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Department of Energy  
Carlsbad Field Office  
P. O. Box 3090  
Carlsbad, New Mexico 88221

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Mr. John E. Kieling, Chief  
Hazardous Waste Bureau  
New Mexico Environment Department  
2905 Rodeo Park Drive East, Building 1  
Santa Fe, New Mexico 87505-6303

NMED  
Hazardous Waste Bureau

Subject: Review of Savannah River Site - CCP Waste Stream Profile Form Number  
SR-RH-SDD.01, *Building 777-10A Physics Laboratory Neutron Sources*

Dear Mr. Kieling:

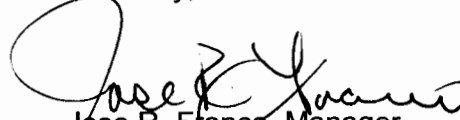
The Department of Energy, Carlsbad Field Office has approved the Waste Stream Profile Form (WSPF) Number SR-RH-SDD.01, *Building 777-10A Physics Laboratory Neutron Sources* for the Central Characterization Program (CCP) at the Savannah River Site.

Enclosed is a copy of the WSPF as required by Section C-5a of the Waste Isolation Pilot Plant, Hazardous Waste Facility Permit, No. NM4890139088-TSDF.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

If you have questions, please contact Mr. J.R. Stroble, Director of the CBFO TRU Sites and Transportation Division, at (575) 234-7313.

Sincerely,

  
Jose R. Franco, Manager  
Carlsbad Field Office

Enclosure

cc: w/enclosure  
S. Holmes, NMED \*ED  
R. Maestas, NMED ED  
C. Smith, NMED ED  
C. Walker, TechLaw ED  
RCRA Chronology Record ED  
WIPP Operating Record ED  
CBFO M&RC

\*ED denotes electronic distribution



**CCP-TP-002, Rev. 26**  
**CCP Reconciliation of DQOs and**  
**Reporting Characterization Data**

**Effective Date: 06/19/2013**

**Attachment 2 – CCP Waste Stream Profile Form**

<b>(1) Waste Stream Profile Number:</b> SR-RH-SDD.01		
(2) Generator site name: Savannah River Site	(3) Generator site EPA ID: SC1890008989	
(4) Technical contact: Irene Joo	(5) Technical contact phone number: 720-982-7174	
(6) Date of audit report approval by New Mexico Environment Department (NMED): September 25, 2014		
(7) Title, version number, and date of documents used for WIPP-WAP Certification: CCP-PO-001, <i>CCP Transuranic Waste Characterization Quality Assurance Project Plan</i> , Revision 21, May 31, 2013 CCP-PO-002, <i>CCP Transuranic Waste Certification Plan</i> , Revision 27, May 31, 2013 CCP-PO-004, <i>CCP/SRS Interface Document</i> , Revision 35, October 8, 2014		
(8) Did your facility generate this waste? YES <input type="checkbox"/> NO <input checked="" type="checkbox"/>		
(9) If no, provide the name and EPA ID of the original generator: NA		
<b>Waste Stream Information</b>		
(10) WIPP ID: SR-RH-SDD.01	(11) Summary Category Group: S5000- Debris Waste	
(12) Waste Matrix Code Group: Heterogeneous Debris Waste	(13) Waste Stream Name: Building 777-10A Physics Laboratory Neutron Sources	
(14) Description from the ATWIR: This waste stream consists of three PuBe sources individually packaged in SWB with polyethylene shielding. <sup>1</sup>		
(15) Defense TRU Waste: YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>		
(16) Check One: CH <input type="checkbox"/> RH <input checked="" type="checkbox"/>		
(17) Number of SWBs NA	(18) Number of Drums NA	(19) Number of Canisters 1 <sup>1</sup>
(17a) Number of SLB2 NA		
(20) Batch Data Report numbers supporting this waste stream characterization: See Characterization Information Summary (CIS) Correlation of Container Identification Numbers to Batch Data Report Numbers		
(21) List applicable EPA Hazardous Waste Numbers: None		
(22) Applicable TRUCON Content Numbers: SR 320		
<b>(23) Acceptable Knowledge Information</b>		
<b>(For the following, enter the supporting documentation used [i.e., references and dates])</b>		
<b>Required Program Information</b>		
(23A) Map of site: CCP-AK-SRS-630, Revision 1, September 26, 2013, Figures 1 and 2		
(23B) Facility mission description: CCP-AK-SRS-630, Revision 1, September 26, 2013, Section 4.3		
(23C) Description of operations that generate waste: CCP-AK-SRS-630, Revision 1, September 26, 2013, Section 4.7		
(23D) Waste identification/categorization schemes: CCP-AK-SRS-630, Revision 1, September 26, 2013, Section 4.6.3		
(23E) Types and quantities of waste generated: CCP-AK-SRS-630, Revision 1, September 26, 2013, Section 4.6.1		
(23F) Correlation of waste streams generated from the same building and process, as applicable: CCP-AK-SRS-630, Revision 1, September 26, 2013, Section 4.6.2		
(24) Waste certification procedures: CCP-TP-530, <i>CCP RH TRU Waste Certification and WWIS/WDS Data Entry</i> , Revision 11, June 19, 2013		
<b>(25) Required Waste Stream Information</b>		

**CCP-TP-002, Rev. 26**  
**CCP Reconciliation of DQOs and**  
**Reporting Characterization Data**

**Effective Date: 06/19/2013**

(25A) Area(s) and building(s) from which the waste stream was generated: CCP-AK-SRS-630, Revision 1, September 26, 2013, Section 5.1	
(25B) Waste stream volume and time period of generation: CCP-AK-SRS-630, Revision 1, September 26, 2013, Section 5.2	
(25C) Waste generating process description for each building: CCP-AK-SRS-630, Revision 1, September 26, 2013, Section 4.7	
(25D) Waste Process flow diagrams: NA	
(25E) Material inputs or other information identifying chemical/radionuclide content and physical waste form: CCP-AK-SRS-630, Revision 1, September 26, 2013, Sections 5.4	
(25F) Waste Material Parameter Weight Estimates per unit of waste: See Table entitled "Waste Stream SR-RH-SDD.01 Waste Material Parameters" in the Summation of Aspects of AK Summary Report: Waste Stream SR-RH-SDD.01	
(26) Which Defense Activity generated the waste:	
Weapons activities including defense inertial confinement fusion	Naval Reactors development
Verification and control technology	X Defense research and development
Defense nuclear waste and material by products management	X Defense nuclear material production
Defense nuclear waste and materials security and safeguards and security investigations	
(27) <b>Supplemental Documentation:</b>	
(27A) Process design documents: NA	
(27B) Standard operating procedures: See References 16 and 17 in the Summation of Aspects of AK Summary Report: Waste Stream: SR-RH-SDD.01, References	
(27C) Safety Analysis Reports: NA	
(27D) Waste packaging logs: See U001, U002 in the Summation of Aspects of AK Summary Report: Waste Stream: SR-RH-SDD.01, Source Documents	
(27E) Test plans/research project reports: See P001, P002 in the Summation of Aspects of AK Summary Report: Waste Stream: SR-RH-SDD.01, Source Documents	
(27F) Site databases: NA	
(27G) Information from site personnel: NA	
(27H) Standard industry documents: See U001 in the Summation of Aspects of AK Summary Report: Waste Stream: SR-RH-SDD.01, Source Documents	
(27I) Previous analytical data: See U001 in the Summation of Aspects of AK Summary Report: Waste Stream: SR-RH-SDD.01, Source Documents	
(27J) Material safety data sheets: NA	
(27K) Sampling and analysis data from comparable/surrogate Waste: See Reference 13 in the Summation of Aspects of AK Summary Report: Waste Stream: SR-RH-SDD.01, References	
(27L) Laboratory notebooks: NA	
<b>Confirmation Information</b>	
<b>Attachment 2 – CCP Waste Stream Profile Form (Continued)</b>	
(28)	Radiography: NA
	Visual Examination: CCP-TP-163, <i>CCP Evaluation of Waste Packaging Records for Visual Examination of Records</i> , Revision 4, June 18, 2013 CCP-TP-500, <i>CCP Remote-Handled Waste Visual Examination</i> , Revision 13, September 23, 2013



# CHARACTERIZATION INFORMATION SUMMARY


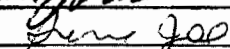
WSPF # SR-RH-SDD.01

Lot 1

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**CCP Characterization Information Summary Cover Page**

Waste Stream #	<u>SR-RH-SDD.01</u>	Lot #:	<u>1</u>
AK Expert Review:	<u>Kevin Peters</u> 	Date:	<u>11/25/2014</u>
SQM Review:	<u>Irene Joo</u> 	Date:	<u>11/25/14</u>

SQM signature certifies that through Acceptable Knowledge testing and/or analysis that the waste identified in this summary is not corrosive, ignitable, reactive, or incompatible with the TSDF.

A summary of the Acceptable Knowledge regarding this waste stream containing specific information about the corrosivity, reactivity, and ignitability of the waste stream is included as an attachment to the Waste Stream Profile Form. By reference, that information is included in this lot.

**List of procedures used:**

**Visual Examination (VE)**

CCP-TP-500	Rev. 13	09/23/13	CCP Remote-Handled Waste Visual Examination
CCP-TP-500	Rev. 12	07/18/13	CCP Remote-Handled Waste Visual Examination
CCP-TP-183	Rev. 4	08/18/13	CCP Evaluation of Waste Packaging Records for Visual Examination of Records
CCP-TP-183	Rev. 3	04/24/12	CCP Evaluation of Waste Packaging Records for Visual Examination of Records

**Project Level Data Validation / DQO Reconciliation:**

CCP-TP-001	Rev. 21	08/08/13	CCP Project Level Data Validation and Verification
CCP-TP-001	Rev. 20	09/27/12	CCP Project Level Data Validation and Verification
CCP-TP-001	Rev. 19	12/29/10	CCP Project Level Data Validation and Verification
CCP-TP-002	Rev. 26	06/19/13	CCP Reconciliation of DQOs and Reporting Characterization Data
CCP-TP-002	Rev. 25	02/11/13	CCP Reconciliation of DQOs and Reporting Characterization Data
CCP-TP-002	Rev. 24	12/28/11	CCP Reconciliation of DQOs and Reporting Characterization Data
CCP-TP-005	Rev. 26	08/12/13	CCP Acceptable Knowledge Documentation
CCP-TP-005	Rev. 25	06/19/13	CCP Acceptable Knowledge Documentation
CCP-TP-005	Rev. 24	11/28/11	CCP Acceptable Knowledge Documentation
CCP-TP-530	Rev. 11	09/19/13	CCP RH TRU Waste Certification and WWIS/WDS Data Entry
CCP-TP-530	Rev. 10	04/25/11	CCP RH TRU Waste Certification and WWIS/WDS Data Entry

**WAP Certification:**

CCP-PO-001	Rev. 21	05/31/13	CCP Transuranic Waste Characterization Quality Assurance Project Plan
CCP-PO-001	Rev. 20	08/18/11	CCP Transuranic Waste Characterization Quality Assurance Project Plan
CCP-PO-004	Rev. 35	10/08/14	CCP/SRS Interface Document
CCP-PO-004	Rev. 34	08/29/13	CCP/SRS Interface Document
CCP-PO-004	Rev. 33	08/19/13	CCP/SRS Interface Document
CCP-PO-004	Rev. 32	10/25/12	CCP/SRS Interface Document
CCP-PO-004	Rev. 31	10/01/12	CCP/SRS Interface Document
CCP-PO-004	Rev. 30	10/17/11	CCP/SRS Interface Document

**WAC Certification:**

CCP-PO-002	Rev. 27	05/31/13	CCP Transuranic Waste Certification Plan
CCP-PO-002	Rev. 26	07/14/11	CCP Transuranic Waste Certification Plan

**CCP Correlation of Container Identification  
 Numbers to Batch Data Report Numbers**

Waste Stream: # SR-RH-SDD.01 Lot # 1

Container ID Number	Historical Container ID	NDA BDR or Radiological Characterization BDR	RTR BDR	VE BDR	Load Management/ Overpack Yes
SDD076307	NA	CCP-RC-SRS-631	NA	SRSRHVE13001	NA
SDD076309	NA	CCP-RC-SRS-631	NA	SRSRHVE13001	NA
SDD076308	NA	CCP-RC-SRS-631	NA	SRSRHVE13001	NA

  
 Signature of Site Project Manager

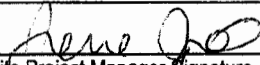
Irene Joo  
 Printed Name 11/25/14  
 Date

**CCP RTR/VE Summary of Prohibited Items and AK Confirmation**

Waste Stream Number: SR-RH-SDD.01

Lot #: 1

Container Number	RTR Prohibited Items	Visual Examination Prohibited Items <sup>ab</sup>	Does the Physical Form of the Waste Match the Waste Stream Description as determined by AK
See correlation of container ID numbers for list of drum numbers in this Lot.	RTR was not used to certify any containers in this lot.	None of the containers in this Lot had prohibited items identified during Visual Examination technique.	The physical form of the waste found in all the containers in this lot match the Waste Stream Description as determined by AK.
a. See Batch Data Reports b. If AK has assigned U134 to this waste stream, then any liquids in these containers are prohibited items (not acceptable by the TSDF).			
Justification for the selection of RTR and/or VE: VE was selected as the characterization method for this lot because the waste containers were newly generated and VE is an acceptable characterization method to meet the applicable Data Quality Objectives for debris in waste stream SR-RH-SDD.01			

  
 Site Project Manager Signature

Irene Joo  
 Printed Name

11/25/14  
 Date



**CCP Reconciliation with Data Quality Objectives**

WSF# SR-RH-SDD.01

Lot # 1

**Sampling Completeness**

**VE**

Number of Valid Samples: 3      Number of Total Samples Analyzed: 3  
 Percent Complete: 100 (QAO is 100%)

**RTR**

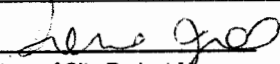
Number of Valid Samples: NA      Number of Total Samples Analyzed: NA  
 Percent Complete: NA (QAO is 100%)

**NDA**

Number of valid samples: 3      Number of Total Samples Analyzed: 3  
 Percent Complete: 100 (QAO is 100%)

	Y/N/NA	Reconciliation Parameter		
1	Y	Waste Matrix Code.		
2	Y	Waste Material Parameter Weights.		
3	Y	The waste matrix code identified is consistent with the type of sampling and analysis used to characterize the waste.		
4	Y	The TRU activity reported in the BDRs for each container demonstrates with a 95% probability that the container of waste contains TRU radioactive waste.		
5	N	AK Sufficiency. Is there an approved AK sufficiency Determination for this waste stream?		
6	Y	The data demonstrates whether the waste stream exhibits a toxicity characteristic under Title 40 Code of Federal Regulations (CFR), Part 261, Identification and Listing of Hazardous Waste, Subpart C, Characteristics of Hazardous Waste.		
7	N	Does the waste stream contain listed waste found in 20.4.1.200 NMAC incorporating 40 CFR Part 261, Subpart D, Lists of Hazardous Wastes.		
8	Y	Waste stream can be classified as hazardous or nonhazardous at the 90-percent confidence level.		
9	Y	The overall completeness, comparability, and representativeness QAOs were met for each of the analytical and testing procedures as specified in CCP-PO-001 Sections C3-1 through C3-2 prior to submittal of a waste stream profile form for a waste steam or waste stream lot.		
		<b>Completeness</b>	<b>Comparability</b>	<b>Representativeness</b>
	Radiography	NA	NA	NA
	VE	Y	Y	Y

Comments: N/A

  
 Signature of Site Project Manager

Irene Joo  
 Printed Name

11/25/14  
 Date

**SUMMATION OF ASPECTS OF AK SUMMARY REPORT:  
WASTE STREAM SR-RH-SDD.01**

**Overview:**

Waste stream SR-RH-SDD.01 consists of Remote Handled (RH) transuranic (TRU) plutonium-beryllium neutron sources generated from the Building 777-10A Physics Laboratory at the Savannah River Site (SRS). The mission of the Physics Laboratory was to house experimental research reactors used to support the development of the technology used during the production of nuclear materials (tritium and plutonium) by the SRS production reactors.

SRS was an integral part of the DOE weapons complex between 1942 and 1992. The subject plutonium-beryllium neutron sources were used to support three research/test reactors in the Physics Laboratory during this period. The Physics Laboratory and sources provided a means to study in detail the operation and performance of production type reactors. The sources were an essential part of the research phase for DOE and the production of nuclear weapons during the Cold War era (Reference C002). TRU waste is eligible for disposal at the WIPP if it has been generated in whole or in part by one of the atomic energy defense activities listed in 42 U.S.C 10101, *Nuclear Waste Policy Act of 1982* (NWPAA) (Reference 14). The neutron sources used in Physics Laboratory operations directly supported defense nuclear materials productions (tritium and plutonium production) and defense research and development (production reactor technology development) (References C002, P001, P002, and U002).

This Summation of the Acceptable Knowledge (AK) Summary Report includes information to support Waste Stream Profile Form (WSPF) number SR-RH-SDD.01 for mixed heterogeneous debris waste generated at SRS. The primary source of information for this Summation is CCP-AK-SRS-630, *Central Characterization Program Acceptable Knowledge Summary Report For Savannah River Site Physics Laboratory Sealed Sources, Waste Stream: SR-RH-SDD.01*, Revision 1, dated September 26, 2013.

**Waste Stream Identification Summary:**

Waste Stream Name:	Building 777-10A Physics Laboratory Plutonium-Beryllium Neutron Sources
Waste Stream Number:	SR-RH-SDD.01
Dates of Waste Generation:	2002
Waste Stream Volume – Current <sup>1</sup>	2 15-gallon drums 1 16-gallon drums
Waste Stream Volume – Projected	None
Summary Category Group:	S5000 – Debris Waste
Waste Matrix Code Group:	Heterogeneous Debris Waste
Waste Matrix Code:	S5400
RH TRU Waste Content Codes:	SR 320
Annual Transuranic Waste Inventory Report (ATWIR) Identification Number:	SR-RH-SDD.01

Note 1: This waste stream consists of two 15-gallon drums and one 16-gallon drum and will be shipped to WIPP using a NS15 RH-TRU canister in a 72B cask.

**Waste Stream Description and Physical Form:**

Waste stream SR-RH-SDD.01 is comprised exclusively of three plutonium-beryllium neutron sources in stainless steel Special Form Capsules (SFCs) packaged in 15- and 16-gallon cans with wood bracing. The plutonium-beryllium source material in each neutron source is contained in a sealed inner stainless steel capsule inside an outer sealed stainless steel capsule. This capsule was placed into an aluminum sleeve/holder tube. The sources have been placed into stainless steel SFCs designed and constructed specifically for these larger plutonium-beryllium neutron sources (References U001 and U002).

Waste Stream SR-RH-SDD.01 meets the *Waste Isolation Pilot Plant Hazardous Waste Facility Permit, Waste Analysis Plan (WIPP-WAP)* (Reference 2) and the *Remote-Handled TRU Waste Characterization Program Implementation Plan (WCPIP)* (Reference 3) waste stream definitions. The waste is similar in material, physical form, hazardous constituents (no hazardous constituents), and radiological properties (plutonium-beryllium neutron sources) and generated from a single process or activity (Physics Laboratory production reactor research).

**Point of Generation:**

**Location**

Waste stream SR-RH-SDD.01 was generated at the Savannah River Site in Aiken, South Carolina.

**Area and/or Buildings of Generation**

Waste stream SR-RH-SDD.01 was generated at the Building 777-10A Physics Laboratory.

**Generating Processes:**

**Description of Waste Generating Processes**

The experimental reactors in the Physics Laboratory played an important role in the operation of heavy water moderated production reactors, particularly in the early months before the first production reactor, R Reactor, went critical in late December of 1953. In the summer and fall of 1953, the experimental reactors in the Physics Laboratory were essential for the study of the Savannah River production reactor design and operation, as well as for the calibration of various standards and monitoring devices required by the reactors. Even though this was the most important of the many uses of Physics Laboratory over the years, the building and its experimental reactors were associated with almost every major aspect of the use and improvements made to the Savannah River production reactors, from 1953 until the basic perfection of the production process in the 1970s (Reference P001).

For most of its existence, the Physics Laboratory was controlled and operated by the Savannah River Laboratory, which oversaw the physics required in the operation and improvements to the production reactors. For this reason, the Physics Laboratory was identified as 777-M, reflecting its ties to both the 700-Area and M-Area, dedicated to manufacturing fuel and target elements. This designation suggests the uniqueness of the building and its function. In fact, the building kept this designation until the early 1980s, when a change in mission required a change in the designation, from 777-M to 777-10A. At that time, reactor work was phased out, and much of the building was adapted for audio-visual work at Savannah River (Reference P001).

The Physics Laboratory was known as the home of Savannah River's experimental reactors. By the 1970s, the building had a total of five experimental reactors: the Process Development Pile; the Standard Pile; the adjoining Exponential Pile or Subcritical Experiment; the Pressurized Exponential Pile; and the Resonance Test Reactor, later renamed the Lattice Test Reactor. The most important of these, however, were the first three. Of these three, the Process Development Pile, a full-scale nuclear mock-up of the heavy water moderated production reactors at Savannah River, was the most significant. The Process Development Pile provided researchers with the opportunity to study the physics of the production reactors and their fuel and target assemblies without having to impede production, and without the radiation problems associated with the production reactors (Reference P001).

There were a number of instruments surrounding the Process Development Pile that were important for its operation and control. Many of these were monitoring instruments, such as the ten boron-coated ion chambers and the twenty-one health monitors. Other important pieces of equipment inside the Process Development Pile tank were the vertical and horizontal traveling monitors that measured neutron flux (Reference P001).

Early start-up of the Process Development Pile at the Physics Laboratory was essential to address specific issues anticipated prior to the start up of the R Reactor. Addressing the physics questions in the Process Development Pile would allow the production reactors to operate at higher power more quickly. The specific early objectives included (Reference P001):

- Establishment of a specific loading pattern for the production reactors,
- Establishment of the limits of safe operation, and
- Establishment of the methods of initial operation for the production reactors

The three plutonium-beryllium neutron sources described in this summation were maintained in Building 777-10A until a 2002 Off-Site Source Recovery Project (OSRP) campaign was conducted to package and remove them from the building. Each source was packaged into a stainless steel SFC specifically manufactured to accommodate these larger sources. Visual examination (VE) was performed by OSRP VE operators as the sources were packaged in the SFCs (References C002, U001, and U002).

### **Waste Stream Material and Chemical Inputs**

Waste stream SR-RH-SDD.01 consists of plutonium-beryllium neutron sources packaged in SFCs.

### **RCRA Determinations**

#### **Historical Waste Management**

The neutron sources were not removed from the Physics Laboratory until 2002 where they were maintained in a reactor or discrete storage areas. During this 2002 campaign to remove sealed sources from SRS Buildings 773-A and 777-10A, the three sources in this waste stream were too large to be disposed of by the OSRP in a pipe overpack component. Since that time, SRS has managed the sources as non-hazardous waste. This determination is supported by the manufactures documentation and corresponding characterization of these type of sources managed by the OSRP. Review of the AK documentation verifies that these sources do not contain or have not been mixed with *Resource Conservation and Recovery Act* (RCRA) hazardous waste constituents (References U001 and U002).

## Hazardous Waste Determinations

### Ignitability, Corrosivity, Reactivity

Sealed sources constitute closed systems (solid isotopic sources sealed in a metal jacket or casing) that preclude the introduction of extraneous materials (such as liquids) that would be ignitable, reactive, or corrosive. Therefore, the waste material in this waste stream does not meet the definition of ignitable, corrosive, or reactive as defined in 40 CFR 261, *Identification and Listing of Hazardous Waste, Subpart D* (References 13 and 21).

#### Ignitability

A solid waste exhibits the characteristic of ignitability as defined in 40 CFR 261.21 if it has any of the following properties: 1) It is a flammable liquid (flash point less than 60°C), 2) It is not a liquid and is capable, under standard temperature and pressure, of causing fire through friction, absorption of moisture, or spontaneous chemical change, 3) It is an ignitable compressed gas, or 4) It is an oxidizer (a substance such as a chlorate, permanganate, inorganic peroxide, or a nitrate, that yields oxygen readily to stimulate the combustion of organic matter)(Reference 21).

Waste stream SR-RH-SDD.01 does not meet the definition of ignitability as defined in 40 CFR 261.21 (Reference 21). Sealed sources constitute closed systems (solid isotopic sources sealed in metal jackets or metal casings) that preclude the introduction of extraneous materials (such as liquids) that would be ignitable. The sources will not cause fire through friction, absorption of moisture, or spontaneous chemical changes. The sources are not compressed gases or oxidizers. Visual examination (VE) of records and VE during repackaging were performed to ensure prohibited materials were not introduced into the waste drums. Therefore, waste stream SR-RH-SDD.01 is not assigned U.S. Environmental Protection Agency (EPA) Hazardous Waste Number (HWN) D001 for ignitability (References 13, 16, 17, U001, and U002).

#### Corrosivity

A solid waste exhibits the characteristic of corrosivity as defined in 40 CFR 261.22 if it has any of the following properties: 1) It is aqueous and has a pH less than or equal to 2 or greater than or equal to 12.5, or 2) It is a liquid and corrodes steel at a rate greater than 0.25 inches per year (Reference 21).

Waste stream SR-RH-SDD.01 does not meet the definition of corrosivity as defined in 40 CFR 261.22. Sealed sources constitute closed systems (solid isotopic sources sealed in metal jackets or metal casings) that preclude the introduction of extraneous materials (such as liquids) that would be corrosive. VE of records and VE during repackaging were performed to ensure prohibited materials were not introduced into the waste drums. Therefore, waste stream SR-RH-SDD.01 is not assigned EPA HWN D002 for corrosivity (References 13, 16, 17, U001, and U002).

#### Reactivity

A solid waste exhibits the characteristic of reactivity as defined in 40 CFR 261.23 if it has any of the following properties: 1) It is normally unstable and readily undergoes violent change without detonating, 2) It reacts violently with water, 3) It forms potentially explosive mixtures with water, 4) When mixed with water, it generates toxic gases, vapors or fumes in a quantity sufficient to present a danger to human health or the environment, 5) It is a cyanide or sulfide bearing waste which, when exposed to pH conditions between 2 and 12.5, can generate toxic gases, vapors or

fumes in a quantity sufficient to present a danger to human health or the environment, 6) It is capable of detonation or explosive reaction if it is subjected to a strong initiating source or if heated under confinement, 7) It is readily capable of detonation or explosive decomposition or reaction at standard temperature and pressure, or 8) It is a forbidden explosive, or Class A or Class B explosive as defined in 49 CFR 173, *Shippers – General Requirements for Shipments and Packagings* (References 21 and 22).

The sources in waste stream SR-RH-SDD.01 are manufactured items that are stable and will not undergo violent chemical change. The sources will not react violently with water, form potentially explosive mixtures with water, or generate toxic gases, vapors, or fumes when mixed with water. The sources do not contain cyanides or sulfides, and are not capable of detonation or explosive reaction. VE of records and VE during repackaging were performed to ensure prohibited materials were not introduced into the waste drums. Therefore, waste stream SR-RH-SDD.01 is not assigned EPA HWN D003 for reactivity (References 13, 16, 17, U001, and U002).

**Toxicity Characteristic**

Based on a review of the manufacturer's documentation and supporting AK documentation, this waste stream does not exhibit the characteristic of toxicity per 40 CFR 261.24 (Reference 21). Analytical data on typical source jacket material (stainless steel and silver solder which is 85 percent silver and 15 percent manganese) do not exceed the toxicity characteristic leaching procedure concentrations that would meet the RCRA characteristic of toxicity for metals. Therefore, no EPA HWNs are assigned to waste stream SR-RH-SDD.01 for toxicity characteristic metal or organic compounds (References 13, U001, and U002).

**Listed Waste**

**F-Listed Waste**

This waste stream is not mixed with F-listed hazardous wastes from non-specific sources as listed in 40 CFR 261.31 (Reference 21). SRS has not identified any F-listed hazardous constituents in this waste, and review of AK documentation found no potential source of any spent solvents used in the process that could contaminate the waste. The waste stream consists only of neutron sources in SFCs. Therefore, no F-listed EPA HWNs are assigned to waste stream SR-RH-SDD.01 (References 13, U001, and U002).

**K-Listed Waste**

Waste stream SR-RH-SDD.01 does not include any of the manufacturing process wastes from the specific industries or sources listed in 40 CFR 261.32 (Reference 21). Therefore, waste stream SR-RH-SDD.01 is not assigned a K-listed HWN.

### **P- and U-listed Wastes**

Waste stream SR-RH-SDD.01 does not contain a discarded commercial chemical product, an off-specification commercial chemical product, or a container residue or spill residue thereof as defined in 40 CFR 261.33 (Reference 21). The waste does not contain or is not mixed with hydrofluoric acid. Therefore, EPA HWN U134 is not assigned to the waste stream. These plutonium-beryllium neutron sources contain beryllium in a mechanically bonded form in each of the three sources. Based on the manufactures specifications and total waste weight (sources plus SFCs and wood bracing) the beryllium will not exceed one weight percent in any of the waste drums ranging from 0.30 percent to 0.40 percent, and therefore will not be present in amounts greater than one percent in the NS15 neutron shielded canister (Reference C003). The physical form of the beryllium is typically powder or sintered solid. However, the EPA has concurred that beryllium-containing sealed sources are not P-listed because the beryllium is not a sole active ingredient or in a powder form. Therefore, waste stream SR-RH-SDD.01 is not assigned a P- or U-Listed EPA HWN (References 13, U001, and U002).

### **Polychlorinated Biphenyls**

This waste stream does not contain polychlorinated biphenyls (PCBs) greater than 50 parts-per-million and is therefore not regulated as a *Toxic Substances Control Act* waste under 40 CFR 761, *Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and use Prohibitions* (Reference 23). Review of the source documentation verifies the absence of PCB materials in the sources and that the sources are strictly inorganic and do not contain organic materials. VE of records and VE during repackaging was performed to ensure that PCB materials were not introduced into the waste drums (References 13, 16, 17, U001 and U002).

### **Prohibited Items**

Based on a review of the manufacturers and AK documentation, waste stream SR-RH-SDD.01 does not contain prohibited items, including; compressed gases, liquids, non-radionuclide pyrophorics, sealed containers greater than four liters, or explosives. VE of records and VE during repackaging were performed to ensure prohibited materials were not introduced into the waste drums (References 13, 16, 17, U001, and U002).

### **Method for Determining Waste Material Parameters Weights per Unit of Waste**

The waste material parameters (WMPs) for the waste stream were estimated by using manufacturer's information relating to the materials of construction associated with the three neutron sources, the OSRP estimates relating to the physical size and composition of the SFCs to be placed into the waste drums, and waste packaging (wooden bracing) included during repackaging of the sources. Based on this assessment only the following WMPs are present in the waste stream: iron based metals/alloys (stainless steel SFC, inside and outside source capsules), aluminum based metals/alloys (aluminum source sleeve/holder), other metals (plutonium and beryllium) and cellulose (wood bracing). The WMP weights were assessed and an average was determined that was applied to the waste stream. The results of the assessment are presented in the table entitled Waste Stream SR-RH-SDD.01 Waste Material Parameters (References C003 and U002). This evaluation does include the wood bracing included during the final transfer and repackaging of the sources into the final waste containers (Reference C003 and U004).

**Waste Stream SR-RH-SDD.01 Waste Material Parameters**

<b>WMP</b>	<b>Average Weight Percent</b>	<b>Weight Percent Range*</b>
Iron-based Metals/Alloys	47.6 %	42.7 – 52.7 %
Aluminum-based Metals/Alloys	1.4 %	1.2 – 1.5 %
Other Metals	0.4 %	0.4 – 0.5 %
Other Inorganic Materials	0.0 %	0.0 – 0.0 %
Cellulosics	50.6 %	45.3 – 55.6 %
Rubber	0.0 %	0.0 – 0.0 %
Plastic (waste materials)	0.0 %	0.0 – 0.0 %
Inorganic Matrix	0.0 %	0.0 – 0.0 %
Organic Matrix	0.0 %	0.0 – 0.0 %
Soils/Gravel	0.0 %	0.0 – 0.0 %
<b>Total Inorganic Waste Ave.</b>	<b>49.4 %</b>	
<b>Total Organic Waste Ave.</b>	<b>50.6 %</b>	

**List of AK Sufficiency Determinations Requested for the Waste Stream**

There are no AK sufficiency determination requests for this waste stream.

**Transportation**

This waste stream and its chemical constituents have been reviewed for consistency with listed TRUCON codes and they are consistent.

**Beryllium**

As described above, beryllium will not exceed 1% by weight of the waste in any payload container.

**Radionuclide Information**

An initial estimate of the radiological content of the three sources was performed during the OSRP effort to package the SRS Physics Laboratory sources in SFCs. The purpose of the characterization was to evaluate the packaging configurations planned during the OSRP source recovery effort at SRS. The primary document used for the characterization of the three sources in waste stream SR-RH-SDD.01 was a drawing produced by Monsanto Research Corporation, which includes (Reference C001):

- Source serial numbers
- Physical dimensions
- Grams of plutonium oxide and beryllium used in each identified source
- Isotopic distribution within the plutonium oxide used for source construction

Using the data from this drawing, the initial content of the sources was estimated. The initial content was then decay corrected using the commercial decay correction package RADDECAY. Radionuclides present in the predicted decayed inventory were selected based on the potential for contribution to 95 percent of total activity in the source. No attempt was made to estimate the activity of activation or decay products, including Sr-90, Cs-137, or Co-60. Each



radionuclide reported in the characterization is identified in the table entitled Reported Radionuclide Mass and Activity for Waste Stream SR-RH-SDD.01 (Reference C001).

#### Reported Radionuclide Mass and Activity for Waste Stream SR-RH-SDD.01

Radionuclide	Source M029		Source M044		Source M045	
	Curies	Grams	Curies	Grams	Curies	Grams
Am-241	2.90E+00	8.36E-01	1.09E+00	3.14E-01	1.50E+00	4.32E-01
Np-237	2.25E-05	3.16E-02	8.43E-06	1.18E-02	1.16E-05	1.63E-02
Pa-233	2.24E-05	1.08E-09	8.39E-06	4.03E-10	1.16E-05	5.58E-10
Pu-238	4.34E+01	2.51E+00	1.63E+01	9.42E-01	2.25E+01	1.30E+00
Pu-239	6.86E-01	1.09E+01	2.58E-01	4.10E+00	3.56E-01	5.66E+00
Pu-240	4.52E-01	1.97E+00	1.70E-01	7.39E-01	2.35E-01	1.02E+00
Pu-241	1.86E+01	1.79E-01	6.98E+00	6.71E-02	9.64E+00	9.27E-02
Pu-242	7.01E-03	1.77E+00	2.85E-04	7.18E-02	3.93E-04	9.90E-02
U-233	1.35E-09	1.38E-07	5.07E-10	5.19E-08	7.00E-10	7.17E-08
U-234	5.24E-03	8.29E-01	1.97E-03	3.12E-01	2.72E-03	4.30E-01
U-237	4.56E-04	5.53E-09	1.71E-04	2.07E-09	2.37E-04	2.87E-09
U-238	3.99E-11	1.17E-04	1.62E-12	4.76E-06	2.24E-12	6.59E-06
<b>Totals</b>	<b>6.61E+01</b>	<b>1.90E+01</b>	<b>2.48E+01</b>	<b>6.56E+00</b>	<b>3.42E+01</b>	<b>9.05E+00</b>

The data was normalized and converted to percentages of the total mass and activity. The result of this calculation is presented in the table entitled Reported Radionuclide Weight and Activity Percent in Waste Stream SR-RH-SDD.01 (References C001 and U003).

#### Reported Radionuclide Weight and Activity Percent in Waste Stream SR-RH-SDD.01

Radionuclide	Relative Weight Percent	Relative Activity Percent	Expected Present (Yes/No)
<b>WIPP Radionuclides</b>			
Am-241	4.65%	4.39%	Yes
Pu-238	13.97%	65.72%	Yes
Pu-239	60.78%	1.04%	Yes
Pu-240	10.96%	0.69%	Yes
Pu-242	3.83%	<0.01%	Yes
U-233	<0.01%	<0.01%	Yes
U-234	4.62%	0.01%	Yes
U-238	<0.01%	<0.01%	Yes
Cs-237	Not Reported		Yes
Sr-90	Not Reported		Yes
<b>Additional Radionuclides</b>			
Pa-233	<0.01%	<0.01%	Yes
U-237	<0.01%	<0.01%	Yes
Np-237	0.18%	<0.01%	Yes
Pu-241	1.00%	28.15%	Yes
<b>Totals</b>	<b>100.00%</b>	<b>100.00%</b>	

Payload management will not be utilized for this waste stream.

**References**

1. CCP-TP-005, *CCP Acceptable Knowledge Documentation*, Carlsbad, New Mexico, Nuclear Waste Partnership, LLC.
2. DOE/WIPP-02-3214, *Remote-Handled TRU Waste Characterization Program Implementation Plan*, Carlsbad, New Mexico, U.S. DOE Carlsbad Field Office
3. *Waste Isolation Pilot Plant Hazardous Waste Facility Permit, Waste Analysis Plan*, New Mexico Environment Department, Santa Fe, New Mexico
4. DOE/WIPP-02-3122, *Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant*, Carlsbad, New Mexico, U.S. Department of Energy
5. CCP-PO-001, *CCP Transuranic Waste Characterization Quality Assurance Project Plan*, Carlsbad, New Mexico, Nuclear Waste Partnership, LLC.
6. CCP-PO-002, *CCP Transuranic Waste Certification Plan*, Carlsbad, New Mexico, Nuclear Waste Partnership, LLC.
7. CCP-PO-505, *CCP Remote-Handled Transuranic Waste Authorized Methods for Payload Control (CCP RH-TRAMPAC)*, Carlsbad, New Mexico, Nuclear Waste Partnership, LLC.
8. DOE/TRU-12-3425, *Annual Transuranic Waste Inventory Report – 2012*, U.S. Department of Energy
9. 40 Code of Federal Regulations (CFR) Part 191, *Environmental Radiation Protection Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes*, Washington, D.C., U.S. EPA, December 20, 1993
10. 40 CFR Part 194, *Criteria for the Certification and Re-Certification of the Waste Isolation Pilot Plant's Compliance with the 40 CFR Part 191 Disposal Regulations*, Washington, D.C., U.S. EPA, February 9, 1996
11. *Criteria for the Certification and Re-Certification of the Waste Isolation Pilot Plant's Compliance with the 40 CFR Part 191 Disposal Regulations: Certification Decision*, Washington, D.C., U.S. EPA, May 18, 1998
12. Public Law 102-579, *The Waste Isolation Pilot Plant Land Withdrawal Act*, October 30, 1992 as amended by Public Law 104-201, September 23, 1996
13. CCP-AK-LANL-008, *Central Characterization Program Acceptable Knowledge Summary Report for Los Alamos National Laboratory Off-Site Source Recovery Project Sealed Sources, Waste Streams: LA-OS-00-01.001, LA-OS-00-03, and LA-OS-00-04*, Carlsbad, New Mexico, Nuclear Waste Partnership, LLC.
14. 42 U.S.C. 10101, *Nuclear Waste Policy Act of 1982*
15. DOE Order 435.1, *Radioactive Waste Management Manual*, U.S. DOE, Environmental Management

16. CCP-TP-163, *CCP Evaluation of Waste Packaging Records for Visual Examination of Records*, Carlsbad, New Mexico, Nuclear Waste Partnership, LLC.
17. CCP-TP-500, *CCP Remote-Handled Waste Visual Examination*, Carlsbad, New Mexico, Nuclear Waste Partnership, LLC.
18. CCP-CP-SRS-632, *Central Characterization Program RH TRU Waste Certification Plan for 40 CFR Part 194 Compliance for SRS, Waste Stream: SR-RH-SDD.01*, Carlsbad, New Mexico, Nuclear Waste Partnership, LLC.
19. DOE/LLW-217, *DOE Waste Treatability Group Guidance*, Idaho Falls, Idaho, INEL-Lockheed Idaho Technologies
20. CCP-RC-SRS-631, *Central Characterization Program Remote-Handled Transuranic Radiological Characterization Technical Report For Savannah River Site Physics Laboratory Sealed Sources, Waste Stream: SR-RH-SDD.01*, Carlsbad, New Mexico, Nuclear Waste Partnership, LLC.
21. 40 CFR Part 261, *Identification and Listing of Hazardous Waste*, U.S. EPA
22. 49 CFR 173, *Shippers – General Requirements for Shipments and Packagings*, U.S. EPA
23. 40 CFR Part 761, *Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and use Prohibitions*, U.S. EPA

**Source Documents**

Source Document Tracking Number	Title
C001	Characterization of Sources from Savannah River Plant
C002	Memo to J. McAlpin from T.J. Feske re: Pu-Be Sources - 777-10A
C003	Waste Stream SR-RH-SDD.01 Physical Parameter Evaluation
P001	Historic American Engineering Record – Physics Assembly Laboratory
P002	Decommissioning the Physics Laboratory, Building 777-10A, at the Savannah River Site (SRS)
P003	NS15 Neutron Shielded Canister
U001	Container Paperwork for Waste Stream SR-RH-SDD.01
U002	Miscellaneous Pu-Be Neutron Source Documentation and Specifications
U003	Reported Radionuclide Evaluation Tables for Waste Stream SR-RH-SDD.01
U004	Miscellaneous Neutron Source Repackaging Photographs