



**Subject: Loss of Containment of Radioactive Material**  
**UN 3332 Radioactive Material, Type A Package, Special Form**  
**Occurring During Transport from Brisbane International**  
**Airport, Australia to Frankfurt International Airport, Germany**  
**between 18 and 22 November 2012**

### **Incident Summary**

A single Type A package containing five (5) Caesium-137 radioactive material special form sealed sources was prepared in Mackay (Queensland, Australia) on 7 November 2012 for the return of the sources to a company in Germany.

The package was first transported by road and rail to a dangerous goods freight forwarding company at Brisbane (Queensland, Australia) where it was placed into an overpack and dangerous goods transport documentation for air transport was prepared.

Radiation levels were checked and the Transport Index = 1.0 was determined at this premises prior to the package being lodged for air transport from Brisbane International Airport, Australia to Frankfurt International Airport, Germany.

At the time of establishing the Transport Index the radioactive material was contained.

The package was then lodged at Brisbane International Airport and accepted for air transport.

The package then travelled on a passenger aircraft from Brisbane, Australia (BNE) departing on 18 November 2012, and arrived at a transit port on 19 November 2012.

Transshipment of the package took place and it then travelled on another passenger aircraft departing on 22 November 2012 and arrived at Frankfurt International Airport, Germany on 22 November 2012.

Upon arrival at Frankfurt the package was detected emitting elevated levels of radiation measured at 23.8 mSv/h which was well in excess of the maximum permitted of 2 mSv/h and not consistent with the declared Transport Index.

Inspection of the package identified that two (2) of the five (5) sealed sources had escaped the containment system of the Type A package during transport.

The point at which the containment was lost was unable to be determined. The maximum possible exposure to passengers of ionising radiation was calculated and found to be; 12.25 mSv on one flight and 5.25 mSv on another flight. The calculation does not take into account possible shielding.

Exposure to ionising radiation was regarded by health authorities as not requiring a response.



The package as received at Frankfurt Airport



Surface level reading of 23.8 mSv/h on arrival at Frankfurt Airport



The Type A package as removed from the overpack.



Opening of the Type A Package at Frankfurt Airport





The containment system as found upon opening of the Type A package clearly showing a sealed source capsule that escaped containment and had become lodged under the lid.



The location of the sealed sources that had escaped containment (circled in red).



The diminished condition of the polystyrene intermediate packaging material of the Type A package resulting from repeated use.

### **Abbreviations**

<b>CASA</b>	Civil Aviation Safety Authority, Australia being the Competent Authority for the air transport of radioactive material in Australian territory
<b>IATA-DGR</b>	International Air Transport Association – Dangerous Goods Regulations – 53 <sup>rd</sup> Edition – 1 January 2012
<b>ICAO-TI</b>	International Civil Aviation Organization – Technical Instructions for the Safe Transport of Dangerous Goods by Air [DOC:9284] 2011-2012 edition
<b>TS-R-1</b>	International Atomic Energy Agency – Regulations for the Safe Transport of Radioactive Material – 2009 Edition – Safety Requirements No. TS-R-1

## **Basic Information**

### **Shipper:**

Mackay.  
Queensland 4740. Australia

### **Freight Forwarder:**

(suburb of Brisbane)  
Queensland 4014. Australia

### **Consignee:**

Germany

### **Radioactive Material:**

5 x Caesium-137 sealed sources.  
Total Activity 53.65 GBq

Serial numbers:

Special Form Approval Certificate issued by the Competent Authority of USA  
USA/0634/S-96, Revision 3 expiring April 30, 2013

### **Packaging:**

One (1) Type A package (L)38 x (W)30 x (H)32 cm in an Overpack

Consisting of:

- i. an inner packaging being a lead pot and lid
- ii. a polystyrene intermediate packaging
- iii. an outer packaging being a fibreboard box

Overpack:

- i. Fibreboard box – 4GV/X30/S/12/-----  
(L)46 x (W)45 x (H)40 cm “OVERPACK” with polystyrene filling

Packaging manufacturer: Type A: Germany  
Overpack: Australia

## Identified Non-Compliances with the ICAO-TI

1. The Dangerous Goods Transport Document (Shippers Declaration for Dangerous Goods) Appendix A – includes an Authorization reference to USA/0356/S-96(Rev 12) which is not applicable to the Special Form Radioactive Material in this consignment

NATURE AND QUANTITY OF DANGEROUS GOODS						
Dangerous Goods Identification						
UN or ID No.	Proper Shipping Name	Class or Division (Subsidiary Risk)	Packing Group	Quantity and type of packing	Packing Inst.	Authorization
UN 3332	RADIOACTIVE MATERIAL, TYPE A PACKAGE, SPECIAL FORM	7		Cs-137 1 TYPE A PACKAGE x 53.85 GBq  OVERPACK USED	Yellow II TI 1.0 DIMS (L) 36 x (W) 30 x (H) 32 cm	Special Form Certificate No USA/0634/ S-96 (Rev 3) and USA/0356/ S-96 (Rev 12) Attached

[Refer to: ICAO-TI 5;4.1.5.6 g). IATA DGR 10.8.3.9.4. TS-R-1: para 544(j)]

2. A Quality Assurance programme was not established and implemented for the use and maintenance of the package. The Quality Assurance programme for the package failed to ensure that packagings are periodically inspected, repaired and maintained in good condition so that they continue to comply with all relevant requirements and specifications, even after repeated use.

Examples of the lack of Quality Assurance are:

- the shipper did not have a copy of instructions from the manufacturer of the Type A package in relation to the proper closing of the inner container.
- As a result of repeated use and no maintenance, the intermediate polystyrene packaging material was deformed to the extent that it no longer assisted to provide a secondary means of ensuring the lid of the containment system was retained.
- the shippers (consignor) processes failed to include checking the closure of the containment system.

Abbildung 26: eine Quelle eingekleidet



Abbildung 35



Abbildung 36



[Refer to: ICAO-TI 1;6.3, 4;9.1.7 and 5;1.1. IATA DGR 10.0.3 and 10.5.7.2 TS-R-1 para's 306, 502 and 543.]



**Other Issues Considered** – that were not contrary to existing requirements

**Package Dimensions – an IATA-DGR requirement**

The dangerous goods transport document (Shippers Declaration for Dangerous Goods) includes the dimensions of the package and not the dimensions of the overpack.

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Package dimensions: (L)38 x (W)30 x (H)32 cm

Overpack dimensions: (L)46 x (W)45 x (H)40 cm

The information required to be provided on a dangerous goods transport document is found in the ICAO-TI 5;4.1.4 and TS-R-1 at para 544.

The same information is found in the IATA-DGR at 10.8.3.

ICAO-TI 5;4.1.5.6 e), TS-R-1 para 544(h) and IATA-DGR 10.8.3.9.3 are equivalent references in relation to packages of II-YELLOW and III-YELLOW.

However, the IATA-DGR is more restrictive and also requires the dimensions of the package, overpack or freight container to be stated.

- *for Category “II-Yellow” and “III-Yellow” only—Transport Index and dimensions including dimensional units of each package, overpack or freight container. The dimensions must be shown in the order length x width (or diameter for drum-shaped packages) x height, with the height as the last dimension. “L”, “W” (or “D”), “H” may be shown immediately preceding each dimension. The Transport Index must be rounded up to the first decimal place;*

Interpretation of this requirement could imply that the dimensions of the package and the overpack and the freight container must be given. Alternatively, interpretation of this requirement could imply that you can decide to give the dimensions of any one these being the package dimensions, or the dimensions of the overpack, or the dimensions of the freight container.

The purpose of the dimensions is to permit calculations to be made in relation to the distance from the surface of a package, overpack or freight container from passengers and animals to ensure separation during flight. [ICAO-TI 7;2.9.6 & IATA-DGR 9.3.10]

The dimensions required for air transport under the IATA-DGR are the actual dimensions of the package being described on the dangerous goods transport document i.e. if it is an overpack then the overpack dimensions are required.



## Package Orientation

The lead containment system was packed in a vertical orientation within the package and overpack. The overpack was labelled with package orientation labels.

The escape of the sealed sources from the containment system indicates that at some stage during transport the package orientation was probably not vertical.



There was no damage or marks evident to the outside of the overpack to indicate that the package had been dropped during handling but there is some indication from wear on labels that the package has been on its side.

If the overpack had been upright at all stages during transport it is unlikely that containment would have been lost during the normal conditions of transport.

It is therefore concluded that the package was not kept upright in accordance with the orientation label during transport but the place at which this occurred is not known other than it was at some point after being checked prior to being lodged at Brisbane Airport, Australia.

## Containment System Closure

The existing requirement for the design of the closure of a containment system for a Type A package is as follows per TS-R-1 para 639. [ICAO-TI 6;7.6.7 and IATA-DGR 10.6.2.4.2]

*The design shall include a containment system securely closed by a positive fastening device which cannot be opened unintentionally or by a pressure which may arise within the package.*

This type of design fails to ensure that a Type A package cannot be shipped without ensuring the proper closure of the containment system and only requires a single means of closure.

It may be more appropriate for Type A package designs to include a containment system that prevents closure of the package without the containment system being closed. Further, it may also be appropriate for any closure on the containment system to also be held securely in place by a secondary means (similar to that required in ICAO-TI 4;1.1.4.1)

## **Closing of Packagings**

The ICAO-TI contains a General Packing Requirement applicable to all classes of dangerous goods except Class 7 as follows:

*...Packaging (including inner packagings and receptacles) must be closed in accordance with the information provided by the manufacturer...*

[ICAO-TI 4;1.1.1 and IATA-DGR 5.0.2.4.1

Similarly, the requirement that a shipper must have the instructions for the closing of the package, and other preparations for shipment, is explicitly stated in the TS-R-1 para 558 [ICAO-TI 4;9.1.8] but unfortunately this does not apply to Type A packages except Type AF (those containing fissile material).

It may be possible to infer that the Quality Assurance programme required by paragraph 306 of the TS-R-1 intends that such instructions should be provided but a specific requirement in the TS-R-1 may be clearer.

In the case of this incident, the shipper did not have any instructions from the package manufacturer relating to closing and preparation of the packaging.

## **Relevant Legislation**

1. Civil Aviation Act 1988 – Section 23 – Dangerous Goods
2. Civil Aviation Safety Regulations 1998 – Part 92 – Dangerous Goods
3. International Civil Aviation Organization – Technical Instructions for the Safe Transport of Dangerous Goods by Air [DOC:9284] 2011-2012 edition
4. International Atomic Energy Agency – Regulations for the Safe Transport of Radioactive Material – 2009 Edition – Safety Requirements No. TS-R-1

*Note: The documents used in this investigation were the documents applicable at the time of transport. This means that some quoted references do not align with newer editions.*

## **Release of this Report**

The Civil Aviation Safety Authority, Australia is the Competent Authority for the air transport of radioactive material in Australian territory. The release of this report is made in the interests of the safety of air navigation and CASA has been communicating with other relevant Competent Authorities in Australia and overseas.

This copy of the report has been de-identified as the identity of the shipper, consignee, freight forwarder and airline are not relevant to the Safety Message and the details in the incident report are provided for consideration in this regard.

### **Safety Recommendations**

In relation to this incident, the following safety recommendations are made:

1. The shipper of Type A packages is requested to review their existing Quality Assurance programme to establish processes and procedures for packagings that will ensure Quality Assurance as required by paragraph 306 of the TS-R-1.
2. The manufacturer of the Type A package is requested to ensure that users of their packagings receive or have access to the information necessary to achieve Quality Assurance in relation to the use (including closure), periodic inspection, repair, maintenance and repeated use of the Type A packagings.
3. Details of the areas identified for improvement in the TS-R-1 will be submitted along with a copy of the report to the International Atomic Energy Agency – Transport Standards Committee and the ICAO Dangerous Goods Panel for consideration.

### **Safety Messages**

The Safety Message is that shippers (consignors) and manufacturers must ensure that they have an effective Management System for the Safe Transport of Radioactive Material. (previously Quality Assurance under para 306 of TS-R-1)

The Management System must include documented processes and procedures in relation to the maintenance, preparation, use and closing of packages.

In particular, where Type A packages are subject to repeated use, each user must have instructions in relation to the inspection, preparation and proper closing of the package. The IAEA document *The Management System for the Safe Transport of Radioactive Material TS-G-1.4* provides relevant guidance.

Persons packing Type A packages must always check the closing of the containment system and the condition of Type A packages being re-used to ensure they are in good condition. Air operators are reminded to ensure that packages bearing orientation labels are handled, stowed, restrained and stored in an upright position.



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17 September 2013