Standard

Packaging and Transport of Uranium Concentrates Version 4

March 2025

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Introduction

This document introduces and describes leading industry practice for the safe transport of natural uranium ore concentrates (UOC). It has been developed by members of the World Nuclear Transport Institute (WNTI) and is intended to share their leading practices with other industry participants. It describes the practices that Consignors should adopt in order to fulfil their obligations to ensure the security and safety of the communities and environments through which their UOC is transported. It should be read in conjunction with applicable national and international regulations for the safe transport of radioactive materials, including UOC.

2.1 The IAEA approach to transport

The International Atomic Energy Agency (IAEA) considers transport to comprise and encompass all operations and conditions associated with and or involved in the movement of radioactive material, including, the design, manufacture, maintenance and repair of packaging and packages, the preparation of the packages, consigning, securing of the packages within the shipping container, the carriage of the cargo including any in-transit storage through to the receipting and unloading at the final destination of the radioactive material cargo. The IAEA philosophy is that radioactive materials are packaged and transported according to their physical, chemical and radiological properties through the adoption of a graded approach, whereby packaging requirements are commensurate with the potentially hazardous nature of the content of the package.

2.2 The IAEA approach to safety

The fundamental IAEA transport safety objective is to protect people and the environment from any harmful effects of ionizing radiation that may arise as a result of activities associated with the transport of radioactive material that give rise to radiation risks.

Safety is concerned with both radiation risks under normal circumstances and radiation risks as a consequence of incidents. Safety measures include actions to prevent incidents and arrangements that are put in place to mitigate consequences should they occur based on a graded approach when evaluating the risk.

This document is specific to natural UOC, which are transported as “Class 7” (radioactive) materials and identified as UN2912. UOC is a relatively weak alpha emitter of radiation and is classified as being a “low specific activity (LSA-I)” radioactive material.

As stated in the 2018 edition Specific Safety Guide No. SSG-26 (Rev.1) Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material at page 309, I.62 the 1973 Edition of the Transport Regulations recognized a category of material whose specific activities are so low that it is inconceivable that an intake could occur which would give rise to a significant radiation hazard, namely, LSA material. This category was defined in terms of a model where it was assumed that it is most unlikely that a person would remain in a dusty atmosphere long enough to inhale more than 10 mg of material.

Whilst dose rates associated with UOC are extremely low, the management of exposure to and contamination from sources of radiation forms an essential component for the safe transport of radioactive materials.

The transportation of UOC is a global undertaking, as producers deliver their production, on behalf of their customers, to toll Converters utilizing supply chain routes traversing international waters, ports, shipping container terminals, public roads and railways. UOC is typically packaged in open head steel drums and shipped in dry ISO shipping containers.

03

Packaging

The packaging used for transporting any form of radioactive material must meet applicable international standards. Industry has for many years, used open head steel drums, conforming to the IAEA standard Type IP-1, as the primary containment for transporting UOC.

3.1 Drum description

UOC is typically packed in 205 to 250 litre open head steel drums having a gross weight (drum and contents) of up to 450 kg. The drums must be suitable for repeated handling, stacking and storage for extended periods of time. They must have a removable top lid secured by a bolted retaining ring to allow for filling and emptying. Drums should have smooth internal and external surfaces to facilitate emptying and cleaning.

Drum designs vary according to local availability and are subject to applicable national and international regulations.

Converter contracts will typically include a drum specification, setting out details of construction, dimensions, markings and maximum gross weights. Whilst there is no IAEA test requirement or standard covering the IP-1 drum, producers and transporters of UOC utilizing the IP-1 drum generally ensure that their drum manufacturer or supplier adopts the testing requirements found in the IAEA regulations as applicable to the IP-2 drum. Those requirements involve a stacking test equivalent to five times the maximum weight of the drum and passing the drop test from 1.2m.

Image 3 Typical drums

Producers are encouraged to develop a close relationship with their drum suppliers, to ensure that all regulatory requirements are fully met.

It is important to note that the Converters are not involved in approving drums, however, most will set specific criteria for maximum weight and dimensions. With regards to the drums, Converters need to be satisfied that the drums conform to the IAEA Regulations, and that the drums prevent the escape of any radioactive material. More importantly they want to know that the drum lids will prevent the ingress of any form of moisture, whilst the drums are stored awaiting processing.

An example of an IP-1 Drum Certification can be found in Appendix 2.

The principal components of any drum are the drum barrel and base, the drum lid, the drum lid locking ring and securing bolt.

Image 3.1 Drum components (conventional style drum)

3.2 Drum body

3.2.1 Open head rolled steel

3.2.2 Both nesting and non-nesting types are in routine used by industry

3.2.3 The interior of the drum should not be galvanized or have any type of coating (including organic).

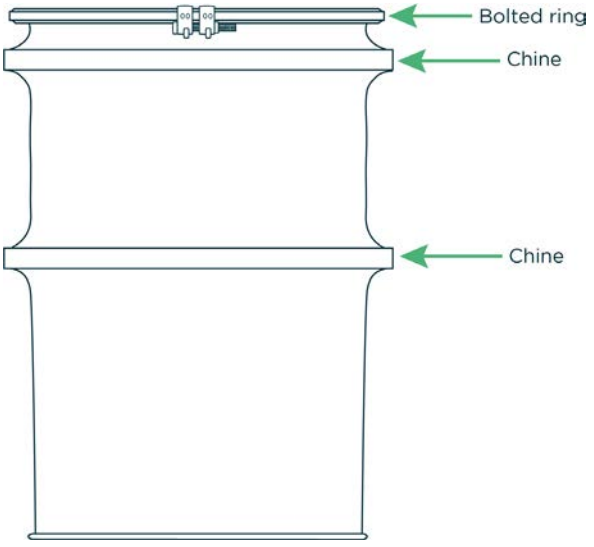


Image 3.2a Nesting style drum
(i.e. will nest when stacked empty, no lower chine)

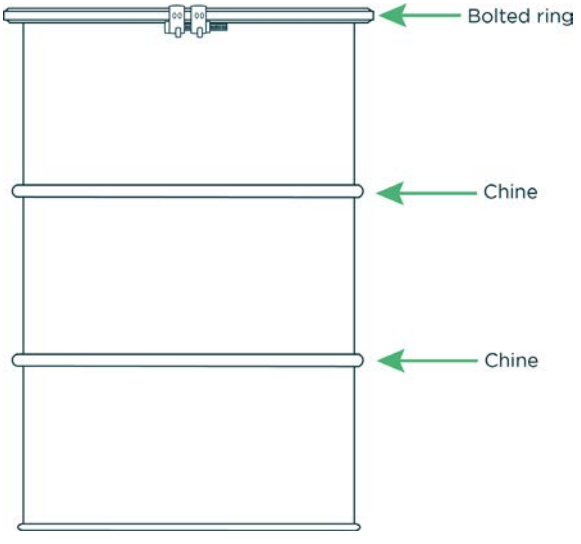


Image 3.2b Conventional (non-nesting) style drum

3.3 Drum lids

3.3.1 Filling is through the open head whole lid system

3.3.2 Drums are emptied by removing the complete lid.

3.3.3 The interior of the drum lid should not be galvanized or have any type of coating (including organic).

Image 3.3a Standard drum lid

Image 3.3b Drum lid

3.4 Bolted retaining ring

3.4.1 A bolted retaining ring should be used to secure the lid to the drum. Clip rings should not be used.

3.4.2 Galvanised retaining rings having either a “C” or “U” ring profile are preferred.

3.4.3 The rings should have sufficient strength and durability to allow for opening and closing of the lid to permit sampling at the point of delivery.

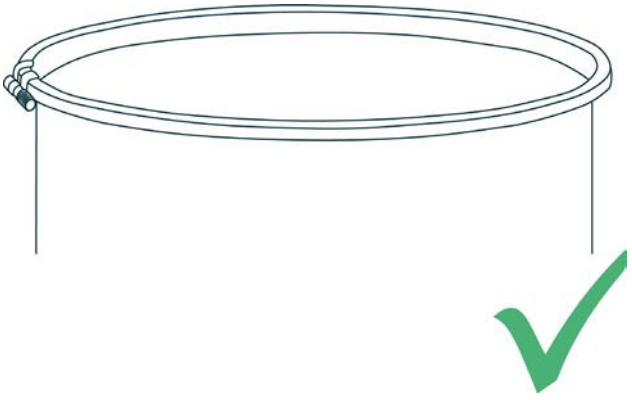


Image 3.4a Bolted retaining ring

Image 3.4b Standard drum lid with C or U section locking ring

3.5. Securing bolt

3.5.1 The retaining ring should be secured with a removable bolt, welding should not be used on the securing bolts (to allow for opening and removal of the lid at the Consignee or Converter premises)

3.5.2 Top bolted rings should not be used (to avoid snagging when drums are stacked)

3.5.3 The use of security tags is permissible.

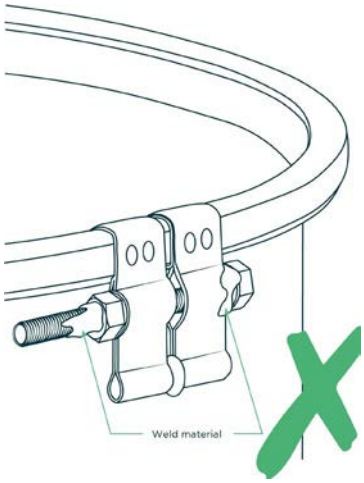


Image 3.5a Side bolted locking ring (welded)

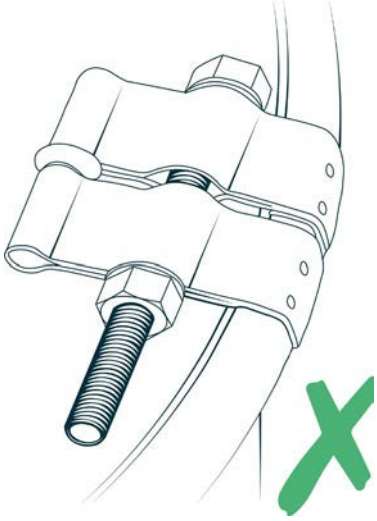


Image 3.5b Top bolted locking ring (unwelded)

3.6 The life of an IP-1 drum (package)

The sole purpose of an IP-1 drum package is to provide a strong and durable package in which to transport Uranium Ore Concentrates from the point of manufacture to a nominated conversion facility. In doing so the drum must contain and prevent the release of its radioactive content.

After arrival at the Converter, drums lids need to be removed to allow spear sample testing of the contents, the lids then need to be refitted and the securing locking bolt retightened. It is for this reason that both the WNTI and the Converters do not allow the welding or crimping of the securing locking bolts.

The IP-1 drum package is a single use (non-returnable item) which after arriving at the nominated overseas converter could spend a lengthy period of time sitting under cover or outside in open storage areas in a varying range of climatic conditions experienced within North America, Canada, France, China, Russia, India. It is for this reason that drums need to be fitted with close fitting lids having adequate capability both to prevent the escape of any radioactive material, but more importantly to prevent the ingress of any form of moisture, whilst the drums are stored awaiting processing.

04

ISO Shipping Containers

The transport of UOC drums typically utilizes ISO shipping containers, however in some areas the use of dry van trailers is common. There are a number of options that Consignors might consider adopting regarding how they manage and make use of ISO shipping containers to transport their UOC.

One option is to utilise Carrier Owned Containers, a second option is to enter into a Container Lease Agreement in conjunction with a Container Leasing Company with the third option being for Consignors to provide their own Shipper Owned Containers for the transport of their cargo.

In all three cases there are strict requirements on controlling any radioactive contamination of both the internal and external surfaces of the ISO shipping container and these are discussed further in this section and also in greater detail within Section 9 Radiological Monitoring and Control of Packaging and Containers.

There is a requirement for all Consignors to comply with the 'Convention for Safe Containers' (CSC):

www.imo.org/en/About/Conventions/Pages/International-Convention-for-Safe-Containers-(CSC).aspx

4.1 Shipping container specification

4.1.1 Twenty foot (20'), dry van, ISO Size Type 22G1, ISO 1496-1 containers.

www.iso.org/standard/59672.html

4.1.2 Containers should be compliant with the requirements of the Institute of International Container Lessors (IICL), the International Convention for Safe Containers (CSC), including the requirement to have a current CSC safety approval plate or an Approved Continuous Examination Program (ACEP) marking attached to a door of the container. A valid (current) CSC container safety approval plate should detail the container type, date of manufacture, maximum gross, container tare and stacking weight details.

www.imo.org/en/About/Conventions/Pages/International-Convention-for-Safe-Containers-(CSC).aspx

Image 4.1 CSC safety approval plate

4.1.3. The loaded weight of the shipping container packed with the drums or UOC and the dunnage must not exceed the limit stated on the container manufacturer's plate or the CSC safety approval plate. The combined weight of drums, dunnage and the container must conform to all applicable regulations, specifically road/rail weight restrictions, from the point of origin through to the final destination.

4.1.4 As required by SOLAS chapter VI, part A, regulation 2, a packed container gross mass shall be verified by weighing the packed container, or by weighing and summing weights of the container and all its contents, prior to stowage aboard ship. The verified gross mass (VGM) shall be communicated in the shipping documents sufficiently in advance to be used by the ship's master or his representative and the terminal representative in the preparation of the ship stowage plan.

https://www.gov.uk/government/publications/verification-of-the-gross-mass-of-packed-containers-by-sea

4.1.5 According to ISO 1496-1, containers should have a minimum of 10 anchor points. However, a total of 20 is preferred, with an equal number on the top and bottom. The preference for 20 anchor points facilitates the securement of drums within the ISO sea container. Additional lashing or anchor points may be added in compliance with the standard and with the permission of the shipping container owners. Appendix 3 shows details of a typical container and internal anchor and lashing points.

4.1.6 Containers should be equipped with fork pockets for lift truck tines (forks) and with the design capacity for lifting a fully loaded container.

4.1.7 Containers should have adequate door seals that prevent the entry or discharge of material or moisture.

4.1.8 At least one of the locking handles on each container door should have a hole capable of allowing the placement of an approved container bolt security seal.

4.1.9 If the containers require repair or modification, such work should be done in accordance with the shipping line approval in the case of carrier's own container. For further information refer to the Institute of International Container Lessors (IICL) Guide for Container Equipment Inspection 6th Edition (IICL-6), which provides details of criteria for determining if containers require repair.

www.iicl.org/store/

4.1.10 The use of timber flooring is preferred since it provides a significantly higher level of friction, anti-skid, anti-slip capability. However alternative flooring materials may be used for other reasons. For instance, steel flooring is easier to clean and decontaminate. Where steel flooring is used, best practice strongly supports the use of anti-slip materials, or ribbed or granulated sheeting or wafers.

4.1.11 Prior to being accepted for use, ISO shipping containers should be free of fixed and non-fixed contamination as described in section 6.1. Painting the flooring or any other surfaces, of the ISO shipping container, in order to fix contamination is not acceptable. ISO shipping containers shall undergo a pre-acceptance inspection by the Consignor, in accordance with Appendix 4 and pre-shipment inspection in accordance with Appendix 5.

4.1.12 After unloading of the drums at the Consignee or Converter premises, the ISO shipping containers should undergo testing to ensure that they are free of any radioactive contamination as per the IAEA requirements and should be certified as "Free for Release" in accordance with Appendix 6.

4.2 Storage of ISO shipping containers awaiting shipment

Ideally, ISO shipping containers awaiting shipment should be stored in a defined dedicated Dangerous Goods cargo area in accordance with the appropriate and relevant international, domestic, and regional regulations.

Where regular storage occurs, it is good practice to always use the same area within the shipping terminal for the storage of ISO containers to assist personnel to identify, familiarize with and to remember Class 7 storage locations.

The ISO shipping containers should be segregated from oxidizing, corrosive, flammable, explosives or other dangerous goods materials.

In selecting storage locations, it is important to select areas to store ISO shipping containers away from offices, accommodation or food canteens, maintenance workshops and areas that experience high or regular volumes of personnel or vehicular traffic.

4.3 Security for ISO shipping containers awaiting shipment

Security requirements for the storage of ISO shipping containers awaiting shipment at a port or terminal can be adequately addressed through the applicable security provisions of the International Ship and Port Facility Security Code (ISPS Code) and the IMDG Code as required by the Convention for the Safety of Life at Sea (SOLAS 74 amended).

Ideally the selected storage area for ISO shipping containers should have adequate CCTV coverage and be subject to regular visual and physical monitoring by personnel.

The ISO shipping containers should not be stored adjacent to fences or in situations whereby the roof of the shipping container could be utilized as a point of purchase to assist unauthorized access. When stored in rows, ISO shipping containers awaiting shipment should be stored with their doors abutting the next container in order to prevent access to the container door mechanisms.

05

ISO Shipping Container Loading

In determining ISO shipping container load configurations and securing, Consignors should undertake a full and complete evaluation of the load restraining system that they intend to utilise to secure their drums or packages within the ISO shipping containers. The evaluation should ensure that the restraining system is in full compliance with the applicable national and international standards. Consignors should also undertake periodic reviews of their load restraint system.

In some countries Consignors/Producers obtain approval for the design of their packaging and securing methodology from their Competent Authority (CA).

Consignors should consider the relationship between maximum gross container weight (the combined weight of the UOC, the drum packages, the dunnage material used to secure the cargo and the tare weight of the empty ISO shipping container) and the limit stated on the ISO shipping container manufacturer's (CSC) plate as well as any road/rail restrictions and the limits set by the intended Consignee or Converter. The combined total weight must also conform to all applicable national and international regulations, specifically road vehicle weight restrictions, applicable within the country of origin of the cargo, any country that the cargo may transit through and the final destination country.

It is important to properly secure drums of UOC inside ISO shipping containers as the container may move in multiple directions during normal transport operations whereby forces may shift an unsecured load to exert excessive pressure against the nose, rear doors or side walls of the ISO shipping container. Drums that are insufficiently blocked and braced may shift to one side of the ISO shipping container causing the container to lean on the rail flatcar or truck trailer which in turn may cause the container to sideswipe and or cause an accident.

Consignors should provide loading personnel with adequate training, including written procedures and diagrams for loading drums into the ISO shipping containers and such procedures should be followed by the facility, which is responsible for loading of the drums. Similarly, Consignees or Converters should also provide unloading personnel with adequate training including written procedures and diagrams for the unloading of ISO shipping containers following arrival at the Consignee or Converter premises.

Shore-based personnel involved in the shipment of dangerous goods must be trained commensurate with their responsibilities. Chapter 1.3 of the IMDG Code defines shore-based personnel such as those who:

- Classify dangerous goods and identify Proper Shipping Names (PSN)'s.
- Pack dangerous goods.
- Mark, label or placard dangerous goods.
- Load or unload Cargo Transport Units (CTU) shipping containers.
- Prepare transport documents for dangerous goods.
- Offer dangerous goods for transport.
- Accept dangerous goods for transport.
- Handle dangerous goods in transport.
- Prepare dangerous goods loading and or stowage plans.
- Load or unload dangerous goods into or from ships.
- Carry dangerous goods in transport.
- Enforce, survey or inspect for compliance with applicable rules and regulations; or are otherwise involved in the transport of dangerous goods as determined by the competent authority.

The training of all persons involved in securing packages of radioactive material should be commensurate with their tasks addressing the:

- Legal responsibilities of parties involved.
- Specific hazards presented by packages of radioactive material.
- Requirements for securing packages specific to mode of transport.
- Methods of retention, associated equipment, design and justification.
- Stowage instruction.
- Checks and controls.
- Practical implementation of the different methods of retention and securing.
- Checking correct stowage before and during carriage.

5.1 Loading Design

Consignors/Producers of UOC should have detailed loading plans that provide a uniform longitudinal and lateral weight distribution allowing for the drums to be tightly nested together within the ISO shipping container. The consignee should be provided the opportunity to review the loading plans to determine if they can unload the drums from the ISO shipping container.

5.1.2 Consignors/Producers of UOC should have detailed loading plans. Drums should be evenly distributed within the ISO shipping container and be arranged so that they are tightly nested together, using dunnage to fill any voids. Consideration should be given to preventing drums from locking and or hanging on each other during transport as this can lead to displacement of the lid and possible deformation of the drum. Drums should be placed so that their locking bolts do not touch the sides of the ISO shipping container or other drums.

5.1.3. Drums may be secured into the ISO shipping container in either a single or double tier configuration. (UOC typically has a high bulk density hence the second tier is normally not fully loaded with drums due to ISO shipping container and / or road weight limitations). Should the loading configuration require a second tier, it shall be separated from the first (lower) tier using slip resisting wafering to minimize the possibility for any movement during transit.

5.1.4. Drums should be restrained with dunnage and or lashing in compliance with the applicable transport regulations in order to prevent longitudinal, lateral and vertical movement during transport. Particular attention should be paid to the securing of any second-tier loading. Chorded polyester (or equivalent) lashing is preferred, as it minimizes the need for dunnage disposal.

Wherever timber dunnage is used, it should be phytosanitary compliant and free of defects which impair its strength or interfere with proper nailing. Dunnage should not be nailed to the ISO shipping container wall.

5.1.5. Any void space between the cargo and the ISO shipping container doors should be blocked with dunnage to prevent shifting during transport. The use of bull boards is recommended to fill this void space.

5.1.6. Samples of UOC may be transported in the same ISO shipping container as the drummed UOC cargo. Samples should be packaged according to the appropriate regulations and be adequately secured within the ISO shipping container.

5.2 Longitudinal, lateral and vertical restraint

5.2.1 The WNTI has adopted the acceleration factors and restraint determinations based upon the Appendix IV, Table IV1 of IAEA SSG-26 (Rev.1). Further details are available in the WNTI Information Paper, Interpretation of the recommendations contained in the Appendix IV of SSG-26 (Rev. 1) – 2018 Edition

https://www.wnti.co.uk/resource/information-paper-interpretation-of-the-recommendations-contained-in-the-appendix-iv-of-ssg-26-rev-1-2018-edition/

'a' The effect of gravity is included.

'b' For packages transported in vehicles lighter than 3,500 kg, higher acceleration values should be considered (Ref EN 12195). No precise value can presently be proposed due to lack of data.

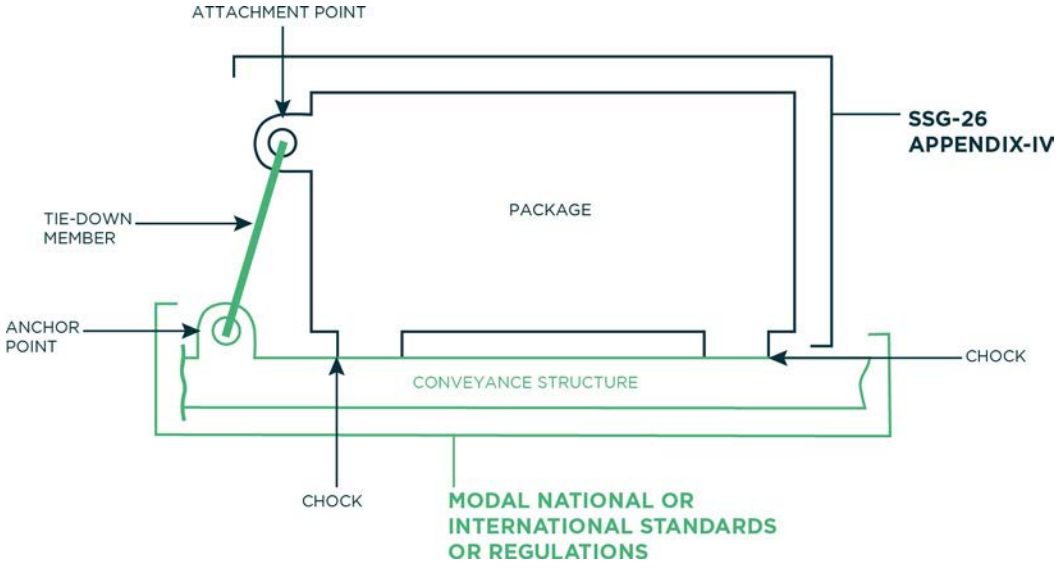
'c' 1.0g should be used if wagons equipped with long-stroke shock-absorbers or if hump and fly shunting operations are explicitly excluded.

TABLE IV.1 ACCELERATION FACTORS FOR PACKAGE RENTENTION SYSTEM DESIGN

MODE	ACCELERATION FACTORS		
	LONGITUDINAL	LATERAL	VERTICAL 'a'
Road	0.8g	-	1g down ± 0.2g 'b'
	-	0.5g	1g down ± 0.2g 'b'
Rail	1.0g/4.0g 'c'	-	1g down ± 0.3g
	-	0.5g	1g down ± 0.3g
Sea/water	0.4g	-	1g down ± 0.8g
	0.24g	0.8g	1g down ± 0.48g
Air	1.0g	-	1g down
	-	1.0g	1g down
	-	-	2.0g up. 2.0g down

Minimum G-Values to be retained for tie down system of UOC drums inside a freight container to be carried by land and sea modes.

Appendix IV of IAEA SSG-26 applies to 'attachments points' which are an integral part of the package. The design and justification of a tie-down system which is not a part of the package (tie-down members, lashing, transport frames, etc.) should be designed in conformance with the adequate rules applying to the mode of transport used and the countries where the transport takes place (these rules may be standards, regulations or guidance and may be international, or in certain cases, national).



5.3 Stowage of ISO shipping containers for sea transport

5.3.1 It is suggested that ISO shipping containers be stowed under deck. Consignors should work closely with their Carriers who in turn should work closely with the Terminal Operators of the en-route passage to achieve this outcome. However, some authorities may need to board the vessel to inspect the ISO shipping containers prior to final approval for transit (e.g. Suez Canal) or berthing so this practice may not always be possible. In these instances, the vessel owners may require that the ISO shipping containers are stowed on deck.

5.3.2 ISO shipping containers should be stowed door to door, or alternatively with doors facing against steel bulkheads as this minimizes the risk for the doors opening should some external event trigger a significant impact or force on the ISO shipping container.

CTU Code:

https://unece.org/transport/documents/standards/ctu-code

Image 5.a Examples of ship loading

06

Markings, Labels and Placard

Markings are specific text and numerical identifying information and detail that the Consignor/Producer must legibly and durably apply to the packaging which describe the radioactive content of the material within the package.

Labels provide information relating to the radiological hazard of the contents in the package. The labels provide an indication of the radiation levels likely to be encountered at the surface of or at a distance of 1 metre away from the package or ISO shipping container by referencing the Transport Index.

Placards contain basic text information along with the applicable UN identifier indicating the presence of radioactive material associated with the package or contents of the ISO shipping container.

Collectively markings, labels and placards provide an effective internationally recognised means of communicating information about radioactive materials that are being transported by road, rail, sea or air transport. They provide important safety related information, to first responders along with a broad range of transporters including; truck, train drivers, shipping ports, terminals, stevedores, ship's crew, customs and border personnel.

6.1 Marking

The following basic information must be marked on the outside of the package;

- Name or address of Consignor/Producer or Consignee/Converter, or both
- The UN number (i.e.) UN 2912 and proper shipping name of the radioactive material.
- If UOC is being transported into or through the USA, the letters "RQ" must be marked on the package in association with the proper shipping name.
- The permissible gross mass of the package, if the package gross mass exceeds 50 kg.
- The package identification, (i.e. TYPE IP-I).

6.2 Labelling

- Each package and ISO shipping container shall bear a category label affixed to two opposite sides (some 180 degrees apart) of the outside of a package and on the outside of all four sides of an ISO shipping container. Any labels that do not relate to the contents shall be removed or covered.

Markings on an IP-1 (UOC) drum label

Category III-YELLOW label typically on an ISO shipping container

Labelling of a Type IP-1 package

6.3 Placards

Placards shall be applied to rail and road vehicles carrying packages or ISO shipping containers of UOC.

Class 7 Placard

UN2912 Placard

Labelling and placarding of an ISO shipping container of UOC

07

Shipping and Transport Documentation

A Consignor/Producer needs to provide and share the following documentation as applicable with their Shipping line Carrier, their Road and or Rail Transporter, Port or Shipping Terminal operators and their Overseas on Carrier. The IMDG Code calls for three documents, the ISO Shipping Container/Vehicle Packing Certificate, the Multimodal Dangerous Goods Form and Emergency Response information.

7.1 The ISO shipping container/vehicle packing certificate (detailed cargo manifest)

UOC is a fully declared, unitized cargo having a regular standardised documentation format, consistent weights that ensure the GCW mass per ISO shipping container is in full accordance with all international standards and has predictable radiation dose rates, that ensure values including the Transport Index follow all requirements detailed within the IAEA SSR-6 (Rev.1) Regulations.

The detailed cargo manifest is created by the Consignor/Producer and summarises information from the drum filling process with ISO shipping container details. This document generally has two components the summarised ISO shipping container packing list and dose rate summary which contains information accumulated from the detailed drum listing.

Appendix 7 has examples of a Container/Vehicle Packing Certificate (detailed cargo manifest).

7.2 The Multimodal Dangerous Goods Form

The Multimodal Dangerous Goods Form (DG) covers all road, rail and ocean transport, addressing delivery information standardized shipping details. A DG for each ISO shipping container within the overall Consignment and accompanies the ISO shipping container for each of the various modal sectors, road, rail, sea, etc.

Whilst the information required is mandatory; the layout of the form is not mandatory.

The document includes standard shipping and forwarding instruction information including full details about the Dangerous Goods properties of the cargo. The packing declaration is a legally enforceable document, signed by the person who packed the goods and the person who prepared the Multimodal DG document.

Appendix 8 has an example of a Multimodal Dangerous Goods Form.

7.3 Emergency response documentation

Appropriate information shall be immediately available at all times for use in emergency response to accidents and incidents involving dangerous goods in transport. The information shall be available away from packages containing the dangerous goods and immediately accessible in the event of an incident.

Methods of compliance include appropriate entries in the special list, manifest or dangerous goods declaration; provision of a separate document such as a Safety Data Sheet (SDS) and the provision of separate documentation such as the Emergency Response Procedures for ships carrying dangerous goods (EmS Guide) for use in conjunction with the transport documentation.

WNTI has created a generic UOC Safety Data Sheet that includes, Product and Company Identification, Hazard Identification, Composition and Information on Ingredients, First Aid Measures, Fire Fighting Measures, Accidental Release Measures, Handling and Storage, Exposure Controls and Personal Protection, Physical and Chemical Properties, Stability and Reactivity, Toxicological Information, Ecological Information, Disposal Considerations, Transport Information, Regulatory Information, Other relevant information and a Glossary of Abbreviations, Acronyms and Terms:

https://www.wnti.co.uk/resource/wnti-good-practice-guide-generic-uoc-data-sheet-2018/

There are a number of other shipping documents that contribute to the overall shipping documentation that is of interest to ports, shipping terminals, road or rail transporters involved in handling UOC cargo.

7.4 The Radioactive Cargo Maritime Booking Request

Whilst these types of documents are not required by regulation, they provide a benefit to both the Shipping line Carrier and the Consignor/Producer. Having full details relating to the nature of the material to be transported allows the Shipping line Carrier to better determine any limitations or issues that the carriage of this type of cargo may create giving them a high degree of confidence in accepting the booking. Also, for the Consignor/Producer, once the booking request is accepted, they can be assured that the cargo will be carried and not delayed apart from unexpected shipping delays or non-product related issues.

7.5 ISO shipping container pre-shipment (receipting advice) document

The container pre-shipment receipting advice is used to notify a port or shipping container terminal of the impending arrival of cargo for export, in the case of UOC cargo alerting the port or terminal that they are about to receive Class 7 cargo. It can be either in paper or electronic format.

Other shipping documentation (which is not part of the regular transport requirement) includes the Certification of Origin and the Pro-forma Invoice which are needed mainly to assist in the facilitation of importation and cargo clearance requirements at the Consignee/Converter discharge port and a Certificate of Marine Insurance.

7.6 Bill of Lading documentation

This is a standard Bill of Lading document that in addition to the standard shipping and forwarding instruction details has information from the ISO Shipping Container/ Vehicle Packing Certificate (detailed cargo manifest) and specific information relating to the Dangerous Goods nature of the cargo.

08

Shipping Notifications

The Consignor must obtain the formal authorization of the Consignee to receive the shipment before departure of the shipment. Email systems have greatly improved the effectiveness and efficiency of exchanging information between key stakeholders involved in transporting international cargo. Due to the strategic nature of the cargo, WNTI acknowledges the importance of having some form of a structured shipping notification system that supports the flow of information to assist in the uninterrupted movement of UOC cargo between Consignor/Producer and the overseas Consignee/Converter facility.

Whilst there are no formal IAEA or IMDG regulations addressing any specific need for shipping notifications covering the transport of UOC, below is a list of recommended, proven, practical shipping related notifications based on years of experience and usage by WNTI members that Consignors/Producers of UOC might consider adopting.

8.1 Pre-shipment notifications

- An initial notification from the Consignor to the Shipping line Carrier for a booking request to carry radioactive material.
- If applicable to export country, notification request to local Competent Authority for approval to transfer and export strategic commodities from country of origin.
- Notification of approvals for export and Customs cargo clearance (1) (Export Declaration Notice).
- Notification to export strategic commodities ISO shipping container terminal (Pre-Receipting Advice).
- Notification/s to overseas government agencies and or shipping ports in countries that have special requirements covering the transit or transshipment of strategic commodities including radioactive materials.
- Notification to Overseas on-Carrier to arrange transport from the discharge port to the Consignee/Converter facility.
- Notification to Consignee/Converter facility to allow them to prepare for import and Customs clearance of the cargo as and where applicable.
- Notification to the Consignee/Converter facility to allow them to prepare for cargo receipting at their facility (2).

8.2 In-transit notifications

Consignors/Producers are strongly urged to track their cargo throughout the entire transport supply chain by making use of any on-line capability that might be provided or available from their Shipping line Carrier and or Overseas on-Carrier (3).

(1) The need for export approval of strategic commodities may vary and be subject to government safeguards and or NPP additional protocols.

(2) The early and updated advice about expected arrival times for the cargo into the Consignee/Converter facility will greatly assist in scheduling the unpacking of ISO shipping containers, resulting faster reconciliation of Consignor/Producer 'stock at converter' and in reduced turnaround time ahead of the ISO shipping containers becoming available for decontamination and their subsequent 'free release' and return back into the global ISO shipping container pool.

(3) The use of on-line technologies to track cargo provides a high degree of confidence around the overall security of the cargo during whilst in-transit.

8.3 Tracking of cargo and pre-advice of delivery to Consignee facility.

The background safeguards processes covering the transfer of UOC involve a number of notifications and approvals between the Consignor (Producer), the Competent Authority/s (CA) in the respective sender and receiver States and the Consignee (Conversion facility). Best practice suggests that in addition to these formal notifications, Consignors provide formal notification and regular updates to their respective Consignees tracking each shipment or delivery. This activity is beneficial for all parties, for the Consignor it provides assurance that their cargo is on track and on time, for the Consignee, it provides adequate notice to affect any Customs clearance activities ahead of the final on-carriage and delivery of the cargo. Consignees are then well prepared to undertake receipting activities associated with unpacking of the cargo and undertaking contamination checks leading to the 'free release' of the ISO shipping containers.

8.4 Post-shipment notifications

- Notification to Consignor/Producer from overseas On-carrier confirming the arrival of cargo at final overseas discharge port and subsequent on-carriage to final destination (4).

- Notification to the Consignor/Producer from the Consignee/Conversion facility confirming the safe arrival of cargo (5).

(1) This notification can also (by arrangement with the Overseas on-carrier be sent on to the Consignee/Converter facility

(2) This notification is most important signifying the end of the transport supply chain process. It provides the Consignor/Producer with a means of notifying the local Competent Authority (CA) in the country of origin that the cargo has arrived safely and securely at the designated Consignee/Converter facility.

09

Radiological Monitoring and Control of Packaging and ISO Shipping Containers

As mentioned in the introduction, the fundamental IAEA transport safety objective is to protect people and the environment from any harmful effects of ionizing radiation that may arise as a result of activities associated with the transport of radioactive material that give rise to radiation risks.

Best practice requires that all packaging associated with radioactive materials be as clean as possible. Contaminants can be introduced onto packages and into ISO shipping containers through exposure to the elements. A rigorous focus on maintaining high standards of housekeeping and associated work practice can provide an effective means of controlling levels of contamination.

Examples of contaminants include various forms of dust, dirt, mud, residues of liquids, particulates suspended in air, etc. For example, “No muddy boots should be worn when packing or checking containers.” In the case of a ISO shipping container, the result of long periods of repetitive abrasion from the tyres of fork lift trucks on non- fixed contamination will result in it becoming ground or embedded into the porous nature of the timber flooring.

The cleanliness of the package and ISO shipping containers can be further compromised by contaminants that may include radioactive “contamination” defined in the IAEA Regulations SSR-6 (Rev.1).

9.1 Contamination limits for the transport of ISO shipping containers

The level of non-fixed contamination on the external surfaces of any ISO shipping container, irrespective of its ownership status shall be kept as low as practicable and under routine conditions of transport, shall not exceed 4 Bq/cm^2 for beta and gamma emitters and low toxicity alpha emitters when averaged over any area of 300 cm^2 of any part of the package surface. This requirement applies to each of the three options discussed in Section 4 ISO Shipping Containers.

ISO Shipping containers, as well as other packaging used for the transport of radioactive material shall not be re-used for the storage or transport of other goods unless they are decontaminated below the level of 0.4 Bq/cm^2 for beta and gamma emitters and low toxicity alpha emitters.

This requirement applies to all ISO shipping containers that will be returned into the global container pool either at the Carrier Owned Containers or the Container Leasing Company. That is the ISO shipping containers will be unloaded and cleaned before being returned into the global container pool.

9.2 Recommended contamination limit

9.2.1 Although not a regulation, the WNTI recommends that Consignors adopt the 0.4Bq/cm^2 value as the applicable standard for all relevant work areas and mobile equipment used when loading drums into ISO shipping containers (effectively reducing the admissible value for a package surface by a factor of 10). This will help to ensure that the ISO shipping containers are free of any possible contamination before leaving the Consignor's premises and facilitate the free release of the empty ISO shipping containers by the Consignee or Converter.

9.2.2 There are two forms of radioactive contamination fixed and non-fixed (or transferable):

Fixed radioactive contamination can come from dust or fine powder residues associated with commonly transported materials such as fertilisers, mineral sands or ceramic tiles that over time may have become embedded, impregnated and ground into relatively porous materials such as the timber flooring found in ISO shipping containers.

The IAEA Regulations indicate that any non-fixed contamination on the external surface of any package shall be kept as low as practicable and under routine conditions of transport shall not exceed 4 Bq/cm^2 for beta and gamma emitters and low-toxicity alpha emitters", such as natural uranium (averaged over any 300 cm^2.)

Minimising the transfer of or retention and collection of contaminants on the packages or ISO shipping containers can greatly assist in reducing the likelihood of radioactive contamination.

Fixed contamination presents a radiation hazard, with the potential for a skin dose from penetrating radiation. However, unlike the non-fixed form, the contaminant (radiation) is embedded and therefore cannot be ingested or inhaled, nor can it be dispersed and spread around.

Non-fixed radioactive contamination is material that can be easily removed from the surface of a package or the internal or external surfaces of an ISO shipping container. It generally occurs in powder, dust or liquid form, which may become airborne, settle or flow anywhere, be carried away by people or equipment and transferred to people, equipment, facilities and conveyances thus creating the potential for further contamination. Due to its greater mobility, non-fixed radioactive contamination generally creates a greater hazard than fixed radioactive contamination and therefore should be removed prior to shipment.

9.3 Measuring contamination

9.3.1 Uranium is an alpha emitter, but the immediate long- lived decay chain of U-238 contains two alpha emitters (U-238 and U-234) and two beta emitters (Th-234 and Pa-234m). Secular equilibrium of these radionuclides is generally reached within 60 to 90 days after extraction.

If the UOC is to be shipped shortly after processing, then only the alpha measurements will provide meaningful results.

Beta measurements should not be measured at the Consignor site. For shipment of aged material close to secular equilibrium, on arrival at the Consignee, Converter site, both alpha and beta measurements are acceptable and beta measurements usually provide greater accuracy and is the preferred method.

9.3.2 For regular shipments, the measurement methods should be agreed between the Consignor and Consignee or Converter, occasionally comparing readings on the same items.

9.3.3 Alpha and beta contamination are measured separately and are not “additive”.

9.3.4 Non-fixed surface contamination can be detected and measured using direct surface activity measurements with a surface contamination meter or by taking wipe tests.

9.3.5 Direct surface activity measurements usually measure the level of fixed plus non-fixed radioactive contamination, whereas wipe tests only measure the level of non-fixed radioactive contamination.

9.3.6 A wipe test involves wiping off some of the non- fixed radioactive contamination from a surface onto a filter (made either from paper for smooth surfaces or from fabric for rough surfaces), whose collected activity is measured using an activity counter or rate meter. This process usually involves making an assumption of the fraction of total contamination collected by the swipe. A typical value is 10% and it is important that this assumption is recorded and documented.

9.3.7 Direct surface activity is measured using a surface contamination meter. In order to measure the desired source of activity, these devices should be fitted with either an alpha or beta probe. Care must be taken as a number of beta probes are also sensitive to gamma radiation and hence will give a false positive due to direct gamma emissions from the UOC.

9.3.8 All measuring instruments should be calibrated regularly as per manufacturer’s instructions or regulatory requirements, and the calibration records should be kept.

9.3.9 Regular checks of instruments in accordance with the manufacturer’s instructions must be performed before using the equipment.

9.3.10 Measurements require the subtraction of background radiation in the measurement area. Failure to take into account subtraction of the background measurement will result in erroneous results. All readings, including the level of background radiation, should be recorded. Background for alpha contamination is usually close to zero.

9.3.11 The detection limit of the measuring instrument should be significantly below the required measuring threshold. In other words, when checking for a contamination standard of 0.4 Bq/cm^2, an instrument having a detection limit below 0.2 Bq/ cm^2 should be used.

9.4 Monitoring of drums

9.4.1 Prior to filling, drums should undergo a visual check for suitability, focusing on any evidence of moisture or rust on the internal surfaces of the drum, any rust, corrosion, punctures and/or visible damage to the external surfaces of the drum, or defects in the seam of the drum barrel or the jointing of the barrel to the drum base and top collar which could result in a failure of the package leading to a leakage of UOC powder.

9.4.2 After filling and closing, the drums should be cleaned, (e.g.) vacuumed and/or washed with water, dried, marked and labelled in accordance with requirements.

9.4.3 After completing the cleaning process, the external surfaces of the drums should be tested for non-fixed radioactive contamination using adequate equipment in accordance with the Consignor’s operating procedure. If the drums have been stored outside in the open, additional care is required when testing the underside of the drums to ensure that no contaminants have been caught up in or around the base of the drum.

9.4.3 Drums should be measured to check surface contamination levels. Whist Consignors can elect to adopt the regulatory transport limit of 4 Bq/cm^2 the WNTI would strongly recommend that Consignors adopt the Free Release contamination level of 0.4 Bq/cm^2 as this will greatly assist in helping to reduce issues with obtaining Free Release certification following unloading of the cargo at the Converter. Drums should be assessed in accordance with the criterion adopted by the Consignor and those not meeting the requirements will require remedial cleaning and re-testing prior to acceptance.

Drums below the regulatory limit of 4 Bq/cm^2 could have an impact on the inner ISO shipping container contamination. If it is the case, the ISO shipping container requires cleaning prior to release in the public area.

9.4.4 Best practice would ideally result in drums being transferred immediately from the drum filling plant directly into ISO shipping containers. Where this is not possible, the drums filled with UOC and awaiting packing into ISO shipping containers should be stored undercover in a clean area so as to minimise contaminants such as moisture or windborne dust as well as the potential for any non-fixed radioactive contamination. The failure to store loaded drums in a clean area may result in the need for the Consignor to consider rewashing and retesting of the drums and associated preparatory work before packing the drums into ISO shipping containers, or to risk the possibility of having the ISO shipping container fail to meet the 'Free Release' testing requirements at the Consignee/Converter facility.

9.5 Monitoring of empty ISO shipping containers

ISO shipping containers may be contaminated by other radioactive cargoes such as bulk or bagged fertilisers or ceramic tiles that can leave residual traces of fixed or non-fixed radioactive contamination. The Consignors/Producers may want to consider testing and monitoring the ISO shipping container for contamination before loading drums into ISO shipping containers.

A reliable long-term source of clean (free of dirt and contamination) structurally sound ISO shipping containers should be secured. Nevertheless, an assessment of the quality of the ISO shipping containers supplied should be performed before they are transported to the production site.

Once on the production site, good practice requires that the ISO shipping containers be checked for radioactive contamination prior to moving them to clean areas within the production site and to loading them with packaged drums of UOC.

The practice of painting over any confirmed contamination on the flooring or any other surfaces of the ISO shipping container to fix the contamination is strictly forbidden and shall not be done. This results in the shipment of a contaminated ISO shipping container which must be decontaminated, often by removing the floor, at the Converter's site with costs being charged to the Consignor.

Appendix 4 sets out a suggested Pre-Use Inspection Checklist for ISO Shipping Containers. The following guidelines provide details regarding industry leading practice for radiological monitoring.

9.6 ISO shipping container pre-loading inspection

9.6.1 Prior to checking for radioactive contamination, the inside and outside of the ISO shipping container should be cleaned of debris. The use of water or liquids should be avoided as these may shield alpha contaminants; drying is essential before measurements.

9.6.2 After cleaning, the fixed plus non-fixed radioactive contamination levels inside the empty container should be measured. All parts of the internal surfaces including walls, floor and ceiling inside the ISO shipping container and doors may be tested by taking measurements. Wipe tests should preferably be taken in the middle of the container walls (laterally and vertically). ISO shipping containers that are not dedicated for the transport of radioactive material should be at the Free Release contamination level of 0.4 Bq/cm2. The ISO shipping containers should be assessed in accordance with the criterion adopted by the Consignor and those not meeting the requirements will require remedial cleaning and re-testing prior to acceptance.

9.6.3 Immediately upon completion of this pre-loading inspection, ensure that the doors of the ISO shipping container are closed to prevent any possibility of the entry of any extraneous contaminants.

9.7 ISO Shipping container loading area

9.7.1 The ISO shipping container loading area should be cleaned thoroughly to remove any extraneous materials that could be carried into the ISO shipping container by personnel or equipment. It is preferable to have a dedicated ISO shipping container loading area covered with some form of clean washable floor covering.

9.8 Loading of drums into ISO shipping containers

9.8.1 Care should be taken to minimise the transfer of any form of contaminant from the package storage area into the empty ISO shipping container.

9.8.2 Using last trip ISO shipping container is strictly forbidden or should have prior agreement with the consignee.

9.8.3 Movement by personnel or equipment within the ISO shipping container packing area should be limited to essential traffic associated with the ISO shipping container loading process. All other traffic should be redirected to other areas.

9.8.4 Workers involved in the loading of packages into ISO shipping containers should wear appropriate clean protective clothing (e.g. gloves, full body overalls and other designated personal protective equipment that may form part of the organizations standard work safety requirements).

9.8.5 Leading practice strongly suggest that packages of UOC should not be loaded into ISO shipping containers during extremely windy or dusty conditions.

9.8.6 The tyres and wheels of any forklift or other equipment being used should be clean and free of contaminants and contamination.

9.8.7 Forklift equipment should be fitted with approved drum handling attachments. Under no circumstances should the forklift tines be used for lifting, moving or the placement of drums into ISO shipping containers.

9.8.8 All material used for packing and securing of the packages in the ISO shipping container including strapping, timber bracing, wedges, chipboard, plywood, etc. must be stored in a clean area prior to being used and must be checked for contamination before use.

9.8.9 At the point of leaving the production site, radiation readings should be measured on all external surfaces of the ISO shipping container to ensure conformance with radioactive contamination standards. The level of radioactive contamination averaged over 300 cm^2 of any surface of the ISO shipping container should not exceed the regulatory transport limit of 4 Bq/cm^2, however, the WNTI would strongly recommend that Consignors adopt the Free Release contamination level of 0.4 Bq/cm^2

9.8.10 As an alternative to measuring the maximum dose rate at 1 meter, the standard value of 0.02 mSv/h for chemical concentrates of uranium, other than uranium hexafluoride as specified in the IAEA, SSR-6 (Rev.1) Regulations, can be used as the maximum radiation dose rate at 1 meter from the container. This value can be used to calculate the Transport Index of the container by multiplying by 100 and the appropriate multiplication factor for the ISO shipping container.

9.9 Determining the activity for transport

9.9.1 The specific activity is the amount of radioactivity (or the decay rate) expressed as Becquerel per unit mass of uranium (Bq/gm). The specific activity is used to convert the amount of uranium in kg into an activity in Bq. It should be noted that the specific activity grows over the course of 60 to 90 days. This is due to the growth of decay products and must be considered when determining the activity for the shipment to be declared on the shipping document. The regulations require that the maximum activity of the radioactive contents during transport be declared on the shipping documents and transport labels.

9.10 Monitoring of the ISO shipping containers during transport

ISO shipping containers should be inspected for damage at each point of transfer throughout the entire supply chain between the production site and the Consignee or Converter premises and when damage is detected photographs should be taken to record the damage. Any damage to ISO shipping containers must be reported to the Consignor.

Temporary repairs can generally be undertaken to address minor damage, abrasions, small holes, etc. However, if spillage is suspected then radiation measurements must be performed prior to any further action. The Consignor should report details relating to the incident to the appropriate Competent Authority as per applicable regulatory and safeguards requirements and arrange recovery.

10

Unpacking of ISO Shipping Containers at Consignee or Converter Premises

10.1 Preparation of the ISO shipping container unloading area

10.1.1. The ISO shipping container offloading area should be easy to decontaminate, providing reasonable protection against weather conditions so that contamination cannot be freely dispersed. Leading practice suggests the use of an indoor unloading area.

10.1.2. The ISO shipping container unloading area should be prepared in a similar manner to the ISO shipping container loading area described in Section 5. As spillage might have occurred during transport, surfaces should be easy to decontaminate; recovery equipment should be present such as protective equipment, plastic sheets, empty drums, vacuum cleaners, etc.

10.1.3. All movement by personnel and equipment within the ISO shipping container offloading area should be limited to essential traffic associated with the package unloading process. All other traffic should be redirected elsewhere.

10.2 Unloading of ISO shipping containers

10.2.1. After opening the ISO shipping container doors, check for any signs of visible contamination such as spillage of UOC powder from drums. Further checks should be carried out as the ISO shipping container is unloaded.

10.2.2. If evidence of spillage is found it should be documented and handled as per site policy. Photographs should be taken of any spillage of UOC. An investigation should be undertaken to identify the source and cause of the spilt material and the Consignor should be informed as well as any relevant regulatory authority.

10.2.2 Workers involved in the unloading of packages from ISO shipping containers should wear appropriate clean protective clothing (e.g. gloves, full body overalls and other designated personal protective equipment that may form part of the organisations work safety requirements).

10.2.3 Care must also be taken during the unloading of packages to ensure that any form of contamination or radioactive material from within the receiving facility is not transferred into the ISO shipping container.

10.2.4 The tyres and wheels of any forklift equipment being used should be clean and free of contaminants and contamination.

10.2.5 Forklift equipment must be fitted with approved drum handling attachments. Under no circumstances should the forklift tines be used for lifting, moving or the placing of drums from ISO shipping containers.

10.2.6 After unloading all drums, check the ISO shipping container floor for evidence of spilt material. If spilt material is detected, it should be collected and handled as per site policy. An investigation as per 10.2.2. should then be undertaken

10.2.7 ISO shipping containers should then be monitored for any radiological contamination in accordance with the guidelines in Section 9, Radiological Monitoring and Control of Packaging and ISO Shipping Containers, so that they can be certified as being suitable for free release.

10.3 Unloading and turnaround of ISO shipping containers at the Consignee/Converter facility.

10.3.1 Whilst the specific processes at each facility may well differ slightly, the fundamental aim will be the checking and receipting of the drums and the placement into dedicated drum storage areas. Once all of the drums have been unloaded from the ISO shipping container, testing and measuring for contamination levels will follow.

10.3.2 It is in the interest of both Consignors/ Producers and Consignees/Converters to endeavour to turn the empty containers around in the shortest space of time. For the Consignor/Producer it can help reduce their overall equipment leasing costs as well as the cost of transporting the now empty Free Released ISO shipping container back to a Container Yard (CY). For the Consignee/Converter it helps to reduce saturating their container storage area providing them with dedicated space for the receipting of additional inbound deliveries of loaded ISO shipping containers.

10.3.3 At this point it is important to note that each Consignee/Converter has an obligation to ensure that the empty ISO shipping containers are below the regulatory limits. Any requirement for re- cleaning and re-testing will result in the Consignee/Converter releasing the ISO shipping container much later with the Consignor/Producer then facing additional equipment leasing and transport charges. The topic of Contamination is addressed in some detail in Section 9 Radiological monitoring and control of Packaging and Containers.

10.3.4 Specific details around how each Consignee/ Converter manages timing for the release of unloaded ISO shipping containers should be a matter decided upon within individual Weighing, Sampling and Analysis (WSA) agreements between each Consignor/Producer and Consignee/Converter. However, as a suggestion a proposed maximum industry timing of 28 days is recommended for ISO shipping container release (if no contamination is found). Where contamination is detected, there should be no maximum number of days for the Consignee/Converter to release them. The suggested maximum timing for the Consignors/ Producers transport agent to collect empty and available ISO shipping containers is 15 days.

11

Free Release of ISO Shipping Containers

Typically, ISO shipping containers are returned to a container yard location agreed between the Consignor and the container owner, empty and certified as being free from contamination by the Consignee or by the Converter, "Free Released". Empty ISO shipping containers should also have all transport labels and markings removed prior to being returned to a Container Yard (CY).

Alternatively, ISO shipping containers may be returned back to the Consignor and not be free released. This requires that the ISO shipping containers remain in dedicated use for the carriage of UOC and that they are transported as required under the applicable regulations for the transport of radioactive materials.

For free release as uncontaminated, the ISO shipping container shall be checked and certified by the Consignee or by the Converter as having levels of contamination less than 0.4 Bq/cm^2.

11.1 ISO shipping container free release procedure

The following survey shall be conducted, and the results recorded. Radiological monitoring should be carried out in accordance with Section 9, Radiological Monitoring and Control of Packaging and ISO Shipping Containers:

11.1.1. A thorough inspection of the ISO shipping container should be conducted including a check for visible contamination. In addition, direct fixed-point measurements of total radioactivity should also be carried out at other representative surfaces. These measurements are required to determine compliance with the modal regulations, for exempted values (free release as uncontaminated). Non- compliance will result in the need for further decontamination activities including a repeat inspection survey.

11.1.2. The direct fixed-point measurements of total radioactivity should be conducted in at least six (6) prescribed locations with the maximum observed total radioactivity value being recorded and documented in Bq/cm^2 (as averaged over 300 cm^2).

The prescribed minimum locations are the floor at the front, floor at the center, floor at the back, inside wall of the container facing right, inside wall of the container left and an external wall of the container near the doors.

11.1.3. Wipe tests for non-fixed contamination should also be undertaken at the six (6) prescribed locations and analysed by either alpha or beta counting.

11.1.4. Any value showing fixed plus non-fixed contamination greater than 0.4 Bq/cm^2 would require that the ISO shipping container undergoing appropriate decontamination activities and a repeat inspection survey.

11.1.5. Using the radiation surveyor's documentation, the responsible person shall indicate and confirm on the release certification documentation compliance with the IMDG Code requirements. A sample release certificate form is attached in Appendix 6. The Consignee will then issue a final "Release Certificate."

Image 11a - Six Minimum Prescribed Locations in an ISO shipping Container

12

Response to Incidents Whilst Transporting UOC

Consignors should have in place clear procedures to manage any incident during transport of ISO shipping containers. Such procedures should take into account the different modes of transport and relevant host country requirements. Carriers and transport agents play an important role in managing any unplanned incidents; therefore, a close collaboration must be maintained with them and plans must be exercised and vetted in advance.

When selecting transport providers, Consignors should pay close attention to the incident response capabilities of those prospective carriers and transport agents and during the tenure of their relationship undertake regular reviews and updates.

12.1 Incident response action plans

An important precursor to managing incident response is the Incident Response Action Plan (IRAP), which is a standard requirement for ensuring the safe and secure transport of dangerous goods or hazardous materials.

The transportation of UOC is generally undertaken by a number of parties often delivering services on behalf of the Consignor of the cargo. Each party should therefore develop and maintain their own individual IRAP aligned to fulfil their assigned responsibilities along with the capability to address the initial response to any unplanned incident.

An effective IRAP should contain all information needed to support the initial response to an incident, ideally sitting alongside and supporting an organisation's overarching transport plan for managing the movement of their dangerous goods.

As such the IRAP should include references to the organisation's internal operating procedures including incident escalation and managing such escalation as required.

The IRAP is an effective tool designed to help those either involved in or associated with the monitoring, management or physical transportation of dangerous goods or hazardous material. The IRAP identifies specific processes, which are focused around reinstating control following an emergency event.

An effective IRAP for the transport of UOC should focus on developing procedures and processes required to minimize harm to the health and safety of people or the environment in an emergency situation. Procedures include assessment, corrective actions, response to community concern and the implementation of appropriate incident response and measures to regain control of the process.

Consignors can play an important role by educating parties involved in any handling and transportation processes about the characteristics, risks, and sensitivities associated with and transporting their UOC.

12.2 Key components of an IRAP

Purpose	To provide a framework for maintaining control, managing and escalating incidents in order to regain control at the operational level, to identify the structural supporting links for managing major incidents at the corporate level.
Scope	The IRAP should follow an international approach taking into account applicable local and / or regional requirements. The IRAP applies to parties and agencies that, through their work or involvement, may be required to respond to an incident.
Alignment	The IRAP identifies, integrates and references international, national requirements, regulations and safety guides.
Risk assessment	The IRAP identifies and references any risk assessments that have been undertaken to support the IRAP.
Incident response	Classification and assessment of incidents response to each classification Incident reporting, escalation and management processes Specific instructions and technical support for emergency service responders

Many examples of IRAP's prepared by regulators, consignors, shipping ports and transporters can be found by searching the internet.

The Australian Department of Energy Resources and Tourism have published an extensively detailed booklet entitled the Guide to Safe Transport of Uranium Oxide Concentrate. The guide is a consolidation of widely adopted and applied well practiced procedures focused on the safe transport of UOC.

The booklet includes information relating to responding to and dealing with unexpected incidents and events that might occur during transporting of UOC and contains detailed guidance information around the development of IRAPs. It can be accessed through the following website:

www.industry.gov.au/publications/guide-safe-transport-uranium-oxide-concentrate

Appendix 1

Terms Used Throughout this Document

The following terms are used throughout this document and throughout this document the word "should" indicates a recommendation and the word "may" indicates a permission.

ACEP – Approved Container Examination Program (under the CSC) is a container inspection scheme utilized by most major ocean carriers and container lessors to ensure ongoing safety compliance of ISO shipping containers.

Activity – Measure of radioactive disintegrations per unit time, the SI unit of activity is the Becquerel.

Anchor Points – Securing devices located along the top and bottom frame rails of the ISO shipping container with a restraint capacity of 1,000 kg in any direction.

Becquerel (Bq) – The SI unit for activity. One becquerel is equal to one disintegration per second (dps).

Bulk Density – Weight per unit volume for the uranium concentrate powder.

Carrier - An individual or legal entity that is the business of transporting goods for hire. Shipping lines, airlines, trucking companies and railroad companies are all carriers. The carrier may also be an actual carrier (called an under carrier) or a "non-equipment-operating" carrier such a non-vessel operating common carrier or airfreight consolidator. (See also Shipping Line Carrier and Overseas on-Carrier).

Carrier Owned Container – A new or used ISO shipping container owned or leased by a Shipping Line Carrier to transport goods by providing both the container and the transportation service.

Chine – Circumferential ridge(s) around the barrel of a drum.

Competent Authority (CA) - Any person or organization that has the legally delegated or invested authority, capacity, or power to perform a designated function such as manage international shipping regulations, monitor or oversee safeguards requirements.

Consignee – Any government, organization or person that is entitled to take delivery of a consignment. That is, the receiver of an ISO shipping container of uranium ore concentrate cargo.

Consignor – Any government, organization or person that prepares a consignment for transport. That is, the dispatcher of a ISO shipping container of uranium ore concentrate cargo.

Consignment - A batch of goods in the form of a delivery, shipment, load, ISO shipping container load, shipload, boatload, truckload, cargo destined for or delivered to a Consignee.

Container Lease Agreement – An agreement between an ISO Shipping Container Owner (Lessor) and a Consignor (Lessee) that describes the terms associated with a temporary lease of the container.

Container Yard (CY) - Carrier-designated locations at for receiving, storing and delivering loaded containers, as well as for empty container pickup.

Contamination - shall mean the presence of a radioactive substance on a surface in quantities in excess of 0.4 Bq/cm2 for beta and gamma emitters

Contamination (fixed) – This is contamination other than non-fixed contamination.

Contamination (non-fixed) – This is contamination that can be removed from a surface during routine conditions of transport.

Container Maximum Gross Weight – The weight as shown on the CSC plate.

Converter – Facility that processes natural uranium concentrates, typically into natural uranium hexafluoride (UF6).

CSC –Convention for Safe Containers,. An IMO convention held in 1972, which resulted in setting standard safety requirements for ISO shipping containers moving in international transport. Also called CSC.

CSC Plate – A safety approval plate fixed to the external surface of an ISO shipping container (usually the door) bearing construction, loading, and maintenance information.

Dedicated Use – A container in this use is utilised solely for radioactive materials transport and it is not released back into the general container pool.

Direct Fixed-Point Measurement – Measurement of specified points within the ISO shipping container. Direct measurement will measure both fixed and non-fixed contamination.

Double Tier Loading – Where a second layer of drums is loaded on top of the first layer within the ISO shipping container.

Drum – A good quality steel drum as per section 3.

Dunnage – Materials of various types, usually timber, placed into the ISO shipping container to brace the drums to prevent damage due to movement of the drums during transport. Wood dunnage shall be phytosanitary compliant in most jurisdictions.

Filling – The process of filling the drums with uranium concentrate.

Free Release – The release of an uncontaminated ISO shipping container that can be sent back for use with general cargo and that does not require transport under the radioactive materials regulations. By definition the ISO shipping container is free released when the contamination is below 0.4 Bq/cm2 for beta and gamma emitters.

Galvanized – Zinc coated.

Gross Cargo Weight – The total weight of the cargo (the total weight of the UOC product and weight of the drums) based around US DOT requirements.

Gross Container Weight – The Gross Cargo Weight plus the weight of the empty ISO shipping container, also refer to VGM SOLAS requirements.

IAEA – The International Atomic Energy Agency.

IMDG Code – The International Maritime Dangerous Goods Code.

IMO – The International Maritime Organization.

ISO – The International Organization for Standardization.

ISO Container – A freight container constructed to the specifications of ISO 1496-1.

Lashing Points – Securing devices located in any part of the container other than the base structure (other than anchor points) with restraint capacity of 500 kg in any direction.

Last trip container - Describes an ISO shipping container that following unloading of its contents at an overseas conversion facility has been found to be totally unserviceable and unfit to be returned into the general ISO shipping container pool.

Lease Company Container – A new or used ISO shipping container leased by a Consignor from a Container Leasing Company under some form of Container Lease Agreement.

Open Head Steel Drum – A steel drum having a fully removable cover or lid with the base (bottom) being seamed to the drum barrel. Open-head drums make it easier to handle and work with solids (powders) and thicker liquids (sludges, syrups, glues, oils, etc.)

Overseas on-Carrier - in this context the Carrier engaged by the Consignor/Producer to transport the cargo by road, rail and or inland waterway from the final overseas discharge port to the Consignee/ Converter facility.

Package – is the complete product of the packing operation, consisting of the packaging and its contents prepared for transport.

Packaging – one or more receptacles and any other components or materials necessary for the receptacles to perform the containment and other safety functions. That is, the receptacles in which material is contained.

Phytosanitary Compliant – Meets the relevant national regulations covering the import of lumber dunnage.

Producer – Facility (or facilities), which processes natural uranium ore to uranium concentrates. Typically, this is a mill associated with a mining operation.

Responsible Person – Suitably authorized and qualified person, often a Radiation Protection Officer or equivalent.

Secular Equilibrium – Occurs when the quantity of a radioactive isotope remains constant achieving a stable level of radioactivity since its growth rate due to the decay of a parent isotope equals its decay rate. Following chemical purification, uranium concentrates achieve secular equilibrium within some 60 to 90 days after extraction.

Single Tier Loading – Where only a single layer of drums is loaded within the ISO shipping container.

SI Unit – An internationally accepted coherent system of physical units, derived from the MKSA (meter-kilogram- second-ampere) system, using the meter, kilogram, second, ampere, kelvin, mole, and candela as the basic units (SI units) respectively of the fundamental quantities of length, mass, time, electric current temperature, amount of substance, and luminous intensity.

ISO Shipping Container Owner – A Shipping Line Carrier, a Container Leasing Company or a Consignor.

Shipping Line Carrier – In this context is the Carrier engaged by the Consignor/Producer to transport the cargo by sea from the point of export to the final overseas discharge port.

Shipper Owned Container– In this context a 20' ISO shipping container that is owned by the Consignor/ Producer for the transport of their cargo under "Dedicated Use".

Structural Member – Support that is a constituent part of an ISO shipping container.

Uranium Ore Concentrates (UOC) – Chemical compounds of natural uranium originating from natural ores. Usually produced in a dry powder form the term includes yellowcake and uranium oxide.

Wafering – Use of boards or equivalent materials within an ISO shipping container to spread any point loads and to address and assist in overcoming the possibility for any movement of the cargo during transit.

Weigh, Sample and Analysis agreement (WSA) - A signed contractual agreement between Consignee/ Producer and Consignee/Converter for the storage and acceptance of Uranium Ore Concentrate (UOC).

Woven polyester (Poly Cord) strapping - Polyester filaments woven together in a straight line and encased in a polymer. Woven polyester strapping can be applied using a ratcheting tensioner and a high joint efficient buckle.

Verified Gross Mass (VGM) – Effective gross mass verified by weighing the packed container, or by weighing all the contents of the container (all packages and cargo items, including the mass of the pallets, dunnage and other packing and securing material to be packed in the container) added to the tare mass of the container.

Appendix 2

Example of an IP - 1 Drum Certification

2.1 Example of an IP-1 drum certification

Container Manufacturer Details	Manufacturer XYZ Address
Drawing Number	XYZ-01
Approved Modes of Transport	Road, Ocean, Rail
Approved Contents	Natural uranium
Physical and chemical state	Solid uranium ore concentrate
Activity	Unlimited
Radiation	Mostly alpha with low energy gamma
Other dangerous properties	No other dangerous properties
Description	An open head steel cylindrical container with two or more hoops and a bolted ring closure. The bottom end of which is permanently fixed to the body and the lid can be removed and closed by means of a closing ring.
Dimension	55 US Gallon Drum

The drum shown in drawing number XYZ-01 has been shown to meet the IMDG (SSR-6) criteria for IP-1 packages as summarized below.

6.4.2.1 (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. - The drum can be easily and safely transported and can be properly secured in the conveyance.
6.4.2.2 (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 shall occur, the ability of the package to meet other provisions of this Code would not be impaired. The design shall take account of appropriate safety factors to cover snatch lifting. - The drum has no lifting attachments and drum handling equipment is used to lift the drum.
6.4.2.3 (609)	Attachments and any other features on the outer surface of the package which could be used to lift it shall be designed either to support its mass in accordance with the provisions of 6.4.2.2 or shall be removable or otherwise rendered incapable of being used during transport. - The drum has no lifting attachments.
6.4.2.4 (610)	As far as practicable, the packaging shall be so designed that the external surfaces are free from protruding features and can be easily decontaminated. - The drum has no protruding features and external surfaces are painted which can be easily decontaminated.
6.4.2.5 (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. - Any water collected on the lid of the package can be easily removed.
6.4.2.6 (612)	Any features added to the package at the time of transport which are not part of the package shall not reduce its safety. No features are added to the drum at time of transport.

6.4.2.7 (613)	The package shall be capable of withstanding the effects of any acceleration, vibration or vibration resonance which 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. - Bolt and jam nut closure of drum has been shown to withstand the effects of any acceleration, vibration or vibration resonance which may arise under routine conditions of transport without any deterioration of the closing device.
6.4.2.8 (613A)	The design of the package shall take into account ageing mechanisms. - The drum is a one-time use and the design of a steel drum takes into account ageing mechanisms primarily through materials selection (corrosion resistance, strength and toughness), structural design (load bearing capacity, fatigue resistance), and preventive maintenance (surface protection, handling and storage) considerations.
6.4.2.9 (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. - The drum and contents are physically and chemically compatible with each other and the drum is not affected by the radiation of the contents.
6.4.2.10 (615)	All valves through which the radioactive contents could escape shall be protected against unauthorized operation. - The drum has no valves.
6.4.2.11 (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. - The drum design has taken into account ambient temperatures and pressures that are likely to be encountered in routine conditions of transport.

6.4.2.12 (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 rate at any point on the external surface of the package would not exceed the values specified in 2.7.2.4.1.2, 4.1.9.1.11 and 4.1.9.1.12, as applicable, with account taken of 7.1.4.5.3.3 and 7.1.4.5.5. - UOC is classified as Low Specific Activity material and no shielding is required to meet the dose rates specific above.
6.4.2.13 (618)	For radioactive material having other dangerous properties, the package design shall take into account those properties; see 4.1.9.1.5, 2.0.3.1 and 2.0.3.2. - UOC has no other dangerous properties.
6.4.2.14	Manufacturers and subsequent distributors of packagings shall provide information regarding procedures to be followed and a description of the types and dimensions of closures (including required gaskets) and any other components needed to ensure that packages as presented for transport are capable of passing the applicable performance tests of this chapter. - Drum manufacturer has provided closure instructions.
6.4.7.2 (636)	The smallest overall external dimension of the package shall not be less than 10cm. - All drum dimensions shown on drawing XYZ-01 are greater than 10cm.

Appendix 3

ISO Shipping Container Details

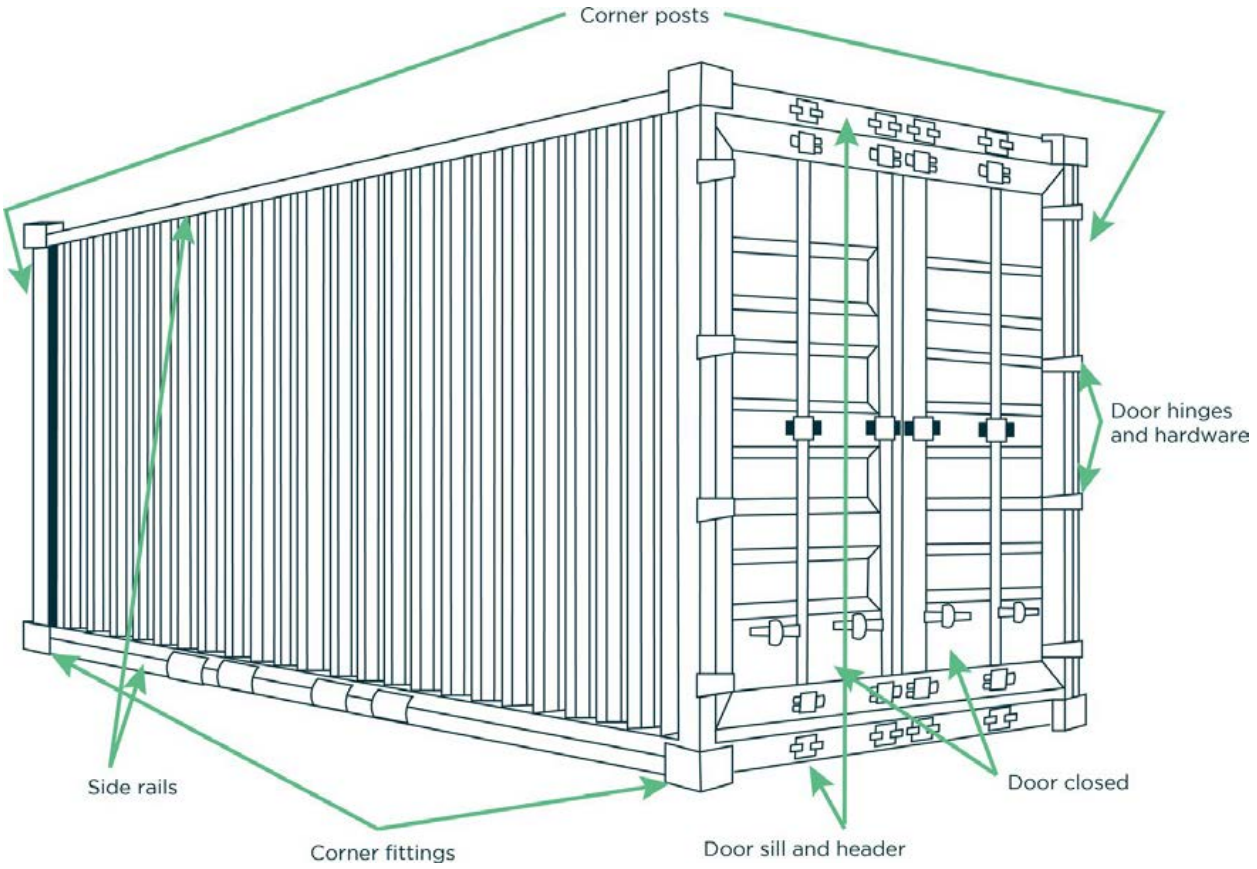


Figure 3.a. - Closed 20' ISO container

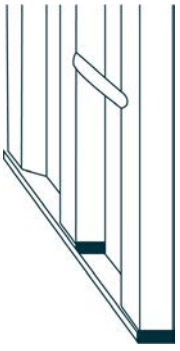


Figure 3.b. - Lashing point

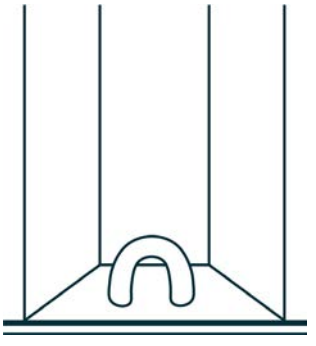


Figure 3.c. - Anchor point

Appendix 4

A Suggested Pre-use Inspection Checklist for ISO Shipping Containers

4.1 External surface inspection

During examination of the CSC plate, check that it is securely attached, check and record the Approved Continuous Examination Program (ACEP) and CSC approval details, container type, date of manufacture, maximum gross, stacking weight of 1.8 g and container tare weight.

Check that the ACEP identification label or the validity of the CSC container safety approval plate and re inspection date has not expired, check the last dates of examination (valid for 5 years for ISO shipping containers less than 5 years old, or valid for 30 months for ISO shipping containers) more than 5 years old.

Remove any previously applied placards, markings and associated warning or advisory labels. Undertake visual checks of all external surfaces which should be free from dents and rust and be in good overall condition, check for holes and cracks. Minor cracks in joints may be filled with silicone if required.

Ensure that any bowing or warping of the roof or wall surfaces fall within the stated Institute of International Container Lessors (IICL) limits.

Check the undercarriage to ensure there is no damage to the under-floor timber, the ISO shipping container floor rails, or the box tine channels, etc. Care must be taken to ensure worker safety when performing these checks. Never stand underneath an ISO shipping container when performing these checks.

Check that all exterior surfaces have minimal surface and no major structural rust. The ISO shipping container should be in good condition and have a visually pleasing appearance. Even though the ISO shipping container is acceptable for use the general appearance of the ISO shipping container has a significant impact on public perception.

Check to ensure both doors are capable of being securely locked and sealed in the closed position, properly secured in the open position, and that gaskets and seals are in good serviceable condition.

Check the top and bottom mounted corner fitting locking structures for serious damage to ensure that the twist locks are not seized, twisted, broken, missing or otherwise inoperative.

4.2 External structural inspection

Check that the main framework (corner posts, corner fittings, bottom and top side rails, bottom and top end rails, door sill and header have no major defects such as dents, bends cracks or breaks in structural members (including under floor cross members).

Check that there is no more than one splice or an improper splice (e.g. a lapped splice) in top or bottom end rails or door headers or more than two splices in any one top or bottom side rail or any splice in a door sill or corner post.

Check for any distortion of the overall configuration sufficient to undermine proper alignment of handling equipment, mounting and securing on a vehicle chassis, container handling equipment, or container racking slots on ocean going vessels.

4.3 Internal inspection

Check that the ISO shipping container has been cleaned free of any previous cargo residue and that there is no dirt or debris left on the floor, and no persistent odours from previous cargoes.

Undertake a survey of the ISO shipping container prior to packing to ensure that no form of contamination is present.

Check that all interior wall and roof surfaces are free of rust. Ensure that any bowing or warping of roof or wall surfaces fall within the stated IICL limits, with no dents greater than 19 mm in depth, regardless of length. The floor shall be in good condition to facilitate its decontamination at Consignee, Converter premises, with no cracks, breaks, holes, protruding nails or screws. If being used for securing and stowage of the cargo, examine that all anchor and lashing points are fit for purpose, not twisted, broken, missing or inoperative.

Undertake a water proof test* to ensure the integrity of the overall sealing capability of the ISO shipping container to effectively prevent the entry or discharge of material or moisture.

Radiological monitoring in accordance with Section 6 may be undertaken prior to loading the drums into the ISO shipping container.

Photographic (digital) records may be kept of the internal and external condition of the ISO shipping container for future reference.

4.4 *Water proof test

This involves entering into the ISO shipping container, having someone close the container doors. Should any indication of daylight be seen through the door seals or from elsewhere within the ISO shipping container it must be assumed that water could gain entry and therefore the ISO shipping container should be deemed unfit for purpose. Due to the extremes of temperature experienced at many if not most mine sites, consideration should be given as to the total time spent inside the closed ISO shipping container. Additionally, caution should be taken as there is always the possibility that residual potent gases from the fumigation of previous cargoes could also be present.

Appendix 5

Pre-shipment Inspection Checklist

5.1 Final check before shipment

After the ISO shipping container has been packed a final check should be undertaken, ideally by persons independent from the packing team.

A visual inspection should be undertaken to ensure stowage arrangements are in compliance with the designated loading procedures and to ensure that there is no extraneous packaging or securing material left inside the ISO shipping container.

Check that the details on the drums match the drum, batch and lot details listed on the container packing log sheet. Close and seal the doors, recording the container and seal numbers.

Check the external container marking, labelling and placarding.

If the ISO shipping container has been inside a facility area or removed from a road chassis or flatbed or a rail wagon where there is a risk of contamination before the full container leaves this area, a designated person is to ensure that container is cleaned on sides, top and bottom with high pressure cleaner or appropriate equipment. Dirt and sand shall be removed from the container bottom seams.

Inspect the empty road or rail conveyance for cleanliness before loading the container. Place placards on road or rail conveyance (if applicable). Radiological monitoring should be carried out according to Section 9.

Photographic (digital) records may be kept of the internal and external condition of the container for future reference.

Appendix 6

An Example of an ISO Shipping Container 'Free Release' Certificate

ISO Shipping Container Certificate of Inspection			
Container Number		Date	

The ISO shipping container (sea, road or rail) identified above has been monitored at the (insert facility company name) and was found to be free of radioactive contamination as defined in the latest applicable Regulations.

CONTAMINATION means the presence of a radioactive substance on a surface in quantities in excess of 0.04 Bq/cm^2, fixed plus non-fixed, for beta and gamma emitters and low-toxicity alpha emitters. Natural uranium is a low-toxicity alpha emitter.

Natural uranium concentrates are comprised primarily of two (2) alpha emitters, 238U and 234U and two (2) beta emitters, 234Pa and 234Th. Once secular equilibrium is established, the total alpha activity will equal the total beta activity therefore radioactivity measurements may be conducted by either alpha measurement or by beta measurements. Contamination is measured as averaged over 300 cm^2 of any part of the surfaces of the shipping container, referencing the applicable edition of the IAEA SSR-6 Regulations for the Safe Transport of Radioactive Material.

Name:		Signature:	
Title:			
Tel:		Mob:	
Email:			

Appendix 7

Examples of ISO Container Packing Lists

The type of information shown in the examples below is the kind of information that forms the basis of the Container/Vehicle Packing Certificate (detailed cargo manifest).

7.1 An example of a detailed cargo manifest, delivery summary at the ISO shipping container (lot) level combined with total activity

Container Summary With Samples

Uranium Corporation Ref#: #########
Booking #: #########
Sailing ex : Country 1
Vessel: Country Express
Export License: C1-EXP-Lic-####

Container	Seal #	Lot	# of Drums	Gross Wt kgs	Net Wt kgs	U3O8 kgs	U kgs	Total Gross Wt (incl. Sample)	Total Net Wt (incl. Sample)	Dunnage kg	Container tare kg	Verified gross mass kg	Total Activity in GBq's per container
XXXU 1111111	UL-1111	10001	35	16,025.2	15,311.2	15,269.9	12,948.332	16,031.9	######	385.3	2,185.0	18,602.2	644
			1	6.7	0.6	0.6	0.508						
XXXU 2222222	UL-2222	10002	35	16,240.4	15,526.4	15,481.4	13,128.291	16,247.1	######	385.3	2,185.0	18,817.4	653
			1	6.7	0.6	0.6	0.507						
XXXU 3333333	UL-3333	10003	35	16,259.9	15,545.9	15,524.1	13,165.220	16,266.6	######	385.3	2,040.0	18,691.9	653
			1	6.7	0.6	0.6	0.508						
XXXU 4444444	UL-34444	10004	35	16,249.9	15,535.9	15,520.4	13,161.173	16,256.4	######	385.3	2,040.0	18,681.7	653
			1	6.5	0.4	0.4	0.339						
		Totals	144	64,802.0	61,921.6	61,798.0	52,404.878	64,802.0	61,921.6	1,541.3	8,450.0	74,793.3	2,603

7.2 An example of a manifest summary of individual drums within each ISO shipping container (lot)

Container Packing List

Uranium Corporation Ref#: ##########
Booking #: ##########
Sailing ex : Country 1 Port
Vessel: Country Express
Container No. XXXU 1111111

Lot	Drum #	Gross Wt kgs	Net Wt kgs	U3O8 kgs	U kgs	TI	Activity GBq	Label
1001	1	457.8629	437.4629	436.2829	369.852	2.0	19	III-Yellow
1001	2	457.8629	437.4629	436.2829	369.852	2.0	19	III-Yellow
1001	3	457.8629	437.4629	436.2829	369.852	2.0	19	III-Yellow
1001	4	457.8629	437.4629	436.2829	369.852	2.0	19	III-Yellow
1001	5	457.8629	437.4629	436.2829	369.852	2.0	19	III-Yellow
1001	6	457.8629	437.4629	436.2829	369.852	2.0	19	III-Yellow
1001	7	457.8629	437.4629	436.2829	369.852	2.0	19	III-Yellow
1001	8	457.8629	437.4629	436.2829	369.852	2.0	19	III-Yellow
1001	9	457.8629	437.4629	436.2829	369.852	2.0	19	III-Yellow
1001	10	457.8629	437.4629	436.2829	369.852	2.0	19	III-Yellow
1001	11	457.8629	437.4629	436.2829	369.852	2.0	19	III-Yellow
1001	12	457.8629	437.4629	436.2829	369.852	2.0	19	III-Yellow
1001	13	457.8629	437.4629	436.2829	369.852	2.0	19	III-Yellow
1001	14	457.8629	437.4629	436.2829	369.852	2.0	19	III-Yellow
1001	15	457.8629	437.4629	436.2829	369.852	2.0	19	III-Yellow
1001	16	457.8629	437.4629	436.2829	369.852	2.0	19	III-Yellow
1001	17	457.8629	437.4629	436.2829	369.852	2.0	19	III-Yellow
1001	18	457.8629	437.4629	436.2829	369.852	2.0	19	III-Yellow
1001	19	457.8629	437.4629	436.2829	369.852	2.0	19	III-Yellow
1001	20	457.8629	437.4629	436.2829	369.852	2.0	19	III-Yellow
1001	21	457.8629	437.4629	436.2829	369.852	2.0	19	III-Yellow
1001	22	457.8629	437.4629	436.2829	369.852	2.0	19	III-Yellow
1001	23	457.8629	437.4629	436.2829	369.852	2.0	19	III-Yellow
1001	24	457.8629	437.4629	436.2829	369.852	2.0	19	III-Yellow

1001	25	457.8629	437.4629	436.2829	369.852	2.0	19	III-Yellow
1001	26	457.8629	437.4629	436.2829	369.852	2.0	19	III-Yellow
1001	27	457.8629	437.4629	436.2829	369.852	2.0	19	III-Yellow
1001	28	457.8629	437.4629	436.2829	369.852	2.0	19	III-Yellow
1001	29	457.8629	437.4629	436.2829	369.852	2.0	19	III-Yellow
1001	30	457.8629	437.4629	436.2829	369.852	2.0	19	III-Yellow
1001	31	457.8629	437.4629	436.2829	369.852	2.0	19	III-Yellow
1001	32	457.8629	437.4629	436.2829	369.852	2.0	19	III-Yellow
1001	33	457.8629	437.4629	436.2829	369.852	2.0	19	III-Yellow
1001	34	457.8629	437.4629	436.2829	369.852	2.0	19	III-Yellow
1001	35	457.8629	437.4629	436.2829	369.852	2.0	19	III-Yellow
1001	36	6.7	0.6	0.6	0.508	2.0	0.025	III-Yellow

Below are some additional examples of alternative options for the Container/Vehicle Packing Certificate (detailed cargo manifest).

Packing lists should include the following information

- Material supplier Customer (account) Mine Origin (Material)
- Type (U3O8, Uranite, UO3, UO4, UO2, (and not only yellow cake))
- Weights should be presented in kg with 3 digits after comma U weight is required, not U3O8 or UO4, etc.
- Depending on the country, the weight has to be specified in kg or in lbs.

Appendix 8

An Example of a Multimodal Dangerous Goods Form

Multimodal dangerous goods form

MULTIMODAL DANGEROUS GOODS FORM

<table>
<tr><td rowspan="3">1. Shipper/Consignor/Sender
Uranium Corporation
123 4th Street
Country 1</td><td colspan="3">2. Transport document number ########</td></tr>
<tr><td>3. Page 1 of # page</td><td colspan="2">4. Shipper's reference ########</td></tr>
<tr><td></td><td colspan="2">5. Freight forwarder's reference #######</td></tr>
<tr><td rowspan="2">6. Consignee
Converter Corporation
567 8th Street
Country 2</td><td colspan="3">7. Carrier (to be completed by the carrier)</td></tr>
<tr><td colspan="3">SHIPPER'S DECLARATION
I hereby declare that the contents of this consignment are fully and accurately described below by the proper shipping name, and are classified, packaged, marked and labelled/placarded and are in all respects in proper condition for transport according to the applicable international and national governmental regulations.</td></tr>
<tr><td colspan="2">8. This shipment is within the limitations prescribed for:
(Delete non-applicable)

Passenger and Cargo Aircraft | Cargo Airplane only</td><td colspan="3" rowspan="3">9. Additional handling information
NO SPECIAL HANDLING REQUIRED
STOWAGE CATEGORY A "separated from" foodstuffs.
The wood packaging in this consignment meets the phytosanitary entry requirements of ISPM15

EMERGENCY RESPONSE:
24-Hour Phone Number: (###) ###-####</td></tr>
<tr><td>10. Vessel/flight No. and date
Vessel / Voyage</td><td>11. Port/place of loading
Country 1</td></tr>
<tr><td>12. Port/place of discharge
Country 2</td><td>13. Destination
Country 2 City</td></tr>
<tr><td>14. Shipping marks</td><td colspan="2">Number and kind of pages; description of goods*</td><td>Gross mass (kg)</td><td>Net mass (kg)</td><td>Cube (m3)</td></tr>
</table>

36 Type IP-1 packages (drums)	######	#####

UN2912 RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY
(LSA-I) CLASS 7
Radionuclide: U (nat)
Physical Form: Solid
Chemical Form: Triuranium Octoxide
Max Activity 20' ISO: 684 GBq
Max Activity Per IP-1 Package: 36 at 19 GBq
Category of 20' ISO: III-Yellow
Category of IP-1 Packages: III-Yellow
Transport Index 20' ISO: 6.0
Transport Index Per IP-1 Package: 2.0

EMS = F-I, S-S
See attached packing list for information on each drum.

15. Container identification No./ vehicle registration No.	16. Seal number(s)	17. Container/vehicle size/type	18. Tare mass (kg)	19.Total gross mass (Including tare) (kg)
XXXU#######	XXXXXXX	20 ft (6m) ISO Closed Container	####	Verified Gross Mass: ######

CONTAINER/VEHICLE PACKING CERTIFICATE

I hereby declare that the goods described above have been packed/loaded into the container/vehicle identified above in accordance with the applicable provisions. †

MUST BE COMPLETED AND SIGNED FOR ALL CONTAINER/VEHICLE LOADS BY PERSON RESPONSIBLE FOR PACKING/LOADING

21. RECEIVING ORGANIZATION RECEIPT

Received the above number of packages/containers/trailers in apparent good order and condition, unless stated hereon:

RECEIVING ORGANIZATION REMARKS:

20. Name of company	Haulier's name	22. Name of company (OF SHIPPER PREPARING THIS NOTE)
Uranium Corporation	TRUCK TRANSPORTATION SERVICES	Uranium Corporation
Name/status of declarant NAME	Vehicle registration No.	Name/status of declarant NAME
Place and date Country 1 Date	Signature and date	Place and date Country 1 Date
Signature of declarant Signature	DRIVER'S SIGNATURE	Signature of declarant Signature

Documentary aspects of the international transport of dangerous goods

Note 1: Description of Dangerous Goods

This information is provided as a guidance only, persons should refer to Chapter 5.4 of the Code for specific requirements. The basic items of information necessary, in addition to the number and kind of packages, and the total quantity (in the description of each dangerous substance, material or article offered for shipment are:

1. The UN number shown for the goods in the IMDG Code preceded by the letters "UN".

2. The proper shipping name,

3. The primary hazard class

The words "Class" or "Division" may be included preceding the primary or subsidiary hazard class or division numbers.

The five elements of the dangerous goods description shall be shown in the order listed above (i.e. 1, 2, 3, 4, and 5) with no information interspersed, except as provided in the Code. Unless permitted or required by the Code, additional information shall be placed after the dangerous goods description. See 5.4.1.4.2 of the Code.

The dangerous goods description shall be supplemented as required by the Code (see 5.4.1.5 of the Code), this includes (as applicable):

- Except for empty and uncleaned packages, the total quantity of dangerous goods bearing a different Proper Shipping Name, UN Number or packing group. The number and kind (e.g. drum, box, etc.) of packages shall also be indicated.
- For other additional information that may be required see 5.4.1.5 of the Code.
- All packages have been externally inspected for damage and only sound packages have been loaded.
- Drums have been stowed in an upright position, unless otherwise authorized by the Competent Authority.
- All packages have been properly packed and secured in the container/vehicle.
- The packages and the container/vehicle have been properly marked, labelled and placarded. Any irrelevant mark, labels and placards have been removed.
- A dangerous goods transport document, as indicated in 5.4.1 of the Code, has been received for each dangerous goods consignment loaded in the container/vehicle.

Whilst the WNTI will use all reasonable efforts to ensure that the information in this standard is accurate, we cannot guarantee the accuracy of all information and we will accept no liability for any loss or damages incurred, howsoever caused, and cannot be held liable for any use or reliance you may make of or put on it. The WNTI also cannot be held liable for your use or inability to use the site or the information or services that it contains. Errors and Omissions Accepted.

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