW/m³ and concentration of alpha emitters exceeding the limitations for Category II (e.g. spent-fuel from research reactors). This waste needs to be disposed of in deep geologic facilities only.

PART II—RESPONSIBILITIES AND ADMINISTRATIVE MEASURES

6.—(1) Primary responsibility for the safe management of radioactive waste rests with the waste generator who shall take all necessary actions to ensure the safety of radioactive waste unless the responsibility has been transferred to another person or organization as approved by the Authority. Responsibilities.

(2) The Authority is responsible for enforcement of compliance of the provisions of these Regulations and all other relevant requirements by waste generators and the operators of Designated Radioactive Waste Management Facilities as established under these Regulations and the implementation of the licensing process for generation and management of radioactive waste.

(3) The waste generator shall be responsible for on-site segregation, collection, characterisation and temporary storage of the radioactive waste arising from his activities and discharge of exempt waste.

(4) All radioactive waste that are not expected to decay to clearance levels within one year from the time of its generation shall be transferred from the waste generator to the Designated Radioactive Waste Management Facilities.

(5) Designated Radioactive Waste Management Facilities shall have the responsibility to discharge exempt waste and to store conditioned radioactive waste until a disposal facility is established and becomes operational and the waste has been disposed of, or the waste has been transported abroad for further processing and disposal.

(6) No person or organization shall dispose of any radioactive waste unless the disposal facility designed and constructed specifically for this purpose is available and licenced.

(7) The Authority shall be responsible for :

(a) management of radioactive waste where the person that generates the waste is incapable of appropriate management of the waste either through—

- (i) bankruptcy, or
- (ii) revocation of licence, or
- (iii) non existence of waste generator, or
- (iv) as may be appropriately determined ; and

(b) recovering of the costs incurred from those responsible, where they are identified.

Licence
application.

7. —(1) No person or organization shall generate or manage radioactive waste without an appropriate licence from the Authority.

(2) All proposals from applicants to generate radioactive waste shall specify the following in a written application to the Authority :

- (a) nature and purpose of the proposed facility and equipment that generates radioactive waste ;
- (b) suggested operational procedures, taking into account reduction of radioactive waste generation to the extent practicable ;
- (c) quantity, type and characteristics of radioactive waste to be generated ;
- (d) proposed destination for the radioactive waste ;
- (e) assessments of the safety and environmental impact of the facility under normal and accident conditions ;
- (f) decommissioning procedures ;
- (g) availability of competent staff and provisions for further training ;
- (h) systems for records keeping and reporting ;
- (i) proposed quality assurance programme ;
- (j) contingency plans in the event of an emergency ;
- (k) proposals for discharge and environmental monitoring as needed ; and
- (l) such other details as the Authority may consider necessary.

(3) The Designated Radioactive Waste Management Facility operator shall specify the following in a written application for the licence to the Authority :

- (a) quantity, type and characteristics of the radioactive waste to be managed ;
- (b) suggested methods, facilities and equipment for management of radioactive waste designed to minimise radioactive waste packages to be disposed of ;
- (c) assessments of the safety and environmental impact of the facility under normal and accident conditions ;
- (d) decommissioning procedures ;
- (e) availability of competent staff and provisions for further training ;
- (f) systems for record keeping and reporting ;
- (g) proposed quality assurance programme ;
- (h) contingency plans in the event of an emergency ;
- (i) proposals for discharge and environmental monitoring ;
- (j) supporting research and development proposals ;
- (k) insurance and liability coverage for the facilities operation ; and
- (l) such other details as the Authority may consider necessary.

(4) An applicant shall pay such fees as prescribed by the Authority to cover the cost of the licensing procedures.

(5) The licensee shall comply with all limit. and conditions specified in the licence including the amounts and characteristics of waste which may be generated, treated, conditioned and stored, and any specific radiation protection and physical security measures.

(6) Any licence issued under regulation 7(1) and (3) shall be :

- (a) valid for such a period as the Authority may determine ;
- (b) renewable by the Authority if the licensee complies with the licence conditions ; and
- (c) subject to supervision or revocation as notified in writing if in the view of the Authority, the licensee has failed to comply with the licence conditions.

8.—(1) Each waste generator shall appoint a technically competent person with the appropriate independence and authority to be a Radioactive Waste Coordinator in order to assist persons using radioactive materials in safe and efficient on-site radioactive waste management.

Radioactive
Waste Co-
ordinator

(2) The Radioactive Waste Coordinator shall :

- (a) establish, maintain and keep up-to-date inventory of radioactive materials and generated waste ;
- (b) make and maintain contact with all on-site persons using radioactive materials and provide an authoritative point of advice and guidance ;
- (c) liaise as needed with the Designated Radioactive Waste Management Facility operator ;
- (d) establish and maintain a record keeping system in such a manner as to facilitate identification, characterisation, collection and storage of radioactive materials that become waste ;
- (e) ensure that on-site transfer of radioactive materials and waste is carried out in accordance with written safety procedures ;
- (f) ensure appropriate shielding, labelling, physical security and proper conservation of waste packages ;
- (g) ensure that any discharge of effluents is made within clearance levels or authorized limits ;
- (h) ensure the disposal of solid waste to a municipal landfills is below clearance levels ;
- (i) report on accidents and inappropriate waste management practices to the facility management ; and
- (j) maintain up to date knowledge of the characteristics of the site sewage system, local municipal landfills, available incinerators for non-radioactive waste and other facilities relevant to the organization of waste management practices.

9.—(1) A person or organization that proposes to import or acquire a device containing a sealed radioactive source shall require the supplier, to receive the source back after its useful lifetime as a condition of any contract for the purchase or transfer.

Return of
sealed
radioactive
source to
supplier.

(2) A copy of the contract shall be submitted to the Authority upon application to import the device to which regulation 9 (1) applies.

(3) The owner of the device to which regulation 9 (1) applies shall be responsible to return the spent sealed source to the supplier in accordance to the contract.

(4) Where the owner of the device to which sub-section 9 (1) applies fails to return the spent sealed source it shall be appropriately stored or transferred to the Designated Radioactive Waste Management Facility for conditioning, storage and disposal at the cost to the owner of the device.

(5) The Authority shall be responsible for management of the spent source where the recipient is incapable (through bankruptcy or as appropriately determined) of returning the source or the licence is revoked, or the recipient no longer exists and the Authority shall request to recover the costs incurred from those responsible, where they are known.

Transfer of spent sealed source to another authorized user.

10.—(1) The transfer of a spent sealed source from one authorized user to another shall be authorized as a radioactive waste management option for that source if :

(a) the initial licensee demonstrates that the integrity of the source can be guaranteed ,

(b) the recipient user satisfies the Authority of his ability to safely use the source as required by the Nigeria Basic Ionizing Radiation Regulations ; and

(c) the recipient user satisfies the Authority of his ability to manage the waste generated thereof, as required by these regulations.

(2) For the purpose of sub-paragraph (1) of this regulation, the initial licensee shall make an assessment of the condition of the source at the point of transfer and make such records, in addition to all previous records of the source, available to the Authority as well as to the recipient user.

(3) The initial licensee shall retain all records pertaining to the source.

Prohibition of importation of radioactive waste.

11. Under no condition, purpose or guise whatsoever, shall any person or organization import a radioactive waste into any part of Nigeria.

Public involvement.

12. The Designated Radioactive Waste Management Facilities operator shall ensure the public accessibility to the organizational policy and programme to improve understanding of waste management issues.

Licence for manufacture, import and distribution of consumer products containing radioactive substance.

13.—(1) A licensee shall be required to manufacture or import and distribute any material or consumer product containing a radioactive source unless otherwise exempted under the provisions of these regulations,

(2) An application for a licence to manufacture or import and distribute consumer products or materials containing radioactive substance shall be approved if :