



**CERTIFICATE NO. ZA/NNR/1005/B(U) – 96**

**REVISION 05**

**PACKAGE DESIGN APPROVAL**

This is to certify that the National Nuclear Regulator, being, for the purpose of the International Atomic Energy Agency, the Competent Authority in the Republic of South Africa, in respect of the transport of radioactive material, has certified the package design, as described herein, and which is intended to contain the authorised radioactive materials described herein, as having met the regulatory requirements for Type B(U) packages as described in the International Atomic Energy Agency, Safety Standards Series No. SSR-6, Regulations for the Safe Transport of Radioactive Material, 2018 Edition, Vienna 2018.

**1 CERTIFICATE**

Effective Date: 02 January 2023

Expiry Date: 02 January 2028

**2 COMPETENT AUTHORITY**

National Nuclear Regulator  
Eco Glades Office Park  
Eco Glades 2  
Block G  
420 Witch Hazel Avenue  
Centurion  
South Africa

**3 THIS CERTIFICATE IS ISSUED ON THE BASIS OF THE APPLICATION SUBMITTED BY**

**Name and Address of Applicant:**

NTP Radioisotopes SOC Ltd, on behalf of South African  
Nuclear Energy Corporation Limited (Necsa) SOC Ltd  
Church Street West  
Pelindaba  
Republic of South Africa

#### 4 TITLE AND IDENTIFICATION OF REPORTS

##### 4.1 Reports

The safety case for the package design comprises the following reports –

	Document Number	Rev	Date	Title/Description
(i)	NTP-SAR-0002	5	23-02-2022	SAFETY ANALYSIS REPORT: "BEATRICE" TRANSPORT PACKAGE: ZA/NNR 1005/B(U)-96
(ii)	RRT-NTP-REP-18001	01	15-06-2018	DOSE RATE AND HEATING RATES IN NTP BEATRICE PACKAGE
(iii)	MES-MEC-REP-0053	2.0	22-02-2012	Thermal analysis of Beatrice transport container
(iv)	NTP-SOP-9010	6	18-02-2022	Handling Instructions for the ZA/NNR 1005/B(U)-96 "BEATRICE" Transport Package
(v)	NTP-REP-12/09		13-02-2012	HANDLING INVESTIGATION: ZA/NNR 1005/B(U)-96 "BEATRICE" TRANSPORT PACKAGE
(vi)	RRT-MCNP-00-2		11-04-2000	DOSE RATE FOR THE O-RING ON A STAINLESS STEEL CANISTER
(vii)	Beatrice recertification 01	5	19-09-2003	Pressure build-up analysis for liquid isotopes in Beatrice transport container
(viii)	NTP-REP-12/51		22-02-2012	DESIGN REPORT FOR THE IPC MK II
(ix)	R04-00/2.1	2.1	07-12-2000	Molybdenum Transport Container Thermal Analysis
(x)	NTP-REP-12/08		22-02-2012	STACKING INVESTIGATION: ZA/NNR 1005/B(U)-96 "BEATRICE" TRANSPORT PACKAGE
(xi)	NTP-VLG-03/57		15-09-2003	REPORT ON PENETRATION TEST ON THE BEATRICE TRANSPORT PACKAGE
(xii)	IPC-REP-166-2	0	04-10-1998	FIRE TEST ON MOLYBDENUM TRANSPORT CONTAINER CONTAINER ZA-CNS-1005
(xiii)	IPC-REP-166/4	0	12-04-2000	FIRE TEST ON TRANSPORT CONTAINER: ZA/CNS-1005 BEATRICE
(xiv)	NTP-REP-18/363		18-06-2018	CONTAINMENT DESIGN ANALYSIS – BEATRICE AND JANE TRANSPORT PACKAGES
(xv)	IPC-REP-166-1	0	06-10-1998	DROP TEST ON MOLYBDENUM TRANSPORT CONTAINER CONTAINER ZA-CNS-1005
(xvi)	IPC-REP-166/3	0	13-04-2000	DROP TEST ON TRANSPORT CONTAINER: ZA/CNS-1005 BEATRICE
(xvii)	NTP-REP-18/280		14-06-2018	STRUCTURAL ASSESSMENT OF THE BEATRICE AND JANE TRANSPORT PACKAGES
(xviii)	MES-MEC-REP-0117	1.0	12-06-2018	Ageing Effect on Thermal Conductivity of Beatrice Container Test Report

## 4.2 Drawings

The Package is fabricated in accordance with the following drawings –

	Drawing Number	Rev	Date	Description
(i)	I:E 144:000	N	03-02-2012	Assembly
(ii)	I:D 144:002	G	13-02-2012	Liner
(iii)	I:C 144:003	H	13-02-2012	Top Liner
(iv)	I:B 144:004	F	13-03-2012	Bottom Liner
(v)	I:C 144:010	L	13-02-2012	Inner Cover
(vi)	I:C 144:011	J	13-02-2012	Top Plate
(vii)	I:C 144:012	E	13-02-2012	Bucket
(viii)	I:B 144:013	G	13-02-2012	Liner
(ix)	I:B 144:014	G	13-02-2012	Lifting Eye
(x)	I:B 144:015	G	13-02-2012	Clevis
(xi)	I:D 144:020	M	13-02-2012	Inner Container
(xii)	I:D 144:021	G	13-02-2012	Outer Casing
(xiii)	I:C 144:022	G	13-02-2012	Uranium Shield
(xiv)	I:D 144:023	M	13-02-2012	Inner Casing
(xv)	I:B 144:024	E	13-02-2012	Bottom Spacer
(xvi)	I:B 144:025	H	13-02-2012	Top Spacer
(xvii)	I:D 144:030	K	13-02-2012	Top Cover
(xviii)	I:B 144:031	E	13-02-2012	Lifting Eye
(xix)	I:B 144:032	F	13-02-2012	Clevis
(xx)	I:B 144:033	E	13-02-2012	Bolt
(xxi)	I:D 144:040	K	13-02-2012	Outer Casing
(xxii)	I:B 144:041	H	13-02-2012	Identification Plate
(xxiii)	I:D 218:001	R6	18-07-2016	IPC MK II

## 5 PACKAGE IDENTIFICATION

5.1 The Package is identified by the Model Number:

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## 6 PACKAGE DESCRIPTION

6.1 The Package Assembly (See Figure 1) consists of a Stainless Steel Inner Container, which is placed inside a Stainless Steel Outer Casing. The Stainless Steel Inner Container is sealed by two “O”-rings that serve as an outer containment barrier. Solid depleted uranium is used to provide shielding in the Inner Container. A Cork Liner, situated between the Inner Container and the Outer Casing, serves as a thermal protective envelope during a fire and serves to cushion the internals from mechanical shocks.

6.2 A cavity inside the Inner Container Shield contains an Inner Product Container fitted with an “O”-ring, which serves as the primary containment for this package. The transport package schematic is detailed in Figure 2.

6.3 The product is placed inside a product bottle into this Inner Product Container.



#### 6.4 Dimensions (approximate) of the Package:

Outer container: Ø286 x 374mm  
Inner container: Ø178 x 238mm (Cavity Ø50 x 103mm)  
Inner product container: Ø49 x 102mm

#### 6.5 Weights (approximate) of the Package:

Outer container: 126 kg  
Inner container: 85 kg  
Depleted Uranium: 74 kg

## 7 AUTHORISED CONTENTS

7.1 The maximum authorised contents of the Beatrice package are given in the table below –

Radionuclide	Activity	Form	Formulation	Product Bottle	Volume
<sup>99</sup> Mo	1500 Ci (55.50 TBq)	Solid	MoO <sub>3</sub> powder	Stainless Steel/ Glass	-
	1500 Ci (55.50 TBq)	Liquid	NaOH solution	Stainless Steel	40ml
	320 Ci (11.84 TBq)	Liquid	NaOH solution stabilised with NH <sub>4</sub> NO <sub>3</sub>	Stainless Steel	40ml
	660 Ci (24.42 TBq)	Liquid	NaOH solution stabilised with NaOCl	Stainless Steel	20ml
	900 Ci (33.30 TBq)	Liquid	NaOH solution stabilised with NaNO <sub>3</sub> or H <sub>2</sub> O <sub>2</sub>	Stainless Steel	20ml
<sup>131</sup> I	250 Ci (9.25 TBq)	Liquid	NaOH solution with or without reducing agent	Glass	20ml
<sup>192</sup> Ir	4000 Ci (148.0 TBq)	Solid	Ir-metal	Stainless Steel	-

## 8 CONDITIONS FOR USE OF THE PACKAGING

The maintenance required on this transport package is described in the handling instructions. NTP-SOP-9010 Rev 6 (or such future revisions as accepted by the competent authority): *Handling Instructions for the ZA/NNR 1005/B(U)-96 "Beatrice" Transport Package* and in essence entails the following:

8.1 The on-condition replacement of the "O"-rings of the Inner Container.

8.2 Replacement of "O"-ring of the Inner Product Container before every shipment.

- 8.3 Replacement of the Inner Product Container after every shipment of liquid I-131, if any leakage from the product bottle into the Inner Product Container has occurred or is suspected.
- 8.4 The coating of all screws with copper grease or Loctite Food Grade Anti-Seize Lubricant before every shipment to prevent galling.
- 8.5 The pressure testing of the Inner Product Container every 3 years.

## 9 NOTIFICATION

- 9.1 The owner of a package, manufactured in accordance with the design covered by this Certificate, shall forward the packaging serial number to the competent authority.
- 9.2 Should a package be disposed of, or change ownership, then this change must be notified to the competent authorities.
- 9.3 Accordingly, the party relinquishing ownership of a package shall forward the name of the new owner to the competent authority.
- 9.4 The consignor of a package that is compliant with the design covered by this Certificate, shall check that the package bears a serial number, as well as a Model Number, as identified in Section 5 above.

## 10 MODE(S) OF TRANSPORT

- 10.1 The package described by this Certificate may be transported by all modes of transport.

## 11 SPECIFICATIONS OF QUALITY ASSURANCE PROGRAMME

- 11.1 A quality assurance system as described in document NTP-PRG-0100 must be applied to the fabrication, testing and usage of the packaging.
- 11.2 All packaging must be periodically inspected and as necessary, repaired and maintained in good condition so that they continue to comply with the relevant requirements and specifications, even after repeated use.

## 12 GENERAL CONDITIONS

- 12.1 Each user of the transport package must have in their possession a copy of this Certificate and all documents necessary to properly prepare the package for transportation.
- 12.2 This Certificate does not relieve the consignor or carrier from the compliance with any requirements of the government of any country through or into which the package will be transported.

**13 MARKING AND LABELS**

13.1 The package must bear the marking ZA/NNR/1005/B(U)-96 in addition to any other required markings and labelling.

**14 RELEVANT REGULATIONS**

14.1 International Atomic Energy Agency Safety Standards Series No. SSR-6, Regulations for the Safe Transport of Radioactive Material, 2018 Edition, Vienna 2018.

**15 EXPIRY DATE**

This Certificate expires at midnight on 02 January 2028.



21/09/22

**D KGOMO**  
**ACTING CHIEF EXECUTIVE OFFICER**

**DATE:**

National Nuclear Regulator  
P O Box 7106  
CENTURION  
0046



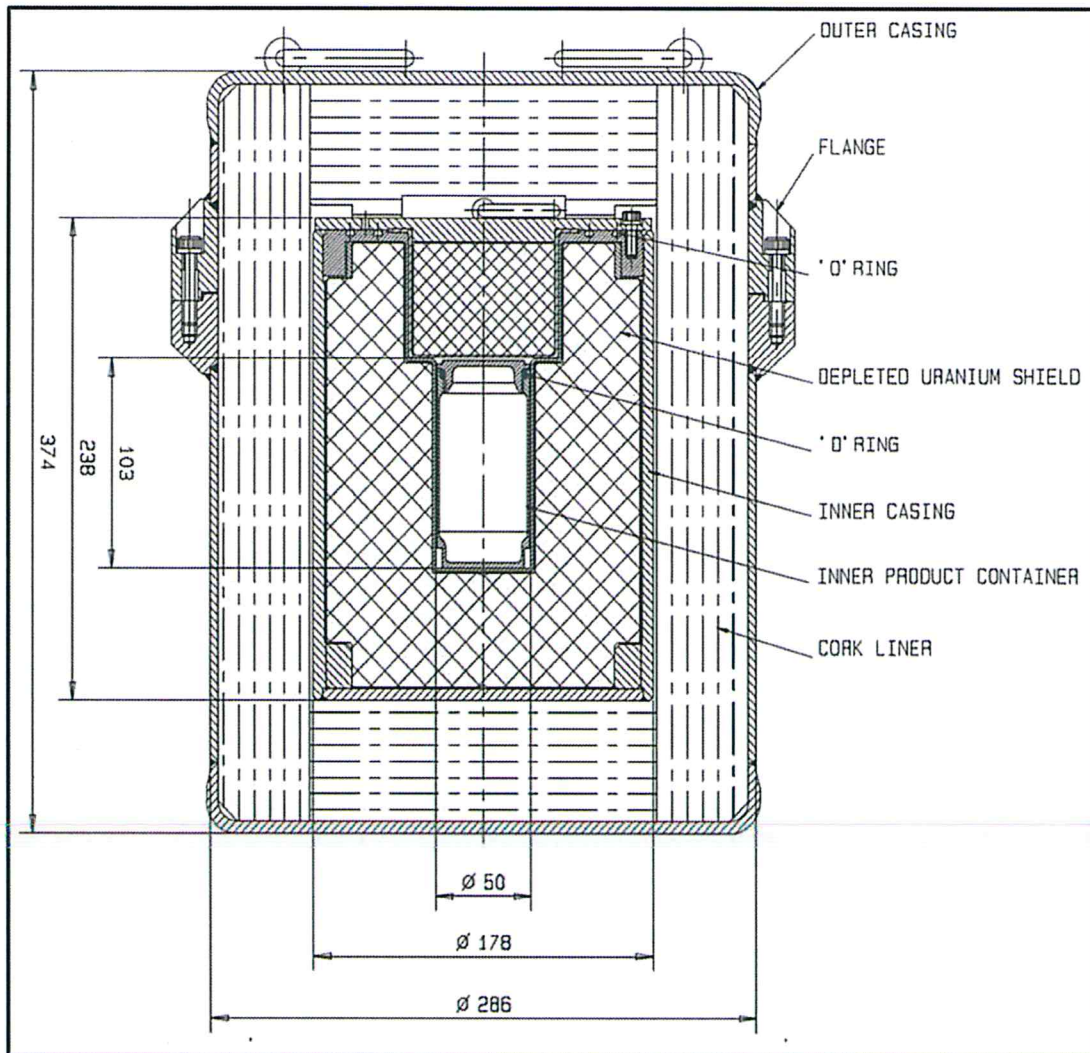


Figure 1: Beatrice Package Outline Drawing

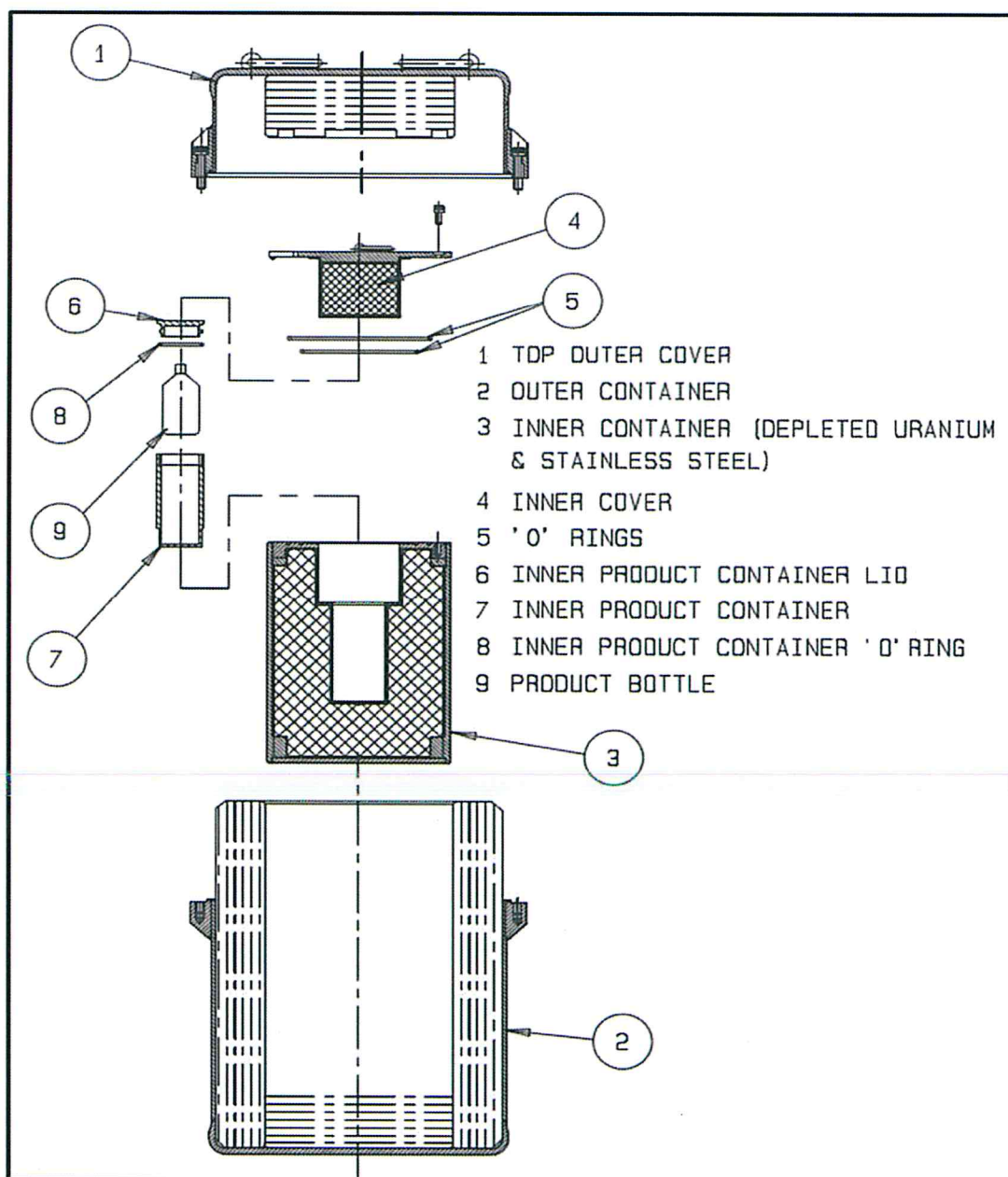


Figure 2: Schematic of Beatrice Package