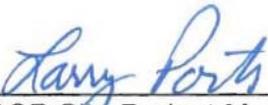


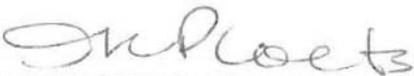
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Revision 0

Waste-Specific Data Package TRAMPAC for 17 Performance Demonstration Program Working Reference Material Sources at the Nevada Test Site

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1.0 INTRODUCTION

1.1 Purpose

The purpose of this Waste-Specific Data Package TRAMPAC for 17 Performance Demonstration Program (PDP) Working Reference Material (WRM) Sources at the Nevada Test Site (NTS) is to describe and document how each of the requirements for HalfPACT or TRUPACT-II transportation is met for sources to be transported from NTS in Mercury, Nevada. The HalfPACT and TRUPACT-II transportation requirements are defined in the *CH-TRU Waste Authorized Methods for Payload Control* (CH-TRAMPAC) (Reference 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 Carlsbad Field Office for small quantity shipments. This Waste-Specific Data Package TRAMPAC for 17 PDP WRM Sources at NTS documents the evaluation of the source 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 (Reference 2) under the Central Characterization Project (CCP) Waste Isolation Pilot Plant (WIPP) certification program.

This document presents the information necessary for HalfPACT or TRUPACT-II shipment of 17 PDP WRM sources packaged in two 55-gallon drums from NTS to the Savannah River Site.

1.2 Scope

This Waste-Specific Data Package TRAMPAC for 17 PDP WRM Sources at NTS applies to Drum Nos. NTS-PDP-1 and NTS-PDP-2, which are yet to be packaged.

As stated in CH-TRAMPAC Section 1.1, "The TRUPACT-II and the HalfPACT have been developed as Type B packagings to provide a safe means of transporting contact-handled (CH) transuranic (TRU) wastes and other authorized payloads..." The TRUPACT-II and HalfPACT Certificates of Compliance (C of C) specify the authorized contents as either material or waste as follows:

- The TRUPACT-II C of C specifies allowed contents in Section 5 (b) (1), Type and Form of Material, as follows: "Dewatered, solid or solidified transuranic and tritium-contaminated materials and waste."
- The HalfPACT C of C specifies allowed contents in Section 5 (b) (1), Type and Form of Material, as follows: "Byproduct, source, and special nuclear material in the form of dewatered, solid or solidified materials and wastes."

1.3 Background

To demonstrate compliance with the WIPP waste characterization program, each testing and analytical facility performing waste characterization activities participates in the PDP. The PDP serves as a quality control check against expected results and provides information about the quality of data generated in the characterization of waste destined for WIPP. Single blind audit samples are prepared and distributed by an independent organization to facilities participating in the PDP. The 17 WRM sources described by this document were used in the NTS PDP evaluation for nondestructive assay techniques to determine TRU radionuclides.

Each PDP WRM source has been certified as a sealed radioactive source as defined by American National Standards Institute (ANSI)/Health Physics Society (HPS), ANSI/HPS N43.6-1997, *Sealed Radioactive Source Classification* (Reference 3). Table 1, WRM Source Descriptions and Sealed Radioactive Source Classifications, provides a summary of the 17 PDP WRM source descriptions and the associated sealed radioactive source ANSI/HPS N43.6-1997 classifications.

Table 1. WRM Source Descriptions and Sealed Radioactive Source Classifications^a

Source Identification No.	Description	ANSI/HPS N43.6-1997 Classification
NTP-0127	High-purity plutonium dioxide dispersed in diatomaceous earth	97C43323
NTP-0128		
NTP-0129		
NTP-0130		
NTP-0131		
NTP-0132		
NTP-0133		
NTP-0134		
NTP-0135		
NTP-0136		
NTP-0144		
NTP-0152		
NTP-0160	High-purity plutonium oxide granules uniformly embedded in a graphite felt matrix	97E43323
NTP-0168		
NTP-0176		
NTP-0184		
NTP-0192		

^a Los Alamos National Laboratory Certificates of Content and Traceability for Department of Energy Carlsbad Area Office PuO₂-Diatomaceous Earth Working Reference Material # NTP 0127, NTP-0128, NTP-0129, NTP-0130, NTP-0131, NTP-0132, NTP 0133, NTP 0134, NTP-0135, NTP-0136, NTP-0144, NTP-0152, and NTP 0160, and PuO₂ Particle-Graphite WRM NTP-0168, NTP-0176, NTP-0184, and NTP-0192, Los Alamos National Laboratory, Los Alamos, New Mexico (Reference 4).

In addition to the sealed radioactive source certificates (Reference 4), this document references CCP plans and procedures that have been or will be used to qualify Drum Nos. NTS-PDP-1 and NTS PDP 2 packaging the PDP WRM sources for HalfPACT or TRUPACT II shipment. The following CCP documents will be implemented for the certification of Drum Nos. NTS-PDP-1 and NTS-PDP-2 based on the compliance data documented herein:

- CCP-PO-401, *CCP Contact-Handled Transuranic Authorized Methods for Payload Control (CCP CH-TRAMPAC) for Intersite Shipments* (Reference 5)
- CCP-TP-404, *CCP Contact-Handled Transuranic Waste Certification Data Entry for Intersite Shipments* (Reference 6)
- CCP-TP-405, *CCP Intersite Shipments of Contact-Handled Transuranic Waste* (Reference 7)

2.0 CONTAINER AND PHYSICAL PROPERTIES REQUIREMENTS

2.1 Authorized Payload Containers

2.1.1 Requirements

As specified by Section 2.1.1 of the CH-TRAMPAC, a 55-gallon drum is an authorized payload container for transport in the HalfPACT or TRUPACT-II, provided it meets the specifications of Section 2.9.1 of the CH-TRAMPAC (Reference 1).

Section 2.1.2 of the CH-TRAMPAC also requires the inspection of the integrity of the payload containers prior to shipment (Reference 1).

2.1.2 Methods of Compliance and Verification

The PDP WRM sources will be packaged in 55-gallon drums that meet the applicable specifications. The 55-gallon drums for the packaging of the PDP WRM sources were procured in accordance with CCD-QA07.001, *Procurement Process* (Reference 8). Upon receipt at NTS, the 55-gallon drums were inspected by NTS personnel in accordance with CCD-QA07.001 to ensure that the drums were compliant with procurement requirements.

Prior to transport, the integrity of each 55-gallon drum will be visually inspected by CCP personnel in accordance with CCP-TP-405 (Reference 7).

2.2 Dunnage

2.2.1 Requirements

As specified in Section 2.2.1 of the CH-TRAMPAC, a shipper shall use empty 55-gallon drums as dunnage to complete a payload configuration if too few loaded payload containers are available. The dunnage 55-gallon drums must meet the specifications of Section 2.9.1 of the CH-TRAMPAC with the exception that dunnage containers shall have at least one open vent port (i.e., not filtered or plugged) (Reference 1).

2.2.2 Methods of Compliance and Verification

Empty 55-gallon drums will be used as dunnage to complete the payload containing the PDP WRM sources. Dunnage containers will meet the specifications of Section 2.9.1 of the CH-TRAMPAC, except as required by Section 2.2.1 of the CH-TRAMPAC dunnage containers have open vent ports (i.e., not filtered or plugged). If the HalfPACT is used, five empty 55-gallon drums meeting these specifications procured by NTS in accordance with CCD-QA07.001 (Reference 8) will be used to complete the HalfPACT payload. If the TRUPACT-II is used, the five empty 55-gallon drums procured by NTS in accordance with CCD-QA07.001 (Reference 8) will be used in combination with seven empty 55-gallon drums procured by CCP in accordance with CCP-QP-015, *CCP Procurement* (Reference 9), to result in the 12 dunnage drums necessary to complete the TRUPACT-II payload. CCP personnel will ensure that dunnage drums meet all applicable requirements in accordance with CCP-TP-405 (Reference 7).

2.3 Container/Assembly Weight

2.3.1 Requirements

As specified by Section 2.3.1 of the CH-TRAMPAC, the applicable weight limit for the 55-gallon drums packaging the PDP WRM sources is 1,000 pounds per 55-gallon drum (Reference 1).

If the 55-gallon drums are transported in a HalfPACT, the following weight limits apply (as specified in Section 2.3.1 of the CH-TRAMPAC):

- 7,600 pounds per HalfPACT payload assembly, including pallets, spacers, guide tubes, slip sheets, reinforcing plates, and banding material
- 18,100 pounds per loaded HalfPACT.

If the 55-gallon drums are transported in a TRUPACT-II, the following weight limits apply (as specified in Section 2.3.1 of the CH-TRAMPAC):

- 7,265 pounds per TRUPACT-II payload assembly, including pallets, spacers, guide tubes, slip sheets, reinforcing plates, and banding material
- 19,250 pounds per loaded TRUPACT-II.

Compliance shall be by measurement. As specified by Section 2.3.2.1 of the CH-TRAMPAC, the weight of each 55-gallon drum shall be determined using a calibrated scale (Reference 1). The scale calibrations shall be in accordance with the National Institute of Standards and Technology (NIST) Handbook 44 or an equivalent standard (Reference 1). The measured weight and measurement error of each payload container shall be recorded in the Payload Container Transportation Certification Document (PCTCD) or the Overpack Payload Container Transportation Certification Document (OPCTCD), as appropriate. The measurement error is determined from the scale calibration tolerance. If multiple scales are used, a bounding value based on the highest scale calibration tolerance may be used to determine the measurement error.

2.3.2 Methods of Compliance and Verification

Drum Nos. NTS-PDP-1 and NTS-PDP-2 will be weighed by NTS personnel in accordance with SOP-2151.507, *TRU Operations Waste Container Management (SBI)* (Reference 10). Pursuant to Section 2.3.2.1 of the CH-TRAMPAC, the scale calibrations shall be in accordance with the NIST Handbook 44 or an equivalent standard (Reference 1). The NTS scale is calibrated in accordance with ANSI/NCSL Z540.3-2006 as specified by OP-2141.001, *Standards and Calibration Laboratory Handbook* (Reference 11) and documented in SOP-2151.529, *Radioactive Waste Management Complex (RWMC) TRU Operations Inspections (SBI)* (Reference 12). As stated in OP-2141.001, measurement standards are traceable to the NIST, nationally recognized standards, or QA approved sources before use. NTS personnel will determine the measurement error associated with the weight values based on the calibration tolerance of the scale used to measure the weight of each drum. If multiple scales are used, a bounding value based on the highest scale calibration tolerance may be used to determine the measurement error.

The PDP WRM sources contain gram quantities of nuclear material (<200 grams per source) and matrix (e.g., approximately 135 grams of diatomaceous earth was used in WRM source fabrication). The weight range of the individual PDP WRM sources is 1,000 to 1,075 grams. With the addition of the weights of the packaging materials (slip-lid metal cans) and the empty 55-gallon drum, the loaded 55-gallon drum weights will be well below the 1,000 lbs. per 55-gallon drum limit. As such, the drums will comply with the applicable maximum allowable gross weight limit of 1,000 pounds per 55-gallon drum following the addition of the measurement error, as specified in Section 2.3.1.1 of the CH-TRAMPAC (Reference 1). In accordance with CCP-TP-404 (Reference 6) and CCP-TP-405 (Reference 7) and using the weight measurement data including error collected by NTS (i.e., drum weight, error determination, and evidence of use of a calibrated scale), CCP personnel will evaluate compliance of each 55-gallon drum with the CH-TRAMPAC limit as specified in Section 2.3.1.1 of the CH-TRAMPAC. The CCP Transportation Certification Official (TCO) will verify compliance with the individual drum weight requirement and document on the PCTCD.

In accordance with CCP-TP-405 (Reference 7), CCP personnel will calculate the total weight of the payload assembly and evaluate compliance with the maximum payload assembly and loaded HalfPACT or TRUPACT-II limits as specified above and in Section 2.3 of the CH-TRAMPAC. Based on the contents of the two loaded 55-gallon drums, the total payload weight (including dunnage drums, measurement errors, and payload assembly materials) will be well below the TRUPACT II maximum payload assembly weight limit of 7,265 pounds. As such, the payload assembly weight limit will be met for either the HalfPACT or TRUPACT-II payload containing Drum Nos. NTS-PDP-1 and NTS-PDP-2. The CCP TCO will verify compliance with the payload weight requirement and document on the Payload Assembly Transportation Certification Document (PATCD).

2.4 Center of Gravity

2.4.1 Requirements

As stated in Section 2.3.1.2 of the CH-TRAMPAC, no center of gravity requirements exist for HalfPACT payloads.

For TRUPACT-II payloads, as required by Section 2.3.1.2 of the CH-TRAMPAC, the total weight of the top seven 55-gallon drums of the payload assembly shall be less than or equal to the total weight of the bottom seven 55-gallon drums (Reference 1).

2.4.2 Methods of Compliance and Verification

As stated in Section 2.3.1.2 of the CH-TRAMPAC, no center of gravity requirements exist for HalfPACT payloads.

If the TRUPACT-II is used for shipment, CCP personnel in accordance with CCP-PO-401 (Reference 5) will complete the payload assembly and loading activities such that the total weight of the top seven 55-gallon drums of the payload assembly is less than or equal to the total weight of the bottom layer of drums. CCP personnel will document compliance with the center of gravity requirement on the PATCD for the TRUPACT-II in accordance with CCP-TP-405 (Reference 7).

2.5 Container Marking

2.5.1 Requirements

As specified by Section 2.4.1 of the CH-TRAMPAC, each payload container shall be labeled with a unique container identification number (Reference 1). 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" (Reference 1). If a seven-pack of only dunnage 55-gallon drums is used in the TRUPACT-II, the containers shall be labeled "EMPTY" or "DUNNAGE." The unique container identification number label is not required for these containers.

2.5.2 Methods of Compliance and Verification

In accordance with SOP-2151.507 (Reference 10) and OP-2151.522, *Radioactive Inventory Control Program (SBI)* (Reference 13), the two 55-gallon drums packaging the PDP WRM sources will be labeled with the following unique container identification numbers:

NTS-PDP-1
NTS-PDP-2.

In accordance with SOP-2151.507 (Reference 10) and OP-2151.522 (Reference 13), each dunnage container is labeled with "DUNNAGE" and, as necessary, a unique identification number (e.g., NTS-DUN-01, NTS-DUN-02). In accordance with CCP-TP-405 (Reference 7), the CCP TCO will verify that the drum numbers listed in the PCTCD match the drum number listed on the label. For the dunnage containers, the CCP TCO will verify the

dunnage numbers listed on the PATCD correspond to the label affixed to the dunnage container.

2.6 Filter Vents

2.6.1 Requirements

As specified by Section 2.5.1 of the CH-TRAMPAC, each payload container to be transported in the HalfPACT or TRUPACT-II shall have one or more filter vents that meet the specifications of Section 2.5.1 of the CH-TRAMPAC (Reference 1).

2.6.2 Methods of Compliance and Verification

In accordance with SOP-2151.507 (Reference 10), Drum Nos. NTS-PDP-1 and NTS-PDP-2 are each vented with one Nuclear Filter Technologies, Inc., Model No. NFT-019DS filter with a hydrogen diffusivity value of $1.85E-05$ moles/second/mole fraction. The filter vent identification numbers are as follows: JI-836 (NTS-PDP-1) and JI-841 (NTS-PDP-2). In accordance with CCP-TP-405 (Reference 7), CCP personnel will visually verify that filter vents have been installed properly and will compare filter numbers to the numbers listed on the PCTCD.

As stated in Section 2.2, the dunnage drums used to complete the HalfPACT or TRUPACT-II payload will have open vent ports (i.e., not filtered or plugged) as required by Section 2.2.1 of the CH-TRAMPAC.

2.7 Liquids

2.7.1 Requirements

As required by Section 2.6.1 of the CH-TRAMPAC, liquid waste is prohibited in payload containers, except for residual amounts in well-drained containers (Reference 1). The total volume of residual liquid in a payload container shall be less than 1 percent (by volume) of the payload container.

2.7.2 Methods of Compliance and Verification

As stated in the sealed radioactive source certificates (Reference 4), the PDP WRM sources contain only either high-purity plutonium dioxide dispersed in diatomaceous earth or high-purity plutonium oxide granules uniformly embedded in a graphite felt matrix in a stainless steel containment assembly. In addition, the implementation of SOP-2151.565, *Waste Examination Technique*

(SBI) (Reference 14), for the packaging of the PDP WRM sources ensures the absence of prohibited items, including liquids. Based on this evaluation, Drum Nos. NTS-PDP-1 and NTS-PDP-2 comply with the restriction on residual liquids of less than 1 percent (by volume).

2.8 Sharp or Heavy Objects

2.8.1 Requirements

As required by Section 2.7.1 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 (Reference 1).

2.8.2 Methods of Compliance and Verification

Per the sealed radioactive source certificates (Reference 4), the PDP WRM sources do not qualify as sharp or heavy objects. Based on this description, sharp or heavy objects are not present in Drum Nos. NTS-PDP-1 and NTS-PDP-2.

2.9 Sealed Containers

2.9.1 Requirements

Sealed containers greater than 4 liters (nominal) are prohibited by Section 2.8.1 of the CH-TRAMPAC (Reference 1) except for Waste Material Type II.2 packaged in a metal container; Waste Material Type II.2 in metal cans does not generate any flammable gas.

2.9.2 Methods of Compliance and Verification

Prior to packaging in the 55-gallon drums, the PDP WRM sources are loaded into slip-lid metal cans that are approximately 11-inches in height and 1.5-inches in diameter. Because these metal cans are closed by a slip lid, they are not considered sealed containers. In addition, the implementation of SOP-2151.565 (Reference 14) for the packaging of the PDP WRM sources ensures the absence of prohibited items, including unvented containers larger than 4 liters. Based on this evaluation, sealed containers are not present in Drum Nos. NTS-PDP-1 and NTS-PDP-2.

3.0 NUCLEAR PROPERTIES REQUIREMENTS

3.1 Nuclear Criticality

3.1.1 Requirements

As specified by Section 3.1.1 of the CH-TRAMPAC, a 55-gallon drum 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 (Reference 1):

- 200 grams for a 55-gallon drum, except for drums containing greater than 1 percent by weight beryllium (Be) or beryllium oxide (BeO) or machine-compacted waste
- 100 grams for a 55-gallon drum containing greater than 1 percent by weight Be or BeO.

As specified by Section 3.1.1 of the CH-TRAMPAC, a HalfPACT or 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 (Reference 1):

- 325 grams for a payload of 55-gallon drums, except for payloads containing greater than 1 percent by weight Be or BeO.

For payloads 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 (Reference 1).

3.1.2 Methods of Compliance and Verification

As stated in the sealed radioactive source certificates (Reference 4), the PDP WRM sources contain only either high-purity plutonium dioxide dispersed in diatomaceous earth or high-purity plutonium oxide granules uniformly embedded in a graphite felt matrix in a stainless steel containment assembly. As verified by SOP-2151.565 (Reference 14) and OP-2151-522 (Reference 13), the PDP WRM sources do not contain Be or BeO in concentrations greater than 1 percent by weight of the contents or machine-compacted waste. As such, the 200-gram FGE limit is applicable to Drum Nos. NTS-PDP-1 and NTS-PDP-2.

The nuclear material content and total alpha activity along with overall uncertainty estimates at 95 percent confidence bounds are specified for each PDP WRM source in the applicable sealed radioactive source certificate (Reference 14). The values have been corrected from the certification date to a calculational date of November 4, 2009. Table 2, WRM Source FGE Values, summarizes the FGE values calculated for each PDP WRM source (Reference 15).

Table 2. WRM Source FGE Values

Source Identification No.	FGE (grams)	Error (grams)	Value + 2X Error (grams)
NTP-0127	2.82E-02	8.06E-06	2.8216E-02
NTP-0128	3.03E-02	8.67E-06	3.0317E-02
NTP-0129	2.73E-02	7.81E-06	2.7316E-02
NTP-0130	2.88E-01	8.23E-05	2.8816E-01
NTP-0131	2.82E-01	8.07E-05	2.8216E-01
NTP-0132	2.78E-01	7.93E-05	2.7816E-01
NTP-0133	2.84E+00	8.13E-04	2.8416E+00
NTP-0134	2.83E+00	8.09E-04	2.8316E+00
NTP-0135	2.83E+00	8.10E-04	2.8316E+00
NTP-0136	1.41E+01	4.04E-03	1.4108E+01
NTP-0144	2.83E+01	8.08E-03	2.8316E+01
NTP-0152	4.70E+01	1.34E-02	4.7027E+01
NTP-0160	6.12E+01	1.75E-02	6.1235E+01
NTP-0168	5.12E-01	3.87E-04	5.1277E-01
NTP-0176	3.26E+00	2.46E-03	3.2649E+00
NTP-0184	7.18E+00	5.43E-03	7.1909E+00
NTP-0192	2.46E+01	1.86E-02	2.4637E+01
TOTAL	195.59	0.07	195.73

Per the above data, the sum of the FGE plus two times the error for all sources is 195.73 FGE. As such, if all PDP WRM sources were packaged together in a single 55-gallon drum, the drum would comply with the 200-gram FGE 55-gallon drum limit (specified in Section 3.1 of the CH-TRAMPAC [Reference 1]). The PDP WRM sources will be packaged in two 55-gallon drums, each of which will be less than 200 FGE regardless of which sources are packaged together. Based on this evaluation, Drum Nos. NTS-PDP-1 and NTS-PDP-2 comply with the 200-gram FGE 55-gallon drum limit.

As the PDP WRM sources do not contain Be or BeO greater than 1 percent by weight, machine-compacted waste, or a significant quantity of Pu-240, the 325-gram FGE limit is applicable to the payloads containing the PDP WRM sources. In accordance with

CCP-PO-401 (Reference 5), CCP personnel will calculate the total fissile mass (FGE) plus the total root sum of squares fissile mass error for the assembled payload and evaluate compliance with the maximum allowable FGE limit of 325 grams per payload. The CCP TCO will review and verify compliance of the drum and payload FGE data that is listed on the applicable PCTCD and PATCD in accordance with CCP-TP-405 (Reference 7).

3.2 Radiation Dose Rates

3.2.1 Requirements

As specified by Section 3.2.1 of the CH-TRAMPAC, the external radiation surface dose rate of a 55-gallon drum shall be less than or equal to 200 millirem per hour (mrem/hour) (Reference 1).

As specified by Section 3.2.1 of the CH-TRAMPAC, the external radiation dose rates of the loaded HalfPACT or 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.

Additional payload container shielding shall not be used to meet the above requirements. However, payload containers that meet the above radiation dose rate requirements without shielding may be shielded to levels that are as low as reasonably achievable (ALARA).

3.2.2 Methods of Compliance and Verification

Prior to shipment, the surface radiation dose rate of Drum Nos. NTS-PDP-1 and NTS-PDP-2 will be surveyed in accordance with the NV/YMP Radiological Control Manual (Reference 16). As specified by Section 3.2.2 of the CH-TRAMPAC, the measurements shall be made with instruments traceable to a national standard (Reference 1). The NV/YMP Radiological Control Manual (Reference 16) requires the dose rate measurements to be made with instruments whose calibration standards are traceable to NIST. CCP personnel will use the data collected in accordance with this procedure to evaluate compliance with the 200-mrem/hour limit for Drum Nos. NTS-PDP-1 and NTS-PDP 2.

Once the HalfPACT or TRUPACT-II is loaded, NTS personnel will measure the surface dose rate and the dose rate at 2 meters of the individual HalfPACT or TRUPACT-II in accordance with NV/YMP Radiological Control Manual, and document the survey information on the loaded shipment survey report. This report will be provided to the CCP TCO. The CCP TCO verifies that the exterior

HalfPACT or TRUPACT-II dose rates are less than or equal to 200 mrem/hour at the surface and less than or equal to 10 mrem/hour at 2 meters.

The implementation of SOP-2151.565 (Reference 14) ensures that no payload container shielding is used in Drum Nos. NTS-PDP-1 and NTS-PDP-2.

3.3 Activity Limits

3.3.1 Requirements

As stated in Section 3.3.1 of the CH-TRAMPAC, no activity limits exist for 55-gallon drums.

As described in Section 2.7.7, Deep Water Immersion, of the HalfPACT and TRUPACT-II Safety Analysis Reports (SARs) (References 17 and 18), a payload shall be acceptable for transport only if the activity plus error (i.e., one standard deviation) is less than or equal to $10^5 A_2$ curies. A_2 values are defined in Title 10, Code of Federal Regulations, Part 71, *Packaging and Transportation of Radioactive Material* (Reference 21).

3.3.2 Methods of Compliance and Verification

As stated in Section 3.3.1 of the CH-TRAMPAC, no activity limits exist for 55-gallon drums.

The nuclear material content and total alpha activity are specified for each PDP WRM source in the applicable sealed radioactive source certificate (Reference 14). The values have been corrected from the certification date to a calculational date of November 4, 2009. Table 3, WRM Source Total A_2 Values, summarizes the total A_2 values for each PDP WRM source (Reference 15).

Table 3. WRM Source Total A₂ Values

Source Identification No.	Total A ₂ Value
NTP-0127	0.09
NTP-0128	0.10
NTP-0129	0.09
NTP-0130	0.91
NTP-0131	0.89
NTP-0132	0.88
NTP-0133	8.98
NTP-0134	8.94
NTP-0135	8.95
NTP-0136	44.60
NTP-0144	89.27
NTP-0152	148.52
NTP-0160	193.37
NTP-0168	1.68
NTP-0176	10.74
NTP-0184	23.63
NTP-0192	81.02
TOTAL	622.66

Per the above data, the sum of the total A₂ values for all sources is 622.66 curies, which is well below the 10⁵ A₂ curie limit for the payload containing all sources

4.0 CHEMICAL PROPERTIES REQUIREMENTS

4.1 Pyrophoric Materials

4.1.1 Requirements

As specified by Section 4.1.1 of the CH-TRAMPAC, radioactive pyrophoric materials shall be present only in small residual amounts (≤ 1 percent [weight]) in payload containers. Radioactive pyrophorics in concentrations greater than 1 percent by weight and all nonradioactive pyrophorics shall be reacted (or oxidized) and/or otherwise rendered nonreactive prior to placement in payload containers (Reference 1).

4.1.2 Methods of Compliance and Verification

As stated in the sealed radioactive source certificates (Reference 14), the PDP WRM sources contain only either high-purity plutonium dioxide dispersed in diatomaceous earth or high-purity plutonium oxide granules uniformly embedded in a graphite felt matrix in a stainless steel containment assembly. The PDP WRM sources do not contain pyrophoric materials. In addition, the implementation of SOP 2151.565 (Reference 14) ensures the absence of prohibited items, including pyrophorics. Based on this evaluation, Drum Nos. NTS-PDP-1 and NTS-PDP-2 comply with the prohibition on nonradioactive pyrophoric materials and the restriction on radioactive pyrophoric materials of less than 1 percent (by weight).

4.2 Explosives, Corrosives, and Compressed Gases

4.2.1 Requirements

As specified by Section 4.2.1 of the CH-TRAMPAC, explosives, corrosives, and compressed gases (pressurized containers) are prohibited from the payload (Reference 1). Used (i.e., empty) aerosol cans are allowed as they do not impact the package internal pressure or flammability (Reference 1). Verification that any aerosol cans are empty shall be by radiography and/or process knowledge (Reference 1).

4.2.2 Methods of Compliance and Verification

As stated in the sealed radioactive source certificates (Reference 14), the PDP WRM sources contain only either high-purity plutonium dioxide dispersed in diatomaceous earth or high-purity plutonium oxide granules uniformly embedded in a graphite felt

matrix in a stainless steel containment assembly. The PDP WRM sources do not contain explosives, corrosives, or compressed gases. In addition, the implementation of SOP-2151.565 (Reference 14) ensures the absence of prohibited items, including explosives, corrosives, and compressed gases. Based on this evaluation, Drum Nos. NTS-PDP-1 and NTS-PDP-2 comply with the prohibition on explosives, corrosives, and compressed gases.

4.3 Chemical Composition

4.3.1 Requirements

As specified by Section 4.3.1 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 (Reference 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 (Reference 1).

4.3.2 Methods of Compliance and Verification

As stated in the sealed radioactive source certificates (Reference 4), the PDP WRM sources contain only either high-purity plutonium dioxide dispersed in diatomaceous earth or high-purity plutonium oxide granules uniformly embedded in a graphite felt matrix in a stainless steel containment assembly. The PDP WRM sources are solid inorganic materials. The packaging materials, which consist of slip-lid metal cans in a 55-gallon drum with no rigid liner, are also solid inorganic materials. Based on the evaluation of the contents and packaging materials, Drum Nos. NTS-PDP-1 and NTS-PDP-2 have been assigned to Waste Material Type II.2, Solid Inorganic Materials in Metal Cans, and CH-TRUCON Code SQ 120A/220A, TRU Isotopic Source Waste, in the CH TRU Waste Content Codes (CH TRUCON) (Reference 19). The chemicals and materials packaged in the PDP WRM sources conform to the CH-TRUCON SQ 120A/220A chemical list, which complies with the list of allowable materials for Waste Material Type II.2 (Table 4.3-4 of the CH-TRAMPAC) (Reference 1). CH-TRUCON Code SQ 120A/220A and its chemical list are provided in Attachment 1, Content Code SQ 120/220 And Chemical List.

4.4 Chemical Compatibility

4.4.1 Requirements

As specified by Section 4.4.1 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 HalfPACT or TRUPACT II using the chemicals in the allowable materials lists (Tables 4.3-1 through 4.3-8 of the CH-TRAMPAC) (Reference 1). The restrictions imposed on the chemical constituents of the content codes ensure compliance with the compatibility requirements.

4.4.2 Methods of Compliance and Verification

Because Drum Nos. NTS-PDP-1 and NTS-PDP-2 contain only chemicals and materials that conform to the CH-TRUCON Code SQ 120A/220A chemical list, the chemical compatibility requirement is met.

5.0 GAS GENERATION REQUIREMENTS

5.1 Pressure Limits

5.1.1 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 (Reference 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 HalfPACT SAR (Reference 18) and Chapter 3.0 of the TRUPACT-II SAR (Reference 17) for Waste Type II payload containers and payloads up to a decay heat of 30 watts in the HalfPACT and 40 watts in the TRUPACT-II (Reference 1).

5.1.2 Methods of Compliance and Verification

The decay heat values for Drum Nos. NTS-PDP-1 and NTS-PDP-2 will result in payloads that are well below the HalfPACT design limit of 30 watts (see Section 5.2). As such, the package decay heat limit will be met for either the HalfPACT or TRUPACT-II payload containing Drum Nos. NTS-PDP-1 and NTS-PDP-2.

5.2 Payload Shipping Category

5.2.1 Requirements

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 (Reference 1).

5.2.2 Methods of Compliance and Verification

In accordance with SOP-2151.565 (Reference 14) and SOP-2151.564, *Container Repackaging and Operations Procedure (SBI)* (Reference 20), the PDP WRM sources will be packaged using the following packaging configuration:

The PDP WRM sources will be placed directly into slip-lid metal cans. The metal cans will be placed directly into a 55-gallon drum without a rigid liner.

Based on the above packaging configuration description, Drum Nos. NTS-PDP-1 and NTS PDP 2 conservatively have been assigned to Content Code SQ 120/220 under packaging configuration SQ 120A/220A in the CH-TRUCON (Reference 19) (see Attachment 1). Table 4, Payload Shipping Category for Drum Nos. NTS-PDP-1 and NTS-PDP-2, summarizes the payload shipping category determined from the packaging description documented for Drum Nos. NTS-PDP-1 and NTS-PDP-2.

Table 4. Payload Shipping Category for Drum Nos. NTS-PDP-1 and NTS-PDP-2

Drum No.	Content Code	Packaging Configuration	Payload Shipping Category
NTS-PDP-1	SQ 120A/SQ 220A	Metal can as innermost layer of confinement	20 0000 0000
NTS-PDP-2			

5.3 Flammable (Gas/VOC) Concentration Limits

5.3.1 Requirements

As specified by Section 5.2 of the CH-TRAMPAC, wastes to be transported in the HalfPACT or TRUPACT II are restricted so that no flammable mixtures can occur in any layer of confinement during shipment (Reference 1).

5.3.2 Methods of Compliance and Verification

As stated in the sealed radioactive source certificates (Reference 4), the PDP WRM sources contain only either high-purity plutonium dioxide dispersed in diatomaceous earth or high-purity plutonium oxide granules uniformly embedded in a graphite felt matrix in a stainless-steel containment assembly. The PDP WRM sources are solid inorganic materials. In addition, the implementation of SOP 2151.565 (Reference 14) verifies that no flammable volatile organic compounds are present in the drums.

5.4 Decay Heat

5.4.1 Requirements

As specified by Section 5.2 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 (Reference 1). The decay heat limit per 55-gallon drum based on the payload shipping category of 20 0000 0000 is 30 watts per 55-gallon drum

transported in a HalfPACT and 40 watts per 55-gallon drum transported in a TRUPACT-II (see Section 5.1 of the CH-TRAMPAC [Reference 1]).

5.4.2 Methods of Compliance and Verification

The nuclear material content and total alpha activity along with overall uncertainty estimates at 95 percent confidence bounds are specified for each PDP WRM source in the applicable sealed source certificate (Reference 4). The values have been corrected from the certification date to a calculational date of November 4, 2009. Table 5, WRM Source Decay Heat Values, summarizes the decay heat values calculated for each PDP WRM source (Reference 15).

Table 5. WRM Source Decay Heat Values

Source Identification No.	Decay Heat (watts)	Error (watts)	Value + Error (watts)
NTP-0127	5.56E-05	1.59E-08	5.5616E-05
NTP-0128	5.98E-05	1.71E-08	5.9817E-05
NTP-0129	5.39E-05	1.54E-08	5.3915E-05
NTP-0130	5.68E-04	1.62E-07	5.6816E-04
NTP-0131	5.57E-04	1.59E-07	5.5716E-04
NTP-0132	5.47E-04	1.56E-07	5.4716E-04
NTP-0133	5.61E-03	1.60E-06	5.6116E-03
NTP-0134	5.58E-03	1.60E-06	5.5816E-03
NTP-0135	5.59E-03	1.60E-06	5.5916E-03
NTP-0136	2.79E-02	7.96E-06	2.7908E-02
NTP-0144	5.57E-02	1.59E-05	5.5716E-02
NTP-0152	9.27E-02	2.65E-05	9.2727E-02
NTP-0160	1.21E-01	3.45E-05	1.2103E-01
NTP-0168	1.01E-03	7.64E-07	1.0108E-03
NTP-0176	6.44E-03	4.87E-06	6.4449E-03
NTP-0184	1.42E-02	1.07E-05	1.4211E-02
NTP-0192	4.86E-02	3.68E-05	4.8637E-02
TOTAL	0.3862	0.0001	0.3863

Per the above data, the sum of the decay heat plus error for all sources is 0.3863 watts. As such, if all PDP WRM sources were packaged together in a single 55-gallon drum, decay heat plus error value for the drum would be less than the 30- or 40-watt limit per 55-gallon drum (if loaded in the HalfPACT or TRUPACT-II, respectively) and less than the HalfPACT or TRUPACT-II design limit of 30 or 40 watts, respectively. The PDP WRM sources will be packaged in two 55-gallon drums, each of which will be less than

30 watts regardless of which sources are packaged together. Based on this evaluation, Drum Nos. NTS-PDP-1 and NTS-PDP-2 comply with the 55-gallon drum decay heat limit and the HalfPACT and TRUPACT-II design limits.

During payload assembly activities to be completed in accordance with CCP-PO-401 (Reference 5), CCP personnel will document compliance with the decay heat requirements on the PCTCDs and PATCD.

5.5 Venting and Aspiration

5.5.1 Requirements

As specified by Section 5.3.1 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 (Reference 1).

5.5.2 Methods of Compliance and Verification

In accordance with SOP-2151.565 (Reference 14), the PDP WRM sources will be newly packaged for transportation. The 55-gallon drums will be vented at the time of generation and will not require aspiration.

6.0 PAYLOAD ASSEMBLY REQUIREMENTS

6.1.1 Requirements

As specified by Sections 6.1 and 6.2 of the CH-TRAMPAC, a HalfPACT or TRUPACT-II payload shall be authorized for shipment by the completion and signing of the PCTCD and the PATCD after verification of compliance with all transportation requirements of the CH-TRAMPAC (Reference 1).

6.1.2 Methods of Compliance and Verification

The CH-TRAMPAC certification of the PDP WRM sources will be completed by the CCP TCO in accordance with CCP-PO-401 (Reference 5) and CCP-TP-405 (Reference 7). CCP-TP-405 details the completion of required transportation certification documents (PCTCDs and PATCD). During the completion of these documents, compliance with the transportation parameter requirements as documented in the previous sections will be verified by the CCP TCO. The shipping records, whose generation is described in CCP-PO-401 (Reference 5), shall be maintained by the CCP for a minimum period of 3 years.

7.0 REFERENCES

1. U.S. Department of Energy, *Contact-Handled Transuranic Waste Authorized Methods for Payload Control (CH-TRAMPAC)*, current revision, U.S. Department of Energy, Carlsbad Field Office, Carlsbad, New Mexico
2. CCP-PO-001, *CCP Transuranic Waste Characterization Quality Assurance Project Plan*, Revision 14, Washington TRU Solutions LLC, Carlsbad, New Mexico
3. American National Standards Institute/Health Physics Society, *Sealed Radioactive Source Classification*, ANSI/HSP N43.6-1997, 1997
4. Los Alamos National Laboratory Certificates of Content and Traceability for Department of Energy Carlsbad Area Office PuO₂-Diatomaceous Earth Working Reference Material # NTP 0127, NTP-0128, NTP-0129, NTP-0130, NTP-0131, NTP-0132, NTP 0133, NTP 0134, NTP-0135, NTP-0136, NTP-0144, NTP-0152, and NTP 0160, and PuO₂ Particle-Graphite WRM NTP-0168, NTP-0176, NTP-0184, and NTP-0192, Los Alamos National Laboratory, Los Alamos, New Mexico
5. CCP-PO-401, *CCP Contact-Handled Transuranic Authorized Methods for Payload Control (CCP CH-TRAMPAC) for Intersite Shipments*, current revision, Washington TRU Solutions LLC, Carlsbad, New Mexico
6. CCP-TP-404, *CCP Contact-Handled Transuranic Waste Certification and Data Entry for Intersite Shipments*, Washington TRU Solutions LLC, Carlsbad, New Mexico
7. CCP-TP-405, *CCP Intersite Shipments of Contact-Handled Transuranic Waste*, current revision, Washington TRU Solutions LLC, Carlsbad, New Mexico
8. National Security Technologies Core Company Directive No. CCD-QA07.001, *Procurement Process*, Revision 0, National Security Technologies, LLC (NSTec), Las Vegas, Nevada
9. CCP-QP-015, *CCP Procurement*, current revision, Washington TRU Solutions LLC, Carlsbad, New Mexico
10. National Security Technologies Standard Operating Procedure No. SOP-2151.507, *TRU Operations Waste Container Management (SBI)*, Revision 6, National Security Technologies, LLC (NSTec), Las Vegas, Nevada.

11. National Security Technologies Organization Procedure No. OP-2141.001, *Standards and Calibration Laboratory Handbook*, Revision 10, National Security Technologies, LLC (NSTec), Las Vegas, Nevada
12. National Security Technologies Standard Operating Procedure No. SOP-2151.529, *Radioactive Waste Management Complex (RWMC) TRU Operations Inspections (SBI)*, Revision 0, National Security Technologies, LLC (NSTec), Las Vegas, Nevada
13. National Security Technologies Organization Procedure No. OP-2151.522, *Radioactive Inventory Control Program (SBI)*, Revision 15, National Security Technologies, LLC (NSTec), Las Vegas, Nevada
14. National Security Technologies Standard Operating Procedure No. SOP-2151.565, *Waste Examination Technique (SBI)*, Revision 1, National Security Technologies, LLC (NSTec), Las Vegas, Nevada
15. E-mail from J. Harvill to J. A. Biedscheid, subject: NTS Source Rev.2.xls (attached), dated November 6, 2009
16. NV/YMP Radiological Control Manual, Las Vegas, Nevada
17. U.S. Department of Energy, *Safety Analysis Report for the TRUPACT-II Shipping Package*, current revision, U.S. Department of Energy, Carlsbad Field Office, Carlsbad, New Mexico.
18. U.S. Department of Energy, *Safety Analysis Report for the HalfPACT Shipping Package*, current revision, U.S. Department of Energy, Carlsbad Field Office, Carlsbad, New Mexico
19. U.S. Department of Energy, DOE/WIPP 01-3194, *CH-TRU Content Codes (CH-TRUCON)*, current revision, U.S. Department of Energy, Carlsbad Field Office, Carlsbad, New Mexico
20. National Security Technologies Standard Operating Procedure No. SOP-2151.564, *Container Repackaging and Operations Procedure (SBI)*, Revision 1, National Security Technologies, LLC (NSTec), Las Vegas, Nevada
21. U.S. Nuclear Regulatory Commission, Title 10, Code of Federal Regulations, Part 71 (10 CFR 71), *Packaging and Transportation of Radioactive Material*, U.S. Nuclear Regulatory Commission, Washington, D.C.

Attachment 1 – Content Code SQ 120/220 And Chemical List

CONTENT CODE: SQ 120, SQ 220 (See Waste Packaging Description Table)

CONTENT DESCRIPTION: TRU Isotopic Source Waste

GENERATING SITE: Various

WASTE DESCRIPTION: The waste consists of sealed sources.

GENERATING SOURCE: These wastes are generated from various operations at the sites.

WASTE FORM: The waste consists of solid, inorganic source material and sources sealed in metal jackets. Sources may include well logging sources used for oil exploration, neutron sources for university research, heat sources, cardiac pacemaker components (source capsules, batteries, and pacemakers), gamma gauges, gauge sources (moisture density gauges, level gauges, bone density gauges), calibration sources (smoke detectors and instrument calibration), and X-ray fluorescence sources for scientific and research applications. Source constituents may include americium-241, plutonium-238, plutonium-239, cesium-137, and beryllium.

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

WASTE PACKAGING DESCRIPTION TABLE

Code	Description*
SQ 120A SQ 220A	The isotopic source is sealed in a metal jacket and/or placed in a metal can. The metal jacket/can may be placed in a maximum of four plastic bags, one of which is a liner bag, and is placed in a 55-gallon drum that may be lined with a rigid liner. The same packaging configuration may be used for a direct load SWB or a direct load TDOP.

*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 into a TDOP, any liner bag is an SWB liner. All bag closures are in accordance with the CH-TRAMPAC.

Attachment 1 – Content Code SQ 120/220 And Chemical List (Continued)

ASSAY: The waste consists of manufactured, sealed isotopic sources. Radiological data are typically well documented by the manufacturer for these sources. Therefore, the isotopic composition of the waste need not be determined by direct analysis or measurement of the waste unless documentation is not available. If necessary, assay for all payload containers shall be performed in accordance with the CH-TRAMPAC.

FREE LIQUIDS: There are no free liquids in this waste.

EXPLOSIVES/COMPRESSED GASES: There are no explosives and/or compressed gases in this waste.

PYROPHORICS: There are no pyrophorics in this waste.

CORROSIVES: There are no corrosives in this waste.

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 II.2 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. Site personnel shall ensure that packaged isotopic source wastes comply with the external radiation dose rate limits for the payload container and the packaging, as stated in the CH-TRAMPAC.

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 120/220 And Chemical List (Continued)

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

Content Code SQ 120/220
(Continued)

TRU ISOTOPIC SOURCE WASTE

GROUP 101:	COMBUSTIBLE AND FLAMMABLE MATERIALS, MISCELLANEOUS Grease Nitrile rubber gloves Paper Polyethelene Polypropylene Polyvinyl chloride Synthetic rubber Wood	T T T T T T T T
GROUP 102:	EXPLOSIVES Calcium	T
GROUP 105:	REDUCING AGENTS, STRONG (Constituents reacted prior to loading in payload containers.) Calcium Sodium	T T
GROUP 107:	WATER REACTIVE SUBSTANCES (Constituents reacted prior to loading in payload containers.) Calcium Potassium Sodium oxide Sodium	T T T T
OTHER INORGANICS	Americium oxide Beryllium windows Ceramic Cesium in glass Filter media (Inorganic) Magnesium oxide Glass, labware Plutonium oxide Sand Soil Silicon oxide	D T D D D D D D D D D
OTHER SOLIDIFICATION MATERIAL/ABSORBENTS	Vermiculite	D

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