



## International Isotopes Inc.

September 26, 2008

Attention: Document Control Desk  
Director, Division of Spent Fuel Storage and Transportation  
Office of Nuclear Material Safety and Safeguards  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555-001

Subject: Request for Continued Use of DOT Specification 20WC-5/2R after October 1, 2008

Dear Sir or Madam,

International Isotopes, Inc. submitted a request to the US Department of Transportation on June 23, 2008 in accordance with Title 49 Code of Federal Regulations §107.105 *Application for special permit*, requesting the continued use of the 20WC-5/2R Type B shipping package after October 1, 2008. A second letter addressing DOT comments regarding the application request was submitted on August 6, 2008. The information provided to the DOT in the aforementioned correspondences coincides with that required by US Nuclear Regulatory Commission RIS 2008-18. This being the case, I have provided copies of the June 23<sup>rd</sup> Application and August 6<sup>th</sup> Response to Comments with this letter to provide the justification for an extension to the use of the 20WC-5/2R for Co-60 target transfers from the DOE's Advanced Test reactor and the International Isotopes, Inc. facility located in Idaho Falls, ID.

We are requesting an expedited review of this request in that our plan to transport one Co-60 target before the October 1, 2008 deadline will not be met due to maintenance activities in the DOE's ATR which prevents the lowering of target transport casks into the reactor canal. Should you have any questions regarding the application, please contact me by phone at (208) 524-5300 or by email at [jjmiller@intisoid.com](mailto:jjmiller@intisoid.com)

Sincerely,

John J. Miller, CHP  
International Isotopes Inc.  
4137 Commerce Circle  
Idaho Falls, ID 83401

JJM-2008-26

cc.

Michele Sampson  
U.S. Nuclear Regulatory Commission  
Mail Stop E3 D2M  
Executive Boulevard Building  
6003 Executive Blvd.  
Rockville, MD 20852

NHSS24  
Add: Michele Sampson  
E-RIDS



## International Isotopes Inc.

June 23, 2008

Associate Administrator for Hazardous Materials Safety  
Attention Special Permits, PHH-31  
Pipeline and Hazardous Materials Safety and Administration  
U.S. Department of Transportation  
Office of Hazardous Materials Technology  
East Building 1200 New Jersey Ave. SE  
Washington, D.C. 20590-0001

**Subject: Request for Special Permit**

Dear Sir or Madam,

In accordance with Title 49 Code of Federal Regulations §107.105 *Application for special permit*, International Isotopes Inc. requests a special permit for the continued use of the 20WC-5/2R Type B shipping package after October 1, 2008. A substantial effort to replace this package prior to October 1, 2008 commenced in February of 2005. Unfortunately the replacement Type B(U) package will not be ready until sometime after the October 1, 2008 date which makes the 20WC-5/2R Type B package configuration obsolete.

Attached you will find the special permit application, prepared in accordance with §107.105 along with supporting documentation. Should you have any questions regarding the application, please contact me by phone at (208) 524-5300 or by email at [jjmiller@intisoid.com](mailto:jjmiller@intisoid.com)

Sincerely,

John J. Miller, CHP  
International Isotopes Inc.  
4137 Commerce Circle  
Idaho Falls, ID 83401

JJM-2008-14

Application for Special Permit in Accordance with Title 49 Sub-Part B  
International Isotopes, Inc.

Items required per 49 CFR § 107.105

§107.105 (a)(2)

Company Name: International Isotopes, Inc.  
Address: 4137 Commerce Circle Idaho Falls, ID 83401  
Name and Title of Contact Individual: John J. Miller, Radiation Safety Officer  
Phone Number: (208) 524-5300  
Email Address: jjmiller@intisoid.com

§107.105 (a)(3) If the applicant is not a resident of the United States, a designation of agent for service in accordance with § 105.40 of this part; and

Not Applicable

§107.105 (a)(4) For a manufacturing special permit, a statement of the name and street address of each facility where manufacturing under the special permit will occur

Not applicable

§107.105 (b) *Confidential treatment* to request confidential treatment for information contained in the application, the applicant shall comply with § 105.30(a).

Not applicable

§107.105 (c) *Description of special permit proposal* The application must include the following information that is relevant to the special permit proposal:

§107.105 (c)(1) A citation of the specific regulation from which the applicant seeks relief;

International Isotopes, Inc. requests relief from Title 49 CFR §173.416 (c), *Continued use of an existing Type B packaging constructed to DOT Specification 6M, 20WC, or 21WC is authorized until October 1, 2008 if it conforms in all aspects to the requirements of this subchapter in effect on October 1, 2003.*

§107.105 (c)(2) Specification of the proposed mode or modes of transportation;

Highway/Truck; Exclusive Use

§107.105 (c)(3) A detailed description of the proposed special permit (e.g., alternative packaging, test, procedure or activity) including, as appropriate, written descriptions, drawings, flow charts, plans and other supporting documents;

International Isotopes, Inc. requests the continued use of the DOT 20WC-5/2R Specification Packaging configuration after October 1, 2008 to support shipments of Co-60 from the Department of Energy's Advanced Test Reactor to International Isotopes, Inc.'s facility located in Idaho Falls, Idaho.

The special permit would only be valid for shipments that originate at the DOE's Advanced Test Reactor, located in Scoville, Idaho and end at International Isotopes, Inc. facility located in Idaho Falls, ID. These will be

Application for Special Permit in Accordance with Title 49 Sub-Part B  
International Isotopes, Inc.

exclusive use shipments and will travel along a designated 57.1 mile route.

The special permit would be valid for a single specific package. This package consists of (1) DOT Specification 20WC-5, Serial No. 2228 (1) DOT Specification 2R, Serial No. INIS-2R-1 and the tungsten/lead shield insert referred to as the INIS-2 Isotope Transfer Container.

These shipments will consist of 1 mm x 1mm pellets of Co-60 housed in 1 or 2 aluminum irradiation targets. The physical form of the material will be solid metal, normal form. Activity not to exceed 10,000 Ci.

The following documents are provided to support this applications:

INIS-DWG-007: Drawing of 2R Shielded Insert

INIS-DWG-019: Drawing of 2R

OP-SRC-010: Unloading and Loading 20WC5

OP-SRC-003: Loading and Unloading the INIS - 2 Isotope Transfer Container at the ATR Canal

§107.105 (c)(4) A specification of the proposed duration or schedule of events for which the special permit is sought.

International Isotopes, Inc. requests that this special permit go into effect on October 1, 2008 and remain valid for twelve months following the issuance of the certificate of compliance for the Alpha Omega Services Model AOS series of Type B (U) containers. This twelve month extension is requested so that sufficient time is provided to manufacture a Model AOS-100A to replace the 20WC-5/2R configuration and to develop the Safety Analysis Report needed that authorizes the use of the Model AOS-100A in the Department of Energy's Advanced Test Reactor canal.

International Isotopes, Inc. or the Department of Energy MOA contractor for the INL will act as the shipper of record for this special permit and would utilize International Isotopes Transportation Services as the carrier. Shipments made under the special permit will be controlled in accordance with the U.S. Nuclear Regulatory Commission's RAMQC Order, EA-05-006.

International Isotopes, Inc. anticipates shipping two targets per quarter after October 1, 2008. Each target would be shipped under this special permit for a total of 8 shipments per year.

International Isotopes Inc, plans on shipping a Co-60 target from the DOE's ATR to our Idaho Falls Facility in August 2008. We are unable to stock pile Co-60 in our facility prior to the October 1, 2008 deadline for the following reasons:

1. Targets are irradiated for a period of 18 to 30 months before they achieve specific activities sufficient enough to manufacture teletherapy sources. Target irradiations are staggered so that the desired specific activity becomes available over the course of the year.

Application for Special Permit in Accordance with Title 49 Sub-Part B  
International Isotopes, Inc.

2. Target transfers and canal operations must be scheduled during reactor outages. The next outage occurs on August, 23 2008, this is the last outage prior to October 1, 2008. Reactor outage dates are subject to change.
3. Targets are utilized shortly after they are removed from the reactor so that sources may be manufactured with the highest possible specific activities. Removing targets prematurely or before they are needed reduces the effectiveness of the Co-60 for teletherapy source manufacturing.

The earliest possible use of the special permit would occur the 3<sup>rd</sup> week of January 2009, corresponding to the first Advanced Test Reactor Outage after October 1, 2008.

§107.105 (c)(5) A statement outlining the applicant's basis for seeking relief from compliance with the specified regulations and, if the special permit is requested for a fixed period, a description of how compliance will be achieved at the end of that period;

International Isotopes, Inc. requests relief from the regulation 49 CFR §173.416 (c), so that it may continue its Co-60 source manufacturing operations.

The Alpha Omega Services Model AOS-100 Series of casks was expected to be licensed in the summer of 2008, with sufficient time to manufacture a replacement container before October 1, 2008. The following time line of events is provided to show that Alpha Omega Services and International Isotopes, Inc. had acted promptly to develop and license a replacement cask. Also note that the Model AOS-100 Series of containers was intended to replace other transportation packages that will expire October 1, 2008.

1. February 25, 2005 - Alpha Omega Services and GE Hitachi enter into an agreement to develop a new family of Type B(U) containers.
2. March 10, 2005 – Initial program meeting
3. April 29, 2005 – Project plan finalized and issued
4. May 1, 2006 – Completed scoping analysis
5. March 12, 2007 – Fabricated prototype, Model AOS-165, the largest cask in the family.
6. April 15, 2007 – Completed Type B Package testing
7. August 21, 2007 – International Isotopes, Inc. enters into an agreement with Alpha Omega Services to be the exclusive world-wide distributor of the AOS-100 Series of casks.
8. September 28, 2007 – Completed package design documentation.
9. October 12, 2007 – Completed Safety Analysis report

Application for Special Permit in Accordance with Title 49 Sub-Part B  
International Isotopes, Inc.

10. November 18, 2007 – Submitted license application to NRC
11. April 28, 2008 – At the request of the US NRC, Alpha Omega Services retracts application. The U.S. NRC believed that given the quantity of comments it would be more efficient if AOS retracted the application, addressed the comments and resubmitted the application when comment resolution was complete.
12. June 13, 2008 – NRC issues letter (Docket No. 71-9316, TAC no. L24142) acknowledging AOS's request to withdrawal the application. This letter also includes NRC comments on

Continued use of the 20WC-5/2R transport configuration is necessary for International Isotopes Inc. to continue its Co-60 Source production operations. These sources are utilized in a number of beneficial medical, industrial and research applications in the United States and abroad.

On average International Isotopes, Inc. provides 5 to 6 Co-60 teletherapy sources for cancer treatment per year to less developed countries. We anticipate growth in the business segment to continue as we are one of only two teletherapy source manufacturers in North America and the demand for Co-60 teletherapy sources in less developed countries has been on the rise. International Isotopes, Inc. anticipates the need to manufacture four more teletherapy sources during the remainder of calendar year 2008, two of these sources manufactured after October 1, 2008. Each Co-60 source would be expected to treat 100 - 150 cancer patients per week.

In addition to teletherapy sources, the Co-60 produced and transferred from the DOE's Advanced Test Reactor to the International Isotopes Inc. facility in Idaho Falls is utilized in radiography sources, imaging sources employed by US Customs at US Ports of Entry to conduct cargo security scans.

It is not possible or reasonable to "break-down" a single Co-60 target into multiple Type A shipments. The Co-60 hot cell facility located at the DOE's Test Reactor Area was placed out of service in 1998 and is scheduled for decommissioning and demolition in 2009. There is no other facility on the INL site that would be capable of handling the Co-60 targets. Additionally a typical target would consist of approximately 900 Type A shipments. The packaging and transportation costs associated with 900 Type A shipments would render the Co-60 worthless.

International Isotopes, Inc. evaluated other Type B packages that could be used instead of the 2R/20WC-5 shielded insert configuration. The following criteria must be met in order for the container to be a viable alternative.

1. The container is authorized for use within the Advanced Test Reactor Canal.
2. The container is authorized for domestic use.
3. The container is authorized to transport Co-60/metal/normal form.

Application for Special Permit in Accordance with Title 49 Sub-Part B  
International Isotopes, Inc.

4. The container cavity dimension can accommodate a ½ inch or 5/8 inch target.
5. The container dimensions do not exceed, 28 inches in diameter, 42 inches in height and 36 inches in depth.
6. The container is authorized for use or can be revalidated after October 1, 2008.

The basis for the criteria first criterion limits the number of containers that are available. The table below summarizes the containers that are currently authorized for use in the ATR canal:

Container	Authorized for use in ATR Canal	Authorized for domestic use	Meets dimensional restrictions	Cavity dimension can accommodate Target	Authorized to Transport Co-60 Target	Valid after October 1, 2008
GE-2000 USA/9228/B(U)- 96F	YES	YES	NO	YES	YES	YES
MDS Nordian F-168 X USA/0214/B(U)	YES	NO	NO	YES	YES	YES
GE-1500 USA/5939/B( )F	YES (Serial #1506)	YES	NO	YES	NO	NO
GE-100 USA/5926/B( )F	YES	YES	YES	NO	NO	NO
BMI-1 USA/5957/B( )F	YES	YES	NO	YES	YES	NO
INIS 2R/20WC-5	YES	YES	YES	YES	YES	NO

This table does not include a Specification 6M/2R configuration with tungsten insert utilized for smaller target material.

Compliance with the regulations would be achieved once the Model AOS-100 Series of Type B(U) containers has been licensed.

§107.105 (c)(6) If the applicant seeks emergency processing specified in § 107.117, a statement of supporting facts and reasons;

Not applicable

§107.105 (c)(7) Description of the hazardous materials planned for transport under the special permit:

This special permit would only be utilized to transport Class 7 radioactive material. Nuclide, Co-60, solid metal normal form. The Co-60 is in the form of 1 mm x 1 mm nickel plated cobalt pellets. These pellets are housed in an

Application for Special Permit in Accordance with Title 49 Sub-Part B  
International Isotopes, Inc.

aluminum irradiation target assembly which has been seal welded and leak checked. Co-60 activity would range from 7,500 Ci to 10,000 Ci.

- §107.105 (c)(8) Description of each package, including specification or special permit number, as applicable, to be used in conjunction with the requested special permit.

The package consists of 3 components; (1) the inner tungsten/lead shield, (2) the DOT specification 2R (49 §178.360), and (3) the DOT Specification 20WC-5 (49 §178.362 October 1, 2003).

- §107.105 (c)(9) For alternative packagings, documentation of quality assurance controls, package design, manufacture, performance test criteria, in-service performance and service-life limitations.

International Isotopes, Inc. maintains an NRC Approved Quality Assurance Program and performs annual preventive maintenance on the 20WC-5, the specification 2R and the shielded insert. In addition to the annual maintenance the components of this package are inspected prior to shipment and upon receipt. These inspections along with the annual maintenance are documented and maintained on file.

There was no performance testing of the 20WC-5 or 2R as these packages were manufactured to specification.

- §107.105 (c)(10) When a Class 1 material is forbidden for transportation by aircraft except under a special permit (see Columns 9A and 9B in the table in 49 CFR 172.101), an applicant for a special permit to transport such Class 1 material on passenger-carrying or cargo-only aircraft with a maximum certificated takeoff weight of less than 12,500 pounds must certify that no person within the categories listed in 18 U.S.C. 842(i) will participate in the transportation of the Class 1 material.

Not applicable.

- §107.105 (d) *Justification of special permit proposal.* The application must demonstrate that a special permit achieves a level of safety at least equal to that required by regulation, or if a required safety level does not exist, is consistent with the public interest. At a minimum, the application must provide the following:

- §107.105 (d)(1) Information describing all relevant shipping and incident experience of which the applicant is aware that relates to the application;

International Isotopes, Inc. has utilized the 20WC-5/2R with shielded insert configuration to transport Co-60 targets from the DOE's Advanced Test reactor Facility to the International Isotope Inc facility located in Idaho Falls, ID on the following dates:

7/6/06 Target # 381: 367.8 TBq

6/7/07 Target # 432: 242.2 TBq

9/6/07 Target # 428: 327.5 TBq



Application for Special Permit in Accordance with Title 49 Sub-Part B  
International Isotopes, Inc.

3/26/08 Target # 381: 376.5 TBq

All shipments were conducted as scheduled and without incident.

§107.105 (d)(2) A statement identifying any increased risk to safety or property that may result if the special permit is granted, and a description of the measures to be taken to address that risk;

International Isotopes Inc, does not believe there is any increased risk to safety or property that may result if the special permit is granted. However the following additional controls will be taken when shipments are conducted under this special permit:

1. International Isotopes, Inc. will notify the State of Idaho, US NRC, and the US DOT of the shipment, including estimated time of departure and arrival, and transportation route.
2. Shipments conducted under this special permit will occur during daylight hours and will be scheduled to avoid peak traffic times.
3. Shipments conducted under this special permit will occur during favorable weather conditions.
4. Shipments conducted under this special permit will be escorted from the DOE's INL Site to International Isotope, Inc. facility in Idaho Falls, ID, in accordance with Idaho Administrative Code, IDAPA 39.03.12, paragraphs 400, 600, 700 and 800, copies of which are attached.
5. Escort and transport vehicle speed not to exceed posted speed limits or 50 miles per hour, whichever is lower.

§107.105 (d)(3)(i) Substantiation, with applicable analyses, data or test results, that the proposed alternative will achieve a level of safety that is at least equal to that required by the regulation from which the special permit is sought; or

Not Applicable

§107.105 (d)(3)(ii) If the regulations do not establish a level of safety, an analysis that identifies each hazard, potential failure mode and the probability of its occurrence, and how the risks associated with each hazard and failure mode are controlled for the duration of an activity or life-cycle of a packaging.

Refer to the hazard analysis table provided on the preceding page.

Application for Special Permit in Accordance with Title 49 Sub-Part B  
International Isotopes, Inc.

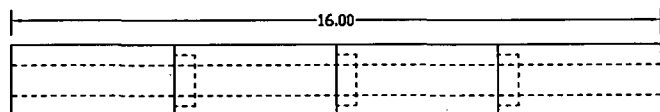
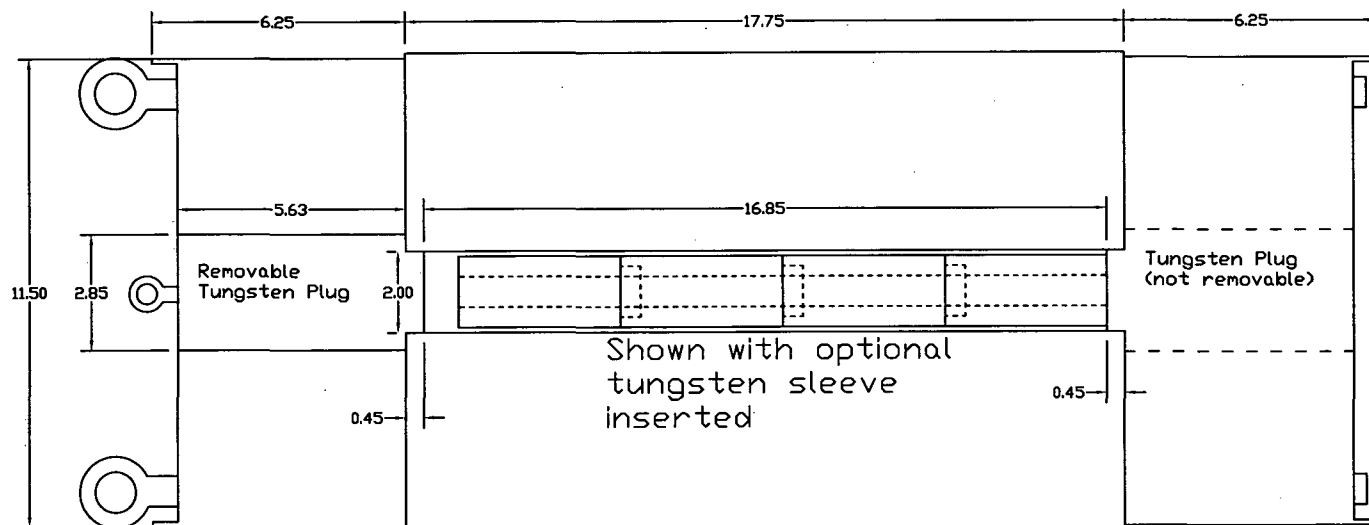
20WC-5/2R Co-60 Target Transportation Package Hazardous Analysis Table			
Potential Hazard or Failure Mode	Probability of Occurrence	Risk to Safety or Property	Mitigation
Single Vehicle Accident	Low to Moderate (weather dependent)	Damage to vehicle and property, injury to driver, jettison of cargo, breach of containment.	<ul style="list-style-type: none"> <li>• Travel during daylight hours along designated route</li> <li>• Restrict vehicle operating speed,</li> <li>• Shipment conducted during favorable weather conditions,</li> <li>• Load tied down in accordance with FMCSA cargo Security Rules.</li> <li>• Package inspected, loaded and maintained in accordance with written procedures.</li> </ul>
Multi Vehicle Accident	Low to Moderate (weather and traffic density dependent)	Damage to vehicles and property, injury to drivers and passengers, jettison of cargo, breach of containment.	<ul style="list-style-type: none"> <li>• Travel during daylight hours along designated route</li> <li>• Restrict vehicle operating speed,</li> <li>• Shipment conducted during low traffic density periods</li> <li>• Escort vehicle used in accordance with IDAPA 39.03.12</li> <li>• Shipment conducted during favorable weather conditions,</li> <li>• Load tied down in accordance with FMCSA cargo Security Rules.</li> <li>• Package inspected, loaded and maintained in accordance with written procedures</li> </ul>
Release of radioactive material	Very Low	Spread of contamination to environment and property.	<ul style="list-style-type: none"> <li>• 2R Containment Vessel and 20WC-5 built to specification</li> <li>• Co-60 contained in aluminum seal welded target housing which are leak tested prior to loading into reactor.</li> <li>• Package inspected, loaded and maintained in accordance with written procedures</li> </ul>
Loss of Shielding/movement of radioactive material	Very Low	Radiation levels which would pose a threat to the public.	<ul style="list-style-type: none"> <li>• Tungsten and lead shield 2R insert designed to house Co-60 target assembly, rated for 11,000 Ci of Co-60.</li> <li>• Shielded insert designed to fit snugly within the 2R containment vessel.</li> <li>• Co-60 pellets seal welded inside aluminum target housing, position of Co-60 pellets in target assembly fixed in position with sleeve and divots for each of the 1 mm x 1mm pellets.</li> <li>• Radiography of completed targets prior to loading into reactor to verify cobalt pellet placement.</li> </ul>

Application for Special Permit in Accordance with Title 49 Sub-Part B  
International Isotopes, Inc. – Supporting Documents

1. INIS-DWG-007 - Drawing of 2R Shielded Insert
2. INIS-DWG-019 - Drawing of 2R
3. OP-SRC-010 - Unloading and Loading 20WC5
4. OP-SRC-003 - Loading and Unloading the INIS 2  
Isotope Transfer Container at the ATR Canal
5. Experimental Safety Analysis for Canal Activities for  
Cobalt Targets for International Isotopes, Incorporated


Shield body and tungsten plugs are made from solid Tungsten  
 Shield endcaps are lead jacketed in 1/8 Stainless Steel

REVISIONS					
LTR.	ECO NO.	DESCRIPTION	BY	DATE	APPROVED
		FIRST ISSUE			

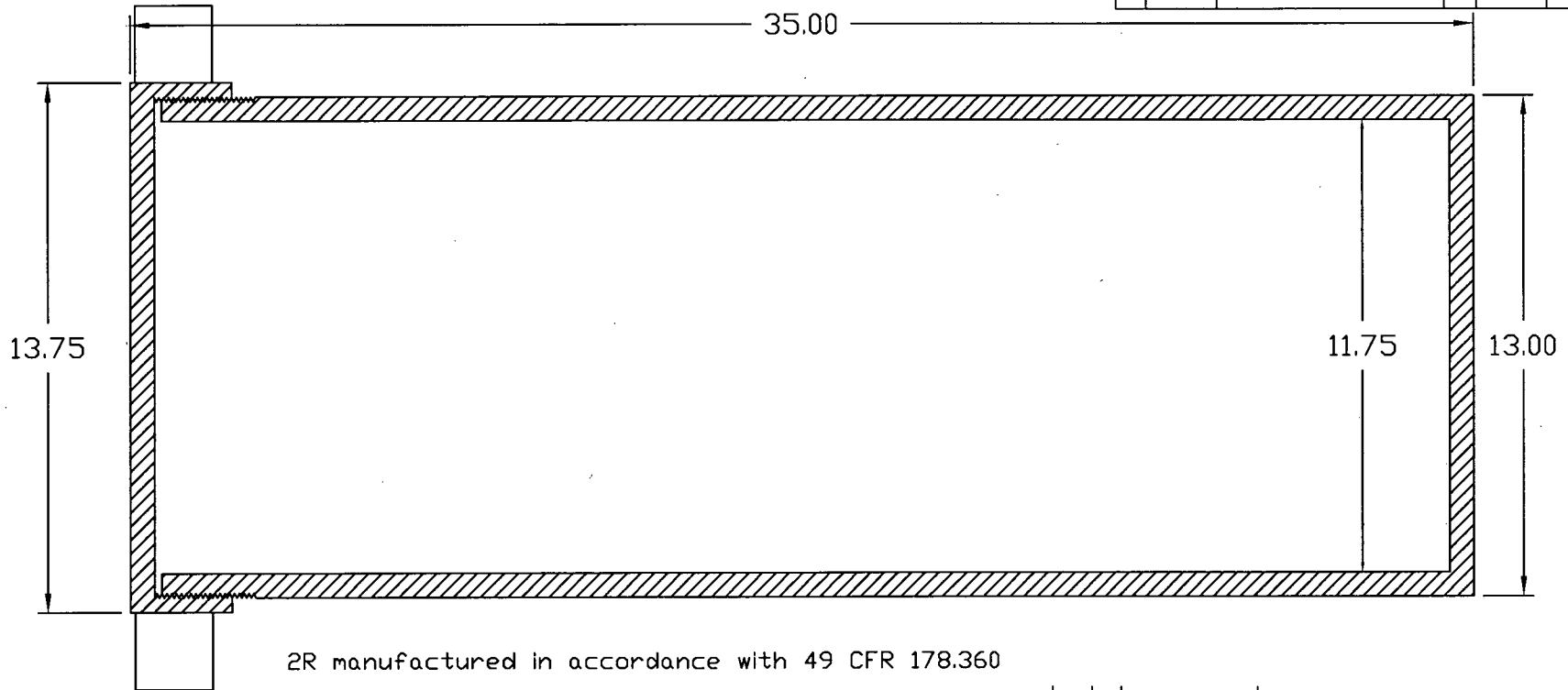


Optional Tungsten Sleeve

Total Weight Approximately 1750 lbs  
 (1800 lbs with optional tungsten sleeve)  
 Removable plug weight Approx 25 lbs

ITEM NO.	ENG. SIZE	PART OR IDENTIFYING NO.	DESCRIPTION	QTY
			 <b>International Isotopes Inc.</b> <i>(Including International Isotopes Idaho Inc. subsidiary)</i>	
TOLERANCE	DRW: DJL	DATE: 7/1/05	INIS-2 Shield	
XXX ±.010	CHECKED: DJL	7/1/05		
XXX ±.005	APPROVED: DJL	7/1/05		
FRACT. 1/64	ENG: N/A			
ANGLES ±30°			DWG. NO. INIS-DWG-007	REV. 0
SCALE: none		Sheet 1 of 1		

REVISIONS					
LTR.	ECO NO.	DESCRIPTION	BY	DATE	APPROVED
		FIRST ISSUE			



2R manufactured in accordance with 49 CFR 178.360

Material of Construction is mild steel Schedule 40 pipe and cap with 0.5 in welded steel bottom.

Ears on cap to facilitate cap removal and installation

ITEM NO.	DWG. SIZE	PART OR IDENTIFYING NO.	DESCRIPTION	QTY
<p><b>I<sup>3</sup> International Isotopes Inc.</b>  <i>(Including International Isotopes Idaho Inc. subsidiary)</i></p>				
TOLERANCE		DRAWN:	DATE:	<p><b>INIS-2R-1</b>            Transport Container</p>
JXX	±.010	D.J.L.	6/19/08	
JXX	±.005	CHECKED:	6/19/08	
FRACT.	21/64	APPROVED	6/19/08	
ANGLES ±30°		ENG:		<p>DWG. NO.  <b>INIS-DWG-0019</b></p>
SCALE none		N/A		
Sheet 1 of 1			REV.	0

<b>TITLE:</b>		<b>Number:</b>	<b>Revision</b>
UNLOADING AND LOADING 20WC5		OP-SRC-010	A
<b>PRI:</b>		<b>Effective Date:</b>	
Jim Mayer		3/15/2008	
<b>PRI Signature and Date:</b>	<b>Document Control Signature and Date:</b>	<b>Quality Assurance Signature and Date:</b>	

**1.0 PURPOSE**

This procedure provides direction for loading and unloading of the 20WC5 type over pack.

**2.0 POTENTIAL HAZARDS**

The potential of radiation exposure and/or contamination exists during the performance of this procedure.

Dosimeters and appropriate PPE should be worn and caution exercised while performing this procedure.

Industrial hazards associated with the inspection and handling of transportation packages such as rigging

Forklift operations, pinch points, splinters, manual lifting, strains, trips, slips and falls exist during the performance of this procedure.

**3.0 APPLICABILITY AND LIMITATIONS**

This procedure applies to the handling and/or loading or unloading of the 20WC5 overpack only. Any other container requires a separate handling procedure.

**4.0 DEFINITIONS**

**5.0 RESPONSIBILITIES**

Technician

**6.0 EQUIPMENT AND MATERIALS**

- Forklift
- Pallet Jack
- Scissorlift Jack
- Shackles
- Socket Set
- Lifting Straps
- Tamper Indicating Device (TID)
- Work Gloves

TITLE:	Number:	Revision
UNLOADING AND LOADING 20WC5	OP-SRC-010	A
		Effective Date:
		3/15/2008

**7.0 PROCEDURE**

**UNLOADING**

\*\*\* When performing this procedure, Complete Appendix A.\*\*\*

7.1 If cask is loaded, inspect tamper indicating device to ensure it is not missing or broken. Inspect the exterior of the package for any damage. If there is a problem with either, contact RSO for further instruction.

T.I.D. Sat \_\_\_\_\_ Unsat \_\_\_\_\_ Tech Initials \_\_\_\_\_  
 Date \_\_\_\_\_

- 7.2 Remove the plates or covers that make the 3 lifting eyes inoperable.
- 7.3 Using a deep socket and ratchet, remove the sixteen (16) ¾” nuts and flat washers located on top of wooden section of overpack. Place nuts and washers into a bag or can for later use.
- 7.4 Using a 20 foot sling, vertically lift the upper wooden section (approximately 400lbs) ensuring that there is no side torque on threaded rods. Lift until upper section is clear from threaded rods.
- 7.5 If 2R and cask are used then proceed with this step, if TYPE A package is used then proceeded to step 7.4. Remove 2R cap by turning counterclockwise. Carefully lift lid off making sure not to mar threads. Attach two (2) lifting eyes to opposite sides of cask.
- 7.6 Secure slings or chains to eyebolts on top of cask or Type A package and vertically lift device ensuring that there is no side torque. Lift until device is clear from overpack.
- 7.7 Once cask or Type A container is removed, survey all components and document on a map. Decon as necessary. Forward survey to RSO.

**NOTE: IF AT ANY TIME UNSAFE RIGGING PROCEDURES ARE OBSERVED, IMMEDIATELY STOP UNLOADING AND PROCEED WHEN SITUATION IS SAFE.**

**LOADING**

- 7.8 Before loading, verify that the 20WC5 has had a pre-trip survey completed and that during the re-assembly of the package, Appendix A and the Inspection checklist are filled out.  
 Survey Complete \_\_\_\_\_ Date \_\_\_\_\_
- 7.9 If this procedure is being performed at I3, then remove cask from hot cell following Cask Loading procedure, OP-SRC-005. Otherwise, proceed to step 7.10.



TITLE:	Number:	Revision
UNLOADING AND LOADING 20WC5	OP-SRC-010	A
		Effective Date:
		3/15/2008

- 7.10 Secure slings or chains to cask or Type A package and begin lifting ensuring that there is no side torque.
- 7.11 Lift device high enough that it clears the threaded rods. Once device is centered over overpack or 2R, carefully lower device ensuring there is no damage to overpack interior or device.
- 7.12 If necessary, place dunnage around cask or Type A package to alleviate movement during transport.
- 7.13 If 2R is being used, then remove lifting eye bolts and carefully replace 2R cap. Turn cap clockwise until snug. Do not over tighten.
- 7.14 Using 20 foot sling, replace wooden lid taking care that alignment marks are together.  
**\*\*\*\*By rocking wooden lid back and forth slightly while lowering onto threaded rods, the wooden lid will settle without binding.\*\*\*\***
- 7.15 Replace and secure the sixteen (16) washers and 3/4" nuts torqueing the nuts to 20 ft/pounds +/- 5lbs. Attach a T.I.D. (Tamper Indicating Device)
- 7.16 Apply the plates or covers that make the lifting eyes inoperable.
- 7.17 Complete shipping checklist on Appendix A. Complete a pre-ship survey and forward to RSO.
- 7.18 Ensure that a copy of the 20WC5 Overpack Certification and a copy of the Type a or Cask Certification accompanies the package during transit by either attaching to overpack or by placing a copy with the shipping papers.

20WC5 Certification \_\_\_\_\_ Type A/Cask \_\_\_\_\_  
 Tech Initials \_\_\_\_\_

**8.0 REFERENCES**

**9.0 ATTACHMENTS**

- 9.1 Appendix A
- 9.2 20WC5 Certification
- 9.3 Type A/Cask Certification





<b>TITLE:</b>	<b>Number:</b>	<b>Revision</b>
UNLOADING AND LOADING 20WC5	OP-SRC-010	A
		<b>Effective Date:</b>
		3/15/2008

Attachment 9.1

**APPENDIX A**  
**20WC5 OVERPACK QA / QC CHECKLIST**  
FOR INCOMING AND OUTGOING SHIPMENTS

ATTACH A COPY OF THIS CHECKLIST TO SHIPPING PAPERWORK AND FORWARD TO QA.  
 PLACE ORIGINAL IN QA / QC FILE FOLDER.

INCOMING \_\_\_\_\_

OUTGOING \_\_\_\_\_

DATE RECEIVED: \_\_\_\_\_

DATE SHIPPED: \_\_\_\_\_

RECEIVED FROM: \_\_\_\_\_

SHIPPED TO: \_\_\_\_\_

**CONDITION RECEIVED:**

**SHIPPING CONDITION**

	SAT	REPAIR NEEDED	SAT	REPAIR NEEDED
INSIDE WOOD	_____	_____	_____	_____
OUTSIDE WOOD	_____	_____	_____	_____
RODS	_____	_____	_____	_____
SKID	_____	_____	_____	_____
PAINT	_____	_____	_____	_____
LABELS	_____	_____	_____	_____
NUTS & FLAT WASHERS	_____	_____	_____	_____
SECURITY SEAL	_____	_____	_____	_____

INSPECTED BY: \_\_\_\_\_

\_\_\_\_\_

DATE: \_\_\_\_\_

\_\_\_\_\_



<b>TITLE:</b>		<b>Number:</b>	<b>Revision:</b>
<b>LOADING AND UNLOADING THE INIS - 2 ISOTOPE TRANSFER CONTAINER AT THE ATR CANAL</b>		<b>OP-SRC-003</b>	<b>A</b>
<b>PRI:</b>			<b>Effective Date:</b>
Jim Mayer			3/15/2008
<b>PRI Signature and Date:</b>	<b>Document Control Signature and Date:</b>	<b>Quality Assurance Signature and Date:</b>	

## 1.0 PURPOSE

- 1.1 This procedure provides direction for loading and unloading the INIS-2 Isotope Transfer Container at the ATR canal.

## 2.0 POTENTIAL HAZARDS

- 2.1 The potential of radiation exposure and/or contamination exists during the performance of this procedure. Dosimetry, and appropriate PPE should be worn and caution exercised while performing this procedure.
- 2.2 Industrial hazards associated with the inspection and handling of transportation packages such as rigging, crane operations, forklift operations, pinch points, manual lifting, strains, trips, slips and falls exist during the performance of this procedure. Appropriate PPE should be worn and caution exercised while performing this procedure.

## 3.0 APPLICABILITY AND LIMITATIONS

- 3.1 This procedure applies to the handling, loading and/or unloading of the INIS-2 Isotope Transfer Container only. Any other container requires a separate handling procedure.
- 3.2 The INIS-2 Shielded insert was designed to hold 6,000 Ci of Co-60. Loading the insert with activity in excess of this designed capacity must be evaluated on a case by case basis.

## 4.0 DEFINITIONS

- 4.1 INIS-2 Isotope Transfer Container – A Type B shipping package consisting of a shielded insert, a steel 2R container and a 20 WC-5 overpack.

## 5.0 RESPONSIBILITIES

- 5.1 International Isotopes Inc. (INIS)
- 5.1.1 Perform all preventative maintenance and annual inspections on the INIS-2 Isotope Transfer Container.

**NOTE: ANY MODIFICATIONS OR MAINTENANCE TO THE INIS-2 ISOTOPE TRANSFER CONTAINER SHALL BE APPROVED BY INTERNATIONAL ISOTOPES INC. PRIOR TO ANY WORK BEING PERFORMED ON THE CONTAINER.**



TITLE:	Number:	Revision
<b>LOADING AND UNLOADING THE INIS #2 ISOTOPE TRANSFER CONTAINER AT THE ATR CANAL</b>	OP-SRC-003	A
		Effective Date:
		3/15/2008

- 5.1.2 Prepare the INIS-2 Isotope Transfer Container for transport to the Test Reactor Area (TRA).
- 5.1.3 Complete necessary portions of the INIS-2 Isotope Transfer Container Loading Record prior to transporting the container to TRA.
- 5.1.4 Transport the container to TRA.
- 5.2 Test Reactor Area (INL) Personnel
  - 5.2.1 Stage the INIS-2 Isotope Transfer Container in the ATR Canal Area.
  - 5.2.2 Perform Section 7 of this Procedure.

## 6.0 SPECIAL EQUIPMENT AND MATERIALS NEEDED

- 6.1 ¾ inch socket wrench with 6 inch extension
- 6.2 Smears
- 6.3 Hoisting and rigging equipment for lifts of 100 lbs and 1800 lbs
- 6.4 Rubber Mallet
- 6.5 Three (3) lifting eyes, two (2) for the Shielded Insert Plug, and one (1) for the Shielded Insert Plug. (Supplied by INIS)

## 7.0 PROCEDURE

- 7.1 Stage the INIS-2 Isotope Transfer Container in the ATR Canal Area.
- 7.2 Using the ¾ inch socket loosen and remove the 16 nuts and washers from the top of the 20 WC-5 overpack lid. (see Figure 1)
- 7.3 Rig to the 20 WC overpack lid and lift the lid off of the overpack body. (See Figure 8)

**NOTE: THE 20 WC OVERPACK LID CAP WEIGHS APPROXIMATELY 100 LBS.**

- 7.4 Remove the cap from the 2R container by turning the cap counter clockwise and lifting the cap off. The “ears” on the 2R cap may be tapped with a rubber mallet to start the cap turning. (See Figure 2)

**NOTE: THE 2R CAP WEIGHS APPROXIMATELY 35 LBS. USE CAUTION WHEN LIFTING**



TITLE:	Number:	Revision
<b>LOADING AND UNLOADING THE INIS #2 ISOTOPE TRANSFER CONTAINER AT THE ATR CANAL</b>	OP-SRC-003	A
		Effective Date:
		3/15/2008

- 7.5 Remove the 3 nuts and washers from the Shield Plug Retaining Bar. (See Figure 3)
- 7.6 Remove the Retaining Bar.
- 7.7 Install two (2) of the supplied lifting eyes onto opposing threaded studs and another lifting eye onto the threaded stud on the shield plug. (See Figure 4)
- 7.8 Rig to the 2 lifting eyes on the shielded insert. (See Figure 4 & 8)

**NOTE: THE SHIELDED INSERT WEIGHS 1800 LBS**

- 7.9 Lift the insert out of the 2R and move it to the cask loading area in the ATR Canal.
- 7.10 Lower the insert into the ATR canal
- 7.11 Using a canal hook tool, remove the shield plug from the insert. (See Figure 4)
- 7.12 IF the insert contains items to be **unloaded** at the ATR canal per Section 2 of the INIS-2 Transfer Container Loading Record (Attachment 9.1 of this Procedure), remove the Isotope Transfer Container Basket (See Figure 5) and place the removed items in an appropriate storage location as directed by ATR Canal Operations.

**NOTE: STEPS 7.12 AND 7.13 ARE NOT APPLICABLE IF SECTION 1 AND SECTION 2 OF THE INIS-2 TRANSFER CONTAINER LOADING RECORD ARE MARKED AS "NONE".**

- 7.13 Record any items unloaded on the INIS-2 Transfer Container Loading Record. (Attachment 9.1 of this Procedure)
- 7.14 Load or verify loaded, an Isotope Transfer Container Basket per Section 3 of the INIS-2 Transfer Container Loading Record. (Attachment 9.1 of this Procedure)
- 7.15 Place the basket containing the items to be loaded into the insert.
- 7.16 Replace the shield plug into the insert. The shield is properly seated when the black line around the plug is even with the top of the insert. (See Figure 6)
- 7.17 Raise the insert out of the canal and allow to drain completely (until water stops dripping from the insert).

<b>TITLE:</b>	<b>Number:</b>	<b>Revision</b>
<b>LOADING AND UNLOADING THE INIS #2 ISOTOPE TRANSFER CONTAINER AT THE ATR CANAL</b>	<b>OP-SRC-003</b>	<b>A</b>
		<b>Effective Date:</b>
		<b>3/15/2008</b>

**NOTE: THE INSERT HAS INTRGREL VENT AND DRAIN PORTS THAT WILL ALLOW COMPLETE DRAINING OF THE INSERT WITHOUT ANY ACTION.**

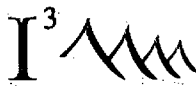
- 7.18 Perform contamination surveys as required to remove the insert from the cask loading area.
- 7.19 Place the insert in the 2R.
- 7.20 Remove the lifting eye from the insert shield plug and from shielded insert.
- 7.21 Replace the shield plug retaining bar and nuts.
- 7.22 Torque the nuts on the shield plug retaining bar to  $15 \pm 5$  ft-lbs.
- 7.23 Lubricate the threads on the 2R cap with neolube.
- 7.24 Replace the 2R cap. Turn by hand until hand tight.
- 7.25 Rig to the 20-5 WC overpack lid and place the lid on the overpack body. Match the black vertical line on the lid to the black vertical line on the 20 WC-5 body. ( See Figure 7)
- 7.26 Replace the 16 washers and nuts. Torque the nuts to  $20 \pm 5$  ft-lbs.
- 7.27 Perform release surveys on 20 WC-5.
- 7.28 Stage the INIS-2 Isotope Transfer Container for shipment.

**8.0 REFERENCES**

- 8.1 20 WC-5 Overpack, 2R and Shielded Insert Figures.

**9.0 ATTACHMENTS**

- 9.1 INIS-2 Transfer Container Loading Record



**International Isotopes Inc.**  
(Including International Isotopes Idaho Inc. subsidiary)

<b>TITLE:</b>	<b>Number:</b>	<b>Revision</b>
<b>LOADING AND UNLOADING THE INIS #2 ISOTOPE TRANSFER CONTAINER AT THE ATR CANAL</b>	OP-SRC-003	A
		<b>Effective Date:</b>
		3/15/2008

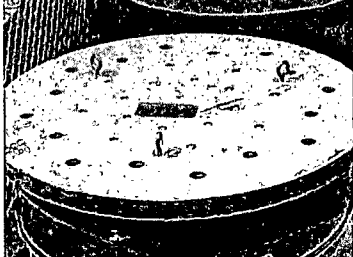
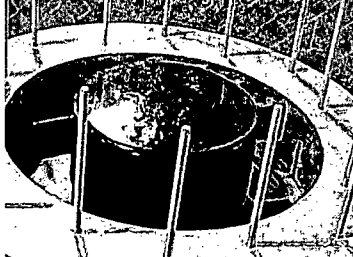
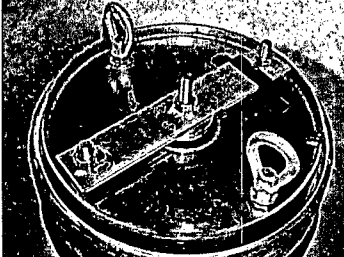
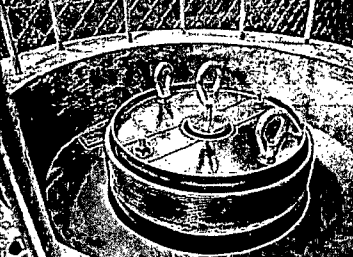

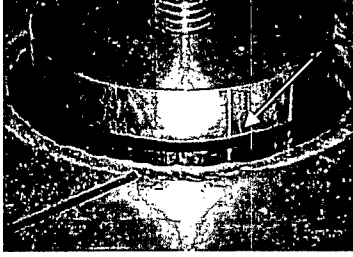
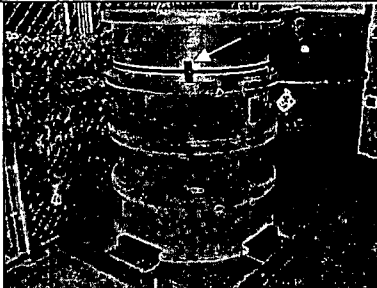
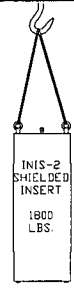
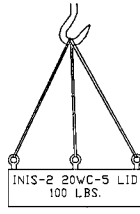
## 9.1 INIS-2 Transfer Container Loading Record

<b>Section 1: Items loaded at International Isotopes Facility</b>				
Item Description	Quantity	Identification Number	Loaded by	Date
<b>Section 2: Items to be unloaded at the ATR Canal</b>				
Item Description	Quantity	Identification Number	Unloaded by	Date
<b>Section 3: Items to be loaded at the ATR Canal</b>				
Item Description	Quantity	Identification Number	Loaded by	Date



<b>TITLE:</b>	<b>Number:</b>	<b>Revision</b>
<b>LOADING AND UNLOADING THE INIS #2 ISOTOPE TRANSFER CONTAINER AT THE ATR CANAL</b>	<b>OP-SRC-003</b>	<b>A</b>
		<b>Effective Date:</b>
		<b>3/15/2008</b>

**Reference 8.1**  
**20 WC-5 Overpack, 2R and Shielded Insert Figures**

 <p align="center"><b>Figure 1</b> Top of the 20 WC Overpack showing the 16 recessed nut locations and 3 lifting eyes</p>	 <p align="center"><b>Figure 2</b> 2R Cap with "ears"</p>	 <p align="center"><b>Figure 3</b> Shielded insert with Plug Retaining bar installed</p>
 <p align="center"><b>Figure 4</b> Shielded insert with plug retaining bar removed and plug lifting eye installed</p>	 <p align="center"><b>Figure 5</b> Isotope Transfer Container Basket</p>	 <p align="center"><b>Figure 6</b> Insert Shield plug properly seated - The black line is even with the top of the insert</p>
 <p align="center"><b>Figure 7</b> The vertical line is used to properly line up the lid and body when the lid is replaced</p>	 <p align="center"><b>Figure 8</b> Example rigging diagram for the INIS-2 Shielded Insert</p>	 <p align="center"><b>Figure 8</b> Example rigging diagram for the INIS-2 20WC-5 Lid</p>

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**EXPERIMENT SAFETY ANALYSIS**

**for**

**CANAL ACTIVITIES**

**for**

**COBALT TARGETS**

**for**

**INTERNATIONAL ISOTOPES, INCORPORATED**

**Revision 0**

Prepared by:	<u>/s/ see Original on file at ATR Eng</u> Irradiation Test Programs	_____
		Date
Peer Review:	<u>/s/ see Original on file at ATR Eng</u> Experiments Engineering	_____
		Date
Line Management Approval:	<u>/s/ see Original on file at ATR Eng</u> Experiments Engineering	_____
		Date
Facility Safety Engineering:	<u>/s/ see Original on file at ATR Eng</u> ATR Nuclear Safety	_____
		Date
Line Management Independent Review:	<u>/s/ see Original on file at ATR Eng</u> SORC Chairman	_____
		Date

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Experiment Safety Analysis  
for Canal Activities  
for Cobalt Targets for INIS

Revision 0  
Page 2 of 25

**Revision History**

Revision Number	Reason for Change	Affected Pages
0	This ESA only addresses the shipping of cobalt targets to International Isotopes, Inc, using a new shipping container. This ESA supplements the existing ESAs that govern cobalt isotope production [Penny, 2002a and 2002b, and Estes, 2001].	All

UNCLASSIFIED

UNCLASSIFIED

Experiment Safety Analysis  
for Canal Activities  
for Cobalt Targets for INIS

Revision 0  
Page 3 of 25

**Table of Contents**

1	SCOPE .....	4
2	HAZARD CLASSIFICATION .....	4
3	PROCESS DESCRIPTION .....	5
	3.1 Flow Chart Presentation .....	5
	3.2 Description .....	5
	3.3 Safety Envelopes .....	7
4	DEMONSTRATION OF COMPLIANCE UPDATE .....	8
	4.1 ATR TSR and UFSAR Compliance .....	8
5	SAFETY ANALYSIS .....	17
	5.1 Loading INIS-2 for Shipment .....	17
6	UNREVIEWED SAFETY QUESTION .....	23
7	CONCLUSIONS .....	23
8	REFERENCES .....	23
9	ACRONYMS/INITIALIZATIONS .....	25

UNCLASSIFIED

UNCLASSIFIED

Experiment Safety Analysis  
for Canal Activities  
for Cobalt Targets for INIS

Revision 0  
Page 4 of 25

**1. SCOPE**

The purpose of this Experiment Safety Analysis (ESA) is to supplement the existing ESAs on activities for low specific activity (LSA), medium specific activity (MSA), and high specific activity (HSA) cobalt isotope production [Penny, 2002a and 2002b, and Estes, 2001] by adding a new package for shipping cobalt targets directly to an existing customer, International Isotopes, Inc, (INIS). The irradiation of cobalt targets is already addressed by two other ESAs [Penny, 2002a (for LSA/MSA) and 2002b (for HSA)]. The non-irradiation activities of handling, canal storage, assaying, and shipping are addressed by the third ESA [Estes, 2001]. This ESA adds the information on the new INIS-2 shipping container.

This ESA demonstrates the continued safe handling of irradiated cobalt targets for shipment to INIS, as required by the Technical Safety Requirements for the Advanced Test Reactor (ATR) (TSR-186). This ESA addresses the canal activities unique to loading cobalt targets into the INIS-2 shipping container. The activities are evaluated against the general and specific safety analyses criteria for drop-in capsule experiments in the ATR as established by the Upgraded Final Safety Analysis Report (UFSAR) for the Advanced Test Reactor (SAR-153).

This ESA details compliance to TSR 3.9.1 Experiment Safety Margin, Surveillance Requirement 4.9.1.3, and to the ATR UFSAR commitments for experiment facilities.

**2. HAZARD CLASSIFICATION**

The ATR, and the activities therein, by definition is a Hazard Category 1 nuclear facility [DOE, 1997, and SAR-153, 20.1]. Being the most severe category, it will not change as a result of the activities of this ESA since the cobalt inventory will be reduced as a consequence of shipping.

The intra-Reactor Technology Complex (RTC) activities that are outside the ATR are all shipping related. The shipping of irradiated cobalt capsules in the INIS-2 shipping container will be in compliance with the Department of Transportations (DOT) Hazardous Materials Regulations (DOT, 2005) and thus is exempt from the requirements of hazard categorization. Hazards associated with the transportation of hazardous materials have been analyzed and mitigated by adherence to the DOT regulations.

UNCLASSIFIED

UNCLASSIFIED

Experiment Safety Analysis  
for Canal Activities  
for Cobalt Targets for INIS

Revision 0  
Page 5 of 25

**3. PROCESS DESCRIPTION**

3.1 Flow Chart Presentation

This ESA only addresses one step of the process of cobalt production, which is shipping offsite, and only for the INIS-2 shipping container, thus a flow chart for this is not warranted. Shipping is comprised of loading the INIS-2 shipping container, moving the INIS-2 out of ATR onto the transport conveyance, and moving the transport conveyance out the RTC main gate.

3.2 Description

3.2.1 Loading INIS-2 for Shipment

This step includes loading the targets into the INIS-2 shipping container, assembling and preparing the INIS-2 shipping container for shipment, and moving the INIS-2 shipping container outside ATR to the off-site transport conveyance.

Procedures to be Followed:

- DOP-4.8.78, Loading INIS-2 Shipping Container.

Equipment to be Used

The shipping container is the INIS-2, which is a DOT Specification 20WC wooden protective jacket [DOT, 2003a] in combination with a DOT Specification 2R inside containment vessel [DOT, 2003b]. This is a DOT-authorized configuration for Type B quantities of radioactive material, which, for Co-60, is any activity greater than 10.8 curies [DOT, 2005]. INIS-2 has a tungsten/lead/stainless steel shield insert positioned inside the 2R. Only the shield insert is placed in the canal for loading the targets.

The INIS-2 shipping container is the -5 size, which has a maximum gross weight of 4000 pounds, including contents. Its tare weight is approximately 2900 pounds, of which approximately 1850 pounds is the shield insert, approximately 150 pounds is the Spec 2R, and approximately 900 pounds is the Spec 20WC. The overpack diameter is 39.5 inches. The pallet to which the INIS-2 is affixed for handling and shipping weighs an additional 120 pounds (approximate weight). The pallet is 48 inches square. At these weights, mechanical means will have to be employed for handling. A forklift will handle the 20WC-5 "assembly" for ingress into and egress from the canal area, and the canal overhead bridge crane will handle the 20WC lid (205 pounds) and the shield insert (1850 pounds).

The 20WC Specification is only valid through September 30, 2008. Beginning October 1, 2008, a different shipping container will have to be employed, of which there are several existing

UNCLASSIFIED

UNCLASSIFIED

Experiment Safety Analysis  
for Canal Activities  
for Cobalt Targets for INIS

Revision 0  
Page 6 of 25

candidates (GE-2000 for example). INIS will have to identify the replacement, which will result in a revision to this ESAP for incorporation thereof.

Special Personnel Requirements

There are no special personnel requirements other than that prescribed by DOP-4.8.78.

Safety Hazards Present

The safety hazards for the loading, assembly, and preparation of the INIS-2 shipping container are industrial - handling heavy objects and the presence of combustible material (20WC overpack) - and radiological - radiation exposure from the target or uncontrolled spread of radioactive contamination from the act of handling the target.

3.2.2 Transport Within RTC to Main Gate

Procedures to be Followed

Transport of the INIS-2 within RTC to the main gate is simply considered the first "leg" of the off-site shipment, all of which is to be in full compliance with DOT (see 3.2.3). DOT compliance is assessed, and attested to, by the HazMat shipper in accordance with HazMat shipping procedures (MCP-2669 and MCP-3007).

Equipment to be Used

The off-site conveyance will be a truck of adequate capacity to handle the 20WC-5. The truck will be DOT compliant, which, again, will be assessed by the HazMat shipper in accordance with HazMat shipping procedures (MCP-3007).

Safety Hazards Present

The safety hazards for the movement of the loaded INIS-2 within RTC to the main gate are radiological - radiation exposure - and industrial - handling heavy objects and trucks.

3.2.3 Transport from RTC Main Gate

This step is merely a continuance of the offsite shipment from ATR, but is outside the confines of RTC, and therefore is not applicable for this ESA. However, for information only, this step must be in full compliance with DOT shipping regulations [DOE, 2003].

UNCLASSIFIED

UNCLASSIFIED

Experiment Safety Analysis  
for Canal Activities  
for Cobalt Targets for INIS

Revision 0  
Page 7 of 25

3.3 Safety Envelopes

3.3.1 Loading INIS-2 for Shipment

The controlling safety documents are:

- Upgraded Final Safety Analysis Report [SAR-153],
- Technical Safety Requirements [TSR-186], and
- DOT Hazardous Materials Regulations [DOT, 2005]

3.3.2 Transport Within RTC to Main Gate

The controlling safety document is:

- DOT Hazardous Materials Regulations [DOT, 2005]

The ATR-to-RTC main gate leg of transport is not regulated by the DOT, thus should be conducted under a documented safety analysis because it involves a Hazard Category 3 quantity of radioactive material (the quantity of Co-60 exceeds  $2.8E+02$  Curies [DOE, 1997]). Recognizing that DOE's nuclear safety management program [DOE, 2006] considers transportation activities regulated by the DOT to be an acceptable safety envelope, adherence to the DOT HMR is an appropriate safety envelope to bridge from the safety envelope of ATR, where the shipment technically originates, to outside the RTC main gate, where compliance with the DOT HMR is mandatory (see 3.3.3).

3.3.3 Transport from RTC Main Gate

The controlling safety document is:

- DOT Hazardous Materials Regulations [DOT, 2005]

This activity is outside the bounds of this ESA and is presented for information only. This leg of transport is regulated by DOT, hence, compliance with DOT is mandatory [DOE, 2003].

UNCLASSIFIED

UNCLASSIFIED

Experiment Safety Analysis  
for Canal Activities  
for Cobalt Targets for INIS

Revision 0  
Page 8 of 25

**4. DEMONSTRATION OF COMPLIANCE**

**4.1 ATR TSR and ATR UFSAR Compliance**

This section will show compliance with EDF-TRA-ATR-1463 [Thatcher, 2000c] recommended commitments and with the TSR-186 and SAR-153 requirements for loading the INIS-2 shipping container at ATR, and moving it outside ATR for offsite shipment. Where appropriate, requirements that are germane to the irradiation ESAs [Penny, 2002a and 2002b] will still be identified, but presented in an abbreviated format for conciseness.

EDF-TRA-ATR-1463 Compliance	
Commitment	Compliance
Verify that the ATRC reactor is not operating during irradiated experiment loading of the cask	Contained in ATRC procedures.
The lifting restrictions, crane maintenance, and other essential features for assuring reliable load handling must be preserved in a manner at least as stringent as in Standard Practice 10.3.1.7.	Contained in DOP-4.8.78. SP-10.3.1.7 is incorporated by reference into DOP-4.8.78, as well as individual requirements thereof, for example, crane inspections per DOP-2.1.17.
The cask rigging diagram approved by the Experiment Safety Assurance Package (ESAP) must be used whenever handling an experiment cask in the reactor main floor area and the cask rigging diagram must be controlled to prevent unauthorized changes.	The cask rigging diagram approval in the ESAP is not applicable since this work does NOT involve an experiment cask and is NOT performed in the reactor main floor area. However, the intent is met in that the rigging diagram in DOP-4.8.78 is approved by the rigging specialist and the lifting engineer, and Document Control procedures do not permit otherwise, including changes to rigging diagrams without review and approval.
Notification to the Shift Supervisor is required prior to moving a loaded cask.	Contained in DOP-4.8.78. The work steps in Section 4 of the DOP require Shift Supervisor or designated alternate to witness lift heights for cask movements subject to TSR-186, 4.5.5.4 requirements.
Electrical power must be disconnected from the crane during insertion and removal of an experiment from the cask to preclude having a single spurious electrical fault result in a loss of shielding.	This commitment is applicable to bottom loading casks to guard against a spurious upward crane movement that would lift a cask off an experiment, and thus is not applicable to the INIS-2 shipping container because of its top loading design.

UNCLASSIFIED

Experiment Safety Analysis  
for Canal Activities  
for Cobalt Targets for INIS

Revision 0  
Page 9 of 25

ATR TSR and UFSAR Compliance	
Parameter/Requirement	Compliance
<p>TSR 3.5.5 – Cask Handling and Irradiated Fuel Element Storage</p> <p>Cask handling and irradiated fuel element storage shall be per Table 3.5.5-1</p>	<p>The applicable portions of Table 3.5.5-1’s requirements for cask handling in the canal area are contained in RP-2942, Cask Handling – ATR Canal Area TSR Form. RP-2942 is incorporated into DOP-4.8.78.</p>
<p>TSR 3.9.1 Experiment Safety Margin</p> <p>An experiment safety assurance package (ESAP) shall demonstrate compliance to the ATR plant protection criteria for condition 1, 2, 3, and 4 faults.</p>	<p>Compliance for the loading and shipping activities covered by this ESA are documented in Section 5.</p>
<p>TSR 4.9.1.3 Surveillance Requirement for TSR 3.9.1</p> <p>Verify ESAP prior to experiment insertion into the reactor vessel.</p> <p><u>And</u></p> <p>Scheduled startup for experiments in the reactor vessel</p> <p><u>Or</u></p> <p>Prior to experiment or irradiation test material insertion in the canal.</p>	<p>This requirement is not applicable to the loading and shipping activities covered by this ESA.</p>
<p>TSR 5.7.7.2 (Nuclear Criticality Safety)</p> <p>(Because nuclear criticality safety is not applicable to this ESA, the seven individual nuclear criticality safety requirements are not repeated verbatim in this table to save space.)</p>	<p>This requirement is not applicable since cobalt capsules do not contain fissile material.</p>
<p>UFSAR 4.3.2.2 Power Distribution</p> <p>Due to the nature of ATR operation, new experiments are occasionally inserted into the reactor. When new experiments are placed into the reactor, additional analysis is performed to provide assurance that the reactor response with the new experiments meets the established safety envelope.</p>	<p>This requirement is not applicable to the loading and shipping activities covered by this ESA.</p>

UNCLASSIFIED



UNCLASSIFIED

Experiment Safety Analysis  
for Canal Activities  
for Cobalt Targets for INIS

Revision 0  
Page 10 of 25

ATR TSR and UFSAR Compliance	
Parameter/Requirement	Compliance
<p>UFSAR 10.1.5 Classification of Experiment Structures, Systems, and Components</p> <p>Classification of the capsule and canal experiment SSC and the applicability of General Design Criterion 70 to capsule experiment SSC are addressed on a case basis in the ESA for the capsule.</p>	<p>This requirement is not applicable to the loading and shipping activities covered by this ESA.</p>
<p>UFSAR 10.1.7.3.2 Code Compliance of Experiment Containment</p> <p>(Because the requirement is irradiation based only, and is demonstrated by the irradiation ESAs, the specific requirement is not repeated herein for brevity concerns.)</p>	<p>This requirement is not applicable to the loading and shipping activities covered by this ESA.</p>
<p>UFSAR 10.1.7.3.3 Containment of Materials</p> <p>Materials which are incompatible with the reactor fuel element cladding, the reactor primary coolant, canal water coolant, or with reactor primary coolant system (PCS) structural materials must be contained so as not to be released to the PCS or canal as a result of a Condition 2 or 3 fault.</p>	<p>The demonstration of compliance herein is germane for canal water coolant only . The materials of fabrication for the cobalt targets and the non-target components are cobalt, aluminum, and stainless steel [Estes, 2001, Table 1]. Being typical fabrication materials with long histories of use, all these materials are compatible with canal water.</p> <p>The INIS-2 shield insert is the only shipping component that comes in contact with canal water. Its materials of fabrication are stainless steel clad lead and stainless steel clad tungsten. An optional unclad tungsten sleeve is inside the shield insert. Stainless steel clad lead is typical of most shipping containers. Tungsten is not a prohibited material [SP-10.3.1.13].</p>

UNCLASSIFIED

UNCLASSIFIED

Experiment Safety Analysis  
for Canal Activities  
for Cobalt Targets for INIS

Revision 0  
Page 11 of 25

ATR TSR and UFSAR Compliance	
Parameter/Requirement	Compliance
<p><b>UFSAR 10.1.7.3.4 Excluded Materials</b> The following materials are not permitted in an experiment or loop facility within the reactor biological shielding:</p> <ul style="list-style-type: none"> <li>• Unknown Materials - No experiments shall be performed unless the material content, with the exception of trace constituents, is known.</li> <li>• Explosive materials with an equivalent of <math>\geq 25</math> mg of TNT. (Explosive material is a solid or liquid which has an explosion hazard in water or steam, as defined in Lewis (1990), and is used in a configuration that can detonate and produce a shock wave.)</li> <li>• Cryogenic liquids.</li> </ul>	<p>This requirement is not applicable to the loading and shipping activities covered by this ESA.</p>
<p><b>SAR 10.1.7.3.5 Evaluation of Materials</b> The following materials are not used in experiments unless such usage is shown to be in compliance with the primary experiment safety analyses criterion in section 10.1.7.1 and the compliance analyses are completed prior to insertion in the reactor vessel or canal.</p> <ul style="list-style-type: none"> <li>• Radiologically hazardous activation products.</li> <li>• Radiation sensitive materials.</li> <li>• Highly flammable or toxic materials, per se or as by-products of radiation sensitive materials.</li> <li>• Reactive Materials which are defined as any solid or liquid which has a reactivity index of 2 in National Fire Protection Publication 704 (NFPA 1996) or has a disaster or fire hazard indicating detrimental reactions in water or steam in Lewis (1990).</li> </ul>	<p>The irradiation ESAs [Penny, 2002a and 2002b] demonstrate compliance for this evaluation of experiment materials prior to insertion into the canal.</p>

UNCLASSIFIED

Experiment Safety Analysis  
for Canal Activities  
for Cobalt Targets for INIS

Revision 0  
Page 12 of 25

ATR TSR and UFSAR Compliance	
Parameter/Requirement	Compliance
<p>SAR 10.1.7.3.6 Failure of Common Systems</p> <p>The failure of systems that are common to both the experiment facilities and experiments and the plant will not cause interactions (from this common use) that result in total consequences in excess of those specified by the IPT Protection Criterion in section 10.2.6.1 and the ATR Plant Protection Criteria as discussed in Chapter 15 (Accident Analyses) for Conditions 2, 3, and 4.</p>	<p>This requirement is not applicable to the loading and shipping activities covered by this ESA.</p>
<p>SAR 10.1.7.3.7 Physical Layout</p> <p>Components of experiment facilities are located and oriented so as to preclude physical interference with personnel evacuation or with safety-related systems, structures, and components. If displacement of system shielding is involved, measures are to be taken to ensure radiation levels are below the ATR Plant Protection Criteria for occupational exposure</p>	<p>The potential interaction with safety-related systems, structures, and components or interference with personnel evacuation by the activities covered by this ESA are mitigated by adherence to SD-11.1.46, the requirements of which have been incorporated into DOP-4.8.78. There is no displacement of system shielding by the activities covered by this ESA.</p>
<p>SAR 10.1.7.4 Thermal Hydraulic Criteria</p> <p>The conduct of the experiment must not adversely affect decay heat transfer from the canal fuel elements or heat transfer from the PCS.</p> <p>This criterion applies for all experiments in the ATR facility.</p>	<p>The potential interaction with canal fuel element heat transfer by the activities covered by this ESA is mitigated by TSRs that protect canal water level, the requirements of which have been incorporated into DOP-4.8.78.</p>
<p>SAR 10.1.8.1 Quality Review</p> <p>The design, fabrication, testing, and material content of all contractor-supplied experiment hardware are verified in accordance with the contractor's Quality Program Plan (See Chapter 17 (Quality Assurance)). For experiment hardware supplied by other organizations, the design, fabrication, testing and material content are verified in accordance with a Quality Program that has been reviewed by the contractor and found to meet the intent of the</p>	<p>This requirement is not applicable to the loading and shipping activities covered by this ESA.</p>

UNCLASSIFIED

UNCLASSIFIED

Experiment Safety Analysis  
for Canal Activities  
for Cobalt Targets for INIS

Revision 0  
Page 13 of 25

ATR TSR and UFSAR Compliance	
Parameter/Requirement	Compliance
applicable sections of the contractor Quality Program Plan or the contractor verifies that the experiment meets the intent of the applicable sections of the contractor Quality Program Plan. These quality reviews are documented in the ESA.	
<p>SAR 10.1.8.2 Supporting Analyses</p> <p>The contractor is responsible for the adequacy and accuracy of supporting analyses submitted by experimenter organizations. The operation of each experiment facility is compared with the facility design specification to ensure that it is properly enveloped. Each experiment is compared to the safety analysis envelope to ensure the consistency with the assumptions made in the analyses.</p>	<p>The analyses in support of these experiments has been reviewed, concurred with and approved by ATR Experiments [Estes, 2001]. The worker radiological exposure for handling the INIS-2 shipping container is discussed in Section 5.1. The dose assessment shows that this experiment activity is within the applicable safety analysis envelope.</p>
<p>UFSAR 10.3.5 Specific Capsule Irradiation Experiment Safety Analysis Criteria</p> <p>Each capsule irradiation experiment will have an ESA as described in Section 10.1.6, reviewed and approved as described in Section 10.1.8, which addresses the General Experiment Safety Analyses Criteria in Section 10.1.7 and the specific experiment safety analyses criteria described below.</p>	<p>The irradiation ESAs [Penny, 2002a and 2002b] demonstrate code compliance for these specific safety analysis criteria.</p>
<p>SAR 10.4.3 Experiment Handling Evaluations</p> <p>The specific requirements of cask handling as described in Chapter 16 (Derivation of Technical Safety Requirements) will be elements of the ESA.</p> <p>Various experiment handling evolutions require the use of building cranes. Formal documentation shall be available to show limits for each crane used. The document shall indicate load limits, lift heights, allowable reactor status (e.g. operating, shutdown, or defueled) and allowable status of canal storage. Verification of the required documentation is an element of the ESA.</p>	<p>DOP-4.8.78 incorporates form RP-2942, Cask Handling – ATR Canal Area TSR Form, which addresses the requirements of SAR 16.3.2.13. [See also TSR-3.5.5 compliance.]</p> <p>Experiment handling evolutions that are not cask-related, that is, not governed by the TSRs, have been analyzed for height, weight, and location limits for the canal area. These limits are contained in the ATR Building Lift Book [SAR 9.1.5.3]. Assurance that DOP-4.8.78 incorporates the appropriate Lift Book requirements is attained by the SP-10.2.2.3 review of DOPs.</p>

UNCLASSIFIED

UNCLASSIFIED

Experiment Safety Analysis  
for Canal Activities  
for Cobalt Targets for INIS

Revision 0  
Page 14 of 25

ATR TSR and UFSAR Compliance	
Parameter/Requirement	Compliance
<p>For fueled experiments, a minimum cooling time after shutdown will be established to ensure that melting of the experiment will not occur during handling of the experiment.</p> <p>The ESA addresses (a) handling operations which can include assembly, disassembly, storage, and cask handling, (b) limiting fault analyses for each handling evolution, and (c) effects on the experiment during a canal draining accident and demonstrates compliance with the ATR Plant Protection Criteria for all applicable operating conditions.</p>	<p>Not applicable for cobalt targets (not a fueled experiment).</p> <p>See Section 3 for (a) and Section 5 for (b) and compliance with ATR Plant Protection Criteria. For (c), the irradiated cobalt targets will heat up if uncovered during a canal draining accident, but not to the point of melting [Estes, 2001].</p>
<p>UFSAR 10.4.4 Experiment Handling Equipment Testing and Inspection Requirements</p> <p>The detailed description of the TRA Maintenance Program and the Maintenance Implementation Plan, which defines the current status of the TRA programs relative to the applicable DOE orders and industry standards, are provided in Chapter 14 (Initial Test Program, Inservice Surveillance and Maintenance). The ESAP addresses the TRA Maintenance Program for this equipment.</p>	<p>All experiment handling equipment used in canal operations is routinely inspected and maintained.</p> <p>Cranes, forklifts, and hoisting and rigging gear are routinely inspected and maintained. For example, DOP-2.1.17, which is incorporated by reference into DOP-4.8.78, ensures crane/rigging/cask attachments preventive maintenance requirements are met. In addition, as part of each use, inspections are performed to assess the material condition of the INIS-2 shipping container in accordance with DOT requirements [DOT, 2005].</p>
<p>UFSAR 9.5.1.2.1 (Fire Protection) Design Requirements</p> <p>The HAD-116 report, in combination with Table 15.16-1, provides assurances that the ATR can be operated within the safety basis until all recommendations are resolved.</p>	<p>Table 15.16-1 does not specify any SAR commitments for the canal area. Table 15.16-1 recommends that “transient combustible loading restrictions within five feet of (a) cask” be kept “very low”.</p> <p>HAD-116, Section 4.1 states that the ATR administrative combustible control procedure [SD-11.1.45] provides adequate administrative controls for the type of hazards and fire protection features (sprinklers, fire barriers, and</p>

UNCLASSIFIED

UNCLASSIFIED

Experiment Safety Analysis  
for Canal Activities  
for Cobalt Targets for INIS

Revision 0  
Page 15 of 25

ATR TSR and UFSAR Compliance	
Parameter/Requirement	Compliance
	<p>so forth) and reflects the results of Nuclear Safety evaluations.</p> <p>Handling the INIS-2 in the canal area for loading cobalt targets is not identified in SD-11.1.45 as a mode of operation for which a combustible limit has been established. Therefore, it will be assumed that the combustible loading limit will be exceeded and, in accordance with SD-11.1.45, appropriate compensatory measures were identified by the RTC Fire Protection Engineer (FPE) and incorporated into DOP-4.8.78. Assurance that DOP-4.8.78 incorporates the appropriate FPE requirements is attained by the SP-10.2.2.3 review of DOPs.</p>
<p>SAR-153, 15.8 Fuel Storage Canal and Cask Handling Events</p> <p>If the reactor vessel or the canal contains irradiated fuel, the lift height for handling casks east of building grid 7.5 is four feet unless an analysis shows that the higher lift does not exceed the consequences of the bounding cask drop over the canal parapet wall documented in EDF TRA-ATR-1728, "Evaluation of Consequence of Accidental Cask Drops on to the ATR Storage Canal Parapet and Wall."</p>	<p>A lift height greater than four feet is required east of building grid 7.5 in order to extract the shield insert from the overpack (minimum lift height required is 56 inches). An analysis has been performed to a lift height of 65 inches that demonstrates that the higher lift does not exceed the consequences of the bounding cask drop over the canal parapet wall documented in EDF TRA-ATR-1728 (see Section 5.1.3 of this ESA for a more detailed discussion).</p>
<p>SAR-153, 15.8.10 Dropping a Heavy Cask onto the Floor North of the Canal</p> <p>If the reactor vessel or the canal contains irradiated fuel, cask movements over the floor north of the canal shall be limited to casks weighing not more than 20 tons and shall not exceed a height of one foot except as needed to access the canal, the cask cleaning area, or to unload and load transporters.</p>	<p>This requirement for cask handling in the canal area is contained in RP-2942, Cask Handling – ATR Canal Area TSR Form. RP-2942 is incorporated into DOP-4.8.78.</p>

UNCLASSIFIED

Experiment Safety Analysis  
for Canal Activities  
for Cobalt Targets for INIS

Revision 0  
Page 16 of 25

ATR TSR and UFSAR Compliance	
Parameter/Requirement	Compliance
<p>SAR-153, 15.8.10 Dropping a Heavy Cask onto the Floor North of the Canal (continued)</p> <p>If the reactor vessel is defueled and the canal contains irradiated fuel, and if the canal LDW makeup is out of service, cask handling over the floor north of the canal is only allowed west of the pipe tunnel, and valve GT-1-84 must be shut.</p>	<p>This requirement for cask handling in the canal area is contained in RP-2942, Cask Handling – ATR Canal Area TSR Form. RP-2942 is incorporated into DOP-4.8.78.</p>
<p>SAR-153, 15.8.15 Dropping a Cask onto the Main Floor not above a Loop Cubicle or above the Circular Structural and Shielding Wall at the 98 Foot Elevation</p> <p>Cask lifts above the floors not over loop cubicles shall be limited to 10 in. unless specifically approved by the ATR Operations manager.</p>	<p>Not Applicable – handling will not be performed over the Main Floor.</p>

## 5. SAFETY ANALYSIS

This section details compliance to the ATR Plant Protection Criteria (PPC) of SAR-153 for normal operation of, and accident conditions occurring during:

- loading the targets into the INIS-2 shipping container, assembling and preparing the INIS-2 for shipment, and movement of the INIS-2 from the ATR canal area to the off-site transport conveyance outside of ATR.

Compliance to the ATR PPC for normal operation of, and accident conditions occurring during the handling of targets has been demonstrated by the existing canal activities ESA [Estes, 2001].

The movement of the transport conveyance to the RTC main gate and continuing on outside RTC does not require demonstration of compliance to the ATR PPC because it is outside the confines of ATR.

### 5.1 Loading INIS-2 for Shipment

#### 5.1.1 Condition 1 Events (Normal Operation and Operational Transients)

*Radiation Exposure Limits: Off-site Limit - 100 mrem/year effective dose equivalent (EDE) and 10 mrem/year EDE from airborne release; Worker Limit - 5 rem/year total effective dose equivalent (TEDE).*

*Fuel Cladding Protection Limits: The integrity of the fuel cladding is not challenged in Condition 1 except for limited clad defects.*

To limit worker exposure, activities are performed in accordance with the Radiological Control Manual (RCM) [LRD-15001]. The discussion of Section 3 notes that DOP-4.8.78 is used to control the loading and handling of the INIS-2 shipping container. The requirements of the RCM are incorporated into DOP-4.8.78.

There are no Condition 1 events that would lead to reactor fuel damage.

#### 5.1.2 Condition 2 Faults (Faults of Moderate Frequency: Anticipated)

*Radiation Exposure Limits: Off-site Limit – 0.5 rem/year TEDE; Worker Limit - 5 rem/year TEDE.*

*Fuel Cladding Protection Limits: No rupture of the reactor fuel plate cladding is allowed unless the clad failure is the initiating fault. For canal accidents, no melting of the fuel plate cladding is allowed.*



UNCLASSIFIED

Experiment Safety Analysis  
for Canal Activities  
for Cobalt Targets for INIS

Revision 0  
Page 18 of 25

There are no SAR analyzed Condition 2 faults associated with loading and handling a shipping cask that would challenge off-site exposure limits, on-site exposure limits, or the integrity of ATR fuel cladding [SAR-153, 15.0.3.2].

Fire is an anticipated fault (Condition 2) [Thatcher, 2000b]. The INIS-2 introduces combustible material into the ATR because the 20WC protective jacket is fabricated from plywood. The estimated volume and weight of plywood are 25.2 cubic feet and 885 pounds (at a conservative 35 lbs/cuft). The introduction of the 20WC into the ATR is considered to be a transient combustible threat. EDF TRA-ATR-1610 [Thatcher, 2000b] further evaluated fire-induced threats, the result of which was the fire hazard control procedure [SD-11.1.45] to administratively control transient combustibles. Handling the INIS-2 in the canal area for loading cobalt targets is not an identified mode of operation for which a limit has been established. Therefore, it will be assumed that the combustible loading limit will be exceeded and, in accordance with SD-11.1.45, the following compensatory measures were identified by the RTC Fire Protection Engineer and incorporated into DOP-4.8.78:

- A five-foot (minimum) separation is established between the 20WC overpack, including the lid after it is removed, and any loaded spent fuel cask in the canal area;
- A five-foot (minimum) separation is established between the 20WC overpack, including the lid after it is removed, and any building wall;
- Any hot work to be performed in the canal area shall be done in accordance with LRD-14406, "Welding, Cutting, and Other Hot Work", which will require Fire Protection Engineer or designee approval;
- Combustible waste material shall not be stored within ten feet of the overpack or its lid;
- All combustible waste material in the canal area shall be removed at the end of shift, or the end of DOP-4.8.78 should it be completed before the end of shift;
- At least one operable portable fire extinguisher shall be available within the immediate work area around the overpack and its lid;
- A fire watch surveillance shall be established to inspect the area around the overpack and its lid every four hours; and
- The automatic fire suppression system shall be in service, or additional controls as directed by the Fire Protection Engineer shall be implemented.

The above fire hazard controls assure that at the Condition 2 fault frequency, a fire in the ATR building is not expected to result in sufficient damage to a loaded INIS-2 shipping container to result in a radiological release, nor to threaten canal integrity. The ATR PPC are met.

UNCLASSIFIED

UNCLASSIFIED

Experiment Safety Analysis  
for Canal Activities  
for Cobalt Targets for INIS

Revision 0  
Page 19 of 25

5.1.3 Condition 3 Infrequent Faults (Unlikely)

*Radiation Exposure Limits: Off-site and evacuating worker – 6.25 rem whole body and 75 rem thyroid dose.*

*Fuel Cladding Protection Limits: No large releases of uranium or fission products to the primary coolant system will occur.*

The SAR analyzed Condition 3 faults associated with handling a shipping cask that would challenge off-site exposure limits, on-site exposure limits, or the integrity of ATR fuel cladding are [SAR-153, 15.0.3.3]:

- Dropping a heavy cask from an elevation of less than one foot above the canal floor resulting in a small or limited failure of the storage canal;
- Dropping a heavy cask from one foot above the parapet within the restricted cask-lifting areas of the canal; and
- Dropping a heavy cask onto the floor north of the canal.

The INIS-2 shipping container, when fully “assembled” as offered for transport, will be considered to be a cask. Also, the INIS-2’s tungsten/lead/stainless steel shield insert will be considered to be a cask because it alone is all that goes into the canal for loading the cobalt targets. The only other item that is handled is the overpack lid, which will be considered to be a non-cask component.

Non-cask loads and cask movements are evaluated on a case basis and lift restrictions are identified by either the use of Technical Safety Requirement (TSR) or by the ATR Building Lift Book [SAR-153, 15.8.2]. For the purpose herein, the cask movement lift restrictions are deemed to be applicable to the “assembled” INIS-2 and the shield insert because both are treated as a cask; the non-cask load lift restrictions are deemed to be applicable to the INIS-2 overpack lid.

Through application of cask movement restrictions, a cask drop resulting in canal rupture and irradiated fuel elements being uncovered is not credible [SAR-153, 15.8.4.2]. The application of the appropriate restrictions is accomplished via the work control document, which is DOP-4.8.78, as required by the UFSAR [see TSR/UFSAR compliance table for SAR 10.4.3]. The assurance that DOP-4.8.78 contains the appropriate restrictions is attained by the SP-10.2.2.3 review of DOPs [see again compliance table for SAR 10.4.3]. Thus, there is no challenge to the PPC for off-site exposure limits or the integrity of ATR fuel cladding. The challenge to the PPC for worker exposure is addressed later in this section.

UNCLASSIFIED

UNCLASSIFIED

Experiment Safety Analysis  
for Canal Activities  
for Cobalt Targets for INIS

Revision 0  
Page 20 of 25

Two cask movement restrictions do require further analysis, which are:

- Cask lifts west of building grid 7.5 are limited to three feet above the floor (at the 98-foot elevation) to protect the canal west end support structure.
- Cask lifts between the pipe tunnel and building grid 7.5, to load and unload transporters, are acceptable for lifts up to four feet above the floor. If a higher lift height is needed, an analysis will be required to show that the higher lift does not exceed the consequences of the bounding WCF cask drop over parapet and canal wall analyzed in Miller and Murray (2001).

In order to remove (and to re-install) the shielded insert from the wooden overpack, it must be lifted to a height at least 56 inches above the canal area floor to clear the overpack. This physical necessity cannot meet the three-foot restriction west of grid 7.5, thus it can only be handled between the pipe tunnel and grid 7.5. This physical necessity also cannot meet the four-foot restriction between the pipe tunnel and grid 7.5, but prior analysis [USQ-SE-2003-027] demonstrates that lifting a 29,000-pound cask to a 65-inch height does not exceed the consequences of the bounding WCF cask drop over parapet and canal wall analysis [Miller and Murray, 2001]. The shield insert weighs 1,850 pounds, thus is bounded by the analysis. DOP-4.8.78 incorporates both lifting restrictions (lift only between the pipe tunnel and grid 7.5 and 65-inch lift height restriction).

In order to remove (and to re-install) the overpack lid, it must also be lifted to a height at least 56 inches above the canal area floor to clear the overpack, thus it can only be handled between the pipe tunnel and grid 7.5 as well. An existing entry in the Lift Book demonstrates that lifting the overpack lid, which weighs 205 pounds, to a 12-foot height does not perforate the floor, thus would not exceed the consequences of the bounding WCF cask drop over parapet and canal wall analysis. Miscellaneous noncask items weighing not more than 1,300 pounds and greater than 2.5 inches in diameter can be lifted to a height of no more than 12 feet. DOP-4.8.78 incorporates both lifting restrictions (lift only between the pipe tunnel and grid 7.5 and 12-foot lift height restriction).

The handling of the INIS-2 shipping container “assembly” with a forklift for ingress to/egress from ATR is controlled by the Lift Book [SAR-153, 15.8.2]. The Lift Book requirements for “miscellaneous casks” dictate that the height limit be controlled in accordance with a detailed operating procedure that incorporates the TSRs for cask handling. DOP-4.8.78 incorporates a one-foot lift height limit for handling by forklift. In addition, the Lift Book also includes a requirement that cask handling during reactor power operations will not perforate the floor if the cask is dropped. The 4,200-pound, 39.5-inch diameter, INIS-2 shipping container will not perforate the canal area floor if dropped from a height of one foot, which is based on an existing analysis that demonstrates that the 33,350-pound, 38.5-inch diameter GE-2000 cask will not perforate the floor if dropped from one foot [Miller, 1993].

UNCLASSIFIED

UNCLASSIFIED

Experiment Safety Analysis  
for Canal Activities  
for Cobalt Targets for INIS

Revision 0  
Page 21 of 25

The following have been classified as Condition 3 faults in EDF TRA-ATR-1463:

- Dropping the loaded INIS-2 with a resultant loss of shielding; and
- An adverse interaction with safety-related or important-to-safety equipment as a result of a seismic event.

An INIS-2 drop outside the confines of the canal could result in a loss of shielding of its contents. A previous analysis for loss of shielding for the Hot Cell Carrier (White Elephant) Number 3 (WE-3) cask at the cask transfer station demonstrated that the Condition 3 PPC would be met for workers for a 25,000-Curie cobalt-60 payload [Estes, 2001]; DOP-4.8.78 limits contents to 25,000 Curies cobalt-60. The normal payload for the INIS-2 shipping container is a single HSA capsule (approximately 9,000 Curies). The canal area is further from the normally occupied areas analyzed for the WE-3 cask, thus the previous analysis bounds the situation herein and the PPC for worker exposure is met.

The consequence of a seismic event is an adverse interaction with a safety related seismic category I SSC. EDF-TRA-ATR-1564 [Thatcher, 2000a] evaluated spatially-dependent vulnerabilities of safety-related and important-to-safety equipment, the result of which was the system interaction hazard control procedure [SD-11.1.46] that describes inspection practices and limitations on the placement of items deemed a threat based on some type of adverse interaction. In accordance with SD-11.1.46, Appendix B, the important-to-safety equipment in the canal area are:

- (PCS) M-10 emergency pump conduit;
- (Firewater system) handwheel for bottom head EFIS isolation valve GT-T-84;
- (Fuel storage and handling) canal irradiated fuel storage section inflatable seals and emergency canal firewater makeup;
- (LDW) LDW canal makeup; and
- (RMSS) outside confinement, which are the (canal area) south wall, entire floor, various doors, and confinement ductwork and hampers for HVA-2, HVE-1A, HVE-1B, and HVS-1.

The requirement for the canal area is to prohibit placement of material where it may disable any of the above equipment. A specific distance of separation is not defined. Since all of the above are east of the pipe tunnel or south of the canal, except the canal area floor north of the canal, protection is afforded them by restricting all cask and non-cask component handling operations to west of the pipe tunnel, and all storage locations to west of, and at least six feet away from, the pipe tunnel. The canal area floor is protected by adhering to the TSRs and Lift Book. DOP-4.8.78 restricts placement of the INIS-2 as stated herein; compliance with the TSRs and the Lift Book has already been stated.

UNCLASSIFIED

UNCLASSIFIED

Experiment Safety Analysis  
for Canal Activities  
for Cobalt Targets for INIS

Revision 0  
Page 22 of 25

The last consequence of a seismic event is a threat to canal integrity should the INIS-2 fall into the canal. Because the overpack is plywood, the only threat to canal integrity is the shield liner itself falling into the canal, and only if it falls into an unsupported (to bedrock) section of the canal, which could be the case considering where it is handled between the cask loading area and grid 7.5 [SAR-153, Figure 15.8-1]. However, isolating the fuel elements in the canal by use of appropriate bulkheads will preclude fuel melting [SAR-153, 15.8.4]. Thus, there is no challenge to the PPC for the integrity of ATR fuel cladding.

5.1.4 Condition 4 Limiting Faults (Extremely Unlikely)

*Radiation Exposure Limits: Off-site and evacuating worker – 25 rem whole body and 300 rem thyroid dose.*

*Fuel Cladding Protection Limits: The primary coolant pressure boundary must be maintained (unless this failure is the initiator) and reactor confinement must not be damaged.*

The SAR analyzed Condition 4 fault associated with handling a shipping cask that would challenge off-site exposure limits, on-site exposure limits, or the integrity of ATR fuel cladding is [SAR-153, 15.0.3.4]:

- A large failure of the storage canal, which results in a rapid draining of the canal, due to the dropping of a heavy cask from a significant height above the canal floor.

The same argument for the safety analysis for Condition 3 cask handling faults is germane for the Condition 4 cask handling fault – through application of cask movement restrictions, a cask drop resulting in canal rupture and irradiated fuel elements being uncovered is not credible [SAR-153, 15.8.4.2].

The following have been classified as Condition 4 faults in EDF TRA-ATR-1463:

- Heavy load drop of another object onto a loaded INIS-2 shipping container; and
- Collision with a vehicle or a moving cask.

The consequence of either of the above is akin to loss of shielding, for which previous discussions demonstrated that the Condition 3 PPC exposure limits were met. Therefore, the consequences of this fault are within applicable guidelines and no additional controls to prevent or mitigate this occurrence are required.

An additional Condition 4 fault is a fire involving a spent fuel cask, which assumes the INIS-2 overpack is the combustible material. Handling a spent fuel cask is an identified mode of operation for which a limit has been established, which is to keep combustible material to a very low level within five feet of spent fuel casks [SD-11.1.45]. Very low is defined to be 125,000

UNCLASSIFIED

UNCLASSIFIED

Experiment Safety Analysis  
for Canal Activities  
for Cobalt Targets for INIS

Revision 0  
Page 23 of 25

BTU of material. The BTU content of the INIS-2 overpack is  $8.6E+06$  BTUs in accordance with the following:

25.2 cubic feet is 302.4 board feet (at 144 cubic inches per board foot), which is  $8.6E+06$  BTUs (at  $1.0E+06$  BTUs per 35 board feet for hardwoods, which is the most conservative BTU value and which is assumed for plywood [Table 2, SD-11.1.45]).

The constant occupancy of the ATR building, a normally operable fire suppression system in the vicinity of a loaded cask, and the fire hazard controls incorporated into DOP-4.8.78, including a five-foot minimum separation from a spent fuel cask, assure that a fire in the ATR building is NOT expected to result in sufficient damage to a loaded spent fuel cask to result in a radiological release.

**6. UNREVIEWED SAFETY QUESTION**

Based on Sections 2, 3, 4, and 5 of this ESA, and RTC-USQ-2006-232 (attached), the loading and handling of the INIS-2 shipping container does not constitute a USQ.

**7. CONCLUSIONS**

By conforming to this ESA, loading of irradiated cobalt targets for shipment to INIS will be within the ATR Plant Protection Criteria and the TSR/UFSAR safety envelope.

**8. REFERENCES**

ATR PROCEDURES

DOP-2.1.17, Preoperational Inspection of Crane/Rigging/Cask Attachments

DOP-4.8.78, Loading INIS-2 Shipping Container

SD-11.1.45, ATR Facility Fire Hazard Control

SD-11.1.46, ATR System Interaction Hazard Control

SD-11.3.14, ATR Building Lift Book

SP-10.2.2.3, Document Control Supplement to LWP-1201

SP-10.3.1.13, Material Practices and Restrictions for ATR PCS and Experiment Loops

UNCLASSIFIED

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Experiment Safety Analysis  
for Canal Activities  
for Cobalt Targets for INIS

Revision 0  
Page 24 of 25

SP-10.3.1.7, Critical Lifts and Marking of Hoisting and Rigging Equipment at TRA, TRA Maintenance Supplement to PRD-600, Maintenance Management Requirements, Appendix B, Hoisting and Rigging Program

SP 10.6.2.1, Experiment Safety Assurance Package Preparation and Approval

DOE, 1997, DOE Standard (STD) 1027-92, Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports, with Change Notice 1, September 1997

DOE, 2003, DOE Order 460.1B, Packaging and Transportation Safety, April 4, 2003

DOE, 2006, Code of Federal Regulations Title 10 (Energy), Chapter III (Department of Energy), Part 830, Nuclear Safety Management, January 1, 2006

DOT, 2003a, Code of Federal Regulations Title 49 (Transportation), Chapter I, Subchapter C (Hazardous Materials Regulations), Section 178.362 (Specification 20WC Wooden Protective Jacket), October 1, 2003

DOT, 2003b, Code of Federal Regulations Title 49 (Transportation), Chapter I, Subchapter C (Hazardous Materials Regulations), Section 178.360 (Specification 2R Inside Containment Vessel), October 1, 2003

DOT, 2005, Code of Federal Regulations Title 49 (Transportation), Chapter I, Subchapter C (Hazardous Materials Regulations) [also known as U.S. Department of Transportation's Regulations or 49CFR Parts 171 through 180], October 1, 2005

Estes, 2001, Experiment Safety Analysis Package (ESAP) for Isotope Production and Irradiation Service Capsule Experiment Canal Activities, Revision 1, February, 2001

HAD-116, Hazards Assessment Document (HAD) 116, Combination Fire Hazard Analysis and Fire Safety Assessment ATR Building TRA-670, Revision 1

Laboratory Requirements Document (LRD) 14406, Welding, Cutting, and Other Hot Work

Laboratory Requirements Document (LRD) 15001, Radiological Control Manual

Miller, 1993, Engineering Design File (EDF) TRA-ATR-749, Stress Analysis on Drops of GE 2000 Cask in ATR Building, Revision 0

Miller and Murray, 2001, Engineering Design File (EDF) TRA-ATR-1728, Evaluation of Consequences of Accidental Cask Drops onto the ATR Storage Canal Parapet and Wall, Revision 0

UNCLASSIFIED

UNCLASSIFIED

Experiment Safety Analysis  
for Canal Activities  
for Cobalt Targets for INIS

Revision 0  
Page 25 of 25

Management Control Procedure (MCP) 2669, Hazardous Material Shipping

Management Control Procedure (MCP) 3007, Shipment and Receipt of Hazardous Materials

Penny, 2002a, General Electric Low and Medium Specific Activity Cobalt-60 Production Capsule Experiment Safety Analysis Package (ESAP), SKP-42-98, March 26, 1998, with DAR LSA-ESAP-10, May 01, 2002

Penny, 2002b, Experiment Safety Analysis Package for High Specific Activity Cobalt Capsules, SKP-145-02, December 18, 2002

Program Requirements Document (PRD) 310, INEEL Transportation Safety Document (TSD)

SAR-153, Upgraded Final Safety Analysis Report for the Advanced Test Reactor, Revision 16

Thatcher, 2000a, Engineering Design File (EDF) TRA-ATR-1564, Evaluation of ATR Safety-Related and Risk Significant Equipment Location-Dependent Vulnerability, Revision 1

Thatcher, 2000b, Engineering Design File (EDF) TRA-ATR-1610, Comparison of Postulated Fire Events in the ATR Building to ATR UFSAR Chapter 15 Accidents, Revision 0

Thatcher, 2000c, Engineering Design File (EDF) TRA-ATR-1463, Evaluation of Experiment Test Train Handling in ATR

TSR-186, Technical Safety Requirements for the Advanced Test Reactor, Revision 14

USQ-SE-2003-027, (for) Form RP-2942 Cask Handling – ATR Canal Area

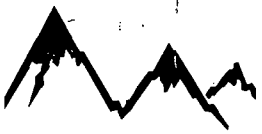
## 9. ACRONYMS

[Note: This list is pared to only those acronyms that may not be common knowledge.]

DOT	Department of Transportation
FPE	fire protection engineer
GE	General Electric
HazMat	hazardous material
HMR	hazardous materials regulations
INIS	International Isotopes, Inc.

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# International Isotopes Inc.

August 6, 2008

Mr. James Williams  
Radioactive Materials Branch  
Office of Hazardous Materials Technology  
Pipeline and Hazardous Materials Safety Administration  
U.S. Department of Transportation  
East Building, E21-330, PHH-23  
1200 New Jersey Avenue, S.E.  
Washington, D.C. 20590-0001

Subject: Special Permit Application, Docket Number 14728-N, Response to Comments

Dear Mr. Williams,

I appreciated the opportunity to meet with you and your colleagues to discuss the comments you had regarding the Special Permit application I submitted June 23, 2008, reference Docket Number 14728-N.

DOT Comment 1: Provide an estimated date of re submittal of AOS-100 package to NRC.

INIS Response to Comment 1: The AOS-100 package is scheduled to be re-submitted to the US NRC on October 1, 2008. The re-submitted package will remove the request to transport liquids and irradiated fuel. The intent is that after the package has been licensed an amendment requesting authorization to transport irradiated fuel will be submitted.

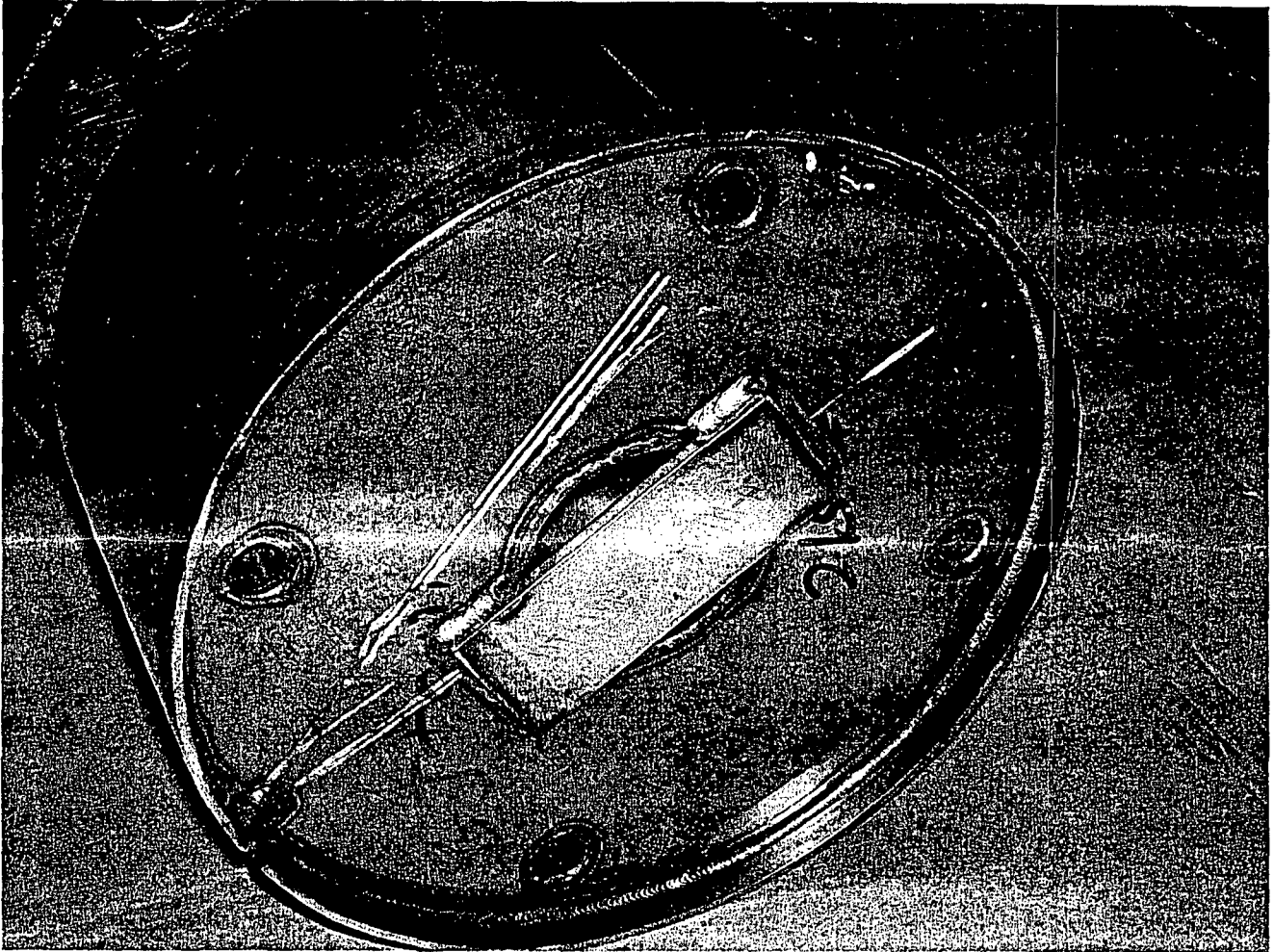
DOT Comment 2: International Isotopes, Inc. procedure OP-SRC-003 Section 3.2 lists the design of the shielded insert at 6,000 Ci yet the special permit requests the use of the shielded insert for targets ranging in activity from 7,500 and 10,000 Ci.

INIS Response to Comment 2: The shielded insert with an additional tungsten sleeve had been designed to hold an 11,000 Ci Co-60 target. This configuration had been used in the past to transport up to 10,200 Ci. Procedure OP-SRC-003 Section 3.2 has been revised to read 9,000 Ci. Revised procedure attached.

DOT Comment 3: Provide a detailed explanation as to what prevents the tungsten bottom plug from falling out of tungsten shield.

INIS Response to Comment 3: A stainless steel bar is welded across the bottom opening of the shield to hold the tungsten bottom plug in place. A photograph of bottom of the tungsten shield is provided on the following page.

## 2R Tungsten Shield Insert Bottom Plug Retention Bar



DOT Comment 4: The evaluation of alternative Type B packages did not include packages that could hold the 2R/Tungsten shield insert, such as the Energy Solutions Models CNS 8-120B and CNS 10-160B.

INIS Response to Comment 4: International Isotopes, Inc. completed a second review of the NRC approved packages listed on the RAMPAC web site utilizing the following additional criteria to classify a container as a viable alternative.

1. An over pack configuration container has cavity dimensions and weight authorizations capable of accommodating the 2R/Tungsten shield.
2. Authorized content activity exceeds target activity
3. The container is available for lease or rental at a cost that would not exceed 25% of the bulk value for Co-60 contained within the target.

The table below lists the casks that were considered in addition to those identified in the initial application:

Container	Over pack Cavity can hold 2R/Tungsten Shield (cavity dimensions and authorized weight)	Authorized content activity could accommodate Co-60 target	Lease rate < 25% bulk Co-60 value
PAS-1 USA/9184/B(U)-96F	NO (content weight limited)	No (50 Ci limit)	N/A
CNS 8-120B USA/9168/B(U)	YES	No Limited to 100 watts decay heat $\approx$ 6,600 Ci Co-60	N/A
CNS 10-160B USA/9204/B(U)-85	YES	No Limited to 100 watts decay heat $\approx$ 6,600 Ci Co-60	N/A
TN-RAM USA/9233/B(U)	YES	YES	NO

Note that the cask requirements of (1) Authorized for domestic use, (2) Authorized for use after October 1, 2008, and (3) Authorized content of Co-60 normal form still apply.

Should you have any questions regarding the application, please contact me by phone at (208) 524-5300 or by email at [jjmiller@intisoid.com](mailto:jjmiller@intisoid.com)

Sincerely,



John J. Miller, CHP  
International Isotopes Inc.  
4137 Commerce Circle  
Idaho Falls, ID 83401

JJM-2008-17