

TRANSPORTE EN EL SUMINISTRO DE FUENTES ENCAPSULADAS DE ALTA ACTIVIDAD

MAFESYS TER SL

EQUIPOS QUE UTILIZAN LAS FUENTES A SUMINISTRAR

- **Irradiadores biológicos para investigación. (Categoría I del IAEA)**
- **Irradiadores de sangre**
- **Equipos de gammagrafía**
- **Irradiadores industriales para esterilización (Categoría III del IAEA)**
- **Equipos de radioterapia**

Ejemplo de equipos Irradiadores biológicos para investigación.

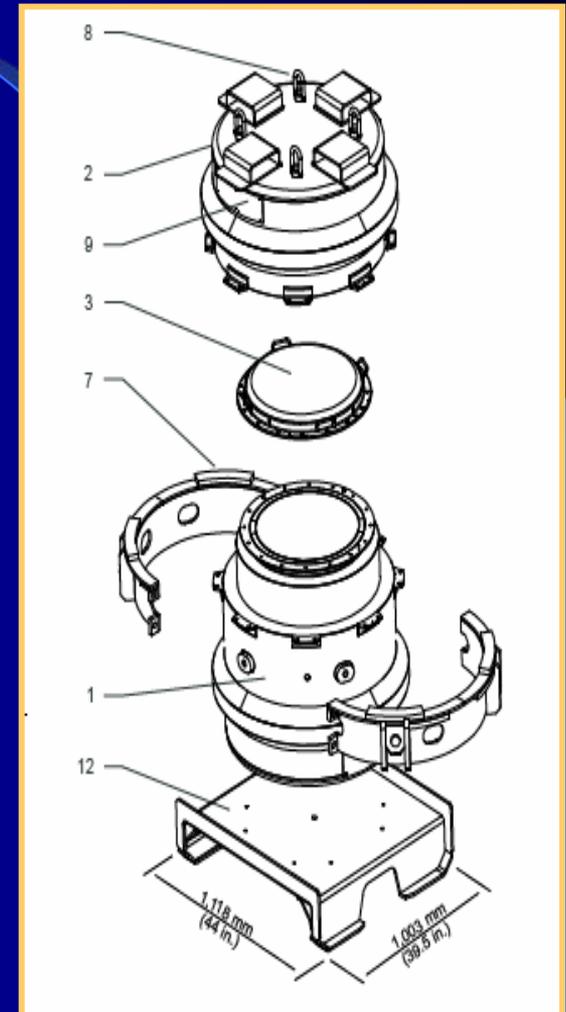


Irradiador de Categoría I según IAEA. Las fuentes selladas están perfectamente contenidas en un contenedor seco construido con materiales sólidos. Las fuentes encapsuladas están blindadas en todo momento y el acceso a ellas de las personas es físicamente imposible.

Cámara de irradiación. Fuentes siempre blindadas



Ejemplo de equipos Irradiadores de sangre y células



Ejemplo de equipos Irradiadores de sangre y células



Equipos de Gammagrafía



Irradiadores tipo piscina. IAEA Categoría III



Equipos de Radioterapia



HITOS A SUPERAR

- LA LOCALIZACION DE LA ACTIVIDAD PRECISA PARA CADA NECESIDAD
- LA LOCALIZACIÓN DE EMBALAJES DE TRANSPORTE APROPIADOS PARA LA ACTIVIDAD DE LAS FUENTES
- LA FABRICACIÓN HOMOLOGACIÓN O CONVALIDACIÓN
- EL ALQUILER DE DICHOS EMBALAJES VACIOS
- EL TRANSPORTE CON CONTENIDO RADIATIVO DE ALTA ACTIVIDAD
- EL TRANSPORTE DE EMBALAJES VACIOS

LOCALIZACION DE LA ACTIVIDAD PRECISA PARA CADA NECESIDAD

- Pocos “fabricantes”**
- Forma, actividad específica y tamaño apropiados**
- Las fuentes deben tener certificados de Forma Especial y hermeticidad actualizados**

LOCALIZACIÓN DE EMBALAJES DE TRANSPORTE APROPIADOS

- **Apropiados para la actividad de las fuentes**
 - El hueco de contención debe ser adecuado para la actividad y para el tamaño
- **Disponibilidad para el alquiler durante el plazo en que se lo necesita y con holgura para imprevistos. Autorización de comercializadora.**
- **Certificación en la UE “y” en USA.**
 - Homologación del diseño en el país de fabricación del contenedor
 - Homologación y convalidación en USA y España.

Fuentes y cápsulas

Product Code	Maximum external dimension (mm)		Active dimensions (mm)	
	Diameter	Length	Diameter	Length
RSL6000	12.49	17.85	9.0	9.6
RSL6010	14.69	20.40	11.2	11.6
RSL6020	17.49	22.90	14.0	14.1
RSL6030	21.29	26.35	17.8	17.6
RSL6040	27.10	28.40	23.6	19.6
RSL6050	30.15	70.35	25.5	52.4
RSL6060	36.15	65.35	32.2	57.0



Glass pencil (2cm Ø, 20 cm Length, 160 gm, 1200 Ci.)



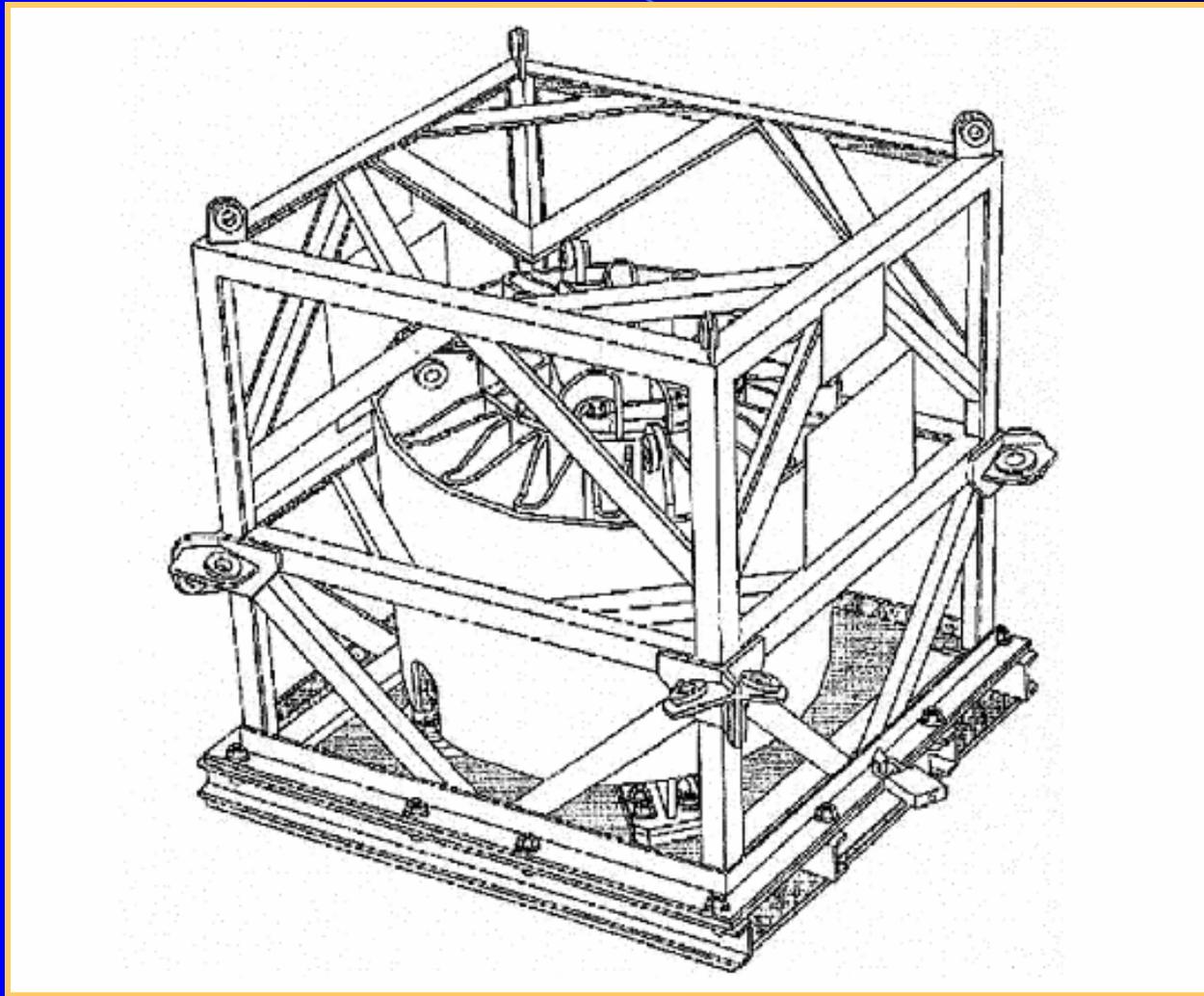
Porta capsulas fuentes y separadores



Porta capsulas



Embalaje del tipo B(U)



FABRICACIÓN HOMOLOGACIÓN Y CONVALIDACION LOCAL

- Coste de fabricación y homologación - Convalidación excesivo.
- Falta de laboratorios de ensayos con capacidad para la realización de las pruebas de homologación
- Mantenimiento de convalidaciones ante la Incertidumbre de nueva utilización en Europa/España.
- Validez para la CE de los homologados en cualquier estado miembro.

ALQUILER DE EMBALAJES VACIOS

- Poquísima disponibilidad de embalajes apropiados. Europeos. USA.
- Rechazo inicial de los propietarios de los existentes por tenerlos comprometidos para transporte de grandes cargas.
- Precios de alquiler disuasorios.

TRANSPORTE DEL MATERIAL RADIATIVO

Se dan 2 situaciones y 2 subcasos:

- Transporte Local/Europeo sujeto a legislación y regulaciones Europeas
- Transporte Trasatlántico (aéreo) sujeto a legislación y regulaciones USA/IATA
 - Fuentes de alta actividad Categoría 1
 - Notificación y autorización previa al envío por las autoridades
 - Más de 100TBq = más de 2700Ci para Cs-137
 - Fuente de alta actividad Categoría 2
 - Menos de 100TBq = menos 2700Ci para Cs-137

Señalización de Bulto Tipo B(U) Reviss 3750 con 99,53TBq de Cs 137



Bulto Tipo B(U) Revis 3750. Contenidos máximos

1.2 Authorised Contents

- a) Encapsulated solid radionuclides in metallic or chloride form as detailed in Section 1.2(c) below, with maximum content weight of 27kg
- b) Any of the radionuclides listed below with the maximum activity, as listed, or mixtures of these radionuclides such that sum of the proportions of the activities does not exceed 1.0

Radionuclide	Physical State	Chemical Composition or State	Maximum Activity
^{60}Co	Solid - Special Form	Metal	12.6PBq (340kCi)
^{137}Cs		Chloride	5.55PBq (150kCi)

- c) The total rate of heat generation shall not exceed 5.24 kW
- d) The carriage of ^{60}Co by air with an activity above 1.2PBq and up to the maximum specified above is only allowed with permission from the air transport authority of each national air space entered or transited. In the UK, this is the Civil Aviation Authority (CAA).

!!! De 12,5 a 20 Kg iii

Destinos Aéreos Europeos

- Problema con Iberia. Cargueros.
- Vuelos USA – MADRID. Cargueros
- Otros destinos europeos
- Problemas para transporte por carretera desde ciertos países europeos.

Descarga de Camión de un Bulto B(U)



Estiba en Camión en Uso Exclusivo



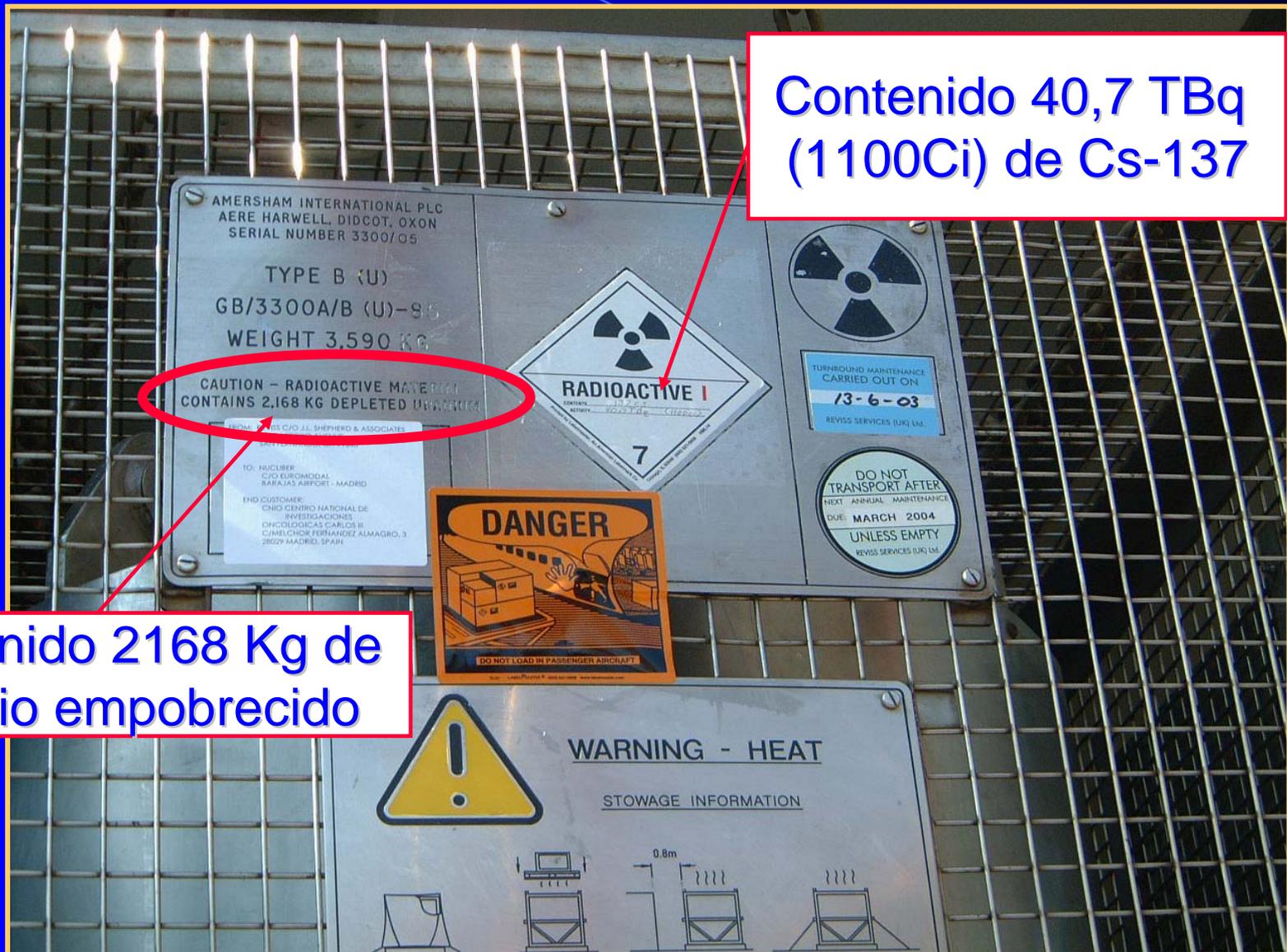
Camión para transporte de Bultos B(U) con fuentes de alta actividad



EL TRANSPORTE DE EMBALAJES VACIOS

- Dificultades con embalajes que contengan D(U) como material de blindaje para transporte marítimo.
- Alto costo de transporte aéreo debido a su gran peso.
- Requisitos muy estrictos para la preparación y certificación que el embalaje está libre de contenido radiactivo.

Contenido de Uranio empobrecido



Contenido 40,7 TBq
(1100Ci) de Cs-137

Contenido 2168 Kg de
uranio empobrecido

Lista de comprobación para preparación de embalajes vacíos

J.L. Shepherd & Associates
1010 Arroyo Ave.
San Fernando, CA 91340

Quality Record

DOMESTIC MOTOR FREIGHT/AIR FREIGHT HEALTH PHYSICS FINAL SURVEY, ROUTINE DETERMINATIONS, CHECKLIST FOR EMPTY, UN2908, EXCEPTED PACKAGE SHIPMENTS

This Survey Checklist is to be used to generate Shipping Document and Bill of Lading information and should be attached to all copies of the Shipping Document for record keeping distribution.

Customer: Revis Job No. MK5221

Empty: Affix UN2908 label to each side and proceed to Survey Data Section

Does any portion of this package contain depleted Uranium? (Yes No N/A
(If yes, this shipment must be processed as a radioactive materials shipment. This form may not be used.)

Empty Type B Package Serial Number: 08 Condition? Good

Interior Contamination: <300 dpm/ 300 cm² /MDCR.

Exterior Contamination: <300 dpm/ 300 cm² /MDCR.

EMPTY (DOT 7A, 2R or OTHER) (circle one)

Package Serial Number or Description: _____ Condition: N/A

Interior: _____ dpm/ _____ cm² /MDCR.

Exterior: _____ dpm/ _____ cm² /MDCR.

Survey Instrument Used: Ludlum 14

Serial Number: 240007

Calibration Due Date: 10-8-08

Package Weight: 3.573 kg _____ lbs

20WC Max Gross Weights: 20WC 01 = 500 lbs
20WC 02 = 1000 lbs
20WC 03 = 2000 lbs
20WC 04 = 4000 lbs
20WC 05 = 6000 lbs
GB/3750 A/B(U)-96

Survey Performed By: [Signature] Date: 8-26-08

Reviewed & Approved By: _____ Date: _____

Lista de Comprobación IATA

2009

DANGEROUS GOODS CHECKLIST FOR A RADIOACTIVE SHIPMENT

The recommended checklist appearing on the following pages is intended to verify shipments at origin.

Never accept or refuse a shipment before all items have been checked.

Is the following information correct for each entry?

SHIPPER'S DECLARATION FOR DANGEROUS GOODS (DGD)

	YES	NO*	N/A
1. Two copies in English and in the IATA format [10.8.1.2; 10.8.1.4 and 8.1.1].....	<input type="checkbox"/>	<input type="checkbox"/>	
2. Full name and address of Shipper and Consignee [10.8.3.1, 10.8.3.2]	<input type="checkbox"/>	<input type="checkbox"/>	
3. If the Air Waybill number is not shown, enter it. [10.8.3.3]	<input type="checkbox"/>	<input type="checkbox"/>	
4. The number of pages shown [10.8.3.4]	<input type="checkbox"/>	<input type="checkbox"/>	
5. The non-applicable Aircraft Type deleted [10.8.3.5]	<input type="checkbox"/>	<input type="checkbox"/>	
6. If full name of Airport or City of Departure or Destination is not shown, enter it. [10.8.3.6 and 10.8.3.7].....	<input type="checkbox"/>	<input type="checkbox"/>	
7. The word "Non-Radioactive" deleted [10.8.3.8]	<input type="checkbox"/>	<input type="checkbox"/>	

Identification

8. UN Number, preceded by prefix "UN" [10.8.3.9.1, Step 1].....	<input type="checkbox"/>	<input type="checkbox"/>	
9. Proper Shipping Name [10.8.3.9.1, Step 2]	<input type="checkbox"/>	<input type="checkbox"/>	
10. Class 7 [10.8.3.9.1, Step 3]	<input type="checkbox"/>	<input type="checkbox"/>	
11. Subsidiary Risk, in parentheses, immediately following Class [10.8.3.9.1, Step 4]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Packing Group if required for Subsidiary Risk [10.8.3.9.1, Step 5]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Quantity and Type of Packing

13. Name or Symbol of Radionuclide(s) [10.8.3.9.2, Step 6 (a)].....	<input type="checkbox"/>	<input type="checkbox"/>	
14. A description of the physical and chemical form if in other form [10.8.3.9.2, Step 6 (b)]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. "Special Form" (not required for UN 3332 or UN 3333) or low dispersible material [10.8.3.9.2, Step 6 (b)]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. The number and type of packages and the activity in becquerel or multiples thereof in each package. For Fissile Material the total weight in grams or kilograms of fissile material may be shown in place of activity [10.8.3.9.2, Step 7]	<input type="checkbox"/>	<input type="checkbox"/>	
17. For different individual radionuclides, the activity of each radionuclide and the words "All packed in one" [10.8.3.9.2, Step 7]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. Activity within limits for Type A packages [Table 10.3.A], Type B, or Type C (see attached competent authority certificate)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. Words "Overpack Used" shown on the DGD [10.8.3.9.2, Step 8].....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Packing Instructions

20. Category of package(s) or overpack [10.8.3.9.3, Step 9 and Table 10.5.C]	<input type="checkbox"/>	<input type="checkbox"/>	
21. Transport Index and dimensions for Category II and Category III only [10.8.3.9.3, Step 9].....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. For Fissile Material the Criticality Safety Index or the words "Fissile Excepted" [10.8.3.9.3, Step 9].....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Authorizations

23. Identification marks shown and a copy of the document in English attached to DGD for the following [10.8.3.9.4, Step 10; 10.5.7.2.2]:			
– Special Form approval certificate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
– Low dispersible material approval certificate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
– Type B package design approval certificate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
– Other approval certificates as required	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24. Additional Handling Information [10.8.3.11]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25. The air transport statement included [10.8.3.12].....	<input type="checkbox"/>	<input type="checkbox"/>	
26. Name and Title (or Department) of Signatory, Place and Date indicated [10.8.3.13 and 10.8.3.14].....	<input type="checkbox"/>	<input type="checkbox"/>	
27. Signature of Shipper [10.8.3.15].....	<input type="checkbox"/>	<input type="checkbox"/>	
28. Amendment or alteration signed by Shipper [10.8.1.7].....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

YES NO* N/A

AIR WAYBILL – HANDLING INFORMATION

29. The statement: "Dangerous goods as per attached Shipper's Declaration" or "Dangerous Goods as per attached DGD" [10.8.8.1(a)]	<input type="checkbox"/>	<input type="checkbox"/>	
30. Cargo Aircraft Only or CAO, if applicable [10.8.8.1(b)]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31. Where non-dangerous goods are included, the number of pieces of dangerous goods shown [10.8.8.2].....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

PACKAGE(S) AND OVERPACKS

32. Same number and type of packagings and overpacks delivered as shown on DGD	<input type="checkbox"/>	<input type="checkbox"/>	
33. Unbroken transportation seal [10.6.2.4.1.2; 10.6.2.5.2] and package in proper condition for carriage [9.1.1.3; 9.1.1.4].....	<input type="checkbox"/>	<input type="checkbox"/>	

Markings

34. Industrial packages and packages containing Fissile material marked as per 10.7.1.3.3 or 10.7.1.3.7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
35. Type A packages, marked as per 10.7.1.3.4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
36. Type B packages, marked as per 10.7.1.3.5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
37. Type C packages, marked as per 10.7.1.3.6	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
38. The UN Number [10.7.1.3.1]	<input type="checkbox"/>	<input type="checkbox"/>	
39. The Proper Shipping Name [10.7.1.3.1]	<input type="checkbox"/>	<input type="checkbox"/>	
40. The full Name and Address of the Shipper and Consignee [10.7.1.3.1]	<input type="checkbox"/>	<input type="checkbox"/>	
41. The permissible gross weight if it exceeds 50 kg [10.7.1.3.1]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Labelling

42. Two correctly completed Radioactive Hazard labels on opposite sides [10.7.3.3; 10.7.4.3.1]	<input type="checkbox"/>	<input type="checkbox"/>	
43. Applicable label(s) identifying the Subsidiary risk next to the Radioactive Hazard labels [10.7.3.2; 10.7.4.3] completed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
44. Two Cargo Aircraft Only labels, if required, on the same surface near the Hazard labels [10.7.4.2.4; 10.7.4.3.1; 10.7.4.4.1].....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
45. For fissile materials, two correctly completed Criticality Safety Index (CSI) labels on the same surface as the hazard labels [10.7.3.3.4; 10.7.4.3.1].....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
46. All labels correctly affixed and irrelevant marks and labels removed [10.7.1.1; 10.7.2.1; 10.7.4]	<input type="checkbox"/>	<input type="checkbox"/>	

For Overpacks

47. Packaging markings as required must be clearly visible or reproduced on the outside of the overpack [10.7.1.4.1]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
48. The word "Overpack" marked if all markings are not visible [10.7.1.4.2]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
49. Hazard labels reflect total for overpack [10.7.3.4]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
50. Conditions of 10.7.3.4 complied with	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

GENERAL

51. State and Operator variations complied with [2.9]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
52. Cargo Aircraft Only shipments, a cargo aircraft operates on all sectors	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
53. Packages containing Carbon dioxide solid (dry ice), the marking, labelling and documentary requirements complied with [Packing Instruction 904; 7.1.5.1 (e); 7.2.3.10].....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Comments: _____

Checked by: _____

Place: _____ Signature: _____

Date: _____ Time: _____

"IF ANY BOX IS CHECKED "NO", DO NOT ACCEPT THE SHIPMENT AND GIVE A DUPLICATE COPY OF THIS COMPLETED FORM TO THE SHIPPER.

Documentos para devolución

UN2908
Container Return Notification

To: Transport Administrator, REVISS Services (UK) Ltd
Fax: +44 (0) 1235 435064

From:

Please complete this form, attach following documents and fax to the number at the top of this form.

- ATTACH COPY OF DANGEROUS GOODS DECLARATION* (by sea/air) or CONSIGNOR CERTIFICATE (by road)
 - ATTACH MONITORING CERTIFICATE
 - ATTACH COPY OF AIR/SEA WAYBILL*
- *Note a Dangerous Goods Declaration may not be required for the shipment of 'Excepted /Limited Quantity Packages', however the Air/Sea Waybill must include the appropriate UN number and Proper Shipping Name when this is the situation (neither is required for 'Exempt' consignments)

Please be advised that we are ready to return the following container(s):

Container Type	Serial Number	Total Weight in Kg

They will be returned under the following shipping name (✓ tick one only):

- UN2908 – Radioactive material, Excepted package – Empty packaging
 UN2910 – Radioactive material, Empty package – Limited quantity of material
 UN2912 – Radioactive material, Low Specific Activity (LSA-I)
 Non Class 7 or Exempt empty shipping package

Method of return (air/road/sea) _____

Estimated date of return: _____

Carrier: _____

Signed: _____ Date: _____

Print Name: _____ Contact No: _____ Fax: _____

REVISS Services (UK) Ltd, confirm acceptance/non-acceptance of the above packages.

Acceptance:

Please forward details of shipment. (Time of arrival and destination in UK.)

Please remember to remove all inbound content and address labels before placing return address and empty label.

Non-Acceptance:

Please arrange the following before the containers can be returned/accepted:

Signed: _____ Date: _____

PLEASE DO NOT DESPATCH CONTAINERS UNTIL ACCEPTANCE HAS BEEN GIVEN BY REVISS SERVICES (UK) LTD

UN2908
CONSIGNOR'S CERTIFICATE

Package Number/Reference: _____

Contents description; EMPTY

Date of Despatch; _____

FROM	TO
	REVISS Services (UK) Ltd. Building 466 Harwell Campus Didcot. OXON. OX11 0TN UK.

UN Number: UN2908
Proper shipping name: Radioactive material, excepted package, empty

Example

packaging.

Contents: N/A

Shipping Container No: _____ Gross Weight: _____ kg.

Physical Form; Liquid Solid Special Form* Gas

Chemical Form; N/A

Category; I-White II-Yellow III-Yellow Transport Index; N/A

If Type B, Certificate Number; N/A

*Special Form, Certificate Number; N/A

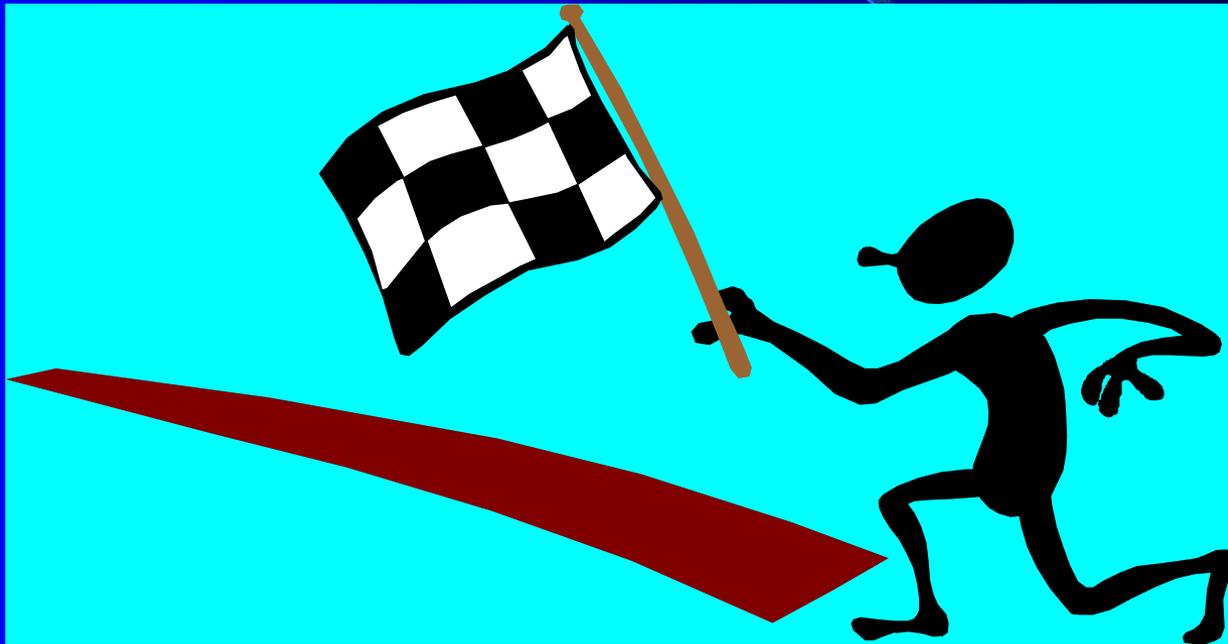
I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, marked, labelled/placarded and are in all respects in a proper condition for transport according to the applicable international and national governmental regulations.

Name: _____ Signed: _____ Date: _____

RESUMEN DE LAS DIFICULTADES

- POCOS MODELOS DE EMBALAJE B(U) PARA EL TAMAÑO DE LOS PORTAFUENTES
- DIFICULTAD CRECIENTE DE ENSAYOS PARA HOMOLOGACIÓN COMO B(U)
- ALTO PRECIO DE FABRICACION Y ALQUILER DE LOS EMBALAJES
- COSTOS IMPLICADOS EN EL PROCESO DE RENOVACIÓN DE CERTIFICADOS B(U) Y DE CONVALIDACIONES REGLAMENTARIAS
- RECHAZO DE LOS TRANSPORTISTAS POR TRATARSE DE MATERIAS RADIATIVAS Y (DU) (IBERIA Y NAVIERAS) AUNQUE SE CUMPLAN LOS REQUISITOS REGLAMENTARIOS.

MUCHAS GRACIAS



Miguel Ángel Fernández-Enríquez
Mafesyster, SL.