RADIOACTIVE MATERIAL, TYPE A PACKAGE, non-special form, non-fissile or fissile-excepted

I. GENERAL PROVISIONS

110. For radioactive material having subsidiary risks, and for transport of radioactive material with other dangerous goods, the relevant transport regulations for dangerous goods shall apply in addition to these Regulations.

507. In addition to the radioactive and fissile properties, any other dangerous properties of the contents of the package, such as explosiveness, flammability, pyrophoricity, chemical toxicity and corrosiveness, shall be taken into account in the packing, labelling, marking, placarding, storage and transport in order to be in compliance with the relevant transport regulations for dangerous goods of each of the countries through or into which the materials will be transported, and, where applicable, with the regulations of the cognizant transport organizations, as well as these Regulations.

301. Doses to persons shall be below the relevant dose limits in accordance with GSR Part 3 [2]. Protection and safety shall be optimized in order that the magnitude of individual doses, the number of persons exposed and the likelihood of incurring exposure shall be kept as low as reasonably achievable, economic and social factors being taken into account, within the restriction that the doses to individuals are subject to dose constraints. A structured and systematic approach shall be adopted and shall include consideration of the interfaces between transport and other activities.

302. A radiation protection programme shall be established for the transport of radioactive material. The nature and extent of the measures to be employed in the programme shall be related to the magnitude and likelihood of radiation exposures. The programme shall incorporate the requirements of paras 301, 303–305, 311 and 562. Programme documents shall be available, on request, for inspection by the relevant competent authority.

303. For occupational exposures arising from transport activities, where it is assessed that the effective dose either:

(a) is likely to be between 1 and 6 mSv in a year, a dose assessment programme via workplace monitoring or individual monitoring shall be conducted; or

(b) is likely to exceed 6 mSv in a year, individual monitoring shall be conducted.

When individual monitoring or workplace monitoring is conducted, appropriate records shall be kept.
304. In the event of a nuclear or radiological emergency during the transport of radioactive material, provisions established by relevant national and/or international organizations shall be observed to protect human life, health, property and the environment. Consignors and carriers shall establish, in advance, arrangements for preparedness and response for emergencies that may occur during transport in accordance with the national emergency arrangements and emergency management system. The establishment of such arrangements are contained in Ref. [4, 14].

305. Emergency arrangements shall take into account all postulated emergencies and their consequences, and shall consider the formation of other dangerous substances that may result from the reaction between the contents of a consignment and the environment in the event of an accident. Guidance for the establishment of such provisions are contained in Ref. [4, 14].

311. Workers shall receive appropriate training concerning radiation protection, including the precautions to be observed in order to restrict their occupational exposure and the exposure of other persons who might be affected by their actions.

562. Packages, overpacks and freight containers containing radioactive material and unpackaged radioactive material shall be segregated during transport and during storage in transit:

(a) From workers in regularly occupied working areas by distances calculated using a dose criterion of 5 mSv in a year and conservative model parameters;

(b) From members of the public in areas where the public has regular access by distances calculated using a dose criterion of 1 mSv in a year and conservative model parameters;

(c) From undeveloped photographic film by distances calculated using a radiation exposure criterion for undeveloped photographic film due to the transport of radioactive material of 0.1 mSv per consignment of such film;

(d) From other dangerous goods in accordance with para. 506.

506. Consignments shall be segregated from other dangerous goods during transport in compliance with the relevant transport regulations for dangerous goods of each of the countries through or into which the materials will be transported, and, where applicable, with the regulations of the cognizant transport organizations, as well as these Regulations.

303. For occupational exposures arising from transport activities, where it is assessed that the effective dose either:

(a) Is likely to be between 1 and 6 mSv in a year, a dose assessment programme via workplace monitoring or individual monitoring shall be conducted; or

(b) Is likely to exceed 6 mSv in a year, individual monitoring shall be conducted.

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305. Emergency arrangements shall take into account all postulated emergencies and their consequences, and shall consider the formation of other dangerous substances that may result from the reaction between the contents of a consignment and the environment in the event of an accident. Guidance for the establishment of such provisions are contained in Ref. [4, 14]

554. The consignor shall provide in the transport documents a statement regarding actions, if any, that are required to be taken by the carrier. The statement shall be in the languages deemed necessary by the carrier or the authorities concerned and shall include at least the following points:

[(a) Supplementary requirements for loading, stowage, carriage, handling and unloading of the package, overpack or freight container, including any special stowage provisions for the safe dissipation of heat (see para. 565), or a statement that no such requirements are necessary;

(b) Restrictions on the mode of transport or conveyance and any necessary routeing instructions;]

(c) Emergency arrangements appropriate to the consignment.

306. A management system based on international, national or other standards acceptable to the competent authority shall be established and implemented for all activities within the scope of the Regulations, as identified in para. 106, to ensure compliance with the relevant provisions of these Regulations. Certification that the design specification has been fully implemented shall be available to the competent authority. The manufacturer, consignor or user shall be prepared:

(a) To provide facilities for inspection during manufacture and use;

(b) To demonstrate compliance with these Regulations to the competent authority.

Where competent authority approval is required, such approval shall take into account and be contingent upon the adequacy of the management system.

106. These Regulations apply to the transport of radioactive material by all modes on land, water, or in the air, including transport that is incidental to the use of the radioactive material. Transport comprises all operations and conditions associated with, and involved in, the movement of radioactive material; these include the design, manufacture, maintenance and repair of packaging, and the preparation, consigning, loading, carriage including in-transit storage, shipment after storage, unloading and receipt at the final destination of loads of radioactive material and packages. A graded approach is applied in specifying the performance standards in these Regulations, which are characterized in terms of three general severity levels:

(a) Routine conditions of transport (incident free);

(b) Normal conditions of transport (minor mishaps);

(c) Accident conditions of transport.

311. Workers shall receive appropriate training concerning radiation protection, including the precautions to be observed in order to restrict their occupational exposure and the exposure of other persons who might be affected by their actions.
312. Persons engaged in the transport of radioactive material shall receive training in the contents of these Regulations commensurate with their responsibilities.

313. Individuals such as those who classify radioactive material; pack radioactive material; mark and label radioactive material; prepare transport documents for radioactive material; offer or accept radioactive material for transport; carry or handle radioactive material in transport; mark or placard or load or unload packages of radioactive material into or from transport vehicles, bulk packagings or freight containers; or are otherwise directly involved in the transport of radioactive material as determined by the competent authority; shall receive the following training:

(a) General awareness/familiarization training:

(i) Each person shall receive training designed to provide familiarity with the general provisions of these Regulations.

(ii) Such training shall include a description of the categories of radioactive material; labelling, marking, placarding and packaging and segregation requirements; a description of the purpose and content of the radioactive material transport document; and a description of available emergency response documents.

(b) Function specific training: Each person shall receive detailed training concerning specific radioactive material transport requirements that are applicable to the function that person performs;

(c) Safety training: Commensurate with the risk of exposure in the event of a release and the functions performed, each person shall receive training on:

(i) Methods and procedures for accident avoidance, such as proper use of package handling equipment and appropriate methods of stowage of radioactive material.

(ii) Available information for any relevant abnormal event during transport and how to use it.

(iii) General dangers presented by the various categories of radioactive material and how to prevent exposure to those hazards, including, if appropriate, the use of personal protective clothing and equipment.

(iv) Immediate procedures to be followed in the event of an unintentional release of radioactive material, including any emergency response procedures for which the person is responsible and personal protection procedures to be followed.

314. Records of all safety training undertaken shall be kept by the employer and made available to the employee if requested.

315. The training required in para. 313 shall be provided or verified upon employment in a position involving radioactive material transport and shall be periodically supplemented with retraining as deemed appropriate by the competent authority.

313. Individuals such as those who classify radioactive material; pack radioactive material; mark and label radioactive material; prepare transport documents for radioactive material; offer or accept radioactive material for transport; carry or handle radioactive material in transport; mark or placard or load or unload packages of radioactive material into or from transport
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vehicles, bulk packagings or freight containers; or are otherwise directly involved in the transport of radioactive material as determined by the competent authority; shall receive the following training:

(a) General awareness/familiarization training:

   (i) Each person shall receive training designed to provide familiarity with the general provisions of these Regulations.

   (ii) Such training shall include a description of the categories of radioactive material; labelling, marking, placarding and packaging and segregation requirements; a description of the purpose and content of the radioactive material transport document; and a description of available emergency response documents.

(b) Function specific training: Each person shall receive detailed training concerning specific radioactive material transport requirements that are applicable to the function that person performs;

(c) Safety training: Commensurate with the risk of exposure in the event of a release and the functions performed, each person shall receive training on:

   (i) Methods and procedures for accident avoidance, such as proper use of package handling equipment and appropriate methods of stowage of radioactive material.

   (ii) Available information for any relevant abnormal event during transport and how to use it.

   (iii) General dangers presented by the various categories of radioactive material and how to prevent exposure to those hazards, including, if appropriate, the use of personal protective clothing and equipment.

   (iv) Immediate procedures to be followed in the event of an unintentional release of radioactive material, including any emergency response procedures for which the person is responsible and personal protection procedures to be followed.

501. Before a packaging is first used to transport radioactive material, it shall be confirmed that it has been manufactured in conformity with the design specifications to ensure compliance with the relevant provisions of these Regulations and any applicable certificate of approval. The following requirements shall also be fulfilled, if applicable:

(a) If the design pressure of the containment system exceeds 35 kPa (gauge), it shall be ensured that the containment system of each packaging conforms to the approved design requirements relating to the capability of that system to maintain its integrity under that pressure.

(b) For each packaging intended for use as a Type B(U), Type B(M) or Type C package and for each packaging intended to contain fissile material, it shall be ensured that the effectiveness of its shielding and containment and, where necessary, the heat transfer characteristics and the effectiveness of the confinement system, are within the limits applicable to or specified for the approved design.

(c) For each packaging intended to contain fissile material, it shall be ensured that the effectiveness of the criticality safety features is within the limits applicable to or specified for the design, and in
particular where, in order to comply with the requirements of para. 673, neutron poisons are specifically included, checks shall be performed to confirm the presence and distribution of those neutron poisons.

502. Before each shipment of any package, it shall be ensured that the package contains neither:

(a) Radionuclides different from those specified for the package design; nor

(b) Contents in a form, or physical or chemical state, different from those specified for the package design.

503. Before each shipment of any package, it shall be ensured that all the requirements specified in the relevant provisions of these Regulations and in the applicable certificates of approval have been fulfilled. The following requirements shall also be fulfilled, if applicable:

(a) It shall be ensured that lifting attachments that do not meet the requirements of para. 608 have been removed or otherwise rendered incapable of being used for lifting the package, in accordance with para. 609.

[(b) Each Type B(U), Type B(M) and Type C package shall be held until equilibrium conditions have been approached closely enough to demonstrate compliance with the requirements for temperature and pressure, unless an exemption from these requirements has received unilateral approval.

(c) For each Type B(U), Type B(M) and Type C package, it shall be ensured by inspection and/or appropriate tests that all closures, valve and other openings of the containment system through which the radioactive contents might escape are properly closed and, where appropriate, sealed in the manner for which the demonstrations of compliance with the requirements of paras 659 and 671 were made.

(d) For packages containing fissile material, the measurement specified in para. 677(b) and the tests to demonstrate closure of each package as specified in para. 680 shall be performed.]

(e) For packages intended to be used for shipment after storage, it shall be ensured that all packaging components and radioactive contents have been maintained during storage in a manner such that all the requirements specified in the relevant provisions of these Regulations and in the applicable certificates of approval have been fulfilled.

608. The design shall be such that any lifting attachments on the package will not fail when used in the intended manner and that if failure of the attachments should occur, the ability of the package to meet other requirements of these Regulations would not be impaired. The design shall take account of appropriate safety factors to cover snatch lifting.

609. Attachments and any other features on the outer surface of the package that could be used to lift it shall be designed either to support its mass in accordance with the requirements of para. 608 or shall be removable or otherwise rendered incapable of being used during transport.

608. The design shall be such that any lifting attachments on the package will not fail when used in the intended manner and that if failure of the attachments should occur, the ability of the package to meet other requirements of these Regulations would not be impaired. The design shall take account of appropriate safety factors to cover snatch lifting.
607. The *package* shall be so designed in relation to its mass, volume and shape that it can be easily and safely transported. In addition, the *package* shall be so designed that it can be properly secured in or on the *conveyance* during transport.

608. The *design* shall be such that any lifting attachments on the *package* will not fail when used in the intended manner and that if failure of the attachments should occur, the ability of the *package* to meet other requirements of these Regulations would not be impaired. The *design* shall take account of appropriate safety factors to cover snatch lifting.

609. Attachments and any other features on the outer surface of the *package* that could be used to lift it shall be designed either to support its mass in accordance with the requirements of para. 608 or shall be removable or otherwise rendered incapable of being used during transport.

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

611. As far as practicable, the outer layer of the *package* shall be so designed as to prevent the collection and the retention of water.

612. Any features added to the *package* at the time of transport that are not part of the *package* shall not reduce its safety.

613. The *package* shall be capable of withstanding the effects of any acceleration, vibration or vibration resonance that may arise under routine conditions of transport without any deterioration in the effectiveness of the closing devices on the various receptacles or in the integrity of the *package* as a whole. In particular, nuts, bolts and other securing devices shall be so designed as to prevent them from becoming loose or being released unintentionally, even after repeated use.

613bis. The *design* of *packages* shall take into account ageing mechanisms.

614. The materials of the *packaging* and any 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.

615. All valves through which the *radioactive contents* could escape shall be protected against unauthorized operation.

616. The *design* of the *package* shall take into account ambient temperatures and pressures that are likely to be encountered in routine conditions of transport.

617. A *package* shall be so designed that it provides sufficient shielding to ensure that, under routine conditions of transport and with the maximum *radioactive contents* that the *package* is designed to contain, the *dose equivalent rate* at any point on the external surface of the *package* would not exceed the values specified in paras 516, 527 and 528, as applicable, with account taken of paras 566(b) and 573.

516. The radiation level dose equivalent rate at any point on the external surface of an excepted package shall not exceed 5 μSv/h.

527. Except for *packages* or *overpacks* transported under *exclusive use* by rail or by road under the conditions specified in para. 573(g), or under *exclusive use* and *special arrangement* by
vessel or by air under the conditions specified in para. 575 or para. 573, respectively, the maximum dose equivalent rate at any point on the external surface of a package or overpack shall not exceed 2 mSv/h.

573. For consignments under exclusive use, the dose equivalent rate shall not exceed:

a) 10 mSv/h at any point on the external surface of any package or overpack, and may only exceed 2 mSv/h provided that:

(i) The vehicle is equipped with an enclosure that, during routine conditions of transport, prevents the access of unauthorized persons to the interior of the enclosure.

(ii) Provisions are made to secure the package or overpack so that its position within the vehicle enclosure remains fixed during routine conditions of transport.

(iii) There is no loading or unloading during the shipment.

(b) 2 mSv/h at any point on the outer surfaces of the vehicle, including the upper and lower surfaces, or, in the case of an open vehicle, at any point on the vertical planes projected from the outer edges of the vehicle, on the upper surface of the load, and on the lower external surface of the vehicle.

(c) 0.1 mSv/h at any point 2 m from the vertical planes represented by the outer lateral surfaces of the vehicle, or, if the load is transported in an open vehicle, at any point 2 m from the vertical planes projected from the outer edges of the vehicle.

575. Packages or overpacks having a surface radiation level greater than 2 mSv/h, unless being carried in or on a vehicle under exclusive use in accordance with Table 10, footnote (a), shall not be transported by vessel except under special arrangement.

Table 10, footnote (a). Packages or overpacks carried in or on a vehicle that are in accordance with the provisions of para. 573 may be transported by vessels provided that they are not removed from the vehicle at any time while on board the vessel.

573. For consignments under exclusive use, the dose equivalent rate shall not exceed:

a) 10 mSv/h at any point on the external surface of any package or overpack, and may only exceed 2 mSv/h provided that:

(i) The vehicle is equipped with an enclosure that, during routine conditions of transport, prevents the access of unauthorized persons to the interior of the enclosure.

(ii) Provisions are made to secure the package or overpack so that its position within the vehicle enclosure remains fixed during routine conditions of transport.

(iii) There is no loading or unloading during the shipment.
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(b) 2 mSv/h at any point on the outer surfaces of the vehicle, including the upper and lower surfaces, or, in the case of an open vehicle, at any point on the vertical planes projected from the outer edges of the vehicle, on the upper surface of the load, and on the lower external surface of the vehicle.

(c) 0.1 mSv/h at any point 2 m from the vertical planes represented by the outer lateral surfaces of the vehicle, or, if the load is transported in an open vehicle, at any point 2 m from the vertical planes projected from the outer edges of the vehicle.

579. Packages or overpacks having a surface radiation level greater than 2 mSv/h shall not be transported by air except by special arrangement.

528. The maximum dose equivalent rate at any point on the external surface of a package or overpack under exclusive use shall not exceed 10 mSv/h.

566. Loading of freight containers and accumulation of packages, overpacks and freight containers shall be controlled as follows:

[(a) Except under the condition of exclusive use, and for consignments of LSA-I material, the total number of packages, overpacks and freight containers aboard a single conveyance shall be so limited that the sum of the TIs aboard the conveyance does not exceed the values shown in Table 10.]

(b) The dose equivalent rate under routine 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 vehicle or freight container, except for consignments transported under exclusive use by road or rail, for which the radiation limits around the vehicle are set forth in para. 573(b) and 573(c).

573. For consignments under exclusive use, the dose equivalent rate shall not exceed:

a) 10 mSv/h at any point on the external surface of any package or overpack, and may only exceed 2 mSv/h provided that:

(i) The vehicle is equipped with an enclosure that, during routine conditions of transport, prevents the access of unauthorized persons to the interior of the enclosure.

(ii) Provisions are made to secure the package or overpack so that its position within the vehicle enclosure remains fixed during routine conditions of transport.

(iii) There is no loading or unloading during the shipment.

(b) 2 mSv/h at any point on the outer surfaces of the vehicle, including the upper and lower surfaces, or, in the case of an open vehicle, at any point on the vertical planes projected from the outer edges of the vehicle, on the upper surface of the load, and on the lower external surface of the vehicle.

(c) 0.1 mSv/h at any point 2 m from the vertical planes represented by the outer lateral surfaces of the vehicle, or, if the load is transported in an open vehicle, at any point 2 m from the vertical planes projected from the outer edges of the vehicle.
618. For radioactive material having other dangerous properties, the package design shall take into account those properties (see paras 110 and 507).

110. For radioactive material having subsidiary risks, and for transport of radioactive material with other dangerous goods, the relevant transport regulations for dangerous goods shall apply in addition to these Regulations.

507. In addition to the radioactive and fissile properties, any other dangerous properties of the contents of the package, such as explosiveness, flammability, pyrophoricity, chemical toxicity and corrosiveness, shall be taken into account in the packing, labelling, marking, placarding, storage and transport in order to be in compliance with the relevant transport regulations for dangerous goods of each of the countries through or into which the materials will be transported, and, where applicable, with the regulations of the cognizant transport organizations, as well as these Regulations.

619. For packages to be transported by air, the temperature of the accessible surfaces shall not exceed 50°C at an ambient temperature of 38°C with no account taken for insolation.

620. Packages to be transported by air shall be so designed that if they were exposed to ambient temperatures ranging from –40°C to +55°C, the integrity of containment would not be impaired.

621. Packages containing radioactive material to be transported by air shall be capable of withstanding, without loss or dispersal of radioactive contents from the containment system, an internal pressure that produces a pressure differential of not less than maximum normal operating pressure plus 95 kPa.

635. Type A packages shall be designed to meet the requirements specified in paras 607–618 and, in addition, the requirements of paras 619–621 if carried by air, and of paras 636–651.

607. The package shall be so designed in relation to its mass, volume and shape that it can be easily and safely transported. In addition, the package shall be so designed that it can be properly secured in or on the conveyance during transport.

608. The design shall be such that any lifting attachments on the package will not fail when used in the intended manner and that if failure of the attachments should occur, the ability of the package to meet other requirements of these Regulations would not be impaired. The design shall take account of appropriate safety factors to cover snatch lifting.

609. Attachments and any other features on the outer surface of the package that could be used to lift it shall be designed either to support its mass in accordance with the requirements of para. 608 or shall be removable or otherwise rendered incapable of being used during transport.

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

611. As far as practicable, the outer layer of the package shall be so designed as to prevent the collection and the retention of water.

612. Any features added to the package at the time of transport that are not part of the package shall not reduce its safety.
613. The package shall be capable of withstanding the effects of any acceleration, vibration or vibration resonance that may arise under routine conditions of transport without any deterioration in the effectiveness of the closing devices on the various receptacles or in the integrity of the package as a whole. In particular, nuts, bolts and other securing devices shall be so designed as to prevent them from becoming loose or being released unintentionally, even after repeated use.

613bis. The design of packages shall take into account ageing mechanisms.

614. The materials of the packaging and any 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.

615. All valves through which the radioactive contents could escape shall be protected against unauthorized operation.

616. The design of the package shall take into account ambient temperatures and pressures that are likely to be encountered in routine conditions of transport.

617. A package shall be so designed that it provides sufficient shielding to ensure that, under routine conditions of transport and with the maximum radioactive contents that the package is designed to contain, the dose equivalent rate at any point on the external surface of the package would not exceed the values specified in paras 516, 527 and 528, as applicable, with account taken of paras 566(b) and 573.

516. The radiation level dose equivalent rate at any point on the external surface of an excepted package shall not exceed 5 μSv/h.

527. Except for packages or overpacks transported under exclusive use by rail or by road under the conditions specified in para. 573(a), or under exclusive use and special arrangement by vessel or by air under the conditions specified in para. 575 or para. 579, respectively, the maximum dose equivalent rate at any point on the external surface of a package or overpack shall not exceed 2 mSv/h.

573. For consignments under exclusive use, the dose equivalent rate shall not exceed:

a) 10 mSv/h at any point on the external surface of any package or overpack, and may only exceed 2 mSv/h provided that:

(i) The vehicle is equipped with an enclosure that, during routine conditions of transport, prevents the access of unauthorized persons to the interior of the enclosure.

(ii) Provisions are made to secure the package or overpack so that its position within the vehicle enclosure remains fixed during routine conditions of transport.

(iii) There is no loading or unloading during the shipment.

(b) 2 mSv/h at any point on the outer surfaces of the vehicle, including the upper and lower surfaces, or, in the case of an open vehicle, at any point on the vertical planes
projected from the outer edges of the vehicle, on the upper surface of the load, and on the lower external surface of the vehicle.

(c) 0.1 mSv/h at any point 2 m from the vertical planes represented by the outer lateral surfaces of the vehicle, or, if the load is transported in an open vehicle, at any point 2 m from the vertical planes projected from the outer edges of the vehicle.

575 Packages or overpacks having a surface radiation level greater than 2 mSv/h, unless being carried in or on a vehicle under exclusive use in accordance with Table 10, footnote (a), shall not be transported by vessel except under special arrangement.

Table 10, footnote (a), Packages or overpacks carried in or on a vehicle that are in accordance with the provisions of para 573 may be transported by vessels provided that they are not removed from the vehicle at any time while on board the vessel.

573 For consignments under exclusive use, the dose equivalent rate shall not exceed:

a) 10 mSv/h at any point on the external surface of any package or overpack, and may only exceed 2 mSv/h provided that:

(i) The vehicle is equipped with an enclosure that, during routine conditions of transport, prevents the access of unauthorized persons to the interior of the enclosure.

(ii) Provisions are made to secure the package or overpack so that its position within the vehicle enclosure remains fixed during routine conditions of transport.

(iii) There is no loading or unloading during the shipment.

(b) 2 mSv/h at any point on the outer surfaces of the vehicle, including the upper and lower surfaces, or, in the case of an open vehicle, at any point on the vertical planes projected from the outer edges of the vehicle, on the upper surface of the load, and on the lower external surface of the vehicle.

(c) 0.1 mSv/h at any point 2 m from the vertical planes represented by the outer lateral surfaces of the vehicle, or, if the load is transported in an open vehicle, at any point 2 m from the vertical planes projected from the outer edges of the vehicle.

579 Packages or overpacks having a surface radiation level greater than 2 mSv/h shall not be transported by air except by special arrangement.

528 The maximum dose equivalent rate at any point on the external surface of a package or overpack under exclusive use shall not exceed 10 mSv/h.
Loading of freight containers and accumulation of packages, overpacks and freight containers shall be controlled as follows:

[(a) Except under the condition of exclusive use, and for consignments of LSA-I material, the total number of packages, overpacks and freight containers aboard a single conveyance shall be so limited that the sum of the TIs aboard the conveyance does not exceed the values shown in Table 10.]

(b) The dose equivalent rate under routine 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 vehicle or freight container, except for consignments transported under exclusive use by road or rail, for which the radiation limits around the vehicle are set forth in para. 573(b) and 573(c).

573. For consignments under exclusive use, the dose equivalent rate shall not exceed:

a) 10 mSv/h at any point on the external surface of any package or overpack, and may only exceed 2 mSv/h provided that:

   (i) The vehicle is equipped with an enclosure that, during routine conditions of transport, prevents the access of unauthorized persons to the interior of the enclosure.

   (ii) Provisions are made to secure the package or overpack so that its position within the vehicle enclosure remains fixed during routine conditions of transport.

   (iii) There is no loading or unloading during the shipment.

(b) 2 mSv/h at any point on the outer surfaces of the vehicle, including the upper and lower surfaces, or, in the case of an open vehicle, at any point on the vertical planes projected from the outer edges of the vehicle, on the upper surface of the load, and on the lower external surface of the vehicle.

(c) 0.1 mSv/h at any point 2 m from the vertical planes represented by the outer lateral surfaces of the vehicle, or, if the load is transported in an open vehicle, at any point 2 m from the vertical planes projected from the outer edges of the vehicle.

573. For consignments under exclusive use, the dose equivalent rate shall not exceed:

a) 10 mSv/h at any point on the external surface of any package or overpack, and may only exceed 2 mSv/h provided that:

   (i) The vehicle is equipped with an enclosure that, during routine conditions of transport, prevents the access of unauthorized persons to the interior of the enclosure.

   (ii) Provisions are made to secure the package or overpack so that its position within the vehicle enclosure remains fixed during routine conditions of transport.

   (iii) There is no loading or unloading during the shipment.
(b) 2 mSv/h at any point on the outer surfaces of the vehicle, including the upper and lower surfaces, or, in the case of an open vehicle, at any point on the vertical planes projected from the outer edges of the vehicle, on the upper surface of the load, and on the lower external surface of the vehicle.

(c) 0.1 mSv/h at any point 2 m from the vertical planes represented by the outer lateral surfaces of the vehicle, or, if the load is transported in an open vehicle, at any point 2 m from the vertical planes projected from the outer edges of the vehicle.

618. For radioactive material having other dangerous properties, the package design shall take into account those properties (see paras 110 and 507).

110. For radioactive material having subsidiary risks, and for transport of radioactive material with other dangerous goods, the relevant transport regulations for dangerous goods shall apply in addition to these Regulations.

507. In addition to the radioactive and fissile properties, any other dangerous properties of the contents of the package, such as explosiveness, flammability, pyrophoricity, chemical toxicity and corrosiveness, shall be taken into account in the packing, labelling, marking, placarding, storage and transport in order to be in compliance with the relevant transport regulations for dangerous goods of each of the countries through or into which the materials will be transported, and, where applicable, with the regulations of the cognizant transport organizations, as well as these Regulations.

636. The smallest overall external dimension of the package shall not be less than 10 cm.

619. For packages to be transported by air, the temperature of the accessible surfaces shall not exceed 50°C at an ambient temperature of 38°C with no account taken for insolation.

620. Packages to be transported by air shall be so designed that if they were exposed to ambient temperatures ranging from −40°C to +55°C, the integrity of containment would not be impaired.

621. Packages containing radioactive material to be transported by air shall be capable of withstanding, without loss or dispersal of radioactive contents from the containment system, an internal pressure that produces a pressure differential of not less than maximum normal operating pressure plus 95 kPa.

637. The outside of the package shall incorporate a feature such as a seal that is not readily breakable and which, while intact, will be evidence that the package has not been opened.

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

639. The design of the package shall take into account temperatures ranging from −40°C to +70°C for the components of the packaging. Attention shall be given to freezing temperatures for liquids and to the potential degradation of packaging materials within the given temperature range.

640. The design and manufacturing techniques shall be in accordance with national or international standards, or other requirements, acceptable to the competent authority.
641. The design shall include a containment system securely closed by a positive fastening device that cannot be opened unintentionally or by a pressure that may arise within the package.

642. Special form radioactive material may be considered as a component of the containment system.

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

644. 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.

645. The containment system shall retain its radioactive contents under a reduction of ambient pressure to 60 kPa.

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

647. A radiation shield that 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 that is independent of any other packaging structure.

648. A package shall be so designed that if it were subjected to the tests specified in paras 719–724, it would prevent:

(a) Loss or dispersal of the radioactive contents;

(b) More than a 20% increase in the maximum radiation-level dose equivalent rate at any external surface of the package, except when the maximum dose equivalent rate on the external surface is below 10 μSv/h. In this case, there shall be no increase of more than 2 μSv/h in the maximum dose equivalent rate at any external surface of the package.

649. The design of a package intended for liquid radioactive material shall make provision for ullage to accommodate variations in the temperature of the contents, dynamic effects and filling dynamics.

650. A Type A package designed to contain liquid radioactive material shall, in addition:

(a) Be adequate to meet the conditions specified in para. 648(a) if the package is subjected to the tests specified in para. 725; and

(b) Either:

(i) Be provided with sufficient absorbent material to absorb twice the volume of the liquid contents. Such absorbent material must be suitably positioned so as to contact the liquid in the event of leakage; or
(ii) Be provided with a containment system composed of primary inner and secondary outer containment components designed to enclose the liquid contents completely and to ensure their retention within the secondary outer containment components, even if the primary inner components leak.

638. A package shall be so designed that if it were subjected to the tests specified in paras 719–724, it would prevent:

(a) Loss or dispersal of the radioactive contents;

(b) More than a 20% increase in the maximum dose equivalent rate at any external surface of the package, except when the maximum dose equivalent rate on the external surface is below 10 μSv/h. In this case, there shall be no increase of more than 2 μSv/h in the maximum dose equivalent rate at any external surface of the package.

651. A Type A package designed for gases shall prevent loss or dispersal of the radioactive contents if the package were subjected to the tests specified in para. 725. A Type A package designed for tritium gas or for noble gases shall be excepted from this requirement.

636. The smallest overall external dimension of the package shall not be less than 10 cm.

637. The outside of the package shall incorporate a feature such as a seal that is not readily breakable and which, while intact, will be evidence that the package has not been opened.

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

639. The design of the package shall take into account temperatures ranging from −40°C to +70°C for the components of the packaging. Attention shall be given to freezing temperatures for liquids and to the potential degradation of packaging materials within the given temperature range.

640. The design and manufacturing techniques shall be in accordance with national or international standards, or other requirements, acceptable to the competent authority.

641. The design shall include a containment system securely closed by a positive fastening device that cannot be opened unintentionally or by a pressure that may arise within the package.

642. Special form radioactive material may be considered as a component of the containment system.

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

644. 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.

645. The containment system shall retain its radioactive contents under a reduction of ambient pressure to 60 kPa.

646. All valves, other than pressure relief valves, shall be provided with an enclosure to retain any leakage from the valve.
647. A radiation shield that 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 that is independent of any other packaging structure.

648. A package shall be so designed that if it were subjected to the tests specified in paras 719–724, it would prevent:

(a) Loss or dispersal of the radioactive contents;

(b) More than a 20% increase in the maximum radiation level-dose equivalent rate at any external surface of the package, except when the maximum dose equivalent rate on the external surface is below 10 μSv/h. In this case, there shall be no increase of more than 2 μSv/h in the maximum dose equivalent rate at any external surface of the package.

649. The design of a package intended for liquid radioactive material shall make provision for ullage to accommodate variations in the temperature of the contents, dynamic effects and filling dynamics.

650. A Type A package designed to contain liquid radioactive material shall, in addition:

(a) Be adequate to meet the conditions specified in para. 648(a) if the package is subjected to the tests specified in para. 725; and

(b) Either:

(i) Be provided with sufficient absorbent material to absorb twice the volume of the liquid contents. Such absorbent material must be suitably positioned so as to contact the liquid in the event of leakage; or

(ii) Be provided with a containment system composed of primary inner and secondary outer containment components designed to enclose the liquid contents completely and to ensure their retention within the secondary outer containment components, even if the primary inner components leak.

648. A package shall be so designed that if it were subjected to the tests specified in paras 719–724, it would prevent:

(a) Loss or dispersal of the radioactive contents;

(b) More than a 20% increase in the maximum radiation level-dose equivalent rate at any external surface of the package, except when the maximum dose equivalent rate on the external surface is below 10 μSv/h. In this case, there shall be no increase of more than 2 μSv/h in the maximum dose equivalent rate at any external surface of the package.

801. For package designs where it is not required that a competent authority issue a certificate of approval, the consignor shall, on request, make available for inspection by the relevant competent authority, documentary evidence of the compliance of the package design with all the applicable requirements.
819. Packages not requiring competent authority approval of design (excepted packages, [Type IP-1, Type IP-2, Type IP-3 and Type A packages]) shall meet this Edition of these Regulations in full, except that:

(a) Packages that meet the requirements of the 1985 or 1985 (As Amended 1990) Editions of these Regulations:

(a) May continue in transport provided that they were prepared for transport prior to 31 December 2003 and are subject to the requirements of para. 822, if applicable; or

(b) May continue to be used, provided that all the following conditions are met:

(i) They were not designed to contain uranium hexafluoride.

(ii) The applicable requirements of para. 306 of this Edition of these Regulations are applied.

(iii) The activity limits and classification in Section IV of this Edition of the Regulations are applied.

(iv) The requirements and controls for transport in Section V of this Edition of these Regulations are applied.

B. Packages that meet the requirements of the 1996 Edition, 1996 Edition (Revised), 1996 (As amended 2003), 2005, 2009 or 2012 Editions of these Regulations:

(a) May continue in transport provided that they were prepared for transport prior to 31 December 2025 and are subject to the requirements of para. 822, if applicable; or

(b) May continue to be used, provided that all the following conditions are met:

(i) The applicable requirements of para. 306 of this Edition of these Regulations are applied;

(ii) The activity limits and classification in Section IV of this Edition of the Regulations are applied;

(iii) The requirements and controls for transport in Section V of this Edition of these Regulations are applied; and

(iv) The packaging was not manufactured or modified after 31 December 2025.


822. Packages containing fissile material that is excepted from classification as “FISSILE” according to para. 417 a)(i) or (iii) of the 2009 Edition of these Regulations prepared for transport before 31 December 2014 may continue in transport and may continue to be classified as non-fissile or fissile-excepted except that the consignment limits in Table 4 of the 2009 Edition of these Regulations shall apply to the conveyance. The consignment shall be transported under exclusive use.

306. A management system based on international, national or other standards acceptable to the competent authority shall be established and implemented for all activities within the scope of the Regulations, as identified in para. 106, to ensure compliance with the relevant provisions of these Regulations. Certification that the design specification has been fully implemented shall be available to the competent authority. The manufacturer, consignor or user shall be prepared:
(a) To provide facilities for inspection during manufacture and use;

(b) To demonstrate compliance with these Regulations to the competent authority.

Where competent authority approval is required, such approval shall take into account and be contingent upon the adequacy of the management system.

These Regulations apply to the transport of radioactive material by all modes on land, water, or in the air, including transport that is incidental to the use of the radioactive material. Transport comprises all operations and conditions associated with, and involved in, the movement of radioactive material; these include the design, manufacture, maintenance and repair of packaging, and the preparation, consigning, loading, carriage including in-transit storage, shipment after storage, unloading and receipt at the final destination of loads of radioactive material and packages. A graded approach is applied in specifying the performance standards in these Regulations, which are characterized in terms of three general severity levels:

(a) Routine conditions of transport (incident free);
(b) Normal conditions of transport (minor mishaps);
(c) Accident conditions of transport.

2. CONTENTS LIMITS FOR PACKAGES

Fissile material and packages containing fissile material shall be classified under the relevant entry as “FISSILE”, in accordance with Table 1 unless excepted by one of the provisions of subparagraphs (a)–(f) of this paragraph and transported subject to the requirements of para. 570. All provisions apply only to material in packages that meet the requirements of para. 636, unless unpackaged material is specifically allowed in the provision:

(a) Uranium enriched in uranium-235 to a maximum of 1% by mass, and with a total plutonium and uranium-233 content not exceeding 1% of the mass of uranium-235, provided that the fissile nuclides are distributed essentially homogeneously throughout the material. In addition, if uranium-235 is present in metallic, oxide or carbide forms, it shall not form a lattice arrangement.

(b) Liquid solutions of uranyl nitrate enriched in uranium-235 to a maximum of 2% by mass, with a total plutonium and uranium-233 content not exceeding 0.002% of the mass of uranium, and with a minimum nitrogen to uranium atomic ratio (N/U) of 2.

(c) Uranium with a maximum uranium enrichment of 5% by mass of uranium-235 provided:

(i) There is no more than 3.5 g of uranium-235 per package.

(ii) The total plutonium and uranium-233 content does not exceed 1% of the mass of uranium-235 per package.

(iii) Transport of the package is subject to the consignment limit provided in para. 570(c).

(d) Fissile nuclides with a total mass not greater than 2.0 g per package, provided the package is transported subject to the consignment limit provided in para. 570(d).
(e) Fissile nuclides with a total mass not greater than 45 g, either packaged or unpackaged, subject to the requirements of para. 570(e).

(f) A fissile material that meets the requirements of paras 570(b), 606 and 802.

429. Type A packages shall not contain activities greater than either of the following:

(a) For special form radioactive material — \(A_1\);

(b) For all other radioactive material — \(A_2\).

430. For mixtures of radionuclides whose identities and respective activities are known, the following condition shall apply to the radioactive contents of a Type A package:

\[
\sum_i B(i) A_1(i) + \sum_j C(j) A_2(j)
\]

where

- \(B(i)\) is the activity of radionuclide \(i\) as special form radioactive material;
- \(A_1(i)\) is the \(A_1\) value for radionuclide \(i\);
- \(C(j)\) is the activity of radionuclide \(j\) as other than special form radioactive material;
- \(A_2(j)\) is the \(A_2\) value for radionuclide \(j\).

504. A package shall not contain any items other than those that are necessary for the use of the radioactive material. The interaction between these items and the package, under the conditions of transport applicable to the design, shall not reduce the safety of the package.

3. CONTAMINATION

508. The non-fixed contamination on the external surfaces of any package shall be kept as low as practicable and, under routine conditions of transport, shall not exceed the following limits:

(a) 4 Bq/cm\(^2\) for beta and gamma emitters and low toxicity alpha emitters;

(b) 0.4 Bq/cm\(^2\) for all other alpha emitters.

These limits are applicable when averaged over any area of 300 cm\(^2\) of any part of the surface.

509. Except as provided in para. 514, the level of non-fixed contamination on the external and internal surfaces of overpacks, freight containers and conveyances shall not exceed the limits specified in para. 508. This requirement does not apply to freight containers used as packagings, either loaded or empty.

514. A freight container or conveyance dedicated to the transport of unpackaged radioactive material under exclusive use shall be excepted from the requirements of paras 509 and 513 solely with regard to its internal surfaces and only for as long as it remains under that specific exclusive use.

509. Except as provided in para. 514, the level of non-fixed contamination on the external and internal surfaces of overpacks, freight containers and conveyances shall not exceed the limits specified in para. 508. This requirement does not apply to freight containers used as packagings, either loaded or empty.
The non-fixed contamination on the external surfaces of any package shall be kept as low as practicable and, under routine conditions of transport, shall not exceed the following limits:

(a) 4 Bq/cm$^2$ for beta and gamma emitters and low toxicity alpha emitters;
(b) 0.4 Bq/cm$^2$ for all other alpha emitters.

These limits are applicable when averaged over any area of 300 cm$^2$ of any part of the surface.

Except as provided in para. 514, any conveyance, or equipment or part thereof that has become contaminated above the limits specified in para. 508 in the course of the transport of radioactive material, or that shows a dose equivalent rate in excess of 5 μSv/h at the surface, shall be decontaminated as soon as possible by a qualified person and shall not be reused unless the following conditions are fulfilled:

(a) The non-fixed contamination shall not exceed the limits specified in para. 508.
(b) The dose equivalent rate resulting from the fixed contamination shall not exceed 5 μSv/h at the surface.

The non-fixed contamination on the external surfaces of any package shall be kept as low as practicable and, under routine conditions of transport, shall not exceed the following limits:

(a) 4 Bq/cm$^2$ for beta and gamma emitters and low toxicity alpha emitters;
(b) 0.4 Bq/cm$^2$ for all other alpha emitters.

These limits are applicable when averaged over any area of 300 cm$^2$ of any part of the surface.

4. MAXIMUM RADIATION LEVELS

526. Except for consignments under exclusive use, the TI of any package or overpack shall not exceed 10, nor shall the CSI of any package or overpack exceed 50.

527. Except for packages or overpacks transported under exclusive use by rail or by road under the conditions specified in para. 573(a), or under exclusive use and special arrangement by vessel or by air under the conditions specified in para. 573 or para. 579, respectively, the maximum radiation level dose equivalent rate at any point on the external surface of a package or overpack shall not exceed 2 mSv/h.

573. For consignments under exclusive use, the radiation level–dose equivalent rate shall not exceed:

a) 10 mSv/h at any point on the external surface of any package or overpack, and may only exceed 2 mSv/h provided that:

(i) The vehicle is equipped with an enclosure that, during routine conditions of transport, prevents the access of unauthorized persons to the interior of the enclosure.
(ii) Provisions are made to secure the package or overpack so that its position within the vehicle enclosure remains fixed during routine conditions of transport.
(iii) There is no loading or unloading during the shipment.

(b) 2 mSv/h at any point on the outer surfaces of the vehicle, including the upper and lower surfaces, or, in the case of an open vehicle, at any point on the vertical planes projected from the outer edges of the vehicle, on the upper surface of the load, and on the lower external surface of the vehicle.

(c) 0.1 mSv/h at any point 2 m from the vertical planes represented by the outer lateral surfaces of the vehicle, or, if the load is transported in an open vehicle, at any point 2 m from the vertical planes projected from the outer edges of the vehicle.

575. Packages or overpacks having a surface radiation level dose equivalent rate greater than 2 mSv/h, unless being carried in or on a vehicle under exclusive use in accordance with Table 10, footnote (a), shall not be transported by vessel except under special arrangement.

Table 10, footnote (a). Packages or overpacks carried in or on a vehicle that are in accordance with the provisions of para. 575 may be transported by vessels provided that they are not removed from the vehicle at any time while on board the vessel.

573. For consignments under exclusive use, the radiation level dose equivalent rate shall not exceed:

a) 10 mSv/h at any point on the external surface of any package or overpack, and may only exceed 2 mSv/h provided that:

(i) The vehicle is equipped with an enclosure that, during routine conditions of transport, prevents the access of unauthorized persons to the interior of the enclosure.

(ii) Provisions are made to secure the package or overpack so that its position within the vehicle enclosure remains fixed during routine conditions of transport.

(iii) There is no loading or unloading during the shipment.

(b) 2 mSv/h at any point on the outer surfaces of the vehicle, including the upper and lower surfaces, or, in the case of an open vehicle, at any point on the vertical planes projected from the outer edges of the vehicle, on the upper surface of the load, and on the lower external surface of the vehicle.

(c) 0.1 mSv/h at any point 2 m from the vertical planes represented by the outer lateral surfaces of the vehicle, or, if the load is transported in an open vehicle, at any point 2 m from the vertical planes projected from the outer edges of the vehicle.

579. Packages or overpacks having a surface radiation level greater than 2 mSv/h shall not be transported by air except by special arrangement.

528. The maximum radiation level dose equivalent rate at any point on the external surface of a package or overpack under exclusive use shall not exceed 10 mSv/h.

575. Packages or overpacks having a surface radiation level dose equivalent rate greater than 2 mSv/h, unless being carried in or on a vehicle under exclusive use in accordance with Table 10, footnote (a), shall not be transported by vessel except under special arrangement.
Table 10, footnote (a). Packages or overpacks carried in or on a vehicle that are in accordance with the provisions of para. 573 may be transported by vessels provided that they are not removed from the vehicle at any time while on board the vessel.

For consignments under exclusive use, the radiation level dose equivalent rate shall not exceed:

a) 10 mSv/h at any point on the external surface of any package or overpack, and may only exceed 2 mSv/h provided that:

(i) The vehicle is equipped with an enclosure that, during routine conditions of transport, prevents the access of unauthorized persons to the interior of the enclosure.

(ii) Provisions are made to secure the package or overpack so that its position within the vehicle enclosure remains fixed during routine conditions of transport.

(iii) There is no loading or unloading during the shipment.

(b) 2 mSv/h at any point on the outer surfaces of the vehicle, including the upper and lower surfaces, or, in the case of an open vehicle, at any point on the vertical planes projected from the outer edges of the vehicle, on the upper surface of the load, and on the lower external surface of the vehicle.

(c) 0.1 mSv/h at any point 2 m from the vertical planes represented by the outer lateral surfaces of the vehicle, or, if the load is transported in an open vehicle, at any point 2 m from the vertical planes projected from the outer edges of the vehicle.

5. CATEGORIES OF PACKAGES AND OVERPACKS

523. The TI for a package, overpack or freight container, or for unpackaged LSA-I or SCO-I or SCO-III, shall be the number derived in accordance with the following procedure:

(a) Determine the maximum radiation level dose equivalent rate in units of millisieverts per hour (mSv/h) at a distance of 1 m from the external surfaces of the package, overpack, freight container or unpackaged LSA-I and SCO-I and SCO-III. The value determined shall be multiplied by 100 and the resulting number is the TI. For uranium and thorium ores and their concentrates, the maximum radiation level dose equivalent rate at any point 1 m from the external surface of the load may be taken as:

(i) 0.4 mSv/h for ores and physical concentrates of uranium and thorium;

(ii) 0.3 mSv/h for chemical concentrates of thorium;

(iii) 0.02 mSv/h for chemical concentrates of uranium, other than uranium hexafluoride.

(b) For tanks, freight containers and unpackaged LSA-I, SCO-I and SCO-III, the value determined in step (a) shall be multiplied by the appropriate factor from Table 7.

(c) The value obtained in steps (a) and (b) shall be rounded up to the first decimal place (for example, 1.13 becomes 1.2), except that a value of 0.05 or less may be considered as zero.
524. The TI for each rigid overpack, freight container or conveyance shall be determined as the sum of the TIs of all the packages. For a shipment from a single consignor, the consignor may determine the TI by direct measurement of dose equivalent rate.

524bis. The TI for a non-rigid overpack shall be determined only as the sum of the TIs of all the packages.

529. Packages, overpacks and freight containers shall be assigned to either category I-WHITE, II-YELLOW or III-YELLOW in accordance with the conditions specified in Table 8 and with the following requirements:

(a) For a package, overpack or freight container, the TI and the surface radiation level dose equivalent rate conditions shall be taken into account in determining which category is appropriate. Where the TI satisfies the condition for one category but the surface radiation level dose equivalent rate satisfies the condition for a different category, the package, overpack or freight container shall be assigned to the higher category. For this purpose, category I-WHITE shall be regarded as the lowest category.

(b) The TI shall be determined following the procedures specified in paras 523 and 524.

(c) If the surface radiation level dose equivalent rate is greater than 2 mSv/h, the package or overpack shall be transported under exclusive use and under the provisions of paras 573(a), 575 or 579, as appropriate.

(d) A package transported under a special arrangement shall be assigned to category III-YELLOW except under the provisions of para. 530.

(e) An overpack or freight container that contains packages transported under special arrangement shall be assigned to category III-YELLOW except under the provisions of para. 530.

523. The TI for a package, overpack or freight container, or for unpackaged LSA-I, SCO-I or SCO-III shall be the number derived in accordance with the following procedure:

(a) Determine the maximum radiation level dose equivalent rate in units of millisieverts per hour (mSv/h) at a distance of 1 m from the external surfaces of the package, overpack, freight container or unpackaged LSA-I, SCO-I and SCO-III. The value determined shall be multiplied by 100 and the resulting number is the TI. For uranium and thorium ores and their concentrates, the maximum radiation level dose equivalent rate at any point 1 m from the external surface of the load may be taken as:

(i) 0.4 mSv/h for ores and chemical concentrates of uranium and thorium;

(ii) 0.3 mSv/h for chemical concentrates of thorium;

(iii) 0.02 mSv/h for chemical concentrates of uranium, other than uranium hexafluoride.

(b) For tanks, freight containers and unpackaged LSA-I, SCO-I and SCO-III, the value determined in step (a) shall be multiplied by the appropriate factor from Table 7.

(c) The value obtained in steps (a) and (b) shall be rounded up to the first decimal place (for example, 1.13 becomes 1.2), except that a value of 0.05 or less may be considered as zero.
524. The TI for each rigid overpack, freight container or conveyance shall be determined as the sum of the TIs of all the packages. For a shipment from a single consignor, the consignor may determine the TI by direct measurement of dose equivalent rate.

524bis. The TI for a non-rigid overpack shall be determined only as the sum of the TIs of all the packages.

573. For consignments under exclusive use, the radiation level dose equivalent rate shall not exceed:

a) 10 mSv/h at any point on the external surface of any package or overpack, and may only exceed 2 mSv/h provided that:

(i) The vehicle is equipped with an enclosure that, during routine conditions of transport, prevents the access of unauthorized persons to the interior of the enclosure.

(ii) Provisions are made to secure the package or overpack so that its position within the vehicle enclosure remains fixed during routine conditions of transport.

(iii) There is no loading or unloading during the shipment.

(b) 2 mSv/h at any point on the outer surfaces of the vehicle, including the upper and lower surfaces, or, in the case of an open vehicle, at any point on the vertical planes projected from the outer edges of the vehicle, on the upper surface of the load, and on the lower external surface of the vehicle.

(c) 0.1 mSv/h at any point 2 m from the vertical planes represented by the outer lateral surfaces of the vehicle, or, if the load is transported in an open vehicle, at any point 2 m from the vertical planes projected from the outer edges of the vehicle.

575. Packages or overpacks having a surface radiation level dose equivalent rate greater than 2 mSv/h, unless being carried in or on a vehicle under exclusive use in accordance with Table 10, footnote (a), shall not be transported by vessel except under special arrangement.

Table 10, footnote (a). Packages or overpacks carried in or on a vehicle that are in accordance with the provisions of para. 573 may be transported by vessels provided that they are not removed from the vehicle at any time while on board the vessel.

573. For consignments under exclusive use, the radiation level dose equivalent rate shall not exceed:

a) 10 mSv/h at any point on the external surface of any package or overpack, and may only exceed 2 mSv/h provided that:

(i) The vehicle is equipped with an enclosure that, during routine conditions of transport, prevents the access of unauthorized persons to the interior of the enclosure.

(ii) Provisions are made to secure the package or overpack so that its position within the vehicle enclosure remains fixed during routine conditions of transport.

(iii) There is no loading or unloading during the shipment.
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(b) 2 mSv/h at any point on the outer surfaces of the vehicle, including the upper and lower surfaces, or, in the case of an open vehicle, at any point on the vertical planes projected from the outer edges of the vehicle, on the upper surface of the load, and on the lower external surface of the vehicle.

(c) 0.1 mSv/h at any point 2 m from the vertical planes represented by the outer lateral surfaces of the vehicle, or, if the load is transported in an open vehicle, at any point 2 m from the vertical planes projected from the outer edges of the vehicle.

579. Packages or overpacks having a surface radiation level greater than 2 mSv/h shall not be transported by air except by special arrangement.

530. For each package or overpack, the UN number and proper shipping name shall be determined (see Table 1). In all cases of international transport of packages requiring competent authority approval of design or shipment, for which different approval types apply in the different countries concerned by the shipment, the UN number, proper shipping name, categorization, labelling and marking shall be in accordance with the certificate of the country of origin of design.

6. MARKING AND LABELLING

507. In addition to the radioactive and fissile properties, any other dangerous properties of the contents of the package, such as explosiveness, flammability, pyrophoricity, chemical toxicity and corrosiveness, shall be taken into account in the packing, labelling, marking, placarding, storage and transport in order to be in compliance with the relevant transport regulations for dangerous goods of each of the countries through or into which the materials will be transported, and, where applicable, with the regulations of the cognizant transport organizations, as well as these Regulations.

531. Each package shall be legibly and durably marked on the outside of the packaging with an identification of either the consignor or consignee, or both. Each overpack shall be legibly and durably marked on the outside of the overpack with an identification of either the consignor or consignee, or both, unless these markings of all the packages within the overpack are clearly visible.

532. Each package shall be legibly and durably marked on the outside with the UN marking as specified in Table 9. Additionally, each overpack shall be legibly and durably marked with the word “OVERPACK” and the UN marking as specified in Table 9 unless all the markings of the packages within the overpack are clearly visible.

533. Each package of gross mass exceeding 50 kg shall have its permissible gross mass legibly and durably marked on the outside of the packaging.

534. Each package that conforms to:

(a) An IP-1, IP-2 or IP-3 design shall be legibly and durably marked on the outside of the packaging with “TYPE IP-1”, “TYPE IP-2” or “TYPE IP-3”, as appropriate.

(b) A Type A package design shall be legibly and durably marked on the outside of the packaging with “TYPE A”.

(c) An IP-2, IP-3 or a Type A package design shall be legibly and durably marked on the outside of the packaging with the international vehicle registration code (VRI code) of the country of origin of
design and either the name of the manufacturer or other identification of the packaging specified by the competent authority of the country of origin of design.

538. Each package, overpack and freight container shall bear the labels conforming to the applicable models in Figs 2–4, except as allowed under the alternative provisions of para. 543 for large freight containers and tanks, according to the appropriate category. In addition, each package, overpack and freight container containing fissile material, other than fissile material excepted under the provisions of para. 412, shall bear labels conforming to the model in Fig. 5. Any labels that do not relate to the contents shall be removed or covered.

543. Large freight containers carrying unpackaged LSA-I material or SCO-I or packages other than excepted packages, and tanks shall bear four placards that conform to the model given in Fig. 6. The placards shall be affixed in a vertical orientation to each side wall and to each end wall of the large freight container or tank. Any placards that do not relate to the contents shall be removed. Instead of using both labels and placards, it is permitted, as an alternative, to use enlarged labels only, where appropriate, as shown in Figs 2–4, except having the minimum size shown in Fig. 6.

417. Fissile material and packages containing fissile material shall be classified under the relevant entry as “FISSILE”, in accordance with Table 1 unless excepted by one of the provisions of subparagraphs (a)–(f) of this paragraph and transported subject to the requirements of para. 570. All provisions apply only to material in packages that meet the requirements of para. 636, unless unpackaged material is specifically allowed in the provision:

(a) Uranium enriched in uranium-235 to a maximum of 1% by mass, and with a total plutonium and uranium-233 content not exceeding 1% of the mass of uranium-235, provided that the fissile nuclides are distributed essentially homogeneously throughout the material. In addition, if uranium-235 is present in metallic, oxide or carbide forms, it shall not form a lattice arrangement.

(b) Liquid solutions of uranyl nitrate enriched in uranium-235 to a maximum of 2% by mass, with a total plutonium and uranium-233 content not exceeding 0.002% of the mass of uranium, and with a minimum nitrogen to uranium atomic ratio (N/U) of 2.

(c) Uranium with a maximum uranium enrichment of 5% by mass of uranium-235 provided:

(i) There is no more than 3.5 g of uranium-235 per package.

(ii) The total plutonium and uranium-233 content does not exceed 1% of the mass of uranium-235 per package.

(iii) Transport of the package is subject to the consignment limit provided in para. 570(c).

(d) Fissile nuclides with a total mass not greater than 2.0 g per package, provided the package is transported subject to the consignment limit provided in para. 570(d).

(e) Fissile nuclides with a total mass not greater than 45 g, either packaged or unpackaged, subject to the limits provided in requirements of para. 570(e). (f) A fissile material that meets the requirements of paras 570(b), 606 and 802.
539. The labels conforming to the applicable models in Figs 2–4 shall be affixed to two opposite sides of the outside of a package or overpack or on the outside of all four sides of a freight container or tank. The labels conforming to the model in Fig. 5, where applicable, shall be affixed adjacent to the labels conforming to the applicable models in Figs 2–4. The labels shall not cover the markings specified in paras 531–536.

531. Each package shall be legibly and durably marked on the outside of the packaging with an identification of either the consignor or consignee, or both. Each overpack shall be legibly and durably marked on the outside of the overpack with an identification of either the consignor or consignee, or both, unless these markings of all the packages within the overpack are clearly visible.

532. Each package shall be legibly and durably marked on the outside with the UN marking as specified in Table 9. Additionally, each overpack shall be legibly and durably marked with the word “OVERPACK” and the UN marking as specified in Table 9 unless all the markings of the packages within the overpack are clearly visible.

533. Each package of gross mass exceeding 50 kg shall have its permissible gross mass legibly and durably marked on the outside of the packaging.

534. Each package that conforms to:

(a) An IP-1, IP-2 or IP-3 design shall be legibly and durably marked on the outside of the packaging with “TYPE IP-1”, “TYPE IP-2” or “TYPE IP-3”, as appropriate.

(b) A Type A package design shall be legibly and durably marked on the outside of the packaging with “TYPE A”.

(c) An IP-2, IP-3 or a Type A package design shall be legibly and durably marked on the outside of the packaging with the international vehicle registration code (VRI code) of the country of origin of design and either the name of the manufacturer or other identification of the packaging specified by the competent authority of the country of origin of design.

535. Each package that conforms to a design approved under one or more of paras 807–816 and 820 shall be legibly and durably marked on the outside of the packaging with the following information:

(a) The identification mark allocated to that design by the competent authority;

(b) A serial number to identify uniquely each packaging that conforms to that design;

(c) “TYPE B(U)”, “TYPE B(M)” or “TYPE C”, in the case of a Type B(U), Type B(M) or Type C package design

536. Each package that conforms to a Type B(U), Type B(M) or Type C package design shall have the outside of the outermost receptacle, that is resistant to the effects of fire and water, plainly marked by embossing, stamping or other means resistant to the effects of fire and water with the trefoil symbol shown in Fig. 1.

Each label conforming to the applicable models in Figs 2–4 shall be completed with the following information:
540. (a) Contents:

(i) Except for LSA-I material, the name(s) of the radionuclide(s) as taken from Table 2, using the symbols prescribed therein. For mixtures of radionuclides, the most restrictive nuclides must be listed to the extent the space on the line permits. The group of LSA or SCO shall be shown following the name(s) of the radionuclide(s). The terms “LSA-II”, “LSA-III”, “SCO-I”, “SCO-II” and SCO-III shall be used for this purpose.

(ii) For LSA-I material, the term “LSA-I” is all that is necessary; the name of the radionuclide is not necessary.

(b) Activity: The maximum activity of the radioactive contents during transport expressed in units of becquerels (Bq) with the appropriate SI prefix symbol (see Annex II). For fissile material, the total mass of fissile nuclides in units of grams (g), or multiples thereof, may be used in place of activity.

(c) For overpacks and freight containers, the “contents” and “activity” entries on the label shall bear the information required in para. 540(a) and 540(b), respectively, totalled together for the entire contents of the overpack or freight container except that on labels for overpacks or freight containers containing mixed loads of packages containing different radionuclides, such entries may read “See Transport Documents”.

(d) TI: The number determined in accordance with paras 523 and 524 (no TI entry is required for Category I-WHITE).

523. The TI for a package, overpack or freight container, or for unpackaged LSA-I or SCO-I, shall be the number derived in accordance with the following procedure:

(a) Determine the maximum radiation level-dose equivalent rate in units of millisieverts per hour (mSv/h) at a distance of 1 m from the external surfaces of the package, overpack, freight container or unpackaged LSA-I and SCO-I. The value determined shall be multiplied by 100 and the resulting number is the TI. For uranium and thorium ores and their concentrates, the maximum radiation level-dose equivalent rate at any point 1 m from the external surface of the load may be taken as:

(i) 0.4 mSv/h for ores and physical concentrates of uranium and thorium;

(ii) 0.3 mSv/h for chemical concentrates of thorium;

(iii) 0.02 mSv/h for chemical concentrates of uranium, other than uranium hexafluoride.

(b) For tanks, freight containers and unpackaged LSA-I, SCO-I and SCO-III, the value determined in step (a) shall be multiplied by the appropriate factor from Table 7.

(c) The value obtained in steps (a) and (b) shall be rounded up to the first decimal place (for example, 1.13 becomes 1.2), except that a value of 0.05 or less may be considered as zero.

524. The TI for each rigid overpack, freight container or conveyance shall be determined as the sum of the TIs of all the packages. For a shipment from a single consignor, the consignor may determine the TI by direct measurement of dose equivalent rate.
524bis. The TI for a non-rigid overpack shall be determined only as the sum of the TIs of all the packages.

543. Large freight containers carrying unpackaged LSA-I material or SCO-I or packages other than excepted packages, and tanks shall bear four placards that conform to the model given in Fig. 6. The placards shall be affixed in a vertical orientation to each side wall and to each end wall of the large freight container or tank. Any placards that do not relate to the contents shall be removed. Instead of using both labels and placards, it is permitted, as an alternative, to use enlarged labels only, where appropriate, as shown in Figs 2–4, except having the minimum size shown in Fig. 6.

545. Except as otherwise provided in these Regulations, no person may offer radioactive material for transport unless it is properly marked, labelled, placarded, described and certified on a transport document, and otherwise in a condition for transport as required by these Regulations.

7. REQUIREMENTS BEFORE SHIPMENT

501. Before a packaging is first used to transport radioactive material, it shall be confirmed that it has been manufactured in conformity with the design specifications to ensure compliance with the relevant provisions of these Regulations and any applicable certificate of approval. The following requirements shall also be fulfilled, if applicable:

(a) If the design pressure of the containment system exceeds 35 kPa (gauge), it shall be ensured that the containment system of each packaging conforms to the approved design requirements relating to the capability of that system to maintain its integrity under that pressure.

(b) For each packaging intended for use as a Type B(U), Type B(M) or Type C package and for each packaging intended to contain fissile material, it shall be ensured that the effectiveness of its shielding and containment and, where necessary, the heat transfer characteristics and the effectiveness of the confinement system, are within the limits applicable to or specified for the approved design.

(c) For each packaging intended to contain fissile material, it shall be ensured that the effectiveness of the criticality safety features is within the limits applicable to or specified for the design, and in particular where, in order to comply with the requirements of para. 673, neutron poisons are specifically included, checks shall be performed to confirm the presence and distribution of those neutron poisons.

502. Before each shipment of any package, it shall be ensured that the package contains neither:

(a) Radionuclides different from those specified for the package design; nor

(b) Contents in a form, or physical or chemical state, different from those specified for the package design.

503. Before each shipment of any package, it shall be ensured that all the requirements specified in the relevant provisions of these Regulations and in the applicable certificates of approval have been fulfilled. The following requirements shall also be fulfilled, if applicable:

(a) It shall be ensured that lifting attachments that do not meet the requirements of para. 608 have been removed or otherwise rendered incapable of being used for lifting the package, in accordance with para. 609.
608. The design shall be such that any lifting attachments on the package will not fail when used in the intended manner and that if failure of the attachments should occur, the ability of the package to meet other requirements of these Regulations would not be impaired. The design shall take account of appropriate safety factors to cover snatch lifting.

609. Attachments and any other features on the outer surface of the package that could be used to lift it shall be designed either to support its mass in accordance with the requirements of para. 608 or shall be removable or otherwise rendered incapable of being used during transport.

546. The consignor shall include in the transport documents with each consignment the identification of the consignor and consignee, including their names and addresses, and the following information, as applicable, in the order given:

(a) The UN number assigned to the material as specified in accordance with the provisions of paras 401 and 530, preceded by the letters “UN”.

(b) The proper shipping name, as specified in accordance with the provisions of paras 401 and 530.

(c) The UN class number “7”.

(d) The subsidiary hazard class or division number(s) corresponding to the subsidiary risk label(s) required to be applied, when assigned, shall be entered following the primary hazard class or division and shall be enclosed in parentheses.

(e) The name or symbol of each radionuclide or, for mixtures of radionuclides, an appropriate general description or a list of the most restrictive nuclides.

(f) A description of the physical and chemical form of the material, or a notation that the material is special form radioactive material or low dispersible radioactive material. A generic chemical description is acceptable for chemical form.

(g) The maximum activity of the radioactive contents during transport expressed in units of becquerels (Bq) with the appropriate SI prefix symbol (see Annex II). For fissile material, the mass of fissile material (or mass of each fissile nuclide for mixtures, when appropriate) in units of grams (g), or appropriate multiples thereof, may be used in place of activity.

(h) The category of the package, overpack or freight container, as assigned per paragraph 529, i.e. I-WHITE, II-YELLOW, III-YELLOW.

(i) The TI of the package, overpack or freight container, as assigned per paragraph 529 (categories II-YELLOW and III-YELLOW only).

(j) For fissile material:

(i) Shipped under one exception of subparagraphs 417(a)–(f), reference to that para.;

(ii) Shipped under para. 417(c)–(e), the total mass of fissile nuclides;
(iii) Contained in a package for which one of para. 674(a)–(c) or 675 is applied, reference to that para.;

(iv) The CSI, where applicable.

(k) The identification mark for each competent authority certificate of approval (special form radioactive material, low dispersible radioactive material, fissile material excepted under para. 417(f), special arrangement, package design or shipment) applicable to the consignment.

(l) For consignments of more than one package, the information contained in para. 546(a)–(k) shall be given for each package. For packages in an overpack, freight container or conveyance, a detailed statement of the contents of each package within the overpack, freight container or conveyance and, where appropriate, of each overpack, freight container or conveyance shall be included. If packages are to be removed from the overpack, freight container or conveyance at a point of intermediate unloading, appropriate transport documents shall be made available.

(m) Where a consignment is required to be shipped under exclusive use, the statement “EXCLUSIVE USE SHIPMENT”.

(n) For LSA-II, LSA-III, SCO-I, SCO-II and SCO-III, the total activity of the consignment as a multiple of $A_2$. For radioactive material for which the $A_2$ value is unlimited, the multiple of $A_2$ shall be zero.

401. Radioactive material shall be assigned to one of the UN numbers specified in Table 1 in accordance with paras 408–434.

416. Radioactive material may be classified as low dispersible radioactive material only if it meets the requirements of para. 608, taking into account the requirements of paras 663 and 802.

605. Low dispersible radioactive material shall be such that the total amount of this radioactive material in a package shall meet the following requirements:

(a) The radiation level dose equivalent rate at 3 m from the unshielded radioactive material does not exceed 10 mSv/h.

(b) If subjected to the tests specified in paras 736 and 737, the airborne release in gaseous and particulate forms of up to 100 μm aerodynamic equivalent diameter would not exceed 100 $A_2$. A separate specimen may be used for each test.

(c) If subjected to the test specified in para. 703, the activity in the water would not exceed 100 $A_2$. In the application of this test, the damaging effects of the tests specified in (b) shall be taken into account.

665. A package containing low dispersible radioactive material shall be so designed that any features added to the low dispersible radioactive material that are not part of it, or any internal components of the packaging, shall not adversely affect the performance of the low dispersible radioactive material.

802. Competent authority approval shall be required for the following:

(a) Designs for:

(i) Special form radioactive material (see paras 803, 804 and 823);
(ii) Low dispersible radioactive material (see paras 803 and 804);

(iii) Fissile material excepted under para. 417(f) (see paras 805 and 806);

(iv) Packages containing 0.1 kg or more of uranium hexafluoride (see para. 807);

(v) Packages containing fissile material, unless excepted by para. 417, 674 or 675 (see paras 814–816 and 820);

(vi) Type B(U) packages and Type B(M) packages (see paras 808–813 and 820);

(vii) Type C packages (see paras 808–810).

(b) Special arrangements (see paras 829–831).

(c) Certain shipments (see paras 825–828[to check new #]).

(d) Radiation protection programme for special use vessels (see para. 576(a)).

(e) Calculation of radionuclide values that are not listed in Table 2 (see para. 403(a)).

(f) Calculation of alternative activity limits for an exempt consignment of instruments or articles (see para. 403(b)).

The certificates of approval for the package design and the Shipment may be combined into a single certificate.

803. The design for special form radioactive material shall require unilateral approval. The design for low dispersible radioactive material shall require multilateral approval. In both cases, an application for approval shall include:

(a) A detailed description of the radioactive material or, if a capsule, the contents; particular reference shall be 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 tests that have been carried out and their results, or evidence based on calculative methods, to show that the radioactive material is capable of meeting the performance standards, or other evidence that the special form radioactive material or low dispersible radioactive material meets the applicable requirements of these Regulations.

(d) A specification of the applicable management system, as required in para. 306.

(e) Any proposed pre-Shipment actions for use in the consignment of special form radioactive material or low dispersible radioactive material.

A management system based on international, national or other standards acceptable to the competent authority shall be established and implemented for all activities within the scope of the Regulations, as identified in para. 106, to ensure compliance with the relevant provisions.
of these Regulations. Certification that the design specification has been fully implemented shall be available to the competent authority. The manufacturer, consignor or user shall be prepared:

(a) To provide facilities for inspection during manufacture and use;

(b) To demonstrate compliance with these Regulations to the competent authority.

Where competent authority approval is required, such approval shall take into account and be contingent upon the adequacy of the management system.

These Regulations apply to the transport of radioactive material by all modes on land, water, or in the air, including transport that is incidental to the use of the radioactive material. Transport comprises all operations and conditions associated with, and involved in, the movement of radioactive material; these include the design, manufacture, maintenance and repair of packaging, and the preparation, consigning, loading, carriage including in-transit storage, shipment after storage, unloading and receipt at the final destination of loads of radioactive material and packages. A graded approach is applied in specifying the performance standards in these Regulations, which are characterized in terms of three general severity levels:

(a) Routine conditions of transport (incident free);
(b) Normal conditions of transport (minor mishaps);
(c) Accident conditions of transport.

The competent authority shall establish a certificate of approval stating that the approved design meets the requirements for special form radioactive material or low dispersible radioactive material and shall attribute to that design an identification mark.

The quantity of radioactive material in a package shall not exceed the relevant limits for the package Type A as specified below.

Packages containing radioactive material may be classified as Type A packages provided that the conditions of paras 429 and 430 are met.

Type A packages shall not contain activities greater than either of the following:

(a) For special form radioactive material — $A_1$;

(b) For all other radioactive material — $A_2$.

For mixtures of radionuclides whose identities and respective activities are known, the following condition shall apply to the radioactive contents of a Type A package:

$$
\sum_i B(i) A_1(i) + \sum_j C(j) A_2(j)
$$

where
B(i) is the activity of radionuclide i as special form radioactive material;
A₁(i) is the A₁ value for radionuclide i;
C(j) is the activity of radionuclide j as other than special form radioactive material;
A₂(j) is the A₂ value for radionuclide j.

429. **Type A packages** shall not contain activities greater than either of the following:
(a) For special form radioactive material — A₁;
(b) For all other radioactive material — A₂.

430. For mixtures of radionuclides whose identities and respective activities are known, the following condition shall apply to the radioactive contents of a Type A package:

\[ \sum_i B(i) A_1(i) + \sum_j C(j) A_2(j) \]

where
B(i) is the activity of radionuclide i as special form radioactive material;
A₁(i) is the A₁ value for radionuclide i;
C(j) is the activity of radionuclide j as other than special form radioactive material;
A₂(j) is the A₂ value for radionuclide j.

530. For each package or overpack, the UN number and proper shipping name shall be determined (see Table 1). In all cases of international transport of packages requiring competent authority approval of design or shipment, for which different approval types apply in the different countries concerned by the shipment, the UN number, proper shipping name, categorization, labelling and marking shall be in accordance with the certificate of the country of origin of design.

547. The consignor shall include in the transport documents a certification or declaration in the following terms:

“I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name and are classified, packaged, marked and labelled/placarded, and are in all respects in proper condition for transport in accordance with the applicable international and national governmental regulations.”

548. If the intent of the declaration is already a condition of transport within a particular international convention, the consignor need not provide such a declaration for that part of the transport covered by the convention.

549. The declaration shall be signed and dated by the consignor. Facsimile signatures are acceptable where applicable laws and regulations recognize the legal validity of facsimile signatures.

550. If the dangerous goods documentation is presented to the carrier by means of electronic data processing (EDP) or electronic data interchange (EDI) transmission techniques, the signature(s) may be replaced by the name(s) (in capitals) of the person authorized to sign.

551. When radioactive material, other than when carried in tanks, is packed or loaded into any freight container or vehicle that will be transported by sea, those responsible for packing the container or vehicle shall provide a container/vehicle packing certificate specifying the container/vehicle identification number(s) and certifying that the operation has been carried out in accordance with the applicable conditions of the IMDG Code [8].
552. The information required in the transport documents and the container/vehicle packing certificate may be incorporated into a single document, if not, the documents shall be attached one to the other. If the information is incorporated into a single document, the document shall include a signed declaration such as:

“It is declared that the packing of the goods into the container/vehicle has been carried out in accordance with the applicable provisions”.

This declaration shall be dated and the person signing it shall be identified on the document. Facsimile signatures are acceptable where applicable laws and regulations recognize the legal validity of facsimile signatures.

553. The declaration shall be made on the same transport document that contains the particulars of consignment listed in para. 546.

546. The consignor shall include in the transport documents with each consignment the identification of the consignor and consignee, including their names and addresses, and the following information, as applicable, in the order given:

(a) The UN number assigned to the material as specified in accordance with the provisions of paras 401 and 530, preceded by the letters “UN”.

(b) The proper shipping name, as specified in accordance with the provisions of paras 401 and 530.

(c) The UN class number “7”.

(d) The subsidiary hazard class or division number(s) corresponding to the subsidiary risk label(s) required to be applied, when assigned, shall be entered following the primary hazard class or division and shall be enclosed in parentheses.

(e) The name or symbol of each radionuclide or, for mixtures of radionuclides, an appropriate general description or a list of the most restrictive nuclides.

(f) A description of the physical and chemical form of the material, or a notation that the material is special form radioactive material or low dispersible radioactive material. A generic chemical description is acceptable for chemical form.

(g) The maximum activity of the radioactive contents during transport expressed in units of becquerels (Bq) with the appropriate SI prefix symbol (see Annex II). For fissile material, the mass of fissile material (or mass of each fissile nuclide for mixtures, when appropriate) in units of grams (g), or appropriate multiples thereof, may be used in place of activity.

(h) The category of the package, overpack or freight container, as assigned per paragraph 529, i.e. I-WHITE, II-YELLOW, III-YELLOW.

(i) The TI of the package, overpack or freight container, as assigned per paragraph 529 (categories II-YELLOW and III-YELLOW only).

(j) For fissile material:

   (i) Shipped under one exception of subparagraphs 417(a)–(f), reference to that para.;
(ii) Shipped under para. 417(c)–(e), the total mass of fissile nuclides;

(iii) Contained in a package for which one of para. 674(a)–(c) or 675 is applied, reference to that para.;

(iv) The CSI, where applicable.

(k) The identification mark for each competent authority certificate of approval (special form radioactive material, low dispersible radioactive material, fissile material excepted under para. 417(f), special arrangement, package design or shipment) applicable to the consignment.

(l) For consignments of more than one package, the information contained in para. 546(a)–(k) shall be given for each package. For packages in an overpack, freight container or conveyance, a detailed statement of the contents of each package within the overpack, freight container or conveyance and, where appropriate, of each overpack, freight container or conveyance shall be included. If packages are to be removed from the overpack, freight container or conveyance at a point of intermediate unloading, appropriate transport documents shall be made available.

(m) Where a consignment is required to be shipped under exclusive use, the statement “EXCLUSIVE USE SHIPMENT”.

(n) For LSA-II, LSA-III, SCO-I, SCO-II and SCO-III, the total activity of the consignment as a multiple of $A_2$. For radioactive material for which the $A_2$ value is unlimited, the multiple of $A_2$ shall be zero.

**401.** Radioactive material shall be assigned to one of the UN numbers specified in Table 1 in accordance with paras 408–434.

**416.** Radioactive material may be classified as low dispersible radioactive material only if it meets the requirements of para. 605, taking into account the requirements of parars 665 and 802.

**605.** Low dispersible radioactive material shall be such that the total amount of this radioactive material in a package shall meet the following requirements:

(a) The radiation level–dose equivalent rate at 3 m from the unshielded radioactive material does not exceed 10 mSv/h.

(b) If subjected to the tests specified in paras 736 and 737, the airborne release in gaseous and particulate forms of up to 100 μm aerodynamic equivalent diameter would not exceed 100 $A_2$. A separate specimen may be used for each test.

(c) If subjected to the test specified in para. 703, the activity in the water would not exceed 100 $A_3$. In the application of this test, the damaging effects of the tests specified in (b) shall be taken into account.

**665.** A package containing low dispersible radioactive material shall be so designed that any features added to the low dispersible radioactive material that are not part of it, or any internal components of the packaging, shall not adversely affect the performance of the low dispersible radioactive material.

**802.** Competent authority approval shall be required for the following:
(a) Designs for:

(i) Special form radioactive material (see paras 803, 804 and 823);

(ii) Low dispersible radioactive material (see paras 803 and 804);

(iii) Fissile material excepted under para. 417(f) (see paras 805 and 806);

(iv) Packages containing 0.1 kg or more of uranium hexafluoride (see para. 807);

(v) Packages containing fissile material, unless excepted by para. 417, 674 or 675 (see paras 814–816 and 820);

(vi) Type B(U) packages and Type B(M) packages (see paras 808–813 and 820);

(vii) Type C packages (see paras 808–810).

(b) Special arrangements (see paras 829–831).

(c) Certain shipments (see paras 825–828[to check new #]).

(d) Radiation protection programme for special use vessels (see para. 576(a)).

(e) Calculation of radionuclide values that are not listed in Table 2 (see para. 403(a)).

(f) Calculation of alternative activity limits for an exempt consignment of instruments or articles (see para. 403(b)).

The certificates of approval for the package design and the Shipment may be combined into a single certificate.

803. The design for special form radioactive material shall require unilateral approval. The design for low dispersible radioactive material shall require multilateral approval. In both cases, an application for approval shall include:

(a) A detailed description of the radioactive material or, if a capsule, the contents; particular reference shall be 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 tests that have been carried out and their results, or evidence based on calculative methods, to show that the radioactive material is capable of meeting the performance standards, or other evidence that the special form radioactive material or low dispersible radioactive material meets the applicable requirements of these Regulations.

(d) A specification of the applicable management system, as required in para. 302.
(e) Any proposed pre-shipment actions for use in the consignment of special form radioactive material or low dispersible radioactive material.

A management system based on international, national or other standards acceptable to the competent authority shall be established and implemented for all activities within the scope of the Regulations, as identified in para. 106, to ensure compliance with the relevant provisions of these Regulations. Certification that the design specification has been fully implemented shall be available to the competent authority. The manufacturer, consignor or user shall be prepared:

(a) To provide facilities for inspection during manufacture and use;
(b) To demonstrate compliance with these Regulations to the competent authority.

Where competent authority approval is required, such approval shall take into account and be contingent upon the adequacy of the management system.

106. These Regulations apply to the transport of radioactive material by all modes on land, water, or in the air, including transport that is incidental to the use of the radioactive material. Transport comprises all operations and conditions associated with, and involved in, the movement of radioactive material; these include the design, manufacture, maintenance and repair of packaging, and the preparation, consigning, loading, carriage including in-transit storage, shipment after storage, unloading and receipt at the final destination of loads of radioactive material and packages. A graded approach is applied in specifying the performance standards in these Regulations, which are characterized in terms of three general severity levels:

(a) Routine conditions of transport (incident free);
(b) Normal conditions of transport (minor mishaps);
(c) Accident conditions of transport.

304. The competent authority shall establish a certificate of approval stating that the approved design meets the requirements for special form radioactive material or low dispersible radioactive material and shall attribute to that design an identification mark.

421. The quantity of radioactive material in a package shall not exceed the relevant limits for the package Type A as specified below.

428. Packages containing radioactive material may be classified as Type A packages provided that the conditions of paras 429 and 430 are met.
Type A packages shall not contain activities greater than either of the following:

(b) For all other radioactive material — $A_2$.

For mixtures of radionuclides whose identities and respective activities are known, the following condition shall apply to the radioactive contents of a Type A package:

$$\sum_i \frac{B(i)}{A_1(i)} + \sum_j \frac{C(j)}{A_2(j)}$$

where

- $B(i)$ is the activity of radionuclide $i$ as special form radioactive material;
- $A_1(i)$ is the $A_1$ value for radionuclide $i$;
- $C(j)$ is the activity of radionuclide $j$ as other than special form radioactive material;
- $A_2(j)$ is the $A_2$ value for radionuclide $j$.

Type A packages shall not contain activities greater than either of the following:

(a) For special form radioactive material — $A_1$;
(b) For all other radioactive material — $A_2$.

For mixtures of radionuclides whose identities and respective activities are known, the following condition shall apply to the radioactive contents of a Type A package:

$$\sum_i \frac{B(i)}{A_1(i)} + \sum_j \frac{C(j)}{A_2(j)}$$

where

- $B(i)$ is the activity of radionuclide $i$ as special form radioactive material;
- $A_1(i)$ is the $A_1$ value for radionuclide $i$;
- $C(j)$ is the activity of radionuclide $j$ as other than special form radioactive material;
- $A_2(j)$ is the $A_2$ value for radionuclide $j$.

For each package or overpack, the UN number and proper shipping name shall be determined (see Table 1). In all cases of international transport of packages requiring competent authority approval of design or shipment, for which different approval types apply in the different countries concerned by the shipment, the UN number, proper shipping name, categorization, labelling and marking shall be in accordance with the certificate of the country of origin of design.

The consignor shall provide in the transport documents a statement regarding actions, if any, that are required to be taken by the carrier. The statement shall be in the languages deemed necessary by the carrier or the authorities concerned and shall include at least the following points:

(a) Supplementary requirements for loading, stowage, carriage, handling and unloading of the package, overpack or freight container, including any special stowage provisions for the safe dissipation of heat (see para. 565), or a statement that no such requirements are necessary;
(b) Restrictions on the mode of transport or conveyance and any necessary routeing instructions;
(c) Emergency arrangements appropriate to the consignment.
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565. Provided that its average surface heat flux does not exceed 15 W/m² and that the immediate surrounding cargo is not in sacks or bags, a package or overpack may be carried or stored among packaged general cargo without any special stowage provisions except as may be specifically required by the competent authority in an applicable certificate of approval.

555. The consignor shall retain a copy of each of the transport documents containing the information specified in paras 546, 547, 551, 552 and 554, as applicable, for a minimum period of three months.

When the documents are kept electronically, the consignor shall be able to reproduce them in a printed form.

546. The consignor shall include in the transport documents with each consignment the identification of the consignor and consignee, including their names and addresses, and the following information, as applicable, in the order given:

(a) The UN number assigned to the material as specified in accordance with the provisions of paras 401 and 530, preceded by the letters “UN”.

(b) The proper shipping name, as specified in accordance with the provisions of paras 401 and 530.

(c) The UN class number “7”.

(d) The subsidiary hazard class or division number(s) corresponding to the subsidiary risk label(s) required to be applied, when assigned, shall be entered following the primary hazard class or division and shall be enclosed in parentheses.

(e) The name or symbol of each radionuclide or, for mixtures of radionuclides, an appropriate general description or a list of the most restrictive nuclides.

(f) A description of the physical and chemical form of the material, or a notation that the material is special form radioactive material or low dispersible radioactive material. A generic chemical description is acceptable for chemical form.

(g) The maximum activity of the radioactive contents during transport expressed in units of becquerels (Bq) with the appropriate SI prefix symbol (see Annex II). For fissile material, the mass of fissile material (or mass of each fissile nuclide for mixtures, when appropriate) in units of grams (g), or appropriate multiples thereof, may be used in place of activity.

(h) The category of the package, overpack or freight container, as assigned per paragraph 529, i.e. I-WHITE, II-YELLOW, III-YELLOW.

(i) The Ti of the package, overpack or freight container, as assigned per paragraph 529, (categories II-YELLOW and III-YELLOW only).

(j) For fissile material:

(i) Shipped under one exception of subparagraphs 417(a)–(f), reference to that para.;

(ii) Shipped under para. 417(c)–(e), the total mass of fissile nuclides;

(iii) Contained in a package for which one of para. 674(a)–(c) or 675 is applied, reference to that para.;
(iv) The CSI, where applicable.

(k) The identification mark for each competent authority certificate of approval (special form radioactive material, low dispersible radioactive material, fissile material excepted under para. 417(f), special arrangement, package design or shipment) applicable to the consignment.

(l) For consignments of more than one package, the information contained in para. 546(a)–(k) shall be given for each package. For packages in an overpack, freight container or conveyance, a detailed statement of the contents of each package within the overpack, freight container or conveyance and, where appropriate, of each overpack, freight container or conveyance shall be included. If packages are to be removed from the overpack, freight container or conveyance at a point of intermediate unloading, appropriate transport documents shall be made available.

(m) Where a consignment is required to be shipped under exclusive use, the statement “EXCLUSIVE USE SHIPMENT”.

(n) For LSA-II, LSA-III, SCO-I, SCO-II and SCO-III, the total activity of the consignment as a multiple of $A_2$. For radioactive material for which the $A_2$ value is unlimited, the multiple of $A_2$ shall be zero.

401. Radioactive material shall be assigned to one of the UN numbers specified in Table 1 in accordance with paras 408–434.

416. Radioactive material may be classified as low dispersible radioactive material only if it meets the requirements of para. 605, taking into account the requirements of paras 665 and 802.

605. Low dispersible radioactive material shall be such that the total amount of this radioactive material in a package shall meet the following requirements:

(a) The radiation level–dose equivalent rate at 3 m from the unshielded radioactive material does not exceed 10 mSv/h.

(b) If subjected to the tests specified in paras 736 and 737, the airborne release in gaseous and particulate forms of up to 100 μm aerodynamic equivalent diameter would not exceed 100 $A_2$. A separate specimen may be used for each test.

(c) If subjected to the test specified in para. 703, the activity in the water would not exceed 100 $A_2$. In the application of this test, the damaging effects of the tests specified in (b) shall be taken into account.

665. A package containing low dispersible radioactive material shall be so designed that any features added to the low dispersible radioactive material that are not part of it, or any internal components of the packaging, shall not adversely affect the performance of the low dispersible radioactive material.

802. Competent authority approval shall be required for the following:

(a) Designs for:

(i) Special form radioactive material (see paras 803, 804 and 823);

(ii) Low dispersible radioactive material (see paras 802 and 803).
(iii) *Fissile material* excepted under para. 417(f) (see paras 805 and 806);

(iv) *Packages* containing 0.1 kg or more of uranium hexafluoride (see para. 807);

(v) *Packages* containing fissile material, unless excepted by para. 417, 674 or 675 (see paras 814–816 and 820);

(vi) *Type B(U) packages* and *Type B(M) packages* (see paras 808–813 and 820);

(vii) *Type C packages* (see paras 808–810).

(b) *Special arrangements* (see paras 829–831).

(c) *Certain shipments* (see paras 825–828[to check new #]).

(d) *Radiation protection programme* for special use vessels (see para. 576(a)).

(e) Calculation of radionuclide values that are not listed in Table 2 (see para. 403(a)).

(f) Calculation of alternative activity limits for an exempt *consignment* of instruments or articles (see para. 403(b)).

The certificates of *approval* for the *package design* and the *Shipment* may be combined into a single certificate.

306. The *design* for *special form radioactive material* shall require *unilateral approval*. The *design* for *low dispersible radioactive material* shall require *multilateral approval*. In both cases, an application for *approval* shall include:

(a) A detailed description of the *radioactive material* or, if a capsule, the contents; particular reference shall be 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 tests that have been carried out and their results, or evidence based on calculative methods, to show that the *radioactive material* is capable of meeting the performance standards, or other evidence that the *special form radioactive material* or *low dispersible radioactive material* meets the applicable requirements of these Regulations.

(d) A specification of the applicable *management system*, as required in para. 306.

(e) Any proposed pre-*Shipment* actions for use in the *consignment* of *special form radioactive material* or *low dispersible radioactive material*.

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A *management system* based on international, national or other standards acceptable to the *competent authority* shall be established and implemented for all activities within the scope of the Regulations, as identified in para. 306 to ensure compliance with the relevant
provisions of these Regulations. Certification that the design specification has been fully implemented shall be available to the competent authority. The manufacturer, consignor or user shall be prepared:

(a) To provide facilities for inspection during manufacture and use;
(b) To demonstrate compliance with these Regulations to the competent authority.

Where competent authority approval is required, such approval shall take into account and be contingent upon the adequacy of the management system.

These Regulations apply to the transport of radioactive material by all modes on land, water, or in the air, including transport that is incidental to the use of the radioactive material. Transport comprises all operations and conditions associated with, and involved in, the movement of radioactive material; these include the design, manufacture, maintenance and repair of packaging, and the preparation, consigning, loading, carriage including in-transit storage, shipment after storage, unloading and receipt at the final destination of loads of radioactive material and packages. A graded approach is applied in specifying the performance standards in these Regulations, which are characterized in terms of three general severity levels:

(a) Routine conditions of transport (incident free);
(b) Normal conditions of transport (minor mishaps);
(c) Accident conditions of transport.

The competent authority shall establish a certificate of approval stating that the approved design meets the requirements for special form radioactive material or low dispersible radioactive material and shall attribute to that design an identification mark.

The quantity of radioactive material in a package shall not exceed the relevant limits for the package Type A as specified below.

Packages containing radioactive material may be classified as Type A packages provided that the conditions of paras 429 and 430 are met.

Type A packages shall not contain activities greater than either of the following:

(a) For special form radioactive material — $A_1$;
(b) For all other radioactive material — $A_2$.

For mixtures of radionuclides whose identities and respective activities are known, the following condition shall apply to the radioactive contents of a Type A package:
\[
\sum B(i) \frac{A_1(i)}{A_1(i)} + \sum C(j) \frac{A_2(j)}{A_2(j)}
\]

where

- \(B(i)\) is the activity of radionuclide \(i\) as special form radioactive material;
- \(A_1(i)\) is the \(A_1\) value for radionuclide \(i\);
- \(C(j)\) is the activity of radionuclide \(j\) as other than special form radioactive material;
- \(A_2(j)\) is the \(A_2\) value for radionuclide \(j\).

429. **Type A packages** shall not contain activities greater than either of the following:
   (a) For special form radioactive material — \(A_1\);
   (b) For all other radioactive material — \(A_2\).

430. For mixtures of radionuclides whose identities and respective activities are known, the following condition shall apply to the radioactive contents of a **Type A package**:

\[
\sum B(i) \frac{A_1(i)}{A_1(i)} + \sum C(j) \frac{A_2(j)}{A_2(j)}
\]

where

- \(B(i)\) is the activity of radionuclide \(i\) as special form radioactive material;
- \(A_1(i)\) is the \(A_1\) value for radionuclide \(i\);
- \(C(j)\) is the activity of radionuclide \(j\) as other than special form radioactive material;
- \(A_2(j)\) is the \(A_2\) value for radionuclide \(j\).

530. For each **package** or **overpack**, the UN number and proper shipping name shall be determined (see Table 1). In all cases of international transport of **packages** requiring competent authority approval of design or shipment, for which different approval types apply in the different countries concerned by the shipment, the UN number, proper shipping name, categorization, labelling and marking shall be in accordance with the certificate of the country of origin of design.

547. The **consignor** shall include in the transport documents a certification or declaration in the following terms:

“I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name and are classified, packaged, marked and labelled/placarded, and are in all respects in proper condition for transport in accordance with the applicable international and national governmental regulations.”

551. When radioactive material, other than when carried in tanks, is packed or loaded into any freight container or vehicle that will be transported by sea, those responsible for packing the container or vehicle shall provide a container/vehicle packing certificate specifying the container/vehicle identification number(s) and certifying that the operation has been carried out in accordance with the applicable conditions of the IMDG Code [8].

552. The information required in the transport documents and the container/vehicle packing certificate may be incorporated into a single document, if not, the documents shall be attached one to the other. If the information is incorporated into a single document, the document shall include a signed declaration such as:
“It is declared that the packing of the goods into the container/vehicle has been carried out in accordance with the applicable provisions”.

This declaration shall be dated and the person signing it shall be identified on the document. Facsimile signatures are acceptable where applicable laws and regulations recognize the legal validity of facsimile signatures.

554. The consignor shall provide in the transport documents a statement regarding actions, if any, that are required to be taken by the carrier. The statement shall be in the languages deemed necessary by the carrier or the authorities concerned and shall include at least the following points:

(a) Supplementary requirements for loading, stowage, carriage, handling and unloading of the package, overpack or freight container, including any special stowage provisions for the safe dissipation of heat (see para. 565), or a statement that no such requirements are necessary;

(b) Restrictions on the mode of transport or conveyance and any necessary routeing instructions;

(c) Emergency arrangements appropriate to the consignment.

565. Provided that its average surface heat flux does not exceed 15 W/m² and that the immediate surrounding cargo is not in sacks or bags, a package or overpack may be carried or stored among packaged general cargo without any special stowage provisions except as may be specifically required by the competent authority in an applicable certificate of approval.

825. Multilateral approval shall be required for:

(a) The shipment of Type B(M) packages not conforming with the requirements of para. 639 or designed to allow controlled intermittent venting.

(b) The shipment of Type B(M) packages containing radioactive material with an activity greater than 3000 A₁ or 3000 A₂, as appropriate, or 1000 TBq, whichever is the lower.

(c) The shipment of packages containing fissile material if the sum of the CSIs of the packages in a single freight container or in a single conveyance exceeds 50. Excluded from this requirement shall be shipments by seagoing vessels, if the sum of the CSIs does not exceed 50 for any hold, compartment or defined deck area and the distance of 6 m between groups of packages or overpacks, as required in Table 11, is met.

(d) Radiation protection programmes for shipments by special use vessels in accordance with para. 576(a).

(e) The shipment of SCO-III.

576. The transport of consignments by means of a special use vessel that, by virtue of its design, or by reason of its being chartered, is dedicated to the purpose of carrying radioactive material, shall be excepted from the requirements specified in para. 566 provided that the following conditions are met:
(a) A radiation protection programme for the shipment shall be approved by the competent authority of the flag state of the vessel and, when requested, by the competent authority at each port of call.

(b) Stowage arrangements shall be predetermined for the whole voyage, including any consignments to be loaded at ports of call en route.

(c) The loading, carriage and unloading of the consignments shall be supervised by persons qualified in the transport of radioactive material.

566. Loading of freight containers and accumulation of packages, overpacks and freight containers shall be controlled as follows:

(a) Except under the condition of exclusive use, and for consignments of LSA-I material, the total number of packages, overpacks and freight containers aboard a single conveyance shall be so limited that the sum of the TIs aboard the conveyance does not exceed the values shown in Table 10.

(b) The radiation level dose equivalent rate under routine 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, vehicle or freight container, except for consignments transported under exclusive use by road or rail, for which the radiation limits around the vehicle are set forth in para. 573(b) and 573(c).

(c) The sum of the CSIs in a freight container and aboard a conveyance shall not exceed the values shown in Table 11.

573. For consignments under exclusive use, the radiation level dose equivalent rate shall not exceed:

a) 10 mSv/h at any point on the external surface of any package or overpack, and may only exceed 2 mSv/h provided that:
   (i) The vehicle is equipped with an enclosure that, during routine conditions of transport, prevents the access of unauthorized persons to the interior of the enclosure.
   (ii) Provisions are made to secure the package or overpack so that its position within the vehicle enclosure remains fixed during routine conditions of transport.
   (iii) There is no loading or unloading during the shipment.

b) 2 mSv/h at any point on the outer surfaces of the vehicle, including the upper and lower surfaces, or, in the case of an open vehicle, at any point on the vertical planes projected from the outer edges of the vehicle, on the upper surface of the load, and on the lower external surface of the vehicle.

(c) 0.1 mSv/h at any point 2 m from the vertical planes represented by the outer lateral surfaces of the vehicle, or, if the load is transported in an open vehicle, at any point 2 m from the vertical planes projected from the outer edges of the vehicle.
826. A competent authority may authorize transport through or into its country without shipment approval, by a specific provision in its design approval.

8. PROVISIONS CONCERNING TRANSPORT OPERATIONS

8.1 Modal requirements

573. For consignments under exclusive use, the dose equivalent rate shall not exceed:

- a) 10 mSv/h at any point on the external surface of any package or overpack, and may only exceed 2 mSv/h provided that:
  - (i) The vehicle is equipped with an enclosure that, during routine conditions of transport, prevents the access of unauthorized persons to the interior of the enclosure.
  - (ii) Provisions are made to secure the package or overpack so that its position within the vehicle enclosure remains fixed during routine conditions of transport.
  - (iii) There is no loading or unloading during the shipment.

- b) 2 mSv/h at any point on the outer surfaces of the vehicle, including the upper and lower surfaces, or, in the case of an open vehicle, at any point on the vertical planes projected from the outer edges of the vehicle, on the upper surface of the load, and on the lower external surface of the vehicle.

- c) 0.1 mSv/h at any point 2 m from the vertical planes represented by the outer lateral surfaces of the vehicle, or, if the load is transported in an open vehicle, at any point 2 m from the vertical planes projected from the outer edges of the vehicle.

574. In the case of road vehicles, no persons other than the driver and assistants shall be permitted in vehicles carrying packages, overpacks or freight containers bearing category II-YELLOW or III-YELLOW labels.

575. Packages or overpacks having a surface dose equivalent rate greater than 2 mSv/h, unless being carried in or on a vehicle under exclusive use in accordance with Table 10, footnote (a), shall not be transported by vessel except under special arrangement.

| Table 10 footnote a | Packages or Overpacks carried in or on a vehicle that are in accordance with the provisions of para. 575 may be transported by vessels provided that they are not removed from the vehicle at any time while on board the vessel. |

573. For consignments under exclusive use, the dose equivalent rate shall not exceed:

- a) 10 mSv/h at any point on the external surface of any package or overpack, and may only exceed 2 mSv/h provided that:
  - (i) The vehicle is equipped with an enclosure that, during routine conditions of transport, prevents the access of unauthorized persons to the interior of the enclosure.
  - (ii) Provisions are made to secure the package or overpack so that its position within the vehicle enclosure remains fixed during routine conditions of transport.
  - (iii) There is no loading or unloading during the shipment.
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(b) 2 mSv/h at any point on the outer surfaces of the vehicle, including the upper and lower surfaces, or, in the case of an open vehicle, at any point on the vertical planes projected from the outer edges of the vehicle, on the upper surface of the load, and on the lower external surface of the vehicle.

576. The transport of consignments by means of a special use vessel that, by virtue of its design, or by reason of its being chartered, is dedicated to the purpose of carrying radioactive material, shall be excepted from the requirements specified in para. 566 provided that the following conditions are met:

(a) A radiation protection programme for the shipment shall be approved by the competent authority of the flag state of the vessel and, when requested, by the competent authority at each port of call.

(b) Stowage arrangements shall be predetermined for the whole voyage, including any consignments to be loaded at ports of call en route.

(c) The loading, carriage and unloading of the consignments shall be supervised by persons qualified in the transport of radioactive material.

566. Loading of freight containers and accumulation of packages, overpacks and freight containers shall be controlled as follows:

(a) Except under the condition of exclusive use, and for consignments of LSA-I material, the total number of packages, overpacks and freight containers aboard a single conveyance shall be so limited that the sum of the Ts aboard the conveyance does not exceed the values shown in Table 10.

(b) The radiation level dose equivalent rate under routine 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, vehicle or freight container, except for consignments transported under exclusive use by road or rail, for which the radiation limits around the vehicle are set forth in para. 573(b) and 573(c).

(c) The sum of the CSIs in a freight container and aboard a conveyance shall not exceed the values shown in Table 11.

573. For consignments under exclusive use, the radiation level dose equivalent rate shall not exceed:

a) 10 mSv/h at any point on the external surface of any package or overpack, and may only exceed 2 mSv/h provided that:

(i) The vehicle is equipped with an enclosure that, during routine conditions of transport, prevents the access of unauthorized persons to the interior of the enclosure.

(ii) Provisions are made to secure the package or overpack so that its position within the vehicle enclosure remains fixed during routine conditions of transport.

(iii) There is no loading or unloading during the shipment.

(b) 2 mSv/h at any point on the outer surfaces of the vehicle, including the upper and lower surfaces, or, in the case of an open vehicle, at any point on the vertical planes projected from...
the outer edges of the vehicle, on the upper surface of the load, and on the lower external surface of the vehicle.

(c) 0.1 mSv/h at any point 2 m from the vertical planes represented by the outer lateral surfaces of the vehicle, or, if the load is transported in an open vehicle, at any point 2 m from the vertical planes projected from the outer edges of the vehicle.

579. Packages or overpacks having a surface radiation level dose equivalent rate greater than 2 mSv/h shall not be transported by air except by special arrangement.

580. A consignment that conforms to the requirements of para. 515, in which the activity of the radioactive contents does not exceed one tenth of the limits prescribed in Table 4, and that does not contain uranium hexafluoride, may be accepted for domestic movement by national postal authorities, subject to such additional requirements as those authorities may prescribe.

515. Excepted packages shall be subject only to the following provisions in Sections V and VI:

(a) The requirements specified in paras 503–505, 507–513, 516, 530–533, 545, 546 introductory sentence, 546(a), 546 (j)(i) and (ii) 546(k), 546 (m), 550–553, 555, 556, 561, 564, 570, 582 and 583;

(b) The requirements for excepted packages specified in para. 622;

(c) The requirements specified in paras 580 and 581, if transported by post.

All relevant provisions of the other sections shall apply to excepted packages.

581. A consignment that conforms to the requirements of para. 515, in which the activity of the radioactive contents does not exceed one tenth of the limits prescribed in Table 4, and that does not contain uranium hexafluoride, may be accepted for international movement by post, subject to the following additional requirements as prescribed by the Acts of the Universal Postal Union:

(a) It shall be deposited with the postal service only by consignors authorized by the national authority.

(b) It shall be dispatched by the quickest route, normally by air.

(c) It shall be plainly and durably marked on the outside with the words “RADIOACTIVE MATERIAL — QUANTITIES PERMITTED FOR MOVEMENT BY POST”. These words shall be crossed out if the packaging is returned empty.

(d) It shall carry on the outside the name and address of the consignor with the request that the consignment be returned in the case of non-delivery.

(e) The name and address of the consignor and the contents of the consignment shall be indicated on the internal packaging.

515. Excepted packages shall be subject only to the following provisions in Sections V and VI:
(a) The requirements specified in paras 503–505, 507–513, 516, 530–533, 545, 546 introductory sentence, 546(a), 546 (j)(i) and (ii) 546(k), 546 (m), 550–553, 555, 556, 561, 564, 570, 582 and 583;

(b) The requirements for excepted packages specified in para. 622;

(c) The requirements specified in paras 580 and 581, if transported by post.

All relevant provisions of the other sections shall apply to excepted packages.

8.2 Placarding

507. In addition to the radioactive and fissile properties, any other dangerous properties of the contents of the package, such as explosiveness, flammability, pyrophoricity, chemical toxicity and corrosiveness, shall be taken into account in the packing, labelling, marking, placarding, storage and transport in order to be in compliance with the relevant transport regulations for dangerous goods of each of the countries through or into which the materials will be transported, and, where applicable, with the regulations of the cognizant transport organizations, as well as these Regulations.

543. Large freight containers carrying unpackaged LSA-I material or SCO-I or packages other than excepted packages, and tanks shall bear four placards that conform to the model given in Fig. 6. The placards shall be affixed in a vertical orientation to each side wall and to each end wall of the large freight container or tank. Any placards that do not relate to the contents shall be removed. Instead of using both labels and placards, it is permitted, as an alternative, to use enlarged labels only, where appropriate, as shown in Figs 2–4, except having the minimum size shown in Fig. 6.

544. Where the consignment in the freight container or tank is unpackaged LSA-I or SCO-I or where a consignment in a freight container is required to be shipped under exclusive use and is packaged radioactive material with a single UN number, the appropriate UN number for the consignment (see Table 1) shall also be displayed, in black digits not less than 65 mm high, either:

(a) In the lower half of the placard shown in Fig. 6 and against the white background; or

(b) On the placard shown in Fig. 7.

When the alternative given in (b) is used, the subsidiary placard shall be affixed immediately adjacent to the main placard, on all four sides of the freight container or tank.

545. Except as otherwise provided in these Regulations, no person may offer radioactive material for transport unless it is properly marked, labelled, placarded, described and certified on a transport document, and otherwise in a condition for transport as required by these Regulations.

571. Rail and road vehicles carrying packages, overpacks or freight containers labelled with any of the labels shown in Figs 2–5, or carrying unpackaged LSA-I material or SCO-I or consignments under exclusive use, shall display the placard shown in Fig. 6 on each of:

(a) The two external lateral walls in the case of a rail vehicle;

(b) The two external lateral walls and the external rear wall in the case of a road vehicle.

In the case of a vehicle without sides, the placards may be affixed directly on the cargo carrying unit provided that they are readily visible. In the case of large tanks or freight containers, the placards on
the tanks or freight containers shall suffice. In the case of vehicles that have insufficient area to allow the fixing of larger placards, the dimensions of the placard described in Fig. 6 may be reduced to 100 mm. Any placards that do not relate to the contents shall be removed.

572. Where the consignment in or on the vehicle is unpackaged LSA-I material or SCO-I or SCO-III, or where a consignment is required to be shipped under exclusive use and is packaged radioactive material with a single UN number, the appropriate UN number (see Table 1) shall also be displayed, in black digits not less than 65 mm high, either:

(a) In the lower half of the placard shown in Fig. 6, against the white background; or

(b) On the placard shown in Fig. 7.

When the alternative given in (b) is used, the subsidiary placard shall be affixed immediately adjacent to the main placard, either on the two external lateral walls in the case of a rail vehicle or on the two external lateral walls and the external rear wall in the case of a road vehicle.

8.3 Stowage during transport, storage in transit and segregation

562. Packages, overpacks and freight containers containing radioactive material and unpackaged radioactive material shall be segregated during transport and during storage in transit:

(a) From workers in regularly occupied working areas by distances calculated using a dose criterion of 5 mSv in a year and conservative model parameters;

(b) From members of the public in areas where the public has regular access by distances calculated using a dose criterion of 1 mSv in a year and conservative model parameters;

(c) From undeveloped photographic film by distances calculated using a radiation exposure criterion for undeveloped photographic film due to the transport of radioactive material of 0.1 mSv per consignment of such film;

(d) From other dangerous goods in accordance with para. 506.

506. Consignments shall be segregated from other dangerous goods during transport in compliance with the relevant transport regulations for dangerous goods of each of the countries through or into which the materials will be transported, and, where applicable, with the regulations of the cognizant transport organizations, as well as these Regulations.

506. Consignments shall be segregated from other dangerous goods during transport in compliance with the relevant transport regulations for dangerous goods of each of the countries through or into which the materials will be transported, and, where applicable, with the regulations of the cognizant transport organizations, as well as these Regulations.

563. Category II-YELLOW or III-YELLOW packages or overpacks shall not be carried in compartments occupied by passengers, except those exclusively reserved for couriers specially authorized to accompany such packages or overpacks.

564. Consignments shall be securely stowed.

565. Provided that its average surface heat flux does not exceed 15 W/m² and that the immediate surrounding cargo is not in sacks or bags, a package or overpack may be carried or stored among
packaged general cargo without any special stowage provisions except as may be specifically required by the competent authority in an applicable certificate of approval.

566. Loading of freight containers and accumulation of packages, overpacks and freight containers shall be controlled as follows:

(a) Except under the condition of exclusive use, and for consignments of LSA-I material, the total number of packages, overpacks and freight containers aboard a single conveyance shall be so limited that the sum of the TIs aboard the conveyance does not exceed the values shown in Table 10.

(b) The radiation level dose equivalent rate under routine 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, vehicle or freight container, except for consignments transported under exclusive use by road or rail, for which the radiation limits around the vehicle are set forth in para. 573(b) and 573(c).

(c) The sum of the CSIs in a freight container and aboard a conveyance shall not exceed the values shown in Table 11.

573. For consignments under exclusive use, the radiation level dose equivalent rate shall not exceed:

a) 10 mSv/h at any point on the external surface of any package or overpack, and may only exceed 2 mSv/h provided that:

(i) The vehicle is equipped with an enclosure that, during routine conditions of transport, prevents the access of unauthorized persons to the interior of the enclosure.

(ii) Provisions are made to secure the package or overpack so that its position within the vehicle enclosure remains fixed during routine conditions of transport.

(iii) There is no loading or unloading during the shipment.

(b) 2 mSv/h at any point on the outer surfaces of the vehicle, including the upper and lower surfaces, or, in the case of an open vehicle, at any point on the vertical planes projected from the outer edges of the vehicle, on the upper surface of the load, and on the lower external surface of the vehicle.

(c) 0.1 mSv/h at any point 2 m from the vertical planes represented by the outer lateral surfaces of the vehicle, or, if the load is transported in an open vehicle, at any point 2 m from the vertical planes projected from the outer edges of the vehicle.

567. Any package or Overpack having a TI greater than 10, or any consignment having a CSI greater than 50, shall be transported only under exclusive use.

576. The transport of consignments by means of a special use vessel that, by virtue of its design, or by reason of its being chartered, is dedicated to the purpose of carrying radioactive material, shall be excepted from the requirements specified in para. 566 provided that the following conditions are met:

(a) A radiation protection programme for the shipment shall be approved by the competent authority of the flag state of the vessel and, when requested, by the competent authority at each port of call.
(b) Stowage arrangements shall be predetermined for the whole voyage, including any consignments to be loaded at ports of call en route.

(c) The loading, carriage and unloading of the consignments shall be supervised by persons qualified in the transport of radioactive material.

566. Loading of freight containers and accumulation of packages, overpacks and freight containers shall be controlled as follows:

(a) Except under the condition of exclusive use, and for consignments of LSA-I material, the total number of packages, overpacks and freight containers aboard a single conveyance shall be so limited that the sum of the TIs aboard the conveyance does not exceed the values shown in Table 10.

(b) The radiation level dose equivalent rate under routine 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, vehicle or freight container, except for consignments transported under exclusive use by road or rail, for which the radiation limits around the vehicle are set forth in para. 573(b) and 573(c).

(c) The sum of the CSIs in a freight container and aboard a conveyance shall not exceed the values shown in Table 11.

573. For consignments under exclusive use, the radiation level dose equivalent rate shall not exceed:

a) 10 mSv/h at any point on the external surface of any package or overpack, and may only exceed 2 mSv/h provided that:
   (i) The vehicle is equipped with an enclosure that, during routine conditions of transport, prevents the access of unauthorized persons to the interior of the enclosure.
   (ii) Provisions are made to secure the package or overpack so that its position within the vehicle enclosure remains fixed during routine conditions of transport.
   (iii) There is no loading or unloading during the shipment.

b) 2 mSv/h at any point on the outer surfaces of the vehicle, including the upper and lower surfaces, or, in the case of an open vehicle, at any point on the vertical planes projected from the outer edges of the vehicle, on the upper surface of the load, and on the lower external surface of the vehicle.

c) 0.1 mSv/h at any point 2 m from the vertical planes represented by the outer lateral surfaces of the vehicle, or, if the load is transported in an open vehicle, at any point 2 m from the vertical planes projected from the outer edges of the vehicle.

8.4 Damaged or leaking packages

510. If it is evident that a package is damaged or leaking, or if it is suspected that the package may have leaked or been damaged, access to the package shall be restricted and a qualified person shall, as soon as possible, assess the extent of contamination and the resultant radiation level dose equivalent.
rate of the package. The scope of the assessment shall include the package, the conveyance, the adjacent loading and unloading areas and, if necessary, all other material that has been carried in the conveyance. When necessary, additional steps for the protection of persons, property and the environment, in accordance with provisions established by the relevant competent authority, shall be taken to overcome and minimize the consequences of such leakage or damage.

511. Packages that are damaged or leaking radioactive contents in excess of allowable limits for normal conditions of transport may be removed to an acceptable interim location under supervision, but shall not be forwarded until repaired or reconditioned and decontaminated.

8.5 Decontamination

505. Freight containers, IBCs, tanks, as well as other packagings and overpacks, used for the transport of radioactive material shall not be used for the storage or transport of other goods unless decontaminated below the level of 0.4 Bq/cm² for beta and gamma emitters and low toxicity alpha emitters and 0.04 Bq/cm² for all other alpha emitters.

512. A conveyance and equipment used regularly for the transport of radioactive material shall be periodically checked to determine the level of contamination. The frequency of such checks shall be related to the likelihood of contamination and the extent to which radioactive material is transported.

513. Except as provided in para. 514, any conveyance, or equipment or part thereof that has become contaminated above the limits specified in para. 508 in the course of the transport of radioactive material, or that shows a dose equivalent rate in excess of 5 μSv/h at the surface, shall be decontaminated as soon as possible by a qualified person and shall not be reused unless the following conditions are fulfilled:

(a) The non-fixed contamination shall not exceed the limits specified in para. 508.

(b) The dose equivalent rate resulting from the fixed contamination shall not exceed 5 μSv/h at the surface.

514. A freight container or conveyance dedicated to the transport of unpackaged radioactive material under exclusive use shall be excepted from the requirements of paras 509 and 513 solely with regard to its internal surfaces and only for as long as it remains under that specific exclusive use.

509. Except as provided in para. 514, the level of non-fixed contamination on the external and internal surfaces of overpacks, freight containers and conveyances shall not exceed the limits specified in para. 508. This requirement does not apply to freight containers used as packagings, either loaded or empty.

508. The non-fixed contamination on the external surfaces of any package shall be kept as low as practicable and, under routine conditions of transport, shall not exceed the following limits:

(a) 4 Bq/cm² for beta and gamma emitters and low toxicity alpha emitters;

(b) 0.4 Bq/cm² for all other alpha emitters.
These limits are applicable when averaged over any area of 300 cm$^2$ of any part of the surface.

508. The non-fixed contamination on the external surfaces of any package shall be kept as low as practicable and, under routine conditions of transport, shall not exceed the following limits:

(a) 4 Bq/cm$^2$ for beta and gamma emitters and low toxicity alpha emitters;
(b) 0.4 Bq/cm$^2$ for all other alpha emitters.

These limits are applicable when averaged over any area of 300 cm$^2$ of any part of the surface.

514. A freight container or conveyance dedicated to the transport of unpackaged radioactive material under exclusive use shall be excepted from the requirements of paras 509 and 513 solely with regard to its internal surfaces and only for as long as it remains under that specific exclusive use.

509. Except as provided in para. 514, the level of non-fixed contamination on the external and internal surfaces of overpacks, freight containers and conveyances shall not exceed the limits specified in para. 508. This requirement does not apply to freight containers used as packagings, either loaded or empty.

508. The non-fixed contamination on the external surfaces of any package shall be kept as low as practicable and, under routine conditions of transport, shall not exceed the following limits:

(a) 4 Bq/cm$^2$ for beta and gamma emitters and low toxicity alpha emitters;
(b) 0.4 Bq/cm$^2$ for all other alpha emitters.

These limits are applicable when averaged over any area of 300 cm$^2$ of any part of the surface.

513. Except as provided in para. 514, any conveyance, or equipment or part thereof that has become contaminated above the limits specified in para. 508 in the course of the transport of radioactive material, or that shows a dose equivalent rate in excess of 5 μSv/h at the surface, shall be decontaminated as soon as possible by a qualified person and shall not be reused unless the following conditions are fulfilled:

(a) The non-fixed contamination shall not exceed the limits specified in para. 508.
(b) The dose equivalent rate resulting from the fixed contamination shall not exceed 5 μSv/h at the surface.

8.6 Other Provisions

309. In the event of non-compliance with any limit in these Regulations applicable to radiation level, dose equivalent rate or contamination:

(a) The consignor, consignee, carrier and any organization involved during transport who may be affected, as appropriate, shall be informed of the non-compliance by:

(i) The carrier if the non-compliance is identified during transport; or
(ii) The consignee if the non-compliance is identified at receipt.
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(b) The *carrier, consignor or consignee*, as appropriate, shall:

(i) Take immediate steps to mitigate the consequences of the noncompliance;

(ii) Investigate the non-compliance and its causes, circumstances and consequences;

(iii) Take appropriate action to remedy the causes and circumstances that led to the non-compliance and to prevent a recurrence of circumstances similar to those that led to the non-compliance;

(iv) Communicate to the relevant *competent authority(ies)* on the causes of the non-compliance and on corrective or preventive actions taken or to be taken.

(c) The communication of the non-compliance to the *consignor* and the relevant *competent authority(ies)*, respectively, shall be made as soon as practicable and it shall be immediate whenever an emergency exposure situation has developed or is developing.

582. Customs operations involving the inspection of the *radioactive contents* of a *package* shall be carried out only in a place where adequate means of controlling radiation exposure are provided and in the presence of qualified persons. *Any package* opened on customs instructions shall, before being forwarded to the *consignee*, be restored to its original condition.

583. Where a *consignment* is undeliverable, it shall be placed in a safe location and the appropriate *competent authority* shall be informed as soon as possible and a request made for instructions on further action.
Annex:

417. Fissile material and packages containing fissile material shall be classified under the relevant entry as “FISSILE”, in accordance with Table 1 unless excepted by one of the provisions of subparagraphs (a)–(f) of this paragraph and transported subject to the requirements of para. 570. All provisions apply only to material in packages that meet the requirements of para. 636, unless unpackaged material is specifically allowed in the provision:

(a) Uranium enriched in uranium-235 to a maximum of 1% by mass, and with a total plutonium and uranium-233 content not exceeding 1% of the mass of uranium-235, provided that the fissile nuclides are distributed essentially homogeneously throughout the material. In addition, if uranium-235 is present in metallic, oxide or carbide forms, it shall not form a lattice arrangement.

(b) Liquid solutions of uranyl nitrate enriched in uranium-235 to a maximum of 2% by mass, with a total plutonium and uranium-233 content not exceeding 0.002% of the mass of uranium, and with a minimum nitrogen to uranium atomic ratio (N/U) of 2.

(c) Uranium with a maximum uranium enrichment of 5% by mass of uranium-235 provided:
   (i) There is no more than 3.5 g of uranium-235 per package.
   (ii) The total plutonium and uranium-233 content does not exceed 1% of the mass of uranium-235 per package.
   (iii) Transport of the package is subject to the consignment limit provided in para. 570(c).

(d) Fissile nuclides with a total mass not greater than 2.0 g per package, provided the package is transported subject to the consignment limit provided in para. 570(d).
(e) *Fissile nuclides* with a total mass not greater than 45 g, either packaged or unpackaged, subject to the requirements of para. 570(e).

(f) A *fissile material* that meets the requirements of paras 570(b), 606 and 802.

570. *Fissile material* meeting one of the provisions (a)–(f) of para. 417 shall meet the following requirements:

(a) Only one of the provisions (a)–(f) of para. 417 is allowed per *consignment*.

(b) Only one approved *fissile material in packages* classified in accordance with para. 417(f) is allowed per *consignment* unless multiple materials are authorized in the certificate of approval.

(c) *Fissile material in packages* classified in accordance with para. 417(c) shall be transported in a *consignment* with no more than 45 g of *fissile nuclides*.

(d) *Fissile material in packages* classified in accordance with para. 417(d) shall be transported in a *consignment* with no more than 15 g of *fissile nuclides*.

(e) Unpackaged or packaged *fissile material* classified in accordance with para. 417(e) shall be transported under exclusive use on a *conveyance* with no more than 45 g of *fissile nuclides*.

636. The smallest overall external dimension of the *package* shall not be less than 10 cm.

606. A *fissile material* excepted from classification as “FISSILE” under para. 417(f) shall be subcritical without the need for accumulation control under the following conditions:

(a) The conditions of para. 673(a).

(b) The conditions consistent with the assessment provisions stated in paras 684(b) and 685(b) for *packages*;

(c) The conditions specified in para. 683(a), if transported by air.

673. *Fissile material* shall be transported so as to:

(a) Maintain subcriticality during routine, normal and accident conditions of transport; in particular, the following contingencies shall be considered:

(i) Leakage of water into or out of *packages*;

(ii) Loss of efficiency of built-in neutron absorbers or moderators;

(iii) Rearrangement of the contents either within the *package* or as a result of loss from the *package*;

(iv) Reduction of spaces within or between *packages*;

(v) *Packages* becoming immersed in water or buried in snow;

(vi) Temperature changes.
(b) Meet the requirements:

(i) Of para. 636 except for unpackaged material when specifically allowed by para. 417(e);

(ii) Prescribed elsewhere in these Regulations that pertain to the radioactive properties of the material;

(iii) Of para. 637 unless the material is excepted by para. 417;

(iv) Of paras 676–686, unless the material is excepted by para. 417, 674 or 675.

A number \( N \) shall be derived, such that five times \( N \) packages shall be subcritical for the arrangement and package conditions that provide the maximum neutron multiplication consistent with the following:

(a) There shall not be anything between the packages, and the package arrangement shall be reflected on all sides by at least 20 cm of water.

(b) The state of the packages shall be their assessed or demonstrated condition if they had been subjected to the tests specified in paras 719–724.

A number \( N \) shall be derived, such that two times \( N \) packages shall be subcritical for the arrangement and package conditions that provide the maximum neutron multiplication consistent with the following:

(a) Hydrogenous moderation between the packages and the package arrangement reflected on all sides by at least 20 cm of water.

(b) The tests specified in paras 719–724 followed by whichever of the following is the more limiting:

(i) The tests specified in para. 727(b) and either para. 727(c) for packages having a mass not greater than 500 kg and an overall density not greater than 1000 kg/m³ based on the external dimensions or para. 727(a) for all other packages, followed by the test specified in para. 728 and completed by the tests specified in paras 731–733; or

(ii) The test specified in para. 729.

(c) Where any part of the fissile material escapes from the containment system following the tests specified in para. 685(b), it shall be assumed that fissile material escapes from each package in the array and that all of the fissile material shall be arranged in the configuration and moderation that results in the maximum neutron multiplication with close reflection by at least 20 cm of water.

For packages to be transported by air:

(a) The package shall be subcritical under conditions consistent with the Type C package tests specified in para. 734, assuming reflection by at least 20 cm of water but no water in-leakage.

(b) In the assessment of para. 682, use of special features as specified in para. 680 is allowed provided that leakage of water into or out of the void spaces is prevented when the
package is submitted to the Type C package tests specified in para. 734 followed by the water in-leakage test of para. 733.

802. Competent authority approval shall be required for the following:

(a) Designs for:
(i) Special form radioactive material (see paras 803, 804 and 823);
(ii) Low dispersible radioactive material (see paras 803 and 804);
(iii) Fissile material excepted under para. 417(f); see paras 805 and 806;
(iv) Packages containing 0.1 kg or more of uranium hexafluoride (see para. 807);
(v) Packages containing fissile material, unless excepted by para. 417, 674 or 675 (see paras 814–816 and 820);
(vi) Type B(U) packages and Type B(M) packages (see paras 808–813 and 820);
(vii) Type C packages (see paras 808–810).

(b) Special arrangements (see paras 829–831).

c) Certain shipments (see paras 825–828[16]).

(d) Radiation protection programme for special use vessels (see para. 576(a)).

(e) Calculation of radionuclide values that are not listed in Table 2 (see para. 403(a)).

(f) Calculation of alternative activity limits for an exempt consignment of instruments or articles (see para. 403(b)).

The certificates of approval for the package design and the Shipment may be combined into a single certificate.

805. The design for a fissile material excepted from “FISSILE” classification in accordance with Table 1, under para. 417(f) shall require multilateral approval. An application for approval shall include:

(a) A detailed description of the material; particular reference shall be made to both physical and chemical states.

(b) A statement of the tests that have been carried out and their results, or evidence based on calculative methods, to show that the material is capable of meeting the requirements specified in para. 606.

(c) A specification of the applicable management system as required in para. 306.

(d) A statement of specific actions to be taken prior to Shipment.

606. A fissile material excepted from classification as “FISSILE” under para. 417(f) shall be subcritical without the need for accumulation control under the following conditions:

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(a) The conditions of para. 673(a).

(b) The conditions consistent with the assessment provisions stated in paras 684(b) and 685(b) for packages.

(c) The conditions specified in para. 683(a) if transported by air.

673 Fissile material shall be transported so as to:

(a) Maintain subcriticality during routine, normal and accident conditions of transport; in particular, the following contingencies shall be considered:

(i) Leakage of water into or out of packages;

(ii) Loss of efficiency of built-in neutron absorbers or moderators;

(iii) Rearrangement of the contents either within the package or as a result of loss from the package;

(iv) Reduction of spaces within or between packages;

(v) Packages becoming immersed in water or buried in snow;

(vi) Temperature changes.

(b) Meet the requirements:

(i) Of para. 636 except for unpackaged material when specifically allowed by para. 417(e);

(ii) Prescribed elsewhere in these Regulations that pertain to the radioactive properties of the material;

(iii) Of para. 637 unless the material is excepted by para. 417;

(iv) Of paras 676–686, unless the material is excepted by para. 417, 674 or 675.

684 A number $N$ shall be derived, such that five times $N$ packages shall be subcritical for the arrangement and package conditions that provide the maximum neutron multiplication consistent with the following:

(a) There shall not be anything between the packages, and the package arrangement shall be reflected on all sides by at least 20 cm of water.

(b) The state of the packages shall be their assessed or demonstrated condition if they had been subjected to the tests specified in paras 719–724.
A number N shall be derived, such that two times N packages shall be subcritical for the arrangement and package conditions that provide the maximum neutron multiplication consistent with the following:

(a) Hydrogenous moderation between the packages and the package arrangement reflected on all sides by at least 20 cm of water.

(b) The tests specified in paras 719–724 followed by whichever of the following is the more limiting:

(i) The tests specified in para. 727(b) and either para. 727(c) for packages having a mass not greater than 500 kg and an overall density not greater than 1000 kg/m³ based on the external dimensions or para. 727(a) for all other packages, followed by the test specified in para. 728 and completed by the tests specified in paras 731–733; or

(ii) The test specified in para. 729.

(c) Where any part of the fissile material escapes from the containment system following the tests specified in para. 685(b), it shall be assumed that fissile material escapes from each package in the array and that all of the fissile material shall be arranged in the configuration and moderation that results in the maximum neutron multiplication with close reflection by at least 20 cm of water.

For packages to be transported by air:

(a) The package shall be subcritical under conditions consistent with the Type C package tests specified in para. 734, assuming reflection by at least 20 cm of water but no water in-leakage.

(b) In the assessment of para. 682, use of special features as specified in para. 680 is allowed provided that leakage of water into or out of the void spaces is prevented when the package is submitted to the Type C package tests specified in para. 734 followed by the water in-leakage test of para. 733.

A management system based on international, national or other standards acceptable to the competent authority shall be established and implemented for all activities within the scope of the Regulations, as identified in para. 106, to ensure compliance with the relevant provisions of these Regulations. Certification that the design specification has been fully implemented shall be available to the competent authority. The manufacturer, consignor or user shall be prepared:

(a) To provide facilities for inspection during manufacture and use;

(b) To demonstrate compliance with these Regulations to the competent authority.
Where *competent authority approval* is required, such *approval* shall take into account and be contingent upon the adequacy of the *management system*.

These Regulations apply to the transport of radioactive material by all modes on land, water, or in the air, including transport that is incidental to the use of the radioactive material. Transport comprises all operations and conditions associated with, and involved in, the movement of radioactive material; these include the design, manufacture, maintenance and repair of packaging, and the preparation, consigning, loading, carriage including in-transit storage, shipment after storage, unloading and receipt at the final destination of loads of radioactive material and packages. A graded approach is applied in specifying the performance standards in these Regulations, which are characterized in terms of three general severity levels:

(a) Routine conditions of transport (incident free);
(b) Normal conditions of transport (minor mishaps);
(c) Accident conditions of transport.

The *competent authority* shall establish a certificate of *approval* stating that the approved material meets the requirements for *fissile material* excepted by the *competent authority* in accordance with para. 606 and shall attribute to that *design* an identification mark.

A *fissile material* excepted from classification as “FISSILE” under para. 417(f) shall be subcritical without the need for accumulation control under the following conditions:

(a) The conditions of para. 673(a);
(b) The conditions consistent with the assessment provisions stated in paras 684(b) and 685(b) for packages;
(c) The conditions specified in para. 683(a), if transported by air.

*Fissile material* shall be transported so as to:

(a) Maintain subcriticality during routine, normal and accident conditions of transport; in particular, the following contingencies shall be considered:

(i) Leakage of water into or out of *packages*;
(ii) Loss of efficiency of built-in neutron absorbers or moderators;
(iii) Rearrangement of the contents either within the *package* or as a result of loss from the *package*;
(iv) Reduction of spaces within or between *packages*;
(v) *Packages* becoming immersed in water or buried in snow;
(vi) Temperature changes.

(b) Meet the requirements:

(i) Of para. 636 except for unpackaged material when specifically allowed by para. 417(e);

(ii) Prescribed elsewhere in these Regulations that pertain to the radioactive properties of the material;

(iii) Of para. 637 unless the material is excepted by para. 417;

(iv) Of paras 676–686, unless the material is excepted by para. 417, 674 or 675.

684 A number N shall be derived, such that five times N packages shall be subcritical for the arrangement and package conditions that provide the maximum neutron multiplication consistent with the following:

(a) There shall not be anything between the packages, and the package arrangement shall be reflected on all sides by at least 20 cm of water.

(b) The state of the packages shall be their assessed or demonstrated condition if they had been subjected to the tests specified in paras 719–724.

685 A number N shall be derived, such that two times N packages shall be subcritical for the arrangement and package conditions that provide the maximum neutron multiplication consistent with the following:

(a) Hydrogenous moderation between the packages and the package arrangement reflected on all sides by at least 20 cm of water.

(b) The tests specified in paras 719–724 followed by whichever of the following is the more limiting:

(i) The tests specified in para. 727(b) and either para. 727(c) for packages having a mass not greater than 500 kg and an overall density not greater than 1000 kg/m³ based on the external dimensions or para. 727(a) for all other packages, followed by the test specified in para. 728 and completed by the tests specified in paras 731–733; or

(ii) The test specified in para. 729.

(c) Where any part of the fissile material escapes from the containment system following the tests specified in para. 685(b), it shall be assumed that fissile material escapes from each package in the array and that all of the fissile material shall be arranged in the configuration and moderation that results in the maximum neutron multiplication with close reflection by at least 20 cm of water.
For packages to be transported by air:

(a) The package shall be subcritical under conditions consistent with the Type C package tests specified in para. 734, assuming reflection by at least 20 cm of water but no water in-leakage.

(b) In the assessment of para. 682, use of special features as specified in para. 680 is allowed provided that leakage of water into or out of the void spaces is prevented when the package is submitted to the Type C package tests specified in para. 734 followed by the water in-leakage test of para. 733.

Each package that conforms to a design approved under one or more of paras 807–816 and 820 shall be legibly and durably marked on the outside of the packaging with the following information:

(a) The identification mark allocated to that design by the competent authority;
(b) A serial number to identify uniquely each packaging that conforms to that design;
(c) “TYPE B(U),” “TYPE B(M)” or “TYPE C”, in the case of a Type B(U), Type B(M) or Type C package design.

The approval of designs for packages containing 0.1 kg or more of uranium hexafluoride requires that:

(a) Each design that meets the requirements of para. 634 shall require multilateral approval.
(b) Each design that meets the requirements of paras 631–633 shall require unilateral approval by the competent authority of the country of origin of the design, unless multilateral approval is otherwise required by these Regulations.
(c) The application for approval shall include all information necessary to satisfy the competent authority that the design meets the requirements of para. 631 and a specification of the applicable management system, as required in para. 306.
(d) The competent authority shall establish a certificate of approval stating that the approved design meets the requirements of para. 631 and shall attribute to that design an identification mark.

Subject to multilateral approval, packages designed to contain 0.1 kg or more of uranium hexafluoride may be transported if the packages are designed:

(a) To international or national standards other than ISO 7195 [12], provided an equivalent level of safety is maintained; and/or
(b) To withstand, without leakage and without unacceptable stress, a test pressure of less than 2.76 MPa as specified in para. 718; and/or
(c) To contain 9000 kg or more of uranium hexafluoride and the packages do not meet the requirement of para. 632(c).

In all other respects, the requirements specified in paras 631–633 shall be satisfied.

631. Packages designed to contain uranium hexafluoride shall meet the requirements that pertain to the radioactive and fissile properties of the material prescribed elsewhere in these Regulations. Except as allowed in para. 634, uranium hexafluoride in quantities of 0.1 kg or more shall also be packaged and transported in accordance with the provisions of the International Organization for Standardization document ISO 7195: Packaging of Uranium Hexafluoride (UF6) for Transport [12], and the requirements of paras 632 and 633.

632. Each package designed to contain 0.1 kg or more of uranium hexafluoride shall be designed so that it will meet the following requirements:

(a) Withstand, without leakage and without unacceptable stress, as specified in ISO 7195 [12], the structural test as specified in para. 718, except as allowed in para. 634;

(b) Withstand, without loss or dispersal of the uranium hexafluoride, the free drop test specified in para. 722;

(c) Withstand, without rupture of the containment system, the thermal test specified in para. 728, except as allowed in para. 634.

634. Subject to multilateral approval, packages designed to contain 0.1 kg or more of uranium hexafluoride may be transported if the packages are designed:

(a) To international or national standards other than ISO 7195 [12], provided an equivalent level of safety is maintained; and/or

(b) To withstand, without leakage and without unacceptable stress, a test pressure of less than 2.76 MPa as specified in para. 718; and/or

(c) To contain 9000 kg or more of uranium hexafluoride and the packages do not meet the requirement of para. 632(c).

In all other respects, the requirements specified in paras 631–633 shall be satisfied.

633. Packages designed to contain 0.1 kg or more of uranium hexafluoride shall not be provided with pressure relief devices.

632. Each package designed to contain 0.1 kg or more of uranium hexafluoride shall be designed so that it will meet the following requirements:

(a) Withstand, without leakage and without unacceptable stress, as specified in ISO 7195 [12], the structural test as specified in para. 718, except as allowed in para. 634;

(b) Withstand, without loss or dispersal of the uranium hexafluoride, the free drop test specified in para. 722;

(c) Withstand, without rupture of the containment system, the thermal test specified in para. 728, except as allowed in para. 634.
Subject to multilateral approval, packages designed to contain 0.1 kg or more of uranium hexafluoride may be transported if the packages are designed:

(a) To international or national standards other than ISO 7195 [12], provided an equivalent level of safety is maintained; and/or

(b) To withstand, without leakage and without unacceptable stress, a test pressure of less than 2.76 MPa as specified in para. 718; and/or

(c) To contain 9000 kg or more of uranium hexafluoride and the packages do not meet the requirement of para. 632(c).

In all other respects, the requirements specified in paras 631–633 shall be satisfied.

Packages designed to contain 0.1 kg or more of uranium hexafluoride shall not be provided with pressure relief devices.

A management system based on international, national or other standards acceptable to the competent authority shall be established and implemented for all activities within the scope of the Regulations, as identified in para. 106, to ensure compliance with the relevant provisions of these Regulations. Certification that the design specification has been fully implemented shall be available to the competent authority. The manufacturer, consignor or user shall be prepared:

(a) To provide facilities for inspection during manufacture and use;

(b) To demonstrate compliance with these Regulations to the competent authority.

Where competent authority approval is required, such approval shall take into account and be contingent upon the adequacy of the management system.

These Regulations apply to the transport of radioactive material by all modes on land, water, or in the air, including transport that is incidental to the use of the radioactive material. Transport comprises all operations and conditions associated with, and involved in, the movement of radioactive material; these include the design, manufacture, maintenance and repair of packaging, and the preparation, consigning, loading, carriage including in-transit storage, shipment after storage, unloading and receipt at the final destination of loads of radioactive material and packages. A graded approach is applied in specifying the performance standards in these Regulations, which are characterized in terms of three general severity levels:

(a) Routine conditions of transport (incident free);
(b) Normal conditions of transport (minor mishaps);
(c) Accident conditions of transport.

An application for approval shall include:

(a) A detailed description of the proposed radioactive contents with reference to their physical and chemical states and the nature of the radiation emitted;
(b) A detailed statement of the design, including complete engineering drawings and schedules of materials and methods of manufacture;

(c) A statement of the tests that have been carried out and their results, or evidence based on calculative methods or other evidence that the design is adequate to meet the applicable requirements;

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

(e) If the package is designed to have a maximum normal operating pressure in excess of 100 kPa gauge, a specification of the materials of manufacture of the containment system, the samples to be taken and the tests to be made;

(ebis If the package is to be used for shipment after storage, the applicant shall state and justify the consideration of ageing mechanisms on the safety analysis and within the proposed operating and maintenance instructions.

(f) Where the proposed radioactive contents are irradiated nuclear fuel, the applicant shall state and justify any assumption in the safety analysis relating to the characteristics of the fuel and describe any pre-shipment measurement required by para. 677(b).

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

(h) A reproducible illustration, not larger than 21 cm × 30 cm, showing the make-up of the package;

(i) A specification of the applicable management system as required in para. 306.

(j) For packages which are used for shipment after storage, a gap analysis programme shall be provided. The gap analysis programme shall describe a systematic procedure to consider changes of regulations, changes in technical knowledge and changes of the state of the package design during storage.

677. For irradiated nuclear fuel, the assessments of paras. 680–685 shall be based on an isotopic composition demonstrated to provide either:

(a) The maximum neutron multiplication during the irradiation history, or

(b) A conservative estimate of the neutron multiplication for the package assessments. After irradiation but prior to shipment, a measurement shall be performed to confirm the conservatism of the isotopic composition.

306. A management system based on international, national or other standards acceptable to the competent authority shall be established and implemented for all activities within the scope of the Regulations, as identified in para. 106, to ensure compliance with the relevant provisions of these Regulations. Certification that the design specification has been fully implemented shall be available to the competent authority. The manufacturer, consignor or user shall be prepared:
(a) To provide facilities for inspection during manufacture and use;

(b) To demonstrate compliance with these Regulations to the competent authority.

Where competent authority approval is required, such approval shall take into account and be contingent upon the adequacy of the management system.

106. These Regulations apply to the transport of radioactive material by all modes on land, water, or in the air, including transport that is incidental to the use of the radioactive material. Transport comprises all operations and conditions associated with, and involved in, the movement of radioactive material; these include the design, manufacture, maintenance and repair of packaging, and the preparation, consigning, loading, carriage including in-transit storage, shipment after storage, unloading and receipt at the final destination of loads of radioactive material and packages. A graded approach is applied in specifying the performance standards in these Regulations, which are characterized in terms of three general severity levels:

(a) Routine conditions of transport (incident free);
(b) Normal conditions of transport (minor mishaps);
(c) Accident conditions of transport.