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CCP
Waste-Specific
Data TRAMPAC
for
Battelle Columbus Laboratories
CH-TRU Waste

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1.0 INTRODUCTION

1.1 Purpose

The purpose of this *Waste-Specific Data TRAMPAC for Battelle Columbus Laboratories CH-TRU Waste* is to describe and document how each of the requirements for TRUPACT-II transportation is met for six standard waste boxes (SWBs) of contact-handled (CH) transuranic (TRU) waste to be transported from Battelle Columbus Laboratories (BCL). The transportation requirements are defined in the *Contact Handled Transuranic Waste Authorized Methods for Payload Control (CH-TRAMPAC)* [1]. As specified in Section 1.4 of the CH-TRAMPAC, a waste-specific data TRAMPAC may be written by the shipper and approved by the U.S. Department of Energy (DOE), Carlsbad Field Office for small quantity shipments. This *Waste-Specific Data TRAMPAC for BCL CH-TRU Waste* documents the evaluation of waste data against the requirements of the CH-TRAMPAC. The data evaluation and the documentation of compliance results in this document were completed in accordance with the quality assurance (QA) program [2] under the Central Characterization Project (CCP) Waste Isolation Pilot Plant (WIPP) certification program.

This document presents the information necessary for shipment of six SWBs of CH-TRU waste from BCL.

1.2 Scope

This *Waste-Specific Data TRAMPAC for BCL CH-TRU Waste* applies to payload containers BCSWB-01, -02, -03, -04, -05, and -06.

1.3 Background

BCL generated this waste under a controlled waste management program established under the Battelle Columbus Laboratories Decommissioning Project (BCLDP). The BCL program is defined by a series of procedures that were implemented by the BCL waste generators. CH-TRU waste containers BCSWB-01, -02, -03, -04, -05, and -06 were generated by the BCLDP during the decontamination of the Building JN-4 Plutonium Laboratory at the West Jefferson North site. The waste generation and packaging activities completed as part of the decontamination and decommissioning (D&D) of the Building JN-4 Plutonium Laboratory were as follows [3, 4]:

- Initial physical decommissioning efforts began in January 1978 with the removal of special nuclear materials, miscellaneous items, and equipment from gloveboxes. This process consisted of reducing the size of equipment so that it could be removed from the glove boxes

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through 14-inch diameter bag ports. After size reduction, items were bagged out of the glovebox in thermally sealed bags. Each item was then bagged two more times and sealed with cloth-backed or duct tape. Items removed from gloveboxes included tools, supplies and equipment, false glovebox floors, lighting fixtures, shelving, tool boxes, furnaces, lead bricks, and assorted electrical and plumbing equipment.

- After each glovebox was emptied, a tent was built around the glovebox to allow it to be sectioned. Small items were removed from the tents through bag ports. This process was similar to the process for removing items from gloveboxes. Large items were wrapped in polyethylene sheeting, then double bagged.

- Following removal of the gloveboxes, decontamination of the auxiliary systems was completed in early 1980. All electrical alarms were disconnected and the auxiliary systems, including ceiling tiles and framework, glovebox exhaust systems, and gas and liquid supply lines, were removed and packaged in up to three layers of polyethylene sheeting or drum liner bags.

The D&D waste was packaged into SWBs in 2003 in accordance with WI-1194, *Repackaging of the JN-4 Plutonium Waste* [5]. The implementation of the BCL D&D procedures [3] and WI-1194 [5] resulted in the data and QA records used by this document to demonstrate compliance with the CH-TRAMPAC requirements. References to procedures in the discussion of each transportation parameter requirement in this document are to the implementation results of the procedures for each SWB.

In addition to BCL waste program documents and data, this document references CCP plans and procedures that have been or will be used to qualify BCSWB-01, -02, -03, -04, -05, and -06 for shipment. The following CCP documents will be implemented for the certification of BCSWB-01, -02, -03, -04, -05, and -06 based on the compliance data documented herein:

- CCP-PO-003, *CCP Transuranic Authorized Methods for Payload Control (CCP CH-TRAMPAC)* [6]

- CCP-TP-033, *CCP Shipping of CH TRU Waste* [7]

- CCP-TP-030, *CCP TRU Waste Certification and WWIS Data Entry* [8]

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2.0 CONTAINER AND PHYSICAL PROPERTIES REQUIREMENTS

2.1 Authorized Payload Containers

As specified by Section 2.1.1 of the CH-TRAMPAC, an SWB is an authorized payload container for transport in the TRUPACT-II, provided it meets the specifications of Section 2.9.8 of the CH-TRAMPAC [1]. BCSWB-01, -02, -03, -04, -05, and -06 are SWBs that were procured to Type A specifications through the WIPP Central Procurement Program. The SWBs were provided to BCLDP as a DOE property transfer. Upon receipt, the procured SWBs were inspected by BCLDP as directed by QD-AP-04.1, *Documentation and Control of Purchased Items and Services* [9], to verify compliance with the CH-TRAMPAC specifications and as directed by WA-OP-006, *Procurement and Inspection of Packagings for Hazardous Materials Shipments* [10]. Procurement documents are maintained by the BCLDP Records Management Department in accordance with PR-AP-17.1, *Operation of the Project Records Management System* [11].

Section 2.1.2 of the CH-TRAMPAC also requires the inspection of the integrity of the payload container prior to shipment [1]. Prior to transport, the integrity of each SWB will be visually inspected by CCP personnel in accordance with CCP-TP-033 [7].

2.2 Dunnage

As specified in Section 2.2.1 of the CH-TRAMPAC, a shipper shall use an empty SWB as dunnage to complete a payload configuration if too few loaded payload containers are available [1]. The dunnage container(s) must meet the specifications of Section 2.9.8 of the CH-TRAMPAC with the exception that dunnage containers shall have at least one open vent port (i.e., not filtered or plugged) [1]. If the six SWBs are assembled into TRUPACT-II payloads requiring the use of dunnage (i.e., one loaded SWB per payload), an empty SWB will be used as dunnage to complete the payload. If needed, empty SWBs are available at BCLDP that meet the SWB specifications of Section 2.9.8 of the CH-TRAMPAC, except as required by Section 2.2.1 of the CH-TRAMPAC, the empty SWBs will have at least one open vent port (i.e., not filtered or plugged). The empty SWBs available at BCLDP were obtained under the WIPP Central Procurement Program and provided to BCLDP as a DOE property transfer.

2.3 Container/Assembly Weight

2.3.1 Container/Assembly Weight

Each payload container, payload assembly, and loaded TRUPACT-II shall comply with the applicable weight limits specified in Section 2.3.1.1 of the CH-TRAMPAC [1]. The applicable weight limits for BCSWB-01, -02, -03, -04, -05, and -06 and any dunnage SWBs are as follows [1]:

- 4,000 pounds per SWB
- 7,265 pounds per payload assembly of two SWBs, including pallet, guide tubes, slip sheets (optional), reinforcing plates, and banding material
- 19,250 pounds per loaded TRUPACT-II.

As specified by Section 2.3.2.1 of the CH-TRAMPAC, the weight of each payload container (or dunnage) shall be determined using a calibrated scale [1]. BCSWB-01, -02, -03, -04, -05, and -06 were weighed in accordance with TC-OP-01.4, *Segregation and Packaging of TRU Waste* [12]. The measured weights were recorded in data packages in accordance with TC-AP-01.1, *TRU Waste Data Package Generation* [13]. Based on the calibration records for a similar scale used in the same facility, the scale was calibrated to a National Institute for Standards and Technology (NIST) traceable standard. The error associated with this scale is "5 pounds for the weight range represented by the six SWBs [i.e., 1,060 (BCSWB-01) to 1,905 (BCSWB-03) pounds] [14]. The following table summarizes the determination of the weights for BCSWB-01, -02, -03, -04, -05, and -06 [12]:

Container No.	Weight (Pounds)	Error (Pounds)	Value Plus Error (Pounds)	Maximum Allowable Gross Weight Limit (Pounds)
BCSWB-01	1,060	5	1,065	4,000
BCSWB-02	1,390	5	1,395	4,000
BCSWB-03	1,905	5	1,910	4,000
BCSWB-04	1,140	5	1,145	4,000
BCSWB-05	1,513	5	1,518	4,000
BCSWB-06	1,516	5	1,521	4,000

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BCSWB-01, -02, -03, -04, -05, and -06 comply with the applicable maximum allowable gross weight limit per SWB of 4,000 pounds following the addition of the measurement error, as specified in Section 2.3.1.1 of the CH-TRAMPAC [1].

Prior to shipment, each dunnage SWB will be weighed in accordance with the BCL work instruction for TRUPACT-II loading. CCP personnel will use the data collected in accordance with this work instruction to evaluate compliance with the SWB weight limit of 4,000 pounds.

In accordance with CCP-PO-003 [6], CCP personnel will calculate the total weight of each SWB payload assembly and evaluate compliance with the maximum payload assembly and loaded TRUPACT-II limits as specified above and in Section 2.3.1.1 of the CH-TRAMPAC [1]. As shown in the above table, the weight for all containers is such that the maximum payload assembly weight limit of 7,265 pounds per TRUPACT-II will easily be met. As such, the payload assembly weight limit will be met for the payloads comprised of these containers. CCP personnel shall document compliance with the weight requirement on the Payload Assembly Transportation Certification Document (PATCD).

2.3.2 Center of Gravity

As required by Section 2.3.1.2 of the CH-TRAMPAC, the total weight of the top SWB of the payload assembly in a TRUPACT-II shall be less than or equal to the total weight of the bottom SWB [1]. In accordance with CCP-PO-003 [6], CCP personnel will complete the payload assembly and loading activities such that the total weight of the top SWB of each payload assembly is less than or equal to the total weight of the bottom SWB. CCP personnel shall document compliance with the center of gravity requirement on the PATCD.

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2.4 Container Marking

As specified by Section 2.4.1 of the CH-TRAMPAC, each payload container shall be labeled with a unique container identification number [1].

In accordance with WA-OP-030, *Packaging, Marking and Labeling of Radioactive Waste and Radioactive Mixed Waste (RWM)* [15], the SWBs have been marked with the following unique identification numbers:

- BCSWB-01
- BCSWB-02
- BCSWB-03
- BCSWB-04
- BCSWB-05
- BCSWB-06

As specified in Section 2.4.1 of the CH-TRAMPAC, if a dunnage container is used to complete a payload assembly, the dunnage container shall be labeled with a unique identification number and “EMPTY” or “DUNNAGE” [1]. Any dunnage SWB used to complete a payload assembly will be labeled with a unique container identification number and either “EMPTY” or “DUNNAGE” as documented on the Marking and Labeling Instruction Sheet completed in accordance with WA-OP-030 [16]. In accordance with CCP-TP-033 [7], CCP personnel will verify compliance with the CH-TRAMPAC container marking requirements for any dunnage SWBs.

2.5 Filter Vents

As specified by Section 2.5 of the CH-TRAMPAC, each payload container to be transported in the TRUPACT-II shall have one or more filter vents that meet the specifications of Section 2.5 of the CH-TRAMPAC [1]. BCSWB-01, -02, -03, -04, -05, and -06 are vented with up to four filters each. BCSWB-01, -02, -03, and -04 contain direct load waste. BCSWB-05 and -06 each contain four 55-gallon drums. Drums SDSBC-3635 and SDSBC-3688 (contained by BCSWB-05) each are fitted with one filter. The other six drums have holes punched in the lids [3].

The filters were procured to the specifications of Section 2.5 of the CH-TRAMPAC by Battelle Memorial Institute purchasing and subcontracts representatives from qualified suppliers in accordance with QD-AP-07.1, Supplier Evaluation and Qualification [16], and QD-AP-04.1 [10] and by the CCP in accordance with CCP-QP-015, *CCP Procurement* [17]. Procurement documents are maintained by the BCLDP Records Management Department in accordance with PR-AP-17.1 [12].

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Each filter used in BCSWB-01, -02, -03, -04, -05, and -06 and Drums SDSBC-3635 and SDSBC-3688 (contained by BCSWB-05) is a Model No. NFT-013 with a minimum hydrogen diffusivity of 3.7E-06 mole per second per mole fraction. All filters were manufactured by Nuclear Filter Technologies in one of the following lots:

- March 1999 (Purchase Order #150481, Serial I.D. Nos. BMI-1 through BMI-130)
- February 2001 (Purchase Order #163297, Serial I.D. Nos. BMI-131 through BMI-230)
- February 2002 (Purchase Order #170002, Serial I.D. Nos. BMI-231 through BMI-280)
- October 2002 (Purchase Order #175642, Serial I.D. Nos. BMI-281 through BMI-330)
- January 2005 (Purchase Order #WIPP1-PO404167, Serial I.D. Nos. AF-1796 through AF-1995).

The above information documents compliance with the filter specifications of Section 2.5 of the CH-TRAMPAC for BCSWB-01, -02, -03, -04, -05, and -06 and for Drums SDSBC-3635 and SDSBC-3688 (contained by BCSWB-05).

2.6 Liquids

As required by Section 2.6 of the CH-TRAMPAC, liquid waste is prohibited in payload containers, except for residual amounts in well-drained containers [1]. As documented in TCP-98-04, liquids were used in the laboratory and during D&D operations, however, laboratory and decommissioning procedures required that the liquids be solidified with plaster or disposed of in the hot drain system [4]. BCSWB-01, -02, -03, -04, -05, and -06 were packaged in accordance with TC-OP-01.4 [13]. TC-OP-01.4 directed BCL Operators to visually inspect payload containers during packaging to ensure the absence of free liquids. As documented by the records generated in accordance with TC-OP-01.4 during waste packaging, liquids are not present in the waste. The absence of liquids was documented in the payload container data packages for the SWBs in accordance with TC-AP-01.1 [14]. As such, the total volume of residual liquid in BCSWB-01, -02, -03, -04, -05, and -06 is documented to be less than 1 percent (volume).

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2.7 Sharp or Heavy Objects

As required by Section 2.7 of the CH-TRAMPAC, sharp or heavy objects in the waste shall be blocked, braced, or suitably packaged as necessary to provide puncture protection for the payload containers packaging these objects [1]. The waste forms contained by BCSWB-01, -02, -03, -04, -05, and -06 do not qualify as sharp or heavy objects. D&D operations required any sharp edges remaining after size reduction or disassembly to be padded and taped [3]. The absence of sharp or heavy objects was verified by BCL Operators through visual examination (VE) during the packaging of the SWBs in accordance with TC-OP-01.4 [13]. As such, sharp or heavy objects are not present in BCSWB-01, -02, -03, -04, -05, and -06.

2.8 Sealed Containers

Sealed containers greater than 4 liters (nominal) are prohibited by Section 2.8 of the CH-TRAMPAC [1]. The packaging procedures used during D&D operations did not include the use of sealed containers [3, 5]. The absence of sealed containers was ensured by BCL Operators through VE during the packaging of the SWBs in accordance with TC-OP-01.4 [13]. As described in Section 2.4, each of the 55-gallon drums contained by BCSWB-05 and -06 either is vented with a filter vent or is punctured. As such, the absence of sealed containers greater than 4 liters in BCSWB-01, -02, -03, -04, -05, and -06 is documented.

3.0 NUCLEAR PROPERTIES REQUIREMENTS

3.1 Nuclear Criticality

As specified by Section 3.1 of the CH-TRAMPAC, an SWB payload container shall be acceptable for transport only if the plutonium (Pu)-239 fissile gram equivalent (FGE) plus two times the measurement error (i.e., two standard deviations) is less than or equal to the following limits [1]:

- 325 grams for an SWB, except for SWBs containing greater than 1 percent by weight beryllium (Be) or beryllium oxide (BeO) or machine-compacted waste.
- 100 grams for an SWB containing greater than 1 percent by weight Be or BeO.
- 250 grams for an SWB containing machine-compacted waste.
- SWBs containing greater than 1 percent by weight Be or BeO and machine-compacted waste are not shippable.

Per the description of the contents of the SWBs [3] and description of the historical and D&D operations in the Building JN-4 Plutonium Laboratory [4], BCSWB-01, -02, -03, -04, -05, and -06 do not contain Be or BeO in concentrations greater than 1% by weight of the contents or machine-compacted waste. As such, the 325-gram FGE limit is applicable to BCSWB-01, -02, -03, -04, -05, and -06.

The radionuclide composition and quantities of the waste contained by BCSWB-01, -02, -03, -04, -05, and -06 were determined through non-destructive assay (NDA) measurements of the materials as they were being loaded into containers during the D&D of the Plutonium Laboratory in 1980 and 1981, or during repackaging operations in 2005. The plutonium quantities present in the waste were estimated using a Random Source Interrogation System or gamma spectroscopy.

Using the NDA data, BCL personnel calculated the FGE values of the individual SWBs [15]. The error associated with the FGE value calculated for each SWB encompasses three areas of uncertainty: (1) loading uncertainty, (2) measurement uncertainty, and (3) uncertainty arising from the varying isotopic composition of the materials being processed [15]. These uncertainties were incorporated in the estimation of minimum and maximum FGE values for each SWB. The FGE value ranges have been used to complete the information in the table below with the error multiplied by two as required by Section 3.1 of the CH-TRAMPAC [1].

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Payload Container No.	FGE (grams)	Error (grams)	Value + 2X Error (grams)	Limit (grams)
BCSWB-01	0.3347	0.4552	1.2451	325
BCSWB-02	1.1441	1.5560	4.2561	325
BCSWB-03	0.0593	0.0806	0.2205	325
BCSWB-04	0.1822	0.2478	0.6778	325
BCSWB-05	0.4407	0.5994	1.6395	325
BCSWB-06	0.1144	0.1556	0.4256	325

The FGE value (plus two times the error) of BCSWB-01, -02, -03, -04, -05, and -06 is well below the 325-gram FGE limit per SWB.

As specified by Section 3.1 of the CH-TRAMPAC, a TRUPACT-II shall be acceptable for transport only if the Pu-239 FGE plus two times the measurement error (i.e., two standard deviations) is less than or equal to the following limits [1]:

- 325 grams for a payload of SWBs, except for payloads containing greater than 1 percent by weight Be or BeO.
- 250 grams for a payload of SWBs containing less than or equal to 1 percent by weight Be or BeO and machine-compacted waste.
- 100 grams for a payload of SWBs containing greater than 1 percent by weight Be or BeO.

For payloads of SWBs without machine-compacted waste containing less than or equal to 1 percent by weight Be or BeO and greater than 5 grams of Pu-240 content per payload (as determined after the subtraction of two times the error), the package limits specified in Table 3.1-1 of the CH-TRAMPAC apply.

As BCSWB-01, -02, -03, -04, -05, and -06 do not contain Be or BeO greater than 1 percent by weight, machine-compacted waste, or significant quantities of Pu-240, the 325-gram FGE limit is applicable to the payloads containing BCSWB-01, -02, -03, -04, -05, and -06. In accordance with CCP-PO-003 [6], CCP personnel will calculate the total fissile mass (FGE) plus the total root mean square fissile mass error for the assembled payloads and evaluate compliance with the maximum allowable FGE limit of 325 grams per payload. As shown in the above table, the total FGE value for BCSWB-01, -02, -03, -04, -05, and -06 is well below the 325-gram FGE limit per payload. CCP personnel shall document compliance with the FGE requirement on the PATCD.

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3.2 Radiation Dose Rates

As specified by Section 3.2 of the CH-TRAMPAC, the external radiation surface dose rate of a SWB shall be less than or equal to 200 millirem per hour (mrem/hour) [1]. Prior to shipment, the surface radiation dose rates of BCSWB-01, -02, -03, -04, -05, and -06 will be surveyed in accordance with HP-OP-019, *Radiation and Contamination Survey Techniques* [18]. As specified by Section 3.2.2 of the CH-TRAMPAC, the measurements shall be made with instruments traceable to a national standard [1]. HP-AP-029, *Control of Radiological Measuring Test Equipment and Instruments [RMTEI],* requires the dose rate measurements to be made with instruments whose calibration is traceable to American National Standards Institute (ANSI) Standard N323-A [20]. CCP personnel will use the data collected in accordance with HP-OP-019 to evaluate compliance with the 200-mrem/hour limit will evaluate compliance with the 200-mrem/hour limit for BCSWB-01, -02, -03, -04, -05, and -06.

As specified by Section 3.2 of the CH-TRAMPAC, the external radiation dose rates of the loaded TRUPACT-II shall be less than or equal to 200 mrem/hour at the surface and less than or equal to 10 mrem/hour at 2 meters. In accordance with CCP-PO-003 [6], CCP personnel will survey the loaded TRUPACT-II and evaluate compliance with these radiation dose rate limits.

4.0 CHEMICAL PROPERTIES REQUIREMENTS

4.1 Pyrophoric Materials

As specified by Section 4.1 of the CH-TRAMPAC, nonradioactive pyrophoric materials shall not be packaged into payload containers [1]. Radioactive pyrophoric materials, if present in the waste, shall be limited to less than 1 percent (weight) of the payload container [1]. The only non-radionuclide pyrophoric material identified by acceptable knowledge (AK) is sodium potassium [4]. This material may have been used in the Building JN-4 Plutonium Laboratory; however, laboratory procedures required that the material be dissolved in butyl alcohol prior to disposal [4]. BCSWB-01, -02, -03, -04, -05, and -06 were packaged in accordance with TC-OP-01.4 [13]. TC-OP-01.4 directed BCL operators to use AK information in conjunction with VE during waste generation and packaging to verify the absence of pyrophorics. As documented by the AK records and the records generated in accordance with TC-OP-01.4 during waste packaging, pyrophorics are not present in the waste. The absence of pyrophorics was documented in the payload container data packages for the SWBs in accordance with TC-AP-01.1 [14]. As such, the absence of pyrophoric materials in BCSWB-01, -02, -03, -04, -05, and -06 is documented.

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4.2 Explosives, Corrosives, and Compressed Gases

As specified by Section 4.2 of the CH-TRAMPAC, explosives, corrosives, and compressed gases are prohibited from payload containers [1]. Used (i.e., empty) aerosol cans are allowed as they do not impact the package internal pressure or flammability [1]. Verification that any aerosol cans are empty shall be by radiography and/or process knowledge. [1]

Explosives were not identified by AK [4]. Corrosive liquids were used in the laboratory and during D&D operations; however, laboratory and decommissioning procedures required that the liquids be solidified with plaster or disposed of in the hot drain system [4]. Real-time radiography (RTR) of Building JN-4 Plutonium Laboratory waste drums identified several empty, non-punctured cans [4], which were removed during repackaging in accordance with WI-1194 [5]. BCSWB-01, -02, -03, -04, -05, and -06 were packaged in accordance with TC-OP-01.4 [13]. TC-OP-01.4 directed BCL operators to use AK information in conjunction with VE during waste generation and packaging to verify the absence of explosives, corrosives, and compressed gases. As documented by the AK records and the records generated in accordance with TC-OP-01.4 during waste packaging, explosives, corrosives, and compressed gases are not present in the waste. The absence of explosives, corrosives, and compressed gases was documented in the payload container data packages for the SWBs in accordance with TC-AP-01.1 [14]. As such, the absence of explosives, corrosives, and compressed gases in BCSWB-01, -02, -03, -04, -05, and -06 is documented.

4.3 Chemical Composition

As specified by Section 4.3 of the CH-TRAMPAC, chemical constituents in a payload shall conform to the lists of allowable materials in Tables 4.3-1 through 4.3-8 of the CH-TRAMPAC [1]. The total quantity of chemicals/materials not listed as allowed materials for a given waste material type in any payload container is restricted to less than 5 weight percent total [1]. The wastes contained in BCSWB-01, -02, -03, -04, -05, and -06 are solid organic and inorganic materials [3, 4]. The SWBs have been assigned to Waste Material Type III.1 and Content Code SQ 121, TRU Solid Organic Waste, in the *CH-TRU Waste Content Codes (CH-TRUCON)* [20]. The chemicals and materials packaged in BCSWB-01, -02, -03, -04, -05, and -06 conform to the SQ 121/SQ 221 chemical list, which complies with the list of allowable materials for Waste Material Type III.1 (Table 4.3-6 of the CH-TRAMPAC) [1]. Content Code SQ 121/221 and its chemical list are provided in Attachment 1.

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4.4 Chemical Compatibility

As specified by Section 4.4 of the CH-TRAMPAC, chemical compatibility of the payload materials shall be ensured. As specified in Section 4.4.2 of the CH-TRAMPAC, chemical compatibility of all waste material types has been demonstrated for transport in the TRUPACT-II using the chemicals in the allowable materials lists (Tables 4.3-1 through 4.3-8 of the CH-TRAMPAC) [1]. The restrictions imposed on the chemical constituents of the content codes ensure compliance with the compatibility requirements. Because BCSWB-01, -02, -03, -04, -05, and -06 contain only chemicals that conform to the SQ 121/221 chemical list, the chemical compatibility requirement is met.

5.0 GAS GENERATION REQUIREMENTS

As specified by Section 5.0 of the CH-TRAMPAC, the gases generated in the payload containers and released into the packaging inner containment vessel (ICV) cavity shall be controlled to maintain the pressure within the ICV cavity below the acceptable design pressure of 50 pounds per square inch gauge (psig) [1]. As described in Section 5.2.5.3.3 of the CH-TRAMPAC, compliance with the design pressure limit is ensured by the analysis presented in Chapter 3.0 of the TRUPACT-II SAR for Waste Type III payload containers and payloads up to a decay heat of 23 watts [1]. The decay heat values for BCSWB-01, -02, -03, -04, -05, and -06 will result in payloads that are well below this value.

5.1 Payload Shipping Category

As specified by Section 5.1.1 of the CH-TRAMPAC, each payload container shall be assigned to a payload shipping category that provides information on the waste type, waste material type, and resistance to gas release from the inner layers of confinement [1]. A complete description of the internal packaging configurations for BCSWB-01, -02, -03, -04, -05, and -06 is provided in Content Code SQ 121 under packaging configurations SQ 121FA/221FA, SQ 121GA/221GA, and SQ 121HA/221HA in the CH-TRUCON [20] (see Attachment 1).

The following table summarizes the payload shipping categories determined from the packaging descriptions documented for BCSWB-01, -02, -03, -04, -05, and -06 [3, 4, 5, 13]. BCSWB-01, -02, -03, and -04 contain direct load waste. BCSWB-05 and -06 each contain four 55-gallon drums. Drums SDSBC-3635 and SDSBC-3688 (contained by BCSWB-05) each are fitted with one filter. The other six drums have holes punched in the lids [3]. However, each overpacked drum is conservatively assumed to be fitted with a filter similar to that used in Drums SDSBC-3635 and SDSBC-3688 (contained by BCSWB-05) for the purposes of determining the payload shipping category, which includes

the total resistance to gas release provided by internal packaging confinement layers.

Payload Container No.	Content Code	Packaging Configuration	Payload Shipping Category [2]
BCSWB-01	SQ 121GA	Waste is packaged in one heat-sealed bag.[1] The heat-sealed bag is packaged within two inner bags with twist-and-tape closures. Bagged waste is directly loaded into an SWB with four NFT-013 filters.	30 0109 1537
BCSWB-02	SQ 121G	Waste is packaged in one heat-sealed bag.[1] The heat-sealed bag is packaged within two inner bags with twist-and-tape closures. Bagged waste is directly loaded into an SWB with two NFT-013 filters.	30 0340 1544
BCSWB-03	SQ 121FA	Waste is packaged in three drum liner bags with twist-and-tape closures. Bagged waste is directly loaded into an SWB with four NFT-013 filters.	30 0109 0086
BCSWB-04	SQ 121GA	Waste is packaged in one heat-sealed bag.[1] The heat-sealed bag is packaged within two inner bags with twist-and-tape closures. Bagged waste is directly loaded into an SWB with four NFT-013 filters.	30 0109 1537
BCSWB-05	SQ 121HA	Waste is packaged in one heat-sealed bag.[1] The heat-sealed bag is packaged within two inner bags with twist-and-tape closures. Bagged waste is directly loaded into a 55-gallon drum that is either punctured or fitted with one NFT-013 filter. Four 55-gallon drums are directly loaded into an SWB with four NFT-013 filters.	30 0109 1564
BCSWB-06	SQ 121HA	Waste is packaged in one heat-sealed bag.[1] The heat-sealed bag is packaged within two inner bags with twist-and-tape closures. Bagged waste is directly loaded into a 55-gallon drum with a punctured lid. Four 55-gallon drums are directly loaded into an SWB with four NFT-013 filters.	30 0109 1564

[1] BCL AK indicates that the heat-sealed bags in the SWBs are compliant with the specifications of Appendix 6.13 of the CH-TRU Payload Appendices [21] for allowable configurations including a heat-sealed bag (i.e., 1 heat-sealed bag layer per container and bag surface area >390 square inches) [3].

[2] All containers except BCSWB-02 meet the criteria for using the dose-dependent G value.

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5.2 Flammable (Gas/VOC) Concentration Limits

As specified by Section 5.2 of the CH-TRAMPAC, wastes to be transported in the TRUPACT-II are restricted so that no flammable mixtures can occur in any layer of confinement during shipment [1]. Based on process knowledge and the documentation of individual waste items packaged in BCSWB-01, -02, -03, -04, -05, and -06, no flammable volatile organic compounds (VOCs) were used in the generation of the waste. As such, no flammable VOCs are present in BCSWB-01, -02, -03, -04, -05, and -06.

5.3 Decay Heat

As specified by Section 5.2.3 of the CH-TRAMPAC, compliance with flammable (gas/VOC) limits per payload container may be demonstrated by meeting a decay heat limit per payload container based on the assigned payload shipping category [1]. Using the NDA data, BCL personnel calculated the decay heat values of the individual SWBs [15]. The error associated with the decay heat value calculated for each SWB encompasses three areas of uncertainty: (1) loading uncertainty, (2) measurement uncertainty, and (3) uncertainty arising from the varying isotopic composition of the materials being processed [15]. These uncertainties were incorporated in the estimation of minimum and maximum decay heat values for each SWB. The decay heat value ranges have been used to complete the information in the table below with decay heat value plus error for each SWB equaling the highest value in the decay heat value range for the SWB.

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The following table summarizes the decay heat values and error estimates for BCSWB-01, -02, -03, -04, -05, and -06 and evaluates compliance with the applicable decay heat limits following the addition of the error:

Payload Container No.	Decay Heat Value (watts)	Error (watts)	Value Plus Error (watts)	Limit[a] (watts)
BCSWB-01	0.1571	0.0629	0.22	0.0288
BCSWB-02	0.0086	0.0034	0.012	0.0092
BCSWB-03	0.2571	0.1029	0.36	0.5147
BCSWB-04	0.1714	0.0686	0.24	0.0288
BCSWB-05	0.4429	0.1771	0.62	0.0283
BCSWB-06	0.4786	0.1914	0.67	0.0283

[a]Limit calculated as specified in the CH-TRAMPAC from the payload shipping category listed in Section 5.1.

As shown in the above table, BCSWB-03 complies with the applicable decay heat limit. Because BCSWB-01, -02, -04, -05, and -06 exceed the applicable decay heat limits, HSG measurement of these payload containers was performed, as specified in Section 5.2.5 of the CH-TRAMPAC, by CCP personnel in accordance with CCP-TP-118, *CCP Sampling of Waste Containers* [22]. The samples were analyzed for hydrogen and methane by the INL Environmental Chemistry Laboratory in accordance with Method ACMM-9925.

Based on the results of the HSG sampling, BCSWB-01, -02, -04, -05, and -06, show no detectable flammable gas concentrations [23] and comply with the maximum allowable hydrogen generation rate per payload container.

As shown in the above table, the total decay heat of the payload containers (plus error) is well below the TRUPACT-II design limit of 40 watts. During payload assembly activities to be completed in accordance with CCP-PO-003 [6], CCP personnel will document compliance of the assembled payload with the TRUPACT-II design limit of 40 watts. CCP personnel shall document compliance with the decay heat requirement on the PATCD.

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5.4 Venting and Aspiration

As specified by Section 5.3 of the CH-TRAMPAC, payload containers that have been stored in an unvented condition (i.e., no filter and/or unpunctured liner) shall be aspirated for the specific length of time to ensure equilibration of any gases that may have accumulated in the closed container [1]. BCSWB-01, -02, -03, -04, -05, and -06 were vented during packaging in accordance with TC-OP-01.4 [13] and WI-1194 [5]. Therefore, the aspiration requirement of Section 5.3 of the CH-TRAMPAC is not applicable.

6.0 PAYLOAD ASSEMBLY REQUIREMENTS

As specified by Sections 6.1 and 6.2 of the CH-TRAMPAC, a TRUPACT-II payload shall be authorized for shipment by the completion and signing of the Payload Container Transportation Certification Document(s) (PCTCD) and the PATCD after verification of compliance with all transportation requirements of the CH-TRAMPAC [1]. The certification of BCSWB-01, -02, -03, -04, -05, and -06 and the payloads in which they are assembled will be completed by the CCP Transportation Certification Official in accordance with CCP-PO-003 [6] and CCP-TP-030 [8]. CCP-TP-030 details the completion of required transportation certification documents (PCTCDs and PATCDs). During the completion of these documents, compliance with the transportation parameter requirements as documented in the previous sections will be verified by the CCP Transportation Certification Official. The shipping records, whose generation is described in CCP-PO-003, shall be maintained by the CCP for a minimum period of 3 years.

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7.0 REFERENCES

1. U.S. Department of Energy, "Contact-Handled Transuranic Waste Authorized Methods for Payload Control (CH-TRAMPAC)," Revision 21, U.S. Department of Energy, Carlsbad Field Office, Carlsbad, New Mexico.

2. CCP-PO-001, "CCP Transuranic Waste Characterization Quality Assurance Project Plan," current revision, Washington TRU Solutions LLC, Carlsbad, New Mexico.

3. Maheras, Steven J., "Acceptable Knowledge for Contact-Handled Transuranic Waste," June 22, 2004, Battelle Columbus Laboratories, Columbus, Ohio.

4. TCP-98-04, "Building JN-4 Plutonium Laboratory Acceptable Knowledge Document," Battelle Columbus Laboratories, Columbus, Ohio.

5. WI-1194, "Repackaging of the JN-4 Plutonium Waste," Battelle Columbus Laboratories, Columbus, Ohio.

6. CCP-PO-003, "CCP Transuranic Authorized Methods for Payload Control (CCP CH-TRAMPAC)," current revision, Washington TRU Solutions LLC, Carlsbad, New Mexico.

7. CCP-TP-033, "CCP Shipping of CH TRU Waste," current revision, Washington TRU Solutions LLC, Carlsbad, New Mexico.

8. CCP-TP-030, "CCP TRU Waste Certification and WWIS Data Entry," current revision, Washington TRU Solutions LLC, Carlsbad, New Mexico.

9. QD-AP-04.1, "Documentation and Control of Purchased Items and Services," Battelle Columbus Laboratories Decommissioning Project, Columbus, Ohio.

10. WA-OP-006, "Procurement and Inspection of Packagings for Hazardous Materials Shipments," Battelle Columbus Laboratories Decommissioning Project, Columbus, Ohio.

11. PR-AP-17.1, "Operation of the Project Records Management System," Battelle Columbus Laboratories Decommissioning Project, Columbus, Ohio.

12. TC-OP-01.4, "Segregation and Packaging of TRU Waste," Battelle Columbus Laboratories Decommissioning Project, Columbus, Ohio.

13. TC-AP-01.1, "TRU Waste Data Package Generation," Battelle Columbus Laboratories Decommissioning Project, Columbus, Ohio.

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14. Memorandum from T.I. McSweeney and S.J. Maheras to P. Weaver, Subject: Estimating the Uncertainty in the Fissile Gram Equivalents, Watts and Weight Estimates for the Six Standard Waste Boxes, Battelle Columbus Laboratories, Columbus, Ohio, dated May 2005.

15. WA-OP-030, “Packaging, Marking and Labeling of Radioactive Waste and Radioactive Mixed Waste (RMW),” Battelle Columbus Laboratories Decommissioning Project, Columbus, Ohio.

16. QD-AP-07.1, “Supplier Evaluation and Qualification,” Battelle Columbus Laboratories Decommissioning Project, Columbus, Ohio.

17. CCP-QP-015, “CCP Procurement”, current revision, Washington TRU Solutions LLC, Carlsbad, New Mexico.

18. HP-OP-019, “Radiation and Contamination Survey Techniques,” Battelle Columbus Laboratories Decommissioning Project, Columbus, Ohio.

19. HP-AP-029, “Control of Radiological Measuring Test Equipment and Instruments [RMTEI],” Battelle Columbus Laboratories Decommissioning Project, Columbus, Ohio.

20. DOE/WIPP-3194, “CH-TRU Waste Content Codes (CH-TRUCON),” current revision, U.S. Department of Energy, Carlsbad Field Office, Carlsbad, New Mexico.

21. U.S. Department of Energy, “Shipment of CH-TRU Waste Packaging Configurations with an Unvented Heat-Sealed Bag Layer,” Appendix 6.13, CH-TRU Payload Appendices, Revision 0, U.S. Department of Energy, Carlsbad Field Office, Carlsbad, New Mexico.

22. CCP-TP-118, “CCP Sampling of Waste Containers,” Washington TRU Solutions LLC, Carlsbad, New Mexico.

23. Idaho National Laboratory, Gas Headspace Analysis Data Report, No. ECL05029C, issued to C.A. Stepzinski (CCP), Idaho National Laboratory, Idaho Falls, Idaho, dated.

Attachment 1 – Content Code SQ. 121 and Chemical List

CONTENT CODE: SQ 121, SQ 221 (See Waste Packaging Description Table)

CONTENT DESCRIPTION: Solid Organic Waste

GENERATING SITE: Various

WASTE DESCRIPTION: This waste consists of a variety of combustible and noncombustible organic items.

GENERATING SOURCES: These wastes were generated from various operations at the sites.

WASTE FORM: The waste may include combustible items such as cloth and paper products (e.g., from the cleanup of spills), rags, coveralls and booties, plastic, cardboard, rubber, wood, surgeons gloves, and Kimwipes. The waste may also include filter waste, (e.g., dry box filters, HEPA filters, and filter cartridges); noncombustible Benelex and plexiglas neutron shielding, blacktop, concrete, dirt, and sand; leaded gloves and aprons comprised of Hypalon rubber and lead oxide impregnated neoprene; and small amounts of metal waste. This waste may also include particulate and sludge-type organic process solids immobilized/solidified with Portland cement, vermiculite, Aquaset, or Petroset. The waste may also include items from decontamination and decommissioning activities (tools, supplies, equipment, etc.) and stabilized plutonium ash.

WASTE PACKAGING: Details of the waste packaging for each code are presented in the following table:

WASTE PACKAGING DESCRIPTION TABLE

Code	Description*
SQ 121A SQ 221A	The waste is placed directly into a 55-gallon drum, an SWB, or a TDOP with no layers of confinement.
SQ 121AA SQ 221AA	The waste is placed directly into a metal can with the filter removed from the bung hole. The metal can is contained in a 55-gallon drum that is lined with a rigid liner. The rigid liner lid is removed.
SQ 121AB SQ 221AB	The waste is contained in one-gallon paint cans. The one-gallon paint cans are placed directly into a 55-gallon drum with no confinement layers and no rigid liner.
SQ 121B SQ 221B	The waste is packaged directly into one plastic bag and is then placed into a 55-gallon drum, an SWB, or a TDOP.
SQ 121C SQ 221C	The waste is packaged directly into two plastic bags and is then placed into a 55-gallon drum, an SWB, or a TDOP.
SQ 121D SQ 221D	The waste is packaged directly into three plastic bags and is then placed into a 55-gallon drum, an SWB, or a TDOP.
SQ 121DA SQ 221DA	The waste is packaged directly into two plastic inner bags and one plastic liner bag. The waste is then placed into a 55-gallon drum with no rigid liner.
SQ 121E SQ 221E	The waste is packaged directly into three plastic inner bags and is then placed into a 55-gallon drum with no rigid liner. No closed plastic liner bags are used inside the 55-gallon drum.
SQ 121F SQ 221F	The waste is packaged in three drum liner bags with twist-and-tape closures. Bagged waste is directly loaded into an SWB with two filters each having a minimum hydrogen diffusivity value of 3.7×10^{-6} mol/sec/mole fraction.

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Attachment 1 – Content Code SQ. 121 and Chemical List (Continued)

Code	Description*
SQ 121FA SQ 221FA	The waste is packaged in three drum liner bags with twist-and-tape closures. Bagged waste is directly loaded into an SWB with four filters each having a minimum hydrogen diffusivity value of 3.7×10^{-6} mol/sec/mole fraction.
SQ 121G SQ 221G	The waste is packaged in one heat-sealed bag meeting the specifications of Appendix 6.13 of the CH-TRU Payload Appendices. The heat-sealed bag is packaged within two inner bags with twist-and-tape closures. Bagged waste is directly loaded into an SWB with two filters each having a minimum hydrogen diffusivity value of 3.7×10^{-6} mol/sec/mole fraction.
SQ 121GA SQ 221GA	The waste is packaged in one heat-sealed bag meeting the specifications of Appendix 6.13 of the CH-TRU Payload Appendices. The heat-sealed bag is packaged within two inner bags with twist-and-tape closures. Bagged waste is directly loaded into an SWB with four filters each having a minimum hydrogen diffusivity value of 3.7×10^{-6} mol/sec/mole fraction.
SQ 121H SQ 221H	The waste is packaged in one heat-sealed bag meeting the specifications of Appendix 6.13 of the CH-TRU Payload Appendices. The heat-sealed bag is packaged within two inner bags with twist-and-tape closures. Bagged waste is directly loaded into a 55-gallon drum that is either punctured or fitted with a filter with a minimum hydrogen diffusivity value of 3.7×10^{-6} mol/sec/mole fraction. The drum has no rigid liner. Four 55-gallon drums are directly loaded into an SWB with two filters each having a minimum hydrogen diffusivity value of 3.7×10^{-6} mol/sec/mole fraction.
SQ 121HA SQ 221HA	The waste is packaged in one heat-sealed bag meeting the specifications of Appendix 6.13 of the CH-TRU Payload Appendices. The heat-sealed bag is packaged within two inner bags with twist-and-tape closures. Bagged waste is directly loaded into a 55-gallon drum that is either punctured or fitted with a filter with a minimum hydrogen diffusivity value of 3.7×10^{-6} mol/sec/mole fraction. The drum has no rigid liner. Four 55-gallon drums are directly loaded into an SWB with four filters each having a minimum hydrogen diffusivity value of 3.7×10^{-6} mol/sec/mole fraction.

* If drums are overpacked in an SWB, a TDOP, or an 85-gallon drum, no closed liner bags are used inside the SWB, the TDOP, or the 85-gallon drum. If waste is placed directly in a TDOP, any liner bag is an SWB liner. All bag closures are in accordance with the CH-TRAMPAC.

ASSAY: Assay for all payload containers shall be performed in accordance with the CH-TRAMPAC. The isotopic composition of the waste is determined from measurements taken on the product material during the processing at the site. The processing organizations transmit the isotopic composition information to the site waste certification organization. Therefore, the isotopic composition of the waste need not be determined by direct analysis or measurement of the waste unless process information is not available.

FREE LIQUIDS: Liquid waste is prohibited in the payload containers (drums, SWBs, or TDOPs) except for residual amounts in well-drained containers. The total volume of residual liquid in a payload container shall be less than 1 volume percent of the payload container. Waste packaging procedures ensure that free liquids are less than 1 volume percent of the payload container.

EXPLOSIVES/COMPRESSED GASES: Explosives and compressed gases in the payload containers are prohibited by waste packaging procedures.

PYROPHORICS: Nonradioactive pyrophorics in the payload containers are prohibited by waste packaging procedures. Waste packaging procedures shall ensure that all pyrophoric radioactive materials are present only in small residual amounts (less than 1 weight percent) in payload containers.

Attachment 1 – Content Code SQ. 121 and Chemical List (Continued)

CORROSIVES: Corrosives are prohibited in the payload containers. Acids and bases that are potentially corrosive shall be neutralized and rendered noncorrosive prior to being a part of the waste. The physical form of the waste and the waste generating procedures ensure that the waste is in a nonreactive form.

CHEMICAL COMPATIBILITY: A chemical compatibility study has been performed on this content code, and all waste is chemically compatible for materials in greater than trace (>1% weight) quantities. The chemicals found in this content code are restricted to the table of allowable materials for Waste Material Type III.1 in the CH-TRAMPAC.

PAYLOAD CONTAINER VENTING AND ASPIRATION: Payload containers in this content code that have been stored in an unvented condition (i.e., no filter and unpunctured liner) will be aspirated using one of the three options described in the CH-TRAMPAC.

ADDITIONAL CRITERIA: In accordance with the CH-TRAMPAC, each drum is fitted with a minimum of one filter vent, and the rigid liner (if present) is punctured. Each SWB is fitted with at least two and up to four filters. Each TDOP is fitted with at least nine filters.

SHIPPING CATEGORY: See Table 2, Summary of Approved Content Codes and Corresponding Shipping Categories.

MAXIMUM ALLOWABLE WATTAGE: The maximum allowable wattages for analytical and test category waste are specified in the CH-TRAMPAC.

Attachment 1 – Content Code SQ. 121 and Chemical List (Continued)

Small Quantity Site
List of Chemicals and Materials
in TRU Waste Content Codes

Content Code SQ 121/221

SOLID ORGANIC WASTE

GROUP 1:	ACIDS, MINERAL, NON-OXIDIZING (Constituents reacted prior to loading in payload containers)	T
GROUP 2:	ACIDS, MINERAL, OXIDIZING (Constituents reacted prior to loading in payload containers)	T
GROUP 3:	ACIDS, ORGANIC (Constituents reacted prior to loading in payload containers)	T
GROUP 4:	ALCOHOLS AND GLYCOLS	T
GROUP 8:	AZO COMPOUNDS, DIAZO COMPOUNDS, AND HYDRAZINES (Constituents reacted prior to loading in payload containers)	T
GROUP 10:	CAUSTICS (Constituents reacted prior to loading in payload container	T
GROUP 11:	CYANIDES	T
GROUP 13:	ESTERS	T
GROUP 14:	ETHERS	T
GROUP 15:	FLUORIDES	T
GROUP 16:	HYDROCARBONS, AROMATIC	T
GROUP 17:	HALOGENATED ORGANICS	T
GROUP 18:	ISOCYANATES	T
GROUP 19:	KETONES	T
GROUP 21:	METALS, ALKALI AND ALKALINE EARTH, ELEMENTAL AND ALLOYS (Constituents reacted prior to loading in payload containers)	T
GROUP 22:	METALS OTHER ELEMENTAL AND ALLOYS IN THE FORM OF POWDERS, VAPORS OR SPONGES	T
GROUP 23:	METALS, OTHER ELEMENTAL AND ALLOYS, AS SHEETS, RODS, MOLDINGS, DROPS, ETC.	D
GROUP 24:	METALS AND METAL COMPOUNDS, TOXIC	D
GROUP 25:	NITRIDES	T
GROUP 28:	HYDROCARBON, ALIPHATIC, UNSATURATED	T
GROUP 29:	HYDROCARBON, ALIPHATIC, SATURATED	T
GROUP 30:	PEROXIDES AND HYDROPEROXIDES, ORGANIC (Constituents reacted prior to loading in payload containers)	T

Attachment 1 – Content Code SQ. 121 and Chemical List (Continued)

Small Quantity Site
List of Chemicals and Materials
in TRU Waste Content Codes

Content Code SQ 121/221
(Continued)

SOLID ORGANIC WASTE

GROUP 32:	ORGANOPHOSPHATES, PHOSPHOTHIOATES AND PHOSPHODITHIOATES	
	Tributyl Phosphate	D
GROUP 101:	COMBUSTIBLE AND FLAMMABLE MATERIALS, MISCELLANEOUS	
	Asphalt	D
	Benelex	D
	Cardboard	D
	Cellulose	D
	Cloth	D
	Fiberglass	M
	Grease	D
	Hydraulic oil	T
	Ion exchange resin	D
	Mineral oil	T
	Molds and Crucibles	D
	Oil	D
	Paper	D
	Plastic	D
	Plexiglas	D
	Polybutadiene	T
	Polyethylene	D
	Polymethyl methacrylate	D
	Polypropylene	D
	Polystyrene	M
	Polyurethane	T
	Polyvinyl chloride	D
	Rags and Cloth	D
	Rubber	D
	Rubber gloves	D
	Rubber gloves (Leaded)	T
	Synthetic rubber	M
	Wood	D
GROUP 103:	POLYMERIZABLE COMPOUNDS (Constituents reacted prior to loading in payload containers)	T
GROUP 104:	OXIDIZING AGENTS, STRONG (Constituents reacted prior to loading in payload containers)	T
GROUP 105:	REDUCING AGENTS, STRONG (Constituents reacted prior to loading in payload containers)	T
GROUP 106:	WATER AND MIXTURES CONTAINING WATER	T
GROUP 107:	WATER REACTIVE SUBSTANCES (Constituents reacted prior to loading in payload containers)	D
OTHER INORGANICS		D

Attachment 1 – Content Code SQ. 121 and Chemical List (Continued)

Small Quantity Site
List of Chemicals and Materials
in TRU Waste Content Codes

Content Code SQ 121/221
(Continued)

SOLID ORGANIC WASTE

OTHER ORGANICS	T
OTHER SOLIDIFICATION MATERIALS/ABSORBENT	
Diatomaceous Earth	M
Florco	M
Hydrated Aquaset II	D
Radsorb	M

Refer to Introduction for a description of the designations used in this chemical list.