Monsanto

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MOUND LABORATORY
Operated for the U. S. Atomic Energy Commission

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March 1, 1971

Mr. D. D. Davis, Area Manager
Dayton Area Office
U. S. Atomic Energy Commission
Post Office Box 66
Miamisburg, Ohio 45342

Attention Mr. E. A. Walker

Dear Mr. Davis:

Pursuant to recent discussions with you, the following is submitted as a tentative plan for sampling, examining, and, in some cases, destructively analyzing plutonium beryllium neutron sources.

At the present time there are 1,500 to 2,000 neutron sources in use by various universities, industries, and government installations. These sources were manufactured principally by Monsanto Research Corporation - Mound Laboratory, Monsanto Research Corporation - Dayton Laboratory, and NLMIC, Apollo, Pennsylvania. These sources range in size from approximately one-third curie to ten curies of encapsulated plutonium-239-beryllium compound. Most of these sources, particularly those manufactured by Mound Laboratory are more than eight years old.

Since the recanning program which was conducted by Mound Laboratory in the early 1960's (ref. "Inspection and Recanning Program of PuBe Neutron Sources," MLM-1188, M. R. Hertz, 1964, copy attached) no attempt has been made to evaluate the integrity of sources in the field, other than the cursory inspections performed by the licensees themselves, which consist of periodic dimensional and alpha wipe checks. Because of the age of these sources a representative sample of them should be recalled and subjected to dimensional, leak check, and radiographic inspection to evaluate the continuing integrity of the sources. In addition, a small sample of the sources should be destructively analyzed to determine fuel/metal compatibility and pressure increase with time.

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Incidentally, as a result of our preliminary inquiries concerning the disposition of neutron sources it is strongly recommended that a closer control over the disposition of these sources be established and maintained.

In recent months various occurrences have highlighted the need for ensuring the integrity of neutron sources. Three instances of potential failure of neutron sources have recently been brought to Mound Laboratory's attention. One source, returned to Mound by Schlumberger Well Services, Inc., had a wipe count on the surface of the source of 30,000 counts according to Schlumberger. This source is presently at Mound Laboratory and is stored in the logging tool in which it was used. A second source, received from NASA, Lewis Research Center, had an apparent bulge. Likewise, a source previously received from George Washington University had a noticeable bulge, and a radiograph of this source showed an apparent crack in the liner beneath the bulge. In addition, there are on hand two returned sources which because of use history were not reused. In storage are approximately 70 reuseable sources held for distribution to educational institutions under programs sponsored by the AEC Division of Nuclear Education and Training.

The program Mound proposes for the sources in the field consists of five phases as follows:

I. Examine all sources currently in storage at Mound.

   a) Non-destructively test 70 sources according to the NDT plan shown in Test Schedule I, attached.

   b) Destructively analyze five sources on hand at Mound according to the destructive analysis plan shown in Test Schedule II, attached.

II. Locate potential problem sources in the field by asking all licensees to perform tests on sources they hold and submit to us the following information on each source.

   a) Wipe check.

   b) Dimensional check.

   c) History of use to which each source was put.

III. Recall problem sources discovered in phase II above.

a) Destructively analyze some of the sources (approximately 10) according to Test Schedule II, attached.

b) Attempt to correlate problem sources with time of fabrication, manufacturing conditions, curie size, etc.

IV. Sample the remaining sources in the field (~ 10%) guided by any correlative factors derived in III.b. above.

a) Destructively analyze some (approximately 2 from each of the 1, 5, and 10 curie sizes) according to Test Schedule II, attached.

b) Non-destructively test all the samples according to Test Schedule I, attached (approximately 120 sources).

V. Evaluate data and make recommendations.

Manpower and costs to perform the above phases of work are presently being accumulated and will be included in a schedule 189 which will be prepared for this work for the FY-1973 budget submission. Phases I and II could be a complished this fiscal year if an early decision to proceed is made and funding is provided.

If you have any questions concerning this information, please let me know.

Very truly yours,

ORIGINAL SIGNED BY
WILLIAM T. CAVE

W. T. Cave, Director
Nuclear Operations

ISDS/WTC

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Enclosures 3

cc: D. D. Davis (2)

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Test Schedule I

NDT Scheme

The non-destructive test scheme consists of the following inspections:

1. Through alpha wipe check.

2. Visual inspection of the integrity of the outer container.

3. Dimensional inspection and comparison of the dimensional inspection results with information on the sources at the time of fabrication.

4. Leak check of the outer container consisting of the following: (a) imposition of high pressure helium on each source for a short period of time followed by (b) vacuum leak check of the source.

5. Radiographic inspection to determine the integrity of the liner of each source.

6. Recalibration of the sources with respect to neutron emission can be performed as an optional inspection step.

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Test Schedule II

Destructive Test Scheme

The destructive test scheme consists of the following inspections:

1. Evaluation of the history of each source.
2. Visual examination of the outer container surface and weld area.
3. Dimensional inspection and comparison with data on the source at the time of fabrication.
4. Helium leak check.
5. Radiography to determine the integrity of the outer container weld.
6. (Optional) Nuclear measurements including neutron and gamma spectra, neutron and gamma dose rates, and total neutron emission.
7. Internal gas pressure measurement and residual gas analysis on outer container.
8. Removal of the outer container by machining.
9. Sectioning and metallography of outer container weld.
10. Wipe check and visual inspection of inner container.
11. Leak check of inner container.
12. Microprobe analysis on inner container.
13. Internal gas pressure measurement and residual gas analysis on inner container.
14. Removal of the fuel from the inner container and metallographic analysis of the weld and the fuel liner interface.
15. (Optional) Fuel analysis including actinides, impurities, and stoichiometry.
16. Interim and final reports on the analyses.

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DAYTON LAB

PU-239-BE NEUTRON SOURCE MANUFACTURING PROCEDURE NSD/6

Scope: This procedure is intended as a guide to the general preparation of plutonium-239-beryllium neutron sources.

1.0 CONTAINER FABRICATION

Material for inner and outer source capsules is checked for compliance to materials specifications.

Dimensions of fabricated container parts are checked with the drawing. If critical dimensions are out of tolerance, a new container will be fabricated.

2.0 CLEANING PROCEDURE

All parts are degreased with acetone and rinsed with clean acetone prior to assembly.

3.0 PLUTONIUM ASSAY (GLOVE BOX OPERATION)

Plutonium metal is crushed into coarse chips using a hydraulic press. The required quantity is then weighed and recorded to the nearest .01 gram.

4.0 BERYLLIUM CUP PREPARATION

A beryllium cup is fabricated to fit within the tantalum inner container such that the total weight of beryllium is at least 50% of that of the plutonium. A recess is drilled of sufficient size to contain the required plutonium.

5.0 PRIMARY ENCAPSULATION (GLOVE BOX OPERATIONS)

Weighed quantity of Pu metal is loaded into the beryllium cup which is then inserted into the tantalum container. Tantalum plug is fitted into the tantalum container and closure made by TIG fusion weld. Capsule is then leak tested by placing in a pressure chamber and subjected to a minimum of 100 psig helium for at least 15 minutes, quickly removed and immersed in water to observe pressure of any bubbles indicating leakage. If a leak is detected, repair is effected by rewelding and the capsule is retested.

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6.0 SOURCE ACTIVATION (GLOVE BOX OPERATION)

The sealed tantalum capsule is placed in a chamber which is purged of air by evacuating to less than 500 microns Hg pressure and refilling with helium. This purging is repeated once, then a vacuum maintained at less than 500 microns Hg pressure. The tantalum capsule is heated by induction coil to 1300-1500°C to initiate the exothermic reaction: $Pu + 13\ Be \rightarrow PuBe_{13}$. This will cause the temperature of the capsule to increase to 1800-2000°C. Induction heating is stopped on visible indication of self-heating. Reaction proceeds to completion and source is allowed to cool naturally to room temperature before being exposed to the atmosphere in order to minimize oxidation of the tantalum. The reacted material is now a neutron emitter and must be handled as such.

7.0 LEAK TESTING PRIMARY CONTAINER (GLOVE BOX OPERATION)

Source is again tested for leaks per item #5.0 above. Tantalum capsule is decontaminated by manual and ultrasonic scrubbing to swipe test of less than 1000 alpha counts per minute, and removed from glove box.

8.0 SECONDARY ENCAPSULATION

Tantalum capsule is inserted in the outer stainless container body. The stainless plug is inserted and closure made by TIG welding. Closure is then leak tested by helium pressure bubble test described in the above paragraphs.

9.0 LEAK TESTING SECONDARY CONTAINER

The source is completely cleaned to a swipe test of less than 10 alpha counts per minute and submitted to an additional testing or quality control procedures that may be required. If no helium leak test is performed, the source is held seven days and the swipe test is repeated to assure there is no leakage. Initial and final swipe test counts are recorded and the source is neutron counted and assayed by calorimetry before preparing for shipment.

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NUCLEAR SOURCES DEPARTMENT

HELIUM LEAK TESTING PROCEDURES, NSD/1

1.1 PURPOSE

To determine if leaks are present in sealed source capsules and/or assemblies.

1.2 GENERAL TEST METHOD

Each source capsule shall be subjected to a pressure of 300 psi minimum with helium for a period of 1/2 hour in a suitable pressure chamber. The capsule shall then be removed to an evacuation chamber. The chamber shall be evacuated to a specified pressure and monitored with a mass-spectrometer type leak detector.

1.3 DETAILED PROCEDURE

1.3.1 Pressurizing

a. Place the component in a pressure tube.

b. Using helium bottle pressure, purge the pressure tube of air.

c. Pressurize the tube to 300 psi minimum with helium and maintain for a period of 1/2 hour.

d. Depressurize the pressure tube and remove the component to the evacuation chamber.

1.3.2 Helium Leak Testing

1.3.2.1 General

a. Operation of the leak detector shall be strictly in accordance with the manufacturer's instructions. At no time shall the leak detector pumps be used to evacuate external manifolds or vacuum chambers.

b. The leak detector and vacuum system shall be calibrated by using a calibrated leak before and after leak testing of each source capsule. When checking th leak detector, the regulated power supply shall be turned on for at least ten minutes before any readings are taken and the internal pressure of the leak tester shall not exceed 0.1 micron for at least five minutes with the throttle valve wide open. The leak detector shall be adjusted so that a leak rate of 1×10^{-6} standard cc/sec shall give a leak ratemeter reading of at least 90% of full scale. Calibration is made using a standard helium leak of $5\text{-}9 \times 10^{-8}$ standard cc/sec.

In calibrating the vacuum system, the roughing pumps shall be isolated from the system, and the standard leak placed at the furthest point from the leak detector. After calibration, valve off the leak. The system background readings shall be 10% or less of the leak calibration level in five minutes.

c. The pieces tested shall be free of dirt, grease, burrs, etc., which would either tend to clog defects or damage the pressure and vacuum fittings.

d. Leak testing shall be performed in well ventilated areas to minimize the possibility of detecting helium contaminated air.

e. The vacuum system, exclusive of the vacuum chamber, shall be kept under a continuous dynamic vacuum.

1.3.2.2 Leak Testing

a. Before each capsule is tested, the following blank tests shall be performed (as shown in "b" - "d" below):

(1) System background shall be determined by a test duplicating normal procedure, but having no source capsule in the vacuum chamber.

(2) Source capsule background shall be determined by testing a solid bar of the same material and with approximately the same configuration as the source capsule. The bar is to be subjected to the pressurization described in section 5.1 prior to being leak tested.

b. Place the component to be tested inside the vacuum chamber.

c. Evacuate the chamber and begin monitoring when the system pressure falls within the range of the leak detector. This shall be done with a maximum leak detector internal pressure of 0.1 microns and with the instrument set for maximum sensitivity. The required procedure is to crack open the throttling valve on the leak tester when the system vacuum reaches 5 microns or less. A full open throttle is made only if the leak tester vacuum can be maintained below 0.1 microns.

d. If no helium signals are given after continuously pumping and testing with an open throttle valve for one minute, isolate the chamber from the vacuum pumps and accumulate any helium leakage for 30 minutes. Monitor chamber following the procedure described in "c".

1.4 DATA REQUIRED

Record the magnitude of leak indication and internal pressure of the system at the time of measurement for each of the following:

a. Chamber background.

b. Standard leak.

c. Solid bar background.

d. Each of the source capsules - including proper identification of the particular source capsule.

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1.5 ACCEPTANCE CRITERIA

Any encapsulated source with an indication of leak greater than 1×10^{-8} std cc/sec shall be considered leaking and subject to repair and retest.

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HELIUM LEAK TESTING PROCEDURE, NSD/1A

Scope: This procedure is to be used when primary source capsule or singly encapsulated source containing an isotope with a half-life greater than five years are to be subjected to a helium mass spectrometer leak test.

1.0 PRELIMINARY PROCEDURES

The capsule is to be subjected to a helium bubble test just after making the closure weld. This test shall consist of pressurizing the capsule in a helium atmosphere at a pressure of 100 psi for 15 minutes. Remove the capsule from the helium atmosphere and immerse it in water. Bubbles from the capsule would be the indication of a leak. If no leaks are indicated, the capsule is to be decontaminated so that a smear over the surface of the capsule would remove no more than 9×10^{-5} μCi of radioactive material.

2.0 TEST PROCEDURES

The capsule would then be subjected to the helium leak test procedure as outlined in procedure NSD/1.

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CLEANLINESS REQUIREMENTS, NSD/3

1.1 GENERAL PROVISIONS

Fabrication and assembly of equipment should be conducted so as to facilitate cleaning and inspection for cleanliness, and to minimize contamination during fabrication. Equipment shall not be manufactured with the expectation of cleaning only after completion of fabrication or assembly. Component parts of equipment shall be clean and maintained in a clean condition up to and including assembly; thereafter, the assembled equipment shall be maintained in a clean condition.

Equipment supplied under this procedure shall be suitably clean for installation directly into a piping system without further cleaning. It is extremely important that contamination be kept to a minimum to prevent adverse effects upon the system such as accelerating the corrosion and wear of equipment.

Equipment shall be cleaned and shipped so that the visible contamination criteria specified by the buyer will be met when reinspected at destination prior to installation. The requirements of this paragraph are not intended to require cutting of component seal welds for internal examination during receipt inspection by the installing activity.

1.2 ACCEPTANCE CRITERIA FOR CLEANLINESS

Unless otherwise specified, equipment shall be clean to the extent that no contamination is visible to a person with normal visual acuity, natural or corrected, under an adequate lighting level on the surface being inspected. Cleanliness need not be determined by an interpretation of the discoloration or dirt obtained by wiping a surface with a wet or dry cloth. This technique should be used to determine the cleanliness of surfaces which cannot be visually inspected due to inaccessibility or geometry. In such cases, the cleanliness shall be evaluated on the basis of type and quantity or contamination as well as the extent of discoloration. Equipment which does not meet these requirements shall be recleaned in accordance with this procedure.

1.3 MEASURES TO PREVENT EQUIPMENT CONTAMINATION

1.3.1 Welding or Brazing

a. When welding or brazing of parts is performed, precautions shall be taken to control splatter and to remove welding and brazing smoke from the equipment.

1.3.2 Exposure to Shop Atmosphere

a. Components with complex internals, which are not accessible to subsequent cleaning shall not be exposed to a general shop area atmosphere more than is absolutely necessary.

1.3.3 Heat Treatment

a. Precautions shall be taken to prevent contamination of surfaces prior to and during heat treatment.

1.3.4 Use of Lubricants

a. A lubricant may be employed during machining operations. Lubricating oil shall be completely removed from the work immediately following machining operations.

1.3.5 Restrictions

a. Mercury or mercury compound-containing instruments or equipment (such as thermometers, manometers, vacuum pumps) shall not be used for any service in connection with fluid systems or components during fabrication, assembly, packaging, installation, examination, testing, or repair. It is not the intent of this procedure to prevent the use of fluorescent lighting fixtures.

b. Lead of materials containing lead or lead compounds as a basic chemical constituent shall not be used in direct contact with the final cleaned surface of nickel base alloys equipment or components. Aluminum shall not be used either as soft pads or hammers to reduce marring during assembly or handling of nickel base alloys equipment or components. It is not the intent of this procedure to prevent the use of aluminum pipe caps.

1.3.6 Handling Equipment

a. In general, cleaned surfaces may be handled with clean hands; however, in production handling of intricate items, such as mechanism parts, clean gloves shall be used.

1.3.7 Exclusion of Foreign Materials

a. During fabrication and assembly of equipment requiring a high degree of cleanliness, extreme care shall be taken to prevent foreign material from being introduced into the equipment.

1.4 MECHANICAL CLEANING REQUIREMENTS

Filing and deburring shall be performed with clean carbide or tool steel hand tools. Wire brushing shall be done with clean corrosion-resistant steel brushes. Handling equipment shall be made of corrosion-resistant or chromium plated steels. Grinding and polishing shall be performed with such a resin or rubber bonded aluminum oxide or silicon carbide grinding wheel or cloth polishing wheel or disc that will assure a cleanly cut surface. Completed equipment shall be cleaned as required to remove any particles from operations such as grinding, polishing and filing.

Mechanical cleaning shall not be used as a final cleaning step. If mechanical cleaning is used, it shall be followed through by a thorough liquid cleaning.

1.4.1 Degreasing by Immersion or Wiping

a. Degreasing of parts having no inaccessible areas or crevices may be performed by immersion in solvent or by wiping with a clean, lintless wiping cloth saturated with the solvent (unused acetone).

1.4.2 Degreasing of Crevices and Inaccessible Areas

a. Parts or surfaces containing crevices or inaccessible areas shall be degreased only by immersion in unused acetone.

1.5 ULTRASONIC CLEANING

Cleaning methods employing ultrasonic cleaning equipment may be used.

1.6 DRYING REQUIREMENTS

Drying may be accomplished by still air.

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PO BE NEUTRON SOURCE MANUFACTURING PROCEDURE NSD/5

Scope: This procedure is intended as an outline guide to the general preparation of a polonium-beryllium neutron source.

1.0 PREPARATION

1.1 Assemble, prepare and check capsule components and associated hardware.

a. Press beryllium powder pellets as required. Record measured dimensions and weight of finished pellets.

2.0 TRANSFER PO-210 TO INNER CAPSULE

2.1 Polonium is received electroplated on platinum gauzes, sealed in glass ampoules. The gauzes are removed from the glass ampoules and loaded into a vaporization "gun."

2.2 Vaporization gun is installed in a vacuum chamber within an induction heating coil.

2.3 Inner source capsule is inserted in a previously prepared chill block which is then positioned and sealed to the above mentioned vacuum chamber.

2.4 Vacuum chamber is evacuated and the vaporization gun is inductively heated to vaporize the polonium which recondenses on the walls of the inner capsule.

3.0 SEALING THE INNER CAPSULE

3.1 Inner capsule containing the Po-120 is removed from the vacuum chamber, withdrawn from the chill block and the previously prepared beryllium target material is inserted.

3.2 Capsule end cap is installed in place and a rough assay of the Po-210 content is made by calorimetry.

3.3 The capsule is then mounted in the welding chill block and placed in the welding rotator. End cap is welded in place using the previously established welding procedure.

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3.4 After visual examination of the weld, a dye penetrant test is performed, if required by the purchaser, and if thermal conditions of the capsule do not obviate the validity of this test.

3.5 Sealed inner capsule is decontaminated and any other required tests and control procedures are performed including final assay of Po-210 content by precision steady-state calorimetry.

4.0 ACTIVATION OF NEUTRON EMISSION

4.1 Sealed inner capsule is placed in an induction heater coil and heated to above the vaporization point of polonium. During heating the neutron emission is monitored on a rate meter, and heating is stopped when no further increase in neutron emission can be observed.

4.2 Capsule is allowed to cool and then checked for contamination.

5.0 FINAL ENCAPSULATION

5.1 Outer capsule is mounted in its welding chill block, in the welding rotator and the finished inner capsule is inserted into position.

5.2 Outer end cap is inserted and welded in place using the previously established welding procedure.

5.3 Finished source is cleaned and final swipe test for alpha contamination is performed. Swipe test must show not more than 1×10^{-5} μC removable alpha contamination.

5.4 After final inspection the source is prepared for shipment.

6.0 GENERAL

6.1 Neutron counting per NSD/4 may be performed either on the completely finished source or on the finished inner capsule, whichever is most practicable.

6.2 Steps 2.0 through 4.2 inclusive, except the rough assay of step 3.2 and the testing in step 3.5, are performed in sealed, controlled atmosphere glove boxes.

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SPECIFICATION FOR NEUTRON COUNTING, NSD/4

1.0 PURPOSE

The purpose of neutron counting is to determine the neutron emission of a source.

1.1 GENERAL TEST METHOD

For this test a BF_3 tube is used inside a polyethylene moderator, generally called a long counter, with a scaler to count the pulses from the tube.

The source to be counted is placed on the counting bar at a specific distance from the tube and the source is rotated during the counting period to average the neutron flux around the source. The source is counted a specific amount of time, normally three times. A standard source is counted at the same distance. The count rate of the source is compared to the standard count rate in order to determine the actual neutron emission rate of the unknown source.

1.2 DETAILED PROCEDURE

1.2.1 Preparation

a. The counter voltage is adjusted to 1300 O.V.

b. The counting bar is set at the proper distance from the counting tube.

c. A neutron background is taken and calculated into neutrons per second.

d. A standard neutron source is counted a specific distance from the tube, three separate times. These counts are averaged.

The standard neutron source has a known emission rate, so from the data taken, a factor (geometry and efficiency) is calculated.

This factor is used in calculating the neutron emission of the unknown source.

1.2.2 Counting of the Samples

a. The sample is counted at the same distance as the standard. The time may vary depending on the emission rate of the source. The time of the count is adjusted so that a minimum of 10,000 counts are recorded on the scaler.

b. The data is then averaged and calculated using the factor to determine the emission rate of the unknown source.

c. The data is recorded and calculations are made as indicated on Neutron Emission Form.

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NUCLEAR PRODUCTS DEPARTMENT

MANUFACTURING PROCEDURE FOR $\begin{matrix}(Pu8Be)\\(AmBe\ )\end{matrix}$ NEUTRON SOURCES NSD/9

Purpose

The purpose of the procedure is to outline the method of producing quality neutron sources in a consistent manner.

1. Container Preparation

The materials for the inner and outer containers are checked to see that they meet applicable specifications. Dimensions of fabricated container parts are checked against the appropriate drawing dimensions. If the purchase order requires a formal inspection report, the dimensions are recorded on MRC Inspection Report Data Sheet (copy attached). Upon receiving container parts in the Nuclear Products Department, the dimensions are rechecked as well as fit, finish, and appearance, and the acceptability noted on the Manufacturing Check List. Out of tolerance or otherwise faulty parts are rejected.

2. Cleaning Procedure

All parts are degreased with acetone and rinsed with clean, C. P. grade acetone prior to assembly.

3. Preparation of $\begin{matrix}(Pu8Be)\\(AmBe\ )\end{matrix}$ Matrix (glove box operation)

The $\begin{matrix}(\text{Plutonium-238})\\(\text{Americium-241})\end{matrix}$ is supplied as the powdered oxide. The required quantity is weighed out to the nearest 0.001 gram. The weighed oxide is placed in a ball mill with typically four times as much beryllium powder by weight, and milled at least 8 hours. The efficiency of milling is checked by observing the neutron yield.

4. Loading and Sealing Inner Capsule (glove box operation)

The prepared mixture is packed into the inner capsule. The capsule is temporarily closed and checked by neutron counting for proper neutron output. If the output is correct, the capsule is sealed by T.I.G. fusion welding.

5. Testing and Cleaning of Inner Capsule (glove box operation)

The seal of the inner capsule is checked by placing the capsule in a pressure chamber and applying 100 Psi of helium pressure for at least 15 minutes. The capsule is then quickly removed

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and immersed in a transparent container of water. Bubbles emitting from the capsule indicate the presence of a leak. Leaking capsules are repaired and retested before proceeding. The acceptable capsules i.e. those showing no bubbles after two minutes observation; are cleaned to a standard alpha swipe test of less than 1×10^{-3} μCi surface contamination. The clean capsule may then be removed from the glove box and transferred to a fume hood for secondary encapsulation.

6. Secondary Encapsulation

The completed inner capsule is inserted into the secondary container. The seal is accomplished by T.I.G. fusion welding. The welded capsule is helium bubble tested as in 5. above, then cleaned to a standard alpha swipe test of less than 1×10^{-5} μCi surface contamination, and subjected to further testing as may be required. If no further testing is required, a second alpha swipe test 7 days after the first, to the same acceptance standard, must be performed prior to release for shipment.

7. Quality Control Inspection

Quality Control inspection is performed on the secondard capsule as may be required by the purchase order. Helium Leak testing, if required, is as specified in MRC procedure, NSD/1; Liquid Penetrant Test as specified in MRC procedure, NSD/2; and/or the capsule may be radiographed according to Mil-Std 271. The neutron flux is calibrated according to MRC procedure NSD/4.

8. Final Assembly

The completed capsule may now be further assembled by adding handling devices, etc. as may be indicated on appropriate assembly drawing.

PRELIMINARY PROCEDURE FOR RETURNING NEUTRON SOURCES

1. Prior to the return of the Pu-Be neutron source(s), you will need to make known your intentions to the AEC leasing office by contacting:

   Mr. P. A. Craig
   Plutonium Leasing Officer
   U. S. Atomic Energy Commission
   Richland Operations Office
   P. O. Box 550
   Richland, Washington 99352

2. Apply for an amendment to your license to authorize, under the provision of CFR-71, delivery of the source(s) to a carrier for transport in the packaging that will be used for that purpose by contacting:

   Mr. D. A. Nussbaumer
   Chief, Source and Nuclear Materials Branch
   Division of Materials Licensing
   U. S. Atomic Energy Commission
   Washington, D. C. 20545

3. Use an approved shipping container. I will send you one if you so desire. Please give me a week or two notice of your expected shipping date. The shipping container is an approved U. S. Department of Transportation Specification 6J container for one curie sources, or 6M for shipping larger sources. Instructions for loading, labels required and lead wire seal(s) will be furnished when warranted.

4. Ship source(s) prepaid to:

   Monsanto Research Corporation
   Mound Laboratory
   Miamisburg, Ohio 45342
   Attn: E. A. DeVer (SS Representative)
   For: Arthur F. Sc. idt

5. Complete the enclosed form, AEC-741 and mail to:

Mr. E. A. DeVer
S. S. Representative
Monsanto Research Corporation
Mound Laboratory
Miamisburg, Ohio 45342

6. Please send me any information you might have concerning the source(s), including name of manufacturer, fabrication date, total amount of enclosed plutonium, source intensity, physical dimensions, encapsulation materials, closure technique, and use to which the source was put (in terms of general source condition).

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