STUK

GUIDE **YVL 6.4** / 4 APRIL 2005

TRANSPORT PACKAGES AND PACKAGINGS FOR RADIOACTIVE MATERIAL

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Authorisation

By virtue of the below acts and regulations, the Radiation and Nuclear Safety Authority (STUK) issues detailed regulations that apply to the safe use of nuclear energy and to physical protection, emergency preparedness and safeguards:

- Section 55, paragraph 2, point 3 of the Nuclear Energy Act (990/1987)
- Section 29 of the Government Resolution (395/1991) on the Safety of Nuclear Power Plants
- Section 13 of the Government Resolution (396/1991) on the Physical Protection of Nuclear Power Plants
- Section 11 of the Government Resolution (397/1991) on the Emergency Preparedness of Nuclear Power Plants
- Section 8 of the Government Resolution (398/1991) on the Safety of a Disposal Facility for Reactor Waste
- Section 30 of the Government Resolution (478/1999) on the Safety of Disposal of Spent Nuclear Fuel.

In the Act on Transport of Dangerous Goods (719/1994, Section 6), the Radiation and Nuclear Safety Authority has been appointed to supervise compliance with the said Act and with the regulations issued on its basis as specified in the Act and the Government Decree. The Radiation and Nuclear Safety Authority issues instructions for transports of nuclear materials and nuclear waste on the basis of the following acts and regulations:

- Section 38 of the Government Decree on the Transport of Dangerous Goods by Road (194/2002).
- Section 37 of the Government Decree on the Transport of Dangerous Goods by Rail (195/2002).
- Section 18 of the Decree on the Transport of Dangerous Goods in Packaged Form by Sea (666/1998).
- Section 21 of the Decree on the Transport of Dangerous Goods by Air (210/1997).

Rules for application

The publication of a YVL guide does not, as such, alter any previous decisions made by STUK. After having heard those concerned, STUK makes a separate decision on how a new or revised YVL guide applies to operating nuclear power plants, or to those under construction, and to licensees' operational activities. The guides apply as such to new nuclear facilities.

When considering how new safety requirements presented in YVL guides apply to operating nuclear power plants, or to those under construction, STUK takes into account section 27 of the Government Resolution (395/1991), which prescribes that *for further safety enhancement, action shall be taken which can be regarded as justified considering operating experience and the results of safety research as well as the advancement of science and technology.*

If deviations are made from the requirements of the YVL guides, STUK shall be presented with some other acceptable procedure or solution by which the safety level set forth in the YVL guides is achieved.

Translation. Original text in Finnish.

1 General

In transporting radioactive materials it is important to take into consideration the radiation danger posed by these materials. In the transport of fissile materials, it is essential for safety that the material remains subcritical in all situations.

In transports of radioactive materials, the packaging is the principal safety factor. The design of the packaging is based on the fact that, under normal transport conditions, the dose rate of external radiation emitted by a package is sufficiently low, and that dangerous amounts of radioactive materials are not released even during an accident. In designing packagings for fissile materials, it is also absolutely necessary to consider and eliminate the possibility of a chain reaction in the event of deformation of the packaging or water penetrating the packaging.

General regulations concerning the transport packages of radioactive materials have been issued in the following transport mode-specific regulations for dangerous goods:

- Decree of the Ministry of Transport and Communications on the Transport of Dangerous Goods by Road (277/2002);
- Decree of the Ministry of Transport and Communications on the Transport of Dangerous Goods by Rail (278/2002);
- European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR);
- Convention concerning International Carriage by Rail (COTIF), RID regulations in Annex I to Appendix B (CIM);
- International Maritime Dangerous Goods Code (IMDG);
- Technical Instructions for the Safe Transport of Dangerous Goods by Air (ICAO-TI);
- Government Decree on the Conformity Assessment of Packaging and Tanks Used for the Transport of Dangerous Goods (302/2001).

Finnish regulations concerning land transports have been issued as decrees of the Ministry of Transport and Communications. International regulations are applied to sea and air transports and to international land transports. These regulations have been brought into force in Finland as decrees, but they have not been translated into Finnish. The transport mode-specific regulations concern all dangerous goods, according to which radioactive materials constitute class 7.

The Radiation and Nuclear Safety Authority (STUK) is the authority that controls the transport of radioactive materials as prescribed in the decrees and decisions concerning the different modes of transport. This Guide defines the requirements set by the Radiation and Nuclear Safety Authority for the design, manufacture and control of use of the transport packages. The Radiation and Nuclear Safety Authority is the authority in Finland that approves the packagings (Decree 302/2001, Section 12). Furthermore, the Radiation and Nuclear Safety Authority, or an inspection body recognized by it, also carries out the required testing, periodic inspections and other examinations of the packagings and tanks. The Radiation and Nuclear Safety Authority is entitled to inspect the quality plans related to the manufacture of packagings (Decree 277/2002, Appendix A, Point 1.7.3). Guide YVL 6.5 defines the requirements and the licence-holder's obligations concerning the transports of nuclear materials and nuclear waste.

2 Definitions

A_1 and A_2 values

A_1 and A_2 values are material-specific activity values given in Table I of Chapter IV of the IAEA's standard IAEA Safety Standard Series, Regulations for the Safe Transport of Radioactive Material, 1996 Edition (Revised) No TS-R-1 (ST-1, Revised), which describe the hazardousness of the radionuclide concerned. The type of packaging and the exemption levels concerning the transport, for instance, are determined on the basis of these values. A_1 value can only be applied to materials in a special form.

Special form

Radioactive material in a special form refers either to solid radioactive material that cannot disperse, or to a sealed capsule containing radioactive material that can be opened only by breaking. Radioactive material in a special form shall be tested in accordance with

specific standards. A certificate issued by an authority acts as proof of the special form.

Fissile material

In accordance with the regulations concerning the transport of dangerous goods, fissile materials mean uranium-233, uranium-235, plutonium-239, plutonium-241 and all materials that contain even one of these. However, unirradiated natural uranium or natural uranium irradiated only in a thermal reactor or depleted uranium is not considered to be fissile material.

Low dispersible material, LDM

Low dispersible (radioactive) material refers either to such solid radioactive material or radioactive material contained in a sealed capsule whose dispersion is only limited and which is not in a powder form.

Package

In connection with radioactive materials, package refers to the packaging with its radioactive contents prepared for transport.

Packaging

Packaging refers to the set of containers and equipment necessary for completely enclosing the radioactive contents. The packaging may include one or several containers, absorbent, equipment to maintain the safety distance, a radiation shield, filling and emptying devices, cooling devices, shock dampers, handling and fastening equipment, etc.

Radioactive material

In this Guide, radioactive material refers to such material containing radionuclides (including fissile material, other nuclear material and nuclear waste) whose activity concentration and total activity in the consignment exceed the limits defined in the regulations concerning the transport of dangerous goods.

Design

Design refers to such description of radioactive material in a special form, low dispersible radioactive material, a package or the packaging that enables it to be identified accurately. The description may include technical specifications, engineering drawings, reports and other relevant material.

Nuclear material

In the Nuclear Energy Act, nuclear material refers to special fissionable materials and source materials, such as uranium, thorium and plutonium, which are suitable for producing nuclear energy.

Nuclear waste

Nuclear waste refers to radioactive waste in the form of spent nuclear fuel or in some other form generated during or as a result of the use of nuclear energy. Nuclear waste also refers to materials, objects and structures, which having become radioactive during the use of nuclear energy and having been removed from use, require special measures owing to the danger posed by their radioactivity.

3 Regulations and responsibility concerning the packages

In accordance with Section 8 of the Act on Transport of Dangerous Goods (719/1994), the consignor shall be liable, for instance, for the fact that dangerous goods prepared for transport have been classified and packed correctly. This requires that the package used for the transport complies with the relevant regulations. Section 11 of the Radiation Act (592/1991) defines the transport of radiation sources as the use of radiation and as radiation operation. Section 14 of the Radiation Act requires that the operator has at its disposal the expertise in issues relating to safety that is necessary for the nature of the operations. In accordance with the Nuclear Energy Act, the transport of nuclear materials is the use of nuclear energy, which requires a licence (990/1987; Sections 3, 2 and 8). One of the prerequisites for granting a licence is that the licence-applicant has the competence and the necessary opportunities to engage in operations safely and in accordance with the obligations imposed by international treaties (990/1987, Section 21).

Although the Radiation Act and Decree and the Nuclear Energy Act and Decree do not contain any regulations concerning packagings, the general safety requirements laid down in them and the requirements set for the transport of nuclear materials and waste require that the material to be transported be also packed safely. The regulations concerning the packagings of radioactive materials have been issued in the transport mode-specific regulations for transports of dangerous goods. These regulations are based on the standard published by the IAEA "IAEA Safety Standard Series, Regulations for the Safe Transport of Radioactive Material," 1996 Edition (Revised) No TS-R-1 (ST-1, Revised), Ref. [12]. This Guide refers directly to the relevant sections in the publication concerned. The standard is being updated regularly. In assessing the safety of transports, the Radiation and Nuclear Safety Authority takes account of the amendments made to the latest version of the standard concerning safety.

4 Packaging types

The safety requirements set for the packagings of radioactive material, the markings of packages and the labels have been defined in Chapters V and VI of the IAEA standard [12] and in the transport mode-specific regulations.

The packaging types (package types) that comply with the regulations are the following:

- an excepted package
- industrial packages, types IP-1, IP-2 and IP-3
- a type A package
- type B packages (B(U) and B(M))
- a type C package.

A package intended for fissile material is given an additional marking "F" (e.g. IP-2F or B(U)F).

Points 408–419 of the IAEA standard [12] define the limit values for the contents of the packages of different types based on the nuclide-specific A_1 and A_2 values. For instance, in the type A package it is permitted to carry radioactive material whose activity does not exceed A_1, if the radioactive material is in a special form. In other cases the upper limit for activity is A_2. Points 606–670 of the above standard give the detailed requirements for the packages of different types. Additional requirements for the packages of fissile material have been defined in Points 671–682 of the above standard.

5 Acceptance procedure for the packagings

5.1 Quality management

In the case of an excepted package, an industrial package of nonfissile material or a type A package, no official approval is required for their design. However, the manufacturer shall have a quality management system that covers the manufacture of these packagings as well. Material proving that the design requirements have been perfectly fulfilled shall be available to the Radiation and Nuclear Safety Authority on request (see, e.g., Ref. [12], Point 310 or Decree 277/2002, Appendix A, Point 1.7.3).

5.2 Packagings requiring approval

The competent authority shall approve, after due consideration, the designs of packages other than the above-mentioned packages for radioactive material before the use of the corresponding packagings is allowed. Approval by the competent authority of the countries of consignment and reception and the transit countries (what is called the multilateral approval) is required for the designs of the packages for fissile material (types IP-1F, IP-2F, IP-3F, AF, B(U)F, B(M)F and CF), the packages of the B(U) type intended for the transport of low dispersible material and all packages of the B(M) type.

For other designs of the packages of the B(U) and C types, approval by the competent authority of one country is sufficient. The Radiation and Nuclear Safety Authority or the authority of a country that applies such regulations corresponding to Finland's may give the approval. Before a packaging approved by a foreign authority is used in Finland for the first time, the consignor shall submit a copy of the original approval certificate of the design concerned to the Radiation and Nuclear Safety Authority.

5.3 Approval of a new packaging

The Radiation and Nuclear Safety Authority may give the original approval for a new packaging design. For the purpose of approval, the applicant shall submit the design and testing documentation of the packaging concerned to the Radiation and Nuclear Safety Authority. If practical tests are carried out for the approval, the design documentation and a description of the testing methods to be employed shall be submitted to the Radiation and Nuclear Safety Authority no later than six months before the planned date of testing. The applicant shall inform the Radiation and Nuclear Safety Authority of the testing date, and the Radiation and Nuclear Safety Authority will supervise the tests within the scope it considers necessary. The design documentation shall be complemented by the testing documentation. If the tests are to be replaced by theoretical calculations, reliable and conservative methods shall be employed.

After having verified the validity of the design and testing documentation, the Radiation and Nuclear Safety Authority issues an approval certificate and an identification mark for the design of the packaging.

5.4 Packaging approved by a foreign authority

The Radiation and Nuclear Safety Authority approves a packaging in accordance with a design approved by a foreign authority for use in Finland either by validation of the approval certificate issued by the foreign authority, or by giving a new Finnish identification mark for the design. A Finnish identification mark is normally given only if the design differs from the original.

For the purpose of approval, the design documentation of the packaging and a copy of the approval certificate issued by the foreign authority shall be submitted to the Radiation and Nuclear Safety Authority. Furthermore, a description of the packaging design as well as a report on the tests and their results shall be submitted to STUK. In the case of a packaging for fissile material, a description of the criticality safety of the packaging shall also be submitted.

An application for the use in Finland of a packaging corresponding to a design approved abroad and the documents attached to it shall be submitted to the Radiation and Nuclear Safety Authority no later than three months before that type of packaging is brought into use in Finland.

6 Control of use

For the inspection to be conducted by the Radiation and Nuclear Safety Authority, the consignor shall submit, on request, a report on the compliance with the requirements of the package design (Decree 277/2002, Appendix A, Point 5.1.5.3.3).

The consignor of a package in accordance with a design approved by an authority other than the Radiation and Nuclear Safety Authority shall verify, before the first consignment of the package to Finland, that a copy of the original approval certificate of the package design has been submitted to the Radiation and Nuclear Safety Authority (Decree 277/2002, Appendix A, Point 5.1.5.4).

Before a packaging that requires approval by the Finnish authority is brought into use in Finland, the manufacturer, the consignor or the user shall submit the following documents to the Radiation and Nuclear Safety Authority:

- instructions for handling and use;
- instructions for inspections to be carried out before each transport;
- a periodic inspection programme.

The inspection results shall be documented and the documents shall be available to the Radiation and Nuclear Safety Authority on request. If defects have been discovered during inspections, the results have become out of date or they are not available, the packaging shall not be put into use before it has been inspected with a method approved by the Radiation and Nuclear Safety Authority and found to be free from defects.

The condition of packagings shall be monitored visually. The Radiation and Nuclear Safety Authority and the consignor of the packaging shall be informed of any damage to the packaging discovered during transport and of any deviations from the approved design. If the damage or deviation is of such nature that it jeopardizes the safety of transport, the transport shall be

interrupted as soon as possible, considering the requirements for safe storage of the packaging and for overall safety. The transport shall not be continued without permission of the supervising authority.

7 References

1. Act on Transport of Dangerous Goods (719/1994).
2. Government Decree on the Transport of Dangerous Goods by Road (194/2002).
3. Government Decree on the Transport of Dangerous Goods by Rail (195/2002).
4. Decree on the Transport of Dangerous Goods in Packaged Form by Sea (666/1998).
5. Decree on the Transport of Dangerous Goods by Air (210/1997).
6. Decree of the Ministry of Transport and Communications on the Transport of Dangerous Goods by Road (277/2002).
7. Decree of the Ministry of Transport and Communications on the Transport of Dangerous Goods by Rail (278/2002).
8. European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR), Finnish Treaty Series (23/1979).
9. Convention concerning International Carriage by Rail (COTIF), Appendix B (CIM), Annex I, RID regulations, Finnish Treaty Series (5/1985).
10. The International Maritime Dangerous Goods Code (IMDG) defined in the supplement to the International Convention for the Safety of Life at Sea (SOLAS), Chapter VII, Part A, Rule 1 and the valid regulation of the Finnish Maritime Administration.
11. Technical Instructions for the Safe Transport of Dangerous Goods by Air (ICAO-TI) issued by the International Civil Aviation Organization (ICAO) and aviation regulation OPS M1-18 (5.5.2003).
12. IAEA Safety Standard Series, Regulations for the Safe Transport of Radioactive Material, 1996 Edition (Revised) No TS-R-1 (ST-1, Revised).
13. Government Decree on the Conformity Assessment of Packaging and Tanks Used for the Transport of Dangerous Goods (302/2001).
14. Radiation Act (592/1991).
15. Radiation Decree (1512/1991).
16. Nuclear Energy Act (990/1987).
17. Nuclear Energy Decree (161/1988).