UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

AUG 21 2008

OFFICE OF
AIR AND RADIATION

David C. Moody, Ph.D.
Manager, Carlsbad Field Office
U.S. Department of Energy
P.O. Box 3090
Carlsbad, NM 88221-3090

Dear Dr. Moody:

On July 17–19, 2007, the U.S. Environmental Protection Agency (EPA) conducted a baseline inspection of the remote-handled (RH) transuranic (TRU) waste characterization program implemented by the Savannah River Site (SRS) Central Characterization Project (CCP) for RH debris waste packaged in 87 drum liners from Battelle Columbus Laboratory Decommissioning Project (BCLDP), and which are in interim storage at SRS (Inspection Number EPA-SRS-CCP-RH-07.07-8). EPA conducted follow-up inspections on July 31–August 2, 2007 and December 4–5, 2007. During these inspections, EPA assessed the technical adequacy of the characterization performed through acceptable knowledge (AK) and radiological characterization (RC).

In accordance with 40 CFR 194.8, EPA issued a *Federal Register* notice on May 21, 2008, announcing EPA's proposed approval of the RH TRU waste characterization program at SRS-CCP (73 FR 29504-29507). This *Federal Register* notice also opened a 45-day public comment period on our proposed approval and announced the availability of the inspection report (Air Docket No: A-98-49; II-A4-99). EPA received one public comment on the proposed SRS-CCP inspection report. In the enclosed inspection report (Air Docket No: A-98-49; II-A4-104), Section 9 contains the public comment and EPA's response.

**Approval Summary**

The EPA determined that the records documenting SRS-CCP's RH WC program for the RH debris waste from BCLDP represented activities that were technically adequate. EPA, therefore, is approving the SRS-CCP RH WC program limited to the 87 RH TRU waste drum liners for BCLDP RH debris Waste Stream SR-RL-BCLDP.001 evaluated during the baseline inspection deseribed and documented in the enclosed report. EPA is approving the following WC activities:

(1) The AK process for the 87 drum liners of RH retrievably stored TRU debris in the waste stream designated as Waste Stream SRS-RL-BCLDP.001 currently stored at the TRU storage pads in the E Area of SRS.

(2) The radiological characterization process using dose-to-curie (DTC) and modeling-derived scaling factors, supported by radionuclide data from the analysis of 69 swipe samples, for assigning radionuclide values to 87 drum liners of RH retrievably stored TRU debris in one waste stream, designated as SRS-RL-BCLDP.001, that is documented in CCP-AK-LANL-501, Revision 2, and detailed in this report.

(3) The visual examination (VE) process to identify waste material parameters and the physical form of the waste.

(4) The WIPP Waste Information System (WWIS) to submit both characterization and certification data for RH TRU waste.

(5) The attainment of pertinent data quality objectives (DQOs).

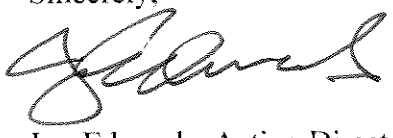
Since no additional WC activities are expected to occur relative to the 87 drum liners of RH debris waste, changes to the WC activities evaluated during the baseline inspection are not anticipated. As stated in Section 9.0 of the enclosed report, any non-BCL RH waste generated at SRS or brought to SRS for characterization will require a new baseline inspection.

In the event that SRS-CCP makes changes to the EPA-approved WC components discussed in the enclosed report and implements them to characterize additional waste from the BCLDP activity (e.g., solids or soil/gravel) associated with D&D activities at Building JN-1 at the BCL, EPA will consider changes that have the potential to affect WC activities to be T1 changes. In addition, SRS-CCP must provide to EPA a copy of the WWIS-controlled spreadsheet showing the manual data entries that were downloaded from CCP-AK-SRS-501 upon completion as a one-time T2 change.

This letter and the final inspection report have been placed in the EPA docket (Air Docket No. A-98-49, II-A4-104) and posted on the EPA website at www.epa.gov/radiation/wipp.

If you have any questions, please contact Rajani Joglekar at (202) 343-9462 or Ed Feltcorn at (202) 343-9422.

Sincerely,



Jon Edwards, Acting Director
Radiation Protection Division

Enclosures

cc: Electronic Distribution
Frank Marcinowski, DOE HQ
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Vernon Daub, CBFO
Casey Gadbury, CBFO
Ava Holland, CBFO
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Allison Pangle, CTAC
Wayne Ledford, CTAC

**DOCKET NO: A-98-49, II-A4-104**

# WASTE CHARACTERIZATION INSPECTION REPORT

## FINAL APPROVAL

## EPA BASELINE INSPECTION NO. EPA-SRS-CCP-RH-07.07-8 OF THE CENTRAL CHARACTERIZATION PROJECT REMOTE-HANDLED TRANSURANIC WASTE CHARACTERIZATION PROGRAM FOR BATTELLE COLUMBUS LABORATORIES DECOMMISSIONING PROJECT WASTES STORED AT THE SAVANNAH RIVER SITE

**July - December, 2007**

**U.S. Environmental Protection Agency**
**Office of Radiation and Indoor Air**
**Center for Waste Management and Regulations**
**1200 Pennsylvania Avenue, NW**
**Washington, DC 20460**

**August 2008**

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## ACRONYMS

| | |
|---|---|
| AK | acceptable knowledge |
| AKE | acceptable knowledge expert |
| Am | americium |
| ANLE | Argonne National Laboratory-East |
| ANSI | American National Standards Institute |
| Ba | barium |
| BC | Battelle Columbus |
| BCL | Battelle Columbus Laboratory |
| BCLDP | Battelle Columbus Laboratory Decommissioning Project |
| BDR | batch data report |
| BMI | Battelle Memorial Institute |
| CAR | Corrective Action Report |
| CBFO | Carlsbad Area Field Office |
| CCP | Central Characterization Project |
| CFR | *Code of Federal Regulations* |
| CH | contact-handled |
| CH-TRAMPAC | Contact-Handled Transuranic Waste Authorized Methods for Payload Control |
| Ci | curie |
| Ci/Ci | curies per curie |
| Ci/L | curies per liter |
| Cm | curium |
| Co | cobalt |
| CPR | cellulose, plastic, and rubber |
| CRR | Characterization Reconciliation Report |
| Cs | cesium |
| CTAC | Carlsbad Technical Assistance Contractor |
| CTP | Confirmatory Test Plan |
| D&D | decontamination and decommissioning |
| DOE | U.S. Department of Energy |
| DQO | data quality objective |
| DR | discrepancy resolution |

| | |
|---|---|
| DTC | dose-to-curie |
| EPA | U.S. Environmental Protection Agency |
| FGE | fissile gram equivalent |
| FR | *Federal Register* |
| Eu | europium |
| g | gram |
| $g/cm^3$ | grams per cubic centimeter |
| HCL | Hot Cell Laboratory |
| HEU | highly enriched uranium |
| HLW | high-level waste |
| INL | Idaho National Laboratory |
| kg | kilogram |
| LANL | Los Alamos National Laboratory |
| LLD | lower limit of detection |
| LWA | *Land Withdrawal Act* |
| LWR | light-water reactor |
| $m^3$ | cubic meter |
| MDA | minimum detectable activity |
| mR/hr | milli Roentgen per hour |
| mrem/hr | millirem per hour |
| MSDS | material safety data sheets |
| N/A | not applicable |
| nCi/g | nanocurie per gram |
| NCR | non-conformance report |
| NDE | non-destructive examination |
| Np | neptunium |
| ORIA | Office of Radiation and Indoor Air |
| PE Ci | plutonium equivalent curie |
| PTS | Project Tracking System |
| Pu | plutonium |
| QA | quality assurance |
| QAO | quality assurance objective |
| QAPD | quality assurance program description |

| | |
|---|---|
| R/hr/Ci | Roentgen per hour per curie |
| RCRA | Resource Conservation and Recovery Act |
| RH | remote-handled |
| RIDS | Record Inventory and Disposition System |
| RTR | real-time radiography |
| Sb | antimony |
| SCG | Summary Category Group |
| SNF | spent nuclear fuel |
| SPM | Site Project Manager |
| Sr | strontium |
| SRS | Savannah River Site |
| Th | thorium |
| T1 | Tier 1 |
| T2 | Tier 2 |
| TBD | to be determined |
| TMU | total measurement uncertainty |
| TRU | transuranic |
| U | uranium |
| VE | visual examination |
| VEE | visual examination expert |
| WAC | waste acceptance criteria |
| WC | waste characterization |
| WCO | Waste Certification Official |
| WCPIP | Waste Characterization Program Implementation Program |
| WIPP | Waste Isolation Pilot Plant |
| WMC | waste matrix code |
| WMP | waste material parameter |
| WSPF | Waste Stream Profile Form |
| WWIS | WIPP Waste Information System |
| Y | yttrium |

## 1.0 EXECUTIVE SUMMARY

In accordance with Title 40, Part 194.8(b), of the *Code of Federal Regulations* [40 CFR 194.8(b)], the U.S. Environmental Protection Agency (EPA or the Agency) conducted Baseline Inspection No. EPA-SRS-CCP-RH-07.07-8 of the Central Characterization Project's (CCP) waste characterization (WC) program for remote-handled (RH) transuranic (TRU) waste at the U.S. Department of Energy's (DOE) Savannah River Site (SRS) located in Aiken, South Carolina. The waste characterized by the SRS-CCP is RH debris waste from the decommissioning of a hot cell laboratory at the Battelle Columbus Laboratory (BCL) that was shipped to SRS for characterization and disposal at the Waste Isolation Pilot Plant (WIPP). EPA conducted a baseline inspection of SRS-CCP's program to characterize this waste in the Washington Group's office in Denver, Colorado, on July 17–19, 2007 and at the DOE's Carlsbad Area Field Office (CBFO) in Carlsbad, New Mexico, on July 31–August 2, 2007 and December 4–5, 2007.

The RH waste from Battelle Columbus Laboratory Decommissioning Project (BCLDP) is packaged in 87 drum liners[1] and is in interim storage at SRS. SRS-CCP characterized this waste by implementing the WC activities discussed in this report and demonstrating compliance with 40 CFR §194.24. SRS-CCP used the historical BCLDP-generated data to develop acceptable knowledge (AK) records. EPA's baseline inspection's sole focus was to evaluate the AK records that had been assembled to document RH TRU WC activities, including recently performed modeling, interpretation, and additional calculations based on previously generated measurement data for BCLDP RH debris Waste Stream SR-RL-BCLDP.001.

On May 21, 2008, EPA issued a Federal Register (FR) notice proposing to approve BCL's TRU RH debris wastes for disposal at WIPP that were characterized using the CCP-implemented RH waste characterization processes (see 73 FR 28504–29507). In response to the proposed approval, EPA received one comment that is docketed in EPA Air Docket ID EPA-HQ-OAR-2008-0410 and which is included verbatim in Section 9 of this report, along with EPA's response. This comment objected to the requirement for a new baseline inspection and approval of any non-BCLDP RH waste that SRS-CCP would characterize for disposal at WIPP. Upon considering and responding to the comment, EPA is finalizing the proposed retrospective approval of RH TRU debris waste for the disposal at WIPP. In addition, EPA approves the RH TRU waste characterization processes discussed in this report that SRS-CCP implemented and EPA evaluated for technical adequacy. No additional RH debris waste from this BCLDP waste stream, i.e., no wastes other than the 87 drum liners discussed in this report, is approved for WIPP disposal. Additionally, following this approval, any non-debris RH waste from BCLDP that SRS-CCP wishes to characterize using the approved WC activities discussed in this report will require EPA approval as a Tier 1 (T1) change.

When proposing to approve the RH TRU WC processes discussed in the May 2008 baseline inspection report, EPA stated that if SRS-CCP embarks on characterizing RH wastes for WIPP disposal other than those generated at BCLDP, a separate baseline inspection and approval will

[1] A liner is a 55-gallon rigid steel liner that fits within a standard 55-gallon drum and acts as an overpack. Specifications for drum liners are provided in Section 8, and are shown in Figure 1.

be necessary. That is, any SRS RH waste destined for WIPP disposal that is characterized by SRS-CCP or another program remains subject to EPA's baseline inspection and approval.

EPA must verify compliance with 40 CFR 194.24 before waste may be disposed of at the WIPP, as specified in Condition 3 of the Agency's certification of the WIPP's compliance with disposal regulations for TRU radioactive waste (63 *Federal Register* (FR) 27354 and 27405, May 18, 1998). EPA Baseline Inspection No. EPA-SRS-CCP-RH-07.07-8 was performed in accordance with the provisions of 40 CFR 194.8(b), as issued in a July 16, 2004, FR notice (Vol. 69, No. 136, pp. 42571–42583). The purpose of the SRS-CCP RH WC inspection was to evaluate the adequacy of the site's WC programs for 87 drum liners in a single RH debris waste stream for disposal at the WIPP. The 87 drum liners of RH debris in this waste stream were generated from the decontamination and decommissioning (D&D) of the Building JN-1 Hot Cell Laboratory (HCL) at the West Jefferson North facility, which operated under the BCLDP from 1955 until D&D began in 1988.

EPA is finalizing the proposed approval of the following WC activities:

(1) The AK process for the 87 drum liners of RH retrievably stored TRU debris in the waste stream designated as Waste Stream SRS-RL-BCLDP.001 currently stored at the TRU storage pads in the E Area of SRS.

(2) The radiological characterization process using dose-to-curie (DTC) and modeling-derived scaling factors, supported by radionuclide data from the analysis of 69 swipe samples, for assigning radionuclide values to 87 drum liners of RH retrievably stored TRU debris in one waste stream, designated as SRS-RL-BCLDP.001, that is documented in CCP-AK-LANL-501, Revision 2, and detailed in this report.

(3) The visual examination (VE) process to identify waste material parameters and the physical form of the waste.

(4) The WIPP Waste Information System (WWIS) to submit both characterization and certification data for RH TRU waste.

(5) The attainment of pertinent data quality objectives (DQOs).

Since no additional WC activities are expected to occur relative to the 87 drum liners of RH debris waste, changes to the WC activities evaluated during the baseline inspection are not anticipated. EPA, therefore, does not expect SRS-CCP to make additional revisions to the documents that were reviewed as part of the baseline inspection and this approval is limited to the WC processes specific to the 87 drum liners that were evaluated in July, August, and December 2007. In the event that SRS-CCP makes changes to the EPA-approved WC components discussed in this report and implements them to characterize additional waste from the BCLDP activity (e.g., solids or soil/gravel) associated with D&D activities at Building JN-1 at the BCL, EPA will consider changes that have the potential to affect WC activities to be T1 changes, as stated above. This report does not list specific T1 or Tier 2 (T2) designations relative to these 87 drum liners containing RH TRU debris waste from BCLDP and the WC components approved at this time. SRS-CCP, however, must provide to EPA a copy of the

WWIS controlled spreadsheet showing the manual data entries that were downloaded from CCP-AK-SRS-501 upon completion as a one-time T2 change.

As experienced at the other RH waste sites, WC activities implemented under the CCP program are customized to site-specific RH waste streams. The applicability of RH WC techniques at one site to RH wastes at other sites is such that significant modifications may be required to individual WC components, and the process of developing documentation or objective evidence is site-specific (see Section 9 for further discussion). As stated in Section 9.0, should SRS-CCP request approval of any non-BCL RH waste generated at SRS or waste brought to SRS for characterization, a new baseline inspection will be necessary.

## 2.0 PURPOSE OF INSPECTION

On May 18, 1998, EPA certified that the WIPP will comply with the radioactive waste disposal regulations in 40 CFR Part 191. In this certification, EPA also included Condition 3, which states that "the Secretary shall not allow shipment of any waste from…any waste generator site other than LANL for disposal at the WIPP until the Agency has approved the processes for characterizing those waste streams for shipment using the process set forth in §194.8." The approval process described in 40 CFR 194.8 requires DOE to (1) provide EPA with information on AK[2] for waste streams proposed for disposal at the WIPP, and (2) implement a system of controls used to confirm that the total amount of each waste component that will be emplaced in the WIPP will not exceed limits identified in the WIPP Compliance Certification Application.

Under the changes to 40 CFR 194.8 promulgated in the July 16, 2004, FR notice, EPA must perform a baseline inspection of a TRU waste generator site's WC program. The purpose of the baseline inspection is to approve the site's WC program based on the demonstration that the program's components, with applicable conditions and limitations, can adequately characterize TRU wastes and comply with the regulatory requirements imposed on TRU wastes destined for disposal at the WIPP. An EPA inspection team conducts an on-site inspection to verify that the site's system of controls is technically adequate and properly implemented. Specifically, EPA's inspection team verifies compliance with 40 CFR 194.24(c)(4), which states the following:

> *Any compliance application shall: . . . Provide information which demonstrates that a system of controls has been and will continue to be implemented to confirm that the total amount of each waste component that will be emplaced in the disposal system will not exceed the upper limiting value or fall below the lower limiting value described in the introductory text of paragraph (c) of this section.*[3]

[2] As of the FR notice of July 16, 2004, EPA has replaced the term *process knowledge* with *acceptable knowledge*. Acceptable knowledge refers to any information about the process used to generate waste, material inputs to the process, and the time period during which the wastes were generated, as well as data resulting from the analysis of waste conducted prior to or separate from the waste certification process authorized by an EPA certification decision to show compliance with Condition 3 of the certification decision.

[3] The introductory text of 40 CFR 194.24(c) states, "For each waste component identified and assessed pursuant to [40 CFR 194.24(b)], the Department shall specify the limiting value (expressed as an upper or lower limit of mass, volume, curies, concentration, etc.), and the associated uncertainty (i.e., margin of error) for each limiting value, of the total inventory of such waste proposed for disposal in the disposal system."

*The system of controls shall include, but shall not be limited to: Measurement; sampling; chain of custody records; record keeping systems; waste loading schemes used; and other documentation.*

In other words, the purpose of the baseline inspection is to implement the requirements of 40 CFR 194 by assessing whether DOE sites that characterize TRU waste prior to disposal at the WIPP are capable of characterizing and tracking the waste. EPA may also conduct follow-up inspections to address issues remaining from the baseline inspection or to seek further clarification/discussion related to WC processes evaluated during a baseline inspection. By approving the WC systems and processes at SRS-CCP that were applied to the 87 drum liners of retrievably stored RH debris waste, EPA confirms that the Agency has evaluated the capabilities of systems and processes implemented by the site to accomplish two tasks: (1) the identification and measurement of waste components that must be tracked for compliance such as plutonium,[4] and (2) the confirmation that the waste in any given container has been properly identified as belonging to the group of approved waste streams.

Based on the adequacies of the WC processes demonstrated during the baseline inspection, including all conditions and limitations, EPA usually specifies which subsequent WC program changes or modifications must undergo further EPA inspection or approval under 40 CFR 194.24. This is accomplished by assigning a tier level to each aspect of the characterization program, i.e., T1 and T2 activities. However, the nature of the WC activities at SRS-CCP is such that no additional characterization activities are anticipated, making a prospectively orientated T1 or T2 assignment irrelevant. Accordingly, no formal tiering is finalized for the SRS-CCP RH WC program at this time. As stated previously, EPA's approval is limited to the 87 drum liners of RH TRU wastes whose characterization is documented in the records evaluated during the inspection and detailed in this report. Should SRS-CCP seek to characterize additional RH wastes from BCLDP for disposal at WIPP, such wastes would be considered a T1 activity and would be addressed accordingly. The rule applying to this baseline inspection can be found in the FR (Vol. 69, No. 136, pp. 42571–42583, July 16, 2004). EPA does not expect to conduct additional SRS-CCP RH waste inspections specific to this waste stream in the future. If SRS-CCP characterizes RH wastes that do not originate at BCLDP for WIPP disposal, a new EPA baseline inspection and approval will be necessary under the authority of 40 CFR 194.8.

## 3.0 PURPOSE OF THIS REPORT

This report documents the basis for EPA's approval decision and explains the results of Baseline Inspection No. EPA-SRS-CCP-RH-07.07-8 in terms of findings or concerns. Specifically, this report does the following:

[4] The potential contents of a single waste stream or group of waste streams determine which processes can adequately characterize the waste. For example, if AK suggests that the waste form is heterogeneous, the site should select the matrix-appropriate radiological characterization technique to obtain adequate radionuclide measurements. VE serves to confirm and quantify waste components, such as cellulosics, rubbers, plastics, and metals. Once the nature of the waste has been confirmed, characterization techniques quantify selected radionuclides in the waste. In some cases, a TRU waste generator site may be able to characterize a range of heterogeneous waste streams or only a few. A site's stated limits on the applicability of proposed WC processes govern the scope of EPA's inspection.

- Describes the characterization systems SRS-CCP submitted for approval
- Delineates a specific set of RH wastes submitted for approval
- Provides objective evidence as basis for the approval of all WC systems and/or waste containers
- Identifies all relevant limitations and or conditions for each WC system and/or waste container
- Provides objective evidence of outstanding findings or concerns in the form of documentation, as applicable
- Describes any tests or demonstrations completed during the course of the inspection and their relevance to EPA's approval decision, as applicable

The listings in each section reference the documents that the EPA inspection team members reviewed in support of the technical determination. To see or obtain copies of any items identified in the attached checklists, write to the following address:

Quality Assurance Manager
USDOE/Carlsbad Field Office
P.O. Box 3090
Carlsbad, NM 88221

EPA's final approval decision regarding the SRS-CCP RH WC program is conveyed to DOE separately by letter. In accordance with 40 CFR 194.8(b)(3), this information is also available on EPA's Web site at http://www.epa.gov/radiation/WIPP.

## 4.0 SCOPE OF INSPECTION

The scope of Baseline Inspection No. EPA-SRS-CCP-RH-07.07-8 included the technical adequacy of the WC systems used by SRS-CCP to characterize 87 drum liners of RH TRU wastes in SRS RH Waste Stream SR-RL-BCLDP.001. At the start of the inspection, SRS-CCP presented the number of drums in Waste Stream SRS-RL-BCLDP.001 as 88. However, SRS-CCP determined that one of these drums did not meet the definition of TRU waste and it was removed from the waste stream directly prior to the inspection, leaving a total of 87 drums within the inspection's scope. The basis for all radiological and physical waste characterization of these 87 drums was AK, and included the identification and quantification of the 10 WIPP-tracked radionuclides ($^{241}$Am, $^{137}$Cs, $^{238}$Pu, $^{239}$Pu, $^{240}$Pu, $^{242}$Pu, $^{90}$Sr, $^{233}$U, $^{234}$U, and $^{238}$U). Accordingly, the inspection's scope consisted of reviewing records of WC activities that had been performed previously in conjunction with the BCLDP, supplemented by data interpretation and manipulation, and the development and application of conceptual models related to WC performed more recently by SRS-CCP.

During an inspection, EPA does not approve characterization data; that function is the sole responsibility of the site being evaluated during the inspection, in this case SRS-CCP. EPA evaluated records that documented the technical aspects of the WC processes implemented by SRS-CCP to characterize 87 drum liners of RH retrievably stored debris waste that were

conducted during the BCLDP. These records included more recent compilations of older information, as well as newer interpretations of, and additional calculations to, older measurement data. The evaluation consisted of interviewing personnel and inspecting records related to the WC processes within the inspection's scope. An important aspect of this evaluation is the objective evidence that documents the effectiveness of the WC processes. Objective evidence typically takes the form of BDRs for radiological characterization and AK accuracy reports. EPA typically selects samples of each of these items based on the number and variety of items that were completed and available for inspecting each WC process, consistent with standard sampling techniques. However, because the WC activities for these BCLDP RH wastes are not ongoing, BDRs were not prepared. Accordingly, EPA evaluated records associated with the characterization of an appropriate sample of the 87 drum liners. EPA examined WC information that was provided within specific SRS-CCP reports that were the equivalent of what is typically contained in BDRs. Based on an evaluation of the WC processes documented in the SRS RH records, EPA determined the technical adequacy of the WC processes within the inspection's scope.

## 5.0 INSPECTION-RELATED DEFINITIONS

During the course of an inspection, EPA inspectors may encounter items or activities that require further inquiry for their potential to adversely affect WC and/or isolation within the repository. The two main categories relevant to WC inspections are identified below:

*Finding*: A determination that a specific item or activity does not conform to 40 CFR 194.24(c)(4). A finding requires a response from CBFO.

*Concern*: A judgment that a specific item or activity may or may not have a negative effect on compliance and, depending on the magnitude of the issue, may or may not require a response. (Concerns not requiring a response do not have to be addressed prior to program approval.)

## 6.0 PERSONNEL

### 6.1 EPA Inspection Team

The members of the EPA WC inspection team are identified in Table 1.

**Table 1. EPA Inspection Team Members**

| Inspection Team Member | Position | Affiliation |
|---|---|---|
| Ms. Rajani Joglekar | Inspection Team Leader | U.S. EPA ORIA |
| Mr. Ed Feltcorn | Inspector | U.S. EPA ORIA |
| Ms. Connie Walker | Inspector | S. Cohen & Associates, Inc. |
| Ms. Dorothy Gill | Inspector | S. Cohen & Associates, Inc. |
| Mr. Patrick Kelly | Inspector | S. Cohen & Associates, Inc. |

## 6.2 Personnel Contacted

EPA and its support personnel conducted interviews with SRS-CCP personnel in several disciplines on several occasions. The personnel contacted represented a sample of the SRS-CCP WC staff, and they are listed in Table 2, along with their affiliation and technical area. This listing is comprehensive and includes personnel present at all meetings conducted as part of this baseline inspection.

**Table 2. Personnel Contacted during Inspection**

| Personnel | Affiliation | Area of Expertise |
|---|---|---|
| Rob Tayloe | CCP | AK/DTC; Scaling Factors |
| Jene Vance | CCP | AK/DTC; Scaling Factors |
| Keith Meger | CCP | AK/DTC; Scaling Factors |
| Eric D'Amico | CCP | RH SPM |
| Larry Porter | CCP | AK, RH SPM; Scaling Factors |
| Steve Schafer | CCP | AK, AKE |
| Kevin Peters | CCP | AK, AKE |
| Mark Doherty | CCP | DTC & Scaling Factors-MS Data |
| J.R. Stroble | DOE/CBFO | RH TRU Waste Certification Manager |
| Irene Quintana | CCP | RH SPM |
| Charlie Riggs | CTAC | Observer |
| Porf Martinez | CTAC | Observer |

# 7.0 PERFORMANCE OF THE INSPECTION

**Background and History: Battelle Columbus and Savannah River Site**

The RH debris waste that is the focus of this inspection came from the West Jefferson North Site, which is part of Battelle Memorial Institute (BMI), located near West Jefferson, Ohio, approximately 15 miles west of the main BMI King Avenue facility in Columbus, Ohio. BMI had supported the first large-scale military application of nuclear power through development of fuel element/assemblies design and materials. The West Jefferson North Site's focus was research in the areas of reactor fuel, control rod, and structural material studies. Since operations began in the JN-1 HCL in 1955, a variety of studies relating to the radiation performance of materials were conducted in the remote-handling facilities in Building JN-1. Experiments in the JN-1 HCL consisted primarily of reactor fuel studies that evaluated uranium, thorium, and plutonium alloys and compounds; control rod material studies of rare-earth absorbers; and evaluations of structural and cladding material. Remedial D&D activities of the West Jefferson North Site facilities began in 1988 under the BCLDP for the purpose of decontaminating the buildings and associated grounds such that they would be suitable for unrestricted use. Battelle completed the BCLDP D&D program with the final shipments of these RH TRU waste to SRS in December 2005 where they are currently stored on the TRU Pad in E Area of SRS. SRS-CCP did not perform any actual characterizations relative to these wastes, but instead was using the BCLDP-generated data to develop AK records that support the WC activities for these 87 RH drums. Accordingly, it was not necessary to conduct this baseline inspection at SRS, and EPA

conducted the review of AK records and discussions with SRS-CCP personnel in Denver, Colorado. Additionally, EPA decided to evaluate the non-destructive examination (NDE) and the WWIS in CCP's Carlsbad office for logistical reasons.

**Inspection Process Overview**

EPA Baseline Inspection No. EPA-SRS-CCP-RH-07.07-8 had the scope described in Section 4.0 above, for the purpose of determining the site's compliance with 40 CFR 194.24. The inspection was conducted in the following steps:

(1) Obtaining and reviewing site procedures, reports, and other technical information related to RH WC activities previously used to characterize these wastes at BCLDP

(2) Preparing technical questions specific to the various aspects of AK prior to the inspection based on the activities cited in the previous bullet

(3) Interacting with CBFO and SRS-CCP personnel to arrange inspection logistics

(4) Evaluating SRS-CCP's implementation of WC processes for adequacy and demonstrating compliance with 40 CFR 194.24 requirements, as evidenced by the records of the WC activities previously conducted at BCLDP

(5) Conducting the baseline inspection in Denver to verify the technical adequacy and/or qualifications of RH WC personnel, procedures, processes, and equipment, as evidenced by the records of the WC activities previously conducted at BCLDP

(6) Recording one finding on an EPA Inspection Issue Tracking Form, which was completed and provided to CBFO and SRS-CCP personnel as it was generated (see Attachment A for a copy of this form)

(7) Communicating with CBFO and SRS-CCP personnel regarding pertinent information

(8) Pursuing resolution of all identified issues prior to completion of the inspection, when feasible

(9) Conducting entrance, exit, and daily briefings for CBFO and SRS-CCP management personnel

(10) Obtaining and reviewing SRS-CCP documents that were revised in response to the EPA finding after the inspection

(11) Conducting additional meetings with SRS-CCP personnel to discuss the revised documents and examine objective evidence for the purpose of addressing the technical issues identified in the finding

(12) Issuing the inspection report and approval

## 8.0 TECHNICAL EVALUATION

EPA examined the AK process and associated information to determine whether the SRS-CCP RH program for characterizing Waste Stream SR-RL-BCLDP.001 from the BCLDP demonstrated compliance with the requirements of 40 CFR 194.8. Due to the approach taken by

SRS-CCP BCLDP, all WC activities relative to the 87 drum liners in this waste stream fall under the general heading of AK. In this report, AK is divided into five sections:

- 8.1, Acceptable Knowledge Overview and Process Analysis
- 8.2, Radiological Characterization
- 8.3, Physical Form and Prohibited Item Characterization – Visual Examination
- 8.4, WIPP Waste Information System
- 8.5, Attainment of Data Quality Objectives

This report format differs from the format that EPA generally uses for baseline inspection reports, where there are multiple sections named for each WC process, i.e., AK, NDA, NDE, and WWIS. Such a format reflects that the WC activities evaluated during the inspection are ongoing and are expected to continue upon approval of the site's WC program. The nature of the SRS-CCP program is different in that all WC activities have occurred and there are no further ongoing WC activities upon approval. The basis for all WC activities consists of records of previously conducted activities, and accordingly, all this information is considered AK. However, the actual information may consist of examinations of the waste using both NDA and NDE, in addition to historical information regarding the waste's nature and origin.

**Waste Containers**

All BCLDP wastes were loaded into 55-gallon steel drum liners (a rigid liner that essentially fits within a 55-gallon drum which acts as overpack). Once the liners were full, lids were installed and the liners were transferred into U.S. Department of Transportation (DOT)-approved containers. This report uses the term *RH drum liner* or *waste liner*, which requires clarification. Any use of the term *liner* in this report means a steel container that fits inside a standard 55-gallon drum. Each liner has the following dimensions: 0.105 inch thick, 32.250" high, with an outer diameter of 22" and an inner diameter of 19.5", as shown in Figure 1. Each liner was sealed once it was full of waste, and 82 of the sealed liners were transferred to DOT-approved, UN/1A2/X400/S/99 55-gallon drums equipped with Nucfil-013 filters (vented). Five additional steel liners were loaded directly into two 72-B RH TRU canisters; three in one canister and two in the other canister. The total waste stream population consists of these 87 drum liners referred to throughout this report. In some cases, this report cites objective evidence (i.e., BCLDP or SRS-CCP reports) that uses the terms *waste container* or *waste drum*, both of which are synonymous with the term *liner*.

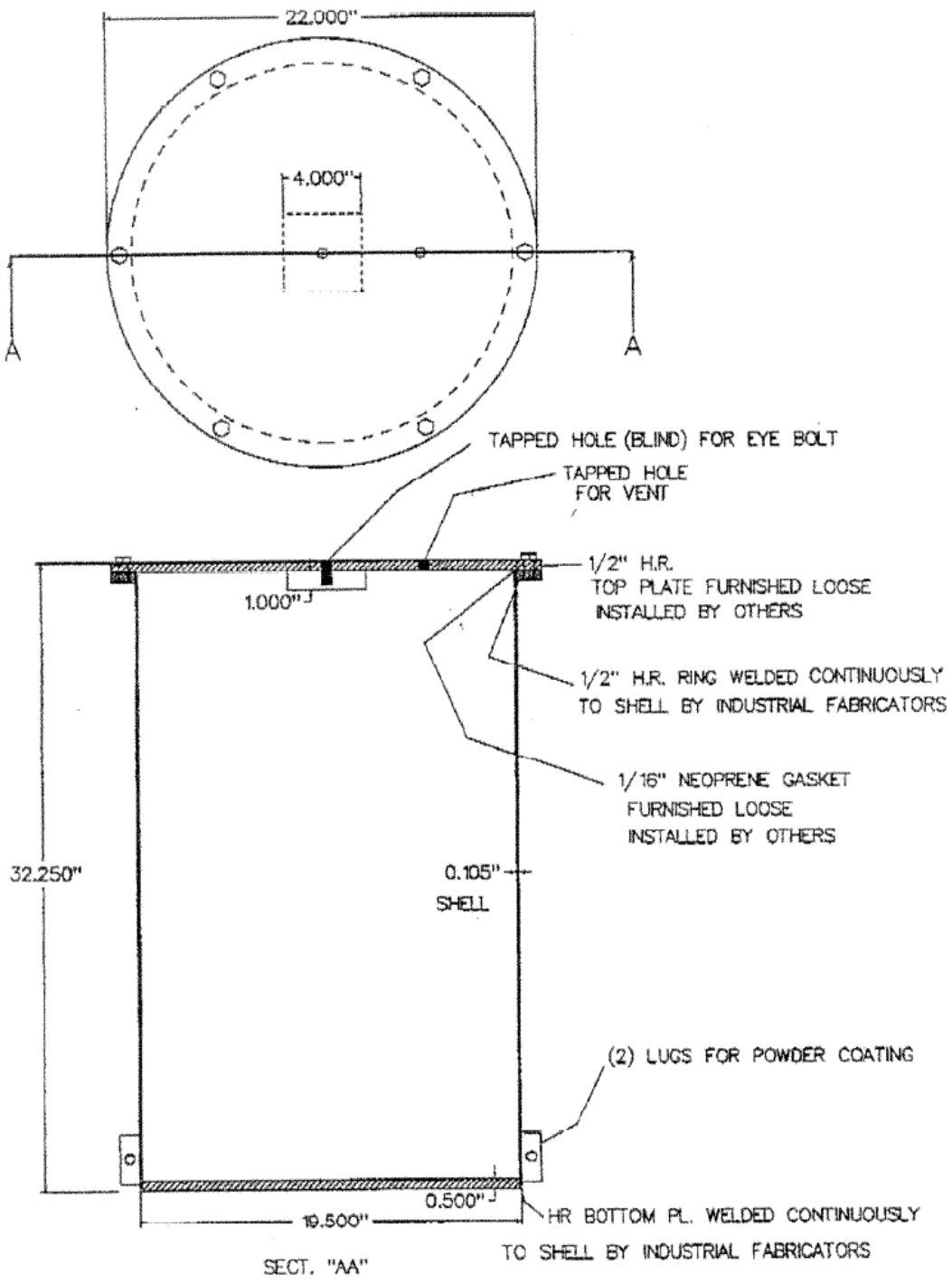


**Figure 1. Configuration and Dimensions of a 55-Gallon Drum TRU RH Liner**

## Waste Origin and Generation

The RH debris in this waste stream was generated from the D&D of Building JN-1 in the West Jefferson North Site of BCL in Columbus, Ohio.[5] The JN-1 HCL was dedicated to reactor fuel research and material evaluation in support of DOE and other federal agencies. Remedial activities of the West Jefferson North facilities began in 1988 under the BCLDP and continued until the final shipment of BCLDP D&D wastes to SRS was made in December 2005. The BCLDP generated a total of 135 55-gallon drums [approximately 29 cubic meters ($m^3$)] of RH wastes, 48 of which are not within the scope of this inspection and are currently stored at DOE's Hanford Site in Richland, Washington.[6] The remaining 87 drums of waste that are the subject of this inspection are composed of 82 individual 55-gallon drums and 5 additional 55-gallon drums that are contained in two 72B RH Casks, 3 drums in 1 cask and 2 drums in the other cask, all of which are currently stored at the TRU Storage Pad in E Area of SRS. The waste components include cellulosics, plastic, rubber, glass, and metal, and less than 50% by volume in any one container consists of homogeneous organic and inorganic materials. Radionuclide components of the waste include $^{241}Am$, $^{238}Pu$, $^{239}Pu$, $^{240}Pu$, $^{241}Pu$, $^{242}Pu$, $^{234}U$, $^{235}U$, $^{238}U$, $^{137}Cs$, and $^{60}Co$. The scope of this inspection was the 87 drum liners of RH wastes currently stored at SRS and does not include the 47 additional 55-gallon drums of BCLDP wastes that are in storage at Hanford.

The approval of additional BCLDP drum liners at Hanford or any other location will require a separate baseline inspection at such time that the site decides to characterize these wastes for disposal at WIPP. The wastes to which this approval applies are discussed in this report and were generated by the BCLDP. The fact that these wastes are stored at SRS has no bearing on characterization activities performed on any other contact-handled (CH) or RH TRU materials at SRS or any other DOE site. Should DOE notify EPA that there are additional containers of RH TRU wastes from the BCLDP for disposal at WIPP apart from the 87 liners discussed in this report, EPA would address the situation as a T1 change, as discussed previously. However, such an option would apply only to BCLDP wastes (such as solids or soil/gravel) that have waste generation and WC elements in common with the 87 liners described in this report.

## Waste Characterization Overview

Acceptable knowledge provides the basis for all radiological and physical WC information. In the case of this specific SRS RH waste stream, wastes were grouped using AK into a debris waste stream of 87 drum liners generated through D&D of the JN-1 HCL. As part of the inspection, EPA reviewed the following with respect to the use of AK for WC:

- Waste stream definition and identification, including radiological content
- Identification of TRU versus non-TRU wastes, i.e., high-level waste (HLW) and spent nuclear fuel (SNF)

[5] The West Jefferson North Site included: Building JN-2 (Critical Assembly Laboratory); Building JN-3 (Research Reactor Building); and Building JN-4 (Plutonium Laboratory). This waste stream only includes wastes from JN-1.

[6] Forty seven of these drums are stored at Hanford and the one drum that SRS-CCP excluded from this waste prior to this inspection is stored at SRS.

- Identification and quantification of the waste's radionuclide content, including uncertainty
- Defense waste status
- Waste Material Parameters (WMP)
- Assignment of waste matrix codes (WMC)
- Role of AK in the characterization methodology, with the determination of quality assurance (QA) equivalency (addressed outside of this report), peer review, or confirmation via modeling used as verification techniques
- Compilation of AK documentation and assembly of required information
- Adequacy of the Waste Characterization Program Implementation Plan (WCPIP) AK process implementation and AK summary report
- AK data traceability for all drums and containers used in the process from data assembly through confirmatory modeling
- AK source document sufficiency
- WCPIP interpretation with respect to AK qualification
- Confirmatory Test Plan (CTP) preparation and plan adequacy
- Characterization Reconciliation Report (CRR) preparation and report adequacy
- Correlation and Surrogate Summary Form and CH-RH correlation
- Personnel training
- AK discrepancy resolution (DR)
- AK accuracy
- Implementation of load management
- Physical form and prohibited item characterization using VE
- WWIS
- Identification of the method for determining DQOs, including those to be attained by AK qualification

Waste Stream SR-RL-BCLDP.001 has been characterized by AK that was qualified through a determination of QA equivalency (not addressed in this report). Because the characterization process is based solely on AK records and the various methods used to verify AK exclusive of confirmatory testing, the entire inspection was based on reviewing documents of activities that had been completed prior to the inspection. BDRs were not prepared to meet WCPIP requirements, and observations of procedural implementation could not be made because all characterization activities had been completed prior to the inspection. No further testing or characterization of the 87 drum liners will be performed.

Radiological information available for this waste stream includes the radiochemical analytical results of 69 swipe[7] samples taken at various locations within JN-1, as well as a memorandum presenting $^{235}U$ enrichment, burn-up, and decay for light-water reactor (LWR) fuel pins. External exposure rate (dose rate)[8] measurements were taken at the time of packaging for all drum liners. The determination of several DQOs was achieved through use of radionuclide-specific scaling factors and isotopic distributions that were applied to dose rate data derived by applying the DTC technique for each drum liner. The scaling factors were derived using ORIGEN2.2[9] modeling with input based on attributes of LWR fuels that were assumed to contribute the majority of the waste stream's radionuclide content. Radionuclide data from the analysis of swipe samples taken throughout the JN-1 facility were used to support the scaling factors derived with ORIGEN2.2 for plutonium and americium isotopes and specific fission products.

**Documents Reviewed**

The list of documents provided below includes all documents related to the SRS-CCP RH radiological characterization program that were evaluated to support this inspection:

- C001, Interview Record: Eugene Sands, Master Research Technician; Larry Stickel, Master Technician; Harley Toy, Manager of Regulatory Compliance and Technical Services; Max Berchtold, JN-1 Lab Technician; George Kirsch, Health Physicist; K.J. Peters and J. Harrison, May 1, 1998
- C002, Packet of Letters Concerning Destruction/Immobilization of Toxic Substances by Intense Gamma Irradiation, L. M. Lowry, H. L. Toy, E. W. Ungar, R. DiSalvo, November 8, 1982, December 13, 1982, December 15, 1982, January 27, 1983
- C003, Letter to Louis B. Myers, re: Characterization of the JN-1 Hot Cell Waste Drums, M. P. Failey, May 1, 1997
- C004, Interview Record: Harley Toy, Manager of Regulatory Compliance and Technical Services; George Kirsch, Health Physicist, Historical Operations in JN-1, K.J. Peters, July 12, 1998
- C005, Interview Record: Scott Kitts, Manager Special Waste Projects, Hanford N-Reactor Process Tube in JN-1, K.J. Peters, July 16, 1998
- C006, Interview Record: Max Berchtold, JN-1 Lab Technician, Historical Operations in JN-1

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[7] The terms *swipe* and *smear* refer to a small piece of absorbent material that is wiped or smeared on a surface area and subsequently analyzed by destructive or nondestructive radiometric techniques to estimate the amount of removable radioactive contamination on the area or item that was wiped. Standard Health Physics practices typically express swipe/smear results in activity units per area or per swipe, e.g., $\mu Ci/100\ cm^2$ or dpm/swipe. Consistent with the usage observed in the BCLDP documents reviewed during this inspection, these two terms are used interchangeably in this report.

[8] Although the terms *dose rate*, *dose equivalent rate*, and *external exposure rate* have different meanings, they are sufficiently similar in this context to allow their use interchangeably in this report. The most prevalent terminology used to express this waste attribute in BCLDP documents is *dose rate*, stated in milliRoentgens per hour (mR/hr), which for our purposes is the equivalent of *dose equivalent rate* expressed in mRem/hr from the standpoint of determining a container's RH status.

[9] The computer code used is ORIGEN2, Version 2.2, which is expressed as ORIGEN2.2 throughout this report.

and Hydraulic Oil Composition (including MSDS), K.J. Peters, July 15, 1998

- C007, Interview Record: Scott Kitts, Manager Special Waste Projects, Separation of Hot Cell Waste from Wastes from Supporting Areas, K.J. Peters, July 22, 1998
- C008, Memorandum to Mike Brown, re: Certification Strategy for Transuranic Waste Generated from the Battelle Columbus Laboratories Decommissioning Project, C98-065, Various, June 25, 1998
- C021, Letter to AK Record, re: Estimates of Waste Stream Generation Volumes and Waste Material Parameter Categories for Building JN-1 Repackaged Waste, K.J. Peters, May 7, 1999
- C033, Letter to Contractors, Richland, Washington; Director, Pacific Northwest Laboratory; President, Westinghouse Hanford Company, re: Spent Nuclear Fuel Records, 96-SFD-059, E.D. Sellers, March 14, 1996
- C034, Memorandum to Elizabeth D. Sellers, re: National Spent Nuclear Fuel Program Evaluation of Hanford Building 327 Material for Applicability of RH-TRU Waste Criteria for Disposal at WIPP, OPE-SFP-081, J. Boyd, March 24, 1997
- C035, Letter to H. J. Hatch, re: Contract No. DE-AC05-96RL13200 - Classification of Nuclear Materials in the 327 Building, 97-SFD-074, E.D. Sellers, April 21, 1997
- C047, Letter to Pete Erickson, re: Findings on the Result of Pressure Wash Decontamination on the JN Waste Matrix, C. Jensen and J. Sarge, July 25, 2000
- C501, Battelle Defense Determination Approval, E. Rose, July 15, 2005
- C502, Surveillance (S-01-37) of the Battelle Columbus Laboratories Decommissioning Project (BCLDP) Remote Handled Waste Characterization, CBFO:QA:TJR:VW:01-1451:UFC:2300, T. Baillieul, September 17, 2001
- C504, Waste Material Parameter Weight Evaluation for Waste Stream SR-RL-BCLDP.001, K.J. Peters, April 11, 2007
- C505, U.S. DOE CAO Audit Report of the Battelle Columbus Laboratories Decommissioning Project, TRU Waste Characterization Activities Related to Acceptable Knowledge, May 7, 1999, Audit Number A-99-15, M.A. Italiano, June 4, 1999
- DR002, Interview Record for Discrepancy Report of George Kirsch, re: Date of the Beginning of Operations of the HEC and Pool, K.J. Peters, July 28, 1998
- DR004, Interview Record of Cidney Voth, re: Evaporation of the JN-1 Transfer/Storage Pool Water, K.J. Peters, April 27, 1999
- DR005, Letter to AK Record, re: Discrepancy Report Relating to Lead Detected in Sample of Pool Water, K.J. Peters, May 12, 1999
- DR006, Letter to AK Record, re: Discrepancy Report Relating to RCRA Metals Detected in Samples Pool Resins and Filters, K.J. Peters, June 29, 1999
- DR009, Letter to AK Record, re: Discrepancy Report Regarding Generation of Four Debris Waste Streams, 5190-01, 5190-02, 5390-01, and 5390-02, K.J. Peters, May 25, 2001

- DR010, Letter to AK Record, re: Discrepancy Report Relating to RCRA Metals Detected in Pool Resins and Filters Samples, and TRU Resin Volume Estimation, S.M. Smith, May 25, 2001
- DR011, RCRA Hazardous Waste Number Assignment Discrepancy Report, K.J. Peters, Date TBD
- P002, Fuel Storage Pool, Pump Room, and Washdown Room JN-1B. Decontamination and Decommissioning Operations, L.B. Myers, M.B. Berchtold, and J.L. Stickel, July 1, 1995
- P003, High Energy Cell, Mezzanine, and Top of HEC JN-1B. Decontamination and Decommissioning Operations, L.B. Myers, M.B. Berchtold, P.D. Faust, and P.A. Tomlin, December 1, 1994
- P004, Waste Storage Shed JN-1A. Decontamination and Decommissioning Operations, L.B. Myers and M.B. Berchtold, June 1, 1995
- P005, Hot Cell Purposes and Activities. Decontamination and Decommissioning Operations, Battelle Columbus Laboratories, September 22, 1997
- P006, Contents of the West Jefferson North Hot Cells and Storage Areas, L.B. Myers, M.B. Berchtold, and E.H. Sands, May 1, 1995
- P008, West Jefferson North Hopper Location and Contents, L.B. Myers and M.B. Berchtold, June 1, 1995
- P009, Chemistry Laboratory, Counting Room and Microprobe Room, L.B. Myers, M.B. Berchtold, P.A. Tomlin, and M.P. Failey, December 1, 1994
- P010, Evaporator Room JN-1A, Louis B. Myers, M.B. Berchtold, and P.A. Tomlin, November 1, 1994
- P011, Controlled Access Area Storage Rooms JN-1A, L.B. Myers, M.B. Berchtold, P.D. Faust, and P.A. Tomlin, October 1, 1994
- P012, Controlled Access Area JN-1A, L.B. Myers, M.B. Berchtold, P.D. Faust, and P.A. Tomlin, September 1, 1994
- P013, Mezzanines JN-1A, L.B. Myers and M.B. Berchtold, September 1, 1994
- P014, Mechanical Test Cell JN-1A, L.B. Myers, C.A. Redd, Sr., and M.B. Berchtold, July 1, 1994
- P015, High Level Cell and Low Level Cell Hydraulic Doors and Hydraulic Door Room JN-1A, L.B. Myers and M.B. Berchtold, September 1, 1994
- P016, Subcells of the High Level and Low Level Cells in JN-1A, L.B. Myers, M.B. Berchtold, and P.A. Tomlin, November 1, 1994
- P017, Low Level Cell JN-1A, L.B. Myers, M.B. Berchtold, T.A. Beddick, P.D. Faust, and P.A. Tomlin, August 1, 1994
- P018, High Level Cell JN-1A, L.B. Myers, M.B. Berchtold, P.D. Faust, and P.A. Tomlin, August 1, 1994

- P019, Charpy Room JN-1A, Louis B. Myers, C.A. Redd, Sr., M.B. Berchtold, June 1, 1994
- P023, Course 7: Metals for Nuclear Power, Lesson Ten: Structural Materials, Metals Engineering Institute, 1958
- P025, Miscellaneous Material Safety Data Sheets (MSDS), Various
- P026, The U.S. Government and Battelle: Partners in Nuclear Research, 1943 - Present, Various, Not Given
- P028, Battelle Columbus Laboratory Hot Cell Facility, Radioactive Material Receipt Record and Survey, Project G-7656-3, T.R. Emswiler, October 24, 1967
- P029, Battelle Memorial Institute - Columbus Laboratory, Radioactive Shipment and Receipt Form, Project 227566, T. R. Emswiler, December 24, 1970
- P032, Procedures Manual for Battelle's Radioisotope, Gamma, and Hot-Cell Laboratories, BMI-PM-662, D.N. Sunderman and R.F. Dickerson, February 20, 1962
- P034, Finding of No Significant Impact and Environmental Assessment, Battelle Columbus Laboratories Decommissioning Project, U.S. DOE Chicago Operations Office, June 1, 1990
- P037, Decontamination Work Plan for Building JN-1, Battelle Columbus Division, November 1, 1990
- P041, Interim Guidance on Ensuring that Waste Qualifies for Disposal at the Waste Isolation Pilot Plant, U.S. DOE CBFO, December 13, 1997
- P076, Acceptable Knowledge Summary, Pool Water Prefilter and Debris, Revision 1, WASTREN, Inc., January 19, 2001
- P077, Waste Management Operating Procedure: Operation and Maintenance of the Alkota Pressure Washer, WA-OP-061, Revision 3, Battelle Columbus Laboratories, March 6, 2001
- P078, Work Instruction: Operation of CAA Pressure Wash System, WI-976, Revision 2, Battelle Columbus Laboratories, November 30, 2000
- P079, Work Instruction: Material Removal from the High Level Cell, WI-1021, Revision 0, BCL, February 2, 2001
- P501, Building JN-1 Hot Cell Laboratory Acceptable Knowledge Document, TCP-98-03, Revision 2, K. J. Peters, August 2001
- P503, Waste Characterization Classification, and Shipping Support Technical Basis Document for BCLDP West Jefferson North Facility, DD-98-04, Revision 4, C. W. Skapik, November 2002
- P505, Segregation and Packaging of TRU Waste, TC-OP-01.4, Revision 2, P. Erickson, Date TBD
- P506, Packaging Video Documentation, TC-OP-01.5, Revision 2, D. Garber, Date TBD
- P511, Technical Basis Document, Acceptable Knowledge Process Description, Repackaging of Building JN-1 Clean-Up Waste Containers, TCP-98-03.1.2, Revision 2, K.J. Peters, WASTREN, Inc., July 2001

- P512, Technical Basis Document, Acceptable Knowledge Process Description, TRU Waste Laundry Decontamination, TCP-98-03.1.3, Revision 1, K.J. Peters, WASTREN, Inc., June 2001
- P514, Identification, Segregation, Separation, and Documentation of Low Level and Radioactive Mixed Waste, WA-OP-020, Revision 7, P. Erickson, Date TBD
- P518, Lessons Learned Report for the BCLDP Transuranic Waste Shipments to Hanford and the Savannah River Site for Interim Storage and Final Characterization, N/A, P. Weaver, November 2006
- P704, Characterization of Remote-Handled Transuranic Waste for the Waste Isolation Pilot Plant – Final Report, National Academy of Sciences, 2002
- P727, CCP Calculation Cover Sheet: SRS TRU Radiological Characterizations, SRS-RH-01, Revision 0, R. Tayloe, June 26, 2007
- P729, Swipe Sample Data Analysis Calculation Package, SRS-RH-03, Revision 0, J. Vance, May 16, 2007
- P735, Fuel Type Evaluation, SRS-RH-09, Revision 0, J. Vance, May 16, 2007
- P737, Calc Package for Determination of Reportable Isotopes, SRS-RH-11, Revision 0, J. Vance, May 16, 2007
- U001, Miscellaneous Maps of Battelle Columbus West Jefferson North Facility, Battelle Columbus Laboratories, Date Not Given
- U002, Description of the Battelle Hot Cell Laboratory, Battelle Columbus Laboratories, Date Not Given
- U003, Battelle-Columbus Hot Cell Laboratory - Capability Summary, Battelle Columbus Laboratories, Date Not Given
- U004, Buildings JN-1, JN-2, and JN-3 Summaries, Battelle Columbus Laboratories, Date Not Given
- U006, ENG-92 Contract Projects Database 1 Printout, Query Dated May 20, 1985
- U008, Nuclear Fuel Inventory at West Jefferson North, Battelle Columbus Laboratories, Date Not Given
- U009, Miscellaneous JN-1 Waste Inventory Data, Battelle Columbus Laboratories, 1988–1997
- U014, ENG-92 Contract Projects Database 2 Printout, Battelle Columbus Laboratories, Query, October 17, 1986
- U016, Nuclear Materials Questionnaires, Battelle Columbus Laboratories, 1985
- U025, Actinide Screen Data for Radionuclides Contained in Strippable Paint from JN-1 Charpy Cell, Battelle Columbus Laboratories, July 17, 2000
- U026, 69 Sample Basis of DD-98-04 Technical Basis Document, Battelle Columbus Laboratories, May 25, 2001

- U509, Waste Management 2000 Presentation and Paper – RH-TRU Waste Packaging Visual Confirmation Using a Dual-Camera Video Security and Documentation System, D. Garber, J. Eide, and K. Peters, Not Dated
- U513, Miscellaneous Inventory Spreadsheets, K.J. Peters, BCLDP, SRS, Hanford, Various
- U516, Waste Management 2002 Paper, Adequacy of a Small Quantity Site RH-TRU Waste Programs in Meeting Proposed WIPP Characterization Objectives, J. Biedscheid, M. Devarakonda, S. Stahl, K. Peters, and J. Eide, 2002
- U734, Review of Spreadsheet WJ_samp.xls "69 Swipes from Battelle", R. Tayloe, August 7, 2001
- CCP-AK-SRS-500: Central Characterization Project Acceptable Knowledge Report for Battelle Columbus Laboratory's Decontamination Project (BCLDP) Remote Handled Transuranic Debris Waste from the Building JN-1 Hot Cell Laboratory, Waste Stream: SR-BL-BCLDP.001, Revision 0, May 17, 2007 and Revision 1, August 27, 2007
- CCP-AK-SRS-501: Central Characterization Project Remote Handled Transuranic Radiological Characterization Technical Report for Remote Handled Transuranic Debris Waste from Battelle Columbus Laboratory's Decontamination Project at the West Jefferson North Facility, Revision 0, June 14, 2007 and Revision 2, November 28, 2007
- CCP-AK-SRS-502: Central Characterization Project RH TRU Waste Certification Plan for 40 CFR Part 194 Compliance and Confirmation Test Plan for BCLDP Waste Stream SR-RL-BCLDP.001, Revision 0, June 11, 2007
- CCP-AK-SRS-503: Central Characterization Project Battelle Columbus Laboratory Decommissioning Project Quality Assurance Equivalency Report and Procedure Matrix for Remote–Handled Transuranic Debris Waste, Revision 0, June 13, 2007
- CCP-TP-506, CCP Preparation of the Remote-Handled Transuranic Waste Acceptable Knowledge Characterization Reconciliation Report, Revision 2
- Characterization Reconciliation Report, BC SRS Waste Stream - SR-RL-BCLDP.001, Attachment 5 and related required documents, prepared July 17, 2007 (Waste Stream Profile Form, Draft, also provided)
- TRU Waste Package Loading Record, BC0048, February 24, 2003
- Qualification Cards for S. Nance, AK Expert (AKE) and R. Tayloe (DTC Technical Specialist), provided July 19, 2007
- Project Office Data Tracking System (PTS), CTS Corrective Action Non Conformance Reporting, provided July 19, 2007
- Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant, DOE/WIPP- 02-3122, Revision 6, November 16, 2006
- Remote-Handled TRU Waste Characterization Program Implementation Plan, DOE/WIPP - 02-3214, Revision 0D
- Scaling Factor Development, Calculation Package No. SRS-RH-01 Revision 0, June 26, 2007 and Revision 2, November 6, 2007

- Dose-to-Curie Correlation for Cs-137 and Co-60, Calculation Package No. SRS-RH-02, Revision 0, June 26, 2007 and Revision 1, November 5, 2007
- Evaluation of Swipe Sample Data, Calculation Package No. SRS-RH-03, Revision 0, June 26, 2007 and Revision 1, October 26, 2007
- Source Uncertainty Using MCNP5, Calculation Package No. RSR-RH-04, Revision 0, May 16, 2007 and Revision 1, November 7, 2007
- Dose-to-Curie Spreadsheet, Calculation Package No. SRS-RH-05, Revision 0, May 16, 2007 and Revision 1, November 7, 2007
- Uncertainty Analysis, Calculation Package No. SRS-RH-06, Revision 0, May 16, 2007 and Revision 1, November 7, 2007
- ORIGEN2.2 Benchmarking for LWR Fuel, Calculation Package No. SRS-RH-07, Revision 0, May 16, 2007
- Evaluation of Different Fuel Type, Calculation Package No. SRS-RH-09, Revision 0, May 16, 2007 and Revision 1, November 5, 2007
- Evaluation of Different Fuel Type, Calculation Package No. SRS-RH-09,
- Swipe Sample Data Decay Correction, Calculation Package No. SRS-RH-10, Revision 0, June 26, 2007 and Revision 1, November 5, 2007
- Determination of Reportable Isotopes, Calculation Package No. SRS-RH-11, Revision 0, May 16, 2007 and Revision 1, November 6, 2007
- Swipe Sample Data Input Check, Calculation Package No. SRS-RH-12, Revision 0, May 25, 2007
- Fission Product Contribution to Dose Rate, Calculation Package No. SRS-RH-13, Revision 0, May 25, 2007 and Revision 1, November 5, 2007
- ORIGEN2.2 Date Extraction Program (OriOout01), Calculation Package No. SRS-RH-14, Revision 0, May 29, 2007
- TC-OP-01.4, Revisions 1 and 2
- TCP-98-05, Revision 3, Training Plan for the Battelle Columbus Laboratories Decommissioning Project (BCLDP) TRU WCP, March 3, 2003
- Training Program, TRU 100, WIPP Indoctrination for the BCLDP TRU WCP Training Program Record, Revision 2, June 15, 2000
- Work Instruction WI-958, Set Up and Packaging of Transuranic Waste in the High Energy Cell, Revision 2, April 1, 2000
- Work Instruction 956, Packaging of Transuranic Waste in the Mechanical Test Cell Addendum 1, March 1,1999
- List of Containers in Waste Stream SR-RL-BCLDP.001
- TRU Waste Packaging Loading Record Itemized Data, Container No. BC0090

- TRU Waste Packaging Loading Record Itemized Data and Audio/Visual recording, Container No. BC0070
- TRU Waste Packaging Loading Record Itemized Data and Audio/Visual recording, Container No. BC0035
- TRU Waste Packaging Loading Record Itemized Data and Audio/Visual recording, Container No. BC0051
- TRU Waste Packaging Loading Record Itemized Data and Audio/Visual recording, Container No. BC0120
- Training Record for VE Operator for Procedure TC-OP-01.4, Revision 2
- Record Inventory and Disposition System (RIDS) for BCLDP from PR-AP-17.1, Revision 5
- WIPP Waste Container Report for Canister ID0051 Housing Container Nos. 001131, 001141, and 001143
- WIPP Waste Container Report, Container No. 001131
- WIPP Waste Container Report, Container No. 001141
- WIPP Waste Container Report, Container No. 001143
- WWIS Data Entry Summary Spreadsheet, Container No. 001131
- RTR Data Sheet, Container No. 001131
- Dose-to-Curie Data sheet, Container No. 001131
- CAR/NCR Email for INL RH Lot 9
- Waste Container Data, Container No. 001117

## 8.1 Acceptable Knowledge Process Overview and Analysis

(1) Waste stream definition for SRS-CCP BCLDP waste stream SR-RL-BCLDP.001 was examined and found to be adequate following incorporation of additional information.

The WCPIP defines *waste stream* as "waste material generated from a single process or activity, or as waste with similar physical, chemical, and radiological properties." Waste Stream SR-RL-BCLDP.001 is a debris waste stream generated in the JN-1 HCL facility during D&D activities performed from May 1999 through August 2004, and was packaged in June, consisting of 87 drum liners.

The EPA inspection team evaluated the physical and radiological compositions of the waste with respect to waste stream definition to ensure they were appropriate. Several references were examined to understand the historical AK assessment of the stream, including, but not limited to, P501, C001, P023, P026, P511, P514, and U513. It was noted that the waste stream was generated solely through D&D of the JN-1 HCL, which included several areas, such as the Mechanical Test Cell, High-Energy Cell, Low-Energy Cell, Alpha-Gamma Cells, Controlled Access Area, and Charpy Room. Wastes generated included the spectrum of D&D-related

debris materials. Reference C504 summarized the WMP content within each drum liner. All waste in the drum liners had been mechanically compacted during loading to reduce void space and maximize waste packaging using a 5,000-pound weight.

It was also noted that this waste stream includes four liners that contained mop heads, as well as residual solidified materials representative of small fines or the solidification of liquids associated with mop heads and other clean-up materials. While the WMPs in these four liners are distinguishable from the remaining D&D waste population, EPA concluded that the four drums containing mop heads and related materials were generated by the same process and should contain the same general material and radiological parameters, so inclusion of the drums in the stream was appropriate. The Acceptable Knowledge Experts (AKEs) interviewed stated that no individual drum liner contained greater that 50% solidified material, so the waste summary category group (SCG) was consistent within the waste stream, as presented in reference C504.

The EPA inspection team determined that the AK record for this waste stream was initiated years prior to completion of waste packaging. For example, AK document P501 was prepared in 2001 and described at least nine separate waste types based on physical form. The EPA inspection team also found that while SRS-CCP considered the debris in this stream to have originated from a single process similar in material, chemical, and radiological properties, BCL representatives packaging the waste during the clean-up process segregated the waste into four separate groupings: hazardous combustibles; non-hazardous combustibles; hazardous non-combustibles; and non-hazardous non-combustibles. The EPA inspection team determined that additional justification and information pertinent to waste stream packaging and waste stream determination were required to better support CCP's conclusion to combine the 87 drum liners into a single waste stream.

As part of EPA's assessment of the waste stream determination, the EPA inspection team tracked and verified several elements of the AK summary (CCP-AK-SRS-500) and its references to ensure that radiological characterization performed was technically supported, with particular emphasis on AK parameters used to develop the JN-1 Standard Isotopic Mix and scaling factors. CCP-AK-SRS-500 presents the JN-1 Standard Isotopic Mix, citing P503 and U516 as among the primary references supporting the determination of this mix. However, P503 has only a general discussion of the isotopic mix determination and does not provide detailed supporting information, and U516 contains proceedings from a presentation given at a Waste Management conference in 2002. The EPA inspection team found that the memorandum documenting $^{235}U$ enrichment, burn-up, and decay was not verified through supporting references or other information. The SRS-CCP AKE stated that some of the original BCL information was not available, and that they could not produce a historic database that cataloged the radiological experiments and parameters relative to the activities within JN-1.

Some references contain worthwhile information, such as U014. The EPA inspection team also determined that the representativeness of the 69 swipe samples used to generate the radionuclide scaling factors was not adequately supported in the AK record. The EPA inspection team determined that it was necessary to better document the origin of $^{235}U$ enrichment, and the burn-up and decay values used as input to ORIGEN2.2 modeling in SRS-CCP documents. EPA

discussed the need for better documentation of the origin of $^{235}U$ enrichment with AKEs, and also issued EPA Finding No. SRS-RH-AK-07-001F, which included a number of technical elements. This was the single finding of the inspection and it is discussed in Sections 8.1 and 8.2 of this report. The aspects that pertain to waste stream determination and radiological characterization are presented below.

**EPA Finding No. SRS-RH-AK-07-001F**: This finding covers four issues. Table 3 indicates where each issue is addressed, identifies the report section where the information provided by SRS-CCP is discussed, and gives the status of the issue. For a full description of this finding, see Attachment A to this report.

**Table 3. Details of EPA Finding No. SRS-RH-K-07-001F**

| EPA Finding No. SRS-RH-AK-07-00F | Issue Summary | Report Section Where Issue is Discussed | Issue Status |
|---|---|---|---|
| Issue (a) | Completeness and adequacy of documentation for AK and radiological characterization | Section 8.1 (1), page 23 | Resolved |
| Issue (b), 1st bullet | Limit waste stream documentation to 87 drum liners at SRS | Section 8.1 (3), page 26 | Resolved |
| Issue (b), 2nd bullet | Clarify isotopic distributions | Section 8.1 (3), page 26 | Resolved |
| Issue (b), 3rd bullet | Expand discussion of radiological characteristics of waste stream | Section 8.1 (3), page 26 | Resolved |
| Issue (c) | Delineation of waste stream | Section 8.1 (1), page 23 | Resolved |
| Issue (d) | Documentation of TMU and radionuclide scaling factors | Section 8.2 (6), page 43<br>Section 8.2 (7), page 45 | Resolved |

**EPA Finding No. SRS-RH-AK-07-001F, Issues (a) and (c):** In August 2001, EPA conducted a surveillance of the BCL RH WC program. In the report sent to DOE (EPA's Technical and Regulatory Support Document for RH Waste Determination, February 2004, transmitted by EPA to DOE by Frank Marcinowski, March 26, 2004), EPA stated that "BC's RH Program could be improved through more diligent acquisition and integration of AK-based radionuclide information to determine isotopic distributions." EPA also questioned the representativeness of swipe samples collected that were later used as part of scaling factor/JN-1 isotopic mix development. EPA concluded that the "AK program data assembly/compilation elements were not complete." EPA concluded that while the radioassay approach had merit, characterization activities performed to support the approach at the time of the 2001 surveillance "were not technically adequate."

EPA's current inspection identifies the following issues related to AK and radiological characterization documentation completeness and adequacy, many of which are related to issues identified in our August 2001 surveillance:

**Issue (a):** Isotopic ratio/composition information from two primary sources was used to develop scaling factors (also the JN-1 Standard Isotopic Mix). The factors were derived from a combination of swipe sample and modeling results, using input data to the model (ORIGEN2.2) that originated in a memorandum from a 1999 meeting. As an auditable record, additional information and rationale supporting the approach is required both for the isotopic distributions based on the swipe data and the recommended burn-up, enrichment, and decay data from the 1991 memorandum. Documentation of the references and data sources that were reviewed and evaluated during the 1999 meeting is necessary to support the conclusions used by SRS-CCP. With regard to the swipe data, the sampling plan and collection, the sample numbers, sampling results, and other relevant information must be summarized to show that the sample data are sufficiently representative of the wastes within Waste Stream SR-RL-BCLDP.001.

**Issue (c):** Through the course of the AK information acquisition and interpretation process, the number of waste streams identified in JN-1 has changed over time. Specifically, the current designation of Waste Stream SR-RL-BCLDP.001 stream was originally identified as four separate waste streams. There is no information given to show these waste streams were combined into a single stream.

**EPA Finding No. SRS-RH-AK-07-001F, Issues (a) and (c) Resolution:** In response to Issues (a) and (c), SRS-CCP provided a formal resolution letter describing their approach, as well as References C510, C511, C513, and C520, three of which contain additional information pertaining to the 1999 memorandum. While the source of information for the parameter ranges in the 1999 memorandum was not cited in C511 other than to cite general text references, C520 indicates that these ranges agree with the fuel libraries associated with ORIGEN 2.2, the sources of which are documented. Reference C513 provides additional information concerning waste origin and distribution.

Reference C510 states that while a sampling plan was not found, SRS-CCP interviewed the individuals that performed the sampling and analysis, and these individuals indicated that the sampling was *authoritative* in nature. SRS-CCP representatives indicated that the samples were selected to include the widest variety of surfaces within JN-1 to ensure that all possible contaminated surfaces were tested. SRS-CCP did not provide additional information to document that this approach was compliant with the WCPIP requirements for representativeness, with the understanding that the WCPIP was not in place at the time of sample collection. Accordingly, SRS-CCP could not demonstrate representativeness of the 69 swipe samples through a statistical analysis. It is evident from the available information that these wastes were transferred and packaged without regard to the generation location within the JN-1 complex (i.e., wastes from different areas were packaged together) and thus potentially contaminating surfaces throughout the JN-1 area. Accordingly, the JN-1 sample collection locations and number of samples taken should result in a reasonable portrayal of the potential contamination of the wastes generated within the JN-1 complex.

EPA's conclusions are based upon interviews with SRS-CCP personnel, as there is no sampling plan or other documentation from the individuals who performed the sampling. To support both SRS-CCP's assessment and EPA's inspection, EPA required that SRS-CCP provide a

memorandum documenting the sampling approach prepared by BCL staff familiar with the swipe sampling at various JN-1 locations where RH debris waste was handled. EPA specifically required that this memorandum address the sampling procedure and rationale that were followed, with emphasis on the following:

(1) Guidance that was followed to develop and execute the sample collection, e.g., DOE Order, CBFO Procedure, or other guidance

(2) Sample protocols (reference the procedure(s) followed)

(3) Reason for initial sample collection and the use of 69 samples to characterize the waste, i.e., why 69 samples were considered sufficient

(4) Reason why the selected samples were considered representative, i.e., selected from a variety of surfaces that were typical of anticipated contamination in all areas

(5) Indicate if the sampling was performed prior to approval of the WCPIP, if this is the case

(6) Specify timing of sampling and the selection of the 69 sample subset

EPA determined that the lack of this information prevents EPA from independently verifying that the data from the 69 swipe samples was representative on the basis of the objective evidence presented. Also, EPA considered it necessary to have this information to support DOE's contention that 69 swipe samples are indeed representative, as discussed in Section 8.2 (2).

SRS-CCP prepared Reference C509, which documented why BCLDP personnel performed the initial waste subdivisions, and why combining four different waste categories into a single stream is appropriate and compliant with WCPIP and requirements.

The CCP responded to EPA's request in April 2008, preparing a memorandum titled "Response to EPA SRS RH Additional Information Request." In response to EPA Items 1 and 2, the memorandum stated the following:

> *The sampling protocol used to collect the smears was the routine health physics survey procedure HP-OP-019, 'Radiation and Contamination Survey Techniques' (AK source document number P751). This procedure, coupled with waste instructions, provided the documentation used by BCLDP to collect the samples. The BCLDP staff considered this procedure as equivalent to the sampling plan at the time. Waste Instruction WI-956 (AK source document number P707) is an example of a waste instruction from the 1999 time frame.*

Review of these references indicates that while HO-OP-019 (P751) certainly contains descriptions of smear survey protocols and other procedures that could also be used in characterization surveys, the document also states in Section 4.2 that "This procedure does not apply to characterization surveys, nor is it intended to alter current or future characterization surveys." Reference P707 describes waste packaging protocols for pool filters and resins that are outside of the current waste stream. The Memorandum also relies heavily on expert judgment and personnel expertise to support appropriate sample collection. In response to EPA Item 3, the Memorandum states that surveyed material, surveyed locations, and statistical analysis (Central

Limit Theorum) indicate that 69 swipe samples are "reasonable and adequate." EPA agrees that the number of samples collected should be sufficient if the initial population selected for sampling adequately captures the variability of the waste population as a whole. In response to EPA Item 4, the Memorandum reiterates information obtained by EPA during the inspection that samples were collected randomly from a variety of surfaces to capture the range of potential isotopic distributions that in the waste. The Memorandum, however, makes no statement regarding collection of samples prior to approval of the WCPIP (EPA Item 5).

EPA recognizes that smear/swipe sampling was performed during the pre-2000 time period (EPA Item 6), while EPA approved the WCPIP addressing RH waste characterization activities in 2003. The WCPIP explicitly *requires* the preparation of a sampling and analysis plan when sampling is performed (Section 4.8.1): "…A sampling plan shall be developed and documented for each RH TRU waste stream….the burden of responsibility for developing a technically sound sampling plan rests with the TRU waste generator." Since the smear samples were taken prior to the sampling and analysis (S&A) plan requirement of the WCPIP, EPA understands that compliance with all WCPIP requirements may not be possible for this waste stream.

In the future, however, EPA expects that the CCP will provide rigorous and detailed information as part of the AK Record to document as much information about waste sampling as possible (such as that provided to resolve this EPA Finding) to meet the WCPIP-based sampling requirements initially for EPA evaluation. When proposing another BCLDP RH waste stream (e.g., BCLDP solids and soil/gravel) for EPA evaluation and approval as a T1 change, the CCP must provide rigorous and detailed sampling and analysis information when CCP cannot fulfill the S&A plan requirement of the WCPIP. Based on the information provided by CCP prior to, during, and since the inspection, EPA concludes that the samples collected, together with Fuel Type Scaling Factor comparisons (discussed in Section 8.2 of this report), results in a reasonable description of the isotopic distribution sufficient to verify AK.

**EPA Finding No. SRS-RH-AK-07-001F, Issues (a) and (c) Status:** Based on the information examined, as discussed here and in Section 8.2 (7), the EPA inspection team determined that the use of the 69 swipe sample data in the manner employed by SRS-CCP resulted in sufficient information to verify isotopic distributions presented in the AK Summary and assumptions discussed later in Section 8.2 of this report. EPA considers both Issues (a) and (c) to be closed.

(2) The identification of these wastes as defense-related, TRU versus HLW, low-level waste, and SNF was examined and accepted.

CCP-AK-SRS-500 stated that the waste met the definition of defense waste, even though the vast majority of radiological material managed in JN-1 was non-defense-related. DOE agrees with SRS-CCP's justification as to the defense determination. DOE is solely responsible for the determination. EPA does not evaluate the defense determination that DOE performs for TRU waste destined for disposal at WIPP. The AK Summary stated that the waste met the definition of defense waste because defense-related naval reactor material was managed in the complex, and defense-related research and development activities took place in JN-1. The occurrence of both activities would cause the defense and non-defense material to be commingled, thus imparting a defense determination to the waste. This is also documented in Reference C501.

The AK Summary indicated that the waste did not contain wastes derived from the separation or reprocessing of constituent elements from reactor fuel, and the waste stream did not contain irradiated fuel elements withdrawn from a reactor. SRS-CCP BCLDP representatives stated that HLW is not included in this waste stream by definition. Similar to the LANL debris waste that lacked an explicit SNF pedigree (see Air Docket No. A-98-49, II-A4-89), the RH debris waste from BCLDP does not have an explicit SNF pedigree.

(3) Sufficiency of the AK summary and implementation of AK as required in Attachment A of the WCPIP were evaluated and found to be adequate upon revision of key documents.

Attachment A of the WCPIP specifies that the following be included in AK summaries:

- Executive summary
- Waste stream identification summary
- AK data and information description
- Program information
- Waste stream information
- Qualification of AK information
- Container-specific information

Attachment A of the WCPIP mandates that the data collection and analysis process should be similar to the process that is used for CH wastes. Both the content of the AK summary and sufficiency of AK implementation were assessed, and EPA determined that the AK Summary adequately addressed the main required elements of the WCPIP. The EPA inspection team, however, found discussion of additional separate waste streams within the text of the AK summary, which implies that SRS-CCP may have been seeking a broader scope of approval than what EPA determined through interview of the AKEs. EPA focused only on Waste Stream SR-RL-BCLDP.001 and limits its evaluation to that waste stream. The EPA inspection team also found the discussion in CCP-AK-SRS-500 concerning the "standard" versus "non-standard" radiological mixes and differing characterization processes confusing. The AKE indicated that this waste stream was only characterized using the JN-1 Standard Isotopic Mix and no other sampling or analysis approach was apparently used to characterize waste outside of this stream. The text of CCP-AK-SRS-500 did not include information pertaining to the general radiological content of materials managed in the JN-1 HCL, including the number of experiments associated with LWR and other reactors or related isotopic information. While the AKE indicated upon interview that only material originating from within JN-1 HCL was present in waste, AK data provided as references and in the CRR were confusing, because it was unclear how radiological data from the JN-2, JN-3, and JN-4 areas pertain to JN-1. This was discussed with SRS-CCP personnel during the inspection and EPA included this issue as a finding on the EPA Inspection Issue Tracking Form that was discussed throughout this report (see Attachment A of this report for a copy of this form). The aspects of the finding that pertain to the content of the AK Summary are presented below:

**EPA Finding No. SRS-RH-AK-07-001F, Issue (b):** EPA's current inspection identifies the following issues related to AK and radiological characterization documentation completeness and adequacy, many of which are related to issues identified in our August 2001 surveillance:

CCP-AK-SRS-500 must be revised to address the following:

- Only describe the SRS waste stream of 87 drum liners subject to this inspection.
- The document states that there are wastes in this stream that exhibit both "standard" and "non-standard" isotopic distributions, and that non-standard waste will undergo separate sampling and analysis. However, the AKE indicated that only "standard" isotopic mix wastes are included in the stream, and there are no wastes that underwent the alternative sampling and analysis approach discussed in the text.
- Include a thorough presentation of general radiological characteristics of wastes. Information such as types of radionuclides handled in JN-1 in the various cells/areas, origin of radionuclides (e.g., LWR), outliers, and any other information necessary to provide a general overview of the radionuclides handled through the course of JN-1 operations is necessary.

**EPA Finding No. SRS-RH-AK-07-001F, Issue (b) Resolution:** SRS-CCP revised CCP-AK-SRS-500, noting that the number of drum liners within the most recent version was correctly reduced to 87. SRS-CCP removed the 88$^{th}$ drum liner from consideration as it did not meet the definition of TRU waste and, hence, not eligible for WIPP disposal. Also, while additional process information and the CCP radiological characterization approach were included in Revision 1 of CCP-AK-SRS-500, the radiological data cited in the EPA finding was included in Revision 2 of CCP-AK-SRS-501. Therefore, the radiological characteristics of waste are adequately defined in the combination of the information presented in the revised CCP-AK-SRS-500 and CCP-AK-SRS-501 reports, as well as supporting references.

**EPA Finding No. SRS-RH-AK-07-001F, Issue (b) Status:** Based on the information examined, the EPA inspection team determined that the AK Summary had been adequately revised to address the above issues. EPA considers this aspect of the finding to be closed.

(4) Data traceability was examined and found to be adequate upon incorporation of additional information.

Data traceability was assessed to understand the hierarchy of information that was ultimately used by AK personnel to identify the physical and radiological parameters associated with this waste stream. SRS-CCP-BCLDP personnel provided the following information pertaining to data traceability:

- Waste Packaging Records for Liners BC0127 (Pressure Wash Filters), BC0075, and BC003 (Liner in Canister)
- Certification Paperwork for Liners BC0127 (Pressure Wash Filters), BC0075, and BC003 (Liner in Canister)
- HP Survey Report for Liners BC0127 (Pressure Wash Filters), BC0075, and BC003 (Liner in Canister)

- CCP-AK-SRS-501, Appendix 3, Waste Container Dose to Curie Conversion Records (All 87 Drum Liners)
- Calculation Packages P729, P7353, and P737

This waste stream did not have individual records pertaining to isotopic characteristics of individual containers (i.e., data that associated the 69 swipe samples with specific containers or campaigns were not available, and individual drum data except for drum loading travelers were not available). The AKE stated that the liners were not typically packaged in the same room or cell where the wastes were generated, so there could be no correlation between wastes and their generation point. However, VE records document the origin of individual waste items within the liners and shows that multiple areas may have contributed to the waste in an individual drum liner. Typically for CH TRU wastes, EPA evaluates traceability of radiological measurements of waste containers (drums) during the on-site inspection. In the case of this RH waste stream, the measurements used to support the WC are historical, which complicates the data traceability evaluation. Assessing data traceability is necessary to understand the origin and hierarchy of radionuclide and physical data associated with each canister. See Sections 8.1 (1) and 8.1 (2), above, regarding deficiencies with respect to radionuclide data traceability and supportability.

(5) Sufficiency of AK support documents and related document tracking was evaluated and was found to be adequate.

A list of AK source document references was prepared using unique identifiers for the different document types following the format used by SRS-CCP for CH wastes. The listing is based on CCP-TP-005 Revision 18, Attachment 4. The listing was complete and was easy to understand, because it followed the same format used for CH waste streams. Several AK support documents were referenced in the text and these documents address the specific element or issue with the AK summary, although applicability does vary. EPA only examines support documentation specific to the technical element referenced in the AK summary that caused that support reference to be selected for examination.

(6) Interpretation of WCPIP was evaluated with respect to contents of the Certification Plan, the CTP and the proposed characterization process and was found to be adequate.

EPA's RH WCPIP framework approval letter dated March 26, 2004, indicated that sites must generate a Certification Plan that explains how RH waste characterization will take place at each site, as well as a CTP. Based on the previous RH inspection experience, EPA determined that combining the Certification Plan and CTP in a single document that described the proposed characterization process would satisfy the EPA requirements. In this instance, however, EPA observed that language within the CTP is sometimes confusing, as indicated in Item 7 below.

(7) Content and technical adequacy of the CTP was evaluated and found to be adequate.

The WCPIP requires a description of the following items to be included in the CTP:

- The waste stream or waste stream lots to which the plan applies

- The confirmatory testing proposed, including the percentage of waste containers that will be subject to confirmatory testing
- The WC DQOs and quality assurance objectives (QAOs) that will be satisfied with the data being qualified
- The DQOs and QAOs that will not be confirmed with the data being qualified and an explanation of how compliance with those DQOs and QAOs will be demonstrated
- How the tested subpopulation is representative of the waste stream or waste stream lot

The required bullets listed above are addressed in the CTP. In the case of this waste stream, the CTP also includes a discussion pertaining to AK accuracy and related DQOs. Because this specific waste stream deals solely with AK-based WC, an evaluation of AK accuracy is not applicable (other than to document this statement in an AK accuracy memorandum and within the CTP). Also, EPA has noted that the use of the term *confirmation* is sometimes confusing in that EPA regards confirmation to mean actual radiological measurement data or estimation of physical contents of a waste container to confirm AK information, but CCP has sometimes used the term in a broader sense when verification activities take place. EPA understands that the form and substance of the CTP is designed to meet the requirements stated in the WCPIP, but care should be exercised in future RH site documentations with regard to the use of the term *confirmation*.

(8) Content and technical adequacy of the CRR was evaluated and the process was found to be adequate as using example data provided for this inspection.

The EPA inspection team evaluated the CRR against requirements in CCP-TP-506, Revision 1, for Waste Stream SR-RL-BCLDP.001 to evaluate if this report reflected the requirements of CCP-TP-506, and to ensure that the CRR addressed requirement elements as specified in the WCPIP, including the following:

- Specification of applicable site and waste stream
- A listing of each DQO
- Data from the AK record that addresses each DQO
- AK source document references that support/provide the data
- A listing of AK record DRs relevant to each DQO, if any
- Documentation, including specific references, of how the AK data for each DQO were qualified, such as batch data reports, corroborative data, proceedings of a peer review, etc.
- Real Time Radiography (RTR) and/or VE summary to document that liquids greater than 1% are absent from the waste and to confirm AK concerning the physical properties of the waste
- A summary presentation of radiological measurement data used to meet the DQOs and to confirm AK

- A complete AK summary
- A complete listing of all container identification numbers used to generate the Waste Stream Profile Form (WSPF), cross-referenced to each BDR
- A listing of AK discrepancies generated by an AK qualification process and the corresponding resolutions
- Signature of the Site Project Manager (SPM)

The example CRR that the EPA inspection team examined included all of the above WCPIP requirements. As had been observed previously for the RH WC programs at INL and Argonne National Laboratory-East (ANLE) (see Docket Nos. A-98-49, II-A4-72 and A-98-49, II-A4-73, respectively), the CRR DQO worksheet (Attachment 3 of CCP-TP-506) for this RH waste stream did not include a listing of the 10 WIPP-tracked radionuclides as part of the DQO assessment process. These radionuclides need to be specified, quantified, and assessed as part of the CRR. In the past, site representatives declined to specifically address these because it is not required by the WCPIP. However, EPA requires information for the 10 WIPP-tracked radionuclides and the CRR generated at other CCP RH TRU sites must include the ten radionuclides. The reason for this is that for the WIPP Performance Assessment performed in conjunction with the WIPP Repository Recertification every 5 years, identification and quantification of the 10 WIPP-tracked radionuclides is essential.

Radiological characterization BDRs are not prepared, because the characterization is performed based solely on AK. However, SRS-CCP documents the compliance of each container with DQOs and other SPM approvals (signatures) on Attachments 1 and 2 of CCP-TP-506, and the results of this analysis are rolled up into Attachments 3 and 4 of CCP-TP-506. The EPA inspection team usually examines these individual attachments to ensure that complete, drum-specific documentation is kept for each container throughout the process, and to ensure that this information is adequately "rolled up." During this inspection, only the single example draft attachment was available. SRS-CCP personnel stated that data will be manually downloaded from CCP-AK-SRS-501 into a WWIS controlled spreadsheet. When such data are entered manually, DOE needs to provide to EPA for review a copy of the WWIS spreadsheet showing manual data entries.

(9) Use of a Correlation and Surrogate Summary Form was evaluated and was found to be adequate.

Completion of a Correlation and Surrogate Summary Form is required when AK information from a related CH waste stream is used in the RH WC. The CCP AKE stated that to date, no CH surrogate container has been identified pertinent to this waste stream.

(10) Personnel training was evaluated and found to be adequate.

Training records for Sherri Nance and Rob Tayloe were examined. Ms. Nance's training was evaluated with respect to training to the RH TRU WCPIP, non-conformance and corrective action processes, the AK procedure presented in Attachment A of the WCPIP, site-specific training relative to the contents of the subject waste stream(s), and determination of radiological

contents of individual drums. The Qualification Card examined demonstrated training in each area except for non-conformances (which should be not applicable for this waste stream) and the determination of the radiological contents of each drum. Where detailed radiological analysis and expertise are required, Messrs. Jene Vance and Rob Tayloe performed those tasks. The expertise of Messrs. Vance and Tayloe was examined and Mr. Tayloe's resume was reviewed, since he was the CCP technical expert for radiological characterization. Although Mr. Tayloe did not show direct training with respect to this area, his resume showed considerable expertise suitable to demonstrating proficiency. In summary, the evaluated AKE and the radiological Subject Matter Expert demonstrated the necessary level of knowledge in the area of radiological assessment through on-the-job training.

(11) Discrepancy Resolution (DR) Forms were examined and found to be adequate.

Because measurement data were not collected for this waste stream and all characterization is based on AK, Non Conformance Reports (NCRs) were not created. Instead, issues identified were AK-AK in nature, so DR forms were created. DR numbers DR001 through DR0010 were provided within the CRR. The forms provided detail AK-AK discrepancies dealing with radiological data in JN-4, transfer pool construction dates, WMP percentage recalculation, evaporation of JN-1 pool water, analytical data pertaining to the JN-1 pool (not included in this waste stream), Resource Conservation and Recovery Act (RCRA) code assignment, waste generation parameter discrepancies, and JN-1 pool water prefilter radiological data (not included in this waste stream). Most of these documents were prepared prior to the current SRS-CCP documentation process, and the documents adequately address the DR process. When SRS-CCP addresses items 1 and 3 above, discrepant data may be identified that require resolution or at least documentation. When this occurs, EPA expects that all discrepancies identified will be documented on DR forms with the appropriate supporting documents, and that this information (if generated) will be placed in the AK record and provided to EPA for review.

(12) A WSPF was examined and was found to be adequate.

An example WSPF was examined for Waste Stream SR-RL-BCLDP.001. The form included the required items as presented in the WCPIP, Attachment 4; the CRR and RH AK summary are also required for submission to CBFO to allow assessment of the WSPF. EPA understands that this form was abbreviated, because it was provided for inspection purposes only, and expects that the completed form will include more AK data, checklists (as applicable), etc., to better present the required information. EPA expects to receive the completed WSPF for review when available.

(13) AK accuracy was assessed for applicability and was adequately addressed in the context of this waste stream.

The WCPIP requires determination of AK Accuracy in three areas: reassignment of the waste to a different SCG; reassignment of the waste to a different waste stream; and stream-specific assessment of radiological parameter accuracy. In the case of Waste Stream SR-RL-BCLDP.001, all characterization was based on AK alone, so an accuracy determination based on measurement versus AK comparisons cannot be performed. SRS-CCP included a discussion of AK Accuracy in the CTP and an AK Accuracy Memorandum. In this document, SRS-CCP cites

comparisons of the modeling/sampling and AK data with respect to TRU waste determination qualification. CCP-AK-SRS-502 states that TRU waste determination qualification is accomplished through comparison of AK and drum liner (also AK) measurement results, while activity determination qualification was accomplished through AK-based modeling and AK sampling results. CCP-AK-SRS-502 also states that AK Accuracy DQOs for residual liquid and physical form are demonstrated through packaging records. While the comparisons do show that AK data are in agreement in the cited examples, the information does not address AK Accuracy, which addresses the comparison of confirmatory measurement data and the AK record. Therefore, EPA concludes that AK Accuracy cannot be assigned for this waste stream, because confirmatory sampling and analysis information were not obtained and, therefore, there is no information on which to base an assessment of AK Accuracy.

(14) The use of load management for this waste stream was assessed and was determined to be not applicable at this time.

The possibility that containers have TRU concentrations less than 100 nCi/g was evaluated. None of the drum liners were reported to have TRU concentrations less than 100 nCi/g. The SRS-CCP SPM stated that this waste stream will not undergo load management, so approval of a load management by EPA is not requested. Since these drum liners are not likely to be opened for repackaging or adding other TRU waste, EPA expects load management not to occur. In a highly unlikely event SRS-CCP considers load management, compliance with Appendix E of the TRU Waste Acceptance Criteria (WAC) is necessary.

## 8.2 Radiological Characterization

EPA evaluated the method by which the required radiological constituents for each waste container were determined. The nature of RH TRU wastes presents some difficulty with respect to obtaining meaningful measurement data, as is routinely done with CH TRU. Apart from the obvious personnel concerns associated with working in external radiation fields in excess of 200 millirem per hour (mrem/hr), RH TRU waste containers typically contain concentrations of energetic photon emitters, i.e., $^{137}Cs$ and/or $^{60}Co$ that prevent a meaningful measurement-based isotopic determination. Accordingly, RH radiological characterization relies heavily on alternate methods such as the development of scaling factors that can correlate an easily measured parameter like external exposure (dose) rate with isotopic distributions for target radionuclides.

**Overview of SRS Radiological Characterization Program**

SRS-CCP's approach to radiological characterization is generally consistent with the requirements and guidance provided in the WCPIP. The overall approach to radiological characterization SRS-CCP used for the BCLDP RH waste has several elements in common with the RH characterization approach EPA observed in the LANL-CCP RH program during EPA inspection No. EPA-LANL-CCP-RH-5.07-8 (see Docket No. A-98-49, II-A4-89). During this RH inspection, the EPA inspection team evaluated the conceptual bases of the characterization approach, including:

- Evaluation of radiochemical analyses of 69 swipe or smear samples taken in the JN-1 facility to support the development of scaling factors using ORIGEN2.2 results
- Development of a DTC correlation as a function of waste density using Microshield® based on each waste liner's measured external exposure (dose) rate, assuming the main contributor to the external exposure was $^{137}Cs$
- Derivation of radionuclide scaling factors for the WIPP-tracked radionuclides using ORIGEN2.2 based on the attributes of LWR fuels

With the exception of the use of radionuclide data from the swipe samples, these techniques have been evaluated in detail during previous RH inspections. For a thorough evaluation of the conceptual basis and application of DTC and the development and application of scaling factors, the reader is directed to the baseline inspection reports for these RH inspections (see Docket Nos. A-98-49, II-A4-72; A-98-49, II-A4-73; and A-98-49, II-A4-89). These characterization methods used for the BCLDP SRS RH wastes were evaluated in terms of the technical adequacy of the approach as supported by the SRS-CCP WC program's documents, procedures, and controls, and the knowledge and understanding of the personnel involved in the RH WC program.

**Technical Evaluation**

The EPA inspection team evaluated the following aspects:

(1) The technical adequacy of the radiochemical swipe data was evaluated and was found to be adequate.

CCP-SSR personnel stated that between 1996 and 1999 hundreds of swipe samples were taken from various areas within the JN-1 Facility as part of the site's routine contamination control program. These samples were collected periodically, depending on the conditions or activities within the facility. Some of the swipe samples were also used to identify the radionuclide content of the subject waste stream and thee swipe sample assay results were used to support the derivation of radionuclide scaling factors. During these surveys, surfaces were identified for the collection of one or more swipe samples of floors, work surfaces, equipment, waste containers and tools that were subsequently submitted for radiochemical analysis. Table 4-2 of CCP-AK-SRS-501 lists the types of surfaces within JN-1 that were swiped. This process produced a total of 47 of swipes and 22 additional samples from high-efficiency particulate air filters from the ventilation system servicing areas within the JN-1 HCL for a total of 69 samples that were submitted for a suite of radiochemical analyses. The analyses consisted of: alpha spectrometry for isotopes of americium, uranium, plutonium and thorium[10]; gamma spectrometry for specific isotopes of cobalt, cesium, europium and antimony; and liquid scintillation counting for the beta-emitting $^{90}Sr$.

The EPA inspection team did not observe objective evidence documenting the purpose for which the swipes were taken, although SRS-CCP personnel stated they were collected to support the

[10] SRS-CCP records do not indicate the specific methodology used to quantify $^{244}Cm$ and $^{237}Np$ although alpha spectrometry is the usual analytical approach used to identify and quantify these radionuclides.

development of radionuclide scaling factors, as stated in CCP-AK-SRS-501. SRS-CCP records indicate that while many of the 10 WIPP-tracked radionuclides were among the list of target radionuclides some were not, specifically $^{241}Pu$[11] and $^{242}Pu$. SRS-CCP personnel stated that the radioanalytical values in CCP-AK-SRS-501 represent all the available values, and that it is possible that all 69 swipe samples were analyzed for the full list of target radionuclides but not all samples showed measurable values for these radionuclides. Accordingly, although 69 swipe samples were analyzed for $^{238}Pu$, $^{60}Co$ and $^{90}Sr$, the analytical results showed 69 measurable values for $^{238}Pu$, 61 measurable values for $^{60}Co$ and 13 measurable values for $^{90}Sr$. Analytical results that were not detected, i.e., below the assay system's lower limit of detection (LLD)[12] for a specific radionuclide, are not available. The numbers of usable values based on these analyses are shown in Table 4, below. Because the EPA inspection team was unable to determine how many swipe samples were taken in JN-1, it is not possible to establish what fraction of the total sampling effort within the JN-1 facility the 69 samples represent, which has bearing on the samples' representativeness, as discussed in Sections 8.1 (1) and 8.2 (2), below. Based on the available information the EPA inspection team accepted that the 69 analytical results that are available constitute all useable radionuclide values discussed in Section 8.1 above and item (2), below.

**Table 4. Summary of the Reported Radionuclides in the 69 Smear Samples**

| Radionuclide | Number of Samples Analyzed | Number of Values Above MDA | Number of Values Below MDA |
|---|---|---|---|
| $^{241}Am$ | 69 | 69 | 0 |
| $^{244}Cm$ | 69 | 69 | 0 |
| $^{238}Pu$ | 69 | 69 | 0 |
| $^{239}Pu/\ ^{240}Pu$ | 69 | 69 | 0 |
| $^{60}Co$ | 69 | 61 | 8 |
| $^{154}Eu$ | 69 | 54 | 15 |
| $^{134}Cs$ | 69 | 49 | 20 |
| $^{233}U/\ ^{234}U$* | 29 | 24 | 5 |
| $^{90}Sr$ | 13 | 13 | 0 |
| $^{238}U$* | 29 | 13 | 16 |
| $^{235}U/^{236}U$ | 29 | 4 | 25 |
| $^{237}Np$ | 24 | 4 | 20 |
| $^{230}Th$ | 24 | 12 | 12 |
| $^{125}Sb$ | 69 | 8 | 61 |

* Two anomalous uranium results were removed from population

The analyses were conducted by a commercial laboratory (Data Chem) and by BMI. The criteria for deciding where the samples were analyzed are not clear but available information suggests that BMI performed all of the gamma spectrometry analyses, Data Chem performed the early

[11] $^{241}Pu$ is not one of the 10 WIPP-tracked radionuclides but it may be useful in developing radionuclide scaling factors.

[12] Although they are technical different, in this context the term *LLD* is taken to be synonymous with Minimum Detectable Activity (MDA).

alpha spectrometry analyses and BMI performed the later alpha spectrometry analyses. No formal evaluation of the Data Chem and BMI radioanalytical data provided by SRS-CCP was deemed unnecessary. Both laboratories provided report sheets that were reviewed during the inspection and examples of these are included in attachments to CCP-AK-SRS-501. The EPA inspection team reviewed a sampling of these data sheets for gamma spectrometry, alpha spectrometry and isotopic uranium from BMI and all were adequate. The swipe data are technically adequate and sufficiently documented to support the development of radionuclide scaling factors.

(2) Representativeness of Radiochemical Swipe Data

The degree to which the 69 swipe samples that were subjected to radiochemical analysis are representative of the wastes that were handled within the JN-1 HCL is of key importance [see Section 8.1, (1), above]. Specifically, the contamination on the swipes must represent the types and characteristics of fuel rods that were handled in JN-1 to technically support the scaling factor development presented in CCP-AK-SRS-501. As discussed above, apart from the analytical results, initially SRS-CCP did not produce additional objective evidence to support the design or intent of the sample collection and analysis process. The most important piece of documentation would be a sampling plan, which would ideally discuss the measures taken to ensure that the samples collected were indeed representative of the materials used within the sampled area. Similarly, detailed information on the types and characteristics of fuel rods that were handled in the JN-1 was not available. Without this information, EPA cannot confirm that the areas/materials that were swiped are representative of the fuels that were handled in JN-1 on the basis of documentation. Accordingly, the EPA inspection team concluded during the July 2007 inspection, that SRS-CCP's contention that the swipes are representative was not adequately supported. This was discussed with SRS-CCP personnel during the inspection and EPA included this in the EPA finding discussed throughout this report.

In the absence of documentation regarding sample collection, the EPA inspection team focused on an empirical determination to address the issue of representativeness. Because exact information regarding the contribution of the fuels handled within JN-1 was unknown, the average scaling factors for all fuel types, i.e., LWR, highly enriched uranium (HEU) and thorium, were plotted against the scaling factors derived from the swipe data and the application of ORIGEN2.2. The comparison is shown in Figure 5-1, of CCP-AK-SRS-501 and is reproduced in this report as Figure 2, below. This plot indicates good agreement between the results of the swipe analyses and the characteristics of LWR fuel for the majority of the radionuclides, with the exception of $^{230}$Th, the uranium isotopes and $^{154}$Eu. SRS-CCP personnel stated that these differences can be explained based on: a lack of equivalent data for $^{230}$Th; the unexpected processing of unirradiated fuel which would skew the uranium values; and, simple radioactive decay of $^{154}$Eu due to its shorter physical half-life. These issues are discussed in detail in CCP-AK-SRS-501, Revision 2.

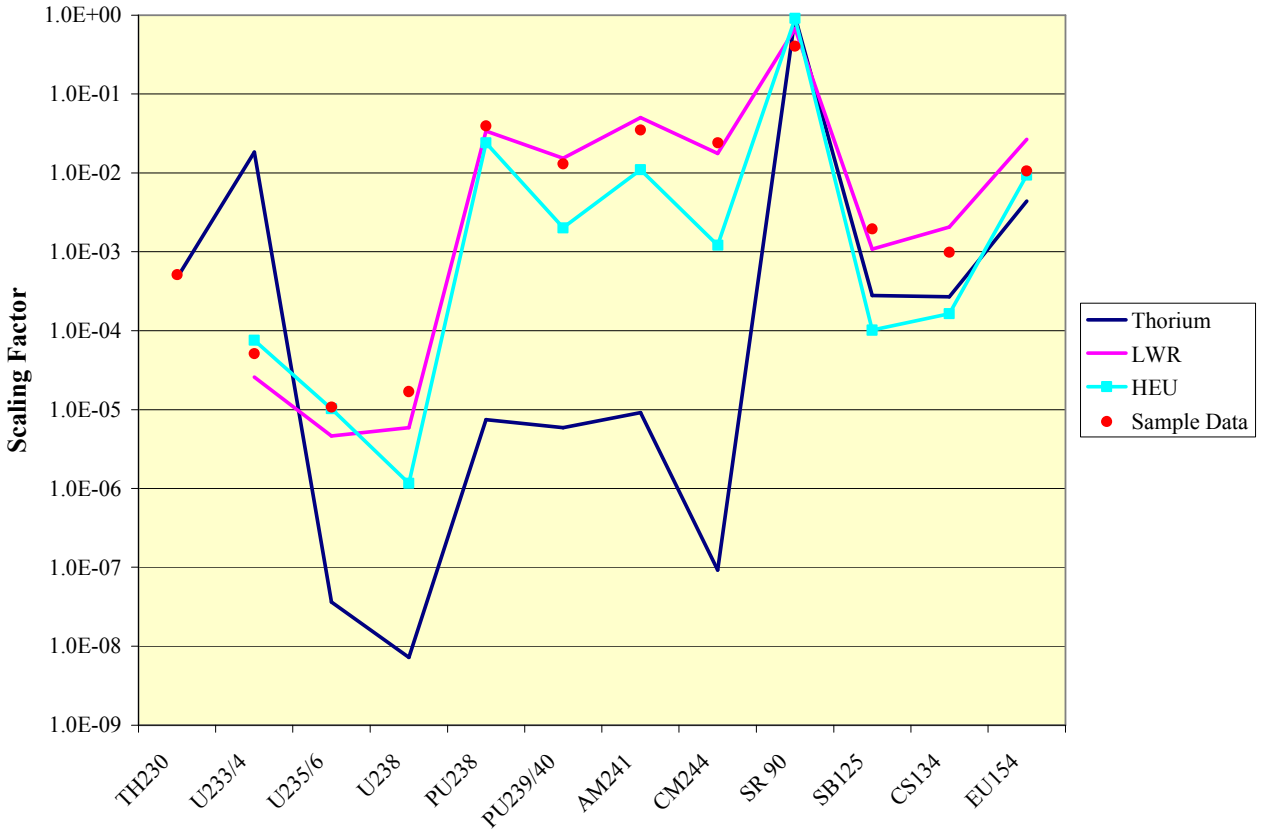


**Figure 2. Comparison of Scaling Factors Representative of Different Fuel Types Against Average Smear Sample Scaling Factors**

Upon examination during and after the inspection, the EPA inspection team personnel agreed that the empirical demonstration shown in Figure 2, below, had considerable technical merit. EPA's acceptance of SRS-CCP's assertion of representativeness is based on the technical merit of the empirical demonstration, as discussed in the preceding paragraph. EPA inspection team personnel revisited this issue following revision of CCP-AK-SRS-501 and the other documents discussed in Section 8.1 (1), above, during the July and December 2007 meetings. The revised documents provide additional details relative to the representativeness of the swipe samples. However, the lack of specific information regarding the design or intent of sample collection is a weakness. In the future, when sample collection plays as important a role in a site's RH WC program as it does for this waste stream, EPA will require that the site provide a sampling plan as required as part of EPA's site procedures review and approval prior to the baseline inspection. Based on the strength of the empirical demonstration supported by the revised documents, EPA agrees that there is sufficient support for SRS-CCP's contention that the swipes are representative of the attributes of LWR. Also, as discussed in Section 8.1 above, based on the additional documentation provided by CCP, EPA concurs that the 69 swipe samples are representative of the different fuel types handled in the hot cell.

(3) The development of radionuclide scaling factor was evaluated and found to be technically adequate.

In the absence of specific fuel irradiation data, information regarding the fuels materials' $^{235}U$ content, burn-up and decay was selected based on the assumption that the majority of the TRU materials within the JN-1 facility were LWR fuels. Ranges for these parameters were developed in 1999 [see Section 8.1 (1)] as input for 1000 ORIGEN2.2 calculations, the results of which were used to derive radionuclide scaling factors for $^{241}Am$, $^{238}Pu$, $^{239}Pu$, $^{240}Pu$, $^{241}Pu$, $^{242}Pu$, $^{234}U$, $^{235}U$, $^{238}U$ and $^{60}Co$ plus the fission product $^{154}Eu$. These scaling factors were compared with radionuclide-specific data generated by the radiochemical analysis of 69 swipe samples that were collected from locations inside the JN-1 facility, as discussed in the previous section. The scaling factor for $^{233}U$ was developed exclusively on the basis of the $^{234}U$ results of the swipe sample analyses, as discussed below. The determination of $^{154}Eu$ and $^{60}Co$ was necessary to account for their potential contribution to the measured dose rate and to identify all radionuclides that contribute to 95% of each liner's radiological hazard[13].
The EPA inspection team evaluated the following aspects:

- Activity values that are used are derived from modeling and statistical metrics that support their use, and the statistical metrics include mean and standard deviation values for each measured radionuclide.
- The appropriateness of the choice of physical constants and radionuclide-specific attributes (specific activity, physical half-life, decay heat, neutron cross-sections, photon transition probabilities, etc.) and the technical correctness of the values assigned to each attribute.
- Isotopic activity values are correlated to each drum liner's major radionuclide content(s) responsible for the measured external dose rate, i.e., $^{137}Cs$ and $^{60}Co$.
- The calculated results used to develop the factors and convert the measured external dose rates to radionuclide activity levels.
- Calculations supporting the scaling factors were performed using appropriate shielding analysis techniques, i.e., Microshield®.

Regarding the second bullet, above, Revision 1 of CCP-AK-SRS-501 did not cite the source of the specific activity and physical half-life values, although SRS-CCP personnel stated that these values were taken from the CH TRAMPAC. The lack of this reference was included in EPA Finding No. SRS-RH-AK-07-001F, which is discussed in Section 8.2 (7), below. All references were appropriately cited in Revision 2 of CCP-AK-SRS-501 that the EPA inspection team reviewed during the December 2007 meeting, which closed this part of the finding.

The purpose of a radionuclide scaling factor is to provide a technically sound method of deriving values for the 10 WIPP-tracked radionuclides within each container based on the container's

[13] Although the determination of a waste container's radiological hazard is not an EPA requirement, this information may be useful in understanding other aspect of a container's radiological characterization.

measured external dose rate. ORIGEN2.2 was used to derive scaling factors for all of the reportable radionuclides based on the ranges of the three parameters listed below as input:

- $^{235}U$ enrichment – 2.0 to 4.0 (weight percent)
- Burn-up – 15k through 45k
- Decay (years post-irradiation to 2002) – 13 through 30

These ranges were based on the assumption that the materials processed in the JN-1 HCL were predominantly LWR fuels, which is discussed earlier in this report. With the exception of $^{233}U$, the scaling factor for each radionuclide was determined by taking the arithmetic mean of 1000 ORIGEN2.2 runs. The treatment of $^{233}U$ is addressed below. The scaling factors are multiplied by the $^{137}Cs$ concentration, which is derived based on the measured dose rate of each drum and the DTC technique discussed below. The mass (gram) quantities of the actinides were extracted from the ORIGEN2.2 output results along with the activity (curie) quantities of the fission products. Mass and activity values can be converted interchangeably using the specific activity values provided in the Contact-Handled Transuranic Waste Authorized Methods for Payload Control (CH-TRAMPAC). The average scaling factors representing the total fuel pin population were calculated by taking the ratios of the average curies of each radionuclide to the average curies of $^{137}Cs$ in a metric ton of fuel. These averages are the actual scaling factors used to derive the quantities and distribution of the radionuclides for all 87 drum liners in this population of BCLDP RH wastes. The standard deviation for each radionuclide was used to calculate the relative standard error associated with its variation in the fuel compositions. CCP-AK-SRS-501, Table 6-1, lists the scaling factors derived in this manner for each of the radionuclides that was used to characterize the 87 drum liners. This table is reproduced as Table 5, below, and lists the scaling factors in units of curies of each radionuclide per curie of $^{137}Cs$ (Ci/Ci $^{137}Cs$).

The scaling factor for $^{233}U$ was developed from the geometric mean of the swipe sample data discussed in a previous section. Because the analytical technique of alpha spectrometry is unable to resolve the peaks of $^{233}U$ and $^{234}U$, the $^{233}U$ activity would be reported as $^{234}U$, a value that includes both $^{233}U$ and $^{234}U$. To provide an upper estimate of both radionuclides, the scaling factor derived for $^{234}U$ based on the swipe sample data is used for $^{233}U$ also.

**Table 5. Radionuclide Scaling Factors**

| Radionuclide | Scaling Factor, Ci/Ci $^{137}$Cs |
|---|---|
| U-233 | 5.12E-05 |
| U-234 | 2.59E-05 |
| U-235 | 3.58E-07 |
| U-238 | 5.89E-06 |
| Pu-238 | 3.41E-02 |
| Pu-239 | 5.83E-03 |
| Pu-240 | 9.48E-03 |
| Pu-241 | 6.87E-01 |
| Pu-242 | 3.01E-05 |
| Am-241 | 5.00E-02 |
| Cm-244 | 1.76E-02 |
| Co-60 | 2.27E-02 |
| Sr-90 | 6.77E-01 |
| Y-90 | 6.77E-01 |
| Cs-137 | 1.00E+00 |
| Ba-137m | 9.46E-01 |

(4) The DTC Correlation was evaluated and found to be technically adequate.

The DTC correlation was based on the following assumptions:

- The waste density was uniform within the liner.
- All liners were nearly completely filled with waste material.
- An iron matrix is the most representative, i.e., photon attenuation is primarily a function of the matrix density rather than composition.
- The vast majority of the measured external exposure rate consists of $^{137}$Cs and/or $^{60}$Co.

Using Microshield®, SRS-CCP developed a DTC correlation for the drum liner configuration illustrated in Figure 1 and expressed it in terms of Roentgen per hour per curie of $^{137}$Cs (R/hr/Ci of $^{137}$Cs). This was based in large part on the shielding calculations for a BCLDP liner filled with RH TRU waste assuming a 1curie source of either $^{137}$Cs or $^{60}$Co uniformly distributed about the waste. Figure 3, below, shows the results of these calculations and the polynomial fit to the calculated data for $^{137}$Cs and $^{60}$Co as a function of waste density. This plot is a composite of Figures 3 and 4 from SRS-RH-02, Revision 1, and is also presented in CCP-AK-SRS-501 as Figure 7-3.

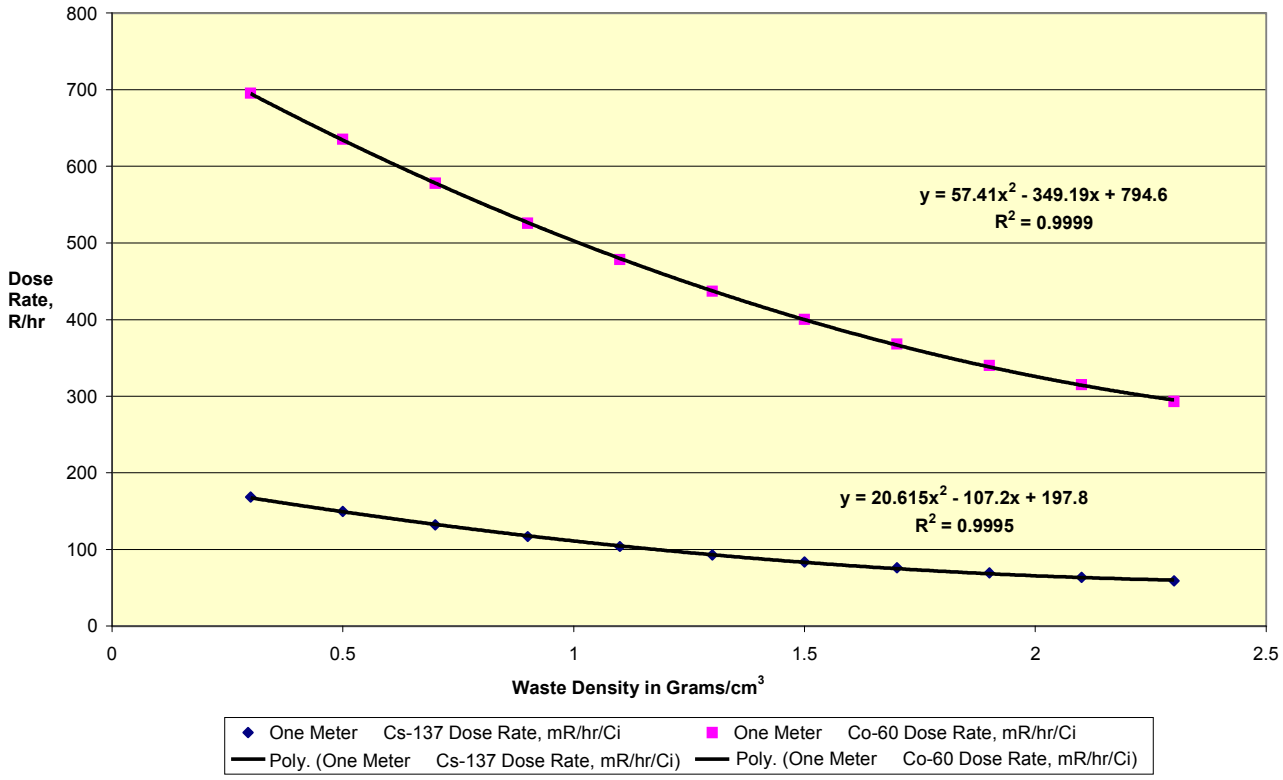


**Figure 3. DTC Correlations as a Function of Waste Density at a Distance of 1 meter Centered on a RH TRU Drum Liner**

The DTC calculations were performed using an EXCEL spreadsheet using the container's gross weight, the estimated fill percentages, and the two dose rate measurements as input. An example of the DTC spreadsheet is shown in Figure 4 for an actual BCLDP RH-TRU waste drum liner, using measured dose rates and container weights from 2002 and the more recently developed radionuclide scaling factors described above. The uncertainties shown in the spreadsheet are associated with this drum liner and indicate the relative magnitude of the overall uncertainties in each of the radionuclide quantities listed on the spreadsheet.

**Waste Container Dose-to-Curie Conversion Record**

DTC Spreadsheet Version 1 102307

| | | |
|---|---|---|
| Date of Survey | 8/22/2002 | |
| Waste Stream Designation | SR-RL-BCLDP.001 | |
| Container Number | BC00AA | |
| Container Gross Weight | 147.4 | kg |
| Estimate Fill Percentages | 100 | % |
| Container Net Weight | 46.7 | |
| Measured Container Dose Rate | | |
| Detector #1 | 100 | mR/hr |
| Detector #2 | 100 | mR/hr |
| Calculated Average Dose Rate | 100 | mR/hr |

| Nuclide | Curie Scaling Factors | Activity (Ci) | Grams | FGE | PECi | Watts | Uncertainty | Uncertainty in Curies | Uncertainty in Grams |
|---|---|---|---|---|---|---|---|---|---|
| **U-233** | **5.12E-05** | 2.81E-05 | 2.88E-03 | 2.59E-03 | 7.21E-06 | 8.18E-07 | 164.41% | 4.62E-05 | 4.73E-03 |
| **U-234** | **2.59E-05** | 1.42E-05 | 2.25E-03 | 0.00E+00 | 0.00E+00 | 4.09E-07 | 85.55% | 1.22E-05 | 1.92E-03 |
| **U-235** | **3.58E-07** | 1.96E-07 | 8.97E-02 | 5.77E-02 | 0.00E+00 | 5.42E-09 | 101.10% | 1.99E-07 | 9.07E-02 |
| **U-238** | **5.89E-06** | 3.24E-06 | 9.52E+00 | 0.00E+00 | 0.00E+00 | 8.20E-08 | 65.33% | 2.11E-06 | 6.22E+00 |
| **Pu-238** | **3.41E-02** | 1.87E-02 | 1.08E-03 | 1.22E-04 | 1.70E-02 | 6.20E-04 | 76.34% | 1.43E-02 | 8.26E-04 |
| **Pu-239** | **5.83E-03** | 3.20E-03 | 5.09E-02 | 5.09E-02 | 3.20E-03 | 9.92E-05 | 64.30% | 2.06E-03 | 3.27E-02 |
| **Pu-240** | **9.48E-03** | 5.21E-03 | 2.27E-02 | 5.10E-04 | 5.21E-03 | 1.62E-04 | 62.80% | 3.27E-03 | 1.42E-02 |
| **Pu-241** | **6.87E-01** | 2.90E-01 | 2.79E-03 | 6.28E-03 | 5.69E-03 | 9.23E-06 | 79.63% | 2.31E-01 | 2.22E-03 |
| **Pu-242** | **3.01E-05** | 1.65E-05 | 4.16E-03 | 3.12E-05 | 1.50E-05 | 4.87E-07 | 88.12% | 1.46E-05 | 3.67E-03 |
| **Am-241** | **5.00E-02** | 3.04E-02 | 8.76E-03 | 1.64E-04 | 3.04E-02 | 1.02E-03 | 76.10% | 2.31E-02 | 6.66E-03 |
| **Cm-244** | **1.76E-02** | 7.85E-03 | 9.60E-05 | 8.64E-06 | 4.13E-03 | 2.70E-04 | 152.91% | 1.20E-02 | 1.47E-04 |
| **Cs-137** | **1.00E+00** | 4.85E-01 | 5.51E-03 | 0.00E+00 | 0.00E+00 | 5.36E-04 | 54.30% | 2.63E-01 | 2.99E-03 |
| **Ba-137m** | **9.46E-01** | 4.59E-01 | 8.53E-10 | 0.00E+00 | 0.00E+00 | 1.81E-03 | 54.30% | 2.49E-01 | 4.63E-10 |
| **Sr-90** | **6.77E-01** | 3.26E-01 | 2.36E-03 | 0.00E+00 | 0.00E+00 | 3.78E-04 | 55.75% | 1.82E-01 | 1.32E-03 |
| **Y-90** | **6.77E-01** | 3.26E-01 | 5.99E-07 | 0.00E+00 | 0.00E+00 | 1.80E-03 | 55.75% | 1.82E-01 | 3.34E-07 |
| **Totals** | | 1.95E+00 | 9.71E+00 | 1.18E-01 | 6.57E-02 | 6.70E-03 | | | |

| | Value | (one Sigma) | |
|---|---|---|---|
| TRU Alpha Activity Concentration | 1.23E+03 | 6.55E+02 | nCi/g |
| TRU Alpha Activity | 5.75E-02 | 3.06E-02 | Ci |
| Total Pu-239 Equiv Activity | 6.57E-02 | 3.57E-02 | Ci |
| Total Pu-239 Fissile Gram Equiv | 1.18E-01 | 7.39E-02 | g |
| Total Decay Heat | 6.70E-03 | 3.62E-03 | W |
| Volume Activity | 1.72E-02 | 9.69E-03 | Ci/L |

**Figure 4. Example Waste Drum DTC Conversion Record**

(5) The definition of this RH waste stream was assessed and found to be adequate.

This inspection focused on a group of 87 drum liners of RH wastes that SRS-CCP stated were contained in a single waste stream, all of which were generated from the D&D of the JN-1 HCL under the BCLDP. The EPA inspection team concluded that the assignment of all 87 RH drum liners to a single waste stream was technically supportable.

(6) Several technical aspects of the radiological characterization process were evaluated and were found to be acceptable.

Fourteen calculation packages were prepared and reviewed by Jene Vance, Jim Holderness, Rob Tayloe and Larry Porter to document development of the scaling factors and the DTC correlation discussed above. These packages provide the technical basis for several aspects, including:

- Application and verification of Microshield® and ORIGEN2.2
- Evaluation of all potential contributors to a container's dose rate, specifically $^{137}Cs$ and $^{60}Co$, and addressing contribution of other fission products
- Development and comparison of scaling factors for three fuel types: LWR, thorium uel, and HEU
- The nature and history of the LWR fuels examined in the JN-1 facility
- Decay correction of the BCLDP swipe data used to confirm the ORIGEN2.2 LWR calculations
- Potential sources of uncertainty [see total measurement uncertainty (TMU), below]

The EPA inspection team members reviewed these 14 packages during the July 2007 inspection and discussed them with the documents' authors and other SRS-CCP personnel. During these discussions, the EPA inspection team questioned several aspects and identified instances where modifications to the calculation packages were required. Some of the modifications required a formal revision of the calculation package (see "Documents Reviewed" in Section 8.0, above). The EPA inspection team reviewed the revised documents at the December 2007 meeting and also had the opportunity to discuss all technical concerns and discrepancies with SRS-CCP personnel. The EPA inspection team found the revised calculation packages to adequately document the technical activities upon which the radionuclide scaling factors were based. All technical issues related to the documentation of technical aspects of the SRS-CCP RH WC approach were resolved.

(7) Evaluation of TMU was performed and found to be adequate following revision of specific SRS-CCP documents.

The development of TMU for the 87 drum liners in Waste Stream SR-RL-BCLDP.001 is based on the propagation of uncertainties present in all aspects of the determination of the radiological constituents of RH TRU waste. The TMU determination included the contributions of:

- Drum liner weight measurement
- $^{137}Cs$ measurement uncertainty
- Scaling factor uncertainty
- MicroShield® issues
- Other gamma emitters
- Individual fuel pin contribution to the total in waste liner
- Burnup history
- Internal code issues
- Modeling

The treatment of TMU is presented in CCP-AK-SRS-501, Revision 1, and Calculation Package No. SRS-RH-06, Revision 0, "Uncertainty Analysis." During the July 2007 inspection, the EPA inspection team determined that these documents did not adequately present the technical basis for the TMU related to the SRS-CCP BCLDP wastes, as discussed below. Additionally, operational aspects of the TMU process were not adequately documented. This issue was discussed with SRS-CCP personnel during the July 2007 inspection and was included as one aspect of Issue (d) in EPA Finding No.SRS-RH-AK-07-001F (see Attachment A of this report for a copy of this form). The other aspect of Issue (d) is addressed in Section (7), below.

**EPA Finding No. SRS-RH-AK-07-001F, Issue (d):** The technical basis for the characterization of these RH wastes with respect to the documentation of Total Measurement Uncertainty (TMU) was not adequately documented in CCP-AK-SRS-501, Revision 1 and Calculation Package No. SRS-RH-06, Revision 0.

**EPA Finding No. SRS-RH-AK-07-001F, Issue (d) Resolution:** Following the July 2007 inspection, SRS-CCP produced Revision 2 of CCP-AK-SRS-501, and Revision 1 of SRS-RH-06, both of which were reviewed by the EPA inspection team member assessing radiological characterization during the December 2007 meeting. Both documents had been modified to better present the technical basis for the TMU determination and to appropriately document the process. They included contributions of all pertinent aspects of the TMU, which are summarized in CCP-AK-SRS-501, Table 8-3, and reproduced as Table 6, below. Upon reviewing the revised documents the EPA inspection team determined that the treatment of TMU for the BCLDP RH wastes was technically adequate and appropriately documented and that the aspect of this issue related to TMU was addressed.

**EPA Finding No. SRS-RH-AK-07-001F, Issue (d) Status:** This issue is closed.

**Table 6. Overall Uncertainty Listed by Radionuclide at a Density of 1.0 g/cm$^3$**

| Radionuclide | Dose Rate Measurement Uncertainty | Other Gamma Emitters | Microshield® Code Uncertainty | Microshield® Model Uncertainty | Scaling Factor Uncertainty | Total Uncertainty |
|---|---|---|---|---|---|---|
| $^{233}$U | 25.0% | 45.6% | 10.0% | 31.4% | 155.2% | 167.0% |
| $^{234}$U | 25.0% | 45.6% | 10.0% | 31.4% | 66.1% | 90.4% |
| $^{235}$U | 25.0% | 45.6% | 10.0% | 31.4% | 85.3% | 105.2% |
| $^{238}$U | 25.0% | 45.6% | 10.0% | 31.4% | 36.3% | 71.5% |
| $^{238}$Pu | 25.0% | 45.6% | 10.0% | 31.4% | 53.7% | 81.7% |
| $^{239}$Pu | 25.0% | 45.6% | 10.0% | 31.4% | 34.4% | 70.6% |
| $^{240}$Pu | 25.0% | 45.6% | 10.0% | 31.4% | 31.6% | 69.2% |
| $^{241}$Pu | 25.0% | 45.6% | 10.0% | 31.4% | 58.2% | 84.8% |
| $^{242}$Pu | 25.0% | 45.6% | 10.0% | 31.4% | 69.4% | 92.8% |
| $^{241}$Am | 25.0% | 45.6% | 10.0% | 31.4% | 53.3% | 81.5% |
| $^{244}$Cm | 25.0% | 45.6% | 10.0% | 31.4% | 143.0% | 155.7% |
| $^{90}$Sr | 25.0% | 45.6% | 10.0% | 31.4% | 12.6% | 62.9% |
| $^{137}$Cs | 25.0% | 45.6% | 10.0% | 31.4% | N/A | 61.6% |

(8) Radionuclide Documentation in lieu of BDRs was assessed and found to be adequate upon revision of specific SRS-CCP documents.

The 87 drum liners of SRS-CCP RH TRU waste were not documented in BDRs, as is typically done at TRU waste sites. Instead, the formal documentation for each canister's radionuclide values was presented in CCP-AK-SRS-501, Revision 1, Attachment 3, pages 47 through 134. The EPA inspection team verified that the data sheet for each RH TRU liner contained the following information:

- Container number
- Waste stream designation
- Net waste weight
- Waste material type
- Measured dose rates from two detectors and the calculated average dose rate in mR/hr
- Scaling factor in grams or curies per mR/hr
- Activity values and uncertainties for the 10 WIPP-tracked radionuclides in nCi/g
- TRU alpha activity and concentration
- Plutonium equivalent curies (PE Ci) in curies
- Fissile gram equivalents (FGE) in grams

- Decay heat in watts
- Volume activity in curies per liter

There were several aspects of CCP-AK-SRS-501, Revision 1, that required clarification, and these prevented a complete technical evaluation of the radiological characterization of the 87 RH TRU drum liners during the Denver inspection. These aspects were discussed with SRS-CCP personnel during the inspection, and were included as the second aspect of Issue (d) in EPA Finding No. SRS-RH-AK-07-001F, part of which is discussed in Section (6), above (see Attachment A of this report for a copy of this form). The other aspects of this finding related to radiological characterization are discussed below.

**EPA Finding No. SRS-RH-AK-07-001F, Issue (d):** The general issue was that CCP--AK-SRS-501 did not adequately document the technical basis for the characterization of these RH wastes with respect to the development of radionuclide scaling factors. The specific issues are as follows:

- CCP-AK-SRS-501 provides the technical basis of the derivation of the radionuclides values for each of the 87 RH TRU drum liners. This document is based on statistical treatments of various data sets that are presented in the calculation packages listed in Section 8.0 above. However, the statistical approaches incorporate both simple arithmetical means and standard deviations, as well as geometric mean and standard deviations, and the documentation of which statistic is used is often unclear. It appears the incorrect statistic is used in some cases, but the calculation packages are not sufficiently clear to allow their technical evaluation.
- CCP-AK-SRS-501 contains several areas that require rewriting to accurately document the technical basis of a specific aspect of the radiological characterization process. Examples include: clarification that the uncertainty for $^{233}U$ is based on the standard deviation of the $^{234}U$; treatment of the LLD; inclusion of references for specific activity, decay heat, etc.; and addressing where in the process the TRU determination is performed.

**EPA Finding No. SRS-RH-AK-07-001F, Issue (d) Resolution:** CCP-AK-SRS-501 and other calculation packages were revised appropriately and were provided to EPA at a December 2007 meeting (see "Documents Reviewed" in Section 8.0, above). The statistical inconsistencies in CCP-AK-SRS-501 and the accompanying calculation packages were corrected, as documented in the revised documents the EPA inspection team reviewed. Clarification regarding the $^{233}U$ uncertainty, additional details regarding the LLD, and the appropriate references for specific activity, decay heat and other derived quantities were included (CH-TRAMPAC) in the revised documents made available to EPA at the December 2007 meeting in Carlsbad, New Mexico. The treatment of TMU presented in Revision 2 of CCP-AK-SRS-501 provides details that were missing from Revision 1 that was evaluated at the July 2007 meeting in Denver. Revision 2 of CCP-AK-SRS-501 and the revisions of the accompanying calculation packages discussed earlier contained sufficient technical details to adequately address the EPA concern.

**EPA Finding No. SRS-RH-AK-07-001F, Issue (d) Status:** This issue is closed.

(9) RH and TRU determinations were evaluated and found to be adequate.

The records addressing the determination that the 87 RH TRU drum liners met the definition of TRU wastes (TRU alpha activity concentration greater than 100 nCi/g) and RH waste (contact dose equivalent rate in excess of 200 mrem/hr) were examined, as discussed below.

- TRU definition: As stated previously, BDRs were not prepared for the 87 RH TRU drum liners in this waste stream. The radionuclide values that were determined for the liners are contained in CCP-AK-SRS-501, Attachment 3, pages 47 through 134. All liners indicate TRU concentrations greater than 100 nCi/gram.

- RH definition: The external exposure rate (dose rate) measurements of each of the RH TRU liners were made at the time the liners were filled, and the measured values are recorded on Health Physics Survey Reports Form DDO-138 in mR/hr. All measurements were made at a distance of 1 meter at the midpoint of the liner's height in two locations 180º degrees apart, i.e., at the three o'clock and nine o'clock positions, and the value recorded for each liner was the arithmetical average of both measurements. The documentation examined during the inspection shows that radiation surveys were controlled by a formal, written procedure, HP-OP-019, "Radiation and Contamination Survey Techniques"; survey procedures cite the appropriate consensus standard, ANSI/NCSL Z540-1; all dose rate measurements were made with the appropriate type of instrument; the serial number for each instrument was listed; all instruments had a current calibration at the time of measurement; and all surveys were performed under a radiation work permit that was identified. The measurement records for the liners indicate external dose rates greater than 200 mR/hr in all cases.

There were no concerns regarding the TRU and RH determinations for Waste Stream SR-RL-BCLDP.001.

### 8.3 Physical Form and Prohibited Item Characterization – Visual Examination

From July 31 through August 1, 2007, EPA performed an inspection of SRS-CCP's VE activities for RH TRU waste from the BCLDP in storage at SRS. SRS-CCP possesses both written and audio/video records of packaging of 87 drum liners from Waste Stream SR-RL-BCLDP.001. During this inspection EPA's focus was on independent verification of the acceptability of VE data contained within the historic records. The review took place at the CBFO offices located in the Skeen Whitlock Building in Carlsbad, New Mexico.

The VE data reviewed were generated between late 1999 and late 2002, in accordance with procedure TC-OP-01.4 and work instructions WI-956 and 958. The procedure had been revised during this time period and SRS-CCP had retrieved Revisions 1 and 2 but did not possess Revision 0. Training of VE personnel was performed in accordance with TCP-98-05 and TRU-100.

(1) Training of VE personnel was assessed and found to be adequate.

All of the personnel who performed VE were contract employees, and all had been trained to applicable site procedures. How these employees were used is documented in the interface document TCP-98-04. The practice at the time the RH drum liners were packaged was to destroy old training records as new ones were generated. Consequently, SRS-CCP could not obtain complete training records for all VE personnel that were involved in the BCLDP project. However, EPA was able to review some training records from the packaging time period, approximately 1999 to 2002.

Procedure TC-OP-01.4 refers to a Visual Examination Expert (VEE) performing the examinations. From the activities performed, EPA concluded that at the time of packaging Waste Certification Officials (WCOs) were equivalent to present day VEEs and VEEs were equivalent to present day VE operators. VE operators and VEEs were required to read procedures and be re-qualified every three years.

(2) Audio/video and written records were reviewed and found to be adequate.

The EPA inspection team selected a random sample of four RH drum liners containers to review during this inspection, Nos. BC0035, BC0051, BC0070, and BC012. Because drum liners were filled over extended periods of time, the recordings for many containers were recorded on multiple tapes. For example, the VE of container No. BC0035 is recorded on tapes E00025, E00034, E00035, E00036, E0038, E00038, E00039, and E00040. Two types of recordings were made, one from a movable focus/angle camera and one from a fixed camera. Although the movable camera images are required to review the VE event, the fixed camera image shows a much wider field of view and provides a superior overview of the process. For the purpose of this inspection, EPA reviewed the movable camera audio/visual tapes for selected packages. They were evaluated as follows:

- BC0035, packages 15, 29, 59, and 66: The EPA inspection team did briefly review the static video for this drum liner but it was not possible to verify the waste items placed in the receiving container using this recording. However, using the movable camera recording the EPA inspection team verified that the waste items individually placed into the receiving container were correctly identified and recorded. The waste items in this drum liner included plastic, rubber, cloth, and paper. The original packaging took place in November 2000 and was reviewed in October 2002. The revision date for the TRU Waste Packaging Loading Record, Loading – Itemized Data record was February 1999.
- BC0051, packages 7 and 17: The majority of waste in this drum liner was steel and other metals. The original packaging took place during July and August 2000 and review of the paper and visual records was performed in February 2003. The EPA inspection team did not identify any discrepancies between the written and visual/audio records. The revision date for the TRU Waste Packaging Loading Record, Loading – Itemized Data record was February 1999.
- BC0070, packages 11 and 14: The revision date for the TRU Waste Packaging Loading Record, Loading – Itemized Data record was August 2001. This revision of the sheet

required additional information to be recorded, including the number of the liner filter, drum filter number and seal, and WMC. This drum liner arrived in the processing area already full of waste. The waste was tipped onto the sorting tray, identified, and then loaded. Similar waste items were loaded into opaque, white buckets, which were then emptied into the receiving container. Placing of items in the white buckets was not recorded, but the items from each bucket were called out (identified orally), as it was loaded. This was discussed with SRS-CCP and the EPA inspection team agreed that this method of drum liner loading did not compromise the technical adequacy of the VE data. Packaging took place in June 2002 and the records were reviewed in November 2002.

- BC0120, packages 4 and 7: This bucket was empty when first viewed on the audio/visual recording. The VE process for this container was similar to the process used for BC0070, because the placing of items in white buckets was not recorded. Waste items were identified as they were tipped into the receiving container. Packaging took place in December 2001, and the records were reviewed in January 2002 and November 2002.

The absence of prohibited items was verified during packaging and review of records and no discrepancies between the written and visual/audio records for these drum liners were identified. The EPA inspection team determined that WMPs were correctly identified and the physical form of the waste was verified. There are no issues related to the use of VE for SRS-CCP RH TRU wastes as a result of this inspection.

### 8.4 WIPP Waste Information System

From July 31 through August 1, 2007 EPA reviewed SRS-CCP's WWIS activities for RH TRU waste in Carlsbad, New Mexico because access to the WWIS database and CCP personnel responsible for maintaining the database were readily available at that location.

EPA previously approved this process and the purpose of this review was to ensure continued compliance with the requirements of the WCPIP. At the time of the review, a total of 132 RH waste containers from INL and ANLE had been emplaced in the WIPP repository, and an additional 68 RH waste containers had been approved for shipment. The EPA inspection team interviewed a CCP WCO and investigated the CCP WWIS procedure by reviewing data for Canister No. ID0051. The canister housed three containers of RH waste, Container Nos. 001131, 001141, and 001143, from RH Waste Stream ID-ANLE-S5000. The same CCP WWIS procedure is used for RH wastes from all DOE sites.

Since EPA approval, CCP has successfully submitted characterization and certification data into WWIS for RH waste from INL and ANL. EPA had conducted a baseline inspection at both sites and approved them for RH WC activities previously. The DTC, VE, or RTR data sheets are used to populate a WWIS Data Entry Summary spreadsheet. The WCO interviewed was able to retrieve the spreadsheet and characterization data sheets for container No. 001131. The EPA inspection team verified that the spreadsheet information matched that in the WIPP Waste Container Report for this container. No discrepancies were identified. The WIPP Waste Container Report for Canister No. ID0051 was also retrieved and reviewed. Using the WIPP Waste Container Reports for the internal containers, the EPA inspection team verified that there were no data errors or discrepancies between these reports.

The EPA inspection team verified that all WMPs for each RH container were reported to WWIS as plastic. EPA calculated the material parameter weights provided in the Waste Container Data Report for each of the inner containers of Canister No. ID0051 and ensured that value was the same as the reported container gross weight. No discrepancies were found for the three containers the EPA inspection team reviewed.

Prior to submitting container data to the WWIS for certification, the NCR and Corrective Action Report (CAR) status of each container was verified. Container data were uploaded to WWIS after this check, based on information that was obtained from CCP QA personnel. EPA verified this process by reviewing an email verifying the NCR/CAR status for containers in INL RH Lot 9. If data were rejected by WWIS, actions were taken to correct and resubmit the data. EPA verified this process by reviewing the history for Container No. 001117 that was rejected by WWIS on June 7, 2007. CCP resolved the data issue and successfully resubmitted the container to WWIS on July18, 2007. As required by the WCPIP, all WMPs are reported to WWIS as plastic. CCP continues to successfully submit RH TRU data for both characterization and certification to WWIS. There were no issues relative to CCP's implementation of the WWIS for RH TRU wastes identified during this audit.

### 8.5 Attainment of Data Quality Objectives

(1) Verification methods for each DQO were assessed and found to be compliant with the WCPIP.

SRS-CCP-BCLDP representatives indicated that AK is the basis for all characterization, and AK will be qualified entirely through demonstration of an equivalent QA program. As indicated previously, this approach comports with requirements set forth in the WCPIP.

(2) Attainment of DQOs was evaluated and found be adequate.

As a result of the analyses presented in Sections 8.1 through 8.4, above, the EPA inspection team assessed how each DQO was addressed. As required in the WCPIP, the following DQOs must be addressed:

- Defense determination
- TRU waste determination
- RH waste determination
- Activity determination (TRU alpha activity per drum liner, including identification and quantification of 10 WIPP-tracked radionuclides)
- Residual liquids
- Physical form, including metals and cellulosics, plastic and rubber

All DQOs are based on AK that is verified through demonstration of an equivalent QA program, and EPA has assessed each element for its technical merit based on the AK record. EPA concludes that SRS-CCP-BCLDP has adequately presented how DQOs will be obtained.

## 9.0 RESPONSE TO COMMENTS

On May 21, 2008, EPA issued an FR notice (73 FR 29504-29507) proposing approval of the RH TRU debris waste from BCLDP and WC processes SRS-CCP used when characterizing this waste. EPA received one comment that was sent to Docket ID No. EPA-HQ-OAR-2008-0410. The actual comment was an enclosure to a July 3, 2008 letter and is included below verbatim, followed by EPA's response to the comment.

**Comment:**

Comments concerning the United States Environmental Protection Agency (EPA) *Proposed Approval of the Central Characterization Project's Remote-Handled Waste Characterization Program at the Savannah River Site* published in the Federal Register on Wednesday May 21, 2008, Volume 73, No. 99, starting on page 29504.

Within the Federal Register Notice, EPA states that, "Upon approval of the RH TRU waste characterization processes discussed in this report, if SRS-CCP embarks on characterizing RH waste other than that generated at BCLDP for WIPP disposal, a separate baseline inspection and approval will be necessary. That is, any SRS RH waste destined for WIPP disposal characterized by SRS-CCP or another program remains subject to EPA's baseline inspection and approval" (page 29506, third column).

The Carlsbad Field Office (CBFO) disagrees with the assertion that a new baseline would be necessary if additional RH waste were characterized at SRS by CCP.

The Code of Federal Regulations, 40 CFR, Part 194, Section 194.8, subsection b(2) states, "The Agency (EPA) will **verify** the compliance of waste characterization **programs** and **processes**. . ." [emphasis added]. By publishing the proposed approval of the SRS-CCP Remote-Handled Waste Characterization Program in the Federal Register, EPA has memoralized its determined [*sic*] that the following CCP processes in place at SRS are compliant with 40 CFR, Part 194, Section 194.8, subsection b(1).

(1) The acceptable knowledge process (page 29506, third column)

(2) The radiological characterization process using dose-to-curie (page 29507, first column)

(3) The visual examination process (page 29507, first column)

(4) The WIPP Waste Information System (page 28507, first column)

(5) The attainment of pertinent Data Quality Objectives (page 29507, first column)

Therefore, The Department of Energy (DOE) contends that the adequacy of these processes has been successfully implemented in accordance with 40 CFR, Part 194, Section 194.8, subsection b(1) as demonstrated by CCP at SRS during the baseline inspection and as indicated in the pending approval. A requirement to re-demonstrate the same processes, should they be used at SRS, would not be a judicious use of either EPA's

or DOE's resources and would not be good stewardship of the finite resources available for the TRU program.

**EPA Response to Comment:**

*EPA agrees with the commenter that CCP had successfully implemented the above listed waste characterization processes demonstrated to EPA during the baseline inspection. EPA, however, disagrees that a re-demonstration of implemented waste characterization processes is not necessary and is not a judicious use of resources for the TRU program available to DOE and EPA.*

*To date, EPA has inspected and evaluated CCP's RH WC program for debris waste from Idaho National Laboratory (INL), Argonne National Laboratory (ANL), Los Alamos National Laboratory (LANL), Battelle Columbus Laboratory (BCL), and Oak Ridge National Laboratory (ORNL). The experience from these five inspections indicates that CCP has customized their radiological characterization and acceptable knowledge WC processes to address unique aspects of RH debris waste at each generator site.*

*The radiological characterization processes observed at these five CCP RH sites have varied. For example, INL and ANL used real-time measured external dose-rate (gamma) and DTC on large populations of containers with ORIGEN-based scaling factors expressed in curies of TRU radionuclides per curie of $^{137}$Cs based on fuel characteristics and burn up. At LANL, the $^{137}$Cs content for each container was calculated in mass and the $^{137}$Cs activity was then derived using a curie-to-dose scaling factor based on historical passive-active neutron measurements from the 1980s for a small, discreet set of wastes. At SRS (BCL), radiological characterization is based on historical dose-rate measurements and the agreement between scaling factors derived from LWR fuel data and the radiochemical results of the 69 swipe samples discussed in Section 8.2 of this report. At ORNL, ORIGEN was not used and scaling factors were instead based on radiochemical and non-destructive analyses of samples that contained predominantly exotic transcurium radionuclides and negligible amounts of plutonium. While there are broad similarities among these five RH WC programs, the differences in the specific techniques are pronounced and the radiological characterization approaches have been largely site-specific. The only RH WC aspects that were common among these sites are non-destructive examination to confirm the absence of prohibited items (free liquid and aerosol cans) and tracking of waste container contents in the WWIS.*

*Given these substantial differences in WC procedures, EPA concludes there is no basis for EPA to determine that SRS-CCP could effectively implement the WC processes used for the BCL debris waste to characterize other RH waste. Therefore, the proposed approval stated that a new baseline would be necessary if SRS-CCP were to apply the processes described in EPA's inspection report to characterize other non-BCLDP RH waste. EPA maintains that position in this final approval. Also, as stated previously, implementation of the RH WC processes described in this report for characterizing non-debris BCLDP waste and/or BCLDP wastes other than the 87 RH drum liners is a T1 change.*

## 10.0 CONCLUSIONS

EPA's inspection team determined that SRS-CCP's RH WC program activities were technically adequate. EPA is approving the SRS-CCP-RH WC program as supported by the documentation examined during this inspection and described in this report. The approval includes the AK process for one RH retrievably stored TRU debris waste stream, SR-RL-BCLDP.001, that was generated by the BCLDP consisting of 87 drum liners that are currently stored at SRS. All aspects of the SRS-CCP documentation in support of this RH waste stream are technically adequate.

EPA requires that all site-specific CCRs at RH TRU sites must address the 10 WIPP-tracked radionuclides, as discussed in Section 8.1 (8) of this report. SRS-CCP must provide to EPA a copy of the WWIS controlled spreadsheet showing the manual data entries that were downloaded from CCP-AK-SRS-501 upon completion. In the future, when sample collection plays as important a role in a site's RH WC program as it does for this BCLDP waste stream, EPA will require that the site provide a sampling plan prior to EPA approval.

**Baseline Approval**

The documents that EPA reviewed during the inspection that are listed in Section 8 of this report adequately support the characterization of SRS-CCP RH Waste Stream SR-RL-BCLDP.001. The waste stream being approved by EPA is of a finite nature (i.e., 87 TRU RH drum liners) that was generated and packaged in the past, and no additional waste containers from BCL belonging to this waste stream exist at SRS or would be subjected in the future to the WC techniques described in the report. Hence, this baseline approval remains applicable only to the debris waste from BCL consisting of 87 TRU RH drum liners and cannot be implemented to characterize any additional waste containers from this waste stream. As stated in Section 9.0, should SRS-CCP request approval of any non-BCL RH waste generated at SRS or waste brought to SRS for characterization, a new baseline inspection will be necessary.

The wastes to which this approval applies are discussed in this report and were generated at the BCLDP; the fact that they are stored at SRS has no bearing on characterization activities performed on any other CH or RH TRU materials at SRS or any other DOE site. This report does not list any specific T1 or T2 designations relative to these 87 waste liners and the WC components inspected and approved by EPA at this time. However, should DOE identify additional containers of RH TRU wastes (e.g., solids or soil/gravel) associated with the D&D of the Building JN-1 HCL at the Jefferson North Facility as being eligible for WIPP disposal apart from the 87 liners that are discussed in this report, EPA notification and approval would be necessary as a T1 change. This report does not list specific T1 or Tier 2 (T2) designations relative to these 87 drum liners containing RH TRU debris waste from BCLDP and the WC components approved at this time. SRS-CCP, however, must provide to EPA a copy of the WWIS controlled spreadsheet showing the manual data entries that were downloaded from CCP-AK-SRS-501 upon completion as a one-time T2 change.

## 11.0 REFERENCES

U.S. Department of Energy, Carlsbad Area Field Office, "Contact-Handled Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant (CH-WAC)," Revision 3, DOE/WIPP-02-3122, Carlsbad, New Mexico, April 25, 2005.

U.S. Environmental Protection Agency, "Criteria for the Certification and Recertification of the Waste Isolation Pilot Plant's Compliance with the Disposal Regulations: Certification Decision; Final Rule," *Federal Register*, Vol. 63, No. 95, May 18, 1998, pp. 27354, 27405.

U.S. Code of Federal Regulations, *Title 40*, *Protection of Environment*, Part 191, "Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes."

U.S. Code of Federal Regulations, *Title 40*, *Protection of Environment*, 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."

U.S. Department of Energy, Carlsbad Area Field Office, "Remote Handled TRU Waste Characterization Program Implementation Plan", DOE/WIPP-02-3214, Revision 0D, Carlsbad, New Mexico, October 30, 2003.

U.S. Department of Energy, Title 40 CFR Part 191, Compliance Certification Application for the Waste Isolation Pilot Plant, DOE/CAO 1996-2184, Carlsbad, New Mexico, 1996.

U.S. Department of Energy, Title 40 CFR Part 191, SUBPART D AND C, Compliance Recertification Application 2004, DOE/WIPP/2004-3231.

U.S. Department of Energy, Carlsbad Area Field Office, "Quality Assurance Program Description (QAPD)", DOE/CBFO-94-1012, Revision 7, Carlsbad, New Mexico, July 2005.

U.S. Nuclear Regulatory Commission, "Contact-Handled Transuranic Waste Authorized Methods for Payload Control (CH-TRAMPAC)."

**Attachment A**

**EPA Inspection Issue Tracking Form,**
**EPA Issue No. SRS-CCP-RH-AK-07-001F**

**Attachment A**
**EPA Inspection Issue Tracking Form, EPA Issue No. SRS-CCP-RH-AK-07-001F**

| | |
|---|---|
| **Inspection No.** EPA-SRS-CCP-RH-07.07-8 | **Issue Number:** SRS-RH-AK-07-001F**,** Revision 3<br>**Date:** July 19, 2007 |
| **Inspectors:** C. Walker/P. Kelly<br>**Attachments?** ☐ YES ☒ NO | **Sample Size:** RH Documentation<br>**Population size (if known):** NA |

**Description of Issue:** In August 2001, EPA conducted a surveillance of the Battelle Columbus (BC) Remote-Handled (RH) Waste Characterization Program. In the report sent to DOE (cited below), EPA stated that: "BC's RH Program could be improved through more diligent acquisition and integration of AK-based radionuclide information to determine isotopic distributions." EPA also questioned the representativeness of swipe samples collected that were later used as part of scaling factor/JN-1 isotopic mix development. EPA concluded that the "AK program data assembly/compilation elements were not complete" (EPA's Technical and Regulatory Support Document for RH Waste Determination, February 2004, transmitted to DOE by Frank Marcinowski, March 26, 2004). EPA also concluded that while the radioassay approach had merit, characterization activities performed to support the approach at the time of the 2001 Surveillance "were not technically adequate." EPA's current inspection identifies the following issues related to the completeness and adequacy of AK and radiological characterization documents, many of which are related to issues identified in our August 2001 surveillance:

a. Isotopic ratio/composition information from two primary sources was used to develop scaling factors (also the JN-1 Standard Isotopic Mix). The factors were derived from a combination of swipe sample and modeling results, with input data to the model (ORIGEN2.2) covered in a memorandum of a meeting in 1999. In order for this to serve as an auditable record additional information and rationale supporting the approach are required for both the isotopic swipe data and the recommended burn up, enrichment, and decay data contained in the 1999 meeting memorandum. Documentation of the references and data sources reviewed and evaluated during the 1999 meeting is necessary to support conclusions. With regard to the swipe data, the sampling plan, collection, number, results and other relevant information must be summarized to show that the sample data are sufficiently representative of the wastes within waste stream SR-RL-BCLDP.001.

b. CCP-AK-SRS-500 must be revised to address the following:

- Only describe the SRS waste stream of 87 liners subject to this inspection.
- The document states that there are wastes in this stream that exhibit both "standard" and "non-standard" isotopic distributions and that non-standard waste will undergo separate sampling and analysis. However, the AKE indicated that only "standard" isotopic mix wastes are included in the stream, and there are no wastes that underwent the alternative sampling and analysis approach discussed in the text.
- Include a thorough presentation of general radiological characteristics of wastes. Information such as types of radionuclides handled in JN-1 in the various cells/areas, origin of radionuclides (e.g., LWR), outliers, and other information necessary to provide a general overview of the radionuclides handled through the course of JN-1 operations are necessary.

c. Through the course of the AK information acquisition and interpretation process, the number of waste streams identified in JN-1 has changed over time. Specifically, the current SR-RL-BCLDO.001 stream was originally identified as four separate waste streams. There is no information given to show these waste streams were combined into a single stream.

d. CCP-AK-SRS-501 does not adequately document the technical basis for the characterization of these RH wastes with respect to the development of radionuclide scaling factors and Total Measurement Uncertainty.

**B. Regulatory Reference:** 40 CFR 194.24(c)

**C. Site requirement(s):**

**D. Discussed with:** J.R. Stroble, Eric D'Amico, Larry Porter, K. Peters, S. Schafer, R. Tayloe, M. Doherty

**E. Additional Comments:** Item c above is resolved as a result of the preparation of reference C509. As a result of changes made to primary documents to resolve items b and d above, there may be a need to make changes to other primary or secondary documents. EPA expects to receive revised copies of these documents with the response to this finding.

**F. Site Response Information:**
**Site Response Required?** ☒YES ☐ NO
**Site Response Due Date:** August 13, 2007