

INFORMATION PAPER

WNTI Glossary

Dedicated to the safe, efficient and reliable transport of radioactive materials



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A

Activity

See Radioactivity.

ADN

(Accord relatif au transport marchandises Dangereuses par voies de Navigation intérieures) European Provisions concerning the International Carriage of Dangerous Goods by Inland Waterways (ECE).

ADR

(Accord européen relatif au transport international des marchandises Dangereuses par Route). European Agreement concerning the international carriage of dangerous goods by road (ECE).

ANSI

American National Standards Institute. A private, non-profit organisation that administers and co-ordinates the voluntary standardisation and conformity assessment system.

Approval

Agreement given by a *Competent Authority* to use a *package* design or make a *shipment*. This *Approval* results in a *licence* which is documented by a *Certificate of Approval*, a *Certificate of Compliance* or equivalent. See *Multilateral Approval* and *Unilateral Approval*.

A1/A2 Values

Under the current *IAEA* Transport Regulations^[2], *A1/A2* values are the *activity* limits for each radioisotope. *A1* is the maximum activity of special form *radioactive material* permitted in a *Type A package*. A2 is the maximum activity of other than special form *radioactive material* permitted in a *Type A package*.

B

Back End

The part of the *nuclear fuel cycle*, which deals with the fuel after it has been used in the reactor. Activities include *spent fuel reprocessing*, recycling of *plutonium* and *Uranium*, radioactive waste management and disposal and decommissioning of *nuclear* installations.

Becquerel (Bq)

The SI unit used to measure *radioactivity*. A becquerel (Bq) measures the rate at which decay is taking place. A sample of *radioactive material* in which radioactive decay takes place each second has an *activity* of one Bq. It is named after Henri Becquerel who first discovered *radioactivity* in 1896 in *Uranium* salt.

Boiling Water Reactor (BWR)

A *light-water reactor* in which water that is used as both coolant and moderator is allowed to boil in the core and the resulting steam is used directly to drive a turbo-alternator.

C

Canister

Receptacle of *radioactive material* used as a handling/storage unit, intended to be loaded into a *package*. A *canister* can have *safety* functions in the *package* design.

Carrier

Any individual, organisation or government undertaking the carriage of radioactive materials by any mode of transport.

Cask

Common name for a *packaging*. Typically used for a heavy *Type B* package for *spent fuel* or *high level waste*.



Category

There are two uses of this term; one in *safety* and one in *security*.

С

- Packages and overpacks are assigned a category based on Transport Index and surface radiation level. This category is expressed in Roman numerals I, II and III mandatorily associated with a colour: I-WHITE, II-YELLOW, III-YELLOW
- Category also designates the different levels of Physical Protection as defined in IAEA INFCIRC 225^[3]. Nuclear material is categorised to Category I, Category II and Category III based on element, isotope, quality and irradiation. Roman numerals are also used here, but there is no colour, which allows disambiguation.

See also Class, Labels and Type.

Certificate of Approval

See Approval.

Certificate of Compliance

See Approval.

Class

Class should be reserved to designate the different kinds of Dangerous Goods as defined by the UN *Orange Book*. *Radioactive material* is classified as Class 7. See *Type* and *Category*.

Competent Authority

Any national, or international regulatory body or authority designated or otherwise recognised as such for any purpose in connection with the *IAEA* Transport Regulations.

Consignee

The person or organisation taking delivery of a *consignment*. Note that upon arrival the *consignment* arrives, the *shipment* stops.

Consignment

Any package or packages, or load of radioactive material presented by a *consignor* for transport.

Consignor

The person or organisation named so in the transport documents such as the Shipper's Declaration,

- The person or organisation preparing a *consignment* for transport.
- The Facility (*nuclear* installation or other) from which the consignment is shipped. When International Conventions or local laws apply, the Facility may be liable for any radioactive damage during transport. The issue of *nuclear liability* and related insurance must be addressed before *shipment*.

Container

- Container may designate a packaging, a freight container such as an ISO container, an overpack, or any other receptacle. Thus for the purpose of radioactive material transport, container should always be explicited.
- Unless demonstrated specifically, a *freight container* is not in itself a *packaging*.

Containment

Methods or physical structure designed to prevent the dispersion of radioactive substances.

Conversion

Chemical process turning *Uranium* oxide into *Uranium Hexafluoride* (UF₆) preparatory to *enrichment*.

Conveyance

- By road or rail: any vehicle such as trailer, semi-trailer, van, lorry, wagon...
- By water: any vessel (seagoing ship or barge, inland waterway craft...), or any hold, compartment, or defined deck area.
- By air: any aircraft.

Criticality

Point where a *nuclear* chain reaction becomes self-sustaining.

Criticality Safety Index (CSI)

A number assigned to a *package*, *overpack* or *freight container*, containing *fissile material*. CSI shall mean a number which is used to provide control over the accumulation of *packages*, *overpacks* or *freight containers* containing *fissile material*.



D

DGR

Dangerous Goods Regulations (IATA).

Dose limits

Principle underlying the basic safety standards that are incorporated into the *IAEA* Transport Regulations, which provides that doses to individuals shall not exceed the limits for the appropriate circumstances.

Dual-use (goods)

Goods that may be used for civilian and military purposes; they are governed by specific regulation such as the EU Dual-Use Regulation - also known as Council Regulation (EC) No 428/2009 (and associated legal amendments).

Dual-purpose (packaging)

- Packaging for spent nuclear fuel that can be used both for transport and for storage (usually interim storage, pending decision on final storage or recycling).
- Multi-purpose packaging or canister is also used, particularly when including the use for final disposal

Е

ECE

United Nations Economic Commission for Europe.

ECOSOC

United Nations Economic and Social Council.

Emergency Preparedness

The capability to take actions that will effectively mitigate the consequences of an emergency for human health and *safety*, quality of life, property and the environment.

Emergency Procedures

A set of instructions describing in detail the actions to be taken by response personnel in an emergency.

Empty

An "empty" packaging is a package that has been emptied after transport. *Radioactive material* may remain, such as heels, contamination or activation of the packaging. Under a certain limit this *empty packaging* can be shipped under Class 7 as an *Excepted Package* (Empty Packaging, UN 2908).

Emptied

Commonly used by Industry to designate *empty packaging* whose residual contamination or activation are bigger than the limits attached to the UN 2908 *Excepted packages*.

Enrichment

The percentage by weight of the fissile *isotope* of *Uranium*, U-235, in a mixture of U-235 and U-238. Natural *Uranium* contains about 0.71% U-235. The initial *enrichment* of *light water reactor* fuel is about 5% U-235.

Excepted Package

Packages in which the allowed radioactive content is restricted to such low levels that the potential hazards in case of release are insignificant. *Excepted Packages* must, therefore, meet general design requirements for all *packages* and other controls during transport, but they are excepted from further design and use requirements.

Exclusive Use

- The sole use, by a single consignor, of a conveyance or a large freight container, in respect of which all initial, intermediate and final loading and unloading is carried out in accordance with the directions of the consignor or consignee.
- The conveyance or the large freight container may then be transported on another conveyance that is shared with other cargoes (with proper regard to exclusion rules).

F

Fissile Nuclide

Uranium-233, *Uranium*-235, *Plutonium*-239 and *Plutonium*-241 in the *IAEA* Transport Regulations.

Fissile Material

Material containing any of the *fissile nuclides*. Excluded from the definition of *fissile material* are the following:

- Natural Uranium or depleted Uranium that is unirradiated.
- Natural Uranium or depleted Uranium that has been irradiated in thermal reactors only.
- Material with *fissile nuclides* less than a total of 0.25g.
- Any combination of above.

Flask

(UK) common name for a cask.

Freight container

Freight container shall mean an article of transport equipment that is of a permanent character and accordingly strong enough to be suitable for repeated use; specially designed to facilitate the transport of goods, by one or other modes of transport, without intermediate reloading, designed to be secured and/or readily handled, having fittings for these purposes.

Fuel assembly

An array of *fuel rods* contained in a regular lattice by means of end grids and spacers, typically of square section.

Fuel cycle

All operations associated with the production of *nuclear energy* including:

- Mining and milling, processing and enrichment of Uranium
- Manufacture of nuclear fuel
- Operation of *nuclear* reactors
- Reprocessing and recycling of nuclear fuel
- Any related research and development activities
- All related waste management activities

Fuel pellets

A cylindrical pellet of sintered *Uranium* oxide, typically about 15 mm long and 10 mm in diameter, which is used in the manufacture of *nuclear fuel* assemblies.

Fuel rod

A long cylindrical tube, typically manufactured from a zirconium alloy, which is filled with a string of *fuel pellets* and then sealed.

G

Gamma Ray

High energy, short wavelength electromagnetic *radiation* emitted from the nucleus. *Gamma ray* always accompanies fission. It is very penetrating and best stopped by thick slabs of concrete or lead. See *Radiation*.

Н

Half Life

The time in which one half of atoms of a particular radioactive substance disintegrates into another *nuclear* form.

Hazard

A process, condition or asset which has the potential to adversely impact the health and *safety* of personnel, the public or the environment.

Health Physics

The science concerned with the recognition, evaluation and control of health *hazards* which may arise from the use and application of *ionizing radiation*.

High level waste (HLW)

Extremely radioactive fission products in *spent fuel* and transuranic elements. They may be separated by *reprocessing* the *spent fuel*, or the *spent fuel* containing them may be regarded as *high level waste*.

r.

IAEA

International Atomic Energy Agency.

Ľ.

IATA

International Air Transport Association.

ICAO

International Civil Aviation Organization.

ICRP

International Commission on Radiological Protection.

IMDG code

International Maritime Dangerous Goods Code (IMO).

IMO

International Maritime Organization.

Industrial Package (IP)

Used to transport material known as *low specific activity* (*LSA*) or *surface contaminated object (SCO*). Three *types* of *industrial packages* (IP-1, IP-2, IP-3) have been specified. These packages differ as to the degree to which they are required to be capable of withstanding damage. All of the combinations of industrial *packaging* and respective admissible *LSA* materials and *SCO* contents are intended to give the equivalent level of *safety*. IP-2 and IP-3 must satisfy some additional test requirements. Many *packages* used in the industry, such as steel drums or bins, could meet the *Industrial Package* requirements.

INES (International Nuclear Event Scale)

A simple scale designed by the *IAEA* for promptly communicating to the public in consistent terms the *safety* significance of events at *nuclear facilities*, transport and storage and use of *radioactive material* and *radiation* sources.

INF Code

International Code for the safe carriage of *packaged* Irradiated Nuclear Fuel (INF), *plutonium* and *high level wastes* in *flasks* on board ships (introduced by the International Maritime Organization in 1993 and became mandatory in January 2001).

INF Class 1 Ship

Ship certified to carry INF cargoes with an aggregate *activity* less than 4,000TBq.

INF Class 2 Ship

Ship certified to carry irradiated *nuclear* fuel or *high level waste* with an aggregate *activity* of less than 2x10⁶ TBq and ships which are certified to carry *plutonium* with an aggregate *activity* less than 2X10⁵ TBq.

INF Class 3 Ship

Ship certified to carry irradiated *nuclear* fuel or *high level wastes* and ships which are certified to carry *plutonium* with no restriction of maximum aggregate *activity* of the material.

INTERTRAN

International computer code for the assessment of the risks of transport operations involving *radioactive material* for normal and accident conditions.

Isotope

One or two or more atoms with the same number of protons in the nucleus but a different number of neutrons.



J

Justification

The process of determining whether a practice is overall, beneficial as required by *ICRP's* system of Radiological Protection, i.e whether the benefits to individuals and to society from introducing or continuing the practice outweigh the harm resulting from the practice.

Κ

No glossary entries under 'K' at present

L

Labels

Used to classify *packages* or *overpacks* of *radioactive materials*. Different *labels* simplify identification of the *packages* contents and facilitate control by workers when handling *packages*.

- White label, Category I TI is zero and maximum radiation at the surface is not more than 0.005mSv/h and no special handling needed.
- Yellow label, Category II TI doesn't exceed 1 and radiation level at the surface does not exceed 0.5mSv/h and little, if any, special handling is needed.
- Yellow label, Category III packages with TI doesn't exceed 10 and a surface radiation of not more than 2mSv/h except under exclusive use as well as higher radiation levels and other packages which require special handling.
- White label, "FISSILE" this label, in addition to the above three labels, gives handling and storage information related to criticality safety.

Note: *Category* in the *labels* is not related to the *Category for Physical Protection* (ex. IAEA INFCIRC225).

Liability

Liability for damage caused by *ionizing radiation* as a consequence of an accident is addressed by the 1963 Vienna Convention on Civil Liability for Nuclear Damage and the 1960 Paris Convention on Third Party Liability in the Field of Nuclear Energy. These instruments determine who is liable, establish minimum amounts of *liability* and the coverage by some form of financial *security*, e.g. insurance. There are other Conventions, such as the Brussels

Convention that bridges the Vienna and Paris Conventions, and national regulations such as in the USA and in Japan. Conventions generally apply (only) in the territory of the countries that signed and ratified them.

Licence

A legal document issued by the regulatory body granting authorisation to perform specified activities e.g. the utilisation of casks for transportation. See *Approval*.

Light Water Reactor (LWR)

A common *nuclear* reactor cooled and usually moderated by ordinary water. See *BWR* and *PWR*.

Low level waste (LLW)

Mildly radioactive or contaminated material, typically from medical or industrial applications of *radioactivity*, and usually disposed of by incineration and burial.

Low Specific Activity (LSA)

Radioactive material which by its nature has a limited specific *activity* or *radioactive material* for which limits of estimated average specific *activity* apply.

Μ

MARPOL

International Convention for the Prevention of Pollution from Ships (*IMO*) adopted by the International Conference on Marine Pollution.

Markings

A descriptive name, identification number, instructions, cautions, weight specification or UN marks or combinations thereof required by the *IAEA* Transport Regulations on outer *packaging* of hazardous materials.

Mining

Uranium is normally mined either using surface (open cut) or underground *mining* techniques, depending on the depth at which the ore is found.

Milling

At the mill, ore is crushed and ground to a fine slurry which is leached in sulphuric acid to allow the separation of *Uranium* from the waste rock.

MOX Fuel

Mixed Oxide (MOX) fuel, made of a mixture of *plutonium* and *Uranium* oxides. *Plutonium* recovered from *reprocessing* spent *nuclear* fuel is mainly used for *MOX* fuel. *MOX* fuel can be used in *light water reactors*.

Multilateral Approval

Approval by the relevant Competent Authority of the country of origin of the package design, or shipment and each country through or into which the consignment is to be transported. The requirements, however, do not apply to a country over which radioactive material is carried in an aircraft, provided there is no scheduled stop in that country.

Multi-purpose

See Dual-purpose.

Ν

Nuclear

- Used adjectively for various words relating to or using energy released in *nuclear* fission (power generation).
- Some radioactive materials that could be used in explosive nuclear devices are called nuclear. They are subject to security measures named Physical Protection, against any unauthorised removal.
- Nuclear is also used instead of radioactive in the context of nuclear liability in case of accidents, so caution is required.

Nuclear Fuel cycle

See Fuel Cycle.

Ο

OTIF

(Organisation intergovernementale pour les Transports Internationaux Ferroviaires)

International organisation for international carriage by rail.

Optimization

Principle underlying the basic *safety* standards that are incorporated into the *IAEA* Transport Regulations, which provides that, taking economic and social factors into account, all exposures shall be kept as low as reasonably achievable (ALARA).

Orange Book

The colloquial term for the United Nations "Recommendations on the Transport of Dangerous Goods"

Model Regulations on the mansport of Dangerous Goods Model Regulations", so called due to the orange colour of its cover. Requirements related to *radioactive material* (*Class* 7) in *Orange Book* are endorsed from the *IAEA* Transport Regulations (TS-R-1) and each modal regulation for dangerous goods (*IMDG code*, *ICAO/TI*, ADR) is based on the *Orange Book*.

Overpack, over-pack

- An enclosure such as a box or bag which is used by a single consignor to facilitate as a handling unit a consignment of one or more packages for convenience of handling, stowage and carriage.
- A prominent exception is the 30B overpack, which is used to contain a UF₆ 30-inch cylinder to provide shock, fire and criticality protection to the package, and is much more than an overpack as defined above by the IAEA Transport Regulations. Such a use of "overpack" instead of e.g. "protective overpack" is not encouraged.

Ρ

Package

A *package* consists of a receptacle called *packaging* and of its contents, as prepared for transport. The *types* of packages covered by the *IAEA* Transport Regulations, which are subject to the *activity* limits and material restrictions and meet the corresponding requirements, are:

- Excepted Package;
- Industrial Package Type 1 (Type IP-1);
- Industrial Package Type 2 (Type IP-2);
- Industrial Package Type 3 (Type IP-3);
- Type A package;
- Type B(U) package;
- Type B(M) package;
- Type C package.

Packages containing fissile material or Uranium Hexafluoride are subject to additional requirements. A package must possess documented evidence that it is safe for transport: see Safety Analysis Report.

Packaging

The assembly of components necessary to enclose the radioactive contents completely. The nature of the *packaging* depends on the nature of the material. The *packaging* may be a high integrity *cask*, a box, drum, or similar receptacle or a *freight container* or tank. In itself, a *packaging* has no *Type*; only a *package* (i.e. *packaging* with its radioactive contents) has a *Type*, i.e. you cannot buy or sell a *Type* IP-2 *packaging*.

PACKTRAM

A personal computer-based database of the *IAEA* containing records on current *package* design, *shipment Approval* certificates, and those certificates that expired within the previous calendar year.

Physical Protection

Procedures for the safeguarding of *radioactive materials* from acts of theft or sabotage. *Physical Protection* also covers sensitive materials that are not radioactive. See also *Nuclear* and *Security*.

Placard

A warning sign made of durable material and placed on the exterior sides of a transport vehicle.

Plutonium

There is no *isotope* for *plutonium* (Pu symbol) in the natural state. *Plutonium*-239, a fissile isotope, is produced by the fission reactions in *nuclear* reactors using *Uranium*-238.

Pressurised water reactor (PWR)

A *light water reactor* in which heat is transferred from the core to a heat exchanger via water kept under high pressure so that a high temperature can be maintained in the primary circuit without boiling. Steam is generated in the secondary circuit.

Price Anderson Act

American legislation outlining the methods for compensating *nuclear* power plant or *nuclear* transport accidents. Passed as subsection 170 of the Atomic Energy Act 1954, the Price Anderson Act established a system in which a combination of government guarantees and private insurance coverage would pay claims for personal injury and property damage caused by *nuclear accidents*.

Q

Quality Assurance

A systematic programme of controls and inspections applied by any organisation or body involved in the transport of *radioactive material*. Its aim is to provide adequate confidence that the standard of safety prescribed in the *IAEA* Transport Regulations (TS-R-1) is achieved in practice.

R

Radiation (Ionizing Radiation)

High-energy electromagnetic waves (such as X-rays and *gamma ray*) and particles (such as alpha and beta particles, neutrons, protons, and heavy nuclei) that cause substances in their paths to dissociate into ions. The spatial distribution of the ionization depends on the kind of *radiation*, its penetrating power, the location of the source, and the nature of the irradiated material.

Radiation Protection Programme

Systematic arrangements which are aimed at providing adequate consideration of *radiation* protection measures. See *Dose limit, justification* and *optimization*.

Radioactivity (Activity)

The emission of *radiation* resulting from the disintegration of unstable nuclei of atoms.

Radioactive material

Radioactive materials are those which undergo a spontaneous disintegration of the nucleus in general. However, radioactive material shall mean any material containing radionuclides where both the activity concentration and the total activity in the consignment exceed the values specified in the IAEA Transport Regulation. They include, but are not limited to, nuclear materials.

Reprocessing

A series of chemical processes used to separate spent nuclear fuel into its component parts, namely unburnt *Uranium* which can be recycled, *plutonium* formed in the reactor which is a *fissile material* and can be recycled as new mixed oxide (*MOX*) *fuel* and fission product wastes, also formed in the reactor, which have to be conditioned for disposal.

RID

Règlement concernant le transport International ferroviaire des marchandies Dangereuses) Regulations concerning the International Carriage of Dangerous Goods by Rail (OTIF).

S

Safeguards

Nuclear safeguards is the term applied to the management of civil nuclear materials to ensure that they cannot be diverted for illicit use and in particular to ensure that proliferation of nuclear weapons cannot occur. The measures include nuclear materials accountancy, containment and surveillance.

Safety

- For radioactive materials: situation where people, goods and the environment are protected against the effects of radiations.
- Especially for maritime transport: situation where people, goods and the environment are protected against natural elements, the cargo, and the action of man.
- These differing meanings may cause confusion when used in the same context, requiring some caution in language.

Safety Analysis Report

Any *package* must have a documented *justification* that it is safe for transport, and in some cases for storage. Such *justification* must be presented to the Safety Authority for Types B, C and for *packages* containing *fissile material* or *Uranium Hexafluoride*, and made available to them upon request for the other packages.

Safety Case

(UK) synonym of Safety Analysis Report.

Security

The prevention and detection of, and response to, theft, sabotage, unauthorised access, illegal transfer or other malicious acts involving *nuclear* material, other radioactive substances or their associated facilities.

Shipment

This is the specific movement of a *consignment* from its place of origin to its destination. A *shipment* may involve several *packages* on/in one or several *conveyances*. *Shipment* should not be used to designate a physical object.

Shipper

Synonym of Consignor.

Shipping Documents

Documents accompanying a *shipment* of *radioactive materials* which must include the following information: shipping name, *hazard class* number 7, identification number, identity of radionuclides contained in the *package*, description of the physical and chemical form of the material, total *activity* of the radioactive content, *category* of *label* on the *package*, and *type* of *package*.

SOLAS

International Convention for the Safety of Life at Sea (IMO).

Special arrangement

Provisions, approved by the *Competent Authority*, under which *consignments* that do not satisfy all the applicable requirements of these Regulations may be transported. Some additional *safety* measures may be required to compensate for not meeting all the normal requirements of the *IAEA* Transport Regulations to provide an equivalent level of *safety*. It has been applied for large components transportation (ex. spent steam generators and reactor vessels).

Special Form Radioactive material

Either an indispersible solid *radioactive material* or a sealed capsule containing *radioactive material*.

Spent fuel (Nuclear Spent Fuel)

Spent fuel is the irradiated fuel discharged at the end of its useful life from a *nuclear* reactor. This occurs because after about three years chemical, physical and *nuclear* changes render the fuel no longer efficient in maintaining a nuclear chain reaction and generating heat.

Surface contaminated object (SCO)

A solid object which is not in itself radioactive but which has *radioactive material* distributed on its surface.

Т

Tests

The safety of radioactive material transport depends primarily on the design of the package rather than on operational control, and the types of packages are defined according to the radioactivity and physical form of the materials they contain. Appropriate mechanical tests related to impacts, thermal tests related to fires, and tests related to the effects of contact with water are specified in the IAEA Transport Regulations.

ΤI

This can mean:

- Technical Instructions for the Safe Transport of Dangerous Goods by Air (*ICAO*)
- Transport Index (see below)

Transport Documents

See Shipping Documents.

Transport Index (TI)

A number assigned to a *package*, *overpack* or *freight container*, which is used to provide control over *radiation* exposure. The value of the *transport index* for a *package* or *overpack* is one factor used in determining the *category* to which the *package* or *overpack* belongs and, hence, which requirements are applicable to its transport. See *Labels* and *Category*.

Transport Safety Standards Committee (TRANSSC)

A standing body of regulatory officials with experience in *radioactive materials* transport *safety*. It provides advice to the *IAEA* secretariat on the overall programme on regulatory aspects of transport *safety* and has a primary role in the development and revision of the *IAEA* transport safety standards.

Туре

Type should be reserved to designate the different kinds of packages as defined in the *IAEA* Transport Regulations (TS-R-1). See *Class* and *Category*.

Type A Package

Intended to provide a safe and economical means to transport relatively small, but significant, quantities of *radioactive*

material. The total *activity* of their contents is appropriately limited (A_1/A_2) , depending on whether they are in unspecified form, or comply with the requirements of special form. They are required to maintain their integrity under the kinds of abuse or mishandling which may be encountered in normal conditions of transport, say, for example, falling from vehicles, dropped during manual handling, exposed to weather, struck by a sharp object, or having other *packages* or cargo stacked on top. They are, therefore, submitted to a water spray test, a free drop test, a stacking test and a penetration *test*.

Type B Package

Used to carry larger amounts of *radioactive material* than *Type A packages*. The *Type B package* must withstand the same normal transport conditions as the *Type A package*, but it must also be capable of withstanding accident conditions, without breach of its *containment* or an increase in *radiation* to a level which would endanger the general public or those involved in rescue or clean up operations. *Type B packages* are submitted to a series of stringent *tests* for resistance to impact, penetration, fire and water immersion.

Type C Package

A more robustly designed *package*, used for the air transport of high *activity* materials. Such *packages* must be designed to withstand *Type A tests* for normal transport conditions. Regarding accident transport conditions, they are submitted to test sequences including a drop test, a puncture/tearing test, an enhanced thermal test, an enhanced water immersion *test* and an impact *test* at a speed of 90m/s. *Type C packages* have not yet been developed.

U

UPU

Universal Postal Union

Unilateral Approval

An *Approval* of a design which is required to be given by the *Competent Authority* of the country of origin of the design only.

Uranium

A chemical element (U symbol). Natural *Uranium* occurring in rocks, water and ore, consists of three main *isotopes*; *Uranium* 238, *Uranium* 235 and *Uranium* 234. *Uranium* 235 is the only natural *fissile nuclide*, an outstanding property that explains its use as an energy source.

Uranium Hexafluoride (UF₆)

A *Uranium* of fluorine compound. *Uranium Hexafluoride* has the property to move from solid state to a liquid or gaseous state by small temperature variations. It is used most of the time in its gaseous state in industrial processes to enrich *Uranium* in the *Uranium*-235 *isotope*.

Uranium Ore Concentrate (UOC)

Uranium ore extracted from the mine, which has undergone nearby a chemical process to produce concentrates in the form of powder or a paste. They contain about 75% *Uranium* or 750kg per metric ton. These concentrates, generally known as "yellow cake" because of their colour, are then shipped from mines to UF₆ *conversion* facilities.

V _____

Vitrification

Vitrification incorporates fission products into a stable glass matrix. The glass then is poured into a stainless steel *canister*, where it solidifies. The fission products then form an integral part of a stable, compact and resistant glass. The *vitrification* process allows the definitive immobilisation and confinement of the fission products in a form suitable for final disposal.

Vitrified residue

Residue (fission products) locked in a solid matrix by virtue of the *vitrification* process. The fission products have been incorporated into glass and are a complete part of the glass in which they are immobilised.

W

No glossary entries under 'W' at present.

Х

No glossary entries under 'X' at present.

Y

No glossary entries under 'Y' at present.

Z

No glossary entries under 'Z' at present.

REFERENCES

- INTERNATIONAL ATOMIC ENERGY AGENCY, Regulations for the Safe Transport of Radioactive material — 2009 edition, IAEA Safety Standards Series No. TS-R-1, IAEA, Vienna (2009).
- [2] INTERNATIONAL ATOMIC ENERGY AGENCY, IAEA Safety Glossary, Terminology Used In Nuclear Safety and Radiation Protection 2007 Edition, IAEA, (2007).
- [3] INTERNATIONAL ATOMIC ENERGY AGENCY, IAEA Nuclear Security Series No.13, Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Revision 5), IAEA, Vienna (2011).

Photographs

- 1 Unloading a cask of vitrified high-level waste, Mutsu-Ogawara Port, Japan
- 2 Road transport of spent fuel in Japan
- 3 Cask for MOX fuel
- 4 Sea transport of vitrified high-level waste
- 5 Unloading operations, Barrow Port, UK
- 6 Preparing drums of uranium ore concentrate for transport
- 7 Front end transport in France
- 8 Rail-road transfer at Valognes Terminal, France
- 9 Rail transport of spent fuel in UK
- 10 Purpose-built vessel, Mutsu-Ogawara Port, Japan
- 11 Uranium ore processed and turned into powder " yellowcake"
- 12 Drums of uranium ore concentrate
- 13 48" Hex cylinders
- 14 Uranium fuel assembly
- 15 Tie-down for fresh fuel transport





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