



Good Practice Guide

**Preparation of Natural Uranium
Samples for Shipment in an
Excepted Package**

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NB

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The information presented in the fact sheet is valid as per December 2019.

Purpose

This Good Practice Guide has been prepared by the World Nuclear Transport Institute (WNTI) industry members to assist and guide Consignors to meet compliance with International Regulations when preparing for transport shipments of sample materials containing natural uranium, chemically separated uranium concentrate samples (solids and liquids) or uranium ore concentrate samples.

In this document we are discussing the following;

- a. **Samples of natural uranium ore, in the form of broken rock that have simply been ‘crushed and ground’ and as such have not been ‘processed’,**

- b. **Materials that have undergone processing in some form or another either being leached, separated and/or extracted (in a liquor based form), or chemically precipitated uranium bearing material,**

- c. **And/or finally dried ‘processed’ material in the form of U_3O_8**

The Guidance given here is based upon the requirements of the International Atomic Energy Agency (IAEA) in their publication (*SSR-6, Rev.1*) titled: *Regulations for the Safe Transport of Radioactive Material* [2018].





This publication is the basis of many international and national regulations for the safe transport of radioactive materials. Compliance with SSR-6 does not necessarily imply that State regulations will be complied with.

It is the Consignor's duty to ensure that the method of packaging the radioactive material is compliant with the regulations of each country that the material is being transported through or into. (A summary can be found in the *WNTI Fact Sheet: Safety Regulations Governing Radioactive Material Transport*).

This Good Practice Guide includes comments that describe the industry agreed best practices in shipping natural uranium samples. The Good Practice Guide however does not relieve the reader from their responsibility to ensure compliance with specific State based regulations applicable to the countries through which the samples are being shipped.

Natural Uranium

Natural uranium is defined as uranium (which is chemically separated, that is item "b" and "c" as described above) containing the naturally occurring distribution of uranium isotopes (approximately 99.28% uranium-238 and 0.72% uranium-235, by mass). A very small mass percentage of uranium-234 is present.

The IAEA Regulations Requirements

The IAEA includes a graded approach within their regulations for transport; hence the regulations provide threshold activity or activity concentration values under which the transport of material is Exempt from regulatory requirements.

When the material is not exempt and presents very low radioactive danger, limited controls in transport are required and the packages are called Excepted packages.

When material requires full control measures whilst the degree of radioactivity concentration exhibited by the material is still lower than certain threshold values, the material is called Low Specific Activity Radioactive Materials (LSA).

Most natural uranium samples can be transported as being either Exempt or Excepted. Others, which are more active, need to be transported as LSA similarly to the uranium ore concentrate (UOC) that uranium mines and processing plants produce.

This Good Practice Guide does not address bulk transport of UOC as all mining companies should be conversant with this (refer to WNTI Fact Sheets, *Package Types used for Transporting Radioactive Materials and The Safe Transport of Uranium Ore Concentrates*).

Exempt Material

The IAEA exemption criteria fall into either of the two categories:

- 1. Material that has an activity concentration, in Bq/g, less than a specified amount; or**
- 2. A consignment that has an activity, in Bq, less than a specified amount.**

The specified activity concentrations and activity amounts referenced are from the IAEA SSR-6 (Rev.1), 2018 edition regulations.

For uranium ore (which includes the progeny in secular equilibrium, that is item “a” in the above purpose), the activity concentration limit for Exempt material which applies is that of U(natural), 1 Bq/g.

The activity limit for an Exempt consignment for U(natural) is 1000 Bq. With consideration of the footnotes linked with those values in the regulations, the activity to be considered is only that of U-238 (hazard provided by the progeny of U-238 in secular equilibrium are already considered).

For uranium ore concentrate (chemical separated uranium in its naturally occurring distribution of uranium isotopes U-238, U-235 and a small amount of U-234, that is item “b” and “c” in the above purpose) the mixture of radionuclide calculation must be used to determine the activity concentration limit for Exempt material.

The calculated activity concentration limit for Exempt material for uranium ore concentrate is approximately 10 Bq/g. The activity limit for an Exempt consignment for uranium ore concentrate is 10,000 Bq.

When determining the activity concentration limit, the amount of uranium (activity) included in the sample per mass of the sample (not including the packaging) should be determined. Here, the mass of impurities within the sample are also included.

For mixtures of radionuclides, the determination of the exemption values may be determined as follows:

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

Where,

$f(i)$ is the fraction of activity or activity concentration of radionuclide i in the mixture;

$X(i)$ is the activity concentration for exempt material or the activity limit for an exempt consignment as appropriate for the **radionuclide i** ; and

X_m is the activity concentration for Exempt material or the activity limit for an Exempt consignment in the case of a mixture.

Once the uranium material within the sample has been confirmed as conforming to the exemption criteria then no further controls on the transport of this material is required.

Excepted Packages

The IAEA criteria for Excepted packages include material in limited quantities that do not exceed those activity limits that are specified in SSR-6. In the case of natural uranium these activity limits are unlimited. In the particular case of U(natural), contribution of all the nuclides of decay chains on U-238 and U-235 were already considered for the determination of the “unlimited” A1/A2 value in Table 2 of SSR-6, Rev.1, independently of their half-lives.

Further requirements for an excepted package specify that the radiation level at any point on the external surface of an excepted package shall not exceed 5 $\mu\text{Sv/h}$. If the radiation level can be demonstrated to be equal to or less than 5 $\mu\text{Sv/h}$ at any point on the external surface of the package, the package may be considered as an Excepted package. For a radiation level in excess of 5 $\mu\text{Sv/h}$ on the external surface of the package, a different packaging should be used. Refer to WNTI Fact Sheet ‘Package Types for Transporting Radioactive Materials’ for more information.

Packaging Design Requirements

Under the IAEA Regulations, the design criteria that excepted packages are required to meet are the general requirements for all packages (refer to WNTI Fact Sheet Package Types for Transporting Radioactive Materials). These requirements are almost identical to those that the IAEA specifies for an industrial package Type 1 (Type IP-1) – the only difference lying in an additional requirement regarding the dimensions of the package for a Type IP-1 package.

Good Practice: Source a package that has been qualified as being an industrial package of Type IP-1 category. UN packages or intermediate bulk containers (IBCs) qualified for dangerous goods could also be used, as long as they are fit for this purpose.

Consignors of uranium bearing materials need to take particular care in ensuring that the containment systems used are robust enough to maintain their integrity in case of minor transport mishap. Special attention must be paid to satisfy the IAEA additional requirements for packages of radioactive material transported by air.

Radiological Requirements

From the SSR-6, the excepted package must adhere to the following:

The non-fixed contamination level of the external surfaces of the package must not exceed an average value of 4 Bq/cm² for any area of 300 cm².

Good Practice: Although not required by the regulations, it is recommended that the non-fixed contamination level on the external surfaces of the package not exceed 0.4 Bq/cm² for any area on 300 cm².

Good Practice: If ores and concentrates are visible or if the packaging looks dirty – clean it, before controlling the level of non-fixed contamination.

The radiation level at the external surfaces of the packages shall be less than 5 Sv/h (0.005 mSv/h).

Good Practice: If possible pack lower activity samples at the outer edges of the package to provide further shielding from any gamma radiation.

Marking Requirements

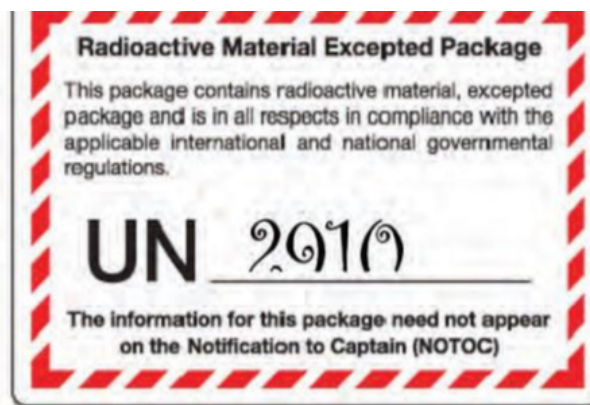
Each package shall be legibly and durably marked on the outside with:

- “UN2910”;

- Name and address of Consignor and/or Consignee (for air transport, both are required); and,
- The gross mass when exceeding 50kg.

Labelling Requirements

As noted above, the symbol “UN2910” needs to be displayed on the outer surface of the package and the marking “RADIOACTIVE” indicating that the contents are radioactive must be visible on opening the package (or on the outer surface of the package if not possible to have it on an inner surface).



In accordance with the Air Transport Regulations (International Civil Aviation Organization (ICAO)’s Annex 18 *Safe Transport of Dangerous Goods by Air* and the associated *Technical Instructions for the Safe Transport of Dangerous Goods by Air* (the “Technical Instructions”), and as also detailed in the International Air Transport Association (IATA) *Cargo Dangerous Goods Regulations*, when transported by air, the handling label “Radioactive Material Excepted Package” should be affixed to the outside of the package.

Documentation

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 contents should be described as UN2910.

In addition, for:

- Air carriage: “UN-2910 – Radioactive Material, Excepted Package – Limited Quality of Material” as the description of the material in the airway bill (Shipper’s Declaration for Dangerous Goods is not required for excepted packages).
- Sea carriage: As with air carriage, a “shipper’s Declaration for Dangerous Goods” is not required for excepted packages, with the condition that the UN number, the Consignor and Consignee names and addresses are shown on a transport document such as a bill of lading, air waybill or another similar document.

Other Dangerous Properties

Any other dangerous properties of the material must be taken into account in order to be compliant with the relevant international dangerous goods regulations and legislation of each country that the transport encroaches on.

Emergency Responses

According to SSR-6, a graded approach is applicable when defining emergency response measures. In the case of excepted packages, which contain small amounts of natural uranium at low concentrations, the consequences of accidents, if any, are minor and there are no radiological reasons for taking special protective actions.

Priorities for rescue, life-saving, first aid, and control of fire and other dangers should take precedence over measuring radiation levels. Unauthorised personnel must be kept away from any accident scene. Radiation Authorities must be notified of accident conditions.



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