

Department of the Army  
U.S. Army Research Institute of  
Environmental Medicine (USARIEM)  
10 General Greene Avenue, Building 42  
Natick, MA 01760-5007

License No. 20-30847-01  
Docket No. 03036434

November 18, 2024

To Whom It May Concern:

The United States Army Research Institute of Environmental Medicine is providing documentation of the last leak test for the Cd-109 before it was returned to E&Z in 2021 for disposal in accordance with our request to decommission our NRC License. I have also provided the return confirmation sent to us by the company once they received the Cd-109.

Sincerely,

GEDDIS.ALYSSA.V  
IRGINIA.15009370  
05

Digitally signed by  
GEDDIS.ALYSSA.VIRGINIA.150  
0937005  
Date: 2024.11.18 10:48:54  
-05'00'

Alyssa Geddis  
Research Biologist  
Radiation Safety Officer  
USARIEM  
Alyssa.v.geddis.civ@health.mil

## RADIOACTIVE PACKAGE SHIPMENT

COMPANY: Eckert & Ziegler Isotope Products

ITEM SHIPPED: Cd-109 x 2 sealed source QUANTITY: 2

RADIONUCLIDE: Cd-109 FORM: LIQUID \_\_\_ SOLID \_\_\_ GAS \_\_\_

AUTHORIZED USER: ~~Dr. Joseph Kehayias~~ Dr. Joseph Kehayias

DATE SHIPPED: 11 Feb 2021

DOES THE SHIPPING CONTAINER/BOX APPEAR DAMAGED: YES \_\_\_ NO X

LABEL ON CONTAINER/BOX: EXEMPT X WHITE I \_\_\_ YELLOW II \_\_\_ YELLOW III \_\_\_

TOTAL ACTIVITY OF SHIPMENT: \_\_\_  $\mu$ Ci 114 MBq

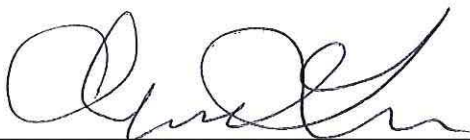
RADIATION LEVELS AT SURFACE OF CONTAINER/BOX: 0.02 mR/hr

## CONTAMINATION SURVEY

	ITEM	CONTAMINATION (cpm)
1	Canister # 1	24
2	Canister # 2	23
3	Inner box	26
4	Inner box	28
5	Styrofoam top	16
6	Styrofoam top	17
7	Outer box	25

<b>8</b>	outerbox	19
<b>9</b>	outer box	20
<b>10</b>	outer box	24
<b>11</b>	k5-160 leak test	45
<b>12</b>	k5-160 leak test	39
<b>13</b>	k5-160 leak test	37
<b>14</b>	Q8-913 leak test	30
<b>15</b>	Q8-913 leak test	31
<b>16</b>	Q8-913 leak test	31
<b>17</b>		
<b>18</b>		
<b>19</b>		
<b>20</b>		

survey of background = 0.012 mR/hr  
survey of box = 0.02 mR/hr



**SHIPPER'S SIGNATURE**

10 Feb 2021

**DATE**

# B2 Return Packing List (RPL)

All information must be provided and legible to ensure proper handling of your return


### Helpful hints before starting

Refer to your source certificate for information needed on this RPL.

Be prepared to make enough copies of sheet B2 to go inside each package to be returned. The original B1/B2 sheets will be used as the packing slip for this return.

If the quantity of sources to be returned exceeds the number of lines below (4), please make a copy of this sheet B2 and continue listing your sources.

ALL information **MUST** be legible, including email and phone number, so that FedEx and/or EZIP can contact the Shipper in case of questions or concerns.


From:		Send to:	
Company Name USARIEM		<b>Attention: Receiving</b>	
Address 10 General Greene Ave, Building 42		<b>Eckert &amp; Ziegler Isotope Products</b>	
City Natick	State MA	Zip 01760	<b>1800 North Keystone Street</b>
RSO or Person responsible for Disposal Receipt Records <i>Alyssa Geddis</i>		<b>Burbank, California 91504</b>	
Phone (508) 206-2294	Fax	Phone (661) 309-1010	
* <b>Email</b> Best Option <i>alyssa.v.geddis.civ@mail.mil</i>		Fax (661) 257-8303	
FedEx Tracking Number from FedEx Air Waybill		Email: <i>nucmedsales@ezag.com</i>	
Please note that the Shipper is responsible for ALL return shipping costs			
<b>RA#</b>		Original two-sided Sheet B1/B2 must be affixed to the OUTSIDE and a copy of the RPL (this page) placed inside of the package.	
Write RA# on outside of package or use provided Return Authorization Label. Please allow a minimum of five (5) business days for disposal processing and generation of your emailed RAF (Return Acknowledgment Form). <b>EZIP does not accept returns through the US Postal Service.</b>		<b>Each returned source to EZIP must be on a one-to-one equivalent source type exchange basis only.</b>	
		For additional returns, please contact EZIP customer service at: (661) 309-1010 for quoting information.	
		<b>Do not return</b> if wipe test results are 5nCi or above, or the source is leaking or damaged. Contact your RSO for instructions.	

Catalog Model #	Source Serial #	Nuclide	Original Activity	Original Ref. Date	Source Wipe Test < 5nCi
1. CD932050010M	Q8-913	Cd-109	10mCi	2018-10-01	<input checked="" type="checkbox"/> Yes
2.	K5-160	Cd-109	20mCi	2013-06-15	<input checked="" type="checkbox"/> Yes
3.					<input type="checkbox"/> Yes
4.					<input type="checkbox"/> Yes

Keep a copy of this form for your records. It may be requested by your regulatory agency.

I acknowledge that the above information is true to the best of my knowledge.

Print Name and Sign: *Alyssa Geddis*

GEDDIS.ALYSSA.VIRGINIA.1500937005  Digitally signed by GEDDIS.ALYSSA.VIRGINIA.1500937005  
Date: 2021.02.05 14:05:19 -05'00'

### For EZIP Use Only

EZIP has received the radioactive sources listed above, except as noted below

Receiver's Name:

Receipt Date:

Sources not received:

N/A



Returns are only accepted at **1800 North Keystone Street, Burbank, California, 91504** in accordance with Eckert & Ziegler Isotope Products' Radioactive Materials License No. 1509-19. All information must be provided to ensure proper handling of your return.

**You Must Complete Items 1 and 2:**

1. Select One Proper Shipping & Hazard Class Below	
✓	UN2910, Class 7, Radioactive Material, Excepted Package, Limited Quantity of Material
	UN2915, Class 7, Radioactive Material, Type A Package, Non-special Form, Non-fissile, or Fissile Excepted
	UN2911, Class 7, Radioactive Material, Excepted Package, Instruments or Articles
	UN3332, Class 7, Radioactive Material, Type A Package, Special Form, Non-fissile, or Fissile Excepted
	Other: UN _____,

2. Write Your 24 Hour Emergency Response phone Number	
(508) 498-1239	<b>This is your 24 hour phone number should an emergency arise with your package during transit.</b>
<b>3. Immediate Hazards To Health:</b> No significant hazards.	
<b>4. Risks Of Fire Or Explosion:</b> None	
<b>5. Immediate Precautions:</b> Keep non-essential people away from area; notify radiation safety authorities.	
<b>6. Emergency Fire Measures:</b> Self-contained breathing apparatus and firefighters' protective gear should be used.	
<b>7. First Aid:</b> Use standard first aid measures as required. Advise medical personnel that victim may be contaminated.	

IT IS THE CERTIFIED SHIPPER'S RESPONSIBILITY TO CONFORM WITH ALL REQUIRED D.O.T. REGULATIONS AND TO ASSURE THAT THE SOURCES RETURNED TO EZIP ARE PROPERLY PACKAGED AND LABELED. THE MATERIALS AND RETURN INSTRUCTIONS EZIP PROVIDES IN NO WAY ALTER, SATISFY, OR INFLUENCE ANY FEDERAL OR STATE REQUIREMENTS. EZIP PROVIDES THESE MATERIALS AS A SERVICE TO ASSIST PROPERLY TRAINED SHIPPERS. EZIP SHALL NOT BE HELD RESPONSIBLE FOR ANY LOSS, INJURY, AND/OR DAMAGE CAUSED BY ERRORS, OMISSIONS, MISPRINTS, OR MISINTERPRETATIONS OF THE CONTENTS OF THIS DOCUMENT FOR ANY UNAUTHORIZED OR INAPPROPRIATE USE.

Proper training is required under federal regulations to handle dangerous goods and/or hazardous materials. All persons and entities must comply with all federal regulations, including but not limited to the specific training requirements of 49 CFR 172.700 – 172.704. The user of these materials assumes responsibility for complying with all applicable laws and regulations regarding the shipment of Dangerous or Hazardous Materials.

Source Serial Number	Wipe Test (CPM)	Efficiency%	DPM	nCi
K5-160	32	71	45	0.023
K5-160	28	71	39	0.020
K5-160	26	71	37	0.018
Q8-913	21	71	30	0.015
Q8-913	22	71	31	0.015
Q8-913	22	71	31	0.015
Canister #1	24	71	34	0.017
Canister #2	23	71	32	0.016
Inner Box #1	26	71	37	0.018
Inner Box #2	28	71	39	0.020
Styrofoam #1	16	71	23	0.011
Styrofoam #2	17	71	24	0.012
Outer Box #1	25	71	35	0.018
Outer Box #2	19	71	27	0.013
Outer Box #3	20	71	28	0.014
Outer Box #4	24	71	34	0.017

} leak test

} wipe test

# NOMINAL SOURCE CERTIFICATE

**Customer:** Department of the Army U.S. Army Research Institute of Environmental  
**Purchase Order No.:** 2102720134  
**Model No.:** XFB-3  
**Catalog No.:** CD932050010M  
**Capsule Type:** A3205-00  
**Active Diameter:** 0.2" (5.08 mm)  
**Cover:** 0.040" Beryllium  
**Backing:** 0.005" Silver

**Certificate Date:** 2018-09-21  
**Quantity:** 1  
**SS&DR No.:** CA0406S112S  
**ISO/ANSI Classification:** ANSI 77C43333  
**Special Form No.:** USA/0336/S-96 Rev 11  
**Nuclide Half Life:** 462.6 ± 0.7 days  
**Recommended Working Life:** 2 years

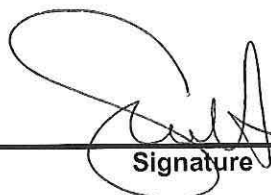
Nuclide	Source No.	Activity	Radiation Output	Reference Date
Cd-109	Q8-913	10 mCi (370 MBq)	Not Applicable	2018-10-01

**Impurities:** Not detected

**Leak Test Information is on Reverse Side:**

- Remarks:**
- This document uses the numerical convention where 1.000 = 1 and 1,000 = 10<sup>3</sup>.
  - This document uses the date convention YYYY-MM-DD in accordance with ISO 8601.
  - Nuclear data were taken from IAEA-TECDOC-619, 1991.
  - ANSI classification is equivalent to ISO2919.

Scott Mah  
Name



Signature

2018-09-21  
Date

**Notebook Page:** 2024-32

ISO 9001 CERTIFIED



THE LEAK TEST(S) INDICATED BY THE CHECKED BOX(ES) WAS(WERE) APPLIED TO DETERMINE THE INTEGRITY OF THE SOURCE DESCRIBED ON THE FRONT SIDE. THE LEAK TESTS INDICATED BELOW WERE EITHER TAKEN DIRECTLY FROM ISO 9978:1992 OR DERIVED FROM THE LEAK TEST METHODS LISTED IN ISO 9978:1992. THE REGULATORY LIMIT FOR LEAK TEST RESULTS IS  $<5$  nCi (185 Bq) FOR BOTH ALPHA AND BETA-GAMMA ACTIVITY. LEAK TEST RESULTS MARKED BELOW CONTAINED  $<5$  nCi (185 Bq) OF REMOVABLE ACTIVITY UNLESS OTHERWISE STATED ON THIS CERTIFICATE.

**Standard Wipe Test**

The source was wiped over its entire surface with a moistened filter paper disk. After drying, the disk was checked for activity using a scintillation detector.

**Special Wipe Test**

The source was wiped over its entire surface with moistened polystyrene. The polystyrene was then dissolved in a liquid scintillation cocktail and counted in a liquid scintillation counter.

**Distilled Water Soak Test**

The source was immersed in distilled water and maintained at  $(50 \pm 5)^{\circ}\text{C}$  for a minimum of four hours or room temperature  $(20 \pm 5)^{\circ}\text{C}$  for 24 hours. After removal of the source, the liquid was a) checked for activity using a liquid scintillation counter, or b) evaporated in a planchet and the residue checked for activity using a windowless proportional counter or end-window G.M. tube.

**Liquid Scintillation Soak Test**

The source was immersed for a minimum of 3 hours at room temperature  $(20 \pm 5)^{\circ}\text{C}$  in a liquid scintillation cocktail, which does not attack the source's outer surface material. The source was stored away from light to avoid photoluminescence. The sealed source was then removed and the activity of the liquid scintillation cocktail was measured.

**Gas Source Test**

The source was placed in a vacuum desiccator and maintained at a pressure of  $<10$  mm Hg for not less than 12 hours. The activity was checked by introducing air into the desiccator and monitoring the air with an end-window G.M. tube.

**Ampoule Leak Test**

The ampoule was kept in an inverted position on a filter paper disk or polystyrene wipe for a minimum of 16 hours. The wipe was then checked for activity using a scintillation detector or liquid scintillation counter.

**Bubble Leak Test**

The container was pressurized to its fill pressure; then soapy water was applied over its valve and neck or, the valve and neck of the vessel were immersed in water. If no growing bubbles were observed, the container was considered leak free.

**Wipe Test for Industrial Ni-63 Sources**

The sources were wipe tested by an approved sampling plan, which called for either 100% of the batch to be individually wipe tested, or, a subset thereof. The wipe test(s) used to test for removable contamination and the results of those tests are recorded on the front of this form.

**Pressure Test for Triotech Kr-85 Sources**

Prior to filling the vessel with Kr-85 gas, the vessel was evacuated to  $<5$  mm Hg, the gas manifold system shut off and the system allowed to stand for a minimum of 30 minutes. A vacuum difference not greater than the known vacuum loss of the manifold system itself signified the vessel did not leak.

**Leak Test Not Applicable**

The active area of the source is uncovered or is protected by a very thin coating. Although the deposit is adherent, it is not designed or certified to pass a standard leak test. The inactive portions of the source have been checked using the standard wipe test or special wipe test depending on the nuclide.

**Other Leak Test**





**Eckert & Ziegler**  
Isotope Products

Eckert & Ziegler Isotope Products  
DBA Isotope Products Laboratories  
1800 N. Keystone Street  
Burbank, California 91504

Tel 661 – 309 - 1010  
Fax 661 – 257 – 8303  
E-mail: [sales@ezag.com](mailto:sales@ezag.com)  
E-mail [nucmedsales@ezag.com](mailto:nucmedsales@ezag.com)  
Web Site: [www.ezag.com](http://www.ezag.com)

## EMERGENCY RESPONSE INFORMATION

### (49CFR 172.600,602,604)

#### 1. PROPER SHIPPING NAME AND HAZARD CLASS

- a) UN2910, Radioactive material, excepted package- limited quantity of material, Class 7
- b) UN2911, Radioactive material, excepted package - instruments, Class 7
- c) UN2911, Radioactive material, excepted package - articles, Class 7
- d) UN2908, Radioactive material, excepted package, empty packaging, Class 7
- e) UN3332, Radioactive material, Type A package, special form, non-fissile or fissile excepted, Class 7
- f) UN3327, Radioactive material, Type A package, fissile, non-special form, Class 7
- g) UN2915, Radioactive material, Type A package, non-special form, non-fissile or fissile excepted, Class 7
- h) UN2916, Radioactive material, Type B(U) package, non-fissile or fissile excepted, Class 7
- i) UN2912, Radioactive material, low specific activity (LSA-I) non-fissile or fissile excepted, Class 7
- j) UN3321, Radioactive material, low specific activity (LSA-II) non-fissile or fissile excepted, Class 7
- k) UN3333, Radioactive material, Type A package, special form, fissile, Class 7
- l) UN2913, Radioactive material, surface contaminated objects (SCO-I) non-fissile or fissile excepted, Class 7
- m) UN2913, Radioactive material, surface contaminated objects (SCO-II) non-fissile or fissile excepted, Class 7
- n) UN2917, Radioactive material, Type B(M) package, non-fissile or fissile excepted, Class 7

2. IMMEDIATE HAZARDS TO HEALTH: No significant hazards

#### 3. RISKS OF FIRE OR EXPLOSION

- a) None
- b) Compressed gas: could explode on exposure to intense heat or flame

4. IMMEDIATE PRECAUTIONS: Keep non-essential people away from area; notify radiation safety authorities.

5. EMERGENCY FIRE MEASURES: Self-contained breathing apparatus and firefighters' protective gear should be used.

6. FIRST AID: Use standard first aid measures as required. Advise medical personnel that victim may be contaminated with low-level radioactive material.

7. Twenty-four (24) hour emergency response numbers call CHEMTREC, Account # 11625: (800) 424-9300 or (703) 527-3887.

# Cd-109

## Standard Capsule Designs

### Activity Tolerance

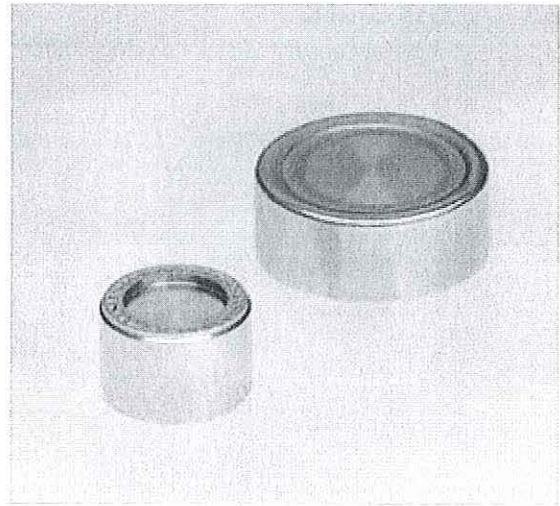
± 15% from nominal

### Recommended Working Life

See Technical Information section.

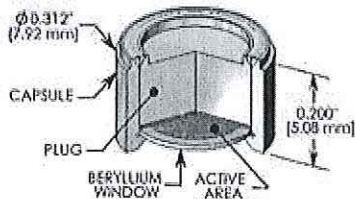
Only typical sources are listed; inquiries are invited for alternative capsule designs and activities.

For Low Energy Gamma and XRF applications, these sources offer a radionuclide with X-ray emissions between 22keV and 26keV contained in a stable, homogeneous active element. For most applications, beryllium window capsules are used.



### 3204 capsule

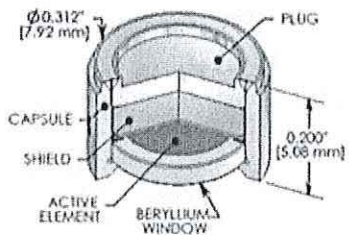
Single-encapsulated stainless steel source with 0.010"/0.254mm beryllium window. ISO rating: C43333



Nominal Activity		Part Numbers	Regulatory
mCi	MBq		
		3204	SS&DR / SFC
1	37	CD932040001M	Yes / Yes
10	370	CD932040010M	Yes / Yes
14	518	CD932040014M	Yes / Yes
20	740	CD932040020M	Yes / Yes
40	1480	CD932040040M	Yes / Yes
			Availability: 4-6 weeks

### 3205 capsule

Single-encapsulated stainless steel source with 0.040"/1.01mm beryllium window. ISO rating: C43333

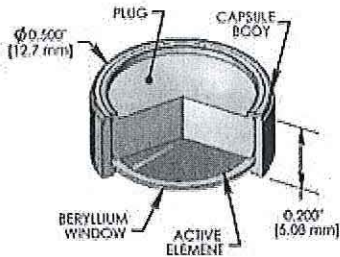


Nominal Activity		Part Numbers	Regulatory
mCi	MBq		
		3205	SS&DR / SFC
1	37	CD932050001M	Yes / No
10	370	CD932050010M	Yes / No
14	518	CD932050014M	Yes / No
20	740	CD932050020M	Yes / No
40	1480	CD932050040M	Yes / No
50	1850	CD932050050M	Yes / No
			Availability: 4-6 weeks



### 3215 capsule

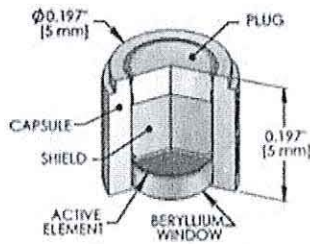
Single-encapsulated stainless steel source with 0.01"/0.25mm beryllium window. ISO rating: C33222



Nominal Activity		Part Numbers	Regulatory
mCi	MBq		
		3215	SS&DR / SFC
1	37	CD932150001M	Yes / No
10	370	CD932150010M	Yes / No
20	740	CD932150020M	Yes / No
50	1850	CD932150050M	Yes / No
			Availability: 4-6 weeks

### 3236 capsule

Single-encapsulated stainless steel source with 0.04"/1.0mm beryllium window. ISO rating: C54243



Nominal Activity		Part Numbers	Regulatory
mCi	MBq		
		3236	SS&DR / SFC
1	37	CD932360001M	Yes / No
5	185	CD932360005M	Yes / No
10	370	CD932360010M	Yes / No
			Availability: 4-6 weeks

Am-241  
Am-241/Bc  
Ba-133  
Cd-109  
Cs-137  
Eu-152  
Fe-55  
Ga-153  
Kr-85  
Mössbauer  
Na-22  
Ni-63  
Pm-147  
Ru-106  
Se-75  
Sr-90  
Yb-169



# RADIONUCLIDE DATA SHEET

[CADMIUM]

Cd-109

48 protons

61 neutrons

**Half Life:** 462.6 days

**Radiation:** Decay Mode: Electron Capture

**Gamma Constant:** 0.198mR/hr per 1 mCi at 30 cm

### Major Gammas:

E(MeV)	# per 100 Dis
0.088	3.70
0.0219	28.9
0.0221	54.5

Max. Beta Range in Air : N/A cm

Max. Beta Range in Water : N/A cm

Average gamma E = 0.09 MeV

### Intake Data (annual):

Minimum Ingestion: 400  $\mu$ Ci equals 5 rem TEDE (WHOLE BODY)

300  $\mu$ Ci equals 50 rem CEDE (Kidneys)

Minimum Inhalation: 50  $\mu$ Ci equals 5 rem TEDE (WHOLE BODY)

40  $\mu$ Ci equals 50 rem CEDE (Kidneys)

### Doses:

**Skin Dose:** Reported for 1  $\mu$ Ci over 10 cm<sup>2</sup> of skin

32.1 mrad/hr (gamma dose)

Point Source: 0 mrad/hr (beta dose)

Disk Source: 0 mrad/hr (beta dose)

### Shielding Information:

Maximum Range For Beta	Plastic	N/A cm
	Aluminum	N/A cm
Tenth Value Thickness For Average Gamma:	Concrete	0 cm
	Lead	0 cm

**Detection information:** Usable Detectors listed with estimate efficiencies

Ludlum 3 w/ pancake probe at 1 cm	%	Liq. Scint. Counter	%
Ludlum 3 w/ NaI probe near surface	%	Gamma Counter	%

### Action Quantities:

Bench Top Quantity Must Be Less Than	400 $\mu$ Ci
Containers Require Labeling When Greater Than	1 $\mu$ Ci
Rooms Require Posting When There Is Greater Than	10 $\mu$ Ci
Contamination Lasting More than 24 hrs Require NRC Notification At	200 $\mu$ Ci