Type A Certificate

1. Introduction

This certificate has been raised in accordance with IAEA SSR-6 2012.

This document has been created in accordance with the HMA Package Design Safety Report revision 1, published 2015.

Model and Description: HMA
Special Form approved for use: CZ/1013/S-96, CZ/1019/S-96 CZ/1026/S-96 B/012/S-96, B/014/S-96 USA/0166/S USA/0392/S-96, USA/0502/S-96, USA/0608/S-96, USA/0627/S-96, USA/0703/S, USA/0712/S-96, USA/0785/S-96, USA/0796/S-96, USA/0812/S-96, USA/0335/S-96 PL/0007/S-96, PL/0008/S-96, PL/0016/S-05, PL/0016/S-96, PL/0017/S-05, PL/0017/S-96, PL/0018/S-05, PL/0021/S-05 PL/0022/S-05, PL/0023/S-05, PL/0024/S-05, PL/026/S-12 PL/0029/S, PL/0016/S-96 RUS/6223/S-96, RUS764937S-96
Open source: The HMA can be used to transport sources that are not in possession of a valid special form certificate. If a special form capsule which does not appear on the above lift is to be transported it must be classed as an open source.
Compliance: This certificate, the PDSR it is based upon, and the associated testing conducted, have been produced and carried out in accordance with the Gilligan Engineering Services Quality Management system. The quality management system has been designed to meet and is audited to demonstrate its compliance with **ISO 9001:2015** and a certificate demonstrating this is available on request. This certificate demonstrates the packages' compliance with **IAEA SSR-6 2012** as a Type A Package.

Maximum package activities loaded as one source in a single shielded container housed within the HMA:

HMA		
	A1 - as special form	A2 - as open source
Americium 241	1 GBq	600 GBq
Cadmium 109	4.07 GBq	4.07 GBq
Caesium 137	2000 GBq	600 GBq
Cobalt 57	10000 GBq	10000 GBq
Cobalt 60	400 GBq	400 GBq
Depleted Uranium	3.6 GBq	3.6 GBq
Iridium 192	1000 GBq	600 GBq
Iron 55	40000 GBq	40000 GBq
Selenium 75	3000 GBq	2000 GBq

Ytterbium 169	4000 GBq	1000 GBq
Gadolinium 153	100000 GBq	9000 GBq
Permissible Gross Weight 250 kg		
The permitted isotopes are to be solid, metallic.		

2. Certificate Validity

Date of Certificate:	**06 August 2021**	Date of Expiry:	**06 August 2026**
Supporting PDSR Reference:	**HMA PDSR, rev1**	Certificate Reference:	**HMA Type A rev3**

Brian Dodds

Gilligan Engineering Services Ltd,

06 August 2021

3. General Requirements

3.1. Handling

IAEA SSR-6 607

The package shall be so designed in relation to its mass, volume, and shape that it can be easily and safely transported. In addition, the package shall be so designed that it can be properly secured in or on the conveyance during transport.

The package comprises two main components: an inner metallic radiography container (the shielded container) and an outer box with a bespoke packing volume assembly. The package will always constitute these two components when it has been properly packaged. The shielded container attributes most of the mass to the package and it is housed approximately in the centre of the drum when it is normal, vertical orientation. This gives the package a predictable centre of mass and ensures the package is stable when either standing vertically or laying on its side. The high package mass does not lend for manhandling the package however it is easily manoeuvred with a forklift truck or similar. The package can be secured in a conveyance using cargo strapping over the surface of the package.

Handling instructions can be found in the HMA Operating Manual which is available on the manufacturer's website or on request.

3.2. Lifting attachments

IAEA SSR-6 608, 609

The design shall be such that any lifting attachments on the package will not fail when used in the intended manner and that if failure of the attachments should occur, the ability of the package to meet other requirements of these Regulations would not be impaired. The design shall take account of appropriate safety factors to cover snatch lifting.

Attachments and any other features on the outer surface of the package which could be used to lift it shall be designed either to support its mass in accordance with the requirements of above or shall be removable or otherwise rendered incapable of being used during transport.

There are no lifting attachments such as handles on the HMA package. There are no attachments that can be made to the HMA drum. The HMA should be manoeuvred into place using lifting equipment and ideally the HMA should be palletised prior to being moved.

Handling instructions can be found in the HMA Operating Manual which is available on the manufacturer's website or on request.

3.3. External Surfaces

IAEA SSR-6 para 610

As far as practicable, the packaging shall be so designed and finished that the external surfaces are free from protruding features and can be easily decontaminated.

The packing volumes used in the HMA are contained in a plastic bag. The plastic bag will give a wipe clean surface to the packing volumes. The stainless-steel drum interior is perfectly smooth and therefore can be easily cleaned if it were to become contaminated. The exterior of the package is a smooth stainless steel 316 surface. This is easily decontaminated.

3.4. Outer Layer

IAEA SSR-6 para 611

As far as practicable, the outer layer of the package shall be so designed as to prevent the collection and the retention of water.

There are no crevices in the surface of the package. It is possible for water to land and be retained on the lid of the package. This water will not be able to enter the package as the lid of the package is sealed. The water will have a maximum amount that can accumulate prior to it over spilling from the lid and the water that does accumulate can be easily dispersed when required. If the drum is lay on its side, it is not possible for water to accumulate.

3.5. Added Features

IAEA SSR-6 para 612

Any features added to the package at the time of transport which are not part of the package shall not reduce its safety.

There are no added features to the package which would reduce its safety.

3.6. Vibration and Mechanical Fixings

IAEA SSR-6 para 613

The package shall be capable of withstanding the effects of any acceleration, vibration or vibration resonance which may arise under routine conditions of transport without any deterioration in the effectiveness of the closing devices on the various receptacles or in the integrity of the package as a whole. In particular, nuts, bolts and other securing devices shall be so designed as to prevent them from becoming loose or being released unintentionally, even after repeated use.

The choice of foam used in the HMA is key. The foam acts as a shock absorber between the high mass of the shielded container and the thin-walled drum during an impact. Moreover, the foam retards any vibration the package undergoes during transportation. Vibration, and resonance caused by vibration, could have untoward effects on the shielded container and the containment. The foam to be used as part of the HMA has been found to limit the effects of vibration on the HMA.

The effects on acceleration have been tested directly on the HMA. During the free drop test there is a very high acceleration force due to the high mass, which the HMA is capable of withstanding.

3.7. Seals

IAEA SSR-6 para 637

The outside of the package shall incorporate a feature such as a seal which is not readily breakable and which, while intact, will be evidence that the package has not been opened.

The HMA contains a locking ring for securing the lid of the package. When the ring is closed a tamper seal can be inserted through a connection in the ring. When a seal is installed in this position it is not possible to open the drum without first breaking or removing the seal.

3.8. External radiation levels

IAEA SSR-6 para 526, 527

Except for consignments under exclusive use, the TI of any package or overpack shall not exceed 10, nor shall the CSI of any package or overpack exceed 50.

Except for packages or overpacks transported under exclusive use by rail or by road under the conditions specified in para. 573, or under exclusive use and special arrangement by vessel or by air under the conditions specified in paras 575 or 579, respectively, the maximum radiation level at any point on the external surface of a package or overpack shall not exceed 2 mSv/h.

If the surface dose rate is greater than 2mSv/hr either the source contained has too high an activity or the shielding offered by the shielded component is not sufficient. The package is not to be transported if the surface dose rate is greater than 2mSv/hr.

4. Additional Requirements

4.1. Overall size

IAEA SSR-6 para 636

The smallest overall external dimension of the package shall not be less than 10 cm.

The package exceeds the minimum requirement of 10cm on all its sides.

4.2. Tie-down

IAEA SSR-6 para 638

Any tie-down attachments on the package shall be so designed that, under normal and accident conditions of transport, the forces in those attachments shall not impair the ability of the package to meet the requirements of these Regulations.

There is no component in the HMA which can be used as a tie down attachment. The package may be tied down using cargo strapping that has been applied evenly over the surface of the package. The strapping can then be anchored either side of the package to a suitable mount in the conveyance.

Instructions regarding how the package may be secured when being transported can be found in the HMA Operating Manual which is available on the manufacturer's website or on request.

4.3. Containment and Shielding and Contamination

IAEA SSR-6 639

The design of the package shall take into account temperatures ranging from –40°C to +70°C for the components of the packaging. Attention shall be given to freezing temperatures for liquids and to the potential degradation of packaging materials within the given temperature range.

Section 2.3(e) of the PDSR details the temperature testing carried out on the package. The package components displayed no degradation within the given temperature range.

IAEA SSR-6 641

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.

The package is required to be sealed against the leakage of radioactive material during transportation. This is achieved by following at least one of the three following procedures.

- The contents have to be possession of a valid SFRAM that is accompanied by a valid (within the previous two years) sealed source test certificate.
- The shielding component of the package must be stored inside two sealed plastic-based bags. There must be the ability to carry out a leakage test in between these two layers. The findings of the leakage test must be reported on the transportation documents.

- The shielding component of the package must be of construction to prevent the release of contamination. This must be able to be verified by a leakage test carried out prior to transportation with the results being shown on the transportation documents. The inner component must then be sealed inside a plastic bag prior to be being installed in the package.

IAEA SSR-6 643

If the containment system forms a separate unit of the package, it shall be capable of being securely closed by a positive fastening device which is independent of any other part of the packaging.

The containment system comprises of either a special form capsule or the shielded container. It is not possible to open the special form capsule inadvertently or unintentionally. IAEA SSR-6 shows it should only be possible to open a special form capsule by the destruction of the capsule. The shielded container will be secured inside two sealed bags. It will not be possible to inadvertently open these bags. All sharp edges on the shielded container will be covered in a tight fitting shrink wrap material to ensure the containment bags cannot be punctured by a sharp edge.

IAEA SSR-6 644

The design of any component of the containment system shall take into account, where applicable, the radiolytic decomposition of liquids and other vulnerable materials and the generation of gas by chemical reaction and radiolysis.

See section 3.4 for compliance.

IAEA SSR-6 645

The containment system shall retain its radioactive contents under a reduction of ambient pressure to 60 kPa.

The containment system will be held in place within the drum by the packing volumes. The loose-fitting nature of the containment bags ensures that so long as the packing volumes are contained within the drum, and the drum remains intact, a reduction of ambient air pressure to 60 kPa will leave the containment system intact. A pressure evaluation has been carried out on for the package. It has been shown in section 2.4(e) of the PDSR that the drum will remain intact with an ambient pressure reduction to 60 kPa.

IAEA SSR-6 647

A radiation shield which encloses a component of the package specified as a part of the containment system shall be so designed as to prevent the unintentional release of that component from the shield. Where the radiation shield and such component within it form a separate unit, the radiation shield shall be capable of being securely closed by a positive fastening device which is independent of any other packaging structure.

The shielded components allowed for transportation in the package is shown later in this certificate. The shielded component provides all the radiation shielding for the package, no significant shielding is offered by the other package materials. The testing the HMA has undergone has satisfied the requirements of IAEA SSR-6 including compliance with para 647.

The shielded containers allowed for transportation satisfy para 647 in that:

- The radioactive material cannot be unintentionally released.
- The radiation shield, or device in which it is contained, can be securely closed.
- The closing mechanism of the device is a positive mechanism such as a keyed lock, a screwed enclosure or similar.

IAEA SSR-6 649

The design of a package intended for liquid radioactive material shall make provision for ullage to accommodate variations in the temperature of the contents, dynamic effects, and filling dynamics.

The package is not permitted to carry liquid contents and therefore the package is not required to comply with this.

IAEA SSR-6 650

A Type A package designed to contain liquid radioactive material shall, in addition:

(a) Be adequate to meet the conditions specified in para. 648(a) if the package is subjected to the tests specified in para. 725.

(b) Either:

(i) Be provided with sufficient absorbent material to absorb twice the volume of the liquid contents. Such absorbent material must be suitably positioned so as to contact the liquid in the event of leakage; or

(ii) Be provided with a containment system composed of primary inner and secondary outer containment components designed to enclose the liquid contents completely and to ensure their retention within the secondary outer containment components, even if the primary inner components leak.

The package is not permitted to carry liquid contents and therefore the package is not required to comply with this.

IAEA SSR-6 651

A package designed for gases shall prevent loss or dispersal of the radioactive contents if the package were subjected to the tests specified in para. 725. A Type A package designed for tritium gas or for noble gases shall be excepted from this requirement.

The package is not permitted to carry gaseous contents and therefore the package is not required to comply with this.

4.4. Chemical Reaction

IAEA SSR-6 614

The materials of the packaging and any components or structures shall be physically and chemically compatible with each other and with the radioactive contents. Account shall be taken of their behaviour under irradiation.

The HMA construction materials are polyurethane foam, polythene, and stainless steel 316. There will be no chemical reaction between any of these components. An analysis was carried out on the reaction of the polyurethane foam with radiation where samples of the material was given a lifetime radiation dose. There was no significant effect as a result of this.

4.5. Valves

IAEA SSR-6 para 615, 646.

All valves through which the radioactive contents could escape shall be protected against unauthorized operation.

All valves, other than pressure relief valves, shall be provided with an enclosure to retain any leakage from the valve.

There are no valves installed on the package.

4.6. Integrity

IAEA SSR-6 para 648

A package shall be so designed that if it were subjected to the tests specified below, it would prevent:

(a) Loss or dispersal of the radioactive contents; and

(b) More than a 20% increase in the maximum radiation level at any external surface of the package.

The package has been tested for normal conditions of transportation. The radioactive contents were contained following each of these tests and the shielding and containment systems remained intact. The PDSR or section 4 of this certificate can be consulted for further evidence of this.

4.7. Air Transport

IAEA SSR-6 para 619

For packages to be transported by air, the temperature of the accessible surfaces shall not exceed 50°C at an ambient temperature of 38°C with no account taken for insolation.

The package has not been certified for transportation by air.

IAEA SSR-6 para 620

Packages to be transported by air shall be so designed that if they were exposed to ambient temperatures ranging from –40°C to +55°C, the integrity of containment would not be impaired.

The package has not been certified for transportation by air.

5. Test Requirements

5.1. Water spray test

IAEA SSR-6 para 721

Water spray test: The specimen shall be subjected to a water spray test that simulates exposure to rainfall of approximately 5 cm per hour for at least one hour.

The water spray test was not conducted on the package. The package design prevents the ingression of water into the package. the package does not hold an IP rating however it was believed the water spray test would not affect the package significantly. The outer drum is manufactured from St Steel 316 and is not affected significantly by water.

5.2. Free drop test

IAEA SSR-6 para 722. (a)

Free drop test: The specimen shall drop onto the target so as to suffer maximum damage in respect of the safety features to be tested:

(a) The height of drop measured from the lowest point of the specimen to the upper surface of the target shall be not less than the distance specified in Table 14 for the applicable mass. The target shall be as defined in para. 717 [IAEA].

The package was suspended 1.2m from the target. The package was intact following the test with only a small crumple on the edge on which it was dropped, approximately 30mm of crushing. The PDSR part 2 can be consulted for evidence of this.

5.3. Stacking test

IAEA SSR-6 para 723

Stacking test: Unless the shape of the packaging effectively prevents stacking, the specimen shall be subjected, for a period of 24 h, to a compressive load equal to the greater of the following:

(a) A total weight equal to 5 times the maximum weight of the package; and

(b) The equivalent of 13 kPa multiplied by the vertically projected area of the package.

The load shall be applied uniformly to two opposite sides of the specimen, one of which shall be the base on which the package would typically rest.

It is not possible for the package to be stacked when lying on its side, the following will assume the package is standing vertically. A mass of 500 kg was applied to the top surface of the package, this is less than the 1250 kg required. It has been shown the package will be capable of withstanding a mass of 1250 kg in the PDSR. It has been deemed unsafe and unlikely the package will stack 6 units high resulting in a load of 1250 kg. The package was completely intact following the test the PDSR part 2 can be consulted for evidence of this.

5.4. Penetration test

IAEA SSR-6 para 724

Penetration test: The specimen shall be placed on a rigid, flat, horizontal surface which will not move significantly while the test is being carried out:

(a) A bar 3.2 cm in diameter with a hemispherical end and a mass of 6 kg shall be dropped and directed to fall, with its longitudinal axis vertical, onto the centre of the weakest part of the specimen, so that, if it penetrates sufficiently far, it will hit the containment system. The bar shall not be significantly deformed by the test performance.

(b) The height of drop of the bar measured from its lower end to the intended point of impact on the upper surface of the specimen shall be 1 m.

A bar of mass of 6Kg, 3.2cm in diameter and having a hemispherical end was suspended 1m above the top of the package. The bar was dropped on the side of the package, in the centre.

The package was intact following the test and the only effect of the test was a small dimple on the side of the stainless drum. The test was passed, the PDSR part 2 can be consulted for evidence of this.

5.5. Packages containing liquids and gases

IAEA SSR-6 para 725. (a)

A specimen, or separate specimens, shall be subjected to each of the following tests unless it can be demonstrated that one test is more severe for the specimen in question than the other, in which case one specimen shall be subjected to the more severe test:

(a) Free drop test: The specimen shall drop onto the target so as to suffer the maximum damage in respect of containment. The height of the drop measured from the lowest part of the specimen to the upper surface of the target shall be 9 m. The target shall be as defined in para. 717 [IAEA].

The package is not permitted to carry gaseous or liquid contents and therefore this test is not required for the package, and it was not carried out.

6. Transport Statement

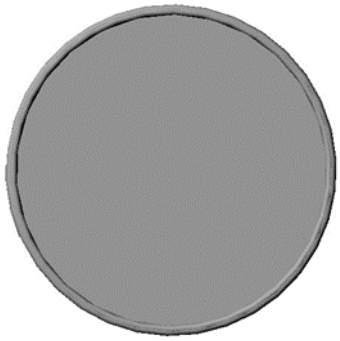
This certificate does not relieve the consignor from compliance with any requirement of the government of any country through or into which the package will be transported.

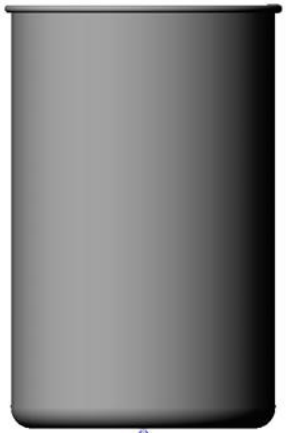
7. Package Illustration

7.1. Preparing the Shielded Container

The shielded container should be closed and secured in line with the manufacturers original Operating Manual.

7.2. Closed Package





7.3. Cutaway Package

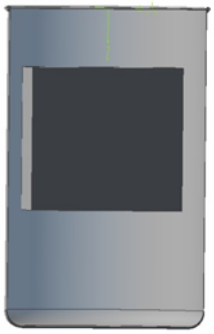


Figure 1 - A cutaway package

7.4. Description

The package comprises a stainless-steel drum, a series of packing volumes (Expanded foam) and a shielded container. The shielded container will contain the radioactive isotope and will account for the majority of the mass of the package.

7.5. Package Contents

Only the contents shown in this certificate are permitted for transportation in the package. No other accessories, components or items are permitted to be transported within the package.

8. Emergency Arrangements

If damage to the package is apparent, expert advice can be sought from the manufacturer, Gilligan Engineering Services telephone +44(0)1661 836886. The package should be segregated from personnel and radiation levels checked.

9. Amendment Control

Revision	Date Published	Comments
0	August 2015	First Issue
1	August 2017	Special Forms List updated
2	August 2019	General Review of Document
3	August 2021	General Review of Document