REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF SEALED SOURCE
(AMENDED IN ITS ENTIRETY)

NO: IL-1082-S-101-S DATE: October 26, 2001

SOURCE TYPE: High Energy Gamma Source

MODEL: RSL2089 (formerly CKC.LSA)

DISTRIBUTOR:

REVISS Services, Inc.
175 East Hawthorn Parkway
Suite 142
Vernon Hills, IL 60061

MANUFACTURER:

REVISS Services (UK) Limited
6 Chiltern Court
Asheridge Road, Chesham
Buckinghamshire, HP5 2PX; England

ISOTOPE:	MAXIMUM ACTIVITY:
Co-60	740 Terabequerels (20 kCi)

LEAK TEST FREQUENCY:

1. "Dry" irradiator plants: 6 months (wipe test)

2. "Wet" irradiator plants: Continuous on-line monitoring of water purification system

PRINCIPAL USE:

(J) Gamma Irradiator, Category I
(K) Gamma Irradiator, Category II
(L) Gamma Irradiator, Category III
(M) Gamma Irradiator, Category IV

CUSTOM SOURCE: ___ YES _X_ NO

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DESCRIPTION:

The Model RSL2089 consists of a stainless steel outer R2089 capsule (Attachment 1) containing either:

- two stainless steel R1700 inner capsules
  or
- one stainless steel R1702 inner capsule,
  or
- two zircalloy R1703 inner capsules

The R2089 has the same dimensions as the previous X2089 but features changes to the inner dimensions and tolerances in order to accommodate the R1702 and R1703 options. The R1700 capsule is the same mechanical design as the previous X9049/1 capsule. The R1702 and R1703 are new design components.

All stainless steel used is to the specification commonly known as 316L. All zircalloy used is to the specification zircalloy 2 or zircalloy 4 (ASTM B351 and B353).

The R1700 and R1702 subassemblies are produced by loading a quantity of nickel coated Co-60 discs or slugs into the capsule body and TIG welding plugs into the ends. The entire space within the R1700 or R1702 capsule is occupied with active Co-60 discs and/or inactive spacers in the form of austenitic stainless steel.

The R1703 subassemblies are produced by loading a quantity of nickel coated Co-59 slugs or discs into the capsule body and TIG or plasma welding plugs into the ends. The entire space within the R1703 capsule is occupied with Co-59 discs. The subassembly is then irradiated for an appropriate period in a reactor in order to activate the Co-59 and manufacture Co-60.

The dimensions of the R2089 capsule are:	maximum length	- 451.600 mm
	maximum diameter	- 11.100 mm
	wall thickness	- 0.680 ± 0.025 mm
The dimensions of the R1700 capsule are:	maximum length	- 210.015 mm
	maximum diameter	- 8.215 mm
	wall thickness	- 0.450 ± 0.050 mm
The dimensions of the R1702 capsule are:	maximum length	- 424.300 mm
	maximum diameter	- 8.190 mm
	wall thickness	- 0.635 ± 0.032 mm

SOURCE TYPE: High Energy Gamma Source

DESCRIPTION: (continued)

The dimensions of the R1703 capsule are:

maximum length	- 212.730 mm
maximum diameter	- 8.050 mm
wall thickness	- 0.640±0.060 mm

The model RSL2089 is produced by inserting either two R1700 subassemblies, two R1703 subassemblies or one R1702 subassembly into the R2089 body with one plug already TIG welded into place. The final plug is then inserted into the R2089 body and TIG welded to achieve closure.

LABELING:

The R2089 capsule is permanently engraved on the outer end caps with the following information:

- Radiation Trefoil
- Co-60
- RSL (acronym of REVISS)
- Unique Serial Number
- Model Number (RSL2089)

One end plug of RSL2089 outer capsule has the serial number engraved on the top and side of the plug. The other end plug has the trefoil (top) and model number (side) engraved. The R1700, R1702 and R1703 capsules are also engraved with a serial number that is unique within the batch of components being handled.

DIAGRAMS:

See Attachments 1, 2, 3, 4 and 5.

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CONDITIONS OF USE:

The model RSL2089 is used primarily in industrial environments for gamma ray sterilization in wet irradiation plants. It could also be used in dry irradiation plants. Environments associated with the use of these irradiators include high temperatures, thermal shock due to sources being brought out of and into the water, high pressures and high/normal pressure cycling and long-term contact with water.

The sources may be used in dry source storage irradiators and environments for these would typically be less harsh. These uses would typically be medical facilities and laboratories. Therefore, the sources would be expected to be subjected to ambient temperatures and pressures. However, high activity sources may be exposed to elevated temperatures and temperature cycling due to internally generated heat. The detailed conditions for use are part of the product specification and are included in the contract between the customer and the supplier. The recommended working life of this source is 20 years.

TESTING OF PROTOTYPES:

The model RSL2089 capsule has been tested in accordance with the requirements of ISO2919:1990(E) (tests equivalent to ANSI/HPS N43.6-1997) and has achieved a rating of E64646 and has also achieved the requirements of the bend test (Class 5). These tests meet or exceed the requirements specified in 10 CFR 36.21 as documented in REVISS Technical Memorandum RTM035 (issue 2). 316L stainless steel was used for both inner and outer components during the bend test since 316L stainless created the greatest amount of internal stress during the test.

The model RSL2089 is approved as a Special Form Certified by the United Kingdom Department of Environment, Transport and the Regions (DETR), Certificate Number GB/343/S-85.

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EXTERNAL RADIATION LEVELS:

Based on gamma energies of 1.173 MeV and 1.332 MeV and a specific gamma ray constant of 1.3 R/hr/Ci at one meter, maximum radiation levels have been calculated to be as follows for a 20 kCi RSL2089 source:

DISTANCE	EXPOSURE
10 cm	9.5×10^5 R/hr (9500 Sv/hr)
30 cm	2.5×10^5 R/hr (2500 Sv/hr)
100 cm	2.4×10^4 R/hr (240 Sv/hr)

The calculations are based on the assumption that the source may be regarded as a series of line sources.

QUALITY ASSURANCE AND CONTROL:

Inner R1700, R1702 and R1703 assemblies are subjected to the following tests after manufacture. These tests are performed in accordance with ISO 9978: 1992 (E) (Note: the vacuum bubble test may be omitted if the helium test used is validated as sensitive to larger leaks):

Test	ISO9978: 1992(E)	ANSI/HPS N43.6-1997
Vacuum Bubble	6.2.1	A2.2.1.
Wipe (limit 50 nCi, 1850 Bq)	5.3.1	A2.1.2
Prefilled Helium or Helium Pressurization	6.1.1 6.1.2	None A2.2.3

R2089 outer capsules are subjected to the following tests after welding. These tests are performed in accordance with ISO 9978: 1992 (E). (Note: the vacuum bubble test may be omitted if the helium test used is validated as sensitive to larger leaks):

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QUALITY ASSURANCE AND CONTROL: (continued)

Test	ISO9978: 1992(E)	ANSI/HPS N43.6-1997
Vacuum Bubble	6.2.1	A2.2.1
Wipe (limit 5 nCi, 185 Bq)	5.3.1	A2.1.2
Prefilled Helium	6.1.1	None
Or Helium Pressurization	6.1.2	A2.2.3

The design, manufacture, inspection, sales and installation of this product are done in accordance with REVISS Services quality system which is certified as compliant with the requirements of ISO 9001:1994 and U.S. NRC Regulatory Guide 6.9. A copy of the **REVISS Services Quality Manual** has been reviewed and approved by the Department.

REVISS Services may subcontract certain production operations to qualified suppliers as controlled and documented within the REVISS Services quality management system.

REVISS Services remains at all times responsible for operations which it subcontracts and retains control of the design, management and quality of such subcontracted operations.

LIMITATIONS AND/OR OTHER CONSIDERATIONS OF USE:

1. The sources shall be distributed only to persons specifically licensed by the NRC or an Agreement State.

   Note: The model RSL2089 can be considered equivalent to the Model CKC.LSA for licensing purposes.

2. These sources may be used in dry source storage irradiators. Sources used in these devices shall be leak tested at intervals not to exceed six months using techniques capable of detecting 0.005 microcurie (185 Bq) of removable contamination. Sources used in wet source storage irradiators shall be tested for contamination according to 10 CFR 36.59(b).

SOURCE TYPE: High Energy Gamma Source

LIMITATIONS AND/OR OTHER CONSIDERATIONS OF USE: (continued)

3. Handling, storage, use, transfer and disposal: To be determined by the licensing authority. In view that the sealed sources exhibit high surface dose rates when unshielded, they should be handled only by experienced licensed personnel using adequate remote handling equipment and procedures. For sources used in Category III and IV irradiators, the sources should be stored under specific water chemistry conditions to be determined by the licensing authority (See 10 CFR 36.63).

4. These sources shall not be subjected to environmental or other conditions of use which would exceed an ANSI N43.6-1997 classification of 64646 and the tests of 10 CFR 36.21.

5. These sources shall not be subject to temperature extremes exceeding 475°C during transport. As a result, activity loadings of the **manufacturer's transportation** containers must not exceed recommended activity loadings.

6. Sources should not be stored for any length of time in contact with plastic based products as this causes degradation of the plastic and release of potentially corrosive products which may compromise source integrity.

7. This registration sheet and the information contained within the references shall not be changed without the written consent of the Department.

SAFETY ANALYSIS SUMMARY:

This source has been distributed for many years under Nycomed Amersham. Based on our review of the information and test data cited below, including the claimed ANSI classification, we continue to conclude that the REVISS Services, Inc. Model RSL2089 source designs are acceptable for licensing purposes. Furthermore, we continue to conclude that the REVISS Services, Inc. Model RSL2089 source would be expected to maintain containment integrity for normal conditions of use and accidental conditions which might occur during the uses specified in this certificate.

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REFERENCES:

The following supporting documents for the REVISS Services, Inc. Model RSL2089 are hereby incorporated by reference and are made a part of this registry document:

- REVISS Services, Inc. letters, with attachments, dated September 25, 1995, February 20, 1997, June 22, 1998, January 26, 1999, June 22, 1999, July 10, 1999, August 2, 1999, May 17, 2000, November 9, 2000, February 2, 2001, March 21, 2001 and **June 27, 2001.**
- Telefacsimiles, with attachments, dated April 20, 2001 (3 each) and April 24, 2001.
- Application dated December 27, 1998.

ISSUING AGENCY: Illinois Department of Nuclear Safety

DATE: 10/26/01 REVIEWED BY: Charles G. Vinson

DATE: 10/26/01 CONCURRENCE: Joseph G. Klinger

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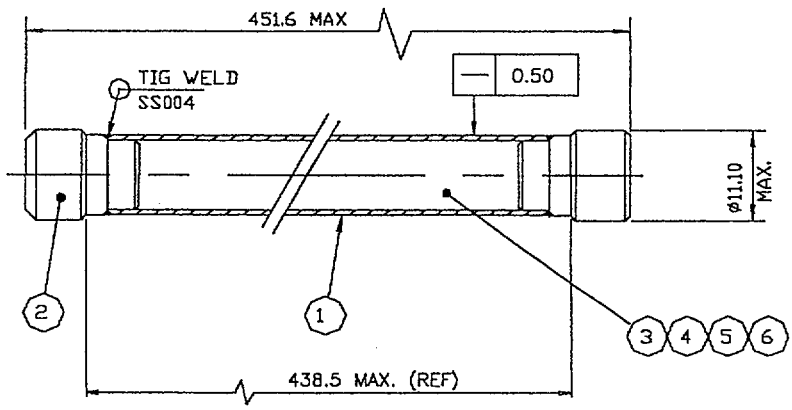
R2089 Capsule Assembly

(all dimensions in mm)

Item	Description	Material	Drawing No.	Number Off		
				A	B	C
1	SUB-ASSEMBLY	STAIN.STL.	SA20890	1	1	1
2	ENGRAVED PLUG TYPE-B	STAIN.STL.	DD20892	1	1	1
3	CAPSULE R1700	ST.ST/Co	GA17000	2		
4	CAPSULE R1702	ST.ST/Co	GA17020		1	
5	CAPSULE R1703	ZIRCALOY/Co	GA17030			2
6	R2089 SPACER	STAIN.STL.	DD20895	1		



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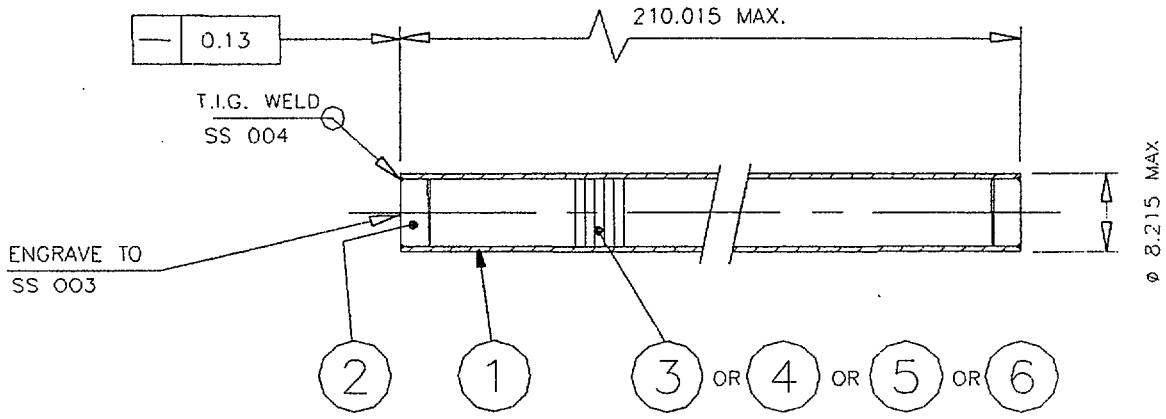
R1700 Capsule Assembly

(all dimensions in mm)

ITEM	DESCRIPTION	MATERIAL	DRAWING NO.	QTY
1	SUB-ASSEMBLY R1700		SA17000	1
2	PLUG	ST.STL.	DI17000 ITEM 2	1
3	SPACER	ST.STL.	DI17001 ITEM 1	A/R
4	DISC	COBALT	DI17001 ITEM 2	A/R
5	INSERT	COBALT	DI17031	A/R
6	LONG SPACER	ST.STL.	DI17002	A/R



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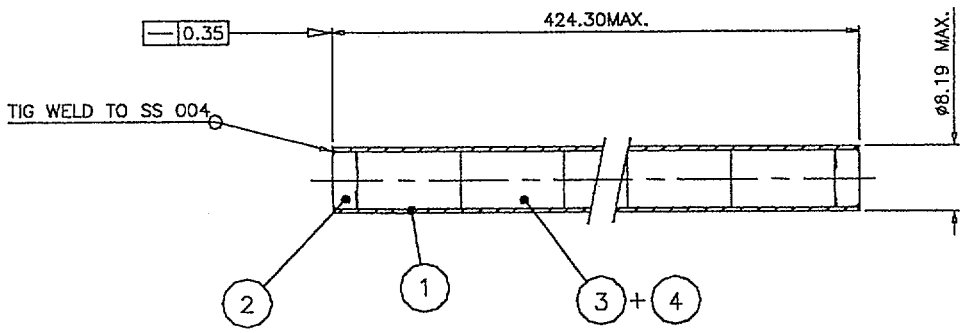
R1702 Capsule Assembly

(all dimensions in mm)

Item	Drawing No.	Description	No.off
1	SA17020	SUB–ASSEMBLY R1702	1
2	DI17020 ITEM 2	PLUG ST. STL.	1
3	DI17031	INSERT COBALT	A/R
4	ø6.3mmx7.0mm max	Spacer (Co–59or300 series st.stl)	A/R



NOTE:

1 DIMENSIONS REFERENCED TO 20°C

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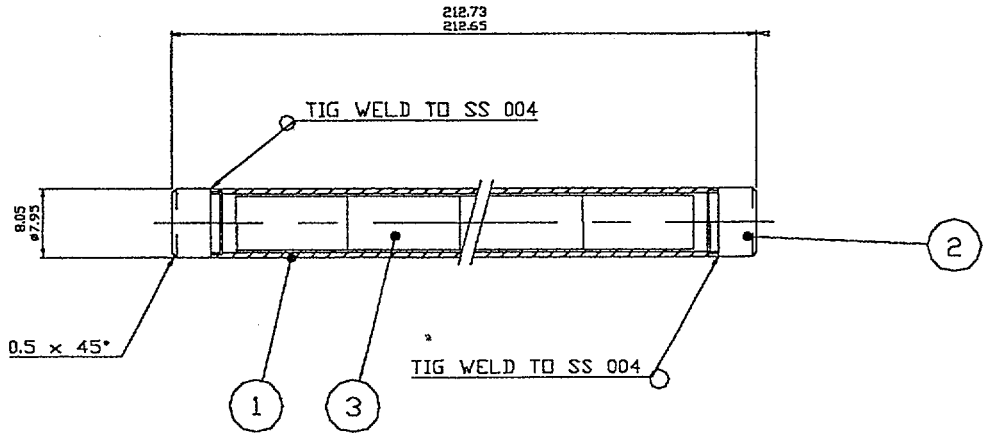
R1703 Capsule Assembly

(all dimensions in mm)

Item	Drawing No.	Description	No.off
1	SA17030	SUB–ASSEMBLY R1703	1
2	DI17030 ITEM 2	PLUG ZIRCALOY	1
3	DI17031	INSERT COBALT	16



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ENGRAVING ARRANGEMENTS