Payload Requirements for TRUPACT-II and HalfPACT

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July 8, 2008

Presentation to the NRC

CH-TRAMPAC

- Contact-Handled Transuranic Waste Authorized Methods for Payload Control (CH-TRAMPAC) document defines authorized contents for TRUPACT-II and HalfPACT
  - Requirements
    - Container/Physical Properties
    - Nuclear Properties
    - Chemical Properties
    - Gas Generation Properties
    - Payload Assembly
  - Allowable compliance methods
  - Documentation of compliance

Methods of Compliance

- Allowable methods of compliance for payload control are as follows:
  - Visual Examination
  - Visual Inspection
  - Radiography
  - Records and Database Information (or knowledge of process)
  - Administrative and Procurement Controls
  - Sampling Program
  - Measurement

Compliance Documentation

- Each shipper shall document compliance with CH-TRAMPAC by:
  - Programmatic TRU Waste Authorized Methods for Payload Control (TRAMPAC)

    -OR-
  - Waste-Specific Data TRAMPAC

Programmatic TRAMPAC

- Prepared by shipper to describe compliance program
- Program reviewed and approved by the DOE-Carlsbad Field Office (CBFO)
- Implementing procedures of TRAMPAC reviewed for completeness and compliance as part of DOE-CBFO audit process

Waste-Specific Data TRAMPAC

- Prepared by shipper to describe small quantity shipment data
- Data for specific shipment reviewed and approved by DOE-CBFO
- Limited quantity shipment may be made by any waste generator who does not have approved programmatic TRAMPAC or a waste generator with limited number of containers not addressed in the site-specific programmatic TRAMPAC

CH-TRUCON Codes

- Containers must have approved CH-TRU Waste Content Codes (CH-TRUCON) to be eligible for shipment in TRUPACT-II or HalfPACT

CH-TRUCON Code Revision Requests

- WIPP CH-TRU Payload Engineer reviews CH-TRUCON code requests and approves only if compliance with CH-TRAMPAC requirements can be demonstrated

- Payload Engineer <u>does not</u> have authority to change the CH-TRAMPAC document or requirements without approval from the NRC

Container and Physical Properties Requirements

Authorized Payload Containers

Authorized Payload Container Type	Number in TRUPACT-II Payload	Number in HalfPACT Payload
55-Gallon Drum	14	7
Standard, S100, S200, *or* S300 Pipe Overpack	14	7
85-Gallon Drum	8	4
100-Gallon Drum	6	3
Standard Waste Box (SWB)	2	1
Ten-Drum Overpack (TDOP)	1	NA

Payload Containers

- Payloads shall be comprised of a single payload container type
- Standard pipe overpacks must be assembled into seven-packs of 6-inch standard pipe overpacks or 12-inch standard pipe overpacks only

Dunnage

- Empty 55-, 85-, 100-gallon drums or an empty SWB used to complete payload configurations if too few payload containers are available that meet transportation requirements
- Must meet specifications of Section 2.9 and have at least one open vent port
- Empty 55-gallon drum(s) can be used as dunnage container(s) to complete a payload of pipe overpacks

Container/Assembly Weight & Center of Gravity

Container	Total Weight Limit
6” standard pipe overpack	328 lbs
12” standard pipe overpack	547 lbs
S100 pipe overpack	550 lbs
S200 pipe overpack	547 lbs
S300 pipe overpack	547 lbs
55-gallon drum	1,000 lbs
85-gallon drum	1,000 lbs
100-gallon drum	1,000 lbs
SWB	4,000 lbs
TDOP	6,700 lbs

TRUPACT-II Assembly	Total Weight Limit
(14) 55-gallon drums	7,265 lbs
(8) 85-gallon drums	7,265 lbs
(6) 100-gallon drums	7,265 lbs
(2) SWBs	7,265 lbs
(1) TDOP	7,265 lbs

HalfPACT Assembly	Total Weight Limit
(7) 55-gallon drums	7,600 lbs
(4) 85-gallon drums	7,600 lbs
(3) 100-gallon drums	7,600 lbs
(1) SWBs	7,600 lbs

Total weight limit for loaded package:
TRUPACT-II = **19,250 lbs**
HalfPACT = **18,100 lbs**

Center of Gravity for TRUPACT-II Payloads

The total weight of the top layer of a payload assembly shall be less than or equal to the total weight of the bottom layer

Container/Assembly Weight & Center of Gravity *(Continued)*

- HalfPACT is a shorter, lighter version of the TRUPACT-II designed and certified for the shipment of heavier payloads
- Average payload container weight in a HalfPACT is increased compared to a TRUPACT-II

Container Marking

- Unique container identification number labeled on each payload container or dunnage container (except when entire second tier of TRUPACT-II payload is dunnage [e.g., seven-pack of 55-gallon drums or SWB])
- Dunnage must be labeled as EMPTY or DUNNAGE

Filter Vents

- Filtered vent(s) or equivalent venting mechanisms required in all payload containers (except dunnage)
- Overpacked containers must be vented
- Filtered vent(s) must meet minimum specifications of Table 2.5-1
  - Flowrate
  - Efficiency
  - Total hydrogen diffusivity
- Specifications may be met using one or more filters per container

Liquids and Sharp/Heavy Objects

Liquids

- Liquid waste prohibited in payload container, except for residual amounts in well-drained containers
- Total volume of residual liquid shall be < 1% (volume) of payload container

Sharp/Heavy Objects

- Blocked or braced to prevent puncture of the payload container

Sealed Containers

- Sealed containers greater than 4 liters (nominal) are prohibited
  - Except for Waste Material Type II.2 (inorganic waste packaged in metal container as the innermost layer of confinement)

Closure of Confinement Layers

- All inner confinement layers shall be closed according to approved methods
  - Twist-and-tape
  - Fold-and-tape
  - Heat-sealed closure or twist-and-tape closure with a minimum of one filter vent
  - Unvented heat-sealed closure for a bag with minimum surface area of ~390 square inches
    - Larger bags are allowed, as the surface area for gas release is greater

Nuclear Properties Requirements

Nuclear Criticality

- Pu-239 Fissile gram equivalent (FGE) limits include 2X measurement error
- If a container is overpacked, only the FGE limits for outermost payload container apply

Table 3.1-1 – Summary of FGE Limits

FGE Limits with No Credit for Pu-240 Poisoning				
Contents	**Payload Container**	**Fissile Limit per Payload Container (Pu-239 FGE)①**	**Fissile Limit per TRUPACT-II Package (Pu-239 FGE)**	**Fissile Limit per HalfPACT Package (Pu-239 FGE)**
Not machine compacted with ≤ 1% by weight Be/BeO	Drum	200	325	325
	Pipe Overpack	200	2,800	1,400
	SWB	325	325	325
	TDOP	325	325	NA③
Not machine compacted with > 1% by weight Be/BeO	Drum	100	100	100
	Pipe Overpack	200	2,800	1,400
	SWB	100	100	100
	TDOP	100	100	NA③
Machine compacted with ≤ 1% by weight Be/BeO	Drum	200	250	250
	Pipe Overpack	Unauthorized	Unauthorized	Unauthorized
	SWB	250	250	250
	TDOP	250	250	NA③
Machine compacted with controls② and ≤ 1% by weight Be/BeO	Drum	200	325	325
	Pipe Overpack	Unauthorized	Unauthorized	Unauthorized
	SWB	Unauthorized	Unauthorized	Unauthorized
	TDOP	Unauthorized	Unauthorized	NA③
Machine compacted with > 1% by weight Be/BeO	Drum	Unauthorized	Unauthorized	Unauthorized
	Pipe Overpack	Unauthorized	Unauthorized	Unauthorized
	SWB	Unauthorized	Unauthorized	Unauthorized
	TDOP	Unauthorized	Unauthorized	NA③

FGE Limits with Credit for Pu-240 Poisoning		
Contents	**Minimum Pu-240 Content in Payload (grams)**	**Fissile Material Limit per Package (Pu-239 FGE)**
Not machine compacted with ≤ 1% by weight Be/BeO in drums or SWB(s)	5	340
	15	360
	25	380

Notes:

① The FGE limit given applies to the payload container regardless of Pu-240 content in the package.

② The contents shall be machine-compacted waste in the form of "puck" drums and meeting the conditions specified in Section 3.1.1

③ Not applicable.

Container Radiation Dose Rates

- Payload containers must meet the surface radiation dose rate limits shown below

Table 3.2-1 – Maximum Surface Dose Rate Limits

Payload Container	Maximum Surface Dose (mrem/hr)
55-Gallon Drum	200
Standard Pipe Overpack	200
S100 Pipe Overpack	179
S200 Pipe Overpack	200
S300 Pipe Overpack	155
85-Gallon Drum	200
100-Gallon Drum	200
SWB	200
TDOP	200

Activity Limits

- ≤406 Ci per payload of either S100 or S300 pipe overpacks (limit includes measurement error)
- S100 and S300 pipe overpack payloads limited to sealed neutron source forms

S100 and S300 Pipe Overpacks Limited to Sealed Source Forms

^{241}Am Be	^{238}Pu O	^{239}Pu Li	^{241}Am
^{238}Pu Be	^{239}Pu O	^{238}Pu B	^{238}Pu
^{239}Pu Be	^{244}Cm O	^{239}Pu F	^{239}Pu
^{241}Am O	^{241}Am Li	^{238}Pu ^{13}C	^{244}Cm

Activity Limits *(Continued)*

- S200 pipe overpacks limited to radionuclides and associated activities listed in Table 3.3-2 of CH-TRAMPAC (limits include measurement error)

Packaging Radiation Dose Rates

- Loaded TRUPACT-II and HalfPACT
  $\leq$ 200 mrem/ hour at surface and
  $\leq$ 10 mrem/hour at 2 meters

Chemical Properties Requirements

Pyrophoric Materials, Explosives, and Corrosives

- Radioactive pyrophorics limited to ≤1% by weight in payload container
- All nonradioactive pyrophorics and radioactive pyrophorics greater than 1% by weight shall be rendered nonreactive prior to placement in the payload container
- No explosives, corrosives, or compressed gases (pressurized containers) in the payload containers
  - Used (i.e., empty) aerosol cans are allowed; aerosol cans that are not empty are prohibited

Chemical Composition & Compatibility

- Chemical compatibility must be ensured for the following conditions
  - For waste in each individual payload container
  - Between contents of payload containers in hypothetical accident conditions
  - Between waste and the TRUPACT-II and HalfPACT inner containment vessel (ICV)
  - Between waste and the TRUPACT-II and HalfPACT O-ring seals

Chemical Composition & Compatibility *(Continued)*

- Evaluation of chemical compatibility is based on EPA method referenced in the CH-TRAMPAC
- List of Allowable materials in Tables 4.3-1 through 4.3-8 meet chemical compatibility requirements
- Site compliance is ensured by use of an approved CH-TRUCON code

Gas Generation Properties Requirements

Requirements

- Hydrogen concentration must not exceed 5% by volume in any layer or confined region of package
- Pressure within TRUPACT-II or HalfPACT ICV must remain below the design pressure of 50 pounds per square inch gauge (psig) for a 60-day period
- Design based wattage limits for the TRUPACT-II and HalfPACT are 40 and 30 watts, respectively

Compliance

- Compliance ensured by one of the following at payload container level:
  - Decay heat limit
  - Measurement
  - Testing
- Compliance may be facilitated at payload assembly level by:
  - Mixing of shipping categories
  - Use of dunnage

Compliance *(Continued)*

- Need to know:
  - Gas generation rate
  - Gas release rate
- Gas generation rate requires:
  - Knowledge of chemical constituents in waste
  - Assessment of radiolytic gas generation potential from chemical constituents

Compliance *(Continued)*

- Potential gas generation mechanisms
  - Thermal
  - Chemical
  - Biological
  - Radiolytic
- Hydrogen generation during transport is primarily due to radiolysis of the waste materials or packaging materials

Compliance *(Continued)*

- Radiolytic gas generation can be quantified by G value
  - $G(H_2)$ value = number of molecules of hydrogen generated per 100 electron volts (eV) of energy absorbed
  - For example, $G(H_2)$ value for water = 1.6
    $G(H_2)$ value for polyethylene = 3.4

Compliance *(Continued)*

- G value determined by chemical form of waste
- All CH-TRU waste can be classified into four general waste types, based on gas generation potential

Determination of Gas Generation Potential

Waste Type	Description
I (10)	Solidified aqueous or homogeneous inorganic solids (packaging materials are allowed) ▪ Absorbed, adsorbed, or solidified inorganic liquid; soils, solidified particulates, or sludges formed from precipitates; and concreted inorganic particulate waste
II (20)	Solid inorganics ▪ Glass, metal, crucibles, and other solid inorganics
III (30)	Solid organics ▪ Plastics (e.g., polyethylene, PVC), cellulose (e.g., paper, cloth, wood), cemented organic solids, and other solidified organics
IV (40)	Solidified organics ▪ Cemented or immobilized organic solvents

Determination of Gas Generation Potential *(Continued)*

- Each waste type is further divided into waste material types
- Each waste material type has a corresponding chemical list in the CH-TRAMPAC (Tables 4.3-1 through 4.3-8) that defines the bounding G value (in addition to ensuring chemical compatibility)
- To qualify for a waste material type, constituents in the waste must conform to the corresponding chemical list

G Values for Hydrogen

Waste Material Type	Waste Description	Existing G-Values (≤ 0.012 w∗y)	Dose Dependent G-Values (≥ 0.012 w∗y)
I.1	Solidified inorganics	1.6	1.6
I.2	Solidified particulates	1.3	1.3
I.3	Cemented inorganic waste materials	0.4	0.4
II.1	Solid inorganics in plastic bags	1.7	0.32
II.2	Solid inorganics in metal cans	0	0
II.3	Inorganics with absorbed ambient moisture (≤ 6%)	0.08	0.08
III.1	Solid organics	3.4	1.09
III.2	90% solid inorganics, 10% solid organics in metal cans	0.34	0.11
III.3	90% solid inorganics, 10% solid organics in plastic	1.85	0.4
IV.1	Solidified organics	NA	NA

Dose-Dependent G Values

- G values are dose dependent (matrix depletion effect)
  - Dose-dependent G values can be used when applicable after a dose requirement has been met
  - Dose-dependent G values cannot be used if absorbed, adsorbed, or solidified aqueous materials are present in the waste

Dose-Dependent G Values
(Continued)

Dose is compared to a watt*year criteria of 0.012 W∗y

Dose = decay heat of container ∗ elapsed time

$$\text{Elapsed Time required for lower G-value} = \frac{0.012\ W*y}{\text{DH of container}}$$

Dose-Dependent G Values
(Continued)

Example 1: A drum of Waste Type II or III with decay heat of 0.168 watt

Required Elapsed Time for Lower G-value $= \frac{0.012\ W*y}{0.168\ W}$

$= 0.0714\ y$

$= 26$ days

This drum must be stored for 26 days to meet matrix depletion criteria

Dose-Dependent G Values
(Continued)

Example 2: A drum of Waste Type II or III with decay heat of 0.085 watt

Required Elapsed Time for Lower G-value $= \frac{0.012\ W*y}{0.085\ W}$

$= 0.1412\ y$

$= 52$ days

This drum must be stored for 52 days to meet matrix depletion criteria

Payload Classification

- Gas release rate requires:
  - Knowledge of packaging configuration
    - Release rates for allowed packaging configurations and confinement layers have been calculated and documented in the SAR
  - Assessment of release rates of hydrogen through packaging configuration

Payload Classification
(Continued)

- Balance between:
  - Gas generation rate ←→ Gas release rate
  - Determines a unique decay heat limit for maintaining ≤5% hydrogen concentration in any layer of confinement based on
    - Shipping period
    - Void volume in TRUPACT-II

Payload Classification
(Continued)

- Available shipping periods
  - 60-day shipping period – "General Case"
  - 20-day shipping period – "Close-Proximity Shipments" (i.e., shipments within ~1,000-mile radius)
  - 10-day shipping period – "Controlled Shipments"
    - Must follow procedures in Appendix 3.6 of CH-TRU Payload Appendices
    - Available for use by any site shipping to WIPP

Payload Classification
(Continued)

- Payload is classified into "shipping categories" based on the balance between gas generation and gas release rates

Overview

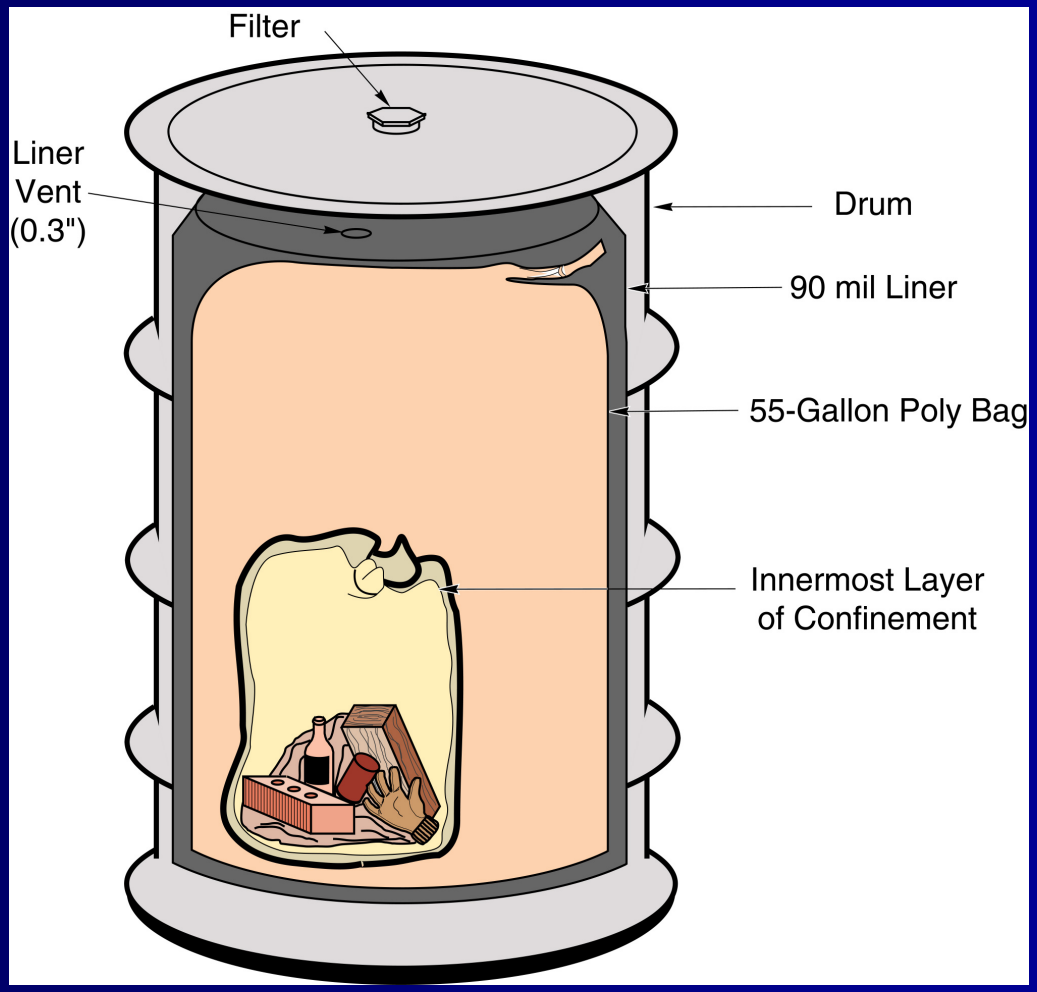
Shipping Category (10 numeric characters)

Example: XX YYYY ZZZZ

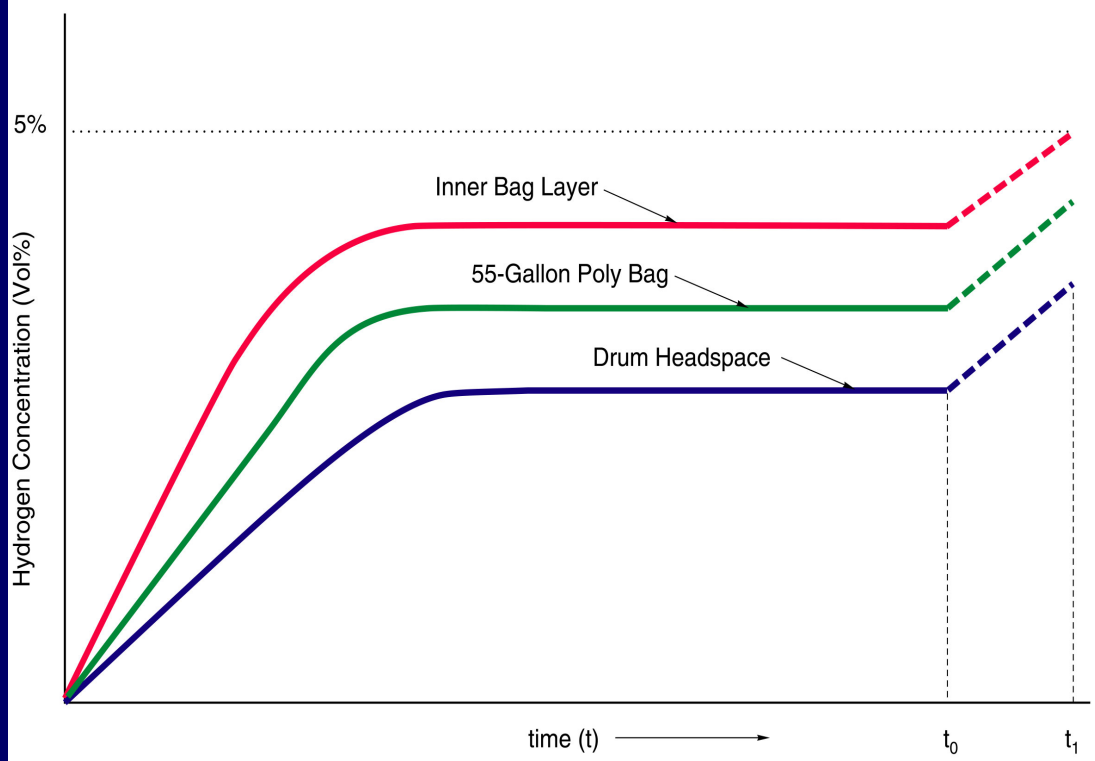
Where:

XX	=	Waste Type
YYYY	=	G value (x 10^2)
ZZZZ	=	Resistance to hydrogen release (x 10^{-4})

Schematic of CH-TRU Waste Drum with Confinement Layers



Graph of H_2 Profile in CH-TRU Waste Drum



t_0 — Time of Emplacement in TRUPACT-II
t_1 - t_0 — 60 Days

Analytical Category Waste

- Flammable volatile organic compounds (VOCs) ≤ 500 parts per million (ppm) in the payload container headspace
- Bounding G value established
  - Applies to containers of Waste Types I, II, and III
- Decay heat limit ensures hydrogen concentration ≤ 5%

Decay Heat Limits for Shipping Categories

- For analytical category waste, decay heat limit is directly derived from payload shipping category (XX YYYY ZZZZ)
- Decay heat limit is defined as:

$$\frac{4824.42 \text{ molecules/mole} * \text{watt-sec/eV}}{(\text{ZZZZ} * \text{YYYY}) \text{ sec-molecules/mole-eV}}$$

Shipping Category Example #1

- Waste Material Type III.1
- 55-gallon drum fitted with 3.7×10^{-6} mol/s/mol fraction minimum hydrogen diffusivity filter vent
- Maximum of two inner bag layers (twist-and-tape closure)
- One liner bag (twist-and-tape closure)
- Rigid drum liner with 0.3-inch diameter hole
- 60-day shipping period

Shipping Category Example #2

- Waste Material Type III.1
- 55-gallon drum fitted with 3.7×10^{-6} mol/s/mol fraction minimum hydrogen diffusivity filter vent
- Maximum of two inner bag layers (twist-and-tape closure)
- One liner bag (twist-and-tape closure)
- Rigid drum liner with 0.3-inch diameter hole
- 10-day shipping period

Effect of Shipping Period

	Payload Shipping Category	Decay Heat Limit
Example 1	30 0340 0481	0.0295 W
Example 2	30 0340 0421	0.0337 W

- Use of 10-day shipping period resulted in ~14% increase in decay heat limit

Shipping Category Example #3

- Waste Material Type III.1
- 55-gallon drum fitted with 3.7×10^{-6} mol/s/mol fraction minimum hydrogen diffusivity filter vent
- One liner bag layer
- Rigid drum liner with no lid
- 60-day shipping period

Shipping Category Example #4

- Waste Material Type III.1
- 55-gallon drum fitted with 3.7×10^{-6} mol/s/mol fraction minimum hydrogen diffusivity filter vent
- One liner bag layer
- Rigid drum liner with no lid
- 10-day shipping period

Effect of Shipping Period

	Payload Shipping Category	Decay Heat Limit
Example 3	30 0340 0120	0.1182 W
Example 4	30 0340 0061	0.2326 W

- Use of 10-day shipping period resulted in ~97% increase in decay heat limit
- Payload shipping categories with fewer layers benefit more from 10-day shipping period

Test Category Waste

- Exceeds one or more limits of the analytical category
  - Exceeds decay heat limit
  - Flammable VOCs >500 ppm
  - Waste that does not have a bounding G value (Waste Type IV)

Test Category Waste
(Continued)

- Two options to determine compliance
  - Option 1: Measurement of headspace
  - Option 2: Full-Container Testing

Test Category Waste
(Continued)

Option 1: Measurement

- Compliance may be demonstrated using a headspace gas measurement along with packaging configuration and container history
- For Waste Types I, II, III only

Test Category: Measurement Option

- Measure headspace gas concentrations
  - Hydrogen
  - Flammable VOCs
- Determine gas/VOC concentrations in innermost layer based on analysis
- Determine compliance with Mixture Lower Explosive Limit (MLEL) by analysis based on hydrogen and VOC concentrations

Flammable VOCs

- Drum age criteria (DAC) requirements apply when sampling for flammable VOCs
  - DAC required to ensure drums meet equilibrium criteria prior to headspace sampling for VOCs

Example: Measurement Option for Gas Generation Requirements

Measured Decay Heat **EXCEEDS** Decay Heat Limit

(0.10 watts) > (0.0920 watts)

NOT SHIPPABLE AS IS
(TEST CATEGORY WASTE)
PROCEED TO NEXT STEP

Measured flammable VOCs > 500 ppm

Headspace sampling to evaluate compliance with MLEL in innermost confinement layer

Example: Measurement Option for Gas Generation Requirements *(Continued)*

EXAMPLE ONLY

	Headspace Measurement	Calculated Innermost Concentration	MLEL
Hydrogen	413 ppm	39,936 ppm (at end of 60 days)	
VOCs	1310 ppm	1,737 ppm	
SUM		**41,673 ppm**	**42,189 ppm**

Flammable gas/VOC sum ≤ MLEL

41,673 ppm ≤ 42,189 ppm

DRUM IS APPROVED TO SHIP

Test Category Waste
(Continued)

Option 2: Full-Container Testing

- For Waste Type IV (which does not have a bounding G value)
- For Waste Type I, II, or III containers that exceed analytical decay heat limits
- Waste Type I, II, or III containers that cannot be qualified by measurement

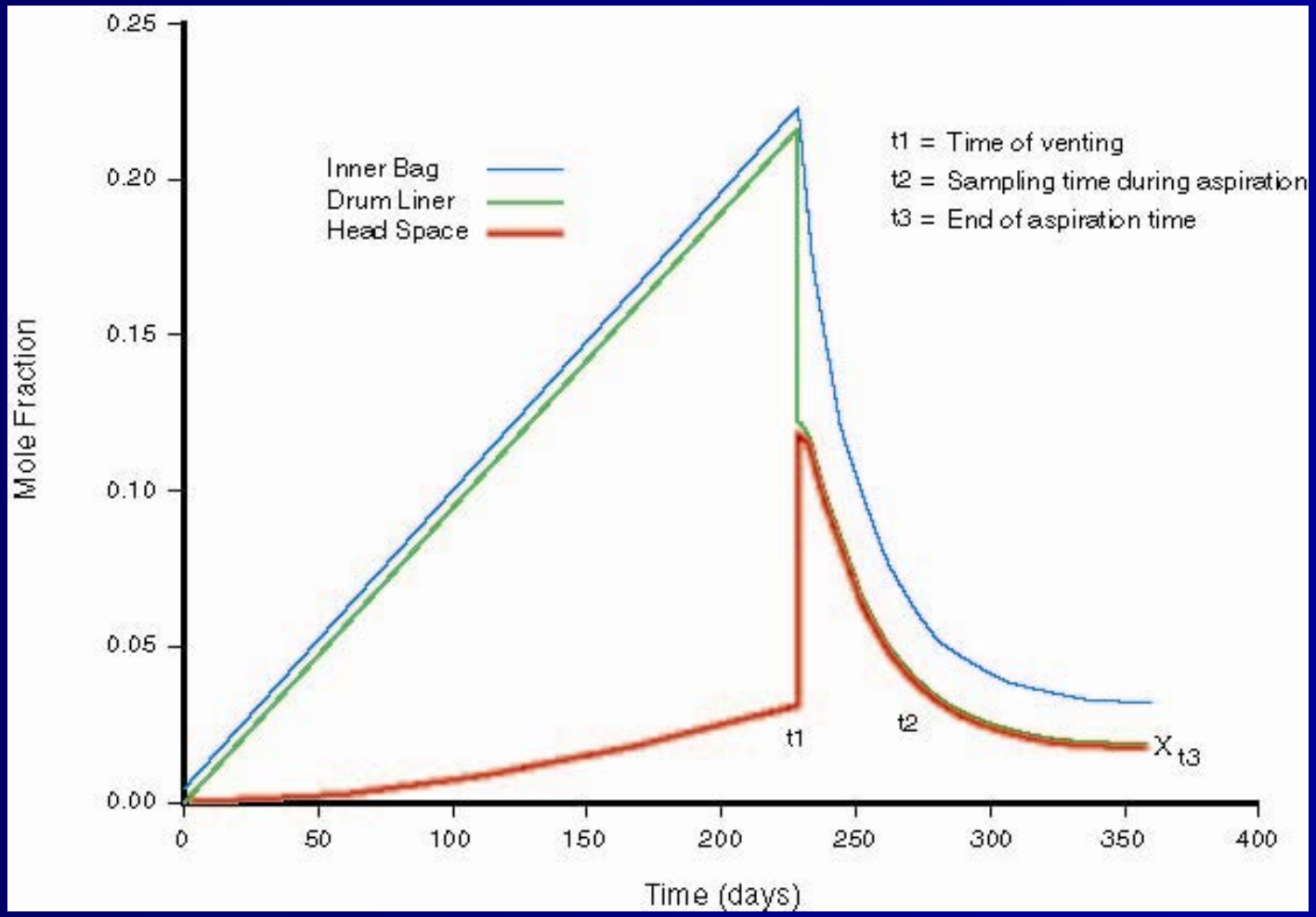
Perform Full-Container Testing

- Hydrogen gas generation rate must be measured and compared to applicable limit
  - Limit depends on shipping category
  - Compliance takes into account concentration of flammable VOCs

Venting and Aspiration

- Aspiration: Venting to ensure equilibrium of any gases that may have accumulated in a closed container
- Required for containers stored in an unvented condition
- Aspiration times specified in lookup tables (Tables 5.3-1 through 5.3-12) for common packaging configurations

Time Profile of Hydrogen Concentration in Payload Container During Accumulation and Subsequent Venting



Option for Using Content Code 154

- Option for shipping high-wattage Waste Material Type III.1 in TRUPACT-II to WIPP
- Waste must be described by one of the 154 packaging configurations in Appendix 6.12 of CH-TRU Payload Appendices

Option for Using Content Code 154 *(Continued)*

- After assembly in TRUPACT-II ICV, the payload containers undergo the application of a vacuum to remove hydrogen that may have accumulated during storage
- After vacuum application, TRUPACT-II ICV is backfilled with an inert gas as an additional margin of safety
- Shipment to WIPP must be made as controlled shipment

Payload Assembly Requirements

Payload Assembly Requirements

- Must use one of the authorized payload configurations
- All containers must comply with transportation requirements
- Payload assembly may include containers of:
  - Same shipping category
  - Different shipping categories

Mixing Shipping Categories

- Must ensure absence of flammable gas mixture for EACH container
- Account for properties of all other containers in payload
- May take credit for dunnage containers

Mixing Shipping Categories *(Continued)*

Flammability Index (FI)

- Ratio of actual FGGR to allowable FGGR multiplied by 50,000
- FI for EACH container must be non-negative value ≤ 50,000
- Calculation considers
  - Flammable gas/VOC concentrations within innermost layer of confinement
  - Void volume of any dunnage containers

Mixing Shipping Categories *(Continued)*

$$FI = \frac{\text{Actual FGGR} * 50{,}000}{\text{Allowable FGGR}}$$

CH-TRAMPAC Compliance Documentation

- Compliance documented in Payload Container Transportation Certification Documents (PCTCDs), Overpack Payload Container Transportation Certification Documents (OPCTCDs), and Payload Assembly Transportation Certification Documents (PATCDs)

CH-TRAMPAC Compliance Documentation *(Continued)*

- Shipment certified by Transportation Certification Official
- Shipping records shall be maintained by the shipper for a minimum period of 3 years

Table 6.2-1 – Payload Container Transportation Certification Document (PCTCD), Analytical Category①

IDENTIFICATION PARAMETERS

Container ID #_____ **Container Bar Code #**_____

Container Designated for Controlled Shipment? O YES O NO

Shipping Category_____ **Content Code**_____

Direct Load Configurations O 55-Gallon Drum O 85-Gallon Drum O 100-Gallon Drum O SWB O TDOP

Fixed Configurations O 6-inch Standard Pipe Overpack O 12-inch Standard Pipe Overpack
O S100 Pipe Overpack O S200 Pipe Overpack O S300 Pipe Overpack
O SWB with Bin (Bin Overpack)

Overpacked Configurations O 85-Gallon Drum with 55-Gallon Drum (85-Gallon Drum Overpack)
O SWB with 55-Gallon Drum(s) (SWB Overpack)
O TDOP with 55-Gallon Drum(s) O TDOP with SWB Overpack
O TDOP with 85-Gallon Drum Overpack(s) O TDOP with 85-Gallon Drum(s)
O TDOP with SWB O TDOP with Bin Overpack

Certification Site_____

CH-TRAMPAC TRANSPORTATION PARAMETERS

Criteria	Filter(s) Identification	
Free liquids are <1% of payload container volume		
Sharp/heavy objects are blocked/braced/suitably packaged	1._____	2._____
Nonradioactive pyrophorics are not present or have been reacted		
Radioactive pyrophorics are ≤1% (weight)	3._____	4._____
Explosives are not present		
Corrosives are not present	5._____	6._____
Pressurized containers and compressed gases are not present		
Sealed containers >4 liters are not present (except in Waste Material Type II.2)	7._____	8._____
Rigid liner (if present) is punctured/vented		
Flammable VOCs are ≤ 500 ppm	9._____	10._____
Surface radiation dose rate is ≤ payload container limit②		

MEASURED PARAMETERS

Container Parameter	Value	Error	Value + 1x Error	Value + 2x Error	Limit
Weight (lbs.)					②
Decay Heat (watts)					
Fissile Mass (FGE)					②

Curie Limits (Ci) *S200 pipe overpacks only* Payload container meets limits specified in Section 3.3 _____Yes/No

UNVENTED WASTE PARAMETERS

Aspiration Method O Option 1 O Option 2A
O Option 2B O Option 3 Required Aspiration Period_____days

Option 1
Container closed time_____months

Options 2A, 2B, or 3
Headspace H_2 Concentration_____mol% Time Container Vented_____days

I certify that the above container meets all the requirements for shipment as stated the CH-TRAMPAC, current revision. The container is approved for ☐ payload assembly or ☐ overpacking.

_____ / _____

TRANSPORTATION CERTIFICATION OFFICIAL / DATE

Notes:

① Follow instructions in Section 6.2.1.1.

② Limits are not applicable if container is to be overpacked.

Table 6.2-3 – Overpack Payload Container Transportation Certification Document (OPCTCD)①

IDENTIFICATION PARAMETERS

Overpack Container ID #_____ **Overpack Container Bar Code #**_____

Container Designated for Controlled Shipment? O YES O NO

Shipping Category②_____

Decay Heat Limit②_____

Hydrogen/Flammable Gas Generation Rate Limit②_____

Overpack Container Type ☐ 85-Gallon Drum ☐ SWB ☐ TDOP

Overpacked Container Type ☐ 55-Gallon Drum(s) ☐ SWB ☐ SWB Overpack

☐ 85-Gallon Drum Overpack(s) ☐ 85-Gallon Drum (s)

☐ Bin Overpack

Weight Limit②_____(lbs.) **Fissile Mass Limit**②_____FGE

Certification Site_____

CH-TRAMPAC TRANSPORTATION PARAMETERS

Surface Radiation Dose Rate ≤ payload container limit②

Filter(s) Identification 1._____ 2._____ 3._____ 4._____ 5._____

6._____ 7._____ 8._____ 9._____ 10._____

OVERPACKED CONTAINER MEASURED PARAMETERS

Overpacked Container ID Number	Weight (lbs.)	Error (lbs.)	Decay Heat (watts)	Error (watts)	Fissile Mass (FGE)	2x Error (FGE)	Hydrogen/ Flammable Gas Generation Rate (mol/s)	Flammability Index②
			←Weight and error of empty overpack container (if applicable)					
Total (A)								
Total RSS Error								
Total + RSS Error								

CERTIFICATION OF COMPLIANCE

Total weight + weight error ≤ limit①

Total fissile mass + 2x fissile mass error ≤ limit②

Decay heat + decay heat error ≤ decay heat limit of shipping category for each analytical category payload container③

Hydrogen/flammable gas generation rate ≤ hydrogen/flammable gas generation rate limit of shipping category for each test category payload container③

FI of each overpacked container meets the following condition: 0 ≤ FI ≤ 50,000④

I certify that the above overpack container meets all the requirements for shipment as an overpack container as stated in the CH-TRAMPAC, current revision. The overpack is approved for
☐ payload assembly or ☐ overpacking.

_____ / _____

TRANSPORTATION CERTIFICATION OFFICIAL / DATE

Notes:

① Follow instructions in Section 6.2.1.3.

② Not applicable if mixing shipping categories pursuant to Section 6.2.4.

③ Limits are not applicable if container is to be overpacked.

④ Applicable if mixing shipping categories pursuant to Section 6.2.4. FI is determined as part of payload assembly (Section 6.2.2).

Table 6.2-4 – Payload Assembly Transportation Certification Document (PATCD)[1]

IDENTIFICATION PARAMETERS

Shipment #: _____ **Packaging OCA Body/Lid #:** _____

Payload Assembly Designated for Controlled Shipment?[2] ○ YES ○ NO

Shipping Category[2]**:**_____

Decay Heat Limit[2]**:**_____

Hydrogen/Flammable Gas Generation Rate Limit[2]**:**_____

Type of Payload: ☐ 55-Gallon Drums ☐ Standard Pipe Overpacks ☐ S100 Pipe Overpacks ☐ S200 Pipe Overpacks ☐ S300 Pipe Overpacks ☐ 85-Gallon Drums ☐ 100-Gallon Drums ☐ SWBs ☐ TDOP

Transportation Packaging: ☐ TRUPACT-II ☐ HalfPACT

Date ICV Closed: _____ **Time ICV Closed:** _____[4]

BOTTOM PAYLOAD ASSEMBLY COMPOSITION

Container ID	Weight (lbs.)	Error (lbs.)	Decay Heat (watts)	Error (watts)	Fissile Mass (FGE)	2x Error (FGE)	Hydrogen/Flammable Gas Generation Rate[5][6][7]	Flammability Index[6][7]
Subtotal (A)								
Subtotal RSS Error (C)								

TOP PAYLOAD ASSEMBLY COMPOSITION (TRUPACT-II Only)

Container ID	Weight (lbs.)	Error (lbs.)	Decay Heat (watts)	Error (watts)	Fissile Mass (FGE)	2x Error (FGE)	Hydrogen/Flammable Gas Generation Rate[5][6][7]	Flammability Index[6][7]
Subtotal (B)								
Subtotal RSS Error (D)								

PAYLOAD TOTALS

Weight of Pallets, Reinforcing Plates, Slip Sheets, Guide Tubes, Adjustable Slings, etc. (E)_____

Total (A+E [+B (TRUPACT-II only]) Weight:_____lbs. Total RSS Weight Error:_____lbs.

Total Decay Heat:_____watts Total RSS Decay Heat Error:_____watts

Total Fissile Mass:_____FGE Total RSS Fissile Mass Error:_____FGE

Bottom Assembly Weight plus Subtotal RSS Error (A+C) (TRUPACT-II Only) _____lbs.

Top Assembly Weight plus Subtotal RSS Error (B+D) (TRUPACT-II Only) _____lbs.

Total Weight plus Total RSS Error_____lbs.

Total Decay Heat plus Total RSS Error_____watts

Total Fissile Mass plus Total RSS Error_____FGE

PAYLOAD CERTIFICATION PARAMETERS

Decay Heat + Error of Each Analytical Category Payload Container ≤ Limit⑧

Hydrogen/Flammable Gas Generation Rate of Each Test Category Payload Container ≤ Limit⑧⑧

Flammability Index of Each Payload Container Meets the Following Condition: 0 ≤ FI ≤ 50,000⑧

Payload Total Gas Release Rate ≤ Limit Calculated in Accordance with Section 6.2.5⑧

Bottom Weight ≥ Top Weight (for TRUPACT-II)

Total Weight plus RSS Error ≤ **7,265** lbs. for TRUPACT-II; ≤ **7,600** lbs. for HalfPACT

Decay Heat plus RSS Error ≤ **40** watts for TRUPACT-II; ≤ **30** watts for HalfPACT

Fissile Mass (Pu-239 FGE) plus RSS Error ≤_____ FGE

Total Activity plus Error for S100 or S300 pipe overpack payloads ≤406 curies.

I certify that the above payload assembly meets all the requirements for shipment as stated in the CH-TRAMPAC, current revision. The payload assembly is approved for shipment.

_____ / _____

TRANSPORTATION CERTIFICATION OFFICIAL / DATE

Notes:

① Follow instructions in Section 6.2.2.

② If the payload is designated for controlled shipment, Table 6.2-5 must also be completed for the shipment of this payload as specified in Section 6.2.3.

③ Not applicable if mixing shipping categories pursuant to Section 6.2.4.

④ Required only for payloads designated for Controlled Shipment (10 days).

⑤ Required for payloads containing test category payload containers.

⑥ Applicable if mixing shipping categories pursuant to Section 6.2.4.

⑦ If the payload assembly consists of overpacked configurations, indicate not applicable (e.g., "NA – Mixing") and record the hydrogen/flammable gas generation rate and FI values for each overpacked container on the appropriate OPCTCD.

⑧ Applicable if shipping pursuant to Section 6.2.5.