

Standard

Packaging and Transport of Uranium Concentrates Version 3

Table of Contents

2	Introduction
3	Packaging4
4	Shipping Containers8
5	Container Loading11
6	Markings, Labels and Placards16
7	Shipping and Transport Documentation18
8	Shipping Notifications20
9	Radiological monitoring and Control of Packaging and Containers22
10	Unpacking of Containers at Consignee or Converter Premises
11	Free Release of Shipping Containers
12	Response to incidents whilst transporting UOC
	Appendix 1 - Terms used throughout this Document
	Appendix 2 - An example of a IP-1 drum specification
	Appendix 3 - ISO Shipping Container details40
	Appendix 4 - A suggested Pre-Use Inspection Checklist for Containers41
	Appendix 5 - Pre-shipment inspection checklist43
	Appendix 6 - An example of a shipping container "Free Release" Certificate44
	Appendix 7 - Examples of Container Packing lists
	Appendix 8 - An example of a Multi modal Dangerous Goods form49
	Appendix 9 - An example of a Bill of Lading for UOC material54
	Appendix 10 - An example of a Radioactive Cargo Booking Request56
	Appendix 11 – An example of a typical chemical specification57

2

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 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 for 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 2012 edition Specific Safety Guide No. SSG-26 Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material at page 292, I.68 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 sea (ISO) containers.

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. Depending on their condition, empty drums are either recycled or disposed of after use.

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, supplier adopts the testing requirements found in the IAEA regulations as applicable to the IP-2 drum. Those requirements involve the stacking of the drums up to a height of 3 m and passing the drop test from 1.2 m).

Image 3 Typical drums

4

Passing this test then allows the State based Competent Authority to approve the drum allowing for the base of each IP-1 drum and its barrel to be embossed or marked with the applicable UN code (e.g.) UN-1A2-Y-420-S.

Producers are encouraged to develop a close relationship with their drum suppliers, to ensure that such requirements as mentioned above are fully met.

It is important to note that the Converters are not involved in approving drums. With regards to the drums, Converters need to be satisfied that the drums conform to the UN standards as described above, 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 and indeed they have an interest in understanding the grade and quality of the UOC.

A typical drum specification can be found in Appendix 2.1 whilst Appendix 2.2 provides an example of a Drum Package Certification

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).





(i.e. will nest when stacked empty, no lower chine)



Image 3.2 b 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 whole complete lid.

3.3.3 In addition to any labelling and marking that may be required for compliance with applicable transport regulations, as best practice, drums should be marked with the following identifying information, Lot number, Drum number, Gross, Tare, Net weight details and Producer related details, Labels should be affixed in two places, 180 degrees apart.

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

Image 3.3a Standard drum lid



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

Image 3.3b Drum lid

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 overseas conversion facility. In doing so the drum must contain and prevent the release of its radioactive content and any ionizing radiation emissions.

After arrival at the Converter, drums lids need to be removed to allow spear sample testing of the contents, the lids then need to 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.

The processing operation requires removal of the drum lids to allow for the contents to be emptied into the process hopper, after which the drums are washed and checked for contamination. Upon passing the contamination checks the drums are temporarily stockpiled awaiting disposal as approved by the applicable Competent Authority (CA).

It is possible for some drums deemed as being suitable for re-use to be re-cycled for use within the conversion facility, however when this occurs all previous identifying markings and labels must either be removed or painted over.

Shipping Containers



The transport of UOC drums typically utilizes ISO shipping containers. There are a number of options that Consignors might consider adopting regarding how they manage and make use of 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 under "Dedicated Use".

In all three cases there are strict requirements on controlling any radioactive contamination within both the internal and external surfaces of the 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 Container's (CSC's):

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

Consignors are encouraged to conform to the requirements of the United States Customs and Border Protection, Customs-Trade Partnership against Terrorism (C-TPAT) antiterrorism initiative when shipping cargo either into or through the USA.

www.cbp.gov/border-security/portsentry/cargo-security/ctpat

4.1 Shipping Container specification

4.1.1 Twenty foot (20'), dry van type, full height, heavy duty 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/ ListOfConventions/Pages/International-Convention-for-Safe-Containers-(CSC). aspx

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TYPE MA HP-TEXT-02 NU	MUFACTURER'S
Textainer Equipment Management Limited Century House, 16 Par-La-Ville Road, Hamilton HM HX, Bermuda	TIMBER COMPONENT TREATMENT IM/TAILILEUM 400/2012 MANUFACTURER: HUIZHOU PACIFIC CONTAINER CO., LTD.
CSC SAFETY A	APPROVAL
DATE MANUFACTURED IDENTIFICATION NO. TEM MAX. GROSS WEIGHT ALLOWABLE STACKING WEIGHT FOR 1.8G RACKING TEST LOAD VALUE 15.24	C 7/2012 J 41 5 5 5 4 0 KGS 67.200 LBS 0 KGS 476.198 LBS 0 KGS 33.600 LBS
ONE DOOR - O ALLOWABLE STACKING WEIGHT FOR RACKING TEST LOAD VALUE DOOR WALL STRENGTH	FF OPERATION 11.86 72.000 KGS 158.733 LBS 7,650 KGS 16.860 LBS 5,650 KGS 12.400 LBS

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.

www.gov.uk/government/publications/ imo-msc-1circ1475-guidelines-regardingthe-verified-gross-mass-of-a-containercarrying-cargo

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 use of chorded strapping to secure the drums. Additional lashing points may be added in compliance with the standard and with the permission of the shipping container owners.

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 CSC ISO 1496-1 requirements and 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, antiskid, 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, 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 shipping container, in order to fix contamination is not acceptable. 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 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 7. Appendix 3 shows details of a typical container and internal lashing points.

4.2 Storage of UOC shipping containers awaiting shipment

Ideally, UOC 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 UOC containers to assist personnel to identify, familiarize with and to remember Class 7 storage locations.

The 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 shipping containers of Class 7 materials 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 UOC shipping containers awaiting shipment

Security requirements for the storage of UOC shipping containers awaiting shipment at a port or shipping container 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 UOC should have adequate CCTV coverage and be subject to regular visual and physical monitoring by personnel.

The 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, UOC shipping containers awaiting shipment should be stored with their doors abutting the next container in order to prevent access to the container door mechanisms.

Container Loading

In determining 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 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 overseas country that the cargo may transit through and the final overseas destination country.

It is important to properly secure drums of UOC inside 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 shipping container. Drums that are insufficiently blocked and braced may shift to one side of the 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 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 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. Amendment 34-08 of the IMDG Code Part 1.3 defined shore-based personnel 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.

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.
- Forces induced by the transport on the carried packages.
- Requirements for securing packages specific to mode of transport.
- Description of the conveyance and equipment.
- 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

5.1.1. 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 shipping container. The consignee should be provided the opportunity to review the loading plans to determine if they can unload the drums from the shipping container.

5.1.2 Drums should be evenly distributed within the 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 shipping container or other drums.

5.1.3. Drums may be secured into the 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 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 shipping container wall. 5.1.5. Any void space between the cargo and the container doors, should be blocked with dunnage to prevent shifting during transport. The use of bull boards is recommended to fill this void space. It should be noted that the doors are not designed nor intended to restrain drums in case they shift.

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

5.2 Longitudinal, Lateral and Vertical Restraint

5.2.1 The WNTI has adopted the acceleration factors and restraint determinations based upon the revision of Appendix IV, Table IV1 of IAEA SSG-26 that were accepted as recommended by TRANSSC 31.

'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 longstroke 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	
MODE	LONGITUDINAL	LATERAL	VERTICAL 'a'
Dead	0.8g	-	1g down ± 0.2g 'b'
Roau	-	0.5g	1g down ± 0.2g 'b'
Deil	1.0g/4.0g 'c'	-	1g down ± 0.3g
Rall	-	0.5g	1g down ± 0.3g
See /water	0.4g	-	1g down ± 0.8g
Sed/ water	0.24g	0.8g	1g down ± 0.48g
	1.0g	-	1g down
Air	-	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 shipping containers for sea transport

5.3.1 It is suggested that 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 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 containers are stowed on deck.

5.3.2 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 container.

CTU Code:

www.unece.org/trans/wp24/ guidelinespackingctus/intro.html



Image 5.b Examples of ship stowage

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 or to describe the contents of an overpack.

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 overpack or freight 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 overpack or freight 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 and Consignee/Converter.
- The UN number (i.e.) UN 2912 and proper shipping name of the radioactive material.
- The permissible gross mass of the package, if the package gross mass exceeds 50 kg.
- The package identification, (i.e. TYPE IP-I).



Image 6.1 Markings on an IP-1 drum

6.2 Labelling

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



Markings on an IP-1 (UOC) drum label



Catergory III-YELLOW label typically on a freight container



Labelling of a Type A package

The software guides the user through the choices of labels by selecting the corresponding UN number for the radioactive materials to be transported, presenting a pictorial of a corresponding package and indicating the correct IMDG Code labelling requirements:

6.3 Placards

Placards shall be applied to rail and road vehicles carrying packages, over packs or freight containers and to rail and road vehicles carrying consignments under exclusive use.



Class 7 Placard



UN2912 Placard



Labelling and placarding of a shipping container of UOC

https://wnti.co.uk/media-centre/ interactive-software-for-labelling-anddocumentation.aspx

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 Container/Vehicle Packing Certificate, the Multimodal Dangerous Goods document and Emergency Response information.

7.1 The Container/Vehicle Packing Certificate (detailed cargo manifest)

UOC is a fully declared predictable, unitized cargo having a regular standardised documentation format, consistent weights that ensure the GCW mass per 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 Regulations.

The detailed cargo manifest is created by the Consignor/Producer, and summarises information from the drum filling process with shipping container details. This document generally has two components the summarised 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 DG document

The Multimodal Dangerous Goods (DG) document covers all road, rail and ocean transport, addressing delivery information standardized shipping details. A multimodal (DG) document for each shipping container within the overall Consignment and accompanies the 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 document.

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, The SDS forms a key part of the transport and shipping documentation with the Consignor/Producer supplying its transporters, handlers and carriers with a copy of their SDS for each consignment.

The 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

www.wnti.co.uk/media/91645/WNTI%20 -%20Good%20Practice%20Guide%20 -%20Generic%20UOC%20Safety%20 Data%20Sheet.pdf

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 document 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. An example of a Radioactive Cargo Maritime Booking Request for a shipment of UOC can be found in Appendix 10

7.5 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 Container/ Vehicle Packing Certificate (detailed cargo manifest) and specific information relating to the Dangerous Goods nature of the cargo.

An example of a Bill of Lading for a shipment of UOC can be found in Appendix 9

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.

- notification of approvals for export and Customs cargo clearance (1) (Export Declaration Notice)
- Notification to export strategic commodities 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 transhipment 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).

8.1 Pre-shipment notifications

- An initial notification from the Consignor to the Shipping line Carrier for a booking request to carry radioactive material.
- Notification request to local Competent Authority for approval to transfer and export strategic commodities from country of origin.

(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 shipping containers, resulting faster reconciliation of Consignor/Producer 'stock at converter' and in

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)

reduced turnaround time ahead of the containers becoming available for decontamination and their subsequent 'free release' and return back into the global 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 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 oncarriage to final destination (4).
- Notification to the Consignor/Producer from the Consignee/Conversion facility confirming the safe arrival of cargo (5)

(4) This notification can also (by arrangement with the Overseas on-carrier be sent on to the Consignee/Converter facility (5) 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.

Radiological Monitoring and Control of Packaging and 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 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 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 shipping containers can be further compromised by contaminants that may include radioactive "contamination" defined in the IAEA Regulations SSR-6.

Contamination limits for the transport of shipping containers

The level of non-fixed contamination on the external surfaces of any 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/cm2 for beta and gamma emitters and low toxicity alpha emitters or 0.4 Bq/cm2 for all other alpha emitters when averaged over any area of 300 cm2 of any part of the package surface. This requirement applies to each of the three options discussed in Section 4 Shipping Containers.

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/cm2 for beta and gamma emitters and low toxicity alpha emitters and 0.04 Bq/cm2 for all other alpha emitters, again being averaged over any area of 300 cm2 of any part of the package surface. This requirement is termed as being the "WNTI recommended Free Release contamination level"

This requirement applies to Carrier Owned Containers and shipping containers falling under some form of Container Lease Agreement in conjunction with a Container Leasing Company, that is whereby the shipping containers will be unloaded and cleaned before being returned into the global container pool.

The above requirement does not apply to Shipper Owned Containers operating under "Dedicated Use" where the container is utilised solely to transport radioactive materials and it is not released back into the general container pool. Being empty packaging that had previously contained radioactive material for return transport purposes they may be classified under UN 2908, Radioactive Material, Excepted Package, Empty Packaging.

9.1 Recommended contamination limit

9.1.1 Although not a regulation, the WNTI recommends that Consignors adopt the 0.4Bq/cm2 value as the applicable standard for all relevant work areas and mobile equipment used when loading drums into shipping containers (effectively reducing the admissible value for a package surface by a factor of 10). This will help to ensure that the shipping containers are free of any possible contamination before leaving the Consignor's premises and facilitate the free release of the empty shipping containers by the Consignee or Converter.

9.1.2 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 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/cm2 for beta and gamma emitters and low-toxicity alpha emitters", such as natural uranium (averaged over any 300 cm2.

Minimising the transfer of or retention and collection of contaminants on the packages or 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 a 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.

9.2 Measuring contamination

9.2.1 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. 9.2.2 For regular shipments, the measurement methods should be agreed between the Consignor and Consignee or Converter, occasionally comparing readings on the same items.

9.2.3 Alpha and beta contamination are measured separately and are not "additive".

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

9.2.5 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.

9.2.6 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.

9.2.7 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.

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

9.2.9 Regular checks of instruments in accordance with the manufacturer's instructions must be

performed before using the equipment.

9.2.10 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.

9.2.11 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/cm2, an instrument having a detection limit below 0.2 Bq/ cm2 should be used.

9.3 Monitoring of drums

9.3.1 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.

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

9.3.3 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. 9.3.4 Drums should be measured to check surface contamination levels. Whist Consignors can elect to adopt the the regulatory transport limit of 4 Bq/cm2 the WNTI would strongly recommend that Consignors adopt the Free Release contamination level of 0.4 Bq/cm2 as this will greatly assist in helping to reduce issues with obtaining Free Release certification following unloading of the cargo at the overseas 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/cm2 could have an impact of the inner shipping container contamination. If it is the case, the shipping container require cleaning prior to release in the public area

9.3.5 Best practice would Ideally result in drums being transferred immediately from the drum filling plant directly into shipping containers. Where this is not possible, the drums filled with UOC and awaiting packing into 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 give consideration to rewashing and retesting of the drums and associated preparatory work before packing the drums into shipping containers, or to risk the possibility of having the shipping container fail to meet the 'Free Release' testing requirements at the Consignee/Converter facility.

9.4 Monitoring of empty shipping containers

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

Once on the production site, good practice requires that the 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 shipping container to fix the contamination is strictly forbidden and shall not be done. This results in the shipment of a contaminated 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 Containers. The following guidelines provide details regarding industry leading practice for radiological monitoring.

9.5 Shipping container pre-loading inspection

9.5.1 Prior to checking for radioactive contamination, the inside and outside of the 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.

9.5.2 After cleaning, the fixed plus non-fixed radioactive contamination levels inside the empty container should be measured. Whist Consignors can elect to adopt the the regulatory transport limit of 4 Bq/cm2 the WNTI would strongly recommend that Consignors adopt the Free Release contamination level of 0.4 Bq/cm2 as this will greatly assist in helping to reduce issues with obtaining Free Release certification following unloading of the cargo at the overseas Converter. The 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 Shipping container loading area

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

9.7 Loading of drums into shipping containers

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

9.7.2 All part of the internal surfaces including walls, floor and ceiling inside the 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). 9.7.3 The shipping container 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. Once again, the WNTI strongly recommends that Consignors adopt the Free Release contamination level of 0.4 Bq/cm2 rather than the regulatory transport limit of 4 Bq/cm2 as this will greatly assist in helping to reduce issues with obtaining Free Release certification following unloading of the cargo at the overseas Converter. Any shipping container found to have levels of radioactive contamination above the criterion level adopted by the Consignor should be thoroughly re-cleaned then retested before being loaded with drums.

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

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

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

9.7.7 Workers involved in the loading of packages into 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).

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

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

9.7.10 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 shipping containers.

9.7.11 All material used for packing and securing of the packages in the 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.

9.7.12 At the point of leaving the production site, radiation readings should be measured on all external surfaces of the shipping container to ensure conformance with radioactive contamination standards. The level of radioactive contamination averaged over 300 cm2 of any surface of the shipping container should not exceed the regulatory transport limit of 0.4 Bq/ cm2.

9.7.13 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 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 freight container.

9.8 Determining the activity for transport

9.8.1 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.

9.9 Preparing shipping containers for transport

If the results detect any radioactive contamination, the shipping container must be re-cleaned before being transported from the production site. Appendix 5 sets out a suggested Pre-Shipment Inspection Checklist

9.9.1 On completion of the drum loading and securing operations extraneous material associated with the loading process must be removed from the shipping container before it is closed and sealed. The container bolt seal reference numbers must be carefully recorded for inclusion with the shipping documentation.

9.9.2 Any area in which shipping containers are to be stored before shipment should ideally be constructed of bituminous or concrete material and be regularly inspected for cleanliness, including the presence of any radioactive contamination.

9.9.3 Before being transported from the Consignors/ Producers facility, the shipping containers (including their undercarriages) should be free of any contamination.

9.9.4 At the point of leaving the Consignors/ Producers facility, radiation readings should be measured on all external surfaces of the shipping container to ensure conformance with radioactive contamination standards. The level of radioactive contamination averaged over 300 cm2 of any surface of the shipping container should not exceed 0.4 Bq/ cm2. 9.9.5 Measure and record maximum dose rates and units of measurement (e.g.) mSv/h for container surface contact and one (1) meter away from the container. The one (1) meter value is used to calculate the Transport Index for the container. All drums loaded into a shipping container should be treated as packages and the dose rate and Transport Index determined according to the IMDG code and other regulations. Individual drums should only be measured separately when they are transported as noncontainerized or partial loads.

9.9.6 As an alternative to measuring the maximum dose rate at one (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 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 shipping container by multiplying by 100 and the appropriate multiplication factor for the freight container.

9.10 Determining the activity for transport

9.10.1 The specific activity is the amount of radioactivity (or the decay rate) expressed as Becquerel per unit mass of uranium (Bq/gm). It should be noted that the specific activity grows over the course of the first 60 to 90 days following production. This is due to the in growth of decay and daughter products and must be considered when determining the total 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, refer to Section 6 Placards, Markings and Labels.

9.11 Monitoring of the shipping containers during transport

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 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.

Unpacking of Containers at Consignee or Coverter Premises

10.1 Preparation of the shipping container unloading area

10.1.1. The 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 shipping container unloading area should be prepared in a similar manner to the 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 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 shipping containers

10.2.1. After opening the 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 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.

10.2.3 Workers involved in the unloading of packages from 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).

10.2.4 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 shipping container.

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

10.2.6 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 shipping containers.

10.2.7 After unloading all drums, check the 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 7.2.2. should then be undertaken

10.2.8 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 Containers, so that they can be certified as being suitable for free release.

10.3 Unloading and turnaround of 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 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 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 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 shipping containers are below the regulatory limits. Any requirement for re-cleaning and re-testing will result in the Consignee/Converter releasing the 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 8 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 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 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 containers is 15 days.

Free Release of Shipping Containers

Typically, 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 shipping containers should also have all transport labels and markings removed prior to being returned to a Container Yard (CY).

Alternatively, containers may be returned back to the Consignor and not be free released. This requires that the 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 container shall be checked and certified by the Consignee or by the Converter as having levels of fixed plus non-fixed contamination totalling less than 0.4 Bq/cm2.

11.1 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 Containers:

11.1.1. A thorough inspection of the 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/cm2 (as averaged over 300 cm2).

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 samples for non-fixed contamination should also be collected 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/cm2 (as averaged over 300 cm2 on any part of the surface) would require that the 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 a shipping Container

Response to Incidents Whilst Transporting UOC

Consignors should have in place clear procedures to manage any incident during transport of 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 organisations 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.

There is also a requirement to include details relating to incident response action plans within the Multimodal Dangerous Goods form for each shipping container being transported.

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 SUP- PORTING 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 focussed 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 websites:

www.industry.gov.au/data-andpublications/guide-to-safe-transport-ofuranium-of-oxide-concentrate

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 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 shipping container with a restraint capacity of 1,000 kg in any direction.

Background Instrument Count Rate – The normal level of radioactivity within the location not originating from the object to be measured.

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-equipmentoperating" 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 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 a 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 shipping container of uranium ore concentrate cargo.

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

Container Lease Agreement – An agreement between a 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 - Radioactive contamination, also called radiological contamination is the deposition of, or presence of radioactive substances on surfaces or within solids, liquids or gases (including the human body), where the presence of such substances is unintended or undesirable.

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 shipping containers moving in international transport. Also called CSC.

CSC Plate – A safety approval plate fixed to the external surface of an 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. This definition is provided to distinguish dedicated use from exclusive use.

Direct Fixed-Point Measurement – Measurement of specified points within the 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 shipping container.

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

Dunnage - Materials of various types, usually timber, placed into the 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.

Exclusive use – In this application, a container is in exclusive use when it is loaded by the consignor and it travels to the consignee under the direction of either the Consignor or Consignee.

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

Free Release – The release of an uncontaminated 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 shipping container is free released when it is uncontaminated.

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 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 a 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 shipping container pool.

Lease Company Container – A new or used 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. Both drums and shipping containers can be packaging.

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 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.

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 a 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 the a 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).

Wipe Papers – Materials, such as cotton swab or filter paper, that are used to rub (wipe) surfaces that are to be measured for non-fixed contamination.

Wipe Sampling - A precautionary and confirmatory method of measuring, monitoring and evaluating the level of removable contamination on workplace surfaces and pieces of equipment for radiation protection purposes to assure decontamination process meet the regulatory release level.

Wipe Samples – Wipe paper that have been used to collect contamination to be assayed using an appropriate method.

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. WNTI recommended Free Release contamination level - The SSR-6 contamination limits for shipping containers that are to be returned into the global shipping container pool to store and or transport other goods.

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.

An Sample of an IP - Drum Specification

2.1 Sample of a Drum Package Specification

Туре	Removable head steel Designator Code 1A2							
Package marking	1A2/Y450/S/ (Year of ma name and approval numb Metal thickness 1.15mm th clause 6.1.3.2	Inufacture, two digits) / (Makers mark or ler issued by the Competent Authority) lickness to be applied as per IMDG Code						
Description	450 kg Gross mass open head all 1.15mm thickness sealable lid and locking ri	head drum (Top head, bo) with 177 mm crimped er ng with nut and bolt	dy and bottom aclosure re-					
Manufacturer	(Insert manufacturer deta	ails here)						
Product name	(Insert manufacturer product name here)							

Specifications

Gross Mass tested	450 kg	Packing group	ll and lll								
Nominal dimensions	608 mm (D) x 862 mm (H), effective stack height 872 mm	Tare mass	Drum 177 mm cap Lid Locking ring	17.5 kg 0.185 g 2.836 kg 1.36 kg							
	Drum body – 1.15 mm thick cold rolled steel with plain internal and baked enamel outside, resistance welded body side seam, end piece rolled to the body										
Method and material of	Drum bottom head - 1.15 mm thick cold rolled steel with plain internal and baked enamel outside										
manufacture	Drum top head- 1.15 mm thick cold rolled steel with Epoxy phenolic resin, baked enamel outside										
	Locking ring – 2 mm galvanised steel, 600 mm diameter, with 8 mm bolt and nut										
Method of closure	Removable head of drum which may incorporate a 177 mm crimp fit steel closure with PVC gasket. The main rim of the sealed using an EPDM foam gasket with the lid being secure a steel locking ring fitted with a nut and bolt.										
Proposed use	PGII & III Dangero 450 kg	us Goods solids wit	h gross mass of no	more than							

2.2 Sample of a Drum Package Test Specification

CERTIFICATE of TEST											
	N.A.T.A. ACCREDITED	LABORATORY NUMBER (1234)									
	PACKAGE PE	ERFORMANCE TESTS									
Date:		Report No:									
Product tested:	450 kg Gross mass open he 1.15 mm as per IMDG Code with locking rind, nut and b	ead steel drum (To 6.1.3.2) with 177 m polt.	op head, body and bo m crimped closure, re	ottom head all e- sealable lid							
Sample selection:	Samples selected and ident	tified by client or t	heir agent.								
Specification:	Please refer to page 2 of th	is report									
Client:											
Te	st (s) Performed	Sample ID	Orientation (as per fig 6.1 ADG Code)	Result							
DROP TEST		13-6344-01	1	PASS							
Six samples fil	led with polycarbonate	13-6344-02	1	PASS							
of 95% capacit	ty and prepared as they	13-6344-03	1	PASS							
would be used	in transport were	13-6344-04	6	PASS							
subjected to o orientations fr	ne drop in one of two om a height of not less than	13-6344-05	6	PASS							
1.2 meters at a	mbient conditions.	13-6344-06	PASS								
Test Method: l the Transport Revised Ed. 6.	JN Recommendations on of Dangerous Goods 17 th 1.5.3										
STACK TEST											
Effective stack 872mm. Numb 4-1=3. Three sa would be used under a comm a superimpose kg gross per p ambient temp Test Method: U the Transport Revised Ed. 6.	c height of package = ber in 3m equivalent stack amples prepared as they d in transport, were placed ion platen and subjected to ed mass of 4,050kg (1,350 ackage) for 24 hours at erature. JN Recommendations on of Dangerous Goods 17 th 1.5.6	13-6344-07 13-6344-08 13-6344-09		PASS PASS PASS							
"The results of	the performance tests repor	ted on this certifi	cate only relate to th	ne samples							
"Use of other p	backaging methods or compo	onents may rende	er testing invalid"								
Checked and s Signatory	igned by Authorised										
Name of Autho	orised Signatory:										

ISO Shipping Container Details



Figure 3.a. - Closed 20' ISO container



Figure 3.b. - Lashing point

Figure 3.c. - Anchor point

A Suggested Pre-use Inspection Checklist for 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 containers less than 5 years old, or valid for 30 months for 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 silicon 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 container floor rails, or the box tine channels, etc. Care must be taken to ensure worker safety when performing these checks. Never stand underneath a shipping container when performing these checks. Check that all exterior surfaces have minimal surface and no major structural rust. The shipping container should be in good condition and have a visually pleasing appearance. Even though the shipping container is acceptable for use the general appearance of the 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 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 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 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 shipping container.

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

4.4 * Water proof test

This involves entering into the container, having someone close the container doors. Should any indication of daylight be seen through the door seals or from elsewhere within the shipping container it must be assumed that water could gain entry and therefore the 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 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.

Pre-shipment Inspection Checklist

5.1 Final check before shipment

After the 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 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 and labelling.

If the 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 6.

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

An Example of a Shipping Container 'Free Release' Certificate

Shipping Container Certificate of Inspection													
Container Number		Date											
The freight (sea, road or rail) container 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													
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:	Name: Signature:												
Title:													
Tel:	Mob:												
Email:													

Examples of 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 shipping container (lot) level combined with radiation dose rates

MANIFEST DEL	ANIFEST DELIVERY SUMMARY and RADIATION DOSE RATE REPORT (Container Packing List)														
Delivery Consig	elivery Consignee: 12345														
Lot No	Cont No	Seal No's	kg Net UOC	% U308	kg Net U308	lbs Net U308	No Drums	kg Drums	kg Product and Drums	Cont Tare	kg GCW	GBqCont	DR@1M	ті	DR@2M
3108	TGHU2795285	242749 750	17,757.00	84.182	14,948.18	32,955.06	63	1,386.00	19,143.00	2,200	21,343.00	510	0.02	6	0.01
3109	CLHU3211734	243001 002	17,759.60	84.018	14,921.24	32,895.66	63	1,386.00	19,145,6	2,300	21,445.60	510	0.02	6	0.01
TOTALS	2	CONTAINERS	35,516.60	84.1	29,869.42	65,850.72	126	2,772.00	38,288.60	4,500	42,788.60	1,020		12	
Dealing Dates				Intial Chinaiaa F	ate.										ee exe in m Cu /ha

This document provides details of the total delivery with radiation dose rate and Transport Index (TI) summarised at the shipping container level

7.2 An example of a manifest summary of individual drums within each shipping container (lot) combining radiation dose rates

MANIFEST SUM	(ANIFEST SUMMARY of DRUM BATCHES within SHIPPING CONTAINER LOTS - (DRUM PACKING LIST)															
Delivery Consig	elivery Consignee: 12345															
Lot No	Cont No	Batch	kg Drum 1	kg Drum 2	kg Drum 3	kg Drum 4	kg Drum 5	kg Drum 6	kg Drum 7	kg Net UOC	kg Drums	KG GrDrWt	% UO4	kg Net UO4	ті	DR@1M
3108	TGHU2795285	24200	282.6	283.6	282.2	283.8	281.8	278.8	280.4	1,973.20	154	2,127.20	83.98	1,657.09	0.1	0.001
3108	TGHU2795285	24201	279.6	286	286.8	281.3	281.5	284.8	282.1	1,982.10	154	2,136.10	83.82	1,661.40	0.1	0.001
3108	TGHU2795285	24202	282.3	279.6	282.5	281.6	281.2	280.9	281.6	1,969.70	154	2,123.70	84.12	1,656.91	0.1	0.001
3108	TGHU2795285	24203	281.5	283.4	280	281.3	279.9	280.4	284.4	1,970.90	154	2,124.90	84.45	1,664.43	0.1	0.001
3108	TGHU2795285	24204	280.3	280.3	284.6	281.6	282.2	282.5	282.6	1,975.10	154	2,129.10	84.13	1,661.65	0.1	0.001
3108	TGHU2795285	24205	279.9	281.1	282.5	280	282.7	279.9	281.1	1,967.20	154	2,121.20	84.45	1,661.30	0.1	0.001
3108	TGHU2795285	24206	280.5	280.7	282	283	281.9	282.6	281.8	1,972.50	154	2,126.50	84.06	1,658.08	0.1	0.001
3108	TGHU2795285	24207	281.5	282.3	281.6	280.3	281	283	281.4	1,971.10	154	2,125.10	84.34	1,662.43	0.1	0.001
3108	TGHU2795285	24208	282.2	282.4	283.8	283.4	283.6	280.6	279.2	1,975.20	154	2,129.20	84.29	1,664.90	0.1	0.001
3108	TGHU2795285		2,530.40	2,539.40	2,546.00	2,537.30	2,535.80	2,533.50	2,534.60	17,757.00	1,386.00	19,143.00	84.182	14,948.18		6

3109	CLHU3211734		2,438.60	2,444.30	2,454.20	2,442.20	2,444.00	2,438.40	2,442.80	17,104,410	1,386.00	18,490.41	84.018	14,370.75		
3109	CLHU3211734	24217	272	271.8	273.6	272.8	273.4	270	269	1,902.70	154	2,056.70	83.79	1,594.26	0.1	0.001
3109	CLHU3211734	24216	271.3	271.7	271.4	269.7	270.8	272.4	271.2	1,898.60	154	2,052.60	83.93	1,593.49	0.1	0.001
3109	CLHU3211734	24215	270.3	270.1	271.8	272.4	271.7	272	271.6	1,900.00	154	2,054.00	83.6	1,588.39	0.1	0.001
3109	CLHU3211734	24214	269.7	270.5	272.3	269.4	272.5	269.3	270.9	1,894.70	154	2,048.70	84.02	1,591.92	0.1	0.001
3109	CLHU3211734	24213	270.1	269.7	274.4	272	272	271.9	272.4	1,902.60	154	2,056.60	84.02	1,598.56	0.1	0.001
3109	CLHU3211734	24212	271.3	272.8	269.8	270.7	269.7	269.8	274.2	1,898.40	154	2,052.40	84.23	1,599.01	0.1	0.001
3109	CLHU3211734	24211	272.1	269	272.3	271	271	270.3	271.4	1,897.20	154	2,051.20	84.18	1,597.06	0.1	0.001
3109	CLHU3211734	24210	269.4	275.4	276.6	270.7	271.3	274.2	271.9	1,909.60	154	2,063.60	84.23	1,608.45	0.1	0.001
3109	CLHU3211734	24209	272.4	273	272	273.2	271.6	268.2	270.2	1,900.70	154	2,054.70	84.16	1,599.62	0.1	0.001

TOTALS	2	4,969.00	4,983.70	5,000.20	4,979.50	4,979.80	4,971.90	4,977.40	34,861.41	2,772.00	37,633.41	84.101	29,318.94	18	•••••
														All dose rates	are in mSv/hr

This document provides details each drum with radiation dose rate and Transport Index (TI) summarised at the drum and shipping container level 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.

7.3 Drum List (Drum List per lot)

Lot No	Number of drums	Gross weight	Tare	Net weight	H ₂ 0%	Dry Net weight	U%	U weight
Total								

7.4 Packing List Without Samples

Lot No	Number of drums	Gross weight	Tare	Net weight	H ₂ 0%	Dry Net weight	U%	U weight
Total								

7.5 Sample Specification (sample associated to the lot)

Lot No	Number of drums	Gross weight	Tare	Net weight	H ₂ 0%	Dry Net weight	U%	U weight
Total								

An Example of a Multi Modal Dangerous Goods Form

Multimodal dangerous goods form

This form meets the requirements of SOLAS 74, Chapter VII, regulation 4 and MARPOL 73/78, Annex III, regulation 4.

NOTE: When this form is used as a container/vehicle packing certificate only, not a combined document, a dangerous goods declaration signed by the shipper or supplier must have been issued or received to cover each dangerous goods consignment packed in the container. The container/vehicle packing certificate is not required for tanks.

1 China au/Canaina au				- 1	2 Turan and all a summary and a summary and								
1. Shipper/Consig	nor:			2	2 Transport document nu			umber:					
	JMPA	.NY		3	3 Page Pages		S	4 9	4 Shippers reference				
Roadrunner Road	k k				1 2			123	12345				
Adelaide SA 500	5	Freight forw	varde	rs									
AUSTRALIA				7	reterence								
6. Consignee:				,									
	CI				SHIPPER S DECLARATION (refer to box 22 below)								
BD223 11103	-31			a	ccurately de	scribe	ed belov	v by th	ne proper shi	pping n	ame(s)	and are	
Narbonne				cl	classified, packaged, marked labelled, placarded, and are in all respects								
FRANCE				in	in proper condition for transport according to the applicable								
8 This shipment is	s with	in the	limitatio	ons pres	cribed for:		9 Add	itional	handling info	ormatio	'n		
Road rail and sea	trans	port					The U	DC is r	backed in ste	el drum	ns that i	meet para	
10 Vessel and dat	te		11 Port	t of load	ing		623 re	quiren	nents, each d	lrum be	ing ma	rked and	
BREMEN EXPRES	SS		Port A	Adelaide	AUSTRALIA	4	labelle	d to re	equirements	as state	ed withi	in Section IV	
12 Port of dischar	ge		13 Fina	al destir	ation		of the	2018 1	AEA Specific	: Sarety	Requir	ements	
HAMBURG			Narbo	onne FR	ANCE		5517 0						
14 Shipping mark	s ľ	No. and	d kind o	of packa	ges; descript	tion o ontair	f goods	*	Net UOC kg	Net U ko	1308 9	Transport Index	
1 1 1 7100	2	2912 Ui	ranium	Oxide C	oncentrate e	each l	naving a	TI	17.057.0	15 0 7 7	7.070	C.	
Lot No. 3108	c	of 2							17,857.8	15,033	3.039	6	
UN Number:			UN291	12									
Proper Shipping	Name:	:	Radioa	{adioactive Material Low Specific Activity (LSA-1 non-fissile)									
UN Class:			7										
Subsidiary Hazar	d:		Nil										
Physical / Chemic	cal Fo	rm:	Dry Po	owder (I	Jer (Uranium Oxide Concentrate as Uranium Oxide U3O8)								
Maximum Activity	y per 2	20'	520 G	Bq (Gig	q (Giga Becquerels)								
Category of Pack	ages:		III Yell	low									
Contents:			48 by	205litre	e (IP-1) steel	drum	s contai	ning U	IN 2912 UOC	each ha	aving a	TI of 2	
Transport Index ((TI):		6										
Name of each rac	dionuc	clide:	MIXED	O OXIDE	S of TRIURA	NIUM	1 OCTA	OXIDE	, U308, URA	NYL UF	RANAT	E	
Packing Group:			ll and										
Shipment Catego	ory:		Under	r Exclusi	ve Use								
Marine Pollutant:			No (N	lot Appli	pplicable)								
Emergency Resp	onse:		XXXX	ERAP a	P applies to this shipment. To activate please phone +XX XXX XXX, Plan								
			Custo	dian is X	XXXX								
15 Container	16 Se	eal no(s) 17	' Contair	ainer/vehicle size and			18 Gross mass wt			19 Gross container wt		
No	242	749 75	o ty	/pe		FO		19,6	607.4 (kg)		21,807	7.4 (kg)	
IGHU2795285				20° GF	container a	as fci	-				TION		
CONTAINER/VE	HICLE		ING CE					21 RECEIVING ORGANIZATION RECEIPT					
packed and load	e that led int	to the	goods contain	describe	ed above n hicle identifi	ave r ied al	been	en Received the above number of packages,					
in accordance with the applicable provis					sions.				and condition unless stated hereon.				
Must be completed and signed for all cor					ner/vehicle l	oads	by	Receiving organization remarks:					
person responsible for packing/loading.					-								
20 Name of company (see note 2 on note					21. Name	21. Name of haulier 22 Name of company preparing this shipp					his shipping		
ACME MINING COMPANY								ACME	MINING COM	IPANY			
Name/status of declarant: Wylie KYOTEE					Vehicle re	eg. No). I	Name/	/status of dee	clarant:	Wylie	KYOTEE	
Place		Date			Signature	and o	date	Place		Da	ate		
Adelaide		31 De	ecembe	er 2018	1			Adelai	de	31	l Decen	nber 2018	
AUSTRALIA								AUSTF	RALIA				
Signature of Declarant					Driver's S	ignatı	ure:	Signat	ure of Declar	ant .		/	

The Multimodal Dangerous Goods form (that accompanies each and every shipping container, includes the normal regular, standard shipping and forwarding instruction information as per above highlighted in red text

Details relating to the specific nature and properties of the Dangerous Goods cargo as per above highlighted in green text as per para 546 of the 2018 IAEA Specific Safety Requirements SSR-6.

The packing declaration is a legally enforceable document, signed by the person who packed the goods and the person who prepared the Multi Modal DG form, refer above section highlighted in blue text.

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 (by volume or mass and, in the case of goods of Class 1, by the net explosive mass of the contents), 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, including the technical name enclosed in parenthesis, as applicable.

3. The primary hazard class or, when assigned, the division of the goods, including the compatibility group letter for class 1.

4. Where assigned subsidiary hazard class or division number(s) shall be entered following the primary class hazard or division and shall be enclosed in parenthesis.
5. Where assigned, the packing group for the substance or article which may be preceded by "PG" (e.g. "PG II").

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 proper shipping name shall be supplemented as required by the Code (see 5.4.1.4.3 of the Code), this includes (as applicable):

- Technical names for "n.o.s" and other generic descriptions. Proper shipping names that are assigned special provision 274 shall be supplemented with their technical or chemical group names.
- The words "EMPTY UNCLEANED" or "RESIDUE LAST CONTAINED" before or after the proper shipping name for empty packaging, including portable containers or bulk packaging, which contain the residues of dangerous goods of classes other than Class 7.
- The word "WASTE" before the proper shipping name for waste dangerous goods (other than radioactive materials) being transported for disposal or processing for disposal, unless this is already a part of the Proper Shipping Name.
- If the Proper Shipping Name of a substance which is transported or offered for transport in a liquid state at a temperature equal to or exceeding 100 °C, or in a solid state at a temperature equal to or exceeding 240°C, does not convey the elevated temperature condition (for example, by using the term "MOLTEN" or "ELEVATED TEMPERATURE" as part of the Proper Shipping Name), the word "HOT" shall immediately precede the Proper Shipping Name.
- If the goods to be transported are marine pollutants the goods shall be identified as "Marine Pollutant". (see 3.1.2.8 of the Code) and for generic or not otherwise specified (N.O.S.) entries the Proper Shipping Name shall be supplemented with the recognised chemical name of the marine pollutant (see 3.1.2.9 of the Code). The term "Marine Pollutant" may be supplemented with the term "Environmentally Hazardous".

 If applicable, the minimum flashpoint if 60oC or below (in oC closed cup (c.c.)). For class 5.2 organic peroxides which are also flammable the flashpoint need not be declared. See 5.4.1.4.3.6 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. For class 1 dangerous goods the quantity shall be the net explosive mass. For dangerous goods transported in salvage packaging an estimate of the quantity of dangerous good shall be given. The number and kind (e.g. drum, box, etc.) of packages shall also be indicated. UN packaging codes may only be used to supplement the description of the kind of package (e.g., one box (4G)). Abbreviations may be used to specify the unit of measurement for the total quantity.
- Note: The number, type and capacity of each inner packaging within the outer packaging of a combination packaging is not required to be indicated.
- Where dangerous goods are transported according to the exceptions for dangerous goods packed in limited quantities provided for in column 7a of the Dangerous Goods List and Chapter 3.4 of the Code, the words "limited quantity" or "LTD QTY" shall be included.
- Where dangerous goods are transported according to the exceptions for dangerous goods packed in excepted quantities provided for in column 7b of the Dangerous Goods List and chapter 3.5 of the Code, the words "dangerous goods in excepted quantities" shall be included.
- Where salvage packaging has been used, the words "SALVAGE PACKAGING" shall be included in the description of the goods.

- For other additional information that may be required see 5.4.1.5 of the Code.
- Examples of dangerous goods descriptions are provided at 5.4.1.4.4 of the Code.
- Extra information is needed for certain goods of Class 1, 4.1, 5.2, 6.2, 7. See 5.4.1 of the Code.
- In certain circumstances special certificates are required. See 5.4.4 of the Code.

Cargo transport units under fumigation (UN 3359) containing no other dangerous goods shall be transported in accordance with the special provisions in Chapter 5.5. of the Code. Transport documents associated with the carriage of such cargo transport units shall be completed in accordance with 5.5.3.7 of the Code and shall include:

(1) the UN number preceded by the letters "UN"; and (2) the Proper Shipping Name followed by the words "AS COOLANT" or "AS CONDITIONER", as appropriate.

For example: UN 1845, CARBON DIOXIDE, SOLID, AS COOLANT.

Note 2: Container/Vehicle Packing Certificate (not required for portable tanks)

The signature given overleaf in Box 20 must be that of the person controlling the container/vehicle operation, who certifies that:

- The container/vehicle was clean, dry and apparently fit to receive the goods.
- If the consignments include goods of Class 1, other than division 1.4, the container is structurally serviceable in accordance with 7.1.2. of the IMDG Code.
- No incompatible goods have been packed into the container/vehicle unless specially authorized by the Competent Authority.

- 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.
- When materials are transported in bulk packaging the cargo has been evenly distributed 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.
- When solid Carbon Dioxide (CO2 dry ice) is used for cooling purposes, the vehicle or freight container is externally marked with a warning mark at each access point where it can be easily seen by persons opening or entering the cargo transport unit, in accordance with 5.5.3.6 of the IMDG Code.
- 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.

An Example of a Bill of Lading for UOC Material

CODE NAME: "CONGENBILL" EDITION 1994						B/L No: 12345						
Consignor, Shipper:							BILL OF LADING TO BE USED WITH					
ACME MINING COMPANY							Reference No: 12345					
Roadrunner Road												
	4 501 4	00										
Consignee	(if nc	t to order):				No	tifu part	v /ada	droca			
COMURHE	X	it to order).				INC	tiry part	y/add	aress:			
USINE de M	1ALV	'ESI										
BP223 11103	3											
Narbonne F	RAN	ICE										
Vessel:	BF	REMEN EXPRES	iS	Load	port:	AD	ELAID E	Disc port	charge t:		HAMBURG	
Containe	er	Bolt Seal	Qty	of	Net U	ос	Net U3	808	UOC	and	Gross Container	
Number	-	Numbers	Dru	ms	(kg)	(kg)	(kg	g)	(kg)	
TGHU27952	285	242749 750	48	3	17,846	5.4	16,805.	670	18,90	2.4	21,302.4	
CLHU32117	34	24300 002	48	3	17,847	7.1	16,784.	557	18,903.1 21,30		21,303.1	
Total	Zotal 2 Containers 96 35,693.5 33,590.227 37,805.5)5.5	42,605.5				
Shippers description of goods: 2 by 20' Dry 20' ISO shipping containe					ach hav	ing	SHIPP SUPPI	PER LIED		Gros	s weight (kg)	
a TI of 6 sai Material as	id to Uran	contain Class 7 ium Oxide Cond	UN29 centra	12 Ra te of	dioactiv Low	CONTAINERS			RS	Ve M	rified Gross	
Specific Ac	tivity	(LSA-1 non-fise	sile) C	atego	ry III		EDN					
(IP-1) steel	n ISO drum) packed secure as each drum ha	ly with wing a	148 b Tlof	y 205li 2	tre	AAN3	6NR1	Г4		42,605.5	
For the pur	pose	of application (of limi	tation	of liabi	ilitv.						
the number	of c	ontainers show	n here	on sh	all be		SHIPPERS LOAD					
considered	as th	ne total number	of pa	ckage	s or uni	its.	AND	2001	NI			
FREIGHT P	ΑΥΑΙ	BLE:		SHI	PPED fr	om t	he Load	Port	in appa	rent a	ood order and	
As per CHA	RTE	R-PARTY dated		con	dition	on I	poard th	ne V	essel fo	or car	riage to the	
-				Discharge Port or so near thereto as she may safely g						nay safely get		
FREIGHT ADVANCE:					the goods specified above.						tion contonts	
Received on account of freight:				and	value a	easu as sta	re, quain ated.	ıy, qı	lantity,	contai	tion, contents	
				IN V	VITNES	SS w	hereof t	he M	aster or	Age	nt of the said	
				Ves	sel has	signe	ed the nu	Imbei	r of Bills	of La	ding indicated	
Lime used for				belo	ow all o omplish	t this	s tenor a he other	nd da s shal	ate, any Lbe voi	one o d	f which being	
loudinglours					R COND		NS OF C	ARRI	AGE SE	E OV	ERLEAF	
Freight payable at:					e and [Date	of Issue:	Adel	aide AL	ISTRA	LIA	
Number of	origi	nal Bills of Ladir	ng:	Sigr	nature:			/	/			
3 originals				1				//				

The Bill of Lading includes the normal regular, standard shipping and forwarding instruction information as per above highlighted in red text The Bill of Lading is a legally binding document, signed by the person responsible for packing the goods and the person signing off on the suitability for shipping of the cargo as presented refer above section highlighted in blue text.

Details relating to the specific nature and properties of the Dangerous Goods cargo as per above highlighted in green text.

BILL OF LADING TO BE USED WITH CHARTER PARTIES

CODE NAME: "CONGENBILL" EDITION 1994

ADOPTED BY THE BALTIC AND INTERNATIONAL MARITIME COUNCIL (BIMCO)

Conditions of Carriage

(1) All the terms conditions, liberties and exceptions of the Charter Party, dated as overleaf, including the Law and Arbitration Clause, are herewith incorporated.

(2) General Paramount Clause

(a) The Hague Rules contained in the International convention for the Unification of certain rules relating to Bills of Lading, dated Brussels the 25th August 1924 as enacted in the country of shipment, shall apply to this Bill of Lading. When no such enactment is in force in the country of shipment, the corresponding legislation of the country of destination shall apply, but in respect of shipments to which no such enactments are compulsorily applicable, the terms of the said Convention shall apply.

(b) Trades where Hague-Visby Rules apply.

In trades where the International Brussels Convention 1924 as amended by the Protocol signed at Brussels on February 23rd 1968 – the Hague-Visby Rules – apply compulsorily, the provisions of the respective legislation shall apply to this Bill of Lading.

(c) The Carrier shall in no case be responsible for loss of or damage to the cargo, howsoever arising prior to loading into and after discharge from the Vessel or while the goods are in the charge of another Carrier.

(3) General Average

General Average shall be adjusted, stated and settled according to York-Antwerp Rules 1994 or any subsequent modification thereof, in London unless another place is agreed in the Charter Party.

Cargo's contribution to General Average shall be paid to the Carrier even when such average is the result of a fault, neglect or error of the Master, Pilot or Crew. The Charterers, Shippers and Consignees expressly renounce the Belgian Commercial Code, Part II, Art. 148.

(4) New Jason Clause

In the event of accident, danger, damage or disaster before or after the commencement of the voyage, resulting from any cause whatsoever, whether due to negligence or not, for which, or for the consequences of which, the Carrier is not responsible, by statute, contract or otherwise, the cargo, shippers, consignees or owners of the cargo will contribute with the Carrier in General Average to the payment of any sacrifices, losses, or expenses of the General Average nature that may be made or incurred and will pay salvage and special charges incurred in respect of the cargo. If a salving vessel is owned or operated by the Carrier, salvage will be paid for as fully as if the said salving vessel or vessels belonged to strangers. Such deposit as the Carrier or his Agents may deem sufficient to cover the estimated contribution of the goods and any salvage and special charges thereon, will, if required be made by the cargo, shippers, consignees or Owners of the goods to the Carrier before delivery.

(5) Both-to-Blame Collision Clause

If the Vessel comes into collision with another vessel as a result of the negligence of the other vessel and any act, neglect or default of the Master, Mariner, Pilot, or the Servants of the Carrier in the navigation or in the management of the Vessel, the owners of the cargo carried hereunder will indemnify the Carrier against all loss or liability to the other or non-carrying vessel or her owners in so far as such loss or liability represents loss of, or damage to, or any claim whatsoever of the owners of the said cargo, paid or payable by the other or non-carrying vessel or her owners to the owners of the said cargo and set off, recouped or recovered by the other or non-carrying vessel or her Owners as part of their claim against the carrying Vessel or Carrier.

The foregoing provisions shall also apply where the Owners, operators or those in charge of any ship or ships or objects other than, or in addition to, the colliding ships or objects are at fault in respect to a collision or contact.

For particulars of cargo, freight, destination, etc., see overleaf

RADIOACTIVE CARGO MARITIME CARRIAGE REQUEST

Appendix 10

An Example of a Radioactive Cargo Booking Request Form

Uranium Oxide Concentrate Class 7 Radioactive Material, Low Specific Activity Product Description LSA-1 Category III Yellow 1. First Vessel Hamburg 11. Third Vessel Bremen Second Vessel Name Express Name: Express Name: 12. Voyage No. 2. Voyage No. 01 7. Voyage No 02 Antigua 8 3. Flag 8. Flag 13. Flag Germany Barbuda 9. Second Port 4 First Port 14 Third Port Seattle Port Adelaide, AUSTRALIA and Country of Loading: 10. Second Port and Country of Loading: 15. Third Port and Country UNITED of Loading: STATES Seattle, 5. First Port Hamburg, GERMANY UNITED and Country of Discharge and Country of Discharge and Country of Discharge: Acme Mining Company Roadrunner Road 16. Shipper: (full name and address) Adelaide SA 5000 AUSTRALIA A.B.N 99 123 456 789 17. Consignee: (full name and COMURHEX USINE de MALVESI BP223 11103 Narbonne FRANCE address) 18.Full Technical Name: Radioactive Material, Low Specific Activity LSA-1 20. Transport License No.: 19. Intended Use: Power Generation TN123 MEP/302/UOC/999A 21 Export License No 22. Country of Origin: AUSTRALIA 24. Country of 23, Import License No. **EURATOM Approval** FRANCE Destination: 48 by IP-1 steel drums securely stowed (to AMSA standards) in each 20 ISO shipping container 25. Packaging identification: 27.Date of expiry of packaging 26. Authority Packaging AMSA Approved N/A certificate 28. Number and Type of 192 drums securely stowed in 4 by 20' ISO shipping containers packages 31. Cargo Net ш. 75,641 29. Category of package 30. Cargo Gross (Kg) 85.241 YELLOW (kg) 34. IAEA Schedule: 5 LSA-32. UN No: 2912 33. IMDG Code-Class: Class 7 35. Proper Shipping Name: Radioactive Material, Low Specific Activity (LSA-1) Non-Fissile-excepted. 36. Name of Radionuclide: Natural Uranium (LSA) Low Specific Activity, (less than 1% U235) 37. Weight of Radionuclide (Kg): 38. Physical Form: 39. Enrichment 71,146.904 Dry Powder Nil [%] 40. Maximum Activity in Becquerel during 440 GBq per ISO 41. Transport Index 6 per ISO Transport: 0.06 (mSv/h) per ISO 42. Radiation at Surface 43. Radiation at 1 M (in 0.02 (mSv/h) per ISO QSv/h): (mSv/h): 44. Fissile status: Non-Fissile 45. Radioactive Material in finished form: NO 46. IMDG Code 5.4.1.5.7.2: The transport document shall include a statement regarding actions, if any, that are required to be taken by the carrier. The statement shall be in the languages deemed necessary by the carrier or the authorities concerned, and shall include at least the following points: 1 - supplementary requirement for the loading, stowage, transport, handling and unloading of the package, over-pack or freight container including any special stowage provisions for the safe dissipation of heat (see 7.1.4.5.2), or a statement that no such requirements are necessary. NO 2 - restrictions on the mode of transport or conveyance and any necessary routing instructions; NO 3 - emergency arrangements appropriate to the consignment. YES Note: The above data will be used to obtain port entry permits from foreign controlling authorities therefore the shipper is responsible for the accuracy of the information contained herein. 47. Completed by the shipper Monday, 31 December 2018 Wylie Kyotee Acme Mining Company Roadrunner Road Delivery: 12345 Adelaide SA 5000 AUSTRALIA

An Example of a Typical Chemical Specification

The minimum uranium content in the Concentrate shall not be less than 65% by weight. Unless otherwise indicated, the contents of impurities given below are expressed as a percentage of total uranium:

REF ASTM NORM C967-13	VALUE %	REF ASTM NORM C967-13	VALUE %
Arsenic (As)	0.05	Potassium (K)	0.20
Barium (Ba)	0.01	Silica (SiO2)	0.50
Boron (B)	0.005	Silver (Ag)	0.01
Calcium (Ca)	0.05	Sodium (Na)	0.50
Carbonate (CO3)	0.20	Sulphates (SO4)	1.00
Chromium (Cr)	0.01	Thorium	0.10
Fluorine (F)	0.01	Titanium	0.01
Halogen (CI)	0.05	Vanadium (V)	0.06
Iron (Fe)	0.15	Zirconium (Zr)	0.01
Moisture (H2O) by weight of concentrate	2.00	Extractable organic	0.10
Molybdenum (Mo)	0.10	Insoluble uranium in HNO3	-
Phosphorus (PO4)	0.10	U234	56 ug/gU



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.

The WNTI offers the use of this standard freely to members and non-members of the transport community. Where any interpretation of the information has been made, it has been done so with the interests of the wider transport community. Although the standard has been extensively reviewed by industry experts, if you have any issues in use or content, please contact the WNTI so we can rectify the issues and conflicts in systems etc.

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WNTI STANDARD Packaging and Transport of Uranium Concentrates Version 3, November 2019

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