

TECHNICAL
PRODUCTS

TRACERLAB

DIVISION OF INTERNATIONAL CHEMICAL AND NUCLEAR CORP.

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2792

AREA CODE 517
894-6600

December 3, 1969

Mr. James C. Malaro
Isotopes Branch
Division of Materials Licensing
United States Atomic Energy Commission
Washington, D. C. 20545

Gentlemen:

The enclosed information concerning sealed sources containing by product material (and cobalt-57) is submitted for your evaluation.

A. Identification

Six capsules are identified as to window material and diameter of capsule by a letter designation. An additional letter and number denotes radio-nuclide and radioactivity level, i.e., RXA-Am-10. Radionuclides involved are Americium-241, cobalt-57, cadmium-109 and iron-55.

B. Proposed Use

These sources are primarily designed to be used in x-ray fluorescence devices but may be used in other situations where the source meets the criteria of use. It is expected that manufacturers of these devices will make application to the AEC specifying Tracerlab's sources by capsule and model number for use in generally licensed devices. These devices are used in the laboratory and would not be subject to any unusual environmental conditions. On occasion the device may be used in the field but would not be subject to any unusual conditions because of the application.

C. Radioisotope

Model numbers have been assigned for Americium-241 up to 30 mCi, Cadmium-109 up to 10 mCi, Cobalt-57 up to 10 mCi and Iron-55 up to 15 mCi. The model number also specifies the type of capsule that will be used. Cadmium, cobalt and iron activities will be electroplated on copper foil and annealed in a hydrogen atmosphere. Americium-241 is deposited as the nitrate into an Al_2O_3 pellet and carefully vacuum dried. Sodium silicate is used to seal the activity.

Sealed Source Files

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PDR RC *
SSD PDR

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Cadmium-109

22 KeV Photons
Capsule

| | <u>RXA</u> | <u>RXB</u> | <u>RXC</u> |
|--------|------------|------------|------------|
| 1 mCi | Cd-1 | Cd-12 | Cd-13 |
| 3 mCi | Cd-3 | Cd-31 | Cd-32 |
| 10 mCi | Cd-10 | Cd-101 | Cd-102 |

Example: A 3 mCi ^{109}Cd source using the RXC mount would be designated as RXC-Cd-32.

Cobalt-57

122 KeV Photons
Capsule

| | <u>RXL</u> | <u>RXM</u> | <u>RXN</u> |
|--------|------------|------------|------------|
| 1 mCi | Co-1 | Co-14 | Co-15 |
| 3 mCi | Co-3 | Co-33 | Co-34 |
| 10 mCi | Co-10 | Co-103 | Co-104 |

Iron-55

6 KeV Photons
Capsule

| | <u>RXA</u> | <u>RXB</u> | <u>RXC</u> |
|---------|------------|------------|------------|
| 0.5 mCi | Fe-0 | Fe-01 | Fe-02 |
| 1 mCi | Fe-1 | Fe-16 | Fe-17 |
| 3 mCi | Fe-3 | Fe-35 | Fe-36 |
| 5 mCi | Fe-5 | Fe-50 | Fe-51 |
| 10 mCi | Fe-10 | Fe-105 | Fe-106 |
| 15 mCi | Fe-157 | Fe-158 | Fe-159 |

Americium-241

11-20 KeV Photons
Capsule

| | <u>RXA</u> | <u>RXB</u> | <u>RXC</u> |
|--------|------------|------------|------------|
| 1 mCi | Am-1 | Am-12 | Am-13 |
| 3 mCi | Am-3 | Am-31 | Am-32 |
| 10 mCi | Am-10 | Am-101 | Am-102 |

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Americium-241

60 KeV Photons
Capsule

| | <u>RXL</u> | <u>RXM</u> | <u>RXN</u> |
|---------|------------|------------|------------|
| 0.1 mCi | Am-0 | Am-01 | Am-02 |
| 1 mCi | Am-14 | Am-15 | Am-16 |
| 3 mCi | Am-33 | Am-34 | Am-35 |
| 10 mCi | Am-103 | Am-104 | Am-105 |
| 30 mCi | Am-30 | Am-31 | Am-32 |

D. Construction

See attached drawings for parts; materials, dimensions and sequence of construction. The berillyum or aluminium windows are cemented to the monel body using Eccobond-276, a high temperature thexotropic epoxide adhesive, which is cured at 180°C. The rear plugs are heliarc welded to the body. Sources are placed directly against the window and if back shielding is required, a tin disc is placed directly in back of the source. The plug must then be shortened by the tin thickness before welding.

E. Prototype Tests

1. Deposited Activities

¹⁰⁹Cd - Wipe tests made on a 2 mCi deposit indicate less than 10⁻⁵% removable activity. Wipe tests made on a 100 mCi deposit indicate less than 0.1% removable activity.

⁵⁷Co - Wipe tests made on a 10 mCi deposit indicate less than 10⁻⁶% removable activity.

²⁴¹Am - Wipe tests made on a raw pellet containing 10 mCi gave no evidence of removable activity.

⁵⁵Fe - Wipe tests made on a 10 mCi electrodeposit indicate less than 10⁻⁴% removable activity.

Note: All smears except ⁵⁵Fe were measured in a 3/4" well sodium iodide crystal. Fe-55 smears counted with a proportional detector.

2. Adherence and Degradation of Eccobond-276

Several pieces of Eccobond-276 were prepared approximately 1" diameter x 1" thick. A tantalum foil was inserted into each mass prior to curing.

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These were then irradiated at the Massachusetts General Hospital using a 1200 Ci ^{60}Co source. The dosage was estimated to be 3×10^6 Rad. There was no apparent change in the appearance of the Eccobond-276 and removal of the embedded tantalum strips was impossible using maximum hand pressure.

Two capsules were then prepared (1 RXB and 1 RXM), by attaching the window material to the monel body using the Eccobond-276 adhesive. A pressure of 20 lbs/in² was then applied to the submerged capsules with no evidence of leakage. The capsules were irradiated to 3×10^6 Rad and the pressure test repeated. Again there was no evidence of leakage through the window.

3. Encapsulated Sources

Standard USASI test procedures were then performed on 2 RXB capsules and 1 RXM capsule, containing no radioactivity, and 1 RXB capsule containing 6 mCi ^{109}Cd . Following each test each capsule was subjected to the vacuum test (USASI B 2.4) and immersion test (USASI B 2.2). The capsule containing the 6 mCi of ^{109}Cd was also smear tested (USASI B 2.1) and found to be free of detectable, removable contamination. In accordance with the tests performed the USASI classification for these sources would be C-32231. Although these tests were not performed on all models there is sufficient similarity between them to assume that they will all fall into the same classification.

The puncture test made on the beryllium window, which obviously failed, produced a tearing effect and did not shatter the material.

F. Quality Control

Each empty capsule prior to being used will be helium leak tested by Acton Laboratories, Acton, Mass. Procedure will detect leaks to 10^{-8} cc/sec.

Each completed source will be subjected to the standard vacuum test, USASI B 2.4, and the standard immersion test, USASI B 2.2.

G. Labelling

Each source will be engraved with the following information: serial number, isotope, activity amount.

The outer container in which a source is packaged will contain the same information and in addition will include: date, radiation symbol and the

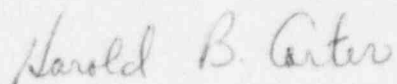
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words, "Caution-Radioactive Material", and our company name.

Very truly yours,



Harold B. Carter
Assistant Manager
Sources & Accessories Department

HBC:mn
Enc.

①

② Co-57 (No)

③ Vacuum light Bright Be.!

M.A.D. Translated Div of ICN
1601 Tropic Rd. Waltham Mass

use: designed
to use in (x-ray
fluor.) devices
(Many expects normal
use in lab)

~~Model~~ ~~isotope~~ ~~Source~~ ~~capsule~~ Designations
~~RxA-Cd~~ RxA, RxB, RxC
RXL, RxM, RxN

| <u>Isotope</u> | <u>Max act (Mci)</u> | <u>Capsule Designations</u> |
|------------------|----------------------|-----------------------------|
| Cd-109 | 10 | RxA, RxB, RxC |
| Fe-55 | 15 | RxA, RxB, RxC |
| Am-241 | 10 | RxA, RxB, RxC |
| Am-241 | 30 | RXL, RxM, RxN |
| Co-57 | 10 | RxA, RxB, RxC |

for their own purposes the
admin. ^{and} ~~translating~~ will identify sources ^{using} ~~with a~~
design which identify capsule type, isotope
and activity. For example an RxA-Am-10 source
would contain 10 Mci of Am-241. The AEC will now
license this source as a model RxA.

2

Add

Const Cd + 1 um electroplated on Cu foil
 + annealed (?) in a hydrogen atmosphere (get better on deposited electrodes)
 Am dep as NO_3 into Al_2O_3 pellet
 + vacuum dried

be on Al windows cemented to metal Body
 using Eccobond-276 Rem plug before welded to Body
 etc. $\text{RxA, B, C} \rightarrow$ window { 4 mil be (vacuum tight Berghco) or
 $\text{RXL, M, N} \rightarrow$ 40 mil Al

| Dimensions (inches) | | | | | |
|---------------------|--------------|--------------|--------------|--------------|--------------|
| RxA | RXL | RxB | RxM | RxC | RXN |
| 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| 0.32 | | 0.43 | | 0.6 | |
| 0.06 | | 0.1 | | 0.1 | |
| | | | | | |

length

Diam

well thickness

gall thickness?

Prot. Tests

USASI C-32231

+ special test to det adherence + degradation of Eccobond-276

Note: was on final but did not pass fracture test suggest

Label

USASI N510-1967

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NUMBER OF OVERSIZE PAGES FILMED ON APERTURE CARD(S) 2

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113
38

517
404
113

343
283
060

Mod Tracerlab Div - ICN

use: lat clines (x-ray fluor)

Models:

Isotopes: Am-241 (up to 20 mci)

(Cd-109 (up to 100 mci))

Models: X-1 X-2

Desc: dep of matl...

Capsule const.

30 mil walls

X-1 0.28" D x 0.24" L window 1 mil monel
braised to capsule Monel plug heliarc welded in place

X-2 0.52" D x 0.5" L ^{min wall thick} 130 mil wall

Prot Test

Portable
Carter - Tracelab

Sept 10 ~~to~~ Dec.

X-ray source

617 894-6600

Proposed Format for Catalog Sheets

SEALED SOURCE

MANUFACTURER:

(Name &
address)

DISTRIBUTOR:

(Name &
address)

MODEL DESIGNATION:

ISOTOPE:

(and maximum activity)

USE:

DESCRIPTION:

Radioisotope (maximum activity per source, chemical and physical form of the byproduct material, and method of depositing material in the source capsule).

Construction of source capsule (dimensions, materials of construction, and method of sealing).

(If source is used with special plugs, adaptors, etc., which are necessary for compatibility with a device, these should be described.)

CLASSIFICATION:

Classify source according to USASI Standard N5.10-1968 or other recognized Classification System or include a brief summary of conditions under which the source is expected to maintain its integrity.

LABELING: