LA-UR-14-23918

SHIPPING PLAN

For the

Establish Americium-Oxide Production Capability Project

at the

Los Alamos National Laboratory

Version 1.60

SHIPPING PLAN

Establish $^{241}AmO_2$ Production Capability Project

Los Alamos National Laboratory

Approvals:

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Table of Contents

Reference

1. Shipping/Packaging Requirements and Methods for Americium-241 Oxide Production Operations; LA-UR-12-25118; Schulte, et al.

REVISION Log

Date	Revision #	Change Description
Oct/13	1.0	Early Rev.
May/14	1.2	Mods from Team review
June/14	1.3	Mods from SME review
July/14	1.5	Mods from DOE-SC/NIDC Review
Sept/14	1.6	Direction from DOE to split into two plans

1.0 Introduction

1.1.1 Background

The Am Program at LANL receives funding/guidance from the DOE Office of Science – Office of Nuclear Physics (DOE-SC), conducts operations in a NNSA Defense Programs (NNSA-DP) Facility with material owned by the NNSA-DP, receives oversight/authorization by the Los Alamos Site Office, and produces product for the National Isotope Development Center (NIDC) for sale to Industry. The Key Performance Parameter (KPP) for capacity, as set in the Project Execution Plan (PEP), is 200 g/yr. with production capacity targeted at nominally 500g/yr., and a "stretch" goal of 750g/yr. A "stretch" goal will lead to ~ 25 shipments/yr.

There are a number of interfaces and requirements for safety, security, product acceptance, and MC&A (Material Control & Accountability) which must be met in order to move this material from the NNSA to Industry. Material will be administratively transferred from NNSA-DP to DOE-SC, and then administratively/physically provided to customers designated by the DOE-SC/NIDC. Because of this complex process, a shipping plan was deemed necessary.

1.1.2 Purpose

This Shipping Plan is intended to provide a high-level discussion on how the requirements from the various organizations will be met as the material moves from the TA-55/PF-4 Vault through processing to shipment and transfer from the NNSA to Industry. This document provides a high-level discussion on how the various requirements, from the organizations providing oversight/guidance, will be met – from the perspective of Shipping.

Because Shipping represents a major set of interfaces across LANL, Los Alamos Site Office, DOE-SC/NIDC, LANL Isotope Production (LANL-IP), DOE-SC, and NNSA-DP there are a number of topics to address. The key topics are Technical (i.e., Drawings, Containers, Shipping Configurations, dose, etc.), QA (i.e., Production Flowsheet, QAP, Customer Specs, etc.), Transfer Methods (i.e., Ownership transfer, Authorizations, MC&A, and Liability, etc.) The material specifications, as noted in the Project Execution Plan, are shown below in Table 1.

Quantity	Specification
^{241}Am isotopic purity	^{241}Am > 99% of all Am by weight
$^{241}AmO_2$ chemical purity	> 95% by weight from NDA methods
Pu content	< 1.0% by weight from NDA methods
Any other individual impurity measured	< 0.5% by weight of any other individual inert impurity measured, including – Al, B, Be, Bi, Ca, Cd, Co, Cr, Fe, K, Mg, Mn, Mo, Na, Ni, Pb, Si, Sn, Zn, Zr, Np, and U by ICP-ACE and ICP-MS

Table 1- Material Specifications

1.1.3 Scope

This plan applies to all activities pertaining to the $^{241}AmO_2$ Project and Programmatic Operations, with a detailed focus on Shipping and the respective interfaces where there is a transfer of ownership.

After the Introduction Section (1.0), this Shipping Plan is divided into two focus areas – Technical Discussion on Containers, and; Material Management & Transfer Requirements. The Technical Section was written to potentially be a standalone document to coordinate with the DOE-SC/NIDC and customer.

Technical Discussion - Containers

Establish Americium-Oxide Production Capability Project

at the

Los Alamos National Laboratory

2.0 Technical

The "Establish Americium-Oxide Production Capability" Project will produce purified $^{241}AmO_2$ (americium-oxide) powder for the DOE-SC (Department of Energy - Office of Science) to be used in industrial applications. A meeting was held in September/2011 between the DOE-SC/NIDC, Los Alamos Site Office, and LANL. At this meeting there was a discussion of requirements and capabilities, including the LANL Baseline Proposal to use a Type B Container. The feedback from this meeting was a request for a conceptual design for containers that would be compatible with an existing Type A Special Form Capsule (SFC) such as the LANL Model II Source Capsule.

Based on the feedback from industry representatives and DOE-SC/NIDC the LANL Team modified the Baseline to incorporate a Type A Special Form Capsule (SFC) shipping strategy. With positive feedback on this approach LANL has since gone forward with the selection of the

LANL Model II Source Capsule as the qualified SFC and the development of containers to be nested within. The designs have been vetted by representatives of Industry and/through the DOE-SC/NIDC. The designs and configurations shown below are the result of this collaborative effort. A more thorough discussion of the development of the technical requirements for transport and containers is contained in a LANL publication[1].

2.1.1 Overview

The designs of new SNM containers meet the specific requirements identified for $^{241}AmO_2$ to allow integration into existing approved storage and shipping containers. The technical requirements for shipping are focused on the delivery of $^{241}AmO_2$, meeting specification requirements, in qualified shipping containers approved for use by the program. These qualified shipping containers have been validated as acceptable to the industry consortium customer, via the National Isotope Development Center (DOE-SC/NIDC). The intent of the design of the $^{241}AmO_2$ containers is an optimization effort to meet the identified requirements, meet the needs of the customers, minimize exposure dose to workers, and to minimize the probability/severity of contamination of customers/workers/equipment. While focused on a (targeted) 30g batch size, the Program would like to maintain the flexibility for larger payloads (e.g., up to two batches in one container).

An additional design requirement is that the assembled shipping package/configuration meets the requirements for radiation exposure limits at the surface of the shipping container (i.e., 200 mrem/hour at surface). From a dose and cost perspective, it is important that repackaging of qualified/packaged lots of $^{241}AmO_2$ – solely to achieve custom or specific batch sizes - be avoided. In special cases however, coordinated through the DOE-SC/NIDC, it is possible to look to honor requests for specific quantities less than 30 grams.

2.1.2 Drawings

The designs of new SNM containers meet the specific requirements identified for $^{241}AmO_2$ to allow integration into existing approved storage and shipping containers. The requirements considered include: required payload capacity, measurement/qualification of payload, diameter, height, weight, sealing of closure, materials of construction, waste minimization, labeling, and exposure limits.

The current drawings for LANL "inner" and "middle" containers are attached in Appendix A. These drawings are the current, signed revisions of the design for the *"SNM Inner Container 12-MET1-S267 R2"* and *"SNM Middle Container 12-MET1-S268 R2"*. These drawings include laser etch labeling instructions for the "inner" and "middle" containers. No substantive design changes to dimensions have been made to these drawings between revisions 1 & 2. Specific direction regarding the surface finish, label etching instructions, and cleaning instructions has been added to the drawings.

[1] "Shipping/Packaging Requirements and Methods for Americium-241 Oxide Production Operations; Louise D. Schulte, Sheldon K. Apgar, Mike L. Caviness, Toby J. Vigil, Lorenzo E. Viramontes, LA-UR-12-25118; September 28, 2012.

The labels will include the CAGE (Commercial & Government Entity) code for the design of the components and the revision controlled/approved drawing number. The labels will also include the CAGE code for subcontractors that manufacture the components. The initial batch of containers will list the LANL CAGE code of 41SP7 as the design/fabricator. A serial number (S/N) will be etched on the walls of the individual containers and this unique number will be referenced in documentation tracking the container, providing a description of material contents.

Example: Laser Etch Labels	Laser Etch Labels – Inner Container
Part Description	SNM Inner Container
CAGE Code: Designer Drawing Number – Rev	41SP7 LANL 14-MET1-S267 R2
Manufacturer: CAGE Code	MFR: 41SP7
S/N: 000x (if utilized)	S/N: 0001

Figure 1. Photo of LANL prototype “middle” and “inner” containers with lids removed.

2.1.3 Containers

A nested configuration of containers will be used to transport the $^{241}AmO_2$ product. The qualified Type A shipping package will consist of a LANL Model II Source Capsule as the “Special Form Capsule”, nested inside a 10 gallon Type A-7A Drum or similar Type A Overpack. Although Type B shipping containers are typically reusable and Type A containers are not reusable, there is a potential for a future capability to perform an evaluation for the return of some containers.

For the handling/packaging of $^{241}AmO_2$ inside PF-4, two containers are used. Both of these containers are specially designed and the result of discussions with the DOE-SC/NIDC and Industry Representatives at the September/2011 meeting and follow-up correspondence. Designs presented to the customer through the DOE-SC/NIDC have received positive feedback. The “middle” container *(12-MET1-S268 R2)* is designed to receive a closed “inner” container *(12-*

MET1-S267 R2) as it is removed from the glovebox. The designs for these LANL containers, including the laser-etch labeling information on the containers, is included in the attachments. The middle container provides a critical contamination control barrier to protect workers from contamination resident on the "inner" container.

2.1.4 Dimensions of Containers

<u>LANL Model II Source Capsule</u>

Considerable effort has been expended to develop container designs that meet the customer's expectations for the dimensional requirements for the LANL Model II Source Capsule, utilized for shipment, working with the LANL internal-use transfer/storage container (SAVY-400 Overpack Container). The design requirement to meet the diameter limit of the LANL Model II Source Capsule along with subsequent limits for nested containers, plus adequate tolerances and gamma shielding for the $^{241}AmO_2$ payload, represents one of the more difficult design constraints.

The LANL Model II Source Capsule lists an internal diameter of 2.06 (+0.012, -0.003)[2]. The outer diameter of 1.95" for the LANL "middle" container will fit within the diameter constraint of the LANL Model II Source Capsule. The outer dimension height of 4.056" for the LANL "middle" container will easily fit within the height constraint LANL Model II Source Capsule (inner dimension height of ~8.5") and, in fact, it is possible to stack two LANL containers. This stacking can be done with the understanding the total amount of material does not exceed the limits for the container.

<u>10 gallon Drum</u>

The selection of an approved Type A overpack drum is less prescriptive than the selection of the LANL Model II Source Capsule along with the "inner" and "middle" containers nested within. Overpack drums with other (internal) advantages not discussed her, might be selected. The 17" height of the 10 gallon/38L Drum (Note: The Team will initially be using the Skolnik Item # CQ1002 Drum). The Type A-7A Drum is one of the smaller drums that will adequately contain the 12" tall LANL Model II Source Capsule.

<u>LANL Internal Storage/Transfer Container</u>

Packaged items of $^{241}AmO_2$ removed from the LANL glovebox environment in an "inner" container are placed into a "middle" container are over-packed into a required LANL SAVY-4000 container when removed from the glovebox and subjected to measurements for qualification and MC&A purposes. The current design for the containers utilizes the 4.38" height constraint originating from the 1 quart SAVY-4000 storage container. The outer dimension height of 4.056" for the LANL "middle" container will fit within the height constraint of the 1 quart SAVY overpack container and includes an allowance for a plastic bag (if required and for LANL use only).

<u>Middle Container</u>

The "middle" container is designed to receive a closed "inner" container as it is removed from the glovebox. This container provides a critical contamination control barrier to protect workers from contamination resident on the "inner" container. The outer diameter of 1.95" for the LANL

[2] Dimensions of existing LANL Model II Source Capsule are taken from LANL Drawing #90Y-219998, "Source Containment Capsule, Module II Detail/Assembly".

"middle" container will fit within the diameter constraint of the LANL Model II Source Capsule (inner diameter of 2.06").

The outer dimension height of 4.056" for the LANL "middle" container will fit within the height constraint LANL Model II Source Capsule (inner dimension height of ~8.5"). The height of the LANL "middle" container (4.056" height) is such that two of these containers could be stacked inside. In the normal package configuration of a single LANL "inner/middle" container assembly, it may be desirable to include a simple "blank" segment of stainless pipe of a length to minimize load shifting/impact if the package is inverted. The outer dimension height of 4.056" for the LANL "middle" container will fit within the height constraint of the 1 quart LANL (i.e., SAVY) overpack container (inner dimension height of 4.38").

Inner Container

The outer diameter of 1.400" for the LANL "inner" container will fit within the diameter constraint of the LANL "middle" container (inner diameter of 1.550"). The outer dimension height of 3.480" for the LANL "inner" container will fit within the height constraint of the LANL "middle" container (inner dimension height of 3.538"). The volume of the "inner" container easily allows the current normal planned standard payload of ~34 g net weight of $^{241}AmO_2$, (~30 g of ^{241}Am isotope) and some room for growth to maximum payload capability.

2.1.5 Shipping Configurations

The $^{241}AmO_2$ material is packaged in a nested configuration for transportation. From innermost container to outermost container, the nesting is as follows.

- Inner Container – The container in direct contact with the $^{241}AmO_2$. Some dose protection, designed to enable protection while handling, but not extensive. Contaminated surfaces on inside & outside. This container is robust but not qualified to any transportation standards.
- Middle Container – Holds the inner container and the next layer of protection with material packaging. Designed to enable a relatively clean (i.e., less than 20 dpm) outer surface to enable handling outside a glovebox environment. This container is robust but not qualified to any transportation standards.
- LANL Model II Source Capsule – Holds the middle container and designed to provide the additional dose protection to guarantee transport and tamper-proof protection. This capsule also provides the capability to ship two middle containers or "center" a single middle container, with nominal batch size amounts, to provide a more balance dose at the boundaries. The LANL Model II Source Capsule is a qualified SFC for use as part of a Type A Package. The use of the SFC allows and A1 quantity of ^{241}Am to be shipped per 49 CFR 173.435.
- 10 gallon Drum – The combination of an approved Type A overpack drum and the LANL Model II Source Capsule provides a qualified Type A package, available for transport to either the DOE-SC/NIDC or directly to the domestic industry customer. Other approved Type A drums could be used with the LANL Model II Source Capsule.

Figure 2. Shipping configuration with inner & middle containers, source capsule, and drum.

The height of the LANL "middle" container is such that two of these nominal batch-sized containers could be stacked inside a LANL Model II Source Capsule. The weight of two nested LANL "inner/middle" container assemblies (~2.6 lb each) would remain within the payload limit (5.5 lb) of the LANL Model II Source Capsule. Or, in the normal package configuration of a single LANL "inner/middle" container assembly, it may be desirable to include a simple "blank" segment of stainless pipe of a length to minimize load shifting/impact if the package is inverted.

The designs of the "inner" and "middle" containers include a method of compressing a sealing disk without the use of conflat bolts to create a robust seal. It is anticipated that the robust nature of the seals of the "inner" and "middle" containers will minimize the probability/severity of contamination of customers, workers, and equipment. The design of the "middle" container is concentrically smooth both inside and out to optimize efficiency in nesting of containers.

2.1.6 Alpha Activity Limits

The LANL Model II Source Capsule currently approved for shipment allows a maximum $^{241}AmO_2$ payload of 9.99 TBq of alpha activity (9.99 x 10^{12} Bq, equal to 270.0 Ci)[3] translates to a limit of 78.4 g of ^{241}Am isotope or 89.2g of pure $^{241}AmO_2$[4]. The heat loading associated with the $^{241}AmO_2$ items is almost entirely due to the energies of alpha decay. A similar alpha activity constraint exists for the approved LANL storage/overpack (SAVY-4000) container utilized at LANL for transfer & storage of SNM outside a glovebox environment. The LANL Detailed Operating Procedure (DOP) that limits Material at Risk (MAR) in individual SAVY-4000 containers outside

[3] "IAEA Certificate of Competent Authority Special Form Radioactive Materials Certificate Number USA/0696/S-96, Revision 4", 2010.
[4] This assumes 100% isotopic purity and 100% chemical purity of the $^{241}AmO_2$ material.

the glovebox to 84 g net weight $^{241}AmO_2$ (74.2 g of ^{241}Am isotope) for the payload of $^{241}AmO_2$ in an individual container[5]. This constraint is slightly more limiting than the payload for the LANL Model II Source Capsule.

The most direct and simple way to ensure the limiting quantity of $^{241}AmO_2$ is not exceeded is control of the balance net weight. While the mass of the ^{241}Am is used for the certifying value for shipping purposes, the Project Team will be focusing on the mass of $^{241}AmO_2$. For these purposes, an operational limit weight limit of 83 g net weight maximum for the payload of $^{241}AmO_2$ in the innermost container would provide adequate certainty that neither limit could ever be exceeded. The LANL approved (SAVY) container also has a thermal limit of 25 watts per container. However, the individual listed activity limit on $^{241}AmO_2$ is more restrictive. The calorimetry measurement will provide verification that the alpha activity has not been exceeded.

2.1.7 Dose

A LANL modeling study was undertaken to better understand dose issues specific to the $^{241}AmO_2$ material packaged inside the nested containers. This study analyzed dose versus the constraints of the configuration for shipment. A portion of the modeling data generated is shown below. The first case (Table 3) shows modeling data for a nominal 30 g batch of ^{241}Am (oxide).

	Dose rate at container surface lower tally (mrem/hr)			Dose rate 30 cm from container surface (mrem/hr)			Dose rate 1 M from container surface (mrem/hr)			Dose rate at the container surface upper tally (mrem/hr)		
	Neutrons	Photons	Total	Neutrons	Photons	Total	Neutrons	Photons	Total	Neutrons	Photons	Total
LANL "inner" container only	235.74	775.64	1038.24	1.21	3.97	5.16	0.12	0.39	0.51	28.73	47.99	74.68
LANL "inner" container nested inside LANL "middle" container	142.21	318.02	468.94	1.18	2.55	3.76	0.12	0.26	0.39	20.35	23.37	42.16
LANL "inner"/"middle" assembly nested inside LANL Model II Source Capsule	72.13	91.27	165.20	1.14	1.36	2.54	0.12	0.14	0.28	1.27	0.37	1.61
LANL "inner"/"middle"/ Model II Source Capsule assembly nested inside Skolnik 10 gallon Type A-7A Drum	4.05	4.83	8.95	0.58	0.67	1.26	0.10	0.11	0.21	0.47	0.23	0.69

Table 3. LANL dose rate estimates for 30 g of ^{241}Am (as americium oxide) in containers.

The second case, in Table 4, represents modeling data is for 78.7 g of ^{241}Am (oxide), the maximum allowable quantity for which the LANL Model II Source Capsule is approved.

	Dose rate at container surface lower tally (mrem/hr)			Dose rate 30 cm from container surface (mrem/hr)			Dose rate 1 M from container surface (mrem/hr)			Dose rate at the container surface upper tally (mrem/hr)		
	Neutrons	Photons	Total	Neutrons	Photons	Total	Neutrons	Photons	Total	Neutrons	Photons	Total
LANL "inner" container only	394.33	1032.10	1659.77	3.20	9.95	13.24	0.32	0.98	1.32	195.18	408.29	464.28
LANL "inner" container nested inside LANL "middle" container	264.33	544.03	866.29	3.12	6.48	9.65	0.32	0.66	1.00	113.21	158.47	222.78
LANL "inner"/"middle" assembly nested inside LANL Model II Source Capsule	152.01	184.37	348.68	3.02	3.88	6.91	0.33	0.43	0.76	3.97	0.72	4.57
LANL "inner"/"middle"/ Model II Source Capsule assembly nested inside Skolnik 10 gallon Type A-7A Drum	10.53	11.97	22.81	1.53	1.72	3.26	0.26	0.28	0.55	1.41	0.61	1.96

Table 4. LANL dose rate estimates for 78.7 g of ^{241}Am (as americium-oxide) in containers.

As shown in Table 4, the dose rate at the nearest sidewall surface of the 10 gallon Type A-7A (Skolnik) Drum is estimated at 22.8 mrem/hr radiation dose rate at for maximum allowable quantity to be shipped. Appropriate packing foam will be placed within the 10 gallon Type A-7A

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[5] TA55-DOP-091, R2, "Nuclear Material Packaging for Storage at TA-55, PF-4", 11/17/2011

Drum to surround the LANL Model II Source Capsule to cushion and center the item within the drum. The use of this packaging material was not credited in the LANL modeling study.

The modeling data represented in Tables 3 & 4 shows that either quantity (nominal or maximum) of pure $^{241}AmO_2$ will not exceed the 200 mrem/hr radiation dose rate at the container surface exposure constraint for the shipment of radioactive items. If the surface of the 7A drum remains below 200 mrem/hr, then it can be shipped non-exclusive use. If the surface exceeds 200 mrem/hr, but is less than 1,000 mrem/hr, then it must be shipped exclusive use (i.e., enclosed vehicle, fixed position in the transport truck, and directly shipped to the receiver).

Due to TA-55 security requirements, it is recommended that the product be shipped on an exclusive basis.

2.1.8 Pictures

Supporting pictures, showing the containers in various configurations, are shown below.

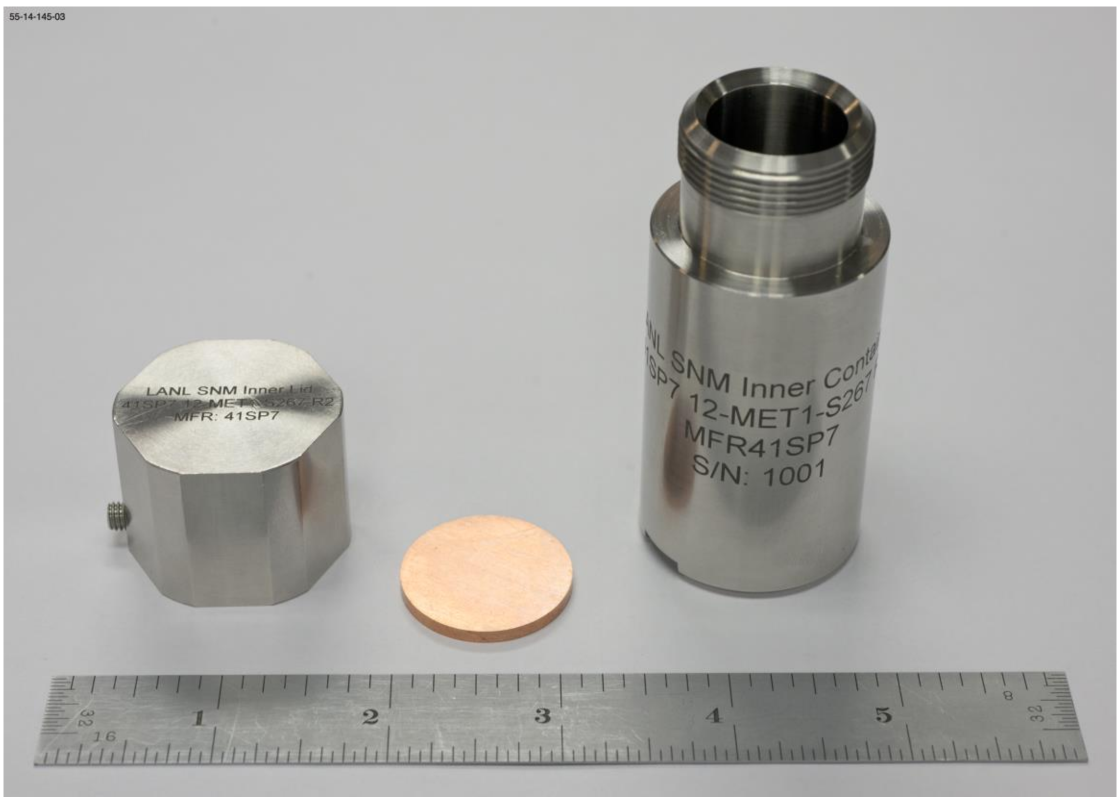


Figure 3. Photo of LANL “inner” container with copper washer (to seal product) and lid

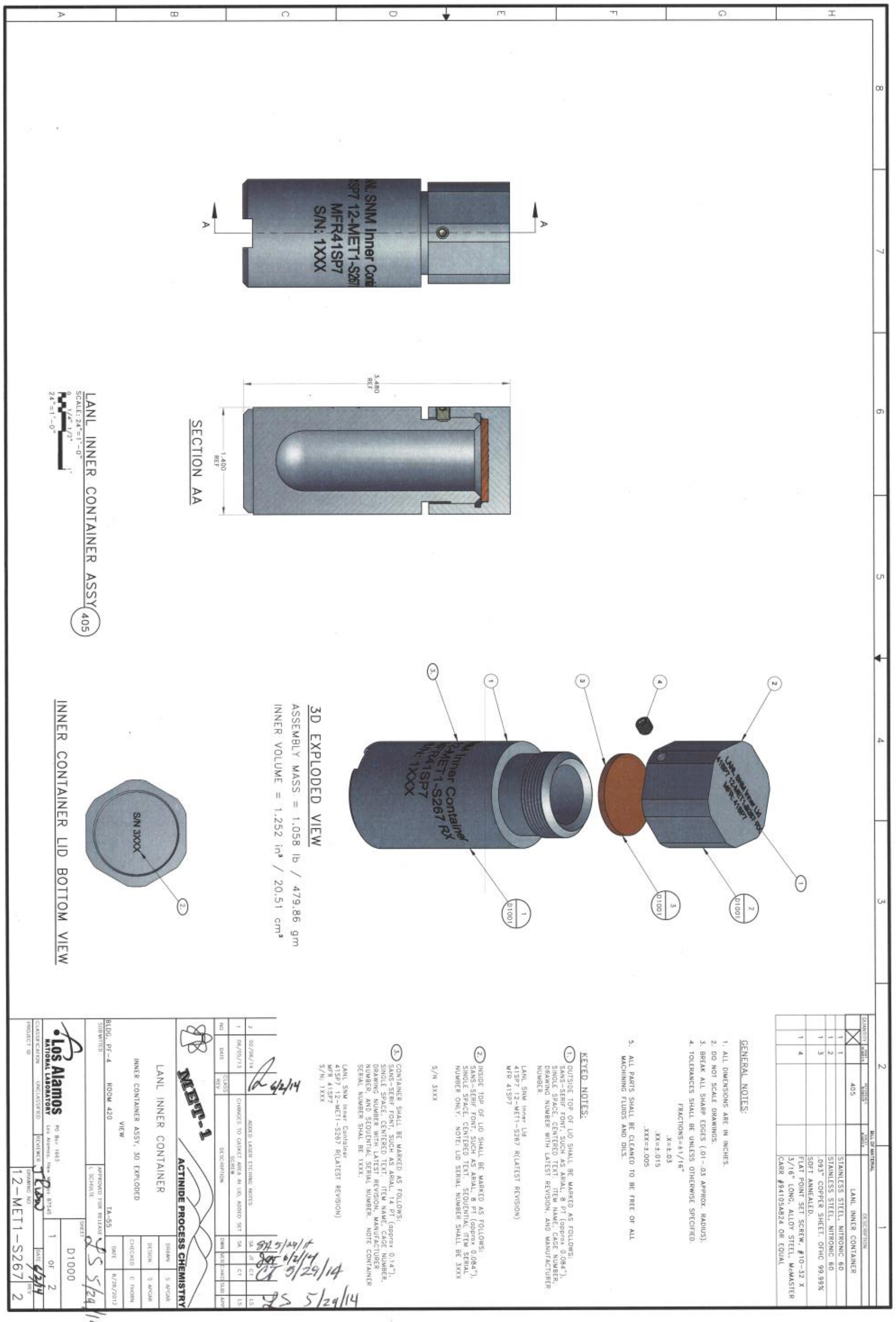
Figure 4. Photo of LANL “middle” container with copper washer (to seal product) and lid

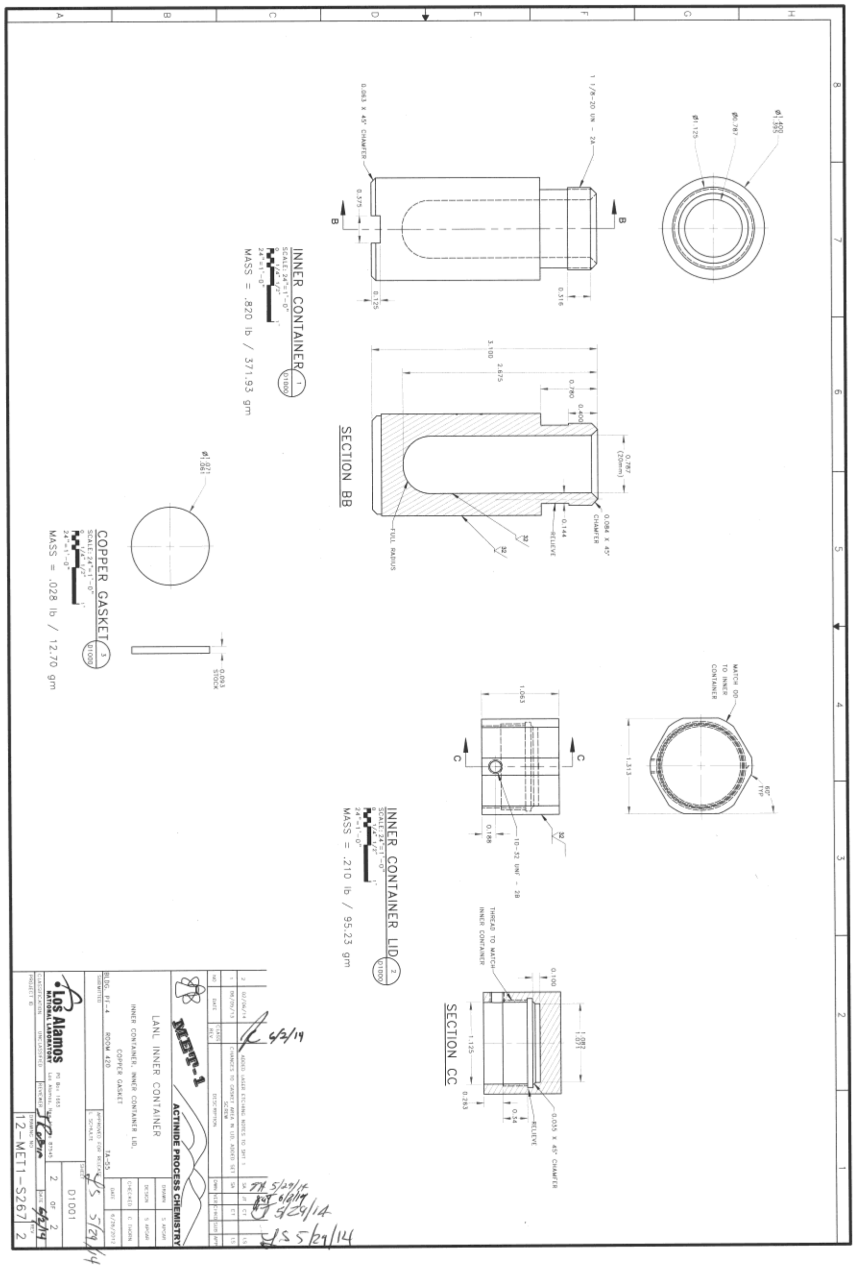
Figure 5. Nested & Sealed “middle” and “inner” containers

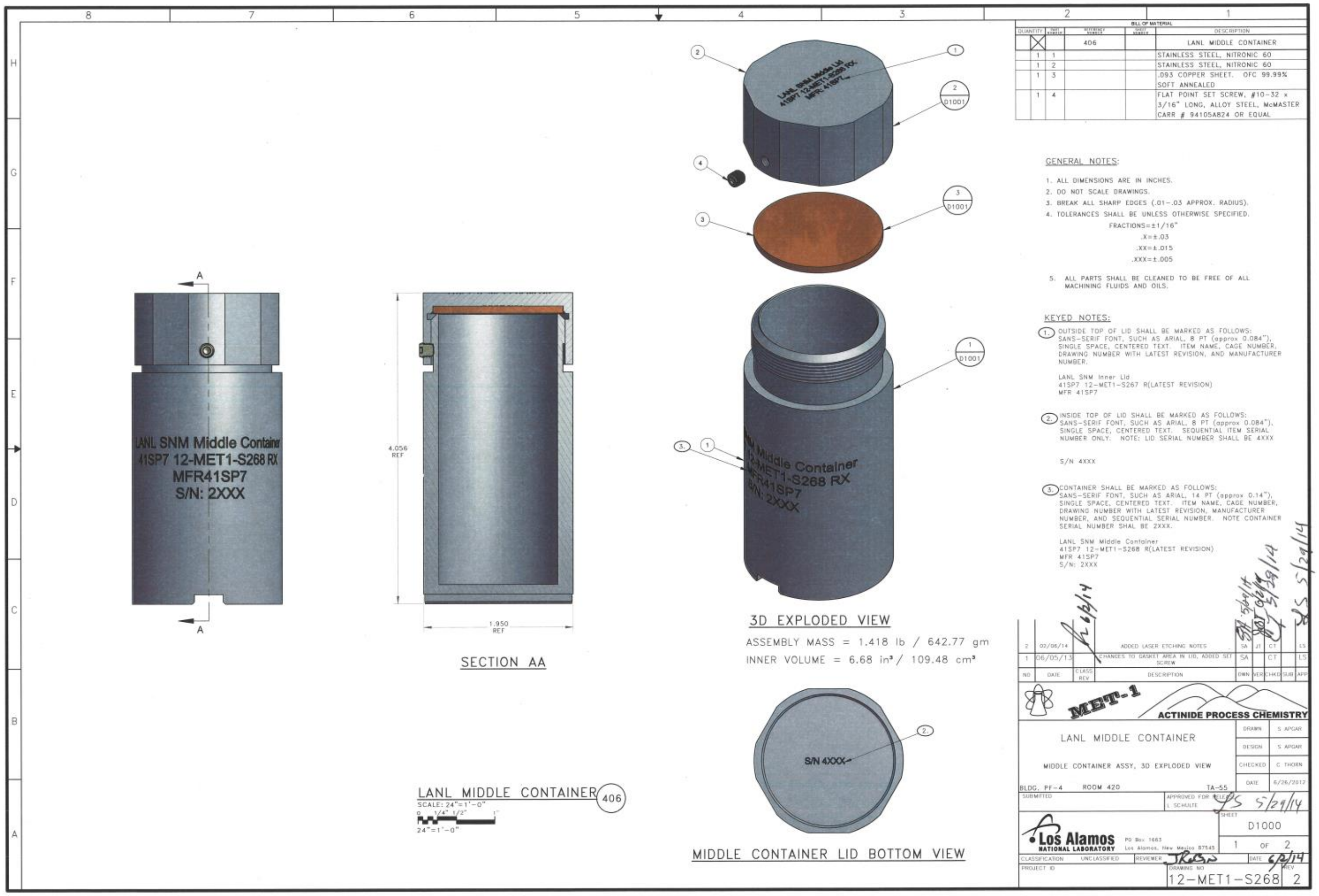
Figure 6. Savy Container used to store materials at TA-55

Figure 7 (left). Jig/Pig holder for middle container. Used as shield/fixture for sealing
Figure 8 (right). Middle container with socket driver used to seal

Appendix A – Container Drawings


LANL SNM Inner Container
12-MET1-S267
MFR41SP7
S/N: 1XXX
SECTION AA
3.480 REF
1.400 REF
LANL INNER CONTAINER ASSY
405
SCALE: 24"=1'-0"
3D EXPLODED VIEW
ASSEMBLY MASS = 1.058 lb / 479.86 gm
INNER VOLUME = 1.252 in³ / 20.51 cm³
S/N 3XXX
INNER CONTAINER LID BOTTOM VIEW
BILL OF MATERIAL
405 LANL INNER CONTAINER
1 1 STAINLESS STEEL, NITRONIC 60
1 2 STAINLESS STEEL, NITRONIC 60
1 3 .093" COPPER SHEET, OFHC 99.99% SOFT ANNEALED.
1 4 FLAT POINT SET SCREW, #10-32 X 3/16" LONG, ALLOY STEEL, McMASTER CARR #94105A824 OR EQUAL
GENERAL NOTES:
1. ALL DIMENSIONS ARE IN INCHES.
2. DO NOT SCALE DRAWINGS.
3. BREAK ALL SHARP EDGES (.01-.03 APPROX. RADIUS).
4. TOLERANCES SHALL BE UNLESS OTHERWISE SPECIFIED.
FRACTIONS=±1/16"
.X=±.03
.XX=±.015
.XXX=±.005
5. ALL PARTS SHALL BE CLEANED TO BE FREE OF ALL MACHINING FLUIDS AND OILS.
KEYED NOTES:
1. OUTSIDE TOP OF LID SHALL BE MARKED AS FOLLOWS: SANS-SERIF FONT, SUCH AS ARIAL, 8 PT (approx 0.084"), SINGLE SPACE, CENTERED TEXT. ITEM NAME, CAGE NUMBER, DRAWING NUMBER WITH LATEST REVISION, AND MANUFACTURER NUMBER.
LANL SNM Inner Lid
41SP7 12-MET1-S267 R(LATEST REVISION)
MFR 41SP7
2. INSIDE TOP OF LID SHALL BE MARKED AS FOLLOWS: SANS-SERIF FONT, SUCH AS ARIAL, 8 PT (approx 0.084"), SINGLE SPACE, CENTERED TEXT. SEQUENTIAL ITEM SERIAL NUMBER ONLY. NOTE: LID SERIAL NUMBER SHALL BE 3XXX
S/N 3XXX
5. CONTAINER SHALL BE MARKED AS FOLLOWS: SANS-SERIF FONT, SUCH AS ARIAL, 14 PT (approx 0.14"), SINGLE SPACE, CENTERED TEXT. ITEM NAME, CAGE NUMBER, DRAWING NUMBER WITH LATEST REVISION, MANUFACTURER NUMBER, AND SEQUENTIAL SERIAL NUMBER. NOTE CONTAINER SERIAL NUMBER SHAL BE 1XXX.
LANL SNM Inner Container
41SP7 12-MET1-S267 R(LATEST REVISION)
MFR 41SP7
S/N: 1XXX
2 02/06/14 ADDED LASER ETCHING NOTES
1 06/05/13 CHANGES TO GASKET AREA IN LID, ADDED SET SCREW
MET-1
ACTINIDE PROCESS CHEMISTRY
LANL INNER CONTAINER
INNER CONTAINER ASSY, 3D EXPLODED VIEW
BLDG. PF-4 ROOM 420 TA-55
Los Alamos NATIONAL LABORATORY
D1000
1 OF 2
12-MET1-S267 2


INNER CONTAINER
SECTION BB
MASS = .820 lb / 371.93 gm
COPPER GASKET
MASS = .028 lb / 12.70 gm
INNER CONTAINER LID
MASS = .210 lb / 95.23 gm
SECTION CC
ACTINIDE PROCESS CHEMISTRY
LANL INNER CONTAINER
Los Alamos
12-MET1-S267


LANL SNM Middle Container
41SP7 12-MET1-S268 RX
MFR41SP7
S/N: 2XXX
A
4.056 REF
1.950 REF
SECTION AA
3D EXPLODED VIEW
ASSEMBLY MASS = 1.418 lb / 642.77 gm
INNER VOLUME = 6.68 in³ / 109.48 cm³
S/N 4XXX
MIDDLE CONTAINER LID BOTTOM VIEW
LANL MIDDLE CONTAINER 406
SCALE: 24"=1'-0"
BILL OF MATERIAL
QUANTITY | PART NUMBER | REFERENCE NUMBER | SHEET NUMBER | DESCRIPTION
406 LANL MIDDLE CONTAINER
1 1 STAINLESS STEEL, NITRONIC 60
1 2 STAINLESS STEEL, NITRONIC 60
1 3 .093 COPPER SHEET. OFC 99.99% SOFT ANNEALED
1 4 FLAT POINT SET SCREW, #10-32 x 3/16" LONG, ALLOY STEEL, McMASTER CARR # 94105A824 OR EQUAL
GENERAL NOTES:
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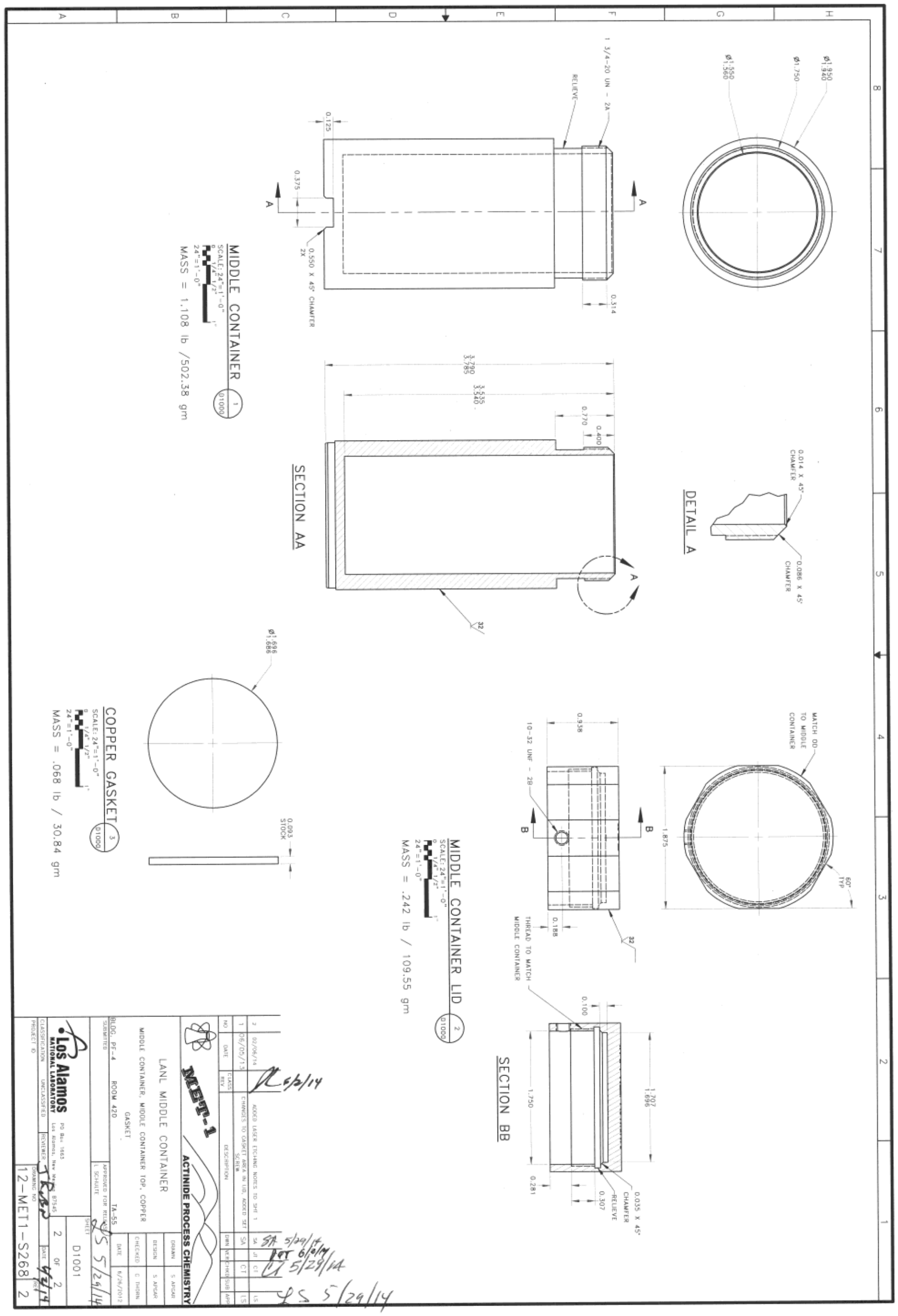
1. OUTSIDE TOP OF LID SHALL BE MARKED AS FOLLOWS: SANS-SERIF FONT, SUCH AS ARIAL, 8 PT (approx 0.084"), SINGLE SPACE, CENTERED TEXT. ITEM NAME, CAGE NUMBER, DRAWING NUMBER WITH LATEST REVISION, AND MANUFACTURER NUMBER.
LANL SNM Inner Lid
41SP7 12-MET1-S267 R(LATEST REVISION)
MFR 41SP7
2. INSIDE TOP OF LID SHALL BE MARKED AS FOLLOWS: SANS-SERIF FONT, SUCH AS ARIAL, 8 PT (approx 0.084"), SINGLE SPACE, CENTERED TEXT. SEQUENTIAL ITEM SERIAL NUMBER ONLY. NOTE: LID SERIAL NUMBER SHALL BE 4XXX
S/N 4XXX
3. CONTAINER SHALL BE MARKED AS FOLLOWS: SANS-SERIF FONT, SUCH AS ARIAL, 14 PT (approx 0.14"), SINGLE SPACE, CENTERED TEXT. ITEM NAME, CAGE NUMBER, DRAWING NUMBER WITH LATEST REVISION, MANUFACTURER NUMBER, AND SEQUENTIAL SERIAL NUMBER. NOTE CONTAINER SERIAL NUMBER SHAL BE 2XXX.
LANL SNM Middle Container
41SP7 12-MET1-S268 R(LATEST REVISION)
MFR 41SP7
S/N: 2XXX
2 02/06/14 ADDED LASER ETCHING NOTES SA JT CT LS
1 06/05/13 CHANGES TO GASKET AREA IN LID, ADDED SET SCREW SA CT LS
NO DATE CLASS REV DESCRIPTION DWN VER CHKD SUB APP
MET-1
ACTINIDE PROCESS CHEMISTRY
LANL MIDDLE CONTAINER
MIDDLE CONTAINER ASSY, 3D EXPLODED VIEW
DRAWN S APGAR
DESIGN S APGAR
CHECKED C THORN
DATE 6/26/2012
BLDG. PF-4 ROOM 420 TA-55
SUBMITTED
APPROVED FOR RELEASE L SCHULTE
SHEET D1000
1 OF 2
Los Alamos NATIONAL LABORATORY
PO Box 1663 Los Alamos, New Mexico 87545
CLASSIFICATION UNCLASSIFIED
REVIEWER
DATE
PROJECT ID
DRAWING NO 12-MET1-S268
REV 2


MIDDLE CONTAINER
MASS = 1.108 lb /502.38 gm
SECTION AA
DETAIL A
MIDDLE CONTAINER LID
MASS = .242 lb / 109.55 gm
SECTION BB
COPPER GASKET
MASS = .068 lb / 30.84 gm
LANL MIDDLE CONTAINER
ACTINIDE PROCESS CHEMISTRY
Los Alamos NATIONAL LABORATORY
12-MET1-S268

Appendix B – SARP

O U.S. Department of Transportation

Pipeline and Hazardous Materials
1200 New Jersey Avenue, S.E. **IAEA CERTIFICATE OF COMPETENT AUTHORITY** Washington D.C.20590
SPECIAL FORM RADIOACTIVE MATERIALS '
CERTIFICATE NUMBER USA/0696/S-96, REVISION 6
Safety Administration

This certifies that the source described has been demonstrated to meet the regulatory requirements for special form radioactive material as prescribed in the regulations of the International Atomic Energy Agency[1] and United States of America[2] for the transport of radioactive materials.

1. Source Identification - Los Alamos National Laboratory (LANL} Model II Source Capsule (formerly QSA Global Inc. Model II Source Capsule).
2. Source Description- Cylindrical single over-encapsulation consisting of a capsule body, sealing plug, impact plug, snap ring, and cap made of stainless steel that provides a metal-to-metal seal when assembled. Approximate outer dimensions are 76.2 mm (3.0 in.) in diameter and 298.5 mm (11.75 in.) in length. Minimum wall thickness is 7.62 mm (0.3 in.). Final assembly shall be in accordance with either attached LANL Drawing 90Y-219998, Rev. H or AEA Technology QSA, Inc. Drawing No. R20047, Rev.B.
3. Radioactive Contents - The capsule described by this certificate is authorized to contain any one of the following single radionuclides, the sole pair of radionuclides, or either one of the two sets of six (6) radionuclides, in the chemical forms identified, and limited to the activities shown, in the table below. The radioactive material is limited to solid form in stainless steel capsules, between layers of non-radioactive stainless steel, or affixed to non-radioactive stainless steel by electroplating or other means. The maximum mass of the contents is limited to 2,500 grams.

Radionuclide(s)	Maximum Activity(ies)	Chemical/Physical Form
Americium-241	9.99 TBq (270.0 Ci)	Oxide or oxide incorporated into a ceramic enamel
Americium-241:Target (Be, Li, C, F, or B)	9.99 TBq (270.0 Ci)	Oxide mixed with target material pressed into a solid pellet or intermetallic
Americium-241:Be AND Cesium-137	Am-241 - 37.0 GBq 1.0 (Ci) Cs-137 - 7.4 GBq (200.0 mCi)	Am-241 - Oxide mixed with beryllium powder pressed into a solid pellet or intermetallic Cs-137 - Cesium in silicate glass matrix, sulfate pellet, compressed anhydrous chloride pellet or aluminosilicate ceramic pellet

---

[1] "Regulations for the Safe Transport of Radioactive Materials, 1996 Edition (Revised)", No. TS-R-1 (ST-1, Revised), published by the International Atomic Energy Agency (IAEA), Vienna, Austria.

[2] Title 49, Code of Federal Regulations, Parts 100 - 199, United States of Americ

CERTIFICATE USA/696/S-96 (REV. 6)

Radionuclide(s)	Maximum Activity(ies)	Chemical/Physical Form
Californium-252	199.8 GBq (5.4 Ci)	Oxide or oxide in sintered palladium metal to form a cermet
Cesium-137	200.0 TBq (5405.4 Ci)	Cesium in silicate glass matrix, sulfate pellet, compressed anhydrous chloride pellet or aluminosilicate ceramic pellet
Cobalt-60	40.0 TBq (1081.1 Ci)	Metal
Curium-244	20.0 TBq (540.5 Ci)	Oxide or oxide incorporated into a ceramic enamel
Iridium-192	37.0 TBq (1000.0 Ci)	Metal
Neptunium-237	20.0 TBq (540.5 Ci)	Metal, alloy, or oxide
Plutonium-238	9.99 TBq (270.0 Ci)	Oxide or oxide incorporated into ceramic or refractory composite plate metal
Plutonium-238:Target (Be, Li, C, F, or B)	9.99 TBq (270.0 Ci)	Metal or oxide mixed with target material pressed into a solid pellet
Plutonium-239 AND Plutonium-238 AND Plutonium-240 AND Plutonium-241 AND Plutonium-242 AND Americium-241	Pu-239 - 3.7 TBq (100 Ci) Pu-238 - 9.99 TBq (270 Ci) Pu-240 - 9.99 TBq (270 Ci) Pu-241 - 40.0 TBq (1081.1 Ci) Pu-242 - 9.99 TBq (270 Ci) Am-241 - 9.99 TBq (270 Ci)	Oxide incorporated into a ceramic, refractory composite, metal foil, or metal plated to substrate

CERTIFICATE USA/696/S-96 (REV. 6)

Radionuclide(s)	Maximum Activity(ies)	Chemical/Physical Form
Plutonium-239:Target (Be, Li, C, F, or B) AND Plutonium-238 AND Plutonium-240 AND Plutonium-241 AND Plutonium-242 AND Americium-241	Pu-239 - 3.7 TBq (100 Ci) Pu-238 - 9.99 TBq (270 Ci) Pu-240 - 9.99 TBq (270 Ci) Pu-241 - 40.0 TBq (1081.1 Ci) Pu-242 - 9.99 TBq (270 Ci) Am-241 - 9.99 TBq (270 Ci)	Metal or oxide mixed with target material pressed into a solid pellet
Strontium-90	37.0 TBq (1000.0 Ci)	Strontium titanate, strontium fluoride, oxide in ceramic enamel or fluoride in aluminum or tin antimony metal matrix
Radium-226	370.0 GBq (10.0 Ci)	Sulfate, chloride, or halide carbonate
Radium-226:Be	370.0 GBq (10.0 Ci)	Sulfate, chloride, or halide carbonate mixed with beryllium target material

4. Special Conditions –

   a. Capsule assembly shall be conducted in accordance with either LANL procedure OSR-OP-190, R.1, Assembly Procedure for LANL Special Form Capsule, or QSA Global Inc. H1070, Rev. 6, Assembly Procedure for the Model II Special Form Capsule.

   b. Capsule components must have been obtained from either LANL or QSA Global Inc.

   c. A copy of either the applicable, completed Traveler Sheet required by LANL procedure OSR-OP-190, R.1, Assembly Procedure for LANL Special Form Capsule, or the Record Sheet required by QSA Global Inc. H1070, Rev. 6, Assembly Procedure for the Model II Capsule, shall be attached to this IAEA Certificate of Competent Authority in order to demonstrate the regulatory requirements for special form radioactive material have been met.

5. Quality Assurance -

   a. Each assembler of the Model II Source Capsule shall register their identity, in writing, and provide evidence of a Quality Assurance program based on international or national standards to the Office of Hazardous Material Technology (PHH-23), Pipeline and Hazardous Materials Administration, U.S. Department of Transportation, Washington, D.C. 20590-0001.

b. Assembly of the Model II Source Capsule shall be performed under the Quality Assurance program registered with the U.S. DOT.

c. Records of Quality Assurance activities required by paragraph 310 of the IAEA regulations[1] shall be maintained and made available to the authorized officials for at least three years after the last shipment authorized by this certificate. Consignors and consignees in the United States exporting or importing shipments under this certificate shall satisfy the requirements of Subpart H of 10 CFR 71.

6. Expiration Date - This certificate expires on November 30, 2015.

This certificate is issued in accordance with paragraph 804 of the IAEA Regulations and Section 173.476 of Title 49 of the Code of Federal Regulations, in response to the petition and information dated December 3, 2010 submitted by the U.S. Department of Energy, Washington, DC, and in consideration of other information on file in this Office.

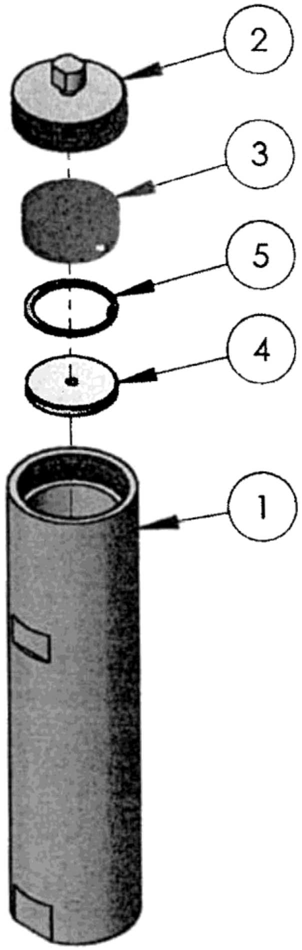
Certified by:

Dr. Magdy El-Sibaie
Associate Administrator for
Hazardous Materials Safety

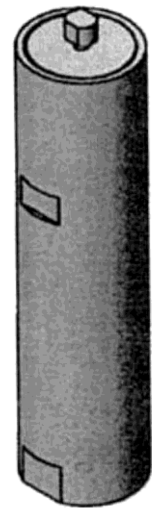
DEC 28 201

(DATE)

Revision 6 - Issued to extend the expiration date.

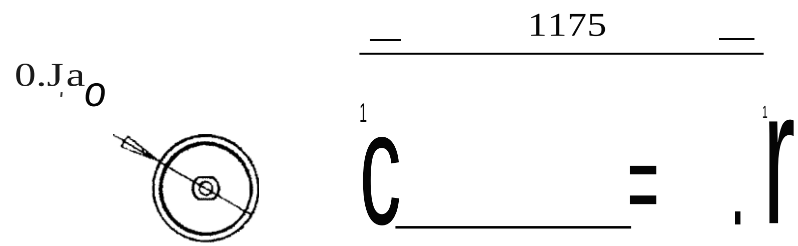


EXPLODED VIEW
SCALE: NONE



ISOMETRIC VIEW
SCALE: NONE

LOs Alamos
NATIONAL LABORATORY



NOTES:
1. THREAD DEPTH .750.
2. THREAD, 2 1/2-10 ACME 2G.
3. ITEM {4) LUBRICANT, DUPONT, KRYTOX LVP FLOURINATED GREASE.

ITEM NO.	PART NUMBER	MATERIAL	Default/ QTY.
1	CAPSULE CYLINDER, LANL P/N 90Y-219998-2	STAINLESS STEEL	1
2	219998-1_AF0Copy		1
3	219998-3_AF0Copy		1
4	IMPACT_PLUG_AFOCopy		1
5	RET_RING-N5000-206_AF0Copy		1

SIMPLIFIED SKETCH DRAWING

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOI£RANCES:
FRACTIONAL
ANGULAR: MACH! BEND!
TWO PLACE DECIMAL
THREE PLACE DECIMAL
INIERPRET GEOIIETRIC TOIERANG PER:
MATERIAL
FINISH

	NAME
DRAWN	MIKE HOOD
CHECJ(fD	MIKE HOOD
ENG APPR.	DANNY MARTINEZ
MFGAPPR.	
Q.A.	
COMMENTS:	

AET-1
OSR
TITLE: SOURCE CONTAINMENT CAPSULE MODULE II

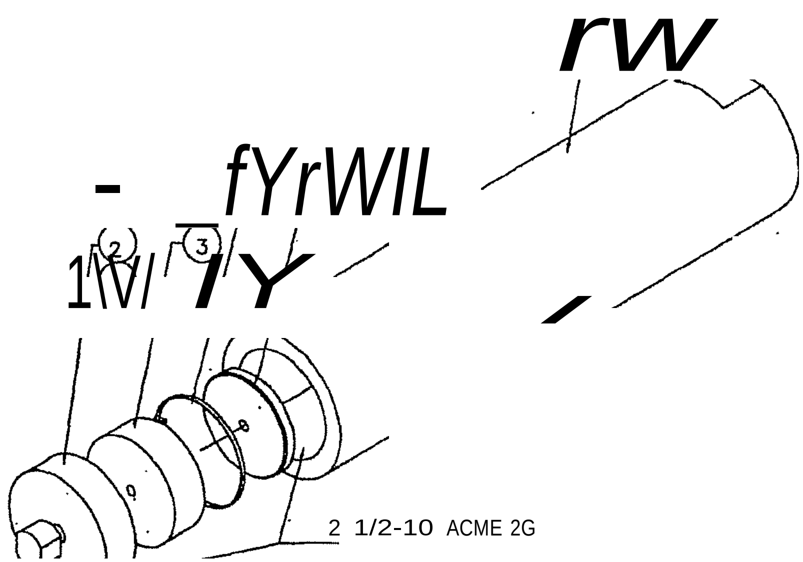
POINT OF CONTACT CRISTY ABEYTA 505 667 4711

SIZE A DWG. NO. 90Y_219998 REV H

NEXI ASSY USED ON
APPUCAIION
DO NOT SCALE DRAWt<G
SCALE: NONE SHEET 1 OF 1

5 4 3 2

CAPSULE AFTER ASSEMBLY
(KNOB SHEARED OFF)



6	LUBRICANT	AR	Dupont Krytox LVP Fluorinated Gf13ose
5	IMPACT PLUG	1	ST.STEEL
	SNAP RING	1	ST.STEE
4			
3			
2			
1	BODY		
ITEM NO.	PART NAME		

APPROVALS	DATE	
[illegible]	2/10/05	[redacted]
[illegible]	10/5/05	

UNLESS OTHERWISE SPECIFIED
1. ALL DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONS ± 1/8
X.X ± 0.12
X.XX ± 0.06
X.XXX ± 0.020

ERF#	SIZE	DWG. NO.
991	B	SCALE: N I S

U.S.
Department of
Transportation

East Building, PHH-23
1200 New Jersey Avenue SE
Washington, D.C. 20590

**Pipeline and
Hazardous
Materials Safety
Administration**

CERTIFICATE NUMBER: USA/0696/S-96, Revision 6

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Manager, Packaging Certification Program
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and QA QSA Global, Inc.
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Budapest, Hungary
Hungary

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Monroe, NY 10950

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Assist. Director Radiation and Biosafety
University of Ottawa
University of Ottawa
Office of Risk Management
1 Nicholas St. Suite 840
Ottawa, ON KIN 7B7
Canada

Material Management & Transfer Requirements

Establish Americium-Oxide Production Capability Project

at the

Los Alamos National Laboratory

3.0 Quality Assurance

A Quality Assurance Plan (QAP), PA-PLAN-01042, has been written and is consistent & compliant with the Isotope Production & Applications Program (IPAP) along with the LANL QAP (i.e., SD 330). This QAP takes advantage of the QA Programs at TA-55 and dovetails into the QAP for the IPAP Office. A graded approach was used to develop the Project QAP that is consistent with the other QAPs. All procurements, procedures, and standards followed for shipping will be consistent with the Project QAP.

3.1.1 Customer Specifications

Customer specifications are noted in the Project Execution Plan (PEP). Americium-241 oxide ($^{241}AmO_2$) is not used for any medical applications. Therefore, the qualification requirements are less stringent than the requirements for use with medical patients. The material specifications for the ^{241}Am, as requested by industry, are listed in Section 1.1.2 These specs are also listed in the Project Execution Plan (PEP) for the Am Project.

The quality evidence generated as delineated in the Requirements Verification Matrix (Table 5) is the basis for the quality evidence package used to submit the product. Also included in the package are product-related Non Conformance Reports, the documentation defining the build history of product (Production Plan, Lot Plan, Travelers, etc.).

Drawing/ Specification	***Requirement***	***Method of Verification***	***Quality Evidence***
^{241}Am isotopic purity	241Am > 99% of all Am by weight	Gamma NDA (primary) TIMS (backup and "gold std")	Lab Report
$^{241}AmO_2$ Chemical Purity	95% by weight from NDA methods	Calorimetry NDA (primary) TIMS (backup and "gold std")	Lab Report
Pu Content	< 1.0% by weight from NDA methods	Gamma (primary) TIMS (backup and "gold std")	Lab Report
Any other individual impurity measured	< 0.5% by weight of any other individual inert impurity measured, including Al, B, Be, Bi, Ca, Cd, Co, Cr, Fe, K, Mg, Mn, Mo, Na, Ni, Pb, Si, Sn, Zn, Zr, Np, and U by ICP-ACE and ICP-MS	ICP-AES ICP-MS	Lab Report

Table 5. Requirements Verification Matrix

It is important to note, certain non-destructive assay (NDA) methods are used to generate the quality evidence for regular production operations. For efforts involving the production of standards or the validation of production data (e.g., audits, assessments, peer review, etc.), certain radiochemistry methods such as TIMS, ICP-AES, or ICP-MS will be used.

3.1.2 Product Release

Requests and authorization for shipments are coordinated through the National Isotope Development Center (DOE-SC/NIDC), which currently performs this service for the medical isotopes produced at LANL, under the LANL Isotope Production (LANL-IP) office. Upon MC&A verification, non-destructive analyses, and other production information evidence that provides validation of the product meeting customer specifications - the production traveler will be reviewed by the Product Engineer, Quality Engineer, and Production Control Representative.

A Process Material Flow Diagram (PMFD) has been prepared for the Am Program, to quantify and track the americium and plutonium materials. The recovered plutonium will remain in NNSA-DP inventory stock and the recovered americium will be transferred to DOE-SC/NIDC. The MC&A Staff will approve this NDA measurement.

To meet customer specifications, a 100 percent test and inspection approach will be used. As production experience increases and a data set of production quantities, yield, and acceptance rates are established, a sampling approach may be developed using statistical based random sampling methods. This approach will be developed, together with a business case, for consideration/approval by the DOE-SC/NIDC. The Manufacturing Quality Control (MQC) organization will perform final product acceptance for LANL, prior to shipment to the customer.

MQC is in the best position to provide this service as they are most familiar with the quality program for the Am Program.

3.1.3 Flowsheet

The flowsheet, depicts the movement of the americium-oxide from the sealing of the inner container inside the LANL glovebox, through the application of the Tamper Indicating Device (TID), performance of NDA measurements, to shipping and customer receipt.

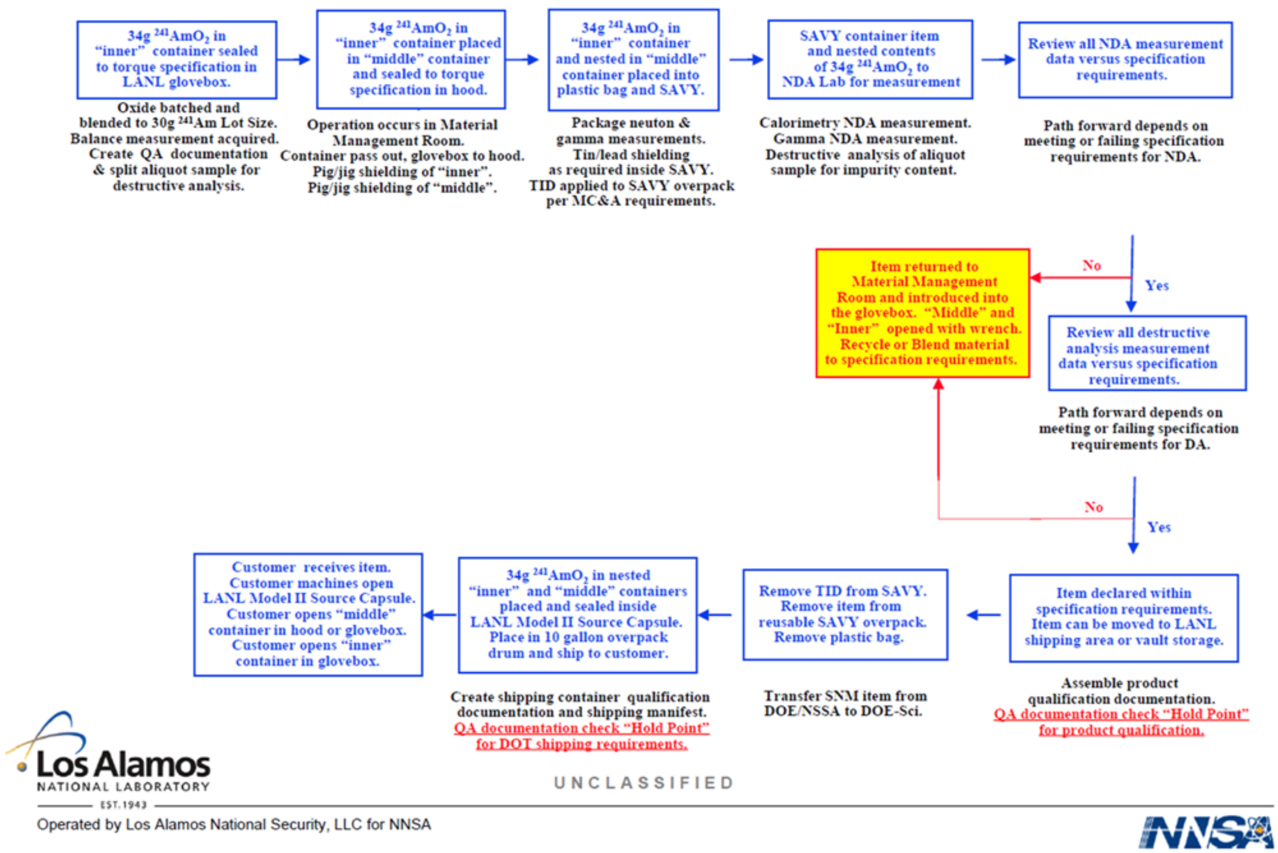

Figure 4. Flowsheet of activities for packaging, shipping, and customer receipt.

The flowsheet is discussed in more detail in the LANL paper, Shipping/Packaging Requirements and Methods for Americium-241 Oxide Production Operations (LA-UR-12-25118; Schulte, et al.) Key supplemental notes are listed below.

1. Authorization to produce is provided by the DOE-SC/NIDC.
2. Product is delivered to the DOE-SC/NIDC or DOE-SC/NIDC designated customer/location.
3. The nominal amount of ^{241}Am per container is roughly 30 grams – in the form of $^{241}AmO_2$. A precise amount is forgone as this effort leads to additional dose for LANL workers.
4. Custom amounts, less than 30 grams, are possible with appropriate notice – at least six months.

5. Customer pays for shipping. Handling shipments that are non-exclusive could prove difficult for LANL, so LANL recommends that shipping be done on an exclusive basis to minimize risk.
6. LANL will not ship to international locations.
7. LANL will take credit for delivery at Freight on Board (FOB) stage.
8. LANL recommends shipments, especially initial shipments, sent directly to DOE-SC/NIDC. This gives DOE-SC/NIDC the option to validate production and shipping paperwork and (potentially) sample product.

4.0 Material Transfer Methods

Having a program that focuses on a material with three owners as it moves from NNSA residues, to a DOE-SC owned final product, that is sold to an industry consortium can have some complexity in both ownership and transfer. This section covers LANL's role in these transfers.

4.1.1 Ownership Transfer

Both plutonium and americium-241 are "accountable" materials. Plutonium already has a well-established accounting system and, with this project, americium is being incorporated into this system. The americium product will move from being under NNSA ownership, while being processed in TA-55/PF-4 to DOE-SC ownership, upon shipment from TA-55/PF-4. Specifics of the ownership and transfer are listed below.

NNSA

Ownership Documentation

While at LANL, both the plutonium and americium within the residues is property of the NNSA, but tracked in a holding account for the DOE-SC. Current feedstream at LANL is assigned to the Am Program. NNSA and LANL have well documented procedures for the creation, control, and protection of Special Nuclear Materials (SNM). A Material Control & Accountability (MC&A) System tracks the inventory, including amounts and locations of SNM. Periodic reports are provided to the NNSA, Site Office, and other oversight organizations. For the current feedstream materials (i.e., residues) a program code/identifier has been established to note these materials are designated for the Am Program.

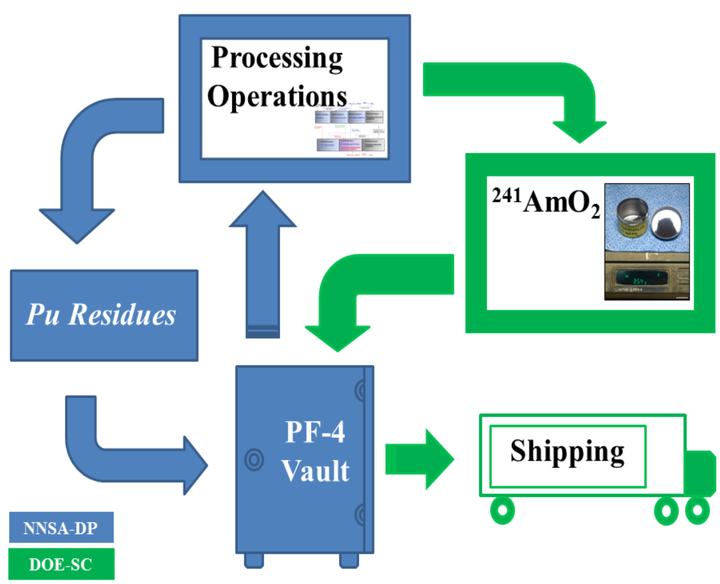

Figure 6. Material Ownership from Vault to Processing to Shipping

Transfer to DOE-SC/NIDC

The product and/or paperwork can be transferred to DOE-SC/NIDC, to provide an option to validate before transfer to the customer.

<u>Ownership Transfer</u>

Once the material is transferred from the PF-4 Vault to production operations, the material is still listed in the MC&A System under NNSA-DP ownership but under the Am Program. The material is also tracked by the production support systems of the Am Program. Once processed through the production and the collection of documentation is completed/reviewed/approved and the material is ready for shipment, ownership of the material is ready to be transferred to the DOE-SC/NIDC. This transfer of ownership – from NNSA-DP to DOE-SC/NIDC is made just prior to shipment, when the production paperwork is certified by MQ and the product is ready to be packaged. Upon receipt and validation of the paperwork and (potentially) the product the DOE-SC/NIDC can transfer ownership to the commercial customer.

<u>Ownership Documentation</u>

The material is transferred to the DOE-SC/NIDC just prior to the shipment (i.e., ready to ship) to leaving LANL. This transfer, just prior to shipment, is necessary to ensure the material has been transferred to DOE-SC/NIDC and the DOE-SC/NIDC security control protocols have been addressed. With this transfer the NNSA safeguards requirements are also terminated. Upon receipt of material, NPI-7 will also looks for confirmation to complete the documentation of transfer. LANL will not ship outside the United States.

Transfer to LANL-IP

If DOE-SC/NIDC wishes to delegate/transfer of the product and/or paperwork, LANL Isotope Production (LANL-IP) could play a role - much of the same process listed above is followed.

<u>Ownership Transfer</u>

During production, the material is still tracked by the LANL MC&A System and with the production support systems of the Am Program. Once processed through the production and the collection of documentation is completed/reviewed/approved and the material is ready for shipment, ownership of the material is ready to be transferred to the LANL-IP. This transfer of ownership – from NNSA-DP to LANL-IP is made just prior to shipment, when the production paperwork is certified by MQ and the product is ready to be packaged. Upon receipt and validation of the paperwork and (potentially) the product LANL-IP can transfer ownership to the commercial customer.

<u>Ownership Documentation</u>

The material is transferred to LANL-IP just prior to the shipment (i.e., ready to ship) to leaving LANL. This transfer, just prior to shipment, is necessary to ensure the material has been transferred to LANL-IP. With this transfer the NNSA safeguards requirements are also terminated. Upon receipt of material, NPI-7 will also looks for confirmation to complete the documentation of transfer. LANL will not ship outside the United States.

Transfer to Commercial Customer

Ownership Documentation

Because of the security constraints at LANL/TA-55/PF-4 and americium is a fissile material, when compared to other isotopes, a separate and more stringent protocol must be developed to ship directly to a commercial customer. Due to the nature of work conducted at TA-55, establishing this protocol could prove difficult. At a minimum, LANL can ship directly to a commercial customer under the following constraints.

- LANL and Site Office hold a pre-approved list of commercial customers approved to receive shipments by the DOE-SC/NIDC.
- Shipping is conducted on an exclusive basis
- Customer holds the appropriate NRC Licenses. Licenses are validated by the DOE-SC/NIDC
- Shipper/Receiver Agreements (if applicable) in place

Other key notes actions are noted below.

1. LANL recommends shipments, especially initial shipments, sent directly to DOE-SC/NIDC.
2. Any material ownership transfer to a commercial customer must be preceded by a separate transaction by the DOE-SC/NIDC or LANL-IP to own the material.
3. LANL (TA-55 or LANL-IP) can act as an agent for the DOE-SC/NIDC.
4. Customer pays for shipping.
5. LANL will not ship to international locations.
6. LANL will take credit for delivery at Freight on Board (FOB) stage.

New Feedstream Materials

The Am Team is pursuing opportunities to locate new feedstream materials for the CLEAR Glovebox Line. Once located, it is expected the Am Program will follow a similar approach, as noted above, to manage the transitions from the owner to LANL and to the DOE-SC/NIDC.

4.1.2 Authorizations

The authorization to produce americium-oxide comes from the DOE-SC. This authorization process is expected to be similar to the authorization process followed by the LANL Isotope Program. Authorizations are expected to note production amounts, customers (potentially), schedules, and funding.

4.1.3 MC&A

The Material Control & Accountability (MC&A) system used by LANL consists of procedures and a tracking system called LANMass. Both plutonium and americium-241 are “accountable” materials and LANL can account for each material appropriately.

4.1.4 Liabilities/Responsibilities

As a government-owned contractor-operated (GOCO) - providing an americium-oxide product to established specifications, authorized to produce by DOE-SC, shipped in qualified/certified containers by qualified shippers, and delivered to the DOE-SC/NIDC or an DOE-SC/NIDC-directed address/customer – LANL is delivering on commitments.

LANL does have extensive control over the materials while these materials are on-site. LANL has very strict controls for the handling & processing of americium, americium-oxide, and similar materials – dictated by the DOE/NNSA and overseen by the Los Alamos Site Office. These controls work very well on-site. However, these controls have a limited capability to mitigate liability off-site. LANL must rely on other government organizations for support on this front.

The americium-oxide produced by LANL is not used in medical applications. Therefore, if the – 1) americium-oxide product is produced to specifications; 2) LANL is authorized by the DOE-SC to produce americium-oxide; 3) shipped in qualified/certified containers by qualified shippers, and; 4) delivered to the DOE-SC/NIDC or an DOE-SC/NIDC-directed address/customer – it is very difficult for LANL to bear responsibility for the use of these materials after delivery.

Appendix C – Other Support

There are other support requirements that could impact shipments, once production operations start.

Quality Assurance Plan (QAP)

A QAP (Quality Assurance Plan (QAP); PA-PLAN-01042) has been written and approved for this project. The purpose of this QAP is to describe how the project meets the requirements of *SD330, Los Alamos National Laboratory Quality Assurance Program*, for establishing and executing a quality management program.

The integration approach for the various Quality Assurance plans is shown in the diagram (right). This QAP was developed as a management system, and this system uses a targeted, requirements-based approach intended to ensure applicable requirements are implemented. QA requirements are applied based on the general applicability of the work. The requirements from SD330 are applied to all work types, using a risk-based graded approach. The system is structured so that those performing work may readily identify the quality assurance requirements and the implementing documents to perform the work.

A Quality Implementation Plan (QIP) has been developed and describes how the quality criteria in the Am Project QAP are implemented.

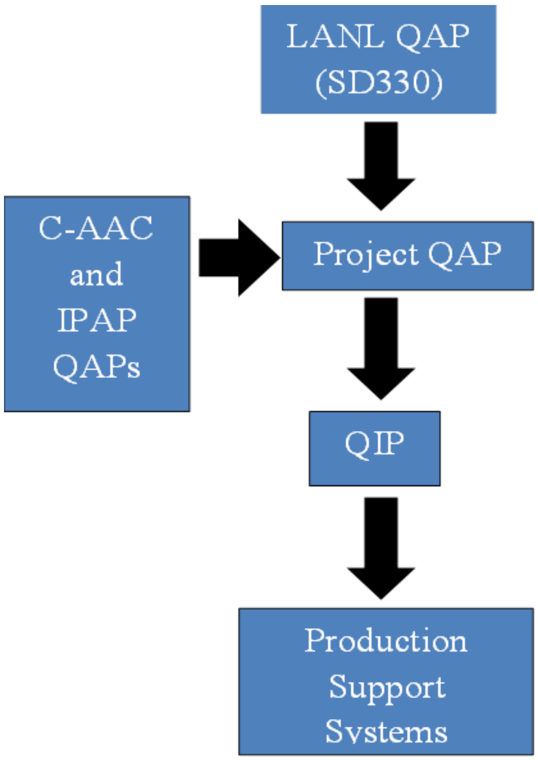

Figure 3. Integration of QA Program Docs.

Assessments/Risk

Internal independent assessments are planned and conducted to evaluate item and service quality, evaluate the adequacy of work performance, and promote improvement. Assessments by external organizations are a part of the LANL independent assessments program. Any planned assessments of the Am Program by the Site Office are communicated to LANL and coordinated with ADPSM management.

Managing risk is an essential element of any project or program management approach. Mitigating risk can translate into improvements in efficiency, productivity, and quality. Risk, as defined in *SD330, Los Alamos National Laboratory Quality Assurance Program*, is based on the unmitigated consequence of the work failing to perform its function with respect to protecting the public, the worker, the environment, classified and strategic assets, and/or in supporting LANL mission requirements.

Cost Accounting
LANL follows a full-cost recovery approach. The Americium Program expects to follow a similar approach as the Isotope Program in cataloging costs once production operations start. This cost accounting effort is expected to follow an approach (i.e., standards) used in industry for cost accounting.

MC&A (Decay)
With a half-life of 432 years, americium-oxide has little risk exposure to the decay issues that complicate the inventory tracking of some short-lived medical isotopes.

Non-Conformance Report
As described in the Am Project Quality Implementation Plan (QIP), whenever a program requirement of any type is not met, a nonconforming condition exists. The process for the identification, control, and disposition of nonconforming items that is used for the $^{241}AmO_2$ Project is documented in P330-6, *Nonconformance Reporting*. Nonconformance Report (NCR) activities for the $^{241}AmO_2$ Project are accomplished in the LANL-wide electronic NCR System.

Safety/Security
The TA-55 site provides extensive security – physical, material controls, and cyber – for both personnel and materials. This security program does mitigate risk of the release of material by unauthorized methods.

The specification for plutonium is from the discard limitations established by the Environmental Management Program. The measurement for neptunium enables a security related tracking feature to note where/when the americium was produced. As americium-241 is not large a proliferation risk as other actinide materials such as weapons plutonium, there is a benefit to the americium program if a graded-approach to security can be applied.

Shipments from TA-55 are tightly controlled and shipping protocols are very strict. Trucks are screened/inspected using various criteria. It recommended that shipments be sent on an exclusive basis to the DOE-SC/NIDC and then received or redirected. LANL cannot make international shipments.