ATOMIC ENERGY LICENSING ACT 1984

RADIATION PROTECTION (TRANSPORT) REGULATIONS 1989

ARRANGEMENT OF REGULATIONS

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ATOMIC ENERGY LICENSING ACT 1984

RADIATION PROTECTION (TRANSPORT) REGULATIONS 1989

IN exercise of the powers conferred by section 68 of the Atomic Energy Licensing Act 1984, the Minister makes the following regulations:

Act 304.

PART I

PRELIMINARY

Citation.

1. These Regulations may be cited as the **Radiation Protection (Transport) Regulations 1989.**

Interpretation.

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

"A_1" means the maximum activity of a special form radioactive material permitted in a Type A package;

"A_2" means the maximum activity of radioactive material, nuclear material or prescribed substance, other than a special form radioactive material, permitted in a Type A package;

"accident conditions of transport" means conditions that prevail during accident, being conditions similar to the conditions simulated by a combination of the tests specified in the Sixth Schedule with respect to a package;

"activity" (A) of an amount of radionuclide in a particular energy state at a given time is the quotient of dN by dt, where dN is the expectation value of the number of spontaneous nuclear transformations from that energy state in the time interval dt, represented by the formula—

$$A = dN/dt;$$

"annual dose" means the dose received over a period of one calender year;

"annual dose limit" means the limit of annual dose, whose value for the respective groups of the population is specified in the Radiation Protection (Basic Safety Standards) Regulations 1988, which must not be exceeded;

P.U. (A) 61/88.

"cargo aircraft" means any aircraft, other than a passenger aircraft, which carries goods or property;

"carrier" means any person undertaking the carriage of radioactive material, nuclear material or prescribed substance by any means of transport;

"competent authority" means a recognized and established authority in a foreign country exercising in that country a jurisdiction in respect of the transport of radioactive material, nuclear material or prescribed substance;

"compliance assurance" means an activity of the Board aimed at ensuring that the applicable provisions of these Regulations are met in practice;

"consignee" means any person who receives a consignment;

"consignment" means any package, or any load of radioactive material, nuclear material or prescribed substance, presented by a consignor for transport;

"consignor" means any person who presents a consignment for transport and is named as the consignor in the transport documents;

"containment system" means an assembly of components, which form part of the packaging, designed for the purpose of preventing the escape of the radioactive content from a package during transport;

"contamination" means the presence of any radioactive material, nuclear material or prescribed substance on a surface in quantities in excess of 0.4 Becquerel per square centimetres (Bq/cm^2) for beta and gamma and low toxicity alpha emitters, or 0.04 Bq/cm^2 for all other alpha emitters;

"criticality" means a self-sustaining chain process of nuclear fission that can be maintained without an additional source of neutrons;

"damaged" means the evaluated or demonstrated condition of the package if it had been subjected to whichever of the following combination of tests are the more limiting:

(a) the tests to demonstrate the normal conditions of transport as specified in the Fifth Schedule followed by the tests to demonstrate the accident conditions of transport as specified in the Sixth Schedule as applied to a package containing fissile material; or

(b) the tests to demonstrate the normal conditions of transport as specified in the Fifth Schedule followed by the Water Immersion Test as specified in the Sixth Schedule;

"defined deck area" means an area on the weather deck of a vessel or on a vehicle deck of a roll-on/roll-off ship or a ferry which is allocated for the stowage of packages;

"depleted uranium" means uranium containing a lesser mass percentage of uranium-235 than in the natural uranium;

"design" means the description of special form radioactive material or packaging which enables such material or packaging to be fully identified and which may include specifications, engineering drawings, reports demonstrating compliance with regulatory requirements and other relevant documentation;

"dose" means dose-equivalent or effective dose-equivalent or committed effective dose-equivalent or committed dose-equivalent;

"dose rate" means the dose per unit time;

"endorsement" means recognition accorded by the Board to any form of approval associated with the transport of radioactive material, nuclear material or prescribed substance issued by a competent authority;

"enriched uranium" means uranium containing a greater mass percentage of uranium-235 than in natural uranium;

"exclusive use" means sole use of a conveyance or of a large freight container with a minimum length of 6 metres by a single consignor and with all initial, intermediate and final loadings and unloadings being carried out in accordance with the directions of the consignor or the consignee;

"fissile material" means uranium-233, uranium-235, plutonium-238, plutonium-239, plutonium-241 or their combinations but does not include natural uranium or depleted uranium which has not been irradiated and natural uranium or depleted uranium which has been irradiated in thermal reactors;

"fixed contamination" means contamination that cannot be removed by wiping the contaminated surface with a filter paper, or wad of dry cotton wool, or any other material of this nature;

"freight container" means a container that is durable in nature and is specially designed to facilitate the transport of goods by one or more modes of transport without intermediate reloading;

"LSA" or "low specific activity material" means LSA-I, LSA-II or LSA-III;

"LSA-I" means—

(a) ores containing naturally occurring radionuclides, such as uranium and thorium, and uranium or thorium concentrates of such ores; or

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

(c) radioactive material, nuclear material or prescribed substance, other than fissile material, for which the A_2 value is limited;

"LSA-II" means—

(a) water with tritium concentration up to 0.8 terabecquerel per litre (TBq/1); or

(b) a material in which the activity is distributed throughout the material and the estimated average specific activity does not exceed 10^{-4} A_2/g for solid and gases, and 10^{-5} A_2/g for liquids;

"LSA-III" means solids in which—

(a) the radioactive material, nuclear material or prescribed substance 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 or ceramic;

(b) the radioactive material, nuclear material or prescribed substance is relatively insoluble or is intrinsically contained in a relatively insoluble matrix, so that, even under loss of packaging, the loss of radioactive material, nuclear material, or prescribed substance per package when subjected to the tests for LSA-III material as specified in the Seventh Schedule would not exceed 0.1 A_2; and

(c) the estimated average specific activity, excluding any shielding material, does not exceed 2×10^{-3} A_2/g;

"maximum normal operating pressure" means the maximum pressure above the atmospheric pressure at the 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 the environmental condition of transport in the absence of venting, external cooling by an ancillary system or other operational controls during transport;

"multilateral approval" means approval of a design or shipment under special arrangement by the relevant competent authority of the country of origin and of each country of transit or into which the consignment is to be transported;

"natural uranium" means uranium containing 0.72 per cent by weight of uranium-235 and no other isotope of uranium except uranium-238 and trace quantities of uranium-234;

"non-conforming package" or "non-conforming packaging" means a package or a packaging which does not meet one or more of the requirements of these Regulations with respect to a package or a packaging;

"non-fixed contamination" means contamination other than fixed contamination;

"normal conditions of transport" means conditions that prevail during routine transport similar to the conditions simulated by tests specified in the Fifth Schedule with respect to a package;

"overpack" means an enclosure which is used by a single consignor to consolidate into one handling unit a consignment of two or more packages for convenience of handling, stowage and carriage;

"package" means packaging with radioactive contents as presented for transport;

"packaging" means an assembly of components necessary to enclose the radioactive contents completely;

"passenger aircraft" means an aircraft that carries any person other than a crew member, a carrier's employee in an official capacity, an authorized representative of the Board or a person accompanying a consignment;

"quality assurance" means a systematic programme of controls and inspections applied by a licensee or a person involved in the transport of radioactive material, nuclear material or prescribed substance which is aimed at providing adequate confidence that the standard of safety prescribed in these Regulations is achieved in practice;

"qualified person" means a person who has special knowledge in the safety measures required in handling radioactive material, nuclear material or prescribed substance, and in the decontamination of things contaminated by radioactive material, nuclear material or prescribed substance and who is approved by the Board;

"radiation level" means the corresponding dose-equivalent rate expressed in millisieverts per hour (mSv/h);

"radioactive content" means any radioactive material, nuclear material or prescribed substance together with any contaminated solids, liquids or gases within the packaging;

"SCO" or "surface contaminated object" means SCO-I or SCO-II;

"SCO-I" means a solid object on which—

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

(b) the fixed contamination on the accessible surface averaged over 300 cm^2 (or the entire accessible surface if less than 300 cm^2) does not exceed 4×10^4 Bq/cm^2 for beta and gamma and low toxicity alpha emitters, or 4×10^3 Bq/cm^2 for all other alpha emitters; or

(c) the non-fixed contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm^2 (or the entire inaccessible surface if less than 300 cm^2) does not exceed 4×10^4 Bq/cm^2 for beta and gamma and low toxicity alpha emitters, or 4×10^3 Bq/cm^2 for all other alpha emitters;

"SCO-II" means a solid object on which either the fixed or the non-fixed contamination on the surface exceeds the applicable limits specified for SCO-I but—

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

(b) the fixed contamination on the accessible surface averaged over 300 cm^2 (or the entire accessible surface if less than 300 cm^2) does not exceed 8×10^5 Bq/cm^2 for beta and gamma emitters and low toxicity alpha emitters or 8×10^4 Bq/cm^2 for all other alpha emitters; or

(c) the non-fixed contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm^2 (or the entire inaccessible surface if less than 300 cm^2) does not exceed 8×10^5 Bq/cm^2 for beta and gamma emitters and low toxicity alpha emitters, or 8×10^4 Bq/cm^2 for all other alpha emitters;

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

"special arrangement"means an arrangement, approved by the Board, under which a consignment which does not fully satisfy the applicable requirements of these Regulations may be transported;

"special form radioactive material" means either an indispersible solid radioactive material, nuclear material or prescribed substance or a sealed capsule containing radioactive material, nuclear material or prescribed substance which satisfies the requirements specified in regulation 20;

"specific activity" means the activity of a radionuclide per unit mass of that nuclide;

"special use vessel" means a vessel which by virtue of its design, or by reason of its being chartered, is dedicated to the purpose of carrying radioactive material, nuclear material or prescribed substance;

"subcritical" means incapable of reaching criticality;

"tank" means—

(a) a tank container;

(b) a road tank vehicle;

(c) a rail tank wagon; or

(d) a receptacle,

with a capacity of not less than 450 litres if intended 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 if intended to contain gases;

"transport" means all operations and conditions associated with and involved in the movement of radioactive material, nuclear material or prescribed substance, including the preparation, consigning, handling, carriage, storage in transit and receipt at the final destination of a package;

"transport index" or "TI" means a single number assigned to a package, overpack, tank or freight container or to unpackaged LSA-I or SCO-I determined in accordance with the method specified in the Eighth Schedule;

"transport document" means document accompanying a package being transported and containing all the necessary information as specified in regulation 48;

"uncompressed gas" means gas at a pressure not exceeding the ambient atmospheric pressure at the time the containment system is closed;

"undamaged" means the condition of the package as it is designed to be presented for transport;

"unirradiated thorium" means thorium containing not more than 10^{-7} grams (g) of uranium-233 per gram of thorium-232;

"unirradiated uranium" means uranium containing not more than 10^{-6} g of plutonium per gram of uranium−235 and not more than 9 megabecquerels (MBq) of fission products per gram of uranium−235;

"vehicle" means a structure capable of moving or being moved by road or by rail;

"vessel" means any seagoing vessel or inland waterway craft used for carrying cargo.

PART II

APPLICATION

Application.

3. (1) These Regulations shall apply to transport of radioactive materials, nuclear materials or prescribed substances by all modes on land, water or in the air, including transport which is incidental to the use of radioactive materials, nuclear materials or prescribed substances.

(2) Notwithstanding subregulation (1), these Regulations shall not apply—

(a) within establishments where radioactive materials, nuclear materials or prescribed substances are produced, used or stored, other than storage in transit;

(b) to human beings who have been implanted with radioisotopic cardiac pacemakers or other devices, or who have been treated with radiopharmaceuticals;

(c) to any radioactive material, nuclear material or prescribed substance which is an integral part of a conveyance.

(3) These Regulations shall not apply where there are provisions in force to the contrary in any international convention to which the Government of Malaysia is a party and where such convention exists, the transport of radioactive materials, nuclear materials or prescribed substance shall be in accordance with the provisions provided therein.

Application of the Radiation Protection (Basic Safety Standards) Regulations 1988. *P.U. (A) 61/88.*

4. The Radiation Protection (Basic Safety Standards) Regulations 1988 shall apply for the protection of transport workers and members of the public who may be exposed to ionising radiation arising from the transport of radioactive materials, nuclear materials or prescribed substances, except where otherwise provided in these Regulations.

PART III

REQUIREMENTS IN PREPARING PACKAGES FOR TRANSPORT

Chapter 1—Requirements for Packagings

Classification of packagings.

5. (1) For the purpose of these Regulations, there shall be four categories of packagings that may be used for the transport of radioactive materials, nuclear materials or prescribed substances, namely—

(a) excepted packaging;

(b) Type A packaging;

(c) Type B packaging; and

(d) industrial packaging.

(2) Type B packagings shall be further categorised into two, namely, Type B(U) packaging and Type B(M) packaging.

(3) Industrial packagings shall be further categorised into three, namely, industrial packaging Type 1 (IP−1), industrial packaging Type 2 (IP−2) and industrial packaging Type 3 (IP−3).

Requirements for excepted packaging.

6. An excepted packaging shall satisfy all the requirements specified in the First Schedule.

Requirements for Type A packaging.

7. A Type A packaging shall satisfy all the requirements specified in the Second Schedule.

Requirements for Type B packaging.

8. A Type B packaging shall satisfy all the requirements specified in the Third Schedule.

Requirements for industrial packaging.

9. An industrial packaging shall satisfy all the requirements specified in the Fourth Schedule.

The use of non-conforming packaging.

10. (1) The Board may authorize the use of a non-conforming packaging if—

(a) conformity with the relevant requirements of these Regulations is in the opinion of the Board impracticable; and

(b) suitable measures to compensate for the known or the anticipated non-conformities are available and the Board believes that the overall levels of safety in transport and in stowage is at least equivalent to that which would have been provided if all the relevant requirements of these Regulations had been met.

(2) An application for authorization to use non-conforming packaging under subregulation (1) shall include a written statement of—

(a) the manner and degree to which the packaging does not conform to the relevant requirements of these Regulations;

(b) the facts on which the applicant bases his belief that compliance with the relevant requirements of these Regulations would be impracticable;

(c) the details of all measures that are proposed to be taken to compensate for the known or anticipated non-conformities; and

(d) any additional information that the Board deems necessary to evaluate the application.

(3) An authorization issued by the Board pursuant to subregulation (1) shall be in writing and shall be subject to such terms and conditions as the Board deems necessary in the interests of health, safety, security and the environment.

Additional requirements for packaging containing materials with dangerous properties, in addition to radioactive properties.

11. A packaging to be used for the transport of radioactive material, nuclear material or prescribed substance having dangerous properties, in addition to radioactive properties, shall comply with the following additional requirements:-

(a) the package design shall take into account all the relevant dangerous properties, including explosiveness, flammability, pyrophoricity, toxicity and corrosiveness; and

(b) the package design shall take into account the formation of other dangerous substances that may result from the reaction between the radioactive content of the package and the atmosphere or water in the event of any damage to the containment system.

Additional requirements for packaging to be transported by air.

12. A packaging to be used for the transport of radioactive material, nuclear material or prescribed substance by air shall comply with the following additional requirements:

(a) the temperature of the accessible surface of the package shall not exceed 50° C at an ambient temperature of 38° C with no account taken for insolation;

(b) the integrity of the containment system of the package shall not be impaired if they were exposed to ambient temperatures ranging from −40° C to +55° C; and

(c) if the packaging is designed to be used for the transport of radioactive material, nuclear material or prescribed substance in liquid state, it shall be so designed as to withstand, without leakage, an internal pressure which produces a pressure differential of not less than 95 kilopascals (kPa).

Additional requirements for packaging containing fissile material.

13. A packaging to be used for the transport of fissile material shall comply with the following additional requirements under the normal conditions of transport:

(a) neither the volume of the package nor any of its associated spacing on the basis of which the criticality of the package was assessed shall suffer more than 5% reduction;

(b) the configuration of the fissile material and the geometry of the containment system of the package shall not be significantly altered so as to lead to an unacceptable increase in the neutron multiplication;

(c) if any physical defect to the package should occur, such defect shall not permit the entry of a 10 centimetres (cm) cube;

(d) water shall not leak into or out of any part of the package; and

(e) the package shall remain subcritical.

The use of overpack.

14. An overpack may be used by a consignor for the purpose of consolidating two or more packages into one handling unit for convenience of handling, stowage and carriage.

Chapter 2—Content Limits for Packages

Content limits for excepted package.

15. (1) An excepted package shall not contain an activity greater than—

(a) the limits specified in columns (B) and (C) of the Tenth Schedule where the radioactive material, nuclear material or prescribed substance is enclosed in or forms a component part of an instrument or other manufactured article; or

(b) the limits specified in column (D) of the Tenth Schedule where the radioactive material, nuclear material or prescribed substance is not enclosed in or does not form a component part of an instrument or other manufactured article.

(2) An excepted package may contain any quantity of such article manufactured of unirradiated natural uranium, unirradiated depleted uranium or unirradiated natural thorium provided that the outer surface of the uranium or thorium is enclosed in an inactive sheath made of metal or some other substantial materials.

(3) Without prejudice to subregulation (1), an excepted package may contain fissile material if it contains—

(a) not more than 15 g of fissile material, provided that the smallest external dimension of each excepted package is not less than 10 cm; or

(b) a homogeneous hydrogeneous solution or a mixture of fissile materials and if the radioactive contents do not exceed the limits of the values of the parameters specified in the Thirteenth Schedule;

(c) not more than 1% by mass of uranium enriched in uranium−235 and a total plutonium and uranium−233 content not exceeding 1% of the mass of uranium−235, provided that the fissile material is distributed essentially homogenously throughout the material and provided further that if uranium−235 is present in metallic, oxide or carbides forms, it shall not form a lattice arrangement within the package; or

(d) not more than 5 g of fissile material in any 10 litre volume, provided that the excepted package maintains the limitations on fissile material distribution under conditions likely to be encountered in the normal conditions of transport; or

(e) not more than 1 kilogram of total plutonium, provided that the content of plutonium−239 or plutonium−241 or their combination does not exceed 20% by mass; or

(f) not more than 2% by mass of liquid solutions of uranyl nitrate enriched in uranium−235, provided that the total plutonium and uranium−233 content does not exceed 0.1% of the mass of uranium−235, and with a minimum nitrogen to uranium atomic ratio (N/U) of 2.

(4) For unpackaged fissile material, the quantity limitation specified in subregulation (3) shall apply to the consignment being carried in or on a conveyance.

Content limits for industrial package.

16. The radioactive content of an industrial package containing LSA or SCO shall be so restricted that—

(a) the radiation level at 3 metres (m) from the unshielded material or object or collection of objects does not exceed 10 millisieverts per hour (mSv/h); and

(b) the activity in a single package shall not exceed the limit for conveyance specified in the Eleventh Schedule.

Content limits for Type A package.

17. (1) The radioactive content of a Type A package shall not be greater than A_1 for a special form radioactive material or A_2 for all other forms of radioactive material, nuclear material or prescribed substance.

(2) For the purpose of these Regulations the values of A_1 and A_2 shall be as specified in the Ninth Schedule.

Content limits for Type B package.

18. A Type B(U) package or Type B(M) package shall not contain—

(a) activity greater than that which is authorized for the package design;

(b) radionuclides different from that which is authorized for the package design; and

(c) radioactive material, nuclear material or prescribed substance in a form or a physical or chemical state different from that which is authorized for the package design.

Content limits for packaging containing fissible material.

19. (1) All packagings containing fissile material shall comply with the applicable activity limits for respective packages as specified in regulations 15, 16, 17 and 18.

(2) A packaging containing fissile material shall not contain—

(a) a mass of fissile material greater than that which is authorized for the package design;

(b) any fissile material different from that which is authorized for the package design; and

(c) any fissile material in a form, physical state or chemical state, or in a spatial arrangement different from that which is authorized for the package design.

(3) The fissile material content of a package shall be restricted such that the package remains subcritical under any or all of the following conditions:

(a) the package is damaged or undamaged;

(b) water leaks into or out of all voids of the package including those within the containment system;

(c) maximum neutron multiplication under the configuration of the fissile material and moderator within the package;

(d) maximum neutron reflection if the package were fully enclosed by an envelope of water 20 cm thick or its equivalent or such greater neutron reflection as may additionally be reflected by the material of the package;

(e) maximum neutron multiplication under new configuration or moderation of the package following rearrangement of the fissile material within the package or rearrangement due to material losses from the package; and

(f) maximum neutron reflection if the package were fully enclosed by an envelope of water 20 cm thick or its equivalent or such greater neutron reflection as may additionally be reflected by the material of the package following rearrangement of the fissile material or moderator within the package or rearrangement due to material losses from the package.

(4) The fissile material content of a package shall be restricted such that if an array of "N" such packages were stacked together in any arrangement, the stack remains subcritical.

(5) The value of "N" shall be derived such that if "5N" undamaged packages with nothing in between the packages and "2N" damaged packages with hydrogenous moderation between the damaged packages to the extent that it would result in the greatest neutron multiplication were stacked together in any arrangement and the stack is closely reflected on all sides by an envelope of water 20 cm thick or its equivalent the resulting neutron reflection does not cause criticality to the stack.

(6) Subcriticality evaluation of a package containing irradiated fissile material shall be based on the actual irradiation experience, taking into account the significant variation in composition of the fissile material.

(7) Subcriticality evaluation of a package containing irradiated fissile material of unknown irradiation experience shall be based on the following assumptions:

(a) the material is regarded as unirradiated if its neutron multiplication decreases with irradiation; and

(b) the material is regarded as irradiated to the maximum neutron multiplication if its neutron multiplication increases with irradiation.

(8) Subcriticality evaluation of a package containing unspecified fissile material, such as residues or scrap, whose fissile composition, mass, concentration, moderation ratio or density is not known or cannot be identified, shall be based on the

assumption that each parameter that is not known has the value which gives the maximum neutron multiplication under normal conditions of transport.

Requirement for special form radioactive material.

20. (1) The design of a special form radioactive material shall require the approval of the Board.

(2) Radioactive material, nuclear material or prescribed substance shall not be transported in a package as a special form radioactive material unless it is so designed that it would satisfy the following requirements:

(a) at least one of its dimensions is not less than 5 millimetres (mm);

(b) it would not break or shatter if it were subjected to—

(i) the Impact Test, the Percussion Test and the Bending Test as specified in Part II of the Seventh Schedule; or

(ii) any other equivalent tests approved by the Board;

(c) it would not melt or disperse if it were subjected to—

(i) the Heat Test as specified in Part II of the Seventh Schedule; or

(ii) any other equivalent tests approved by the Board;

(d) the activity in the water if it were subjected to—

(i) the Leaching Test specified in Part II of the Seventh Schedule, would not exceed 2 kilo-becquerels (kBq); or

(ii) any other equivalent tests approved by the Board for sealed sources, would not exceed the limit set by the Board; and

(e) when a sealed capsule constitutes part of a special form radioactive material, the capsule is so constructed that it can be opened only by destroying it.

Chapter 3—Limits on Radiation Levels on the External Surface of Packages and Overpacks

Limit on radiation level on external surface of excepted package.

21. The radiation level at any point on the external surface of an excepted package shall not exceed 5 microsieverts per hour (μSv/h).

Limit on radiation level on external surface of package and overpack.

22. (1) The radiation level at any point on the external surface of an overpack or of a package other than an excepted package shall not exceed 2 mSv/h.

(2) Notwithstanding subregulation (1), the radiation level at any point on the external surface of a package or an overpack to be transported under exclusive use shall not exceed 10 mSv/h.

Chapter 4—Limits on Contamination Levels on Packages and Overpacks

Limit for non-fixed contamination on the external or internal surface of package or overpack.

23. (1) The non-fixed contamination on the external surface of a package shall be kept as low as is practicable and, under conditions likely to be encountered in the normal conditions of transport, shall not exceed the levels specified in the Twelfth Schedule.

(2) In the case of a freight container or an overpack, the level of the non-fixed contamination on the external or the internal surfaces shall not exceed the limits specified in the Twelfth Schedule.

Chapter 5—Limits on Transport Indices on Packages and Overpacks

Transport index limit for package or overpack.

24. Except for a consignment to be transported under exclusive use or special arrangement, the transport index (TI) of any individual package or overpack shall not exceed 10.

Chapter 6—Marking, Labelling and Placarding

Marking of package.

25. (1) Each package of gross weight exceeding 50 kg shall have its permissible gross weight legibly and durably marked on the outside of the package.

(2) Each package which conforms to a Type A package design shall be legibly and durably marked on the outside of the package with the marking "TYPE A".

(3) Each package which conforms to the requirements specified in regulation 8 shall be legibly and durably marked on the outside of the package with—

(a) the identification mark assigned to that design by the Board;

(b) a serial number to identify each packaging which conforms to that design; and

(c) the marking "TYPE B(U)" for a Type B(U) package design or the marking "TYPE B(M)" for a Type B(M) package design.

(4) Each package which conforms to a Type B(U) or Type B(M) package design shall be conspicuously and durably marked with a trefoil symbol—

(a) which shall conform to the model specified in Figure 1 of the Eighteenth Schedule;

(b) which shall be placed on the outside of the package by embossing, stamping or other means; and

(c) which shall be resistant to fire and water.

Labelling of package and overpack.

26. (1) Each package, other than an excepted package, and each overpack, tank or freight container shall have labels which conform to the labels specified in Figure 2, 3 or 4 of the Eighteenth Schedule, according to the appropriate category.

(2) The labels shall be affixed to the external side of two opposite sides of a package or an overpack, or to the external side of all the four sides of a freight container or tank.

(3) Expected packages shall be labelled with the marking "Radioactive" on the internal surface of the package as a warning of the existence of radioactive material, nuclear material or prescribed substance and the warning shall be clearly visible on opening the package.

(4) The requirement of subregulation (3) need not be complied with if—

(a) the radioactive content of the package already bears the marking "Radioactive"; or

(b) the excepted package contains any manufactured article in which the radioactive content consists solely of unirradiated natural uranium, unirradiated depleted uranium or unirradiated natural thorium.

(5) Any labels which do not relate to the contents shall be removed or otherwise rendered invisible.

Information requirements on labels.

27. (1) Each label shall contain information on the radioactive content, activity and transport index of the labelled package.

(2) The respective symbols of radionuclides as specified in column (A) of Table I of the Ninth Schedule shall be used for the purpose of describing the radioactive content other than LSA-I.

(3) For mixtures of radionuclides—

(a) the respective symbols of the most restrictive nuclides must be be listed to the extent the space permits; and

(b) if inclusive of the group of LSA or SCO, it shall be shown by using "LSA-II", LSA-III", "SCO-I" or "SCO-II", as appropriate, following the symbol of the radionuclide.

(4) For LSA-I, the symbol "LSA-I" shall be used.

(5) The maximum activity of the radioactive contents during transport, expressed in units of becquerels (Bq) using the appropriate SI prefix as specified in the Sixteenth Schedule shall be used for the purpose of describing the activity, but for a fissile material, the mass in units of grams *(g)*, or multiples thereof, may be used.

(6) For overpacks, tanks and freight containers, the "contents" and "activity" entries on the label shall bear the information required in subregulations (2), (3), (4) and (5), totalled together

for the entire contents of the overpacks, tanks or the freight containers.

(7) For overpacks or freight containers containing mixed loads of packages with different radionuclides, the "content" and "activity" entries may simply read "see transport documents".

(8) Each package in category II-YELLOW or III-YELLOW shall have its transport index marked on its label.

Placarding of freight container or tank.

28. (1) A tank or a large freight container containing packages other than excepted packages, shall bear four placards which shall conform with the model specified in Figure 5 of the Eighteenth Schedule and which shall be affixed in a vertical orientation to each side wall and each end wall of the freight container or tank; and any placards which do not relate to the contents shall be removed or otherwise rendered invisible.

(2) As an alternative to the use of a label and a placard, it is permitted to use only labels as shown in Figures 2, 3 and 4 provided that they are enlarged so as to comply with the minimum dimensions as specified in Figure 5 of the Eighteenth Schedule.

(3) Where the consignment in the freight container or tank is—

(a) unpackaged LSA-I; or

(b) SCO-I; or

(c) a consignment of a single United Nations Number commodity as set out in column (B) of the Fifteenth Schedule to be transported under exclusive use,

the appropriate United Nations Number as specified in column (A) of the Fifteenth Schedule shall also be displayed in black digits of not less than 65 mm. high—

(aa) in the lower half of

(i) the placard specified in Figure 5 of the Eighteenth Schedule; or

(ii) the enlarged labels, if enlarged labels are used,

against the white background; or

(bb) on the placard as specified in Figure 6 of the Eighteenth Schedule which shall be affixed immediately adjacent to either the main placard or the enlarged label, on all four sides of the freight container or tank.

Design of labels and placards.

29. The labels and placards required by these Regulations shall conform to the appropriate designs specified in Figures 1, 2, 3, 4, 5 and 6 of the Eighteenth Schedule and shall conform to the colours specified in Figures 2, 3, 4, 5 and 6 of the Eighteenth Schedule.

Chapter 7—Categorisation of Packages and Overpacks

Categorisation of packages and overpacks.

30. (1) All packages and overpacks to be transported shall be categorised into category I-WHITE, II-YELLOW or III-YELLOW in accordance with the conditions specified in the Seventeenth Schedule.

(2) In determining the appropriate category of a package—

(a) both the transport index and radiation level on the surface of the package shall be determined and where the transport index satisfies the condition for one category but the surface radiation level satisfies the condition for a different category, the package shall be assigned the category which is higher; and

(b) category I-WHITE, II-YELLOW and III-YELLOW shall be regarded as the lowest, medium and highest category respectively for the purpose of paragraph *(a)*.

(3) Packages to be transported under exclusive use or a special arrangement or overpacks containing packages to be transported under exclusive use or a special arrangement shall be assigned to category III-YELLOW.

PART IV

RESPONSIBILITIES IN TRANSPORT OF PACKAGES

Chapter 1—General

Prohibition.

31. (1) Without prejudice to the requirements of subregulation (1) of regulation 10, no person shall transport or cause to be transported any radioactive material, nuclear material or prescribed substance unless—

(a) it is packed in a packaging whose design meets all the requirements of these Regulations; and

(b) the consignment is packed, marked, labelled, categorised and placarded in accordance with all the requirements of these Regulations.

(2) No person shall transmit any radioactive material, nuclear material or prescribed substance by post.

Transport of other goods in the same package.

32. (1) A package shall not contain any item other than its radioactive content.

(2) Notwithstanding subregulation (1)—

(a) a package may contain such articles or documents which are necessary for the safe use of its radioactive content provided that there is no interaction among the articles or documents and between them and the packaging or its radioactive contents which would reduce the safety of the package;

(b) a package which contains LSA or SCO may contain other items therein provided that there is no interaction among items and between them and the packaging or its radioactive contents which would reduce the safety of the package.

Transport of other goods together with packages.

33. A person may transport other goods together with a package in the same conveyance under exclusive use provided that the arrangements are controlled only by the consignor and it is not prohibited by other regulations.

Transport of material having dangerous properties.

34. In addition to the radioactive properties, any other dangerous properties of the radioactive contents, including explosiveness, flammability, pyrophoricity, toxicity and corrosiveness, shall be taken into account in preparing the package and during transport.

Transport of non-conforming package.

35. (1) A consignment of any non-conforming package authorized by the Board under regulation 10 shall not be transported except under a special arrangement approved by the Board.

(2) Transportation of a non-conforming package under special arrangement which involves international transboundary movement shall require multilateral approval.

Requirements for transport of empty package.

36. An empty packaging which had previously been used for the transport of radioactive material, nuclear material or prescribed substance may be transported as an expected package provided that—

(a) it is 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 thousand times the levels specified in the Twelfth Schedule for excepted packages; and

(d) any labels or placards which may have been displayed on it in compliance with the requirements of Chapter 6 of PART III are removed or otherwise rendered invisible.

Reuse of tank.

37. A tank which has been used for the transport of radioactive material, nuclear material or prescribed substance shall not be used for the storage or transport of other goods unless it is fully decontaminated.

Notification of loss.

38. In the event of loss or suspected loss of a consignment or part of the consignment, the consignor, carrier or consignee shall jointly or severally forthwith notify the Board of such loss.

39. Any package opened on customs instructions shall be restored by the consignee or consignor or their agents to the conditions which comply with these Regulations for subsequent transportation to its final destination. Customs inspections.

40. In cases of non-delivery where neither the consignor nor the consignee can be identified, whoever is in possession of the package shall ensure that it be placed in a safe location and shall notify the Board immediately. Non-delivery.

Chapter 2—Responsibilities of Consignors

41. The consignor shall ensure that all packages or overpacks comply with all the requirements as specified in PART III of these Regulations before the packages are presented for transport. Packages presented for transport shall comply with PART III.

42. (1) The consignor shall ensure that all packages containing fissile material comply with all the relevant requirements of these Regulations. Control of packages containing fissile material.

(2) The consignor shall ensure that fissile material is packed and transported in such a manner that its subcriticality is maintained under all conditions of transport.

(3) The consignor shall ensure that the following contingencies are considered in preparing the package and in transport:

(a) water leaking into or out of the package;

(b) the loss of efficiency of built-in neutron absorbers or moderators;

(c) the possible rearrangement of the fissile material within the package;

(d) the possible reduction of spaces between the packaging and the radioactive content;

(e) the package becoming immersed in water or buried in snow; and

(f) the possible effects of changes in temperature.

43. (1) If the LSA or the SCO is to be transported in an industrial package, the consignor shall ensure that it is packed in a package with the appropriate integrity level as specified in the Fourteenth Schedule. Control of LSA and SCO.

(2) The consignor shall ensure that the total activity of an LSA or SCO in any single conveyance does not exceed the limits specified in the Eleventh Schedule.

(3) The consignor may cause LSA-I (other than ores containing naturally occurring radionuclides) or, subject to subregulation (4), SCO-I to be transported unpackaged if—

(a) the unpackaged material does not escape from the conveyance and the integrity of the shielding is not affected under the normal conditions of transport; and

(b) the conveyance is under exclusive use.

(4) For SCO-I, the requirement specified in paragraph *(b)* of subregulation (3) shall only apply if—

(a) the accessible and inaccessible surface contamination is more than 4 Bq/cm^2 for beta and gamma emitters and low toxicity alpha emiters or 0.4 Bq/cm^2 for all other alpha emitters; and

(b) it is suspected that the non-fixed contamination on the inaccessible surface is more than 4 Bq/cm^2 for beta and gamma emitters and low toxicity alpha emitters or 0.4 Bq/cm^2 for all other alpha emitters.

(5) The consignor shall ensure that LSA or SCO which is or contains fissile material is packed and transported in accordance with all the applicable requirements of these Regulations.

Control of package in category I-WHITE.

44. The consignor shall ensure that—

(a) the radiation level at any point on the external surface of a package in categori I-WHITE does not exceed 5 μSv/h; and

(b) the transport index of a package in category I-WHITE does not exceed 0.

Control of package in category II-YELLOW.

45. The consignor shall ensure that—

(a) the radiation level at any point on the external surface of a package in category II-YELLOW does not exceed 0.5 mSv/h; and

(b) the transport index of a package in category II-YELLOW does not exceed 1.

Control of package in category III-YELLOW.

46. The consignor shall ensure that—

(a) the radiation level at any point on the external surface of a package in category III-YELLOW does not exceed 2 mSv/h; and

(b) the transport index of a package in category III-YELLOW does not exceed 10.

Control of package in category III-YELLOW under exclusive use.

47. (1) Notwithstanding regulation 46, the consignor shall ensure that the radiation level at any point on the external surface of a package in category III-YELLOW to be transported under exclusive use does not exceed 10 mSv/h.

(2) Any package whose transport index is greater than 10 shall be transported only under exclusive use.

Transport document.

48. (1) The consignor shall ensure that a transport document is prepared for each consignment.

(2) The transport document shall contain the following information, as applicable, in the order given:

(a) the proper shipping name, as specified in column (B) of the Fifteenth Schedule;

(b) the United Nations Class Number "7";

(c) the words "RADIOACTIVE MATERIAL", unless those words are contained in the proper shipping name;

(d) the United Nations Number assigned to the material as specified in column (A) of the Fifteenth Schedule;

(e) for LSA, the group notation, namely, "LSA–I", "LSA–II" or "LSA–III", as appropriate;

(f) for SCO, the group notation, namely, "SCO–I" or "SCO–II", as appropriate;

(g) the name or symbol of each radionuclide as specified in column (A) of Table I of the Ninth Schedule;

(h) a description of the physical and chemical form of the material, or a notation that the material is a special form radioactive material;

(i) the maximum activity of the radioactive contents during transport expressed in units of becquerels (Bq) with the appropriate SI prefix as specified in the Sixteenth Schedule, but for fissile material, the total mass of the fissile material in units of grams (g), or appropriate multiples thereof, may be used in place of the activity;

(j) the category of the package, that is, I–WHITE, II–YELLOW or III–YELLOW;

(k) the transport index (for categories II–YELLOW and III–YELLOW only);

(l) for all items and materials transported under the provisions for an excepted package, the description "RADIOACTIVE MATERIAL, EXCEPTED PACKAGE", and the proper shipping name of the substance or article being transported and the United Nations Number as specified in the column (A) of the Fifteenth Schedule;

(m) for a consignment of fissile material in an excepted package the words "FISSILE EXCEPTED";

(n) the identification mark of the Board or each competent authority approval certificate (special form radioactive material, special arrangement, package design or shipment) applicable to the consignment;

(o) for consignments of packages in an overpack or a freight container, a detailed statement of the contents of each package within the overpack or the freight container and, where appropriate, of each overpack or freight container in the consignment (and if packages are to be removed from the overpack or freight container at a point of intermediate unloading, the appropriate transport document shall be made available); and

(p) where a consignment to be shipped under exclusive use, the statement "EXCLUSIVE USE SHIPMENT".

Declaration.

49. (1) The consignor shall include in the transport document a declaration in the following terms or in terms having an equivalent meaning:

"I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name and are classified, packed, marked and labelled, and are in all respects in proper condition for transport by _____ according to the applicable Malaysian and international regulations.".

(2) If the intent of the declaration is already a condition of transport within a particular international convention to which Malaysia is a party, the consignor need not produce a declaration as in subregulation (1) for that part of the transport covered by the convention.

(3) The declaration shall be signed and dated by the consignor.

Old labels.

50. When an empty packaging which had previously contained radioactive material, nuclear material or prescribed substance is transported as an excepted package, the consignor shall remove old labels or otherwise render them invisible.

Information for carrier.

51. (1) The consignor shall provide in the transport documents instructions regarding actions, if any, that are required to be taken by the carrier and such instructions shall include at least the following:

(a) the supplementary operational instructions for loading, stowage, transport, handling, and unloading of the package, overpack, freight container or tank including any special stowage provisions for the safe dissipation of heat in compliance with paragraph *(a)* of subregulation (2) of regulation 64 or a statement that no such instructions are necessary;

(b) any restriction on the mode of transport or conveyance and any necessary routing instructions; or

(c) an emergency plan appropriate to the consignment.

(2) The applicable competent authority certificates need not accompany the consignment, but the consignor shall be prepared to provide them to the carrier before loading, unloading and any trans-shipment.

Consignor's notification.

52. (1) If a package is transported for the first time after the package design approval certificate is issued, the consignor shall ensure that a copy of the certificate is submitted to the Board or the competent authority of each country through or into which the package is to be transported, before the first shipment is made.

(2) The consignor shall notify the Board and the competent authority of each country through or into which the consignment is to be transported if the following is involved:

(a) a Type B(U) package containing radioactive material, nuclear material or prescribed substance with an activity greater than 3×10^3 A_1 or 3×10^3 A_2, as appropriate, or 1000 TBq whichever is the lower;

(b) a Type B(M) package; or

(c) any shipment under a special arrangement.

(3) The notification mentioned in subregulation (2) shall be in the hands of the Board or each competent authority at least 7 days prior to the commencement of the shipment, but the consignor is not required to send the notification if the required information has been included in the application for approval of the shipment under regulation 81.

(4) The notification shall include—

(a) sufficient information, including all applicable certificate numbers and identification marks, to enable the identification of the package;

(b) information on the date of the shipment, the expected date of arrival and the proposed routing;

(c) the name of the radioactive material, nuclear material or prescribed substance;

(d) a description of the physical and chemical form of the radioactive material, nuclear material or prescribed substance or whether it is a special form radioactive material; and

(e) the maximum activity of the radioactive contents during transport expressed in units of becquerels (Bq) with an appropriate SI prefix as specified in the Sixteenth Schedule, except for fissile material, where the mass in units of grams (g), or multiples thereof, may be used in place of the activity.

Package's certificate and operating instructions.

53. Before making any shipment, the consignor shall ensure that he has—

(a) a copy of every certificate applicable to the package; and

(b) a copy of the operating instructions with regard to the proper closing of the package and other preparations for the shipment.

Special inspection before first shipment.

54. Before the first shipment of any package, the following requirements shall be fulfilled:

(a) if the design pressure of the containment system exceeds 35 kPa, the consignor shall ensure that the containment system of the package conforms to the approved design requirements relating to the capability of that system to maintain its integrity under pressure;

(b) for each Type B package and for each packaging containing fissile material, the consignor shall ensure that the effectiveness of its shielding, containment system, and, where necessary, the heat transfer characteristics, are within the limits applicable to or specified for the approved design; and

(c) for each packaging containing fissile material, where neutron poisons are included as components of the package, the consignor shall cause tests to be performed to confirm the presence and distribution of those neutron poisons.

Inspection before transport.

55. (1) The consignor shall ensure that before any consignment is transported the following items are checked—

(a) all closures, valves or other openings of the package are properly closed in accordance with instructions set out by the designer, manufacturer or distributor of the package;

(b) any feature of the package that could be used as a point of attachment for lifting purposes but which is not designed for that purpose has been removed or otherwise rendered unusable;

(c) in the case of a Type B(M) package or Type B(U) package, thermal and pressure equilibria have been attained;

(d) for each Type B package and for each packaging containing fissile material, all the requirements specified in the approval certificates and the relevant provisions of these Regulations have been satisfied;

(e) the consignee has been advised of the transport of the material to him, has made reasonable arrangements for receipt of the material, and has received a copy of any applicable package design approval certificate; and

(f) the carrier has been advised of the nature of the material, and has received a copy of the package design approval certificate and other information to ensure the safety of the package.

Chapter 3—Responsibilities of Carriers

Transport index limit for conveyance.

56. (1) The carrier shall ensure that the total number of packages, tanks, freight containers or overpacks aboard a single conveyance is limited such that the total sum of the transport indices aboard the conveyance does not exceed the respective values specified in TABLE IV of the Eighth Schedule.

(2) Subregulation (1) shall not apply to consignments of LSA–I.

Limit for non-fixed and fixed contamination of conveyance.

57. (1) The carrier shall ensure that the non-fixed contamination of a conveyance or equipment or part thereof does not exceed the limits specified in the Twelfth Schedule and the radiation level on any surface resulting from fixed contamination does not exceed 5 μSv/h.

(2) Any conveyance or equipment or part thereof which has become contaminated above the limits specified in the Twelfth Schedule or whose radiation level exceeds 5 μSv/h shall not be reused unless it is decontaminated by a qualified person and the residual radiation level on any surface resulting from fixed contamination after decontamination does not exceed 5 μSv/h.

(3) A conveyance or an equipment routinely used for the carriage of radioactive material, nuclear material or prescribed substance shall be periodically checked to determine the level of contamination; and the frequency of such checks shall be related to the likelihood of contamination.

(4) The radiation level under conditions likely to be encountered in the normal conditions of transport shall not exceed 2 mSv/h at any point on, and 0.1 mSv/h at 2 m from, the external surface of the conveyance.

(5) Subregulation (1) shall not apply to an overpack, freight container or conveyance dedicated to the transport of LSA or SCO under exclusive use.

Limits of radiation level for conveyance under exclusive use.

58. (1) For a conveyance under exclusive use the carrier shall ensure that the radiation level at any point on the outer surface of the conveyance or, in the case of an open conveyance, at any point on the vertical planes projected from the outer edges of the conveyance, on the upper surface of the load, and on the lower external surface of the conveyance does not exceed 2 mSv/h.

(2) Notwithstanding subregulation (1), the limit of 2 mSv/h specified in that subregulation may be exceeded only if—

(a) the conveyance is equipped with an enclosure which, during the normal conditions of transport, prevents unauthorized persons from entering it;

(b) measures are taken to secure the package or overpack so that its position within the conveyance remains fixed during the normal conditions of transport; and

(c) there is no loading or unloading of the consignment between the beginning and end of the shipment.

(3) The radiation level shall not exceed 0.1 mSv/h at any point 2 m from the outer lateral surfaces of the conveyance, or, if the load is transported in an open conveyance, at any point 2 m from the vertical planes projected from the outer edges of the conveyance.

(4) In the case of a road vehicle used as a conveyance the radiation level at any normally occupied position shall not exceed 0.02 mSv/h.

Steps to be taken in case of accident.

59. In the event of an accident during the transport of a package, the carrier shall take steps to implement the emergency plan provided by the consignors.

Steps to be taken on discovering damage or leakage.

60. (1) If it is suspected or evident that the package is damaged or leaking, the carrier shall—

(a) immediately inform the Board;

(b) immediately restrict access to the package; and

(c) make assessment on the extent of resulting contamination and the radiation level.

(2) The scope of the assessment specified in paragraph *(c)* of subregulation (1) shall include the package, the conveyance, the adjacent areas, the store and, if necessary, all other materials which have been carried in the same conveyance or stored together.

(3) Additional steps to minimize the radiation risks to persons shall be taken, when necessary, in accordance with provisions established by the Board, the competent authority or international organizations.

Package not to be forwarded.

61. The carrier shall ensure that a leaking package or a package with physical defect which results in the limits for contamination and radiation level on its external surface to be exceeded—

(a) is not removed except under the supervision of the Board or any person authorized by the Board; and

(b) is not forwarded until it is decontaminated, repaired or reconditioned.

The use of conveyance.

62. (1) The carrier shall ensure that the conveyance used for the transport of packages complies with the requirements specified in regulations 56, 57 and 58.

(2) Category II–YELLOW or Category III–YELLOW packages or overpacks shall not be carried in compartments occupied by passengers, except those exclusively reserved for couriers specially authorized to accompany the packages or overpacks.

Package with transport index more than 10.

63. The carrier shall ensure that—

(a) a package having a transport index greater than 10 or having surface radiation level greater than 2 mSv/h is transported only under exclusive use or special arrangement; and

(b) the sum of transport indices in a single freight container or conveyance under exclusive use does not exceed the limits specified in Table IV of the Eighth Schedule.

Stowing for transport.

64. (1) The carrier shall ensure that a consignment is securely stowed.

(2) A package or an overpack may be carried among packaged general cargo without any special stowage provisions if—

(a) its surface heat flux does not exceed 15 watts per square metre (W/m^2) and the immediate surrounding cargo is not in sacks or bags; and

(b) no specific requirements are imposed in the approval certificate;

(3) The carrier may mix packages with different kinds of radioactive contents, including fissile material, and may mix different kinds of packages with different transport indices during transport without specific approval from the Board except in the case of a shipment under special arrangement in which case specific authorization shall be obtained from the Board.

(4) The carrier shall ensure that during loading of tanks and freight containers and accumulation of packages, overpacks, tanks and freight containers—

(a) the total number of packages, overpacks, tanks and freight containers aboard a single conveyance is limited such that the total sum of the transport indices aboard the conveyance does not exceed the values specified in Table IV of the Eighth Schedule except for consignments of LSA–I in which case there shall be no limit on the sum of the transport indices; and

(b) the radiation level under conditions likely to be encountered in the normal conditions of transport does not exceed 2 mSv/h at any point on, and 0.1 mSv/h at 2 m from, the external surface of the conveyance.

Storage in transit.

65. (1) The carrier shall ensure that—

(a) the number of category II–YELLOW and category III–YELLOW packages, overpacks, tanks, freight containers and conveyances grouped together in any one storage area, such as the transit area, terminal building, store-room or assembly yard, is limited such that the total sum of their transport indices in any individual group of such packages, overpacks, tanks, freight containers or conveyances does not exceed 50; and

(b) groups of such packages, overpacks, tanks, freight containers or conveyances are stored so as to maintain a spacing of at least 6 m between a group of packages, overpacks, tanks freight containers or conveyances and other groups of such packages, overpacks, tanks, freight containers or conveyances.

(2) Where the transport index of a single package, overpack, tank or freight container exceeds 50 or the total transport index on board a conveyance exceeds 50, as specified and permitted in Table IV of the Eighth Schedule, the carrier shall ensure that such single package, overpack, tank, freight container or conveyance is stored such that there is a spacing of at least 6 m between it and—

(a) another such single package, overpack, tank, freight container or conveyance; or

(b) other groups of packages, overpacks, tanks or freight containers or other conveyance.

(3) The provisions of subregulations (1) and (2) do not apply to a consignment containing LSA–I.

Transport by rail and road.

66. (1) The carrier shall display the placard specified in Figure 5 of the Eighteenth Schedule—

(a) on the external side of each of the two lateral walls, in the case of a rail vehicle; or

(b) on the external side of each of the lateral walls and on the rear wall, in the case of a road vehicle;

where the rail vehicle or the road vehicle is carrying packages, overpacks, tanks or freight containers labelled with any of the labels as specified in Figure 2, 3 or 4 of the Eighteenth Schedule or is carrying consignments under exclusive use.

(2) Notwithstanding subregulation (1), for rail vehicles or road vehicles without sides, the carrier may affix the placard directly on the consignment-carrying unit, provided that the placard is readily visible, but need not affix any placard where the consignment-carrying unit is a tank or a large freight container which has already been affixed with enlarged labels.

(3) If the vehicle is not carrying any consignment, the carrier shall ensure that placards already affixed to the vehicle are removed or otherwise rendered invisible.

(4) Where the consignment in or on the conveyance is—

(a) unpackaged LSA–I; or

(b) SCO–I; or

(c) a consignment of a single United Nations Number commodity as set out in column (B) of the Fifteenth Schedule to be transported under exclusive use,

the appropriate United Nations Number as specified in column (A) of the Fifteenth Schedule shall also be displayed, in black digits not less than 65 mm high, either in the lower half of the placard as specified in Figure 5 of the Eighteenth Schedule, against the white background, or on the placard specified in Figure 6 of the Eighteenth Schedule.

(5) When the placard as specified in Figure 6 of the Eighteenth Schedule is used for the purpose of subregulation (4), the placard shall be affixed immediately adjacent to the main placard.

(6) The carrier shall ensure that no person other than the driver or his assistant is permitted in road vehicles carrying packages, overpacks, tanks or freight containers bearing category II–YELLOW or category III–YELLOW labels.

Special use vessel.

67. (1) The carrier shall ensure that a package with a surface radiation level greater than 2 mSv/h is not transported in a vessel except under special arrangement or exclusive use.

(2) The transport of consignments by means of a special use vessel need not comply with the requirement of subregulation (1) of regulation 56 if—

(a) there is a radiation protection programme for the shipment approved by the Board or the competent authority of the flag state of the vessel and, if so required, by the competent authority of the country of destination or transit;

(b) the stowage arrangement has been predetermined for the whole voyage, including any consignment to be loaded at ports of call en route; and

(c) the loading, handling and stowage and the unloading of the consignment are supervised by the consignor or the consignee.

Transport by air.

68. (1) The carrier shall ensure that the following are not transported by air:

(a) a vented Type B(M) package;

(b) a package requiring external cooling by an ancillary cooling system;

(c) a package subject to operational controls during transport; and

(d) a package containing liquid pyrophoric materials.

(2) The carrier shall ensure that a package with a surface radiation level greater than 2 mSv/h, is not transported by air except under special arrangement.

(3) A Type B(M) package or a consignment under special arrangement shall not be transported on any passenger aircraft.

Segregation during transport.

69. (1) The carrier shall, during transport, segregate packages, overpacks, freight containers and tanks—

(a) from places occupied by transport workers and members of the public;

(b) from undeveloped photographic film; and

(c) from other dangerous goods.

(2) For the purpose of paragraph *(a)* of subregulation (1), the distance between a package, overpack, tank or freight container and transport workers or members of the public shall be determined such that the annual dose received by them does not exceed 5 mSv for transport workers and 1 mSv for members of the public.

(3) For the purpose of paragraph *(b)* of subregulation (1), the distance between a package, overpack, tank or freight container and undeveloped photographic film shall be determined such that the radiation exposure to the undeveloped photographic film does not exceed 0.1 mSv per consignment of such film.

(4) For the purpose of paragraph *(c)* of subregulation (1), the distance between a package, overpack, tank or freight container and other dangerous goods shall be determined such that it is in compliance with the relevant transport regulations for dangerous goods of each of the countries through or into which the package, overpack, tank or freight container will be transported, and, where applicable, with the regulations of the international transport organisation, as well as these Regulations.

Chapter 4—Responsibilities of Consignees

Examination of the package.

70. (1) A consignee shall, as soon as practicable on receipt of a consignment and before opening it, examine the package for any defects to the package or leakage of its radioactive content.

(2) If the package has or appeared to have defects or its radioactive content is found or appears to be leaking, the consignee shall—

(a) measure the radiation levels on and at 1 m from the external surface of the package; and

(b) measure the activity of the non-fixed contamination on the external surface of the package.

(3) The consignee shall report the result of the measurement carried out pursuant to subregulation (2) to the Board and to the consignor—

(a) within five clear days, if the radiation level exceeds the limits prescribed by these Regulations; and

(b) forthwith, notwithstanding paragraph *(a)*, if the radiation level exceeds 10 mSv/h and 200 μSv/h respectively on and at 1 m from the external surface of the package.

(4) The consignee shall retain records of all observations made pursuant to subregulations (2) and (3) in a form suitable for inspection for a period of at least two years and if requested to do so, provide the Board or a Senior Public Officer with full access to such records.

PART V

ADMINISTRATIVE REQUIREMENTS

Chapter 1—General Requirements

71. The following items shall require the approval of the Board: Items for approval of the Board.

(a) the design of a special form radioactive material;

(b) the design of a Type B package;

(c) the design of a package to be used for the transport of fissile material exceeding the limits specified in subregulation (3) of regulation 15 for excepted packages;

(d) special shipments;

(e) radiation protection programmes for a special use vessel;

(f) special arrangements; and

(g) the assignment of A_1 or A_2 values to individual radionuclides which are not listed in Table I of the Ninth Schedule.

72. Notwithstanding regulation 71, the Board may endorse any approval issued by the competent authority of a foreign country with respect to the items mentioned in paragraphs *(a)*, *(b)*, *(c)*, *(d)*, *(e)*, *(f)* and *(g)* of regulation 71. Endorsement of foreign approval.

73. (1) Any approval of the items specified in paragraphs *(a)*, *(b)* and *(c)* of regulation 71 shall be contingent upon the adequacy of quality assurance. Quality assurance.

(2) Quality assurance shall cover the design, manufacture, testing, documentation, use, maintenance and inspection of all packages or special form radioactive materials.

74. (1) The Board may carry out compliance assurance to ensure that quality assurance is being carried out to the satisfaction of the Board. Compliance assurance

(2) The licensee shall—

(a) provide facilities to the Board in carrying out compliance assurance; and

(b) demonstrate to the Board or any competent authority that—

(i) the construction methods and materials used for the construction of the packaging or the special form radioactive material are in accordance with the approved design specifications; and

(ii) all packagings or special form radioactive materials built to an approved design are maintained so that they continue to comply with all the relevant requirements of these Regulations, even after repeated use.

Chapter 2—Approval For Special Form Radioactive Material

Design of special form radioactive material.

75. An application for approval of a design for special form radioactive material shall include—

(a) a detailed description of the radioactive material, nuclear material or prescribed substance and if a capsule, the content of the capsule with particular reference made to both physical and chemical states;

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

(c) a statement of the results of the tests specified in Part II of the Seventh Schedule, or evidence based on calculations to show that the special form radioactive material meets the relevant requirements of these Regulations; and

(d) evidence of a quality assurance.

Chapter 3—Approval For Package Designs

Design of Type B(U) package.

76. (1) Each design of Type B(U) package shall require the approval of the Board.

(2) An application for approval of a Type B(U) package design shall include—

(a) a detailed description of the proposed radioactive contents with particular reference to its physical and chemical states and the nature of the radiation emitted;

(b) a detailed statement of the design, including certified engineering drawings, schedules of materials and methods of construction to be used;

(c) a statement of the results of the tests specified in Third Schedule or evidence based on calculations or other evidence that the design meets the relevant requirements of these Regulations;

(d) the proposed operating and maintenance instructions for the use of the packaging;

(e) information on the materials used to construct the containment system, its specification and the tests to be made if the packaging is designed to have a maximum normal operating pressure in excess of 100 kPa;

(f) a statement and justification of any assumption made in the safety analysis relating to the characteristics of the fuel where the proposed radioactive content is an irradiated fuel;

(g) any special stowage provisions necessary to ensure the safe dissipation of heat from the package, with consideration given to the various modes of transport and type of conveyance or freight container to be used;

(h) a reproducible illustration not larger than 21 cm by 30 cm showing the make-up of the package; and

(i) evidence of quality assurance.

(3) Where the Type B(U) package is to be used for the transport of fissile material involving international transboundary movement, the design of such package shall require multilateral approval.

77. (1) Each design of Type B(M) package shall require the approval of the Board. Design of Type B(M) package.

(2) An application for the approval of a Type B(M) package design shall include—

(a) all the information required in subregulation (2) of regulation 76 for Type B(U) packages;

(b) a list of the requirements specified in Part II of the Third Schedule which the proposed design does not conform to;

(c) any proposal for supplementary operational controls to be applied during transport which is not specified in these Regulations but are necessary to ensure the safety of the package or to compensate for the deficiencies listed in paragraph *(b)*;

(d) a statement relating to any restrictions on the mode of transport and to any special loading, carriage, unloading or handling procedures; and

(e) the maximum and minimum ambient conditions expected to be encountered during transport and which have been taken into account in the design.

(3) Where the Type B(M) package is to be used for transport involving international transboundary movement, the design of such package shall require multilateral approval.

Package design for fissile material.

78. (1) Each design of a package for the transport of fissile material exceeding the limits specified in subregulation (3) of regulation 15 for excepted packages shall require the approval of the Board.

(2) An application for approval shall include information necessary to satisfy the Board that the design meets all the requirements of these Regulations pertaining to the transport of fissile material and evidence of quality assurance.

(3) Where a package is to be used for the transport of fissile material exceeding the limits specified in subregulation (3) of regulation 15 for excepted packages involving international transboundary movement, the design of such package shall require multilateral approval.

Serial numbers.

79. (1) The manufacturer of a packaging or a special form radioactive material shall assign a serial number to each packaging or special form radioactive material manufactured to a design approved by the Board.

(2) The manufacturer or the maker shall notify the Board of the serial numbers.

(3) The Board shall maintain a register of such serial numbers.

Chapter 4—Approval for Special Shipments

Types of special shipment.

80. (1) The following special shipments shall require approval of the Board or, if it involves international transboundary movement, multilateral approval:

(a) the shipment of a Type B(M) package specially designed to allow controlled intermittent venting;

(b) the shipment of a Type B(M) package containing radioactive material, nuclear material or prescribed substance whose activity is greater than 3×10^3 A_1 or 3×10^3 A_2, as appropriate, or 1000 terabecquerels (TBq), whichever is the lower;

(c) the shipment of packages containing fissile materials if the sum of the transport indices of the packages exceeds 50 as permitted in Table IV of the Eighth Schedule; and

(d) the shipments by a special use vessel.

(2) For the purpose of paragraph *(d)* of subregulation (1), the radiation protection programme for the shipment shall require the approval of the Board or, if it involves international transboundary movement, multilateral approval.

Approval of special shipment.

81. An application for approval of a special shipment shall provide the following information:

(a) the period of time for which the approval is sought;

(b) the actual radioactive contents of the package; the expected modes of transport; the type of conveyance and the probable or the proposed route; and

(c) the details of how the special precautions, special administrative or operational controls, referred to in the package design approval certificates, are to be put into effect.

Approval of shipment under special arrangement.

82. (1) An application for approval of a shipment under special arrangement shall include the information necessary to satisfy the Board that the overall level of safety in transport is at least equivalent to that which would have been provided if all the applicable requirements of these Regulations had been met.

(2) The application shall also include—

(a) a statement why the package cannot be prepared in accordance with the applicable requirements of these Regulations and which part of the regulatory requirements the package does not comply with; and

(b) a statement of any special precautions, special administrative or operational controls which are to be employed during transport to compensate for the non-conformity with the applicable requirements of these Regulations.

(3) Each consignment shipped under a special arrangement shall require multilateral approval if it involves international transboundary movement.

Chapter 5—Approval Certificates

Types of certificate.

83. (1) There shall be five types of approval certificates which may be issued by the Board, namely, approval certificates for—

(a) the design of a special form radioactive material;

(b) the design of all packages, other than expected packages containing fissile material;

(c) the design of Type B packages;

(d) a special shipment; and

(e) a special arrangement.

(2) The package design and special shipment approval certificates may be combined into a single certificate.

Identification mark.

84. Each approval certificate issued by the Board shall be assigned an identification mark and the mark shall be of the following generalized type:

MAL/Number/Type code,

where

(a) "MAL" represents the international vehicle registration identification code of Malaysia;

(b) "Number" represents the number assigned by the Board; and

(c) "Type code" represents the following, used in the order listed:

"AF"	for Type A package design for fissile material;
"B(U)"	for Type B(U) package design;
"B(U)F"	for Type B(U) package design for fissile material;
"B(M)"	for Type B(M) package design;
"B(M)F"	for Type B(M) package design fo fissile material;
"IF"	for industrial package design for fissile material;
"S"	for special form radioactive material;
"T"	for special shipment; and
"X"	for special arrangement.

Chapter 6—Statements

Statement.

85. All statements on the labels, placards, markings and in the transport document shall be in the national language, and in any other language if necessary.

FIRST SCHEDULE

DESIGN REQUIREMENTS FOR EXCEPTED PACKAGINGS

(Regulation 6)

(1) An excepted packaging shall be so designed in relation to its mass, volume and shape that it can be easily and safely handled and transported. It shall be so designed that it can be properly secured in or on the conveyance during transport.

(2) It shall be so designed such that any lifting attachments on the packaging will not fail and if failure of the attachment should occur, the ability of the package to meet other requirements of these Regulations would not be impaired. Assessment shall take into account appropriate safety factors to cover snatch lifting.

(3) Attachments or any other features on the outer surface of the packaging which could be used for lifting shall be designed either to support the mass of the package in accordance with the requirements in paragraph (2) or shall be removable or otherwise rendered incapable of being used during transport.

(4) As far as practicable, the packaging shall be so designed and finished that its external surfaces are free from protruding features and can be easily decontaminated.

(5) As far as practicable, the outer layer of the packaging shall be so designed as to prevent the collection and retention of water.

(6) Any features added to the package at the time of transport which are not part of the package shall not reduce its safety.

(7) It shall be so designed that its integrity is not effected under acceleration, vibration or vibration resonance which may occur under normal conditions of transport. In particular, the effectiveness of the closing devices on the various receptacles as a whole shall not deteriorate and its nuts, bolts and other securing devices shall not become loose or be released unintentionally, even after repeated use.

(8) The materials of the packaging and its components or structures shall be physically and chemically compatible with each other and with the radioactive contents. Account shall be taken of their behaviour under irradiation.

(9) All valves through which the radioactive contents could otherwise escape shall be protected against unauthorized operation.

(10) The packaging, in addition, shall comply with the requirement of regulation 11 if it is to contain material with dangerous properties other than radioactive properties, such as explosiveness, flammability, pyrophoricity, chemical toxicity and corrosiveness.

SECOND SCHEDULE

DESIGN REQUIREMENTS FOR TYPE A PACKAGINGS

(Regulation 7)

(1) A Type A packaging shall meet all the requirements specified in the First Schedule.

(2) The smallest overall external dimension of the packaging shall not be less than 10 cm.

(3) The packaging shall incorporate, on its external surface, a feature, such as a seal, which is not readily breakable and which, while intact, will be evidence that the package has not been opened.

(4) Any tie-down attachments on the packaging shall be so designed that, under both normal and accident conditions of transport, the forces in those attachments shall not impair the ability of the package to meet all the requirements of these Regulations.

(5) The design of the packaging shall take into account the effect of temperature changes ranging from −40°C to 70°C on the components of the packaging Special attention shall be given to the effect of freezing temperatures on the package contents in liquid form and to the potential degradation of packaging materials within a given temperature range.

(6) The design shall include a containment system securely closed by a positive fastening device which cannot be opened unintentionally or by a pressure which may arise from within the package itself.

(7) If the containment system forms a separate unit of the package, it shall be capable of being securely closed by a positive fastening device which is independent of any other part of the package.

(8) The design of any component of the containment system shall take into account, where applicable, the radiolytic decomposition of liquids and other vulnerable materials and the generation of gas by chemical reaction and radiolysis.

(9) The containment system shall retain its radioactive contents under a reduction of ambient pressure to 25 kPa.

(10) All valves, other than pressure relief valves, shall be provided with an enclosure to retain any leakage from the valve.

(11) A radiation shield which encloses a component of the package specified as a part of the containment system shall be so designed as to prevent the unintentional release of that component from the shield. Where the radiation shield and such component within it form a separate unit, the radiation shield shall be capable of being securely closed by a positive fastening device which is independent of any other structure of the packaging.

(12) A Type A package shall be so designed that if it were subjected to the tests to demonstrate its ability to withstand the normal conditions or transport as specified in the Fifth Schedule, it would not—

(a) lose or disperse its radioactive contents; and

(b) lose its shielding intergrity which would result in more than a 20% increase in the radiation level at any point on its external surface.

(13) A Type A packaging to be used for the transport of radioactive liquids shall satisfy the following additional requirements:

(a) the design shall make provisions for ullage to accommodate variations in the temperature of the contents, dynamic effects and filling dynamics;

(b) it shall satisfy the requirements as specified in paragraph (12) except that the height of the drops for the Penetration Test and the Free Drop Test shall be increased to 1.7 m and 9 m respectively; and

(c) the design shall incorporate a containment system composed of primary inner and secondary outer containment components designed to ensure retention of the liquid contents with the secondary outer containment components in case the primary inner components leak, or alternatively, a sufficient absorbent material shall be provided to enable it to absorb twice the volume of its liquid contents and such absorbent material shall be suitably positioned so as to be in contact with the liquid in the event of leakage.

(14) A Type A packaging to be used for the transport of radioactive gases, either compressed or uncompressed, shall meet the additional requirements as specified in subparagraph *(b)* of paragraph (13).

(15) The requirement specified in paragraph (14) shall not apply if the packaging is designed for the transport of—

(a) tritium in gaseous state with an activity not exceeding 40 TBq; or

(b) noble gases in gaseous state with an activity not exceeding A_2.

(16) The packaging in addition, shall comply with the requirement of regulation 12 if it is be carried by air.

THIRD SCHEDULE

DESIGN REQUIREMENTS FOR TYPE B PACKAGINGS

(Regulations 8, 77 (2) *(b)*)

PART I

General Design Requirements for Type B Packagings

(1) A Type B packaging shall meet all the requirements specified in paragraphs (1), (2), (3), (4), (5), (6), (7), (8), (9), (10), and (11) of the Second Schedule.

(2) It shall be so designed that if the package, while containing the maximum allowable radioactive content, were subjected to the tests demonstrating its ability to withstand the accident conditions of transport as specified in the Sixth Schedule, it would retain sufficient shielding to ensure that the radiation level at 1 m from any point on the surface of the package would not exceed 10 mSv/h.

(3) It shall be so designed that, under the ambient conditions, the heat generated within the package by the radioactive content shall not, under normal conditions of transport, adversely affect the integrity of the package to meet all the applicable requirements of these Regulations if it is left unattended for a period of one week.

(4) In complying with the requirement of paragraph (3), particular attention shall be paid to the effects of heat, which—

(a) may alter the arrangement, the geometrical form or the physical state of the radioactive contents or, if the radioactive content is enclosed in a can or a receptacle, cause the can, receptacle or the radioactive content to deform or melt;

(b) may lessen the efficiency of the packaging through diferential thermal expansion, cracking or melting of the radiation shielding material; or

(c) may, in combination with moisture, accelerate corrosion.

TABLE I. Insolation data

Form and location of surface (A)	*Insolation for 12 hours per day* (W/m^2) (B)
Flat surfaces transported horizontally:	
— base	none
— other surface	800
Flat surfaces not transported horizontally:	
— each surface	200[a]
Curved surfaces	400[a]

[a] Alternatively, a sine function may be used, with an absorption coefficient adopted and the effects of possible reflection from neighbouring objects neglected.

(5) It shall be so designed that, under the ambient condition, the temperature on its accessible surfaces shall not exceed 50°C. This requirement shall not apply to a package to be transported under exclusive use.

(6) Without prejudice to the requirement of regulation 12, the temperature of the ambient condition shall be assumed to be at 38°C and the solar insolation condition shall be assumed to be as specified in the Table I for the purpose of requirements specified in paragraphs (3) and (5).

(7) A package which includes thermal protection shall be so designed that such a protection will remain effective after the package is subjected to—

(a) the tests for demonstrating its ability to withstand the normal conditions of transport as specified in the Fifth Schedule; and

(b) a combination of the Mechanical Test Drop I and the Mechanical Test Drop II or the mechanical Test Drop II and the Mechanical Test Drop III, as appropriate, as specified in the Sixth Schedule.

(8) Any thermal protection on the exterior of the package shall not be rendered ineffective by conditions likely to be encountered in the normal or accident conditions of transport and other conditions such as ripping, cutting, skidding, abrasion or rough handling.

(9) It shall be so designed that if it were subjected to the tests for demonstrating its ability to withstand the normal conditions of transport as specified in the Fifth Schedule it would not—

(a) disperse its radioactive content;

(b) lose its radioactive content to more than 10^{-6} A_2 per hour; and

(c) lose its shielding integrity which would result in more than 20% increase in radiation level at any point on its external surface.

(10) It shall be so designed that if it were subjected to—

(a) the tests for demonstrating its ability to withstand the accident conditions of transport, as specified in the Sixth Schedule;

(b) the Mechanical Test Drop II, as specified in the Sixth Schedule;

(c) the Thermal Test, as specified in the Sixth Schedule;

(d) the Water Immersion Test, as specified in the Sixth Schedule; and

(e) either—

(i) the Mechanical Test Drop III, as specified in the Sixth Schedule, for a package with a mass not greater than 500 kg, an overall density not greater than 1000 kilograms per cubic metre (kg/m^3) based on external dimensions and radioactive contents greater than 1000 A_2 not as special form radioactive material; or

(ii) the Mechanical Test Drop I, as specified in the Sixth Schedule, for all other packages,

the accumulated loss of radioactive contents in a period of one week does not exceed 10 A_2 for krypton-85 and does not exceed A_2 for all other radionuclides. The evaluation shall take into account the external contamination limits specified in regulation 23 and in the Twelfth Schedule.

(11) For the purpose of paragraphs (9) and (10), where the radioactive content of a package would be a mixture of different radionuclides, the value of A_2 for the mixture shall be determined in accordance with the method specified in the Ninth Schedule. For krypton-85 the effective A_2 value of 100 TBq may be used.

PART II

Design Requirements for Type B(U) Packagings

(12) A Type B(U) packagings shall meet all the general requirements for Type B packagings specified in Part I.

(13) Its design shall not include a pressure relief system which would allow the release of its radioactive content to the environment.

(14) It shall be so designed that if it were at the maximum operating pressure and subjected to—

(a) the tests for demonstrating its ability to withstand the normal conditions of transport, as specified in the Fifth Schedule; or

(b) the tests for demonstrating its ability to withstand the accident conditions of transport, as specified in the Sixth Schedule,

the level of strains in its containment system would not attain values which would adversely affect the integrity of the package such that it would fail to meet the applicable requirements of these Regulations.

(15) It shall be so designed that it shall never attain a maximum normal operating pressure exceeding a gauge pressure of 700 kPa.

(16) The maximum temperature on its accessible surface during transport shall not exceed 85°C in the absence of insolation under the normal conditions of transport. Account may be taken of barriers or screens intended to give protection to the transport worker without the need for the barriers or screens being subject to any test.

(17) Without prejudice to the requirement of regulation 12, it shall be so designed as to ensure that its integrity is not affected when used in an ambient tempreture ranging from −40°C to +38°C.

(18) Compliance with the permitted activity release limits shall depend neither upon filter nor upon a mechanical cooling system.

(19) If the packaging is to be used for the transport of irradiated nuclear fuel with an activity greater than 37 petabecquerels (PBq), it shall, in addition, be so designed that if it were subjected to the Water Immersion Test, as specified in the Sixth Schedule, there would be no rupture of its containment system.

(20) The design shall make provision for ullage to accommodate variations in the temperature of the contents, dynamic effects and filling dynamics if it is to be used for the transport of radioactive liquids.

(21) The packaging, in addition, shall comply with the requirement of regulation 12 if it is to be carried by air.

PART III

Design Requirements for Type B(M) Packagings

(22) A Type B(M) packaging shall meet all the general requirements for Type B packagings, as specified in Part I, and as far as practicable it shall also meet all the requirements for Type B(U) packagings, as specified in Part II.

(23) Notwithstanding paragraph (22), the requirement for the ambient condition may be different from that which have been specified in Part I provided that it is approved by the Board.

(24) The design of a Type B(M) packaging may incorporate a pressure release system for intermittent venting provided that the operational controls for the venting are acceptable to the Board.

(25) The packaging, in addition, shall comply with the requirement of regulation 12 if it is to be carried by air.

FOURTH SCHEDULE

DESIGN REQUIREMENTS FOR INDUSTRIAL PACKAGINGS

(Regulation 9)

PART I

Design Requirements for Industrial Packagings Type 1 (IP-1)

(1) An industrial packaging Type 1 (IP-1) shall meet all the requirements for excepted packaging, as specified in the First Schedule.

(2) The packaging, in addition, shall comply with the requirement of regulation 12 if it is to be carried by air.

PART II

Design Requirements for Industrial Packagings Type 2 (IP-2)

(3) An industrial packaging Type 2 (IP-2) shall meet all the requirements as specified in Part I for industrial packagings Type 1 (IP-1).

(4) The packaging shall not lose or disperse its radioactive contents and shall not lose its shielding integrity which would result in more than a 20% increase in the radiation level at any point on its external surface if it were to be subjected to—

(a) the Free Drop Test and the Stacking Test as specified in the Fifth Schedule; or

(b) any other equivalent tests which are approved by the Board.

PART III

Design Requirements for Industrial Packagings Type 3 (IP-3)

(5) An industrial packaging Type 3 (IP-3) shall meet all the requirements for industrial packaging Type 1 (IP-1), as specified in Part I.

(6) It shall meet all the requirements for a Type A package, as specified in the Second Schedule.

FIFTH SCHEDULE

TEST PROCEDURES FOR DEMONSTRATING THE ABILITY OF A PACKAGE TO WITHSTAND NORMAL CONDITIONS OF TRANSPORT

(Regulation 2, Second and Third Schedules)

PART I

Preparation of Specimen

(1) *(a)* A specimen package or a prototype shall be carefully selected such that its characteristics and expected range of radioactive contents are closely similar to the characteristics and radioactive contents of a package which is normally presented for transport.

(b) If a scale model package is used, its scale and the scale of the test tools and procedures shall be appropriate and all features which are significant shall be incorporated in preparing the model, test tools and procedures.

(c) A specimen package or a prototype used in the tests specified in this Schedule is hereinafter referred to as a "specimen".

(2) All specimens shall be examined carefully before testing to identify and record their faults or damage including the following:

(a) divergence from the design;

(b) defects in construction; and

(c) corrosion or other deterioration; and

(d) distortion of features.

(3) The containment system and other external features of the specimen shall be clearly specified and recorded so that if any need arises to refer to any part of the specimen, it may be done simply and clearly.

PART II

Test Procedure

(4) The specimen shall be subjected to the Free Drop Test, the Stacking Test and the Penetration Test (in that order) preceded in each case by the Water Spray Test.

(5) The time interval between the conclusion of the Water Spray Test and the succeeding tests shall be such that the water has soaked in to the maximum extent, without appreciable drying of the exterior of the specimen. In the absence of any evidence to the contrary, this interval shall be taken to be two hours if the water spray is applied from four directions simultaneously. No time interval shall elapse, however if the water spray is applied from each of the four directions consecutively.

(6) Subject to the requirements specified in paragraph (5), the same specimen may be used for all the tests.

Water Spray Test

(7) The specimen shall subjected to a water spray that simulates exposures to rainfall of approximately 5 cm per hour for at least one hour.

Free Drop Test

(8) The specimen shall be dropped onto a target so as to suffer maximum damage in respect of the safety features to be tested.

(9) The height of the drop shall be measured from the lowest point of the specimen to the upper surface of the target. It shall be not less than the distance specified in Table I for the respective mass specified therein.

(10) The target shall be a flat horizontal surface with special characteristics such that any increase in its resistance to displacement or deformation upon impact by the specimen would not significantly increase the damage to the specimen.

(11) Where the specimen is that of a package meant to be used for the transport of fissile material the Free Drop Test shall be preceded by a free drop from a height of 0.3 m on each corner or, in the case of a cylindrical package, onto each of the quarters of each rim.

(12) *(a)* For a package with a rectangular shape and made of fibreboard or wood, with a mass not exceeding 50 kg, a separate specimen shall be subjected to a free drop onto each corner from a height of 0.3 m.

(b) For a package with a cylindrical shape and made of fibreboard or wood, with a mass not exceeding 100 kg, a separate specimen shall be subjected to a free drop onto each of the quarters of each rim from a height of 0.3 m.

(13) If the package is meant to be used for the transport of radioactive liquids or gases, the specimen shall be subjected to a modified Free Drop Test in which it is dropped onto a target such that its containment system suffers the maximum damage. The height of the drop measured from the lowest part of the specimen to the upper surface of the target shall be 9 m.

(14) Where it can be demonstrated that the test specified in paragraph (18) is more severe for the specimen in question then the test specified in paragraph (13) need not be carried out.

TABLE I. Free drop distance for Free Drop Test

Package mass (kg) *(A)*	*Free drop distance (m)* *(B)*
package mass $<$ 5 000	1.2
5 000 $\leq$ package mass $<$ 10 000	0.9
10 000 $\leq$ package mass $<$ 15 000	0.6
package mass $\geq$ 15 000	0.3

Stacking Test

(15) Unless the shape of the packaging effectively prevents stacking, the specimen shall be subjected, for a period of 24 hours, to a compressive load equal to whichever is the greater of the following:

(a) the equivalent of 5 times the mass of the actual package; and

(b) the equivalent of 13 kPa multiplied by the vertically projected area of the package.

The load shall be applied uniformly to two opposite sides of the specimen, one of which shall be the base on which the package would normally rest.

Penetration Test

(16) The specimen shall be placed on a rigid, flat, horizontal, surface which shall not move significantly while the test is being carried out.

(17) *(a)* A bar of 3.2 cm in diameter with a hemispherical end and a mass of 6 kg shall be dropped and directed to fall, with its longitudinal axis vertical, onto the centre of the weakest part of the specimen, so that, if it penetrates sufficiently far, it will hit the containment system. The bar shall not be significantly deformed by the test performance.

(b) The height of drop of the bar measured from its lower end to the intended point of impact on the upper surface of the specimen shall be 1 m.

(18) If the package is meant to be used for the transport of radioactive liquids or gases, the Penetration Test shall be modified such that the drop height is increased from 1 m to 1.7 m.

(19) Where it can be demonstrated that the test specified in paragraph (13) is more severe for the specimen in question then the test specified in paragraph (18) need not be carried out.

PART III

Assessment of the Results

(20) After the specimen has been subjected to the applicable tests specified in Part II, an appropriate method of assessment shall be used to assure that the requirements of these Regulations have been met. Parameters, data and the method of calculations used in evaluation shall be those which are generally agree to be reliable and conservative.

(21) *(a)* Faults and damage to the specimen shall be identified and recorded.

(b) The results of the tests shall be used to determine whether the integrity of the containment system and shielding of the specimen has been retained to the extent required by these Regulations.

(c) For packages containing fissile material, it shall also be determined whether the applicable requirements of these Regulations pertaining to the transport of fissile material are fully met.

SIXTH SCHEDULE

TEST PROCEDURES DEMONSTRATING THE ABILITY OF A PACKAGE TO WITHSTAND ACCIDENT CONDITIONS OF TRANSPORT

(Regulation 2, Second and Third Schedules)

PART I

Preparation of Specimen

(1) *(a)* The preparation of specimens shall be the same as specified in Part I of the Fifth Schedule.

(b) A specimen package or a prototype used in tests specified in this Schedule is hereinafter referred to as a "specimen".

PART II

Test Procedures

(2) The specimen shall be subjected to the Mechanical Test and the Thermal Test, in that order. Following these tests either the same specimen or a separate specimen shall be subjected to the Water Immersion Test.

(3) If the package is meant to be used for transporting irradiated nuclear fuel, the Water Immersion Test shall be modified such that the specimen is immersed under a head of water of at least 200 m for a period of not less than one hour. For demonstration purposes, an external gauge pressure of at least 2 megapascals (MPa) shall be deemed to meet the requirement.

(4) *(a)* If the package is meant to be used for transporting fissile material, the specimen shall be subjected to an additional test, that is, the Water Leakage Test which shall be carried out after the Mechanical Test and the Thermal Test.

(b) The Water Leakage Test is not necessary for a package whose design has assumed greatest reactivity following any conceivable water in-leakage or out-leakage from the package.

Mechanical Test

(5) The Mechanical Test consists of three different drop tests, that is the Mechanical Test Drop I, Mechanical Test Drop II and Mechanical Test Drop III. The applicable drop shall be chosen depending on the regulatory requirements of the package under test.

(6) The target shall be a flat horizontal surface with special characteristics such that any increase in its resistance to displacement of deformation upon impact by the specimen would not significantly increase the damage to the specimen.

(7) The order in which the specimen is subjected to the drops shall be such that, on completion of the Mechanical Test, the specimen shall have suffered such damage as will lead to the maximum damage in the Thermal Test which follows.

Mechanical Test Drop I

(8) A specimen shall be dropped onto the target so as to suffer the maximum damage, and the height of the drop measured from the lowest point of the specimen to the upper surface of the target shall be 9 m.

Mechanical Test Drop II

(9) A specimen shall be dropped so as to suffer the maximum damage onto a bar rigidly mounted perpendicularly on the target. The height of the drop measured from the intended point of impact of the specimen to the upper surface of the bar shall be 1 m.

(10) The bar shall be of solid mild steel of circular section, (15.0±0.5) cm in diameter and 20 cm long. If a longer bar would cause greater damage to the specimen then a longer bar shall be used. The upper end of the bar shall be flat and horizontal with its edges rounded off to a radius of not more than 6 mm.

Mechanical Test Drop III

(11) A specimen shall be subjected to a dynamic crush test by positioning the specimen on the target so as to suffer maximum damage by the drop of a 500 kg mass from 9 m onto the specimen. The mass shall consist of a solid mild steel plate 1 m by 1 m and shall fall in a horizontal attitude. The height of the drop shall be measured from the underside of the plate to the highest point of the specimen.

Thermal Test

(12) The Thermal Test shall consist of—

(a) the exposure of a specimen fully engulfed, except for a simple support system, in a hydrocarbon fuel/air fire of sufficient extent and in sufficiently quiescent ambient conditions to provide an emissivity coefficient of at least 0.9, with an average flame temperature of at least 800°C for a period of 30 minutes; or

(b) any other thermal exposure which provides the equivalent total heat input to the specimen.

(13) The fuel source shall extend horizontally at least 1 m, and shall not extend more than 3 m, beyond any external surface of the specimen, and the specimen shall be positioned 1 m above the surface of the fuel source.

(14) After the cessation of external heat input, the specimen shall not be cooled artificially and any combustion of materials of the specimen shall be allowed to proceed naturally. For demonstration purposes, the surface absorptivity coefficient shall be either 0.8 or that value which the specimen may be demonstrated to possess if exposed to the heat source as specified in paragraph (12) and the convective coefficient shall be that value which the designer can justify if the package were exposed to the heat source as specified in paragraph (12).

(15) With respect to the initial conditions for the Thermal Test, the demonstration of compliance shall be based upon the assumption that the specimen is in equilibrium at an ambient temperature of 38°C. The effects of solar radiation may be neglected prior to and during the tests, but must be taken into account in the subsequent evaluation of the specimen response.

Water Immersion Test

(16) The specimen shall be immersed under a head of water of at least 15 m for a period of not less than eight hours in the attitude which will lead to maximum damage to the specimen. For demonstration purposes, an external gauge pressure of at least 150 kPa shall be deemed to meet the requirement.

Water Leakage Test

(17) The specimen shall be immersed under a head of water of at least 0.9 m for a period of not less than eight hours and in the attitude for which maximum leakage of the specimen is expected.

PART III

Assessment of the Test Results

(18) After the specimen has been subjected to the applicable tests specified in Part II, an appropriate method of assessment shall be used to assure that the requirements of these Regulations have been met. Parameters, data and the method of calculations used in evaluation shall be those which are generally agreed to be reliable and conservative.

(19) *(a)* Faults and damage to the specimen shall be identified and recorded.

(b) The result of the tests shall be used to determine whether the integrity of the containment system and shielding has been retained to the extent required by these Regulations.

(c) For packages containing fissile material, it shall also be determined whether the applicable requirements of these Regulations pertaining to the transport of fissile material are fully met.

SEVENTH SCHEDULE

TESTS FOR RADIOACTIVE MATERIAL

(Regulations 20 (2), 75 *(c)*)

PART I

Test for LSA–III

A solid material representing no less than the entire contents of a package shall be immersed for 7 days in water at the ambient temperature. The volume of water to be used in the test shall be sufficient to ensure that at the end of the 7 day test period the free volume of the unabsorbed and unreacted water remaining shall be at least 10% of the volume of the solid test sample itself. The water shall have an initial pH of 6-8 and a maximum conductivity of 1 millisiemen per metre (mS/m) at 20°C.

PART II

Tests for Special Form Radioactive Material

SECTION I

Preparation of Specimen

(1) *(a)* The preparation of specimen shall be the same as specified in Part I of the Fifth Schedule.

(b) If the specimen is a special form radioactive material in a sealed capsule, the capsule shall be carefully characterised and specified.

(2) The special form radioactive material used in the tests specified in this Part is hereinafter referred to as a "specimen".

SECTION II

Test Procedures

(3) The specimen shall be subjected to the Impact Test, the Percussion Test, the Bending Test and the Heat Test. A different specimen may be used for each of the tests. The tests shall be followed by the Leaching Test or any other equivalent tests which are approved by the Board.

(4) A specimen that comprises or simulates radioactive material, nuclear material or prescribed substance enclosed in a sealed capsule may be exempted from the Impact Test, Percussion Test and Heat Test provided that it is subjected to any other equivalent tests which are approved by the Board.

Impact Test

(5) *(a)* The specimen shall be dropped onto the target from a height of 9 m.

(b) The target shall be a flat horizontal surface with special characteristics such that any increase in its resistance to displacement or deformation upon impact by the specimen would not significantly increase the damage to the specimen.

Percussion Test

(6) *(a)* The specimen shall be placed on a sheet of lead which is supported by a smooth solid surface and struck by the flat face of a steel billet so as to produce an impact equivalent to that resulting from a free drop of 1.4 kg through 1 m.

(b) The flat face of the billet shall be 25 mm in diameter with the edges rounded off to a radius of (3.0±0.3) mm.

(c) The lead shall be of the kind with hardness number 3.5 to 4.5 on the Vickers scale and its thickness shall be not more than 25 mm. It shall cover an area greater than that which is covered by the specimen.

(7) A fresh surface of lead shall be used for each impact and the billet shall strike the specimen so as to cause maximum damage.

Bending Test

(8) This test shall apply only to a long and slender specimen with a minimum length of 10 cm and a length to minimum width ratio of not less than 10.

(9) *(a)* The specimen shall be rigidly clamped in a horizontal position so that one half of its length protrudes from the face of the clamp.

(b) The orientation of the specimen shall be such that the specimen will suffer maximum damage when its free end is struck by the flat face of a steel billet.

(c) The billet shall strike the specimen so as to produce an impact equivalent to that resulting from a free vertical drop of 1.4 kg through 1 m.

(d) The flat face of the billet shall be 25 mm in diameter with the edges rounded off to a radius of (3.0±0.3) mm.

Heat Test

(10) A specimen shall be heated in air to a temperature of 800°C and held at that temperature for a period of 10 minutes and shall then be allowed to cool.

Leaching Test

(11) For a specimen which comprises or simulates an indispersible solid material, the Leaching Test shall be performed as set out below.

(a) The specimen shall be immersed for 7 days in water at ambient temperature. The volume of water to be used in the test shall be sufficient to ensure that at the end of the 7-day test period, the free volume of the unabsorted and unreached water remaining shall be at least 10% of the volume of the solid test sample itself. The water shall have an initial pH of 6-8 and a maximum conductivity of 1 mS/m at 20°C.

(b) The water with the specimen shall then be heated to a temperature of (50±5)°C and maintained at this temperature for 4 hours.

(c) The activity of the water shall then be determined.

(d) The specimen shall then be stored for at least 7 days in still air of relative humidity not less than 90% at 30°C.

(e) The specimen shall then be immersed in water of the same specification as in *(a)* above and the water with the specimen heated to (50±5)°C and maintained at this temperature for 4 hours.

(f) The activity of the water shall then be determined.

(12) *(a)* For a specimen which comprises or simulates a radioactive material, nuclear material or prescribed substance enclosed in a sealed capsule, the test shall either be a Leaching Test or any other equivalent tests which are approved by the Board.

(b) The Leaching Test shall consist of the steps set out below.

(i) The specimen shall be immersed in water at ambient temperature. The water shall have an initial pH of 6-8 with a maximum conductivity of 1 mS/m at 20°C.

(ii) The water and the specimen shall be heated to a temperature of (50±5)°C and maintained at this temperature for 4 hours.

(iii) The activity of the water shall then be determined.

(iv) The specimen shall then be stored for at least 7 days in still air at a temperature of not less than 30°C.

(v) The process in (i), (ii) and (iii) shall be repeated.

SECTION III

Assessment of the Results

(13) After the specimen has been subjected to the applicable tests specified in Section II, an appropriate method of assessment shall be used to assure that the requirements of these Regulations have been met. Parameters, data and the method of calculations used in evaluation shall be those which are generally agreed to be reliable and conservative.

(14) *(a)* Faults and damage to the specimen shall be identified and recorded.

(b) The result of the tests shall be used to determine whether the integrity of the special form radioactive material has been retained to the extent required by regulation 20.

EIGHTH SCHEDULE

DETERMINATION OF TRANSPORT INDEX (TI)

(Regulations 2, 56 (1), 63 *(b)*, 64 (4) *(a)*, 65 (2), 80 (1) *(c)*)

(1) The TI based on radiation exposure control for a package, overpack, tank, freight container, or for unpackaged LSA–I or SCO–I, shall be the number derived in accordance with the procedure set out below.

(a) (i) Determine the maximum radiation level at a distance of 1 m from the external surface of the package, overpack, tank, freight container, or unpackaged LSA–I and SCO–I.

(ii) Where the radiation level is determined in units of millirem per hour (mrem/h), the value so obtained shall be the TI.

(iii) Where the radiation level is determined in units of millisievert per hour (mSv/h), the value so determined shall be multiplied by 100 to get the TI.

(b) For uranium ores, thorium ores or their concentrates, the maximum radiation dose rate at any point 1 m from the external surface of the load shall be taken as specified in Table I.

(c) For tanks, freight containers and unpackaged LSA–I and SCO–I, the value determined in step *(a)* above shall be multiplied by the appropriate factor specified in Table II.

The number so obtained shall be rounded up to the first decimal place (e.g. 1.13 becomes 1.2). Where it is equal to 0.05 or less, the number shall be considered as zero.

(2) The TI based on nuclear criticality shall be obtained by dividing the number 50 by the value of N derived using the procedures specified in subregulation (5) of regulation 19 (i.e. TI=50/N).

(3) The value of TI based on nuclear criticality may be zero, provided that an unlimited number of packages grouped together remains subcritical (i.e. N is effectively equal to infinity).

(4) The TI for each consignment shall be determined in accordance with appropriate method specified in Table III.

(5) The TI of each freight container or conveyance shall not exceed the respective limit specified in Table IV.

TABLE I. The maximum dose rate at any point 1 m from the external surface of uranium or thorium ores and concentrates

Ores/concentrates of Thorium or Uranium *(A)*	*Dose rate (mSv/h)* *(B)*
Ores and physical concentrates of uranium and thorium	0.4
Chemical concentrates of thorium	0.3
Chemical concentrates of uranium, other than uranium hexafluoride	0.02

TABLE II. Multiplication factors for determining transport index for large dimension loads

Size of load [a] *(A)*	*Multiplication factor (B)*
size of load $\leq 1\ m^2$	1
$1\ m^2 <$ size of load $\leq 5\ m^2$	2
$5\ m^2 <$ size of load $\leq 20\ m^2$	3
size of load $> 20\ m^2$	10

[a] Largest cross-sectional area of the load being measured.

TABLE III. Determination of transport index (TI)

Item (A)	*Contents (B)*	*Methods of determining TI (C)*
Packages	Non-fissile material	TI for radiation exposure control
	Fissile Material	The larger of the TI for radiation exposure control and the TI for nuclear criticality control
Non-rigid overpacks	Packages	Sum of TI's of all packages contained
Rigid overpacks	Packages	The sum of the TI's of all packages contained, or, for the original consignor, either the TI for radiation exposure control or the sum of the TI's of all packages
Freight containers	Packages or overpacks	Sum of the TI's of all packages and overpacks contained
	LSA or SCO	Either the sum of the TI's or the larger of the TI for radiation exposure control and the TI for nuclear criticality control
Freight containers (under exclusive use)	Packages or overpacks	Either the sum of the TI's or the larger of the TI for radiation exposure control and the TI for nuclear criticality control
Tanks	Non-fissile material	TI for radiation exposure control
	Fissile material	The larger of the TI for radiation exposure control and the TI for nuclear criticality control
Unpackaged	LSA-I and SCO-I	The TI for radiation exposure control

TABLE IV. TI Limit for freight containers and conveyances

Type of freight container or conveyance	*Limit on total sum of TI's in a single freight container or aboard a conveyance*			
	Not under exclusive use		*Under exclusive use*	
	Non-fissile material	*Fissile material*	*Non-fissile material*	*Fissile material*[a]
(A)	*(B)*	*(C)*	*(D)*	*(E)*
Freight container[b]				
Small	50	50	Not applicable	Not applicable
Large	50	50	No limit	100[c]
Vehicle	50	50	No limit	100[c]
Aircraft				
Passenger	50	50	Not applicable	Not applicable
Cargo	200	50	No limit	100[c]
Inland water-way vessel	50	50	No limit	100[c]
Seagoing vessel[d]				
1. *Hold, compartment or defined deck area*				
Packages, overpacks, small freight containers[b]	50	50	No limit	100[c]
Large freight containers[b]	200[e]	50	No limit	100[c]
2. *Total vessel*				
Packages, etc.	200[e]	200[e]	No limit[f]	200[f]
Large freight containers	No limit[e]	No limit[e]	No limit	No limit[e]
3. *Special use vessel*[g]	Not applicable	Not applicable	No limit	As approved[g]

[a] Provided that the transport is direct from the consignor to the consignee without any intermediate in-transit storage, where the total TI exceeds 50.

[b] A small freight container is that which has either an overall outer dimension less than 1.5 m, or an internal volume of not more than 3.0 cubic metre (m^3). Any other freight container shall be considered as large freight container.

[c] In cases in which the total TI is greater than 50, the consignment shall be so handled and stowed that it is always separated from any other package, overpack, tank or freight container carrying radioactive material, nuclear material or prescribed substances by at least 6 m. The intervening space between groups may be occupied by other cargo in accordance with regulation 33 only.

[d] For seagoing vessels the requirements given in 1 and 2 shall both be fulfilled.

[e] Provided that the packages, overpacks, tanks or freight containers, as applicable, are stowed so that the groups are separated from each other by at least 6 m.

[f] Packages or overpacks carried in or on a vehicle under exclusive use may be transported by a vessel provided that they are not removed from the vehicle at any time while on board the vessel.

[g] For special use vessels, such as those used for the carriage of several irradiated fuel flasks, the maximum total sum of TI's shall be subject to multilateral approval, based upon the specific circumstances, subject to the requirements of regulation 67.

NINTH SCHEDULE

CONTENT LIMITS FOR TYPE A PACKAGES

(Regulations 17 (2), 27 (2), 48 (2) *(g)* and 71 *(g)*

(1) The requirements laid down in regulation 17 shall be deemed to be complied with if the activity of the radioactive content of a Type A package does not exceed the A_1 and A_2 values given in Table I for single radionuclides.

(2) For single radionuclides whose identities are known but are not listed in Table I, the requirements laid down in regulation 17 shall be deemed to be complied with if the values of A_1 and A_2 used are calculated such that—

(a) (i) for each radioactive decay chain in which the radionuclides are present in their naturally occurring proportions and in which no daughter nuclide has a half-life either longer than 10 days or longer than that of the parent nuclide shall be considered as a single radionuclide and the activity to be taken into account and the values of A_1 and A_2 to be applied shall be those corresponding to the parent nuclide of that chain; or

(ii) in the case of radioactive decay chains in which any daughter nuclide has a half-life either longer than 10 days or greater than that of the parent nuclide, the parent and such daughter nuclides shall be considered as mixtures of different nuclides; and

(b) the values so obtained are approved by the Board.

(3) For mixtures of radionuclides whose identities and respective activities are known, the requirements laid down in regulation 17 shall be deemed to be complied with if the following conditions are met:

(a) for a special form radioactive material:

$$\sum_i \frac{B(i)}{A_1(i)} \leq 1$$

(b) for other forms of radioactive material, nuclear material or prescribed substance:

$$\sum_i \frac{B(i)}{A_2(i)} \leq 1$$

where

B (i) is the activity of radionuclide (i);
A_1 (i) is the A_1 value for radionuclide (i); and
A_2 (i) is the A_2 value for radionuclide i.

(4) Alternatively, an A_2 value for a mixture of radionuclides may be determined as follows:

$$A_2 = \frac{1}{\sum_i \frac{f(i)}{A_2(i)}}$$

where

f (i) is the fraction of activity of nuclide i in the mixture; and
A_2 (i) is the appropriate A_2 value for nuclide i.

(5) When the identity of each radionuclide is known but the individual activities of some of the radionuclides are not known, the radionuclides may be grouped and the lowest A_1 or A_2 value, as appropriate, for the radionuclides in each group may be used in applying formulas in paragraphs (3) and (4). Groups may be based on the total alpha activity and the total beta/gamma activity when these are known, using the lowest A_1 or A_2 values for the alpha emitters or beta/gamma emitters, respectively.

(6) For the individual radionuclides or for mixtures of radionuclides for which relevant data are not available, the requirements of regulation 17 shall be deemed to be complied with if the A_1 and A_2 values specified in Table II are used.

TABLE I. A_1 and A_2 values for single radionuclides.[1]

Radionuclides			
Symbol (A)	*Name (atomic number)* (B)	*A_1 (TBq)* (C)	*A_2 (TBq)* (D)
^{225}Ac(*)	Actinium (89)	0.6	1×10^{-2}
^{227}Ac		40	2×10^{-5}
^{228}Ac		0.6	0.4
^{105}Ag	Silver (47)	2	2
^{108}Ag^{m}		0.6	0.6
^{110}Ag^{m}		0.4	0.4
^{111}Ag		0.6	0.5
^{26}Al	Aluminium (13)	0.4	0.4
^{241}Am	Americium (95)	2	2×10^{-4}
^{242}Am^{m}		2	2×10^{-4}
^{243}Am		2	2×10^{-4}
^{37}Ar	Argon (18)	40	40
^{39}Ar		20	20
^{41}Ar		0.6	0.6
^{42}Ar(*)		0.2	0.2
^{72}As	Arsenic (33)	0.2	0.2
^{73}As		40	40
^{74}As		1	0.5
^{76}As		0.2	0.2
^{77}As		20	0.5
^{211}At	Astatine (85)	30	2
^{193}Au	Gold (79)	6	6
^{194}Au		1	1
^{195}Au		10	10
^{196}Au		2	2
^{198}Au		3	0.5
^{199}Au		10	0.9
^{131}Ba	Barium (56)	2	2
^{133}Ba^{m}		10	0.9

[1] *a*. Symbol (*) against radionuclides symbols, wherever it appears in this Table means A_1 and/or A_2 values are limited by daughter product decay.

b. Symbol (**) against radionuclides symbols, wherever it appears in this Table means A_1 and A_2 values are unlimited for radiation control purposes only. For nuclear criticality safety this material is subject to the control placed on fissile material.

TABLE I—*(cont.)*

Radionuclides			
Symbol (A)	*Name (atomic number)* (B)	A_1 *(TBq)* (C)	A_2 *(TBq)* (D)
^{133}Ba		3	3
$^{140}Ba(*)$		0.4	0.4
^{7}Be	Beryllium (4)	20	20
^{10}Be		20	0.5
^{205}Bi	Bismuth (83)	0.6	0.6
^{206}Bi		0.3	0.3
^{207}Bi		0.7	0.7
$^{210}Bi^{m}(*)$		0.3	3×10^{-2}
^{210}Bi		0.6	0.5
$^{212}Bi(*)$		0.3	0.3
^{247}Bk	Berkelium (97)	2	2×10^{-4}
^{249}Bk		40	8×10^{-2}
^{76}Br	Bromine (35)	0.3	0.3
^{77}Br		3	3
^{82}Br		0.4	0.4
^{11}C	Carbon (6)	1	0.5
^{14}C		40	2
^{41}Ca	Calcium (20)	40	40
^{45}Ca		40	0.9
^{47}Ca		0.9	0.5
^{109}Cd	Cadmium (48)	40	1
$^{113}Cd^{m}$		20	9×10^{-2}
$^{115}Ca^{m}$		0.3	0.3
^{115}Cd		4	0.5
^{139}Ce	Cerium (58)	6	6
^{141}Ce		10	0.5
^{143}Ce		0.6	0.5
$^{144}Ce(*)$		0.2	0.2
^{248}Cf	Californium (98)	30	3×10^{-3}
^{249}Cf		2	2×10^{-4}
^{250}Cf		5	5×10^{-4}
^{251}Cf		2	2×10^{-4}
^{252}Cf		0.1	1×10^{-3}
^{253}Cf		40	6×10^{-2}
^{254}Cf		3×10^{-3}	6×10^{-4}
^{36}Cl	Chlorine (17)	20	0.5
^{38}Cl		0.2	0.2
^{240}Cm	Curium (96)	40	2×10^{-2}
^{241}Cm		2	0.9
^{242}Cm		40	1×10^{-2}
^{243}Cm		3	3×10^{-4}
^{244}Cm		4	4×10^{-4}
^{245}Cm		2	2×10^{-4}
^{246}Cm		2	2×10^{-4}
^{247}Cm		2	2×10^{-4}

TABLE I—*(cont.)*

Radionuclides			
Symbol (A)	*Name (atomic number)* (B)	A_1 *(TBq)* (C)	A_2 *(TBq)* (D)
^{248}Cm		4×10^{-2}	5×10^{-5}
^{55}Co	Cobalt (27)	0.5	0.5
^{56}Co		0.3	0.3
^{57}Co		8	8
$^{58}Co^{m}$		40	40
^{58}Co		1	1
^{60}Co		0.4	0.4
^{51}Cr	Chromium (24)	30	30
^{129}Cs	Caesium (55)	4	4
^{131}Cs		40	40
^{132}Cs		1	1
$^{134}Cs^{m}$		40	9
^{134}Cs		0.6	0.5
^{135}Cs		40	0.9
^{136}Cs		0.5	0.5
^{137}Cs(*)		2	0.5
^{64}Cu	Copper (29)	5	0.9
^{67}Cu		9	0.9
^{159}Dy	Dysprosium (66)	20	20
^{165}Dy		0.6	0.5
^{166}Dy(*)		0.3	0.3
^{169}Er	Erbium (68)	40	0.9
^{171}Er		0.6	0.5
^{147}Eu	Europium (63)	2	2
^{148}Eu		0.5	0.5
^{149}Eu		20	20
^{150}Eu		0.7	0.7
$^{152}Eu^{m}$		0.6	0.5
^{152}Eu		0.9	0.9
^{154}Eu		0.8	0.5
^{155}Eu		20	2
^{156}Eu		0.6	0.5
^{18}F	Fluorine (9)	1	0.5
^{52}Fe(*)	Iron (26)	0.2	0.2
^{55}Fe		40	40
^{59}Fe		0.8	0.8
^{60}Fe		40	0.2
^{67}Ga	Gallium (31)	6	6
^{68}Ga		0.3	0.3
^{72}Ga		0.4	0.4
^{146}Gd(*)	Gadolinium (64)	0.4	0.4
^{148}Gd		3	3×10^{-4}
^{153}Gd		10	5
^{159}Gd		4	0.5
^{68}Ge(*)	Germanium (32)	0.3	0.3
^{71}Ge		40	40

TABLE I—*(cont.)*

Radionuclides			
Symbol (A)	*Name (atomic number)* (B)	A_1 *(TBq)* (C)	A_2 *(TBq)* (D)
^{77}Ge		0.3	0.3
$^{172}Hf(*)$	Hafnium (72)	0.5	0.3
^{175}Hf		3	3
^{181}Hf		2	0.9
^{182}Hf		4	3×10^{-2}
$^{194}Hg(*)$	Mercury (80)	1	1
$^{195}Hg^{m}$		5	5
$^{197}Hg^{m}$		10	0.9
^{197}Hg		10	10
^{203}Hg		4	0.9
^{163}Ho	Holmium (67)	40	40
$^{166}Ho^{m}$		0.6	0.3
^{166}Ho		0.3	0.3
^{123}I	Iodine (53)	6	6
^{124}I		0.9	0.9
^{125}I		20	2
^{126}I		2	0.9
^{129}I		Unlimited	Unlimited
^{131}I		3	0.5
^{132}I		0.4	0.4
^{133}I		0.6	0.5
^{134}I		0.3	0.3
^{135}I		0.6	0.5
^{111}In	Indium (49)	2	2
$^{113}In^{m}$		4	4
$^{114}In^{m}(*)$		0.3	0.3
$^{115}In^{m}$		6	0.9
^{189}Ir	Iridium (77)	10	10
^{190}Ir		0.7	0.7
^{192}Ir		1	0.5
$^{193}Ir^{m}$		10	10
^{194}Ir		0.2	0.2
^{40}K	Potassium (19)	0.6	0.6
^{42}K		0.2	0.2
^{43}K		1	0.5
^{81}Kr	Krypton (36)	40	40
$^{85}Kr^{m}$		6	6
^{85}Kr		20	10
^{87}Kr		0.2	0.2
^{137}La	Lanthanum (57)	40	2
^{140}La		0.4	0.4
LSA	Low specific activity material (see definition in regulation 2)		

TABLE I—*(cont.)*

Radionuclides			
Symbol (A)	*Name (atomic number)* (B)	A_1 *(TBq)* (C)	A_2 *(TBq)* (D)
^{172}Lu	Lutetium (71)	0.5	0.5
^{173}Lu		8	8
$^{174}Lu^{m}$		20	8
^{174}Lu		8	4
^{177}Lu		30	0.9
MFP	For Mixed Fission Products, use formula for mixtures or Table II		
$^{28}Mg(*)$	Magnesium (12)	0.2	0.2
^{52}Mn	Manganese (25)	0.3	0.3
^{53}Mn		Unlimited	Unlimited
^{54}Mn		1	1
^{56}Mn		0.2	0.2
^{93}Mo	Molybdenum (42)	40	7
^{99}Mo		0.6	0.5
^{13}N	Nitrogen (7)	0.6	0.5
^{22}Na	Sodium (11)	0.5	0.5
^{24}Na		0.2	0.2
$^{92}Nb^{m}$	Niobium (41)	0.7	0.7
$^{93}Nb^{m}$		40	6
^{94}Nb		0.6	0.6
^{95}Nb		1	1
^{97}Nb		0.6	0.5
^{147}Nd	Neodymium (60)	4	0.5
^{149}Nd		0.6	0.5
^{59}Ni	Nickel (28)	40	40
^{63}Ni		40	30
^{65}Ni		0.3	0.3
^{235}Np	Neptunium (93)	40	40
^{236}Np		7	1×10^{-3}
^{237}Np		2	2×10^{-4}
^{239}Np		6	0.5
^{185}Os	Osmium (76)	1	1
$^{191}Os^{m}$		40	40
^{191}Os		10	0.9
^{193}Os		0.6	0.5
$^{194}Os(*)$		0.2	0.2
^{32}P	Phosphorus (15)	0.3	0.3
^{33}P		40	0.9
^{230}Pa	Protactinium (91)	2	0.1
^{231}Pa		0.6	6×10^{-5}
^{233}Pa		5	0.9
^{201}Pb	Lead (82)	1	1
^{202}Pb		40	2
^{203}Pb		3	3
^{205}Pb		Unlimited	Unlimited

TABLE I—*(cont.)*

Radionuclides			
Simbol (A)	*Name (atomic number)* (B)	A_1 *(TBq)* (C)	A_2 *(TBq)* (D)
$^{210}Pb(*)$		0.6	9×10^{-3}
$^{212}Pb(*)$		0.3	0.3
^{103}Pd	Palladium (46)	40	40
$^{107}Pd(*)$		Unlimited	Unlimited
^{109}Pd		0.6	0.5
^{143}Pm	Promethium (61)	3	3
^{144}Pm		0.6	0.6
^{145}Pm		30	7
^{147}Pm		40	0.9
$^{148}Pm^{m}$		0.5	0.5
^{149}Pm		0.6	0.5
^{151}Pm		3	0.5
^{208}Po	Polonium (84)	40	2×10^{-2}
^{209}Po		40	2×10^{-2}
^{210}Po		40	2×10^{-2}
^{142}Pr	Praseodymium (59)	0.2	0.2
^{143}Pr		4	0.5
$^{188}Pt(*)$	Platinum (78)	0.6	0.6
^{191}Pt		3	3
$^{193}Pt^{m}$		40	9
^{193}Pt		40	40
$^{195}Pt^{m}$		10	2
$^{197}Pt^{m}$		10	0.9
^{197}Pt		20	0.5
^{236}Pu	Plutonium (94)	7	7×10^{-4}
^{237}Pu		20	20
^{238}Pu		2	2×10^{-4}
^{239}Pu		2	2×10^{-4}
^{240}Pu		2	2×10^{-4}
^{241}Pu		40	1×10^{-2}
^{242}Pu		2	2×10^{-4}
$^{244}Pu(*)$		0.3	2×10^{-4}
$^{223}Ra(*)$	Radium (88)	0.6	3×10^{-2}
$^{224}Ra(*)$		0.3	6×10^{-2}
$^{225}Ra(*)$		0.6	2×10^{-2}
$^{226}Ra(*)$		0.3	2×10^{-2}
$^{228}Ra(*)$		0.6	4×10^{-2}
^{81}Rb	Rubidium (37)	2	0.9
^{83}Rb		2	2
^{84}Rb		1	0.9
^{86}Rb		0.3	0.3
^{87}Rb		Unlimited	Unlimited
Rb (Natural)		Unlimited	Unlimited
^{183}Re	Rhenium (75)	5	5
$^{184}Re^{m}$		3	3

TABLE I—*(cont.)*

Radionuclides			
Symbol (A)	*Name (atomic number)* (B)	A_1 *(TBq)* (C)	A_2 *(TBq)* (D)
^{184}Re		1	1
^{186}Re		4	0.5
^{187}Re		Unlimited	Unlimited
^{188}Re		0.2	0.2
^{189}Re		4	0.5
Re (Natural)		Unlimited	Unlimited
^{99}Rh	Rhodium (45)	2	2
^{101}Rh		4	4
$^{102}Rh^{m}$		2	0.9
^{102}Rh		0.5	0.5
$^{103}Rh^{m}$		40	40
^{105}Rh		10	0.9
^{222}Rn(*)	Radon (86)	0.2	4×10^{-3}
^{97}Ru	Ruthenium (44)	4	4
^{103}Ru		2	0.9
^{105}Ru		0.6	0.5
^{106}Ru(*)		0.2	0.2
^{35}S	Sulphur (16)	40	2
^{122}Sb	Antimony (51)	0.3	0.3
^{124}Sb		0.6	0.5
^{125}Sb		2	0.9
^{126}Sb		0.4	0.4
^{44}Sc	Scandium (21)	0.5	0.5
^{46}Sc		0.5	0.5
^{47}Sc		9	0.9
^{48}Sc		0.3	0.3
SCO	Surface Contaminated Objects (see definition in regulation 2)		
^{75}Se	Selenium (34)	3	3
^{79}Se		40	2
^{31}Si	Silicon (14)	0.6	0.5
^{32}Si		40	0.2
^{145}Sm	Samarium (62)	20	20
^{147}Sm		Unlimited	Unlimited
^{151}Sm		40	4
^{153}Sm		4	0.5
^{113}Sn(*)	Tin (50)	4	4
$^{117}Sn^{m}$		6	2
$^{119}Sn^{m}$		40	40
$^{121}Sn^{m}$		40	0.9
^{123}Sn		0.6	0.5
^{125}Sn		0.2	0.2
^{126}Sn(*)		0.3	0.3
^{82}Sr(*)	Strontium (38)	0.2	0.2
$^{85}Sr^{m}$		5	5

TABLE I—*(cont.)*

Radionuclides			
Symbol (A)	*Name (atomic number)* (B)	A_1 *(TBq)* (C)	A_2 *(TBq)* (D)
^{85}Sr		2	2
$^{87}Sr^{m}$		3	3
^{89}Sr		0.6	0.5
^{90}Sr(*)		0.2	0.1
^{91}Sr		0.3	0.3
^{92}Sr(*)		0.2	0.2
T (All form)	Tritium (1)	40	40
^{178}Ta	Tantalum (73)	1	1
^{179}Ta		30	30
^{182}Ta		0.8	0.5
^{157}Tb	Terbium (65)	40	10
^{158}Tb		1	0.7
^{160}Tb		0.9	0.5
$^{95}Tc^{m}$	Technetium (43)	2	2
$^{96}Tc^{m}$		0.4	0.4
$^{96}Tc^{m}$		0.4	0.4
$^{97}Tc^{m}$		40	40
^{97}Tc		Unlimited	Unlimited
^{98}Tc		0.7	0.7
$^{99}Tc^{m}$		8	8
^{99}Tc		40	0.9
^{118}Te(*)	Tellurium (52)	0.2	0.2
$^{121}Te^{m}$		5	5
^{121}Te		2	2
$^{123}Te^{m}$		7	7
$^{125}Te^{m}$		30	9
$^{127}Te^{m}$(*)		20	0.5
^{127}Te		20	0.5
$^{129}Te^{m}$(*)		0.6	0.5
^{129}Te		0.6	0.5
$^{131}Te^{m}$		0.7	0.5
^{133}Te(*)		0.4	0.4
^{227}Th	Thorium (90)	9	1×10^{-2}
^{228}Th(*)		0.3	4×10^{-4}
^{229}Th		0.3	3×10^{-5}
^{230}Th		2	2×10^{-4}
^{231}Th		40	0.9
^{232}Th		Unlimited	Unlimited
^{234}Th(*)		0.2	0.2
Th (natural)		Unlimited	Unlimited
^{44}Ti(*)	Titanium (22)	0.5	0.2
^{200}Tl	Thallium (81)	0.8	0.8
^{201}Tl		10	10
^{202}Tl		2	2
^{204}Tl		4	0.5

TABLE I—*(cont.)*

Radionuclides			
Symbol (A)	*Name (atomic number)* (B)	A_1 *(TBq)* (C)	A_2 *(TBq)* (D)
^{167}Tm	Thulium (69)	7	7
^{168}Tm		0.8	0.8
^{170}Tm		4	0.5
^{171}Tm		40	10
^{230}U	Uranium (92)	40	1×10^{-2}
^{232}U		3	3×10^{-4}
^{233}U		10	1×10^{-3}
^{234}U		10	1×10^{-3}
^{235}U		Unlimited (**)	Unlimited (**)
^{236}U		10	1×10^{-3}
^{238}U		Unlimited	Unlimited
U (natural)		Unlimited	Unlimited
U (enriched 5% or less)		Unlimited (**)	Unlimited (**)
U (enriched more than 5%)		10	1×10^{-3}
U (depleted)		Unlimited	Unlimited
^{48}V	Vanadium (23)	0.3	0.3
^{49}V		40	40
^{178}W(*)	Tungsten (74)	1	1
^{181}W		30	30
^{185}W		40	0.9
^{187}W		2	0.5
^{188}W(*)		0.2	0.2
^{122}Xe(*)	Xenon (54)	0.2	0.2
^{123}Xe		0.2	0.2
^{127}Xe		4	4
$^{131}Xe^{m}$		40	40
^{133}Xe		20	20
^{135}Xe		4	4
^{87}Y	Yttrium (39)	2	2
^{88}Y		0.4	0.4
^{90}Y		0.2	0.2
$^{91}Y^{m}$		2	2
^{91}Y		0.3	0.3
^{92}Y		0.2	0.2
^{93}Y		0.2	0.2
^{169}Yb	Ytterbium (70)	3	3
^{175}Yb		30	0.9
^{65}Zn	Zinc (30)	2	2
$^{69}Zn^{m}$		2	0.5
^{69}Zn		4	0.5
^{88}Zr	Zirconium (40)	3	3
^{93}Zr		40	0.2
^{95}Zr		1	0.9
^{97}Zr		0.3	0.3

TABLE II: General values for A_1 and A_2

Contents (A)	*A_1 (TBq) (B)*	*A_2 (TBq) (C)*
Only beta or gamma emitting nuclides are known to be present	0.2	0.02
Alpha emitting nuclides are known to be present or no relevant data are available	0.1	2×10^{-5}

TENTH SCHEDULE

ACTIVITY LIMITS FOR EXCEPTED PACKAGES

(Regulation 15 (1))

	Instrument and articles		*Materials*
Physical state of contents (A)	*Item limits[a] (B)*	*Package limits[a] (C)*	*Package limits[a] (D)*
Solids:			
special form	$10^{-2}A_1$	A_1	$10^{-3}A_1$
other forms	$10^{-2}A_2$	A_2	$10^{-3}A_2$
Liquids:	$10^{-3}A_2$	$10^{-1}A_2$	$10^{-4}A_2$
Gases:			
tritium	$2\times10^{-2}A_2$	$2\times10^{-1}A_2$	$2\times10^{-2}A_2$
special form	$10^{-3}A_1$	$10^{-2}A_1$	$10^{-3}A_1$
other forms	$10^{-3}A_2$	$10^{-2}A_2$	$10^{-3}A_2$

[a] For mixtures of radionuclides, *see* Ninth Schedule.

ELEVENTH SCHEDULE

CONVEYANCE ACTIVITY LIMITS FOR LSA AND SCO IN INDUSTRIAL PACKAGES OR UNPACKAGED

(Regulations 16 *(b)*, 43 (2))

Nature of material (A)	*Activity limit for conveyances other than by inland water-way* (B)	*Activity limit for a hold or compartment of an inland water craft* (C)
LSA–I	No limit	No limit
LSA–II and LSA–III		
Non-combustible solids	No limit	$100A_2$
Combustible solids	$100A_2$	$10A_2$
All liquids	$100A_2$	$10A_2$
All gases	$100A_2$	$10A_2$
SCO	$100A_2$	$10A_2$

TWELFTH SCHEDULE

LIMITS OF NON-FIXED CONTAMINATION ON SURFACES

(Regulations 23, 36 *(c)*, 57 (1), 57 (2))

Contaminated surface (A)	*Applicable Limits Bq/cm²* [a]	
	I[b] (B)	*II*[c] (C)
External surface of excepted package	0.4	0.04
External and internal surfaces of overpacks, freight containers or conveyances and their equipment for carrying excepted packages or non-radioactive consignment	0.4	0.04
External surface of packages other than excepted packages	4	0.4
External and internal surfaces of overpacks, freight containers or conveyances and their equipment for carrying packages other than excepted packages or non-radioactive consignment	4	0.4
External surfaces of freight containers, and conveyances and their equipment used in the carriage of unpackaged radioactive material	4	0.4

[a] These applicable limits shall determined by averaging over any area of 300 square centimetres (cm^2) of any part of the surface.

[b] These limits shall be applicable to beta and gamma emitters and low toxicity alpha emitters.

[c] These limits shall be applicable to all other alpha emitters.

THIRTEENTH SCHEDULE

LIMITATIONS ON HOMOGENEOUS HYDROGENOUS SOLUTIONS OR MIXTURES OF FISSILE MATERIAL

(Regulation 15 (3) *(b)*)

Parameters (A)	*Uranium—235 only* (B)	*Any other fissile material (including mixtures* (C)
Minimum H/X[a]	5200	5200
Maximum concentration of fissile material grams per litre (g/l)	5	5
Maximum mass of fissile material in a package or conveyance (g)	800[b]	500

[a] Where H/X is the ratio of the number of hydrogen atoms to the number of atoms of fissile nuclide.

[b] With a total plutonium and uranium−233 content of not more than 1% of the mass of uranium−235.

FOURTEENTH SCHEDULE

INDUSTRIAL PACKAGE INTEGRITY REQUIREMENTS FOR LSA AND SCO

(Regulation 43 (1))

Contents (A)	*Industrial package type*	
	Exclusive use (B)	*Not under exclusive use* (C)
LSA−I[a]		
Solid	IP−1	IP−1
Liquid and gas	IP−1	IP−2
LSA−II		
Solid	IP−2	IP−2
Liquid and gas	IP−2	IP−3
LSA−III	IP−2	IP−3
SCO−I[a]	IP−1	IP−1
SCO−II	IP−2	IP−2

[a] Under the conditions specified in subregulation (3) of regulation 43, LSA−I and SCO−I may be transported unpackaged.

FIFTEENTH SCHEDULE

EXCERPTS FROM LIST OF UNITED NATIONS NUMBERS, PROPER SHIPPING NAME AND DESCRIPTION AND SUBSIDIARY RISKS

(Regulations 28 (3), 48 (2) and 66 (4))

United Nations Number (A)	*Proper Shipping Name* (B)	*Subsidiary risks* (C)
2910	RADIOACTIVE MATERIAL, EXCEPTED PACKAGE, — INSTRUMENTS or ARTICLES — LIMITED QUANTITY OF MATERIAL — ARTICLES MANUFACTURED FROM NATURAL URANIUM or DEPLETED URANIUM or NATURAL THORIUM — EMPTY PACKAGING	
2912	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA), N.O.S.[a]	
2913	RADIOACTIVE MATERIAL, SURFACE CONTAMINATED OBJECTS (SCO)	
2918	RADIOACTIVE MATERIAL, FISSILE, N.O.S.[a]	
2974	RADIOACTIVE MATERIAL, SPECIAL FORM N.O.S.[a]	
2975	THORIUM METAL, PYROPHORIC	Liable to spontaneous combustion
2976	THORIUM NITRATE, SOLID	Oxidizing substance
2977	URANIUM HEXAFLUORIDE, FISSILE containing more than 1.0 percent uranium-235	Corrosive
2978	URANIUM HEXAFLUORIDE, fissile excepted or non-fissile	Corrosive
2979	URANIUM METAL, PYROPHORIC	Liable to spontaheous combustion
2980	URANYL NITRATE HEXAHYDRATE SOLUTION	Corrosive
2981	URANYL NITRATE, SOLID	Oxidizing substance
2982	RADIOACTIVE MATERIAL, N.O.S.[a]	

[a] N.O.S.—Not otherwise specified.

SIXTEENTH SCHEDULE

INTERNATIONAL SYSTEM OF UNITS SI PREFIXES

(Regulations 27 (5), 48 (2) *(i)*, 52 (4) *(e)*)

Multiplying factor *(A)*	*Prefix* *(B)*	*Symbol* *(C)*
1 000 000 000 000 000 000 = 10^{18}	exa	E
1 000 000 000 000 000 = 10^{15}	peta	P
1 000 000 000 000 = 10^{12}	tera	T
1 000 000 000 = 10^{9}	giga	G
1 000 000 = 10^{6}	mega	M
1 000 = 10^{3}	kilo	k
100 = 10^{2}	hecto	h
10 = 10^{1}	deka	da
0.1 = 10^{-1}	deci	d
0.01 = 10^{-2}	centi	c
0.001 = 10^{-3}	milli	m
0.000 001 = 10^{-6}	micro	u
0.000 000 001 = 10^{-9}	nano	n
0.000 000 000 001 = 10^{-12}	pico	p
0.000 000 000 000 001 = 10^{-15}	femto	f
0.000 000 000 000 000 001 = 10^{-18}	atto	a

SEVENTEENTH SCHEDULE

PART I

CATEGORIES OF PACKAGES

(Regulations 30 (1))

Characteristics of package		*Category*
Transport index (A)	*Maximum radiation level at any point on external surface* (B)	(C)
0	Not more than 0.005 mSv/h	I—WHITE
More than 0 but not more than 1	More than 0.005 mSv/h but not more than 0.5 mSv/h	II—YELLOW
More than 1 but not more than 10	More than 0.5 mSv/h but not more than 2 mSv/h	III—YELLOW
More than 10	More than 2 mSv/h but not more than 10 mSv/h	III—YELLOW*

* To be transported only under exclusive use or special arrangement.

PART II

CATEGORIES OF OVERPACKS INCLUDING FREIGHT CONTAINERS WHEN USED AS OVERPACKS

Transport index (A)	*Category (B)*
0	I—WHITE
TI greater than 0 but less than or equal to 1	II—YELLOW
TI greater than 1	III—YELLOW

EIGHTEENTH SCHEDULE

SIGNS, LABELS AND PLACARDS

(Regulations 25 (4) *(a)*, 26 (1), 28, 29, 66 (1), 66 (4), 66 (5))

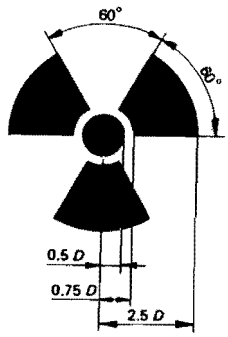

FIGURE 1: The radiation warning symbol shall consist of the conventional trefoil design shown. D is the diameter of the central circle. For signs, the minimum value of D shall be 8 mm.

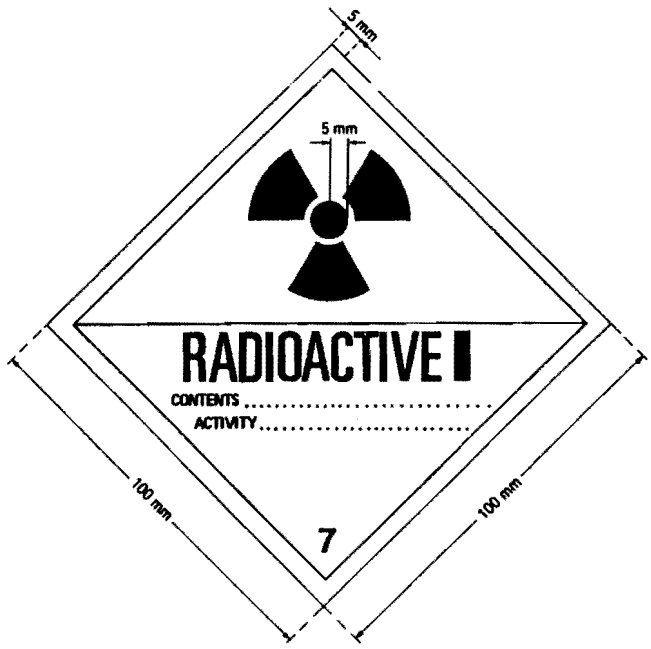

FIGURE 2: Category I—WHITE label. The background colour of the label shall be white, the colour of the trefoil and the printing shall be black and the colour of the category bar shall be red.

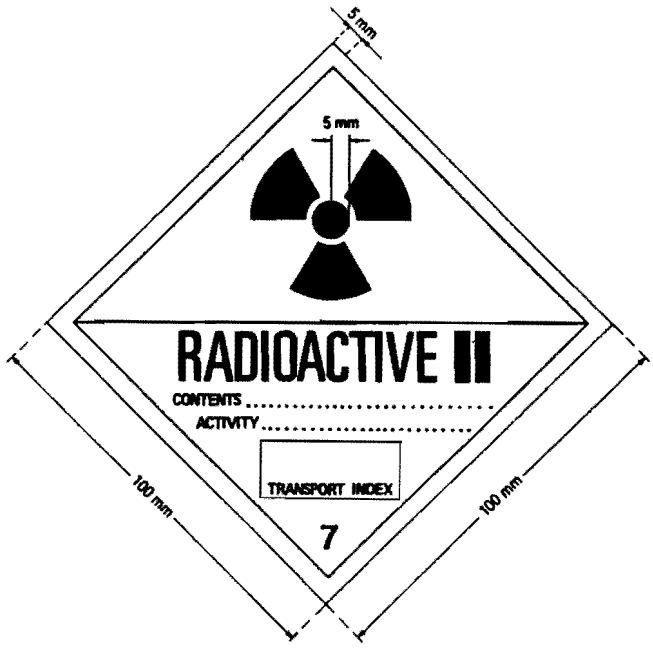

FIGURE 3: Category II-YELLOW label. The background colour of the upper half of the label shall be yellow and of the lower half white, the colour of the trefoil and the printing shall be black and the colour of the category bars shall be red.

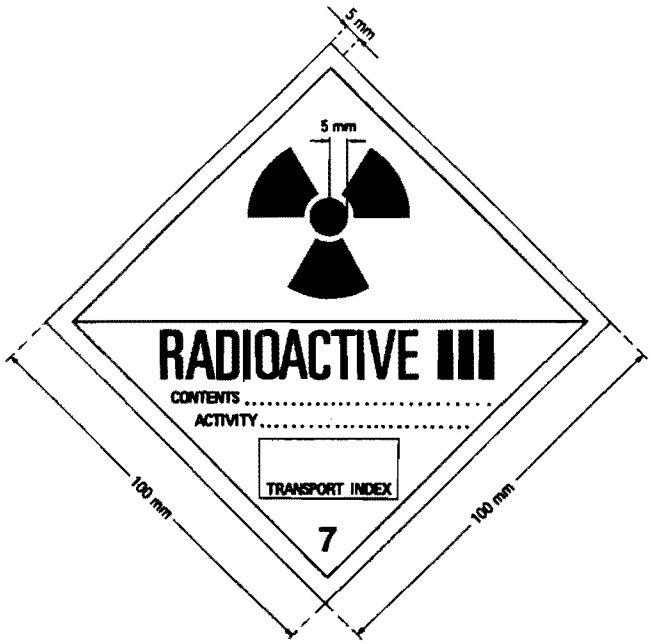

FIGURE 4: Category III-YELLOW label. The background colour of the upper half of the label shall be yellow and of the lower half white, the colour of the trefoil and the printing shall be black and the colour of the category bars shall be red.

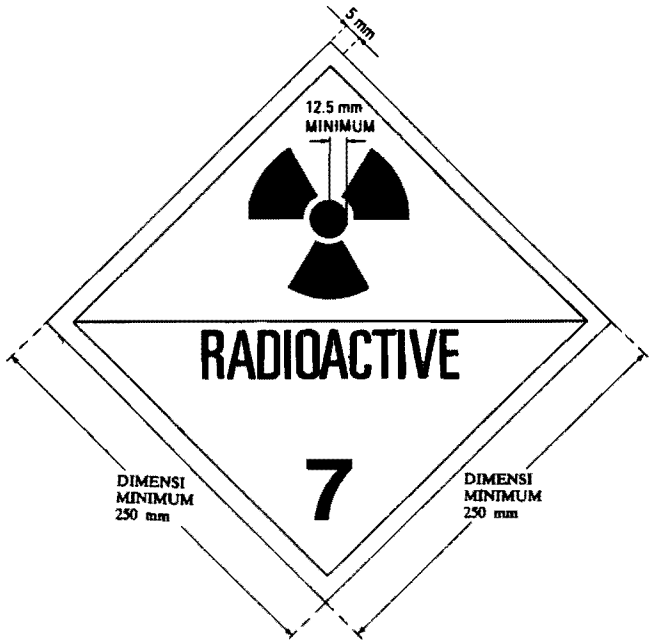

FIGURE 5: Placard. Minimum dimensions are given; when larger dimensions are used the relative proportions must be maintained. The figure "7" shall not be less than 25 mm high. The background colour of the upper half of the placard shall be yellow and of the lower half white, the colour of the trefoil and the printing shall be black. The use of the word "RADIOACTIVE" in the bottom half is optional to allow the alternative use of this placard to display the appropriate United Nations Number for the consignment.

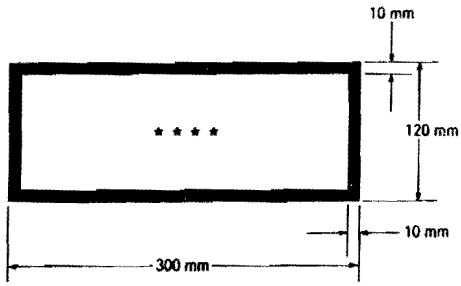

FIGURE 6: Placard for separate display of the United Nations Number. The background colour of the placard shall be orange and the border and United Nations Number shall be black. The symbol "****" denotes the space in which the appropriate United Nations Number as specified in column (A), Sixteenth Schedule shall be displayed.

Made the 15th November 1989.
[LPTA (S): TAD/016/1 Klt. 2; PN. (PU²) 425B/III.]

On behalf and in the name of the Prime Minister,

DATUK DR SULAIMAN BIN HAJI DAUD,
Minister in the Prime Minister's Department

DATUK HAJI MUKHTAR SHAMSUDDIN, P.S.D., J.S.D., S.M.S., S.M.T., S.M.P., K.M.N., P.I.S., KETUA PENGARAH PERCETAKAN NEGARA, MALAYSIA