Safety Evaluation of Receipt of ORNL U-233 at SRS Tank Farm

by

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SAFETY EVALUATION OF RECEIPT OF ORNL U-233 AT SRS TANK FARM

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K. R. B. Menger, Technical Reviewer, WSMS	1/25/00 Date
I. K. Paik, Hazard Analysis Group Manager, WSMS	1/26/00 Date

Safety Evaluation of Receipt of ORNL U-233 at SRS Tank Farm

Introduction

This document serves as a preliminary review to examine potential bounding hazard consequences associated with the receipt of U-233 material from ORNL to the SRS F-Area Tank Farm.

This document is based on information contained within a memorandum from P. D. d'Entremont to M. Montini dated December 2, 1999 (Ref. 1 attached), and information obtained during conversations with facility representatives during the week of January 10, 2000.

Purpose and Scope

DOE currently has approximately 800 kg of U-233 in a number of batches of material at Oak Ridge National Laboratory (ORNL) and Idaho National Engineering Laboratory (INEL). A task team with members from WSRC and ORNL is currently considering a number of options for disposal of this material. This document discusses four of the options being considered in which the U-233 would be transferred directly into the Tank Farm (as requested in Ref. 1). The sole intent of this document is to provide rough consequence (order of magnitude) information to ascertain the potential requirement of Safety Class controls for a facility that may be proposed as part of several alternatives to dispose of excess U-233 material in F-Area High Level Waste Tanks. The effort was intended to show the worst case scenario(s) for doses resulting from airborne releases only and did not consider liquid releases. This review does not constitute a formal hazard assessment document (HAD), hazard analysis (HA) or facility hazard categorization. Neither does the review address potential criticality concerns or chemical incompatibility concerns from mixing the U-233 material with existing material in the high level waste tanks (According to the customer, these hazards are being addressed by the WSRC-ORNL Task Team).

The hazard evaluations were developed qualitatively and semi-quantitatively, and were designed to identify the following for each alternative:

- The major hazardous events
- Safety Class Structures, Systems or Components (SC SSC)
- Administrative controls necessary to protect identified safety functions

This review has been conducted during a very early stage of the facility's pre-conceptual discussion stage. There is no design documentation available at this point, and it is recognized that any attempts to postulate accident scenarios are based on conceptual information only.

Proposed Alternatives

The following information describes the four alternatives evaluated in this review.

The first two alternatives involve slurrying the received material within the facility and pumping it to the F- Area High Level Waste Tanks (Ref. 1).

Alternative 1 – Damp Material Slurrying
The first alternative involves the receipt of U-233 material in the form of a damp powder sealed within special stainless steel containers within a DOT-certified Type B shipping cask. The cask lid would be removed within an internal or external receiving station and the containers would be removed and placed into cells within the facility. Each container would be fitted with nozzles for attaching hoses. The containers would be flushed with water resulting in a powdered material slurry, which is subsequently pumped to one of two designated Type III High Level Waste Tanks within the F-Area Tank Farm.

Alternative 2 – Fusion Melt Slurrying
The second alternative is similar to Alternative 1 except the U-233 material would be received in the form of a fusion melt of U-233 and borax. This fusion melt is produced prior to shipment from Oak Ridge by adding borax to the CEUSP material and melting in a furnace at approximately 1000°C. The molten material is poured directly into the shipping container or solidified outside the container and broken into chunks. The material would be packaged in special stainless steel containers and shipped in a DOT-certified Type B shipping cask. The cask lid would be removed within an internal or external receiving station and the containers would be removed and placed into cells within the facility. Each container would be fitted with nozzles for attaching hoses. The containers would be flushed with water, which would dissolve the fusion melt. The resulting slurry would be pumped to one of two designated Type III High Level Waste Tanks within the F-Area Tank Farm.

The remaining two options considered in this review (as requested in Ref. 1) are called "aluminum pill" options and are described below.

Alternatives 3 and 4 – Aluminum Pill
Alternatives 3 and 4 involve the receipt of the U-233 material within a thin aluminum can. The aluminum cans of material would be sealed within a larger more robust stainless steel canister. The canister would in turn arrive at the facility within a DOT-certified Type B shipping cask. The shipping cask would be opened at the internal or external receiving area of the facility and the stainless steel canister would be removed and placed into the facility. Once the stainless steel canisters are opened, the aluminum cans of material would be removed individually, transported to the waste tank area in a lead "pig", and placed directly into one of the Type III High Level Waste Tanks in F-Area. Once inside the waste tank, the basic solution inside the tank would dissolve the thin aluminum can, releasing the material. A potential problem with this option is the

generation of hydrogen gas within the waste tank as a by-product of the aluminum dissolution.

The primary difference between Alternatives 3 and 4 is the form of the material received within the thin aluminum container. Alternative 3 involves powdered U-233 material while Alternative 4 involves U-233 material in a fusion melt with borax similar to the material used in Alternative 2.

Based on discussions with facility personnel, it has been determined that it is unlikely that the aluminum pill alternatives (Alternatives 3 and 4) described in Reference 1 would be selected. Therefore, this evaluation focuses primarily on the alternatives that involve slurrying the U-233 material (in damp powder or fusion melt form) from the stainless steel containers to the waste tanks.

Analysis Assumptions and Initial Conditions

1. Shipping casks would be delivered on a truck.

2. The material processing facility will be located in the vicinity of the F-Area High Level Waste Tanks.

3. Inventories will be as listed in Reference 1. According to the customer, the worst case U-233 would be that produced by the Consolidated Edison Uranium Solidification Program (CEUSP). It is assumed that the contents of each CEUSP can would be processed and placed into one stainless steel shipping container, i.e. each container would have the contents of one CEUSP can.

4. The material shipped is in the form of a damp powder (relative to the fusion melt alternative, this form is assumed to be the bounding case). Therefore, radiolysis and hydrogen generation is a potential concern. The powder form is also significant in regard to the ease of drying and dispersability during a fire event.

5. Containers could be removed from the shipping cask in open air rather than inside a facility enclosure.

6. As many as 10 stainless steel shipping containers could be removed from the shipping cask and placed in the facility at any one time for processing. Once the cask is opened, it is assumed that the powder in all 10 cans could be dispersed in a fire or explosion event. The release is assumed to occur with no filtration (Leak Path Factor = 1).

7. Canisters will have nozzles that are used for flushing the U-233 powder from the canister.

8. Cans remaining in a sealed Type B DOT-certified cask would not be considered part of the inventory.

9. The facility building and ventilation/filtration system are not credited in mitigating an airborne release from the facility.

10. Combustible materials are assumed to be present in all parts of the facility. The quantity of this combustible material, once ignited, is sufficient to sustain a fire that could breach the containers that are not protected by the sealed shipping cask.

11. The consequences resulting from a release of radiological material are considered to be significantly greater than those from a release of other hazardous constituents (e.g., cadmium) found in the powder. Therefore, this evaluation focuses only on the release of radioactive material.

12. At the customer's request, this review does not address criticality or chemical incompatibility hazards associated with the U-233 material.

Methodology

The methodology used in this review emphasizes those hazardous events that would yield the highest consequences (dose) to the offsite public. While many potential events that might result in a release of radiological material could be postulated, this effort seeks to provide only those events that would be considered as bounding all other credible events. The selection of these bounding categories was based on the information provided and analyst judgement. Should one of the U-233 disposition alternatives described in the input document be selected for implementation, a formal hazard analysis should be performed to confirm and expand upon this review.

Typically, a hazard analyst evaluates potential release mechanisms in seven general event categories: fires, explosions, loss of confinement (leaks, spills), direct radiological exposure (direct exposure of workers to ionizing radiation such as neutrons and gamma radiation), nuclear criticality, externally initiated events (e.g., aircraft impact), and natural phenomena events (e.g., earthquakes, tornadoes). Fires and explosions are the two categories of credible events specifically evaluated because their energy could potentially provide the greatest dispersion of material and highest consequence to the offsite public.

Fire

A fire can be postulated both in the facility due to the presence of electrical and hydraulic equipment and in the truck-receiving station due to the presence of ignition sources and fuels. A fire can be considered an Anticipated ($>10^{-2}$ per year) event in the life of the facility provided no credit is assumed for normal preventive controls. The U-233 material is assumed to be a damp, powdered material. Thus, given exposed material containers (out of the transportation cask) and a fire of sufficient magnitude, the U-233 material could be dried, oxidized and released to the surrounding atmosphere. Given the release mechanism and the dispersion characteristics of the fire event, the release of material from the containers could yield a significant dose to offsite receptors. The release is assumed to escape the facility with no filtration.

Explosion
An explosion can be postulated in the truck receiving station and in the facility. Both ignition sources and potentially explosive materials are available on the vehicle itself, whether within the confines of the facility (e.g. a proposed truck bay) or outside the facility. An explosion involving the truck or other delivery vehicle would probably fall in the Unlikely frequency range (between 10^{-2} and 10^{-4} per year).

Additionally, even in the absence of standard industrial explosive hazards within the facility (i.e., acetylene), an explosion inside the facility could still occur due to the potential ignition of hydrogen within the shipping containers themselves. In this case, hydrogen gas formed by radiolysis could be ignited by sources such as: static electricity discharge, lightning strike surges through equipment, cutting or grinding tools (assuming for some reason a container was required to be cut open). An explosion involving these containers could fall in the Anticipated frequency range (>10^{-2} per year) assuming no credit is taken for preventive features or administrative controls. Thus, given exposed material containers (out of the transportation cask) and the occurrence of an explosion, the containers could be breached and the U-233 material would be released to the surrounding atmosphere. Given the release mechanism and the dispersion characteristics of the explosion event, the release of material from the containers would be expected to yield a significant amount of airborne material and produce a significant dose to offsite receptors. The release is assumed to escape the facility with no filtration.

Consequence Development

Consequences for the postulated fire and explosion events were estimated using RadScreen. RadScreen is a tool which is used to make simple and conservative calculations of radiological dose resulting from the release of nuclear materials from SRS. RadScreen consists of a series of pre-calculated tables which yield effective dose equivalent values in Rem to the receptor, given user-selected input values for the:

- nuclide of concern,
- distance between release and receptor,
- deposition rate of material, and
- release duration.

The nuclide inventory given in the input document (Ref. 1) (includes U-232, U-233, U-234, U-235, U-236, U-238) was used as the basis for determining consequences. The total Source Term was conservatively assumed to involve the material contained in 10 stainless steel shipping containers. A distance of 9.4 kilometers to the offsite receptor from an assumed release point in F-Area was used.

With regard to material deposition during the release event, RadScreen provides three available deposition rates: No Deposition, 0.1 cm/sec, and 1.0 cm/sec. The most conservative value for deposition rate (in regard to the offsite receptor) is the "no deposition" option. A deposition rate that may be considered more realistic is the rate for an unfiltered release of material. This deposition rate, 1.0 cm/sec, results in a smaller quantity of material traveling to the site boundary (therefore a smaller dose to the public) relative to the same release for which no deposition of material is assumed. Both the most conservative deposition value and the less conservative (more realistic) value used for unfiltered releases were evaluated, and the resulting doses were calculated and compared. The results of this comparison are given in the Results section below.

With regard to release duration, RadScreen provides two options: a 3 minute release duration in which all the material is assumed to be released in a 3 minute time period (appropriate for explosions or when the most conservative results offsite are desired), and a 30 minute release duration in which all material is assumed to be released in a 30 minute time frame (most appropriate for fires and other extended release events). Both values were input to facilitate comparison of the consequences, and are listed in the Results section below.

Results

The following results provide effective dose equivalent values in Rem to the offsite receptor from a release of the U-233 material (as listed in the input document - Ref. 1) from 10 stainless steel shipping containers. The results given below may be ratioed to determine consequences for a different number of cans.

Table 1 (Most Conservative)

Dose in Rem for each isotope assuming No Deposition and a 3 Minute Release Duration. Material in 10 stainless steel shipping containers released. Receptor 9.4 km from release point.

U-232	U-233	U-234	U-235	U-236	U-238
41.73	3.04	0.29	0.01	0.01	0.00

Table 2 (Explosion Model)

Dose in Rem for each isotope assuming 1.0 Cm/Sec Deposition Rate and a 3 Minute Release duration. Material in 10 stainless steel shipping containers released. Receptor 9.4 km from release point.

U-232	U-233	U-234	U-235	U-236	U-238
27.31	1.99	0.18	0.00	0.01	0.00

Table 3 (Fire Model)
Dose in Rem for each isotope assuming 1.0 Cm/Sec Deposition Rate and a 30 Minute Release duration. Material in 10 stainless steel shipping containers released. Receptor 9.4 km from release point.

U-232	U-233	U-234	U-235	U-236	U-238
16.69	1.22	0.11	0.00	0.00	0.00

It can be seen that in each case, a release of the material in 10 stainless steel shipping containers will result in:

- "Low" offsite consequences (0.5 rem< dose <5 rem) based on the dose resulting from release of the U-233 isotope alone,
- "Moderate" offsite consequences (5 rem< dose <25 rem) based on the dose resulting from release of the U-232 isotope during a fire event,
- "High" offsite consequences (>25 rem) based on the dose resulting from release of the U-232 isotope during an explosion event. This result also applies to the hypothetical most-conservative release event.

Given the inventory information from Reference 1, and the dose values calculated above, it is estimated that a release of as little as one-third of the material in one stainless steel shipping container is sufficient to result in a dose of 0.5 Rem to the offsite receptor in an unmitigated fire release scenario. This case would require accident analysis and possibly safety class controls. This estimate is based on both the inventory and high specific activity of U-232 and U-233.

In a formal hazard analysis process, these initial estimated consequences (offsite > 0.5 rem) would flag both the fire event and the Anticipated explosion event for additional analyses (accident analysis) and probable Safety-Class controls to prevent or mitigate the release. It is possible that in the accident analysis phase of the process, the event dynamics and release fractions could be analyzed in detail. This would result in a more refined, and potentially lower offsite dose estimate (less than Evaluation Guidelines). In this case, it is possible that Safety Class controls may not be required.

<u>Potential Controls Providing Safety Class Functions</u>
It is envisioned that potential controls (SSCs and Administrative Controls) that could perform Safety Class functions for this proposed facility might include:

- Inventory Control Program
- DOT Type 3 Cask
- Building (or Cell) Construction (including seismic qualification)
- Ventilation and Filtration System (including seismic qualification)
- Combustible Material Control Program
- Stainless Steel Shipping Container Design

- Cask Unloading Procedure (to include disconnecting the truck from the trailer prior to unloading the shipping cask)

References

1. Memorandum from P. D. d'Entremont to M. Montini. "Receipt of U-233 at SRS Tank Farms," Westinghouse Savannah River Company, Aiken, SC, December 22, 1999.

2. RadScreen Users Guide, Westinghouse Safety Management Solutions, Aiken, S.C.

3. Hazard Analysis Methodology Manual (U), WSRC-IM-97-9, Rev. 1, Westinghouse Savannah River Company, Aiken, SC, March 1999.

Ref. 1
to WSRC-TR-2000-031

DON'T SAY IT -- WRITE IT

December 22, 1999

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To: Mike Montini, 703-H

From: P. D. d'Entremont, 703-H, 208-8727 PDdE 8-8727

Receipt of U-233 at SRS Tank Farms

As we discussed a couple weeks ago, a hazards review is needed of receipt of U-233 powder at SRS. The process is at the conceptual stage at this time, so it is probably not necessary to do an actual HAD document at this time. We'd like someone to spend a few hours thinking about it and let us know if there are any special safety concerns with the facility. We are currently guessing that the facility to receive the U-233 would cost about $40 million, but we would increase the estimate if the safety review showed the facility to have special hazards needing extra controls.

We need this review by the time of the management review of the U-233 reports, which is scheduled for the week of 1/24/2000 to 1/31/2000. So we'd like to have a feel for the hazards situation sometime in the week of 1/17/2000. I would be glad to work with whoever is doing the review and supply any extra information needed.

Background

DOE currently has about 800 kg of U-233 in a number of batches of material at Oak Ridge National Laboratory (ORNL) and Idaho National Engineering Laboratory (INEL). Most of this material was originally intended for the manufacture of weapons, and there are no plans to build any more weapons. There are some possible uses for some of the materials, but much of it will be disposed of.[1] Currently, a task team, of which I am a member, is looking at options for disposal. Twenty-three options are being considered at this time.

In four of the options being studied the material is pumped directly into a waste tank. These are the options for which we'd like a hazards analysis. In the other options involving the Tank Farms, the U-233 materials enter through the canyon and are

Attachment - Page 1

transferred to the Tank Farms as normal High-Level Waste, and we think it's safe to assume that the normal Tank Farm SAR will bound the hazards of this waste, perhaps with the exception of criticality, which simply must be prevented.

Tank Farm Transfer Station

In two of the options, the material is received at a Transfer Station. The difference between the two options is in the way the material would be processed at Oak Ridge. The current thinking is that the U-233 materials would be received in a cask, probably a GE-2000 cask. Inside the cask would be a number of containers, probably 7 to 20, each containing some amount of U-233 material.

Although the details of the container configuration and size are not finalized, we can estimate the maximum inventory because it will be limited by the size of the GE-2000 cask. Paul Singley at ORNL has estimated that the contents from processing about 7 CEUSP cans would fit into a cask, so he recommended that I conservatively set the maximum inventory at the contents of 10 cans. The CEUSP (Consolidated Edison Uranium Solidification Program) material is the U-233 material that has the highest radiation rates; the CEUSP material is also hazardous because it contains cadmium. Therefore, we feel it is a good material to use to estimate a bounding source term.

The maximum inventory contained in one cask containing the material from processing of ten CEUSP cans is estimated as follows:

Radionuclide Inventory:

U Isotope	232	233	234	235	236	238	Total
Mass (kg) from processing one CEUSP can	0.000310	0.251	0.0360	1.997	0.145	10.746	13.175
Mass (kg) from processing ten CEUSP cans	0.00310	2.510	0.360	19.972	1.449	107.5	131.8
Wt%	0.002	1.905	0.273	15.159	1.100	81.562	100.000

Chemical Inventory:

Chemical Constituent	U	Cd	Gd	Na	O	H	Total
Mass from processing one CEUSP can (kg)	13.18	0.77	0.095	1.28	4.24	0.127	19.7
Mass from processing ten CEUSP cans (kg)	131.8	7.7	0.95	12.8	42.4	1.27	197

The difference between the two options is in how the material is processed at Oak Ridge. In the first option, designated WBS 1.6,[2] the CEUSP material (currently a monolithic solid) is dissolved in nitric acid and then neutralized with sodium hydroxide. The resulting precipitate is pumped into a container and then the liquid decanted off. The process produces a sludge that is expected to be similar to HLW sludge, i.e. fine particle size, slurryable, and damp.

In the second option, WBS 1.7, the CEUSP material is added to borax and melted in a furnace at around 1000 C, producing a fusion melt. The molten material us poured directly into the shipping container or solidified outside the container and broken into chunks. At any rate, the material would be large particles or chunks.

Shipment

Safety of the material in shipment is the responsibility of Oak Ridge National Lab. The cask used for shipment will have a certificate of compliance from NRC. Although the design for the containers inside the cask has not been finalized, plans are for them to be strong stainless steel vessels able to withstand the overpressure produced if the containers were heated in a transportation fire, vaporizing the water in the sludge.

Receipt at Transfer Station

The transfer station would be located in the vicinity of Tanks 33 and 34 in F area. When the cask arrives at the Tank Farm, the cask is opened, and each container is lifted from the cask and placed in the transfer station. Each container would contain the material from processing of one CEUSP can. The transfer operation would need to be done remotely using a crane, either a yard crane or a bridge crane. Because of the U-232 daughter products in the uranium, expected radiation rates on the exterior of the stainless steel containers are in the neighborhood of 10 to 50 Rad/hr.

The transfer station would be a shielded cell, perhaps 20 feet by 20 feet square, with locations for receiving the shipping containers. Currently, our thinking is that the cell would be designed for contact maintenance, although most operations would be done remotely. There will be no fuel (gasoline, hydrogen, combustible solids) located in the facility, although there will be the need for pressurized water to flush the containers.

Each container will be flushed with water, slurrying the material to a waste tank. In the case of WBS 1.6, the material is simply slurried out like Tank Farm sludge. In the case of WBS 1.7, the water causes the borate in the fusion melt to dissolve, and then the rest of the matrix crumbles into a powdered slurry that can be flushed from the container. During the flushing, there is the potential for leaks and spills. It's probably reasonable to assume that the contents of one container might be spilled on the ground (i.e. one CEUSP can's worth of material). Since there is pressurized water involved, it's also reasonable to assume some spraying of the material.

Criticality

The CEUSP material is highly poisoned with both cadmium and gadolinium. Both should be insoluble under Tank Farm conditions and be tightly bound to the uranium in the same particles, so we believe that a criticality is incredible. Assuming the decision is made to send the CEUSP material to the Tank Farms, we plan a series of experiments to prove that the cadmium and gadolinium remain with the fissile materials in the Tank Farm, similar to the experiments that were done to approve iron and manganese as acceptable neutron poisons.

"Aluminum Pill" Options

There are two other options for transport of CEUSP material to SRS, called the "aluminum pill" options. In WBS 1.12,[2] the material is made at Oak Ridge by an aqueous process (similar to WBS 1.6). The resulting slurry is packaged in a thin aluminum container, like a soda can, then overpacked into a stainless steel container.

When the containers are received at SRS, the soda can is removed from the stainless steel container and lowered into a waste tank. Inside the waste tank, the sodium hydroxide in the supernate dissolves the aluminum, and the powder falls to the floor of the waste tank as sludge.

WBS 1.13 is a similar option, except that the material in the aluminum pill is produced at Oak Ridge using the fusion melt process, similar to WBS 1.7.

One hazard in this process is that hydrogen is produced when aluminum dissolves in sodium hydroxide. About 1200 liters of hydrogen is produced for each kilogram of aluminum dissolved. Current plans are to limit the amount of aluminum put into a waste tank at any one time to 1 kilogram. Calculations show that even if this kilogram dissolved quickly, the maximum concentration that would be reached in a full type III waste tank would be 10% of the LFL for hydrogen.

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[1] C. W. Forsberg et. al., "Disposition Options for Uranium-233," ORNL/TM-13553

[2] R. H. Holdaway, "U-233 Engineering Report Status Teleconference," E-mail of 12/8/99, 11:52 AM

Attachment 1
Estimate Maximum Inventory of U-233 Shipment to Transfer Station
Prepared by Paul D. d'Entremont, 12/22/99

Of the U-233 materials, the CEUSP (Consolidated Edison Uranium Solidification Program) material has about the highest U-232 concentration and also has the cadmium, a hazardous material. Therefore, the CEUSP is used for a bounding source term.

According to Paul Singley (phone conversation of 12/13/99), the contents of 10 CEUSP cans would be a conservative upper limit for the amount of U-233 in a single cask. He estimates that the maximum number of cans that could be fit into the 280-liter cask is about seven, so ten would be a conservative upper bound.

The total amount of material in CEUSP is as follows:

U Isotope	232	233	234	235	236	238	Total
mass(kg) in all CEUSP	0.13	101.143	14.49	796.33	58.38	72.11	1042.585
wt%	0.012	9.701175	1.39	76.38073	5.6	6.92	100

Before the CEUSP material is added to a waste tank, it will be diluted with depleted uranium to below 12% enrichment so that it would not be weapons usable. B[illegible] Hermes at Oak Ridge has computed that if the CEUSP material were diluted to 11% enrichment wit[illegible] [illegible]leted uranium (DU) that had 0.2% U-235, then the total CEUSP inventory would be as follows:

U Isotope	232	233	234	235	236	238	Total
mass(kg) in all CEUSP	0.13	101.14	14.49	796.33	58.38	72.11	1042.59
Added DU @ 0.2% (kg)				8.53		4258.56	4267.09
Totals after DU addition	0.13	101.14	14.49	804.87	58.38	4330.66	5309.68
wt%	0.0024	1.904881	0.272934	15.15852	1.099592	81.56172	100

I'm concerned that the U-235 enrichment is higher than 11%, but that doesn't matter for a safety source term calculation, since depleted uranium is relatively safe and adding more won't adversely affect safety. I will ask Bill Hermes to check these numbers.

The CEUSP material is in 403 cans. Since the materials was processed in a single campaign, the cans are expected to be uniform, so it's reasonable to assume that each can is close to the average. We'll take the average and multiply by ten to get the quantity that would result from the processing of 10 cans.

U Isotope	232	23[illegible]	234	235	236	238	Total
Mass (kg) from one can	0.000310447	0.250975	[illegible]3596	1.997192	0.144875	10.74606	13.17537
Mass (kg) from ten cans	0.003104471	2.509752	[illegible]59601	19.97192	1.448753	107.4606	131.7537
wt%	0.002	1.905	0.273	15.159	1.100	81.562	100.000

The mass from ten cans is a reasonable upper bound for the inventory that would be handled in the Transfer Station at one time.

CHEMICAL INVENTORY
The CEUSP material contains other elements, specifically cadmium (Cd), which is hazardous, and Gadolinium (Gd). Both were added for their neutron poisoning ability. Hermes computed the chemical composition of the mixture after processing as follows:

	U	Cd	Gd	Na	O	H	Total
moles	22364	2754	243	22364	106753	50721	205199
mol%	10.90	1.34	0.12	10.90	52.02	24.72	100.00
mass (kg)	5310	310	38	514	1708	51	7931
mass from one can (kg)	13.17536441	0.768057	0.094711	1.27581	4.238188	0.126858	19.67899
mass from ten cans (kg)	131.7536441	7.680568	0.947109	12.7581	42.38188	1.268583	196.7899

The masses shown for ten cans are a reasonable upper limit for the chemical constituents in the transfer station at one time.

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Approval Requested by (date):

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Derivative Classifier	Classification	Topic
I. K. Paik	U (Does not contain UCNI)	U-233 Disposal

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WSRC-TR-2000-00031, Rev. 0
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Ms. W. F. Perrin, Technical Information Officer
U. S. Department of Energy - Savannah River Operations Office

Dear Ms. Perrin:

REQUEST FOR APPROVAL TO RELEASE SCIENTIFIC/TECHNICAL INFORMATION

The attached document is submitted for classification and technical approvals for the purpose of external release. Please complete Part II of this letter and return the letter to the undersigned by 5/16/2000. The document has been reviewed for classification and export control by a WSRC Classification staff member and has been determined to be Unclassified.

Julie M. Bean, WSRC STI Program Manager

I. DETAILS OF REQUEST FOR RELEASE

Document Number: WSRC-TR-2000-00031,
Author's Name: A. Blanchard
Location: 730-B, 35 Phone 2-7209
Department: Configuration Management
Document Title: Safety Evaluation of Receipt of ORNL U-233 at SRS Tank Farm

Presentation/Publication:
Meeting/Journal: OSTI Reportable

Location: N/A
Meeting Date:

II. DOE-SR ACTION

Date Received by TIO 04/03/2000

[X] Approved for Release
[ ] Approved Upon Completion of Changes
[ ] Approved with Remarks
[ ] Not Approved
[ ] Revise and Resubmit to DOE-SR

Remarks: ______

W. F. Perrin, Technical Information Officer, DOE-SR

10/16/00
Date

OSR 25-82-W# (4-89)
Stores: 26-15460.00

DOE F 241.1
(7-98) p. 1 of 2
(Formerly DOE F 1332.15)
(All other versions are obsolete)

OMB Control No. 1910-1400

US DEPARTMENT OF ENERGY
ANNOUNCEMENT OF U. S. DEPARTMENT OF ENERGY (DOE) SCIENTIFIC AND TECHNICAL INFORMATION (STI)

RECORD STATUS (select one):

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Part I: STI PRODUCT DESCRIPTION

A. STI PRODUCT TYPE (select one)

X.. 1. **Technical Report**

a. Type: ☐ **Topical** ☐ **Semiannual** ☐ **Annual** ☒ **Final** Other (**specify**) ....

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a. Product Type: ...... Conference Proceedings ...... Conference Paper or Other (*abstracts, excerpts, etc.*) ___

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a. Date Filed *(mm/dd/yyyy)* ___/___/___

b. Date Priority *(mm/dd/yyyy)* ___/___/___

c. Patent Assignee ___

..... 8. **Thesis/Dissertation**

B. STI PRODUCT TITLE Safety Evaluation of Receipt of ORNL U-233 at SRS Tank Farm

C. AUTHOR(s) A. ..... Blanchard

E-mail Address(*es*):

D. STI PRODUCT IDENTIFIER

___ 1. Report Number(*s*) WSRC-TR-2000-00031, Rev. 0

___ 2. DOE Contract Number(*s*) DE-AC09-96SR18500

___ 3. R&D Project ID(s) ___

___ 4. Other Identifying Number(*s*) ___

E. ORIGINATING RESEARCH ORGANIZATION Savannah River Site

F. DATE OF PUBLICATION *(mm/dd/yyyy)* 10/16/2000

G. LANGUAGE (*if non-English*) English

(*Grantees and Awardees: Skip to Description/Abstract section at the end of Part I*)

H. SPONSORING ORGANIZATION ___

I. PUBLISHER NAME AND LOCATION (if other than research organization) ___

Availability *(refer requests to [if applicable])*

J. SUBJECT CATEGORIES *(list primary one first)* 11

Keywords Safety Evaluation, U-233, ORNL, Safety Class

K. DESCRIPTION/ABSTRACT

This document serves as a preliminary review to examine potential bounding hazard consequences associated with the receipt of U-233 material from ORNL to the SRS F- Area Tank Farm.

US DEPARTMENT OF ENERGY

ANNOUNCEMENT OF U. S. DEPARTMENT OF ENERGY (DOE) SCIENTIFIC AND TECHNICAL INFORMATION (STI)

DOE F 241.1 (p. 2 of 2)

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Name and/or Position Kevin Schmidt, Manager STI Program & Site Support
E-mail ______ Phone (803) 725-2765
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