REMOTE-HANDLED TRANSURANIC CONTENT CODES

(RH-TRUCON)

[this page is blank to double-side the document]

1.0 INTRODUCTION

The Remote-Handled Transuranic (RH-TRU) Content Codes (RH-TRUCON) document represents the development of a uniform content code system for RH-TRU waste to be transported in the 72-B cask. It will be used to convert existing waste form numbers, content codes, and site-specific identification codes into a system that is uniform across the U.S. Department of Energy (DOE) sites.

The existing waste codes at the sites can be grouped under uniform content codes without any loss of waste characterization information. The RH-TRUCON document provides an all-encompassing description for each content code and compiles this information for all DOE sites. Compliance with waste generation, processing, and certification procedures at the sites (outlined in this document for each content code) ensures that prohibited waste forms are not present in the waste. The content code gives an overall description of the RH-TRU waste material in terms of processes and packaging, as well as the generation location. This helps to provide cradle-to-grave traceability of the waste material so that the various actions required to assess its qualification as payload for the 72-B cask can be performed. The content codes also impose restrictions and requirements on the manner in which a payload can be assembled.

The RH-TRU Waste Authorized Methods for Payload Control (RH-TRAMPAC), Appendix 1.3.7 of the 72-B Cask Safety Analysis Report (SAR), describes the current governing procedures applicable for the qualification of waste as payload for the 72-B cask. The logic for this classification is presented in the 72-B Cask SAR. Together, these documents (RH-TRUCON, RH-TRAMPAC, and relevant sections of the 72-B Cask SAR) present the foundation and justification for classifying RH-TRU waste into content codes. Only content codes described in this document can be considered for transport in the 72-B cask. Revisions to this document will be made as additional waste qualifies for transport.

Each content code uniquely identifies the generated waste and provides a system for tracking the process and packaging history. Each content code begins with a two-letter site abbreviation that indicates the shipper of the RH-TRU waste. The site-specific letter designations for each of the DOE sites are provided in Table 1. Not all of the sites listed in Table 1 have generated/stored RH-TRU waste.

TABLE 1

WASTE SHIPPER SITE IDENTIFICATION CODES

SITE NAME	SITE IDENTIFICATION CODE
Argonne National Laboratory - East (ANL-E)	AE
Argonne National Laboratory - West (ANL-W)	AW
Battelle Columbus Laboratory (BCL)	BC
Battelle - Pacific Northwest Laboratory (PNL)	BP
Bettis Atomic Power Laboratory (BET)	BE
Energy Technology Engineering Center (ETEC)	ET
Idaho National Engineering and Environmental Laboratory (INEEL)	ID
Los Alamos National Laboratory (LANL)	LA
Lawrence Livermore National Laboratory (LLNL)	LL
Mound	MD
Nevada Test Site (NTS)	NT
Oak Ridge National Laboratory (ORNL)	OR
Rocky Flats Environmental Technology Site (RFETS)	RF
Richland Hanford (RH)	RH
Savannah River Site (SRS)	SR

Following the site abbreviation is a three-digit numerical code that categorizes the RH-TRU waste materials. These three-digit codes are based on a system used to characterize contact-handled (CH)-TRU waste. For RH-TRU waste, the first number of the content code is a "3." The last two digits of the three digit code are used to categorize the waste into content codes based on its physical and chemical characteristics. Table 2 lists potential content codes and a short description of each content code. All of the content codes in Table 2 may not be used but are included for completeness. These content codes can be grouped into four basic waste types that encompass all of the RH-TRU waste in the system. The waste types are:

I — Solidified Inorganics
II — Solid Inorganics
III — Solid Organics
IV — Solidified Organics

At the end of each three-digit numerical code is an alpha trailer. This alpha trailer is used to allow segregation of wastes that differ in one or more parameter(s). For example, these alpha trailers may identify differences in the combination of external packaging (e.g., RH-TRU waste canister) and internal packaging configuration used (e.g., use of plastic buckets and bags, metal cans, and overpacking 55-gallon drums in the RH-TRU waste canister), or differences in waste description. Identification by packaging configuration is necessary to characterize the release rate of any generated gases from the waste. Because packaging techniques are unique to a generator/storage site, there is no standard definition for this particular use of alpha trailers or format for their assignment. This content code-specific information is provided in this document.

Each of the content codes for RH-TRU materials has a 5% (by volume) limit on the hydrogen concentration that can be present in any confinement layer of a waste container. The sites have two options to comply with these limits:

Option 1: Convert the 5% restriction on hydrogen concentration to a limit on the allowable hydrogen generation rate for each content code (as described in Appendix 3.6.9 of the 72-B Cask SAR). If it can be shown for a given waste container that this limit can be met, the hydrogen concentration will remain at or below 5% under transportation conditions. Attachment 2 of Appendix 1.3.7 of the 72-B Cask SAR provides procedures to be used for the determination of hydrogen generation rates.

TABLE 2

CONTENT CODES FOR RH-TRU WASTE

311 TRU Solidified Aqueous or Homogeneous Inorganic Solids—cemented or dewatered sludge from aqueous waste treatment process or plutonium recovery operations. Soils that are not contaminated with organic chemicals are classified as homogeneous solids.

312 TRU Solidified Organics - cemented or absorbed organic liquids from production or laboratory processes.

314 TRU Solidified Inorganic Process Solids - cemented inorganic particulate or sludge-like (not chemically precipitated) waste from plutonium recovery operations.

315 TRU Graphite Waste - discarded graphite molds, laboratory equipment and furnace equipment (whole or pieces) from plutonium casting or laboratory operations.

317 TRU Metal/Glass Waste - discarded metal (e.g., tantalum, aluminum, stainless steel) from production or maintenance operations, and discarded labware, windows, containers or Raschig rings from various processes.

320 TRU Isotopic Source Waste.

321 TRU Organic Solid Waste - solid organic waste such as methyl methacrylate (Plexiglas) and Benelex.

322 TRU Inorganic Solid Waste - solid inorganic waste such as insulation, firebrick, concrete.

324 TRU Pyrochemical Salt Waste - used chloride salts from pyrochemical processes such as electrorefining, molten salt extraction or direct oxide reduction.

325 TRU Solid Organic and Solid Inorganic Waste - mixture of paper, plastic, metal and glass waste.

326 TRU Cemented Organic Process Solids - cemented organic particulate, sludge-like (not chemically precipitated) waste or resins.

Option 2: Convert the 5% restriction on hydrogen concentration to a limit on the allowable decay heat per waste container (as described in Appendix 3.6.9 of the 72-B Cask SAR). Since radiolysis of the waste materials is the primary mechanism by which hydrogen can be generated, the 5% limit on hydrogen concentration imposes a limit on the allowable decay heat per waste container. If it can be shown for a given waste container that this limit can be met, the hydrogen concentration will remain at or below 5% under transportation conditions. Procedures for determining the decay heat values for waste containers are described in Appendix 1.3.7 of the 72-B Cask SAR.

The content codes defined in this document are fully characterized with respect to the following parameters:

- Content Description
- Generating Site
- Storage Site (if applicable)
- Waste Description
- Generating Source(s) (as applicable)
- Waste Form
- Waste Packaging
- Method(s) for Isotopic Determination
- Free Liquids
- Explosives/Compressed Gases
- Pyrophorics
- Corrosives
- Chemical Compatibility
- Additional Criteria
- Maximum Allowable Hydrogen Generation Rate – Option 1
- Maximum Allowable Decay Heat Limit – Option 2

Each of these parameters is discussed below.

CONTENT DESCRIPTION: Identifies the physical form of the waste, describing whether it is inorganic or organic, solidified, or solid.

GENERATING SITE: Provides the location of waste generation.

STORAGE SITE (IF APPLICABLE): Provides the location of the waste, if the location is different than the generating site.

WASTE DESCRIPTION: Provides basic information on the nature and main components of the waste.

GENERATING SOURCE(S) (AS APPLICABLE): Lists process(es) and/or building(s) at each site that generate(s) the waste in each content code.

WASTE FORM: Provides more detailed information on the waste contents, how the waste is processed, and specific information about the constituents.

WASTE PACKAGING: Describes, in detail, techniques necessary for waste packaging in a given content code. This includes a description of the type and configuration of the internal waste packaging.

METHOD(S) FOR ISOTOPIC DETERMINATION: Describes the methods utilized to obtain fissile material content and decay heat values (if applicable) for a particular content code. Acceptable methods are described in the RH-TRAMPAC.

FREE LIQUIDS: Describes the authorized procedures used by the sites to ensure that the limits imposed on free liquids (<1% by volume) are met for each content code.

EXPLOSIVES/COMPRESSED GASES: Identifies the methods used to preclude the presence of explosives or compressed gases and the method for secondary verification of this requirement.

PYROPHORICS: Describes the controls in place at each site to ensure that pyrophoric materials in RH-TRU waste are not present in quantities greater than 1% by weight.

CORROSIVES: Describes the controls in place to ensure that corrosive materials in RH-TRU waste are either not present or are neutralized or immobilized prior to placement in a waste container.

CHEMICAL COMPATIBILITY: Describes the controls in place to ensure chemical compatibility for the waste contents and the 72-B cask. Trace chemicals/materials are components present in the waste in less than 1% quantities by weight. The total quantity of trace chemicals/materials not listed as allowable materials in the waste or not complying with the bounding G value(s) for the particular waste shall not exceed 5% by weight.

ADDITIONAL CRITERIA: Provides details on how the waste qualifies for shipment by meeting additional transport requirements (e.g., ensuring bags are slashed or punctured, filtering of drums).

MAXIMUM ALLOWABLE HYDROGEN GENERATION RATES - OPTION 1: This section provides the maximum allowable hydrogen generation rates for each content code. Maximum allowable hydrogen generation rates are provided (where applicable) for an RH-TRU waste canister (fixed and removable lid) or for each drum or can in an RH-TRU waste canister.

MAXIMUM ALLOWABLE DECAY HEAT LIMITS - OPTION 2: This section provides the maximum allowable decay heat limit for each content code. Maximum decay heat limits are provided (where applicable) for an RH-TRU waste canister (fixed and removable lid) or for each drum or can in an RH-TRU waste canister. Maximum decay heat limits based on dose-dependent G values are also provided for applicable content codes.

With the information listed in this RH-TRUCON document and applicable physical measurements specified by the 72-B Cask SAR, waste can be properly qualified for transport in the 72-B cask. The waste form must have been pre-assigned a content code in order to qualify for shipment.

PAGES 9 THROUGH 13 HAVE BEEN DELETED

CONTENT CODE: BC 312A

CONTENT DESCRIPTION: Solidified Organic Waste

GENERATING SITE: Battelle Columbus Laboratories (BCL)

STORAGE SITE: BCL

WASTE DESCRIPTION: This waste consists of solidified organic and inorganic wastes.

GENERATING SOURCE(S): This waste is generated during research and development activities conducted in Building JN-1.

WASTE FORM: The waste consists primarily of inorganic and organic liquids that have been solidified using Floor Dry. The inorganic liquids include acids and acid solutions and elemental mercury. The organic liquids include hydraulic oil, waste water, sludge of sand and mixed fission products (dust, small fragments); small items such as tools; and nonhalogenated organic liquids such as glycols, oils, and alcohols.

WASTE PACKAGING: The waste will be placed directly into a 55-gallon drum with no layers of confinement. The drum is lined with a steel liner. Three drums will then be placed into the RH-TRU waste canister.

METHOD(S) FOR ISOTOPIC DETERMINATION: The isotopic information required to demonstrate compliance with the limits on fissile content, decay heat, and curie content will be determined based on the waste generation source and configuration, which establish the initial radionuclide compositions based on location and initial use. A combination of assaying samples and modeling of the isotopic generation processes results in the establishment of a mixture that characterizes the waste in the content code and the majority of waste at the Battelle Columbus Laboratories Decommissioning Project (BCLDP). Using shipping package modeling, dose rate and weight measurements based on the mixture then allow the BCLDP to determine the isotopic inventory. As required, additional radioassays (e.g., confirming gamma spectrometry) will be performed.

FREE LIQUIDS: Liquid waste, except for residual amounts in well-drained containers, is prohibited in the drums. 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. Absorbents such as Radsorb or diatomaceous earth (e.g., Floor Dry) will be added to any waste matrix that has the potential to dewater after packaging.

EXPLOSIVES/COMPRESSED GASES: Explosives and compressed gases in the payload containers are prohibited by waste packaging procedures. If present, pressurized cans shall be punctured and emptied prior to packaging.

PYROPHORICS: Waste packaging procedures shall ensure that all pyrophoric radioactive and nonradioactive materials are present only in small residual amounts (less than 1 weight percent) in payload containers.

CORROSIVES: Corrosives are prohibited in the payload container. 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% by weight) quantities. The chemicals found in this content code are identified in the attached list and are restricted to the allowable chemical lists determined by the methodology found in the RH-TRU 72-B Cask Safety Analysis Report (SAR).

ADDITIONAL CRITERIA: Each drum is fitted with a minimum of one filter vent with a minimum hydrogen diffusivity of 3.7E-06 mole/second/mole fraction. The steel liner is fitted with a filter with a minimum hydrogen diffusivity of 3.7E-06 mole/second/mole fraction.

MAXIMUM ALLOWABLE HYDROGEN GENERATION RATES - OPTION 1: The maximum allowable hydrogen generation rate limits are as follows:

Confinement Layer	Maximum Allowable Hydrogen Generation Rate Limits Fixed Lid Canister (moles/second)	Maximum Allowable Hydrogen Generation Rate Limits Removable Lid Canister (moles/second)
Can	N/A	N/A
Drum	3.8391E-08	3.2850E-08
Canister	1.1517E-07	9.8550E-08

MAXIMUM ALLOWABLE DECAY HEAT LIMITS - OPTION 2: There is no decay heat limit for this content code as no G values have been established. Waste cannot be transported under Option 2.

THIS PAGE INTENTIONALLY LEFT BLANK

BATTELLE COLUMBUS LABORATORIES CONTENT CODE BC 312A
SOLIDIFIED ORGANIC WASTE

MATERIALS AND CHEMICALS >1%

DIATOMACEOUS EARTH (Floor Dry)
ACIDS AND ACID SOLUTIONS
MERCURY
HYDRAULIC OIL, GLYCOLS, OILS, AND ALCOHOLS
SAND
RADSORB
VERMICULITE
AQUA-SET/PETRO-SET

MATERIALS AND CHEMICALS <1%

METALS (including stainless steel, aluminum, iron, copper, lead, beryllium, and zirconium)

THIS PAGE INTENTIONALLY LEFT BLANK

CONTENT CODE: BC 314A

CONTENT DESCRIPTION: Cemented Inorganic Process Solids

GENERATING SITE: Battelle Columbus Laboratories (BCL)

STORAGE SITE: BCL

WASTE DESCRIPTION: This waste consists of slugs produced from dissolving fuel specimens in an acid solution that was then diluted several times and mixed with cement and allowed to solidify in foam cups.

GENERATING SOURCE(S): This waste is generated during repackaging of the waste materials generated from research and development activities conducted in Building JN-1.

WASTE FORM: The waste consists of slugs produced from dissolving fuel specimens in an acid solution, which was then diluted several times and mixed with cement and allowed to solidify in foam cups. The slugs will contain limited amounts of radionuclides from fuel because of this dilution. The waste matrix will also include Floor Dry added during repackaging to absorb any water from condensation or dewatering.

WASTE PACKAGING: The waste will be placed directly into a 55-gallon drum with no layers of confinement. The drum is lined with a steel liner. Three drums will then be placed into the RH-TRU waste canister.

METHOD(S) FOR ISOTOPIC DETERMINATION: The isotopic information required to demonstrate compliance with the limits on fissile content, decay heat, and curie content will be determined based on the waste generation source and configuration, which establish the initial radionuclide compositions based on location and initial use. A combination of assaying samples and modeling of the isotopic generation process used in the establishment of a mixture that characterizes the waste in the content code and the majority of waste at the Battelle Columbus Laboratories Decommissioning Project (BCLDP). Using shipping package modeling, dose rate and weight measurements based on the mixture then allow the BCLDP to determine the isotopic inventory. As required, additional radioassays (e.g., confirming gamma spectroscopy) will be performed.

FREE LIQUIDS: Liquid waste, except for residual amounts in well-drained containers, is prohibited in the drums. 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. Absorbents such as diatomaceous earth (e.g., Floor Dry) will be added to any waste matrix that has the potential to dewater after packaging.

EXPLOSIVES/COMPRESSED GASES: Explosives and compressed gases in the payload containers are prohibited by waste packaging procedures. If present, pressurized cans shall be punctured and emptied prior to packaging.

PYROPHORICS: Waste packaging procedures shall ensure that all pyrophoric radioactive and nonradioactive materials are present only in small residual amounts (less than 1 weight percent) in payload containers.

CORROSIVES: Corrosives are prohibited in the payload container. 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% by weight) quantities. The chemicals found in this content code are identified in the attached list and are restricted to the allowable chemical lists determined by the methodology found in the RH-TRU 72-B Cask SAR.

ADDITIONAL CRITERIA: Each drum is fitted with a minimum of one filter vent with a minimum hydrogen diffusivity of 3.7E-06 mole/second/mole fraction. The steel liner is fitted with a filter with a minimum hydrogen diffusivity of 3.7E-06 mole/second/mole fraction.

MAXIMUM ALLOWABLE HYDROGEN GENERATION RATES - OPTION 1: The maximum allowable hydrogen generation rate limits are as follows:

Confinement Layer	Maximum Allowable Hydrogen Generation Rate Limits Fixed Lid Canister (moles/second)	Maximum Allowable Hydrogen Generation Rate Limits Removable Lid Canister (moles/second)
Can	N/A	N/A
Drum	3.8391E-08	3.2850E-08
Canister	1.1517E-07	9.8550E-08

MAXIMUM ALLOWABLE DECAY HEAT LIMITS - OPTION 2: The maximum allowable decay heat limits are as follows:

Confinement Layer	Maximum Allowable Decay Heat Limits Fixed Lid Canister (watts)	Maximum Allowable Decay Heat Limits Removable Lid Canister (watts)
Can	N/A	N/A
Drum	0.6033	0.5170
Canister	1.8100	1.5500

THIS PAGE INTENTIONALLY LEFT BLANK

BATTELLE COLUMBUS LABORATORIES CONTENT CODE BC 314A
CEMENTED INORGANIC PROCESS SOLIDS

MATERIALS AND CHEMICALS >1%

DIATOMACEOUS EARTH (Floor Dry)
CEMENT SLUGS

MATERIALS AND CHEMICALS <1%

NITRIC ACID
WATER

THIS PAGE INTENTIONALLY LEFT BLANK

CONTENT CODE: BC 321A

CONTENT DESCRIPTION: Solid Organic Waste

GENERATING SITE: Battelle Columbus Laboratories (BCL)

STORAGE SITE: BCL

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

GENERATING SOURCE(S): This waste is generated from activities supporting the decontamination and decommissioning of Building JN-1 under the Battelle Columbus Laboratories Decommissioning Project (BCLDP).

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. The waste may also include particulate and sludge-type organic process solids immobilized/solidified with Portland cement, vermiculite, Aqua-Set, or Petro-Set.

WASTE PACKAGING: The waste will be placed directly into a 55-gallon drum with no layers of confinement. The drum is lined with a steel liner. Three drums will then be placed into the RH-TRU waste canister.

METHOD(S) FOR ISOTOPIC DETERMINATION: The isotopic information required to demonstrate compliance with the limits on fissile content, decay heat, and curie content will be determined based on the waste generation source and configuration, which establish the initial radionuclide compositions based on location and initial use. A combination of assaying samples and modeling of the isotopic generation process, results in the establishment of a mixture that characterizes the waste in the content code and the majority of waste at the BCLDP. Using shipping package modeling, dose rate and weight measurement based on the mixture then allow the BCLDP

to determine the isotopic inventory. As required, additional radioassays (e.g., confirming gamma spectroscopy) will be performed.

FREE LIQUIDS: Liquid waste, except for residual amounts in well-drained containers, is prohibited in the drums. 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. Absorbents such as Radsorb or diatomaceous earth (e.g., Floor Dry) will be added to any waste matrix that has the potential to dewater after packaging.

EXPLOSIVES/COMPRESSED GASES: Explosives and compressed gases in the payload containers are prohibited by waste packaging procedures. If present, pressurized cans shall be punctured and emptied prior to packaging.

PYROPHORICS: Waste packaging procedures shall ensure that all pyrophoric radioactive and nonradioactive materials are present only in small residual amounts (less than 1 weight percent) in payload containers.

CORROSIVES: Corrosives are prohibited in the payload container. 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% by weight) quantities. The chemicals found in this content code are identified in the attached list and are restricted to the allowable chemical lists determined by the methodology found in the RH-TRU 72-B Cask SAR.

ADDITIONAL CRITERIA: Each drum is fitted with a minimum of one filter vent with a minimum hydrogen diffusivity of 3.7E-06 mole/second/mole fraction. The steel liner is fitted with a filter with a minimum hydrogen diffusivity of 3.7E-06 mole/second/mole fraction.

MAXIMUM ALLOWABLE HYDROGEN GENERATION RATES - OPTION 1: The maximum allowable hydrogen generation rate limits are as follows:

Confinement Layer	Maximum Allowable Hydrogen Generation Rate Limits Fixed Lid Canister (moles/second)	Maximum Allowable Hydrogen Generation Rate Limits Removable Lid Canister (moles/second)
Can	N/A	N/A
Drum	4.4110E-08	3.6380E-08
Canister	1.3233E-07	1.0914E-07

MAXIMUM ALLOWABLE DECAY HEAT LIMITS - OPTION 2: The maximum allowable decay heat limits are as follows:

Confinement Layer	Maximum Allowable Decay Heat Limits Fixed Lid Canister (watts)		Maximum Allowable Decay Heat Limits Removable Lid Canister (watts)	
	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year ≥0.012)	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year ≥0.012)
Can	N/A	N/A	N/A	N/A
Drum	0.1283	0.3263	0.1127	0.2710
Canister	0.3850	0.9790	0.3380	0.8130

THIS PAGE INTENTIONALLY LEFT BLANK

BATTELLE COLUMBUS LABORATORIES CONTENT CODE BC 321A
SOLID ORGANIC WASTE

MATERIALS AND CHEMICALS >1%

BLACKTOP (Asphalt)
CELLULOSICS
RUBBER
DIATOMACEOUS EARTH (Floor Dry)
GLASS
IRON-BASED METAL/ALLOYS
PAPER
PLASTIC
RADSORB
CLOTH
CARDBOARD
WOOD
KIMWIPES
FILTERS
BENELEX
PLEXIGLAS
NEOPRENE
PORTLAND CEMENT
VERMICULITE
AQUA-SET/PETRO-SET
OTHER INORGANICS

MATERIALS AND CHEMICALS <1%

METALS (including aluminum, lead, zirconium, stainless steel, and carbon steel)
CONCRETE
SOIL

THIS PAGE INTENTIONALLY LEFT BLANK

CONTENT CODE: BC 321B

CONTENT DESCRIPTION: Solid Organic Waste

GENERATING SITE: Battelle Columbus Laboratories (BCL)

STORAGE SITE: BCL

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

GENERATING SOURCE(S): This waste is generated during the change-out of resins in the Transfer/Storage Pool filtering system in Building JN-1 (Hot Cell Laboratory).

WASTE FORM: The waste may include filter waste (e.g., pool filters); nuclear grade resin, resin bags, paper, rubber gloves, Floor Dry bags, seals, hoses, valves, and clamps.

WASTE PACKAGING: The waste will be placed directly into a 55-gallon drum with no layers of confinement. The drum may be lined with a steel or polyethylene liner. Three drums will then be placed into the RH-TRU waste canister.

METHOD(S) FOR ISOTOPIC DETERMINATION: The isotopic information required to demonstrate compliance with the limits on fissile content, decay heat, and curie content will be determined based on the waste generation source and configuration, which establish the initial radionuclide compositions based on location and initial use. A combination of assaying samples and modeling of the isotopic generation process results in the establishment of a mixture that characterizes the waste in the content code. Using shipping package modeling, dose rate and weight measurements based on the mixture then allow the Battelle Columbus Laboratories Decommissioning Project (BCLDP) to determine the isotopic inventory. As required, additional radioassays (e.g., confirming gamma spectrometry) will be performed.

FREE LIQUIDS: Liquid waste, except for residual amounts in well-drained containers, is prohibited in the drums. 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. Absorbents such as Radsorb or diatomaceous earth (e.g., Floor Dry) will be added to any waste matrix that has the potential to dewater after packaging.

EXPLOSIVES/COMPRESSED GASES: Explosives and compressed gases in the payload containers are prohibited by waste packaging procedures. If present, pressurized cans shall be punctured and emptied prior to packaging.

PYROPHORICS: Waste packaging procedures shall ensure that all pyrophoric radioactive and nonradioactive materials are present only in small residual amounts (less than 1 weight percent) in payload containers.

CORROSIVES: Corrosives are prohibited in the payload container. 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% by weight) quantities. The chemicals found in this content code are identified in the attached list and are restricted to the allowable chemical lists determined by the methodology found in the RH-TRU 72-B Cask SAR.

ADDITIONAL CRITERIA: Each drum is fitted with a minimum of one filter vent with a minimum hydrogen diffusivity of 3.7E-06 mole/second/mole fraction. The steel or polyethylene liner, if present, is either punctured or fitted with a filter with a minimum hydrogen diffusivity of 3.7E-06 mole/second/mole fraction.

MAXIMUM ALLOWABLE HYDROGEN GENERATION RATES - OPTION 1: The maximum allowable hydrogen generation rate limits are as follows:

Confinement Layer	Maximum Allowable Hydrogen Generation Rate Limits Fixed Lid Canister (moles/second)	Maximum Allowable Hydrogen Generation Rate Limits Removable Lid Canister (moles/second)
Can	N/A	N/A
Drum	4.4110E-08	3.6380E-08
Canister	1.3233E-07	1.0914E-07

MAXIMUM ALLOWABLE DECAY HEAT LIMITS - OPTION 2: The maximum allowable decay heat limit limits are as follows:

Confinement Layer	Maximum Allowable Decay Heat Limits Fixed Lid Canister (watts)		Maximum Allowable Decay Heat Limits Removable Lid Canister (watts)	
	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year ≥0.012)	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year ≥0.012)
Can	N/A	N/A	N/A	N/A
Drum	0.1557	0.2460	0.1370	0.2163
Canister	0.4670	0.7380	0.4110	0.6490

THIS PAGE INTENTIONALLY LEFT BLANK

BATTELLE COLUMBUS LABORATORIES CONTENT CODE BC 321B
SOLID ORGANIC WASTE

MATERIALS AND CHEMICALS >1%

CELLULOSICS, PAPER, PLASTIC (≤12 weight %)
RUBBER
DIATOMACEOUS EARTH (Floor Dry)
ION EXCHANGE RESIN (≤80 weight %)
IRON-BASED METAL/ALLOYS
RADSORB
RESIN BAGS
FILTERS
OTHER INORGANICS

MATERIALS AND CHEMICALS <1%

METALS (including aluminum, lead, zirconium, stainless steel, and carbon steel)

THIS PAGE INTENTIONALLY LEFT BLANK

CONTENT CODE: BC 322A

CONTENT DESCRIPTION: Solid Inorganic Waste

GENERATING SITE: Battelle Columbus Laboratories (BCL)

STORAGE SITE: BCL

WASTE DESCRIPTION: This waste consists of a variety of glass and metal materials.

GENERATING SOURCE(S): This waste is generated during repackaging of the waste materials generated from research and development activities conducted in Building JN-1.

WASTE FORM: The waste consists primarily of glass and metal debris. Glass debris includes laboratory glassware, windows, leaded glass windows, and various glass apparatus. Metal items may include deteriorated berry cans, cable, wire, planchets, signs, valves, piping, strapping, tools, foils, sheeting, fixtures, equipment (e.g., pumps or motors that have had all oil or any other free liquids removed to <1%), hardware (e.g., nuts, bolts, brackets), specimen vials, fuel rod cladding, metallurgical mounts, and lead lined tubing. Metals of construction include stainless steel, aluminum, iron, copper, lead, beryllium, and zirconium.

WASTE PACKAGING: The waste will be placed directly into a 55-gallon drum with no layers of confinement. The drum is lined with a steel liner. Three drums will then be placed into the RH-TRU waste canister.

METHOD(S) FOR ISOTOPIC DETERMINATION: The isotopic information required to demonstrate compliance with the limits on fissile content, decay heat, and curie content will be determined based on the waste generation source and configuration, which establish the initial radionuclide compositions based on location and initial use. A combination of assaying samples and modeling of the isotopic generation process used in the establishment of a mixture that characterizes the waste in the content code and the majority of waste at the Battelle Columbus Laboratories Decommissioning Project (BCLDP). Using shipping package modeling, dose rate and weight measurements based on the mixture then allow the BCLDP to determine the isotopic inventory. As required, additional radioassays (e.g., confirming gamma spectroscopy) will be performed.

FREE LIQUIDS: Liquid waste, except for residual amounts in well-drained containers, is prohibited in the drums. 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. Absorbents such as diatomaceous earth (e.g., Floor Dry) will be added to any waste matrix that has the potential to dewater after packaging.

EXPLOSIVES/COMPRESSED GASES: Explosives and compressed gases in the payload containers are prohibited by waste packaging procedures. If present, pressurized cans shall be punctured and emptied prior to packaging.

PYROPHORICS: Waste packaging procedures shall ensure that all pyrophoric radioactive and nonradioactive materials are present only in small residual amounts (less than 1 weight percent) in payload containers.

CORROSIVES: Corrosives are prohibited in the payload container. 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% by weight) quantities. The chemicals found in this content code are identified in the attached list and are restricted to the allowable chemical lists determined by the methodology found in the RH-TRU 72-B Cask SAR.

ADDITIONAL CRITERIA: Each drum is fitted with a minimum of one filter vent with a minimum hydrogen diffusivity of 3.7E-06 mole/second/mole fraction. The steel liner is fitted with a filter with a minimum hydrogen diffusivity of 3.7E-06 mole/second/mole fraction.

MAXIMUM ALLOWABLE HYDROGEN GENERATION RATES - OPTION 1: The maximum allowable hydrogen generation rate limits are as follows:

Confinement Layer	Maximum Allowable Hydrogen Generation Rate Limits Fixed Lid Canister (moles/second)	Maximum Allowable Hydrogen Generation Rate Limits Removable Lid Canister (moles/second)
Can	N/A	N/A
Drum	3.8391E-08	3.2850E-08
Canister	1.1517E-07	9.8550E-08

MAXIMUM ALLOWABLE DECAY HEAT LIMITS - OPTION 2: The maximum allowable decay heat are as follows:

Confinement Layer	Maximum Allowable Decay Heat Limits Fixed Lid Canister (watts)	Maximum Allowable Decay Heat Limits Removable Lid Canister (watts)
Can	N/A	N/A
Drum	18.10	15.50
Canister	54.30	46.50

THIS PAGE INTENTIONALLY LEFT BLANK

BATTELLE COLUMBUS LABORATORIES CONTENT CODE BC 322A
SOLID INORGANIC WASTE

MATERIALS AND CHEMICALS >1%

CEMENT
DIATOMACEOUS EARTH (Floor Dry)
GLASS
METALS (including stainless steel, aluminum, iron, copper, lead, beryllium, and zirconium)
IRON-BASED METAL/ALLOYS
OTHER INORGANICS

MATERIALS AND CHEMICALS <1%

CARBON TETRACHLORIDE
1,1,1-TRICHLOROETHANE
TRICHLOROETHYLENE

THIS PAGE INTENTIONALLY LEFT BLANK

CONTENT CODE: ET 325A

CONTENT DESCRIPTION: Solid Organic and Inorganic Waste

GENERATING SITE: Energy Technology Engineering Center (ETEC)

STORAGE SITE: ETEC

WASTE DESCRIPTION: This waste consists of Hot Laboratory debris including paper, plastic, metal and glass.

GENERATING SOURCE(S): Solid organic and inorganic debris waste was generated during decontamination and decommissioning (D&D) operations at the former ETEC-associated Hot Laboratory.

WASTE FORM: The debris waste consists of miscellaneous waste materials removed from the facility during D&D, including a small capped pipe that contains unirradiated plutonium oxide/ uranium oxide pieces from ETEC's former Nuclear Materials Development Facility, canisters of paint chips surrounded by lead shielding, and a lead brick.

WASTE PACKAGING: The waste is in two plastic bag layers, which are folded and taped, in a 55-gallon drum. Three 55-gallon drums are then placed into the RH-TRU waste canister.

METHOD(S) FOR ISOTOPIC DETERMINATION: The required isotopic information to demonstrate compliance with the limits on fissile content, decay heat, and curie content will be determined based on acceptable knowledge, the radioassay of samples, or on total drum activity measurements, taken on the product material.

FREE LIQUIDS: Liquid waste, except for residual amounts in well-drained containers, is prohibited in the drums. 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. If present, pressurized cans shall be punctured and emptied prior to packaging.

PYROPHORICS: Process knowledge indicates that no non-radioactive pyrophoric material was generated in association with the waste. Waste packaging procedures shall ensure that all radioactive pyrophoric materials are present only in small residual amounts (less than 1 weight percent) in payload containers.

CORROSIVES: Corrosives are prohibited in the payload container. Acids and bases that are potentially corrosive shall be neutralized or 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% by weight) quantities. The chemicals found in this content code are identified in the attached list and are restricted to the allowable chemical lists determined by the methodology found in the RH-TRU 72-B Cask SAR.

ADDITIONAL CRITERIA: Each drum is fitted with a minimum of one filter vent. Drum filters have a minimum hydrogen diffusivity of 3.7E-06 mole/second/mole fraction. If present, rigid liners in 55-gallon drums shall be punctured with a ≥0.3-inch diameter hole for gas release.

MAXIMUM ALLOWABLE HYDROGEN GENERATION RATES - OPTION 1: The maximum allowable hydrogen generation rate limits are as follows:

Confinement Layer	Maximum Allowable Hydrogen Generation Rate Limits Fixed Lid Canister (moles/second)	Maximum Allowable Hydrogen Generation Rate Limits Removable Lid Canister (moles/second)
Can	N/A	N/A
Drum	3.2270E-08	2.8160E-08
Canister	9.6810E-08	8.4480E-08

MAXIMUM ALLOWABLE DECAY HEAT LIMITS - OPTION 2: The maximum allowable decay heat limits are as follows:

Confinement Layer	Maximum Allowable Decay Heat Limits Fixed Lid Canister (watts)		Maximum Allowable Decay Heat Limits Removable Lid Canister (watts)	
	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year ≥0.012)	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year ≥0.012)
Can	N/A	N/A	N/A	N/A
Drum	0.1047	0.3633	0.0963	0.3367
Canister	0.3140	1.0900	0.2890	1.0100

THIS PAGE INTENTIONALLY LEFT BLANK

ENERGY TECHNOLOGY ENGINEERING CENTER (ETEC)
CONTENT CODE ET 325A
IDC 253
SOLID ORGANIC AND INORGANIC WASTE

MATERIALS AND CHEMICALS >1%

CLOTH
CONCRETE PARTICULATE
FILTERS
GLASS
METALS(e.g., aluminum, titanium, iron, copper, lead, tungsten, brass, steel and stainless steel, tantalum)
PuO/UO PIECES (unirradiated; Pu content 0.7 g)
PAINT CHIPS (strippable paint)
PLASTIC
PAPER
VERMICULITE

MATERIALS AND CHEMICALS <1%

CLEANERS
OILS
SOLVENTS
SEALANT MATERIAL

THIS PAGE INTENTIONALLY LEFT BLANK

CONTENT CODE: ET 326A

CONTENT DESCRIPTION: Solidified Organic Process Waste

GENERATING SITE: Energy Technology Engineering Center (ETEC)

STORAGE SITE: ETEC

WASTE DESCRIPTION: This waste consists of drain line residue, including organic sludges and sludge-like materials, steel and concrete components.

GENERATING SOURCE(S): This waste is primarily solidified sludge that was removed from the former ETEC-associated Hot Laboratory drain line system and drain tank during decontamination and decommissioning operations. The waste includes fines that are the result of cutting and grinding operations.

WASTE FORM: The waste consists of materials that were washed out of operational hot cells. The primary constituents are steel and fuel element fines (including TRU, fission products, and activated cladding residue) from declad grinding and cutting operations, sludge wastes, steel and concrete debris, sand, dirt, grinding materials, and concrete dust/particulate. The sludge wastes are, in part, the result of solidification or liquid absorption procedures using diatomaceous earth, fly ash, cement, or concrete.

WASTE PACKAGING: The waste is packaged directly into 55-gallon drums or will be packaged in closed 1-gallon paint cans, larger vented metal cans, or punctured 5-gallon buckets and then will be placed into a 55-gallon drum. The 1-gallon paint cans or 5-gallon buckets may also be overpacked in the larger vented metal cans and then placed into a 55-gallon drum. The drums may be lined with thick annular concrete shields (between the waste containers and the drum walls). Bottom and top concrete shields plus thick steel lids may also be used inside the drums. Three 55-gallon drums are then placed into the RH-TRU waste canister.

METHOD(S) FOR ISOTOPIC DETERMINATION: The required isotopic information to demonstrate compliance with the limits on fissile content, decay heat, and curie content will be determined based on acceptable knowledge, the radioassay of samples, and on total drum activity measurements taken on the product material during the processing at the site.

FREE LIQUIDS: Liquid waste, except for residual amounts in well-drained containers, is prohibited in the drums. The total volume of residual liquid in a payload container shall be less than 1 volume percent of the payload container. Site procedures for liquid absorption and solidification 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. If present, pressurized cans shall be punctured and emptied prior to packaging.

PYROPHORICS: Process knowledge indicates that no non-radioactive pyrophoric material was generated in association with waste. Waste packaging procedures shall ensure that all radioactive pyrophoric materials are present only in small residual amounts (less than 1 weight percent) in payload containers.

CORROSIVES: Corrosives are prohibited in the payload container. Acids and bases that are potentially corrosive shall be neutralized or 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% by weight) quantities. The chemicals found in this content code are identified in the attached list and are restricted to the allowable chemical lists determined by the methodology found in the RH-TRU 72-B Cask SAR.

ADDITIONAL CRITERIA: Each drum is fitted with a minimum of one filter vent. Drum filters have a minimum hydrogen diffusivity of 3.7E-06 mole/second/mole fraction. Inner containers greater than 4 liters in volume are punctured or vented to allow free gas release.

MAXIMUM ALLOWABLE HYDROGEN GENERATION RATES - OPTION 1: The maximum allowable hydrogen generation rate limits are as follows:

Confinement Layer	Maximum Allowable Hydrogen Generation Rate Limits Fixed Lid Canister (moles/second)	Maximum Allowable Hydrogen Generation Rate Limits Removable Lid Canister (moles/second)
Can	N/A	N/A
Drum	4.8140E-08	3.9515E-08
Canister	1.4442E-07	1.1855E-07

MAXIMUM ALLOWABLE DECAY HEAT LIMITS - OPTION 2: The maximum allowable decay heat limits are as follows:

Confinement Layer	Maximum Allowable Decay Heat Limits Fixed Lid Canister (watts)		Maximum Allowable Decay Heat Limits Removable Lid Canister (watts)	
	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year ≥0.012)	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year ≥0.012)
Can	N/A	N/A	N/A	N/A
Drum	0.2107	0.5600	0.1870	0.4967
Canister	0.6320	1.6800	0.5600	1.4900

THIS PAGE INTENTIONALLY LEFT BLANK

CONTENT CODE: ET 326B

CONTENT DESCRIPTION: Solidified Organic Process Waste

GENERATING SITE: Energy Technology Engineering Center (ETEC)

STORAGE SITE: ETEC

WASTE DESCRIPTION: This waste consists of drain line residue, including organic sludges and sludge-like materials, steel and concrete components.

GENERATING SOURCE(S): This waste is primarily solidified sludge that was removed from the former ETEC-associated Hot Laboratory drainline system and drain tank during decontamination and decommissioning operations. The waste includes fines that are the result of cutting and grinding operations.

WASTE FORM: The waste consists of materials that were washed out of operational hot cells. The primary constituents are steel and fuel element fines (including TRU, fission products, and activated cladding residue) from declad grinding and cutting operations, sludge wastes, steel and concrete debris, sand, dirt, grinding materials, and concrete dust/particulate. The sludge wastes are in part the result of solidification or liquid absorption procedures using diatomaceous earth, fly ash, cement, or concrete.

WASTE PACKAGING: The waste is packaged directly into an RH-TRU waste canister, or will be packaged in closed 1-gallon paint cans, larger vented metal cans, or punctured 5-gallon buckets and then placed into an RH-TRU waste canister. The 1-gallon paint cans or 5-gallon buckets may also be overpacked in the larger vented metal cans and then placed into the RH-TRU waste canister.

METHOD(S) FOR ISOTOPIC DETERMINATION: The required isotopic information to demonstrate compliance with the limits on fissile content, decay heat, and curie content will be determined based on acceptable knowledge, the radioassay of samples, and on total drum activity measurements taken on the product material during the processing at the site.

FREE LIQUIDS: Liquid waste, except for residual amounts in well-drained containers, is prohibited in the drums. The total volume of residual liquid in a payload container shall be less than 1 volume percent of the payload container. Site procedures for liquid absorption and solidification 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. If present, pressurized cans shall be punctured and emptied prior to packaging.

PYROPHORICS: Process knowledge indicates that no non-radioactive pyrophoric material was generated in association with the waste. Waste packaging procedures shall ensure that all radioactive pyrophoric materials are present only in small residual amounts (less than 1 weight percent) in payload containers.

CORROSIVES: Corrosives are prohibited in the payload container. Acids and bases that are potentially corrosive shall be neutralized or 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% by weight) quantities. The chemicals found in this content code are identified in the attached list and are restricted to the allowable chemical lists determined by the methodology found in the RH-TRU 72-B Cask SAR.

ADDITIONAL CRITERIA: Each RH-TRU waste canister is fitted with a minimum of one filter vent. Waste canister filters will have with a minimum hydrogen diffusivity as specified in Appendix 1.3.5 of the 72-B Cask SAR. Inner containers greater than 4 liters in volume are punctured or vented to allow free gas release.

MAXIMUM ALLOWABLE HYDROGEN GENERATION RATES - OPTION 1: The maximum allowable hydrogen generation rate limits are as follows:

Confinement Layer	Maximum Allowable Hydrogen Generation Rate Limits Fixed Lid Canister (moles/second)	Maximum Allowable Hydrogen Generation Rate Limits Removable Lid Canister (moles/second)

Can	N/A	N/A
Drum	N/A	N/A
Canister	1.8449E-07	1.3677E-07

MAXIMUM ALLOWABLE DECAY HEAT LIMITS - OPTION 2: The maximum allowable decay heat limits are as follows:

Confinement Layer	Maximum Allowable Decay Heat Limits Fixed Lid Canister (watts)		Maximum Allowable Decay Heat Limits Removable Lid Canister (watts)	
	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year ≥0.012)	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year ≥0.012)
Can	N/A	N/A	N/A	N/A
Drum	N/A	N/A	N/A	N/A
Canister	0.6110	1.6200	0.5290	1.4000

THIS PAGE INTENTIONALLY LEFT BLANK

ENERGY TECHNOLOGY ENGINEERING CENTER (ETEC)
CONTENT CODE ET 326
SOLIDIFIED ORGANIC PROCESS WASTE

MATERIALS AND CHEMICALS >1%

ABSORBENTS (diatomaceous earth, vermiculite, fly ash, cement, concrete)
CONCRETE AND CONCRETE DUST/PARTICULATE
DIRT
GLASS
GRINDING MATERIALS (carborundum, other carbides)
IRON OXIDES
METALS (including carbon steel [containers, weir boxes, grindings and shavings], aluminum, chromium, titanium, zinc, beryllium, magnesium, calcium, iron, nickel, copper, mercury, tungsten, zirconium, cadmium, brass stainless steel [primarily grindings and shavings], molybdenum, lead)
PAINT CHIPS
PLASTIC
SAND (silica and alumina based)

MATERIALS AND CHEMICALS <1%

ACETONE
ALCOHOL
ALCONOX
BIG ORANGE CLEANER
CALCIUM CARBONATE
CAUSTIC CLEANERS: Oakite, MX-12, Big K (potassium hydroxide)
DOWANOL
ELECTROPOLISH (phosphoric and sulfuric acid)
FOGPROOF
FREON
GRAPHITE
HYDROFLUORIC, NITRIC, HYDROCHLORIC, CITRIC, PERCHLORIC/OXALIC ACID

ENERGY TECHNOLOGY ENGINEERING CENTER (ETEC)
CONTENT CODE ET 326
(Continued)
SOLIDIFIED ORGANIC PROCESS WASTE

MATERIALS AND CHEMICALS <1%

KEROSENE
OIL, MINERAL OIL, HYDRAULIC OIL, CUTTING OIL, SPRAY LUBRICANTS
PETROSET, AQUASET, EARTH-TITE
RADIAC WASH
SODIUM OXIDE
TRICHLOROETHYLENE
TURCO PRODUCTS (alkaline cleaners), DEFOAMING AGENTS
WINDEX
ZEP SPRAY

CONTENT CODE: ID 322A

CONTENT DESCRIPTION: Solid Inorganic Waste

GENERATING SITE: Argonne National Laboratory-East (ANL-E)

STORAGE SITE: Idaho National Engineering and Environmental Laboratory (INEEL)

WASTE DESCRIPTION: The waste consists of non-combustible hot cell debris waste generated at the Argonne National Laboratory. The waste includes laboratory equipment, tools, fixtures, glassware, used epoxy-contaminated containers, pipe, tubing, fitting, fasteners, firebrick, ferrous and nonferrous metal scraps and parts, used and worn out cutting wheels/saw blades that were used to section the fuel rod, pieces of Type 304 or HT-9 stainless steel used to clad the examined fuel rod, pieces of the mounting epoxy, and small electric motors.

GENERATING SOURCES: The waste was generated during operations that were carried out in alpha-gamma hot cells in the examination of many types of fuel rods/elements for different reactor types and reactor operations. The hot cell examinations involved the preparation of metallurgical mounts of fuel specimens for metallurgical analysis, photography, fission product migration studies, fuel phase transformation sites, etc. The preparation of these samples resulted in materials within the hot cell being contaminated with test fuel residue and eventually being discarded as waste. Hot cell operations are highly structured and proceduralized because of the material being handled within the cell.

WASTE FORM: Based on the operations governed by the examination procedures, the lists of items documented in the site waste safety analysis report, and the list of items and materials required to implement the examination procedure, probable items can be listed that would be included in the waste. The following items are directly contaminated with radioactivity from fuel cutting and grinding operations:

- Hot cell materials contaminated by “swarf” generated by two cuts through the fuel element
- A reinforced abrasive cutoff wheel
- Small containers with excess tin-bismuth alloy for making a conductive metallurgical mount
- Copper-filled diallyl phthalate powder.

In the event that a metallurgical specimen of fuel was prepared, the fuel specimen is separated to the extent possible from the mounting material and is also considered to be reusable fuel material and is saved. As a result, the used mounts, with removed fuel, may also form part of the stored waste.

WASTE PACKAGING: The waste items are placed in a 7.5-gallon metal container or bucket. Two of these containers/buckets are placed in a 20-mil paper-lined PVC bag. Prior to 1990, these bags were heat-sealed; these bags will be punctured when a gas sample is obtained, prior to shipping. The gas sampler punctures the bags while obtaining gas samples. Since 1990 these paper-lined PVC bags have not been sealed and filters have been added to allow passage of any gasses that might be generated. There are no expected layers of confinement after the sampler punctures the bag. There may be occasional containers with less than one-gallon capacity that were not penetrated. The PVC bag is placed into a 30-gallon (DOT 17H) steel drum. The drum lid gasket is replaced with a permeable tubular O-ring of styrene butadiene and is filter vented. A maximum of three drums are placed into the RH-TRU waste canister.

METHOD(S) FOR ISOTOPIC DETERMINATION: The Gamma Spectrometer Scanning with acceptable knowledge (GSAK) technique will be used for the final waste stream characterization. This technique assays for key activation and fission product (by gamma spectroscopy) then correlates these results with the known irradiation history of the parent spent fuel material that generated the contamination to determine the total nuclide content. Analysis results are used to calculate Pu-239 fissile gram equivalents (plus error) and decay heat (plus error), if applicable.

FREE LIQUIDS: Liquid waste is prohibited in the drums. 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 and that other materials are not included.

EXPLOSIVES/COMPRESSED GASES: Explosives and compressed gases in the payload containers are prohibited by waste packaging procedures. If present, pressurized cans shall be punctured and emptied prior to packaging.

PYROPHORICS: Waste packaging procedures shall ensure that all pyrophoric radioactive and nonradioactive materials are present only in small residual amounts (less than 1 weight percent) in payload containers. Sodium in the waste has been reacted with ethyl alcohol, mixed with pelletized clay, and dried. Nitrates and oxidizing agents are neutralized or reduced, mixed with pelletized clay, and dried to ferrous or ferric salts.

CORROSIVES: Corrosives are prohibited by waste packaging procedures in the payload container. Acids and bases that are potentially corrosive shall be neutralized and rendered noncorrosive prior to being a part of the waste. The physical forms 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% by weight) quantities. The chemicals found in this content code are identified in the attached list and are restricted to the allowable chemical lists determined by the methodology found in the RH-TRU 72-B Cask SAR.

ADDITIONAL CRITERIA: Each drum is fitted with a minimum of one filter vent with a minimum hydrogen diffusivity of 3.7E-06 mole/second/mole fraction.

MAXIMUM ALLOWABLE HYDROGEN GENERATION RATES - OPTION 1: The maximum allowable hydrogen generation rate limits are as follows:

Confinement Layer	Maximum Allowable Hydrogen Generation Rate Limits Fixed Lid Canister (moles/second)	Maximum Allowable Hydrogen Generation Rate Limits Removable Lid Canister (moles/second)
Can	N/A	N/A
Drum	4.8140E-08	3.9515E-08
Canister	1.4442E-07	1.1855E-07

MAXIMUM ALLOWABLE DECAY HEAT LIMITS - OPTION 2: The maximum allowable decay heat limits are as follows:

Confinement Layer	Maximum Allowable Decay Heat Limits Fixed Lid Canister (watts)		Maximum Allowable Decay Heat Limits Removable Lid Canister (watts)	
	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year ≥0.012)	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year ≥0.012)
Can	N/A	N/A	N/A	N/A
Drum	0.3283	0.4000	0.2903	0.3533
Canister	0.9850	1.2000	0.8710	1.0600

CONTENT CODE: ID 322B

CONTENT DESCRIPTION: Solid Inorganic Waste

GENERATING SITE: Argonne National Laboratory-East (ANL-E)

STORAGE SITE: Idaho National Engineering and Environmental Laboratory (INEEL)

WASTE DESCRIPTION: The waste consists of non-combustible hot cell debris waste generated at the Argonne National Laboratory. The waste includes laboratory equipment, tools, fixtures, glassware, used epoxy-contaminated containers, pipe, tubing, fitting, fasteners, firebrick, ferrous and nonferrous metal scraps and parts, used and worn out cutting wheels/saw blades that were used to section the fuel rod, pieces of Type 304 or HT-9 stainless steel used to clad the examined fuel rod, pieces of the mounting epoxy, and small electric motors.

GENERATING SOURCE(S): The waste was generated during operations that were carried out in alpha-gamma hot cells in the examination of many types of fuel rods/elements for different reactor types and reactor operations. The hot cell examinations involved the preparation of metallurgical mounts of fuel specimens for metallurgical analysis, photography, fission product migration studies, fuel phase transformation sites, etc. The preparation of these samples resulted in materials within the hot cell being contaminated with test fuel residue and eventually being discarded as waste. Hot cell operations are highly structured and proceduralized because of the material being handled within the cell.

WASTE FORM: Based on the operations governed by the examination procedures, the lists of items documented in the site waste safety analysis report, and the list of items and materials required to implement the examination procedure, probable items can be listed that would be included in the waste. The following items are directly contaminated with radioactivity from fuel cutting and grinding operations:

- Hot cell materials contaminated by “swarf” generated by two cuts through the fuel element
- A reinforced abrasive cutoff wheel
- Small containers with excess tin-bismuth alloy for making a conductive metallurgical mount
- Copper-filled diallyl phthalate powder.

In the event that a metallurgical specimen of fuel was prepared, the fuel specimen is separated to the extent possible from the mounting material and is also considered to be reusable fuel material and is saved. As a result, the used mounts, with removed fuel, may also form part of the stored waste.

WASTE PACKAGING: The waste will be placed directly into a filtered 55-gallon drum. No layers of confinement will be present in the drum; all plastic bags acting to confine gases will be slashed or punctured. Three drums will then be placed into the RH-TRU canister.

METHOD(S) FOR ISOTOPIC DETERMINATION: The Gamma Spectrometer Scanning with acceptable knowledge (GSAK) technique will be used for the final waste stream characterization. This technique assays for key activation and fission product (by gamma spectroscopy) then correlates these results with the known irradiation history of the parent spent fuel material that generated the contamination to determine the total nuclide content. Analysis results are used to calculate Pu-239 fissile gram equivalents (plus error) and decay heat (plus error), if applicable.

FREE LIQUIDS: Liquid waste is prohibited in the drums. 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 and that other materials are not included.

EXPLOSIVES/COMPRESSED GASES: Explosives and compressed gases in the payload containers are prohibited by waste packaging procedures. If present, pressurized cans shall be punctured and emptied prior to packaging.

PYROPHORICS: Waste packaging procedures shall ensure that all pyrophoric radioactive and nonradioactive materials are present only in small residual amounts (less than 1 weight percent) in payload containers. Sodium in the waste has been reacted with ethyl alcohol, mixed with pelletized clay, and dried. Nitrates and oxidizing agents are neutralized or reduced, mixed with pelletized clay, and dried to ferrous or ferric salts.

CORROSIVES: Corrosives are prohibited by waste packaging procedures in the payload container. Acids and bases that are potentially corrosive shall be neutralized and rendered noncorrosive prior to being a part of the waste. The physical forms 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% by weight) quantities. The chemicals found in this content code are identified in the attached list and are restricted to the allowable chemical lists determined by the methodology found in the RH-TRU 72-B Cask SAR.

ADDITIONAL CRITERIA: Each drum is fitted with a minimum of one filter vent with a minimum hydrogen diffusivity of 3.7E-06 mole/second/mole fraction.

MAXIMUM ALLOWABLE HYDROGEN GENERATION RATES - OPTION 1: The maximum allowable hydrogen generation rate limits are as follows:

Confinement Layer	Maximum Allowable Hydrogen Generation Rate Limits Fixed Lid Canister (moles/second)	Maximum Allowable Hydrogen Generation Rate Limits Removable Lid Canister (moles/second)
Can	N/A	N/A
Drum	4.8140E-08	3.9515E-08
Canister	1.4442E-07	1.1855E-07

MAXIMUM ALLOWABLE DECAY HEAT LIMITS - OPTION 2: The maximum allowable decay heat limits are as follows:

Confinement Layer	Maximum Allowable Decay Heat Limits Fixed Lid Canister (watts)		Maximum Allowable Decay Heat Limits Removable Lid Canister (watts)	
	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year ≥0.012)	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year ≥0.012)
Can	N/A	N/A	N/A	N/A
Drum	0.3283	0.4000	0.2903	0.3533
Canister	0.9850	1.2000	0.8710	1.0600

THIS PAGE INTENTIONALLY LEFT BLANK

CONTENT CODE: ID 322C

CONTENT DESCRIPTION: Solid Inorganic Waste

GENERATING SITE: Argonne National Laboratory-East (ANL-E)

STORAGE SITE: Idaho National Engineering and Environmental Laboratory (INEEL)

WASTE DESCRIPTION: The waste consists of non-combustible hot cell debris waste generated at the Argonne National Laboratory. The waste includes laboratory equipment, tools, fixtures, glassware, used epoxy-contaminated containers, pipe, tubing, fitting, fasteners, firebrick, ferrous and nonferrous metal scraps and parts, used and worn out cutting wheels/saw blades that were used to section the fuel rod, pieces of type 304 or HT-9 stainless steel used to clad the examined fuel rod, pieces of the mounting epoxy, and small electric motors.

GENERATING SOURCE(S): The waste was generated during operations that were carried out in alpha-gamma hot cells in the examination of many types of fuel rods/elements for different reactor types and reactor operations. The hot cell examinations involved the preparation of metallurgical mounts of fuel specimens for metallurgical analysis, photography, fission product migration studies, fuel phase transformation sites, etc. The preparation of these samples resulted in materials within the hot cell being contaminated with test fuel residue and eventually being discarded as waste. Hot cell operations are highly structured and proceduralized because of the material being handled within the cell.

WASTE FORM: Based on the operations governed by the examination procedures, the lists of items documented in the waste safety analysis report, and the list of items and materials required to implement the examination procedure, probable items can be listed that would be included in the waste. The following items are directly contaminated with radioactivity from fuel cutting and grinding operations:

- Hot cell materials contaminated by “swarf” generated by two cuts through the fuel element
- A reinforced abrasive cutoff wheel
- Small containers with excess tin-bismuth alloy for making a conductive metallurgical mount
- Copper-filled diallyl phthalate powder.

In the event that a metallurgical specimen of fuel was prepared, the fuel specimen is separated to the extent possible from the mounting material and is also considered to be reusable fuel material and is saved. As a result, the used mounts, with removed fuel, may also form part of the stored waste.

WASTE PACKAGING: The waste will be placed directly into an RH-TRU canister. No layers of confinement will be present in the canister; all plastic bags acting to confine gases will be slashed or punctured.

METHOD(S) FOR ISOTOPIC DETERMINATION: The Gamma Spectrometer Scanning with acceptable knowledge (GSAK) technique will be used for the final waste stream characterization. This technique assays for key activation and fission product (by gamma spectroscopy) then correlates these results with the known irradiation history of the parent spent fuel material that generated the contamination to determine the total nuclide content. Analysis results are used to calculate Pu-239 fissile gram equivalents (plus error) and decay heat (plus error), if applicable.

FREE LIQUIDS: Liquid waste is prohibited in the drums. 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 and that other materials are not included.

EXPLOSIVES/COMPRESSED GASES: Explosives and compressed gases in the payload containers are prohibited by waste packaging procedures. If present, pressurized cans shall be punctured and emptied prior to packaging.

PYROPHORICS: Waste packaging procedures shall ensure that all pyrophoric radioactive and nonradioactive materials are present only in small residual amounts (less than 1 weight percent) in payload containers. Sodium in the waste has been reacted with ethyl alcohol, mixed with pelletized clay, and dried. Nitrates and oxidizing agents are neutralized or reduced, mixed with pelletized clay, and dried to ferrous or ferric salts.

CORROSIVES: Corrosives are prohibited by waste packaging procedures in the payload container. Acids and bases that are potentially corrosive shall be neutralized and rendered noncorrosive prior to being a part of the waste. The physical forms 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% by weight) quantities. The chemicals found in this content code are identified in the attached list and are restricted to the allowable chemical lists determined by the methodology found in the RH-TRU 72-B Cask SAR.

ADDITIONAL CRITERIA: Each RH-TRU canister is fitted with a minimum of one filter vent. Waste canister filters will have a minimum filter diffusivity as specified in Appendix 1.3.5 of the RH-TRU 72-B Cask SAR.

MAXIMUM ALLOWABLE HYDROGEN GENERATION RATES - OPTION 1: The maximum allowable hydrogen generation rate limits are as follows:

Confinement Layer	Maximum Allowable Hydrogen Generation Rate Limits Fixed Lid Canister (moles/second)	Maximum Allowable Hydrogen Generation Rate Limits Removable Lid Canister (moles/second)
Can	N/A	N/A
Drum	N/A	N/A
Canister	1.8449E-07	1.3677E-07

MAXIMUM ALLOWABLE DECAY HEAT LIMITS - OPTION 2: The maximum allowable decay heat limits are as follows:

Confinement Layer	Maximum Allowable Decay Heat Limits Fixed Lid Canister (watts)		Maximum Allowable Decay Heat Limits Removable Lid Canister (watts)	
	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year ≥0.012)	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year ≥0.012)
Can	N/A	N/A	N/A	N/A
Drum	N/A	N/A	N/A	N/A
Canister	0.9510	1.1600	0.8230	1.0000

THIS PAGE INTENTIONALLY LEFT BLANK

CONTENT CODE: ID 322D

CONTENT DESCRIPTION: Solid Inorganic Waste

GENERATING SITE: Argonne National Laboratory-East (ANL-E)

STORAGE SITE: Idaho National Engineering and Environmental Laboratory (INEEL)

WASTE DESCRIPTION: The waste consists of non-combustible hot cell debris waste generated at the Argonne National Laboratory. The waste includes laboratory equipment, tools, fixtures, glassware, used epoxy-contaminated containers, pipe, tubing, fitting, fasteners, firebrick, ferrous and nonferrous metal scraps and parts, used and worn out cutting wheels/saw blades that were used to section the fuel rod, stainless steel cladding for fuel rods, pieces of the mounting epoxy, and small electric motors.

GENERATING SOURCES: The waste was generated during operations that were carried out in alpha-gamma hot cells in the examination of many types of fuel rods/elements for different reactor types and reactor operations. The hot cell examinations involved the preparation of metallurgical mounts of fuel specimens for metallurgical analysis, photography, fission product migration studies, fuel phase transformation sites, etc. The preparation of these samples resulted in materials within the hot cell being contaminated with test fuel residue and eventually being discarded as waste. Hot cell operations are highly structured and proceduralized because of the material being handled within the cell.

WASTE FORM: Based on the operations governed by the examination procedures, the lists of items documented in the site waste safety analysis report, and the list of items and materials required to implement the examination procedure, probable items can be listed that would be included in the waste. The following items are directly contaminated with radioactivity from fuel cutting and grinding operations:

- Hot cell materials contaminated by “swarf” generated by two cuts through the fuel element
- A reinforced abrasive cutoff wheel
- Small containers with excess tin-bismuth alloy for making a conductive metallurgical mount
- Copper-filled diallyl phthalate powder.

In the event that a metallurgical specimen of fuel was prepared, the fuel specimen is separated to the extent possible from the mounting material and is also considered to be reusable fuel material and is saved. As a result, the used mounts, with removed fuel, may also form part of the stored waste.

WASTE PACKAGING: The waste items are placed in a 7.5-gallon metal waste can with an ungasketed cover. Two of these waste cans are placed in a fiber drum pouch spreader, which is placed in the first of two heat-sealed, filtered 20-mil PVC bags. The pouch spreader serves to ease the placement of cans in the PVC bag and provide puncture resistance. The first PVC bag is placed inside a 100-mil polyethylene drum liner, with a 1/16-inch polyethylene disk placed loosely on top of the PVC bag to provide puncture resistance from above. The drum liner is placed inside the second heat-sealed, filtered 20-mil PVC bag. The second PVC bag is placed into a 30-gallon (DOT 17H) steel drum. The drum lid gasket is replaced with a permeable tubular O-ring of styrene butadiene and is filter vented. A maximum of three drums are placed into the RH-TRU waste canister.

METHOD(S) FOR ISOTOPIC DETERMINATION: The final waste stream characterization will be through the use of acceptable knowledge, which will be verified through the peer review process in accordance with 40 CFR 194.22(b). Acceptable knowledge information is used to calculate Pu-239 fissile gram equivalents (plus error) and decay heat (plus error), if applicable. Gamma spectrometer scanning may be used for any additional confirmation, as necessary. This technique assays for key activation and fission product (by gamma spectroscopy) then correlates these results with the known irradiation history of the parent spent fuel material that generated the contamination to determine the total nuclide content.

FREE LIQUIDS: Liquid waste is prohibited in the drums. 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 and that other materials are not included.

EXPLOSIVES/COMPRESSED GASES: Explosives and compressed gases in the payload containers are prohibited by waste packaging procedures. If present, pressurized cans shall be punctured and emptied prior to packaging.

PYROPHORICS: Waste packaging procedures shall ensure that all pyrophoric radioactive and nonradioactive materials are present only in small residual amounts (less than 1 weight percent) in payload containers. Sodium in the waste has been reacted with ethyl alcohol, mixed with pelletized

clay, and dried. Nitrates and oxidizing agents are neutralized or reduced, mixed with pelletized clay, and dried to ferrous or ferric salts.

CORROSIVES: Corrosives are prohibited by waste packaging procedures in the payload container. Acids and bases that are potentially corrosive shall be neutralized and rendered noncorrosive prior to being a part of the waste. The physical forms 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% by weight) quantities. The chemicals found in this content code are identified in the attached list and are restricted to the allowable chemical lists determined by the methodology found in the RH-TRU 72-B Cask SAR.

ADDITIONAL CRITERIA: Each drum is fitted with a minimum of one filter vent with a minimum hydrogen diffusivity of 3.7E-06 mole/second/mole fraction.

MAXIMUM ALLOWABLE HYDROGEN GENERATION RATES - OPTION 1: The maximum allowable hydrogen generation rate limits are as follows:

Confinement Layer	Maximum Allowable Hydrogen Generation Rate Limits Fixed Lid Canister (moles/second)	Maximum Allowable Hydrogen Generation Rate Limits Removable Lid Canister (moles/second)
Can	N/A	N/A
Drum	2.9289E-08	2.5859E-08
Canister	8.7867E-08	7.7577E-08

MAXIMUM ALLOWABLE DECAY HEAT LIMITS - OPTION 2: The maximum allowable decay heat limits are as follows:

Confinement Layer	Maximum Allowable Decay Heat Limits Fixed Lid Canister (watts)		Maximum Allowable Decay Heat Limits Removable Lid Canister (watts)	
	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year ≥0.012)	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year ≥0.012)
Can	N/A	N/A	N/A	N/A
Drum	0.2060	0.5966	0.1840	0.5266
Canister	0.6180	1.7898	0.5520	1.5798

IDAHO NATIONAL ENGINEERING AND ENVIRONMENTAL LABORATORY
CONTENT CODE ID 322
SOLID INORGANIC WASTE

MATERIALS AND CHEMICALS (>1% by weight)

FERROUS METALS: carbon steel, stainless steel, iron (wrought and cast forms)
NONFERROUS METALS: aluminum, brass, bronze, copper, lead, tin (wrought and cast forms)
GLASS: bottles, tubing, beakers, plates
CERAMICS: firebrick, porcelain insulators, quartz, vycor, boron nitride
PASSIVATED CHEMICALS: Vermiculite and pelletized clay containing evaporation residues from alcohol dissolution.

MATERIALS AND CHEMICALS (<1% by weight)

ALCOHOLS AND GLYCOLS
NEUTRALIZED CAUSTICS

THIS PAGE INTENTIONALLY LEFT BLANK

CONTENT CODE: ID 325A

CONTENT DESCRIPTION: Solid Organic and Inorganic Waste

GENERATING SITE: Argonne National Laboratory-East (ANL-E)

STORAGE SITE: Idaho National Engineering and Environmental Laboratory (INEEL)

WASTE DESCRIPTION: The waste consists of hot cell debris waste generated at the Argonne National Laboratory, which includes combustible and non-combustible wastes. Combustible wastes include paper, plastic, and polyvinyl chloride (PVC) containers, rubber O-rings and gloves, rags, cotton swabs, and other similar combustible items that are contaminated by fine particles of radiological material. Non-combustible wastes include lab equipment, tools, fixtures, glassware, used epoxy-contaminated containers, pipe, tubing, fitting, fasteners, firebrick, ferrous and nonferrous metal scraps and parts, used and worn out cutting wheels/saw blades that were used to section the fuel rod, pieces of Type 304 or HT-9 stainless steel used to clad the examined fuel rod, pieces of the mounting epoxy, and small electric motors.

GENERATING SOURCE(S): The waste was generated during operations that were carried out in alpha-gamma hot cells in the examination of many types of fuel rods/elements for different reactor types and reactor operations. The hot cell examinations involved the preparation of metallurgical mounts of fuel specimens for metallurgical analysis, photography, fission product migration studies, fuel phase transformation sites, etc. The preparation of these samples resulted in materials within the hot cell being contaminated with test fuel residue and eventually being discarded as waste. Hot cell operations are highly structured and proceduralized because of the material being handled within the cell.

WASTE FORM: Based on the operations governed by the examination procedures, on the lists of items documented in the waste safety analysis report, and on the list of items and materials required to implement the examination procedure, probable items can be listed that would be included in the waste. The following items are directly contaminated with radioactivity from fuel cutting and grinding operations:

- Hot cell materials contaminated by “swarf” generated by two cuts through the fuel element
- A reinforced abrasive cutoff wheel

- Rags or wipes used to clean element sections or wipe the shallow stainless steel pan used to catch swarf or cutting/grinding fluid
- A poly beaker with some unused green Bakelite powder
- Small containers with excess tin-bismuth alloy for making a conductive metallurgical mount
- Polyethylene sheet used under the epoxy mounting operation
- Copper-filled diallyl phthalate powder
- Conductive epoxy
- Black marker pen, white paint, and artist's brush.

In the event that a metallurgical specimen of fuel was prepared, the fuel specimen is separated to the extent possible from the mounting material and is also considered to be reusable fuel material and is saved. As a result, the used mounts, with removed fuel, may also form part of the stored waste.

WASTE PACKAGING: The waste items are placed in a 7.5-gallon metal container or bucket. Two of these containers/buckets are placed in a 20-mil paper-lined PVC bag. Prior to 1990, these bags were heat-sealed; these bags will be punctured when a gas sample is obtained, prior to shipping. The gas sampler punctures the bags while obtaining gas samples. Since 1990 these paper-lined PVC bags have not been sealed and filters have been added to allow passage of any gasses that might be generated. There are no expected layers of confinement after the sampler punctures the bag. There may be occasional containers with less than one-gallon capacity that were not penetrated. The PVC bag is placed into a 30-gallon (DOT 17H) steel drum. The drum lid gasket is replaced with a permeable tubular O-ring of styrene butadiene and is filter vented. A maximum of three drums are placed into the RH-TRU waste canister.

METHOD(S) FOR ISOTOPIC DETERMINATION: The Gamma Spectrometer Scanning with acceptable knowledge (GSAK) technique will be used for the final waste stream characterization. This technique assays for key activation and fission product (by gamma spectroscopy) then correlates these results with the known irradiation history of the parent spent fuel material that generated the contamination to determine the total nuclide content. Analysis results are used to calculate Pu-239 fissile gram equivalents (plus error) and decay heat (plus error), if applicable.

FREE LIQUIDS: Liquid waste is prohibited in the drums. 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 and that other materials are not included.

EXPLOSIVES/COMPRESSED GASES: Explosives and compressed gases in the payload containers are prohibited by waste packaging procedures. If present, pressurized cans shall be punctured and emptied prior to packaging.

PYROPHORICS: Waste packaging procedures shall ensure that all pyrophoric radioactive and nonradioactive materials are present only in small residual amounts (less than 1 weight percent) in payload containers. Sodium in the waste has been reacted with ethyl alcohol, mixed with pelletized clay, and dried. Nitrates and oxidizing agents are neutralized or reduced, mixed with pelletized clay, and dried to ferrous or ferric salts.

CORROSIVES: Corrosives are prohibited by waste packaging procedures in the payload container. Acids and bases that are potentially corrosive shall be neutralized and rendered noncorrosive prior to being a part of the waste. The physical forms 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% by weight) quantities. The chemicals found in this content code are identified in the attached list and are restricted to the allowable chemical lists determined by the methodology found in the RH-TRU 72-B Cask SAR.

ADDITIONAL CRITERIA: Each drum is fitted with a minimum of one filter vent with a minimum hydrogen diffusivity of 3.7E-06 mole/second/mole fraction.

MAXIMUM ALLOWABLE HYDROGEN GENERATION RATES - OPTION 1: The maximum allowable hydrogen generation rate limits are as follows:

Confinement Layer	Maximum Allowable Hydrogen Generation Rate Limits Fixed Lid Canister (moles/second)	Maximum Allowable Hydrogen Generation Rate Limits Removable Lid Canister (moles/second)
Can	N/A	N/A
Drum	4.8140E-08	3.9515E-08
Canister	1.4442E-07	1.1855E-07

MAXIMUM ALLOWABLE DECAY HEAT LIMITS - OPTION 2: The maximum allowable decay heat limits are as follows:

Confinement Layer	Maximum Allowable Decay Heat Limits Fixed Lid Canister (watts)		Maximum Allowable Decay Heat Limits Removable Lid Canister (watts)	
	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year ≥0.012)	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year ≥0.012)
Can	N/A	N/A	N/A	N/A
Drum	0.1447	0.4967	0.1277	0.4400
Canister	0.4340	1.4900	0.3830	1.3200

CONTENT CODE: ID 325B

CONTENT DESCRIPTION: Solid Organic and Inorganic Waste

GENERATING SITE: Argonne National Laboratory-East (ANL-E)

STORAGE SITE: Idaho National Engineering and Environmental Laboratory (INEEL)

WASTE DESCRIPTION: The waste consists of hot cell debris waste generated at the Argonne National Laboratory, which includes combustible and non-combustible wastes. Combustible wastes include paper, plastic, and polyvinyl chloride (PVC) containers, rubber O-rings and gloves, rags, cotton swabs, and other similar combustible items that are contaminated by fine particles of radiological material. Non-combustible wastes include lab equipment, tools, fixtures, glassware, used epoxy-contaminated containers, pipe, tubing, fitting, fasteners, firebrick, ferrous and nonferrous metal scraps and parts, used and worn out cutting wheels/saw blades that were used to section the fuel rod, pieces of Type 304 or HT-9 stainless steel used to clad the examined fuel rod, pieces of the mounting epoxy, and small electric motors.

GENERATING SOURCE(S): The waste was generated during operations that were carried out in alpha-gamma hot cells in the examination of many types of fuel rods/elements for different reactor types and reactor operations. The hot cell examinations involved the preparation of metallurgical mounts of fuel specimens for metallurgical analysis, photography, fission product migration studies, fuel phase transformation sites, etc. The preparation of these samples resulted in materials within the hot cell being contaminated with test fuel residue and eventually being discarded as waste. Hot cell operations are highly structured and proceduralized because of the material being handled within the cell.

WASTE FORM: Based on the operations governed by the examination procedures, on the lists of items documented in the waste safety analysis report, and on the list of items and materials required to implement the examination procedure, probable items can be listed that would be included in the waste. The following items are directly contaminated with radioactivity from fuel cutting and grinding operations:

- Hot cell materials contaminated by “swarf” generated by two cuts through the fuel element
- A reinforced abrasive cutoff wheel

- Rags or wipes used to clean element sections or wipe the shallow stainless steel pan used to catch swarf or cutting/grinding fluid
- A poly beaker with some unused green Bakelite powder
- Small containers with excess tin-bismuth alloy for making a conductive metallurgical mount
- Polyethylene sheet used under the epoxy mounting operation
- Copper-filled diallyl phthalate powder
- Conductive epoxy
- Black marker pen, white paint, and artist's brush.

In the event that a metallurgical specimen of fuel was prepared, the fuel specimen is separated to the extent possible from the mounting material and is also considered to be reusable fuel material and is saved. As a result, the used mounts, with removed fuel, may also form part of the stored waste.

WASTE PACKAGING: The waste will be placed directly into a filtered 55-gallon drum. No layers of confinement will be present in the drums; all plastic bags acting to confine gases will be slashed or punctured. Three drums will then be placed into the RH-TRU waste canister.

METHOD(S) FOR ISOTOPIC DETERMINATION: The Gamma Spectrometer Scanning with acceptable knowledge (GSAK) technique will be used for the final waste stream characterization. This technique assays for key activation and fission product (by gamma spectroscopy) then correlates these results with the known irradiation history of the parent spent fuel material that generated the contamination to determine the total nuclide content. Analysis results are used to calculate Pu-239 fissile gram equivalents (plus error) and decay heat (plus error), if applicable.

FREE LIQUIDS: Liquid waste is prohibited in the drums. 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 and that other materials are not included.

EXPLOSIVES/COMPRESSED GASES: Explosives and compressed gases in the payload containers are prohibited by waste packaging procedures. If present, pressurized cans shall be punctured and emptied prior to packaging.

PYROPHORICS: Waste packaging procedures shall ensure that all pyrophoric radioactive and nonradioactive materials are present only in small residual amounts (less than 1 weight percent) in payload containers. Sodium in the waste has been reacted with ethyl alcohol, mixed with pelletized

clay, and dried. Nitrates and oxidizing agents are neutralized or reduced, mixed with pelletized clay, and dried to ferrous or ferric salts.

CORROSIVES: Corrosives are prohibited by waste packaging procedures in the payload container. Acids and bases that are potentially corrosive shall be neutralized and rendered noncorrosive prior to being a part of the waste. The physical forms 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% by weight) quantities. The chemicals found in this content code are identified in the attached list and are restricted to the allowable chemical lists determined by the methodology found in the RH-TRU 72-B Cask SAR.

ADDITIONAL CRITERIA: Each drum is fitted with a minimum of one filter vent with a minimum hydrogen diffusivity of 3.7E-06 mole/second/mole fraction.

MAXIMUM ALLOWABLE HYDROGEN GENERATION RATES - OPTION 1: The maximum allowable hydrogen generation rate limits are as follows:

Confinement Layer	Maximum Allowable Hydrogen Generation Rate Limits Fixed Lid Canister (moles/second)	Maximum Allowable Hydrogen Generation Rate Limits Removable Lid Canister (moles/second)
Can	N/A	N/A
Drum	4.8140E-08	3.9515E-08
Canister	1.4442E-07	1.1855E-07

MAXIMUM ALLOWABLE DECAY HEAT LIMITS - OPTION 2: The maximum allowable decay heat limits are as follows:

Confinement Layer	Maximum Allowable Decay Heat Limits Fixed Lid Canister (watts)		Maximum Allowable Decay Heat Limits Removable Lid Canister (watts)	
	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year ≥0.012)	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year ≥0.012)
Can	N/A	N/A	N/A	N/A
Drum	0.1447	0.4967	0.1277	0.4400
Canister	0.4340	1.4900	0.3830	1.3200

CONTENT CODE: ID 325C

CONTENT DESCRIPTION: Solid Organic and Inorganic Waste

GENERATING SITE: Argonne National Laboratory-East (ANL-E)

STORAGE SITE: Idaho National Engineering and Environmental Laboratory (INEEL)

WASTE DESCRIPTION: The waste consists of hot cell debris waste generated at the Argonne National Laboratory, which includes combustible and non-combustible wastes. Combustible wastes include paper, plastic, and polyvinyl chloride (PVC) containers, rubber O-rings and gloves, rags, cotton swabs, and other similar combustible items that are contaminated by fine particles of radiological material. Non-combustible wastes include lab equipment, tools, fixtures, glassware, used epoxy-contaminated containers, pipe, tubing, fitting, fasteners, firebrick, ferrous and nonferrous metal scraps and parts, used and worn out cutting wheels/saw blades that were used to section the fuel rod, pieces of Type 304 or HT-9 stainless steel used to clad the examined fuel rod, pieces of the mounting epoxy, and small electric motors.

GENERATING SOURCE(S): The waste was generated during operations that were carried out in alpha-gamma hot cells in the examination of many types of fuel rods/elements for different reactor types and reactor operations. The hot cell examinations involved the preparation of metallurgical mounts of fuel specimens for metallurgical analysis, photography, fission product migration studies, fuel phase transformation sites, etc. The preparation of these samples resulted in materials within the hot cell being contaminated with test fuel residue and eventually being discarded as waste. Hot cell operations are highly structured and proceduralized because of the material being handled within the cell.

WASTE FORM: Based on the operations governed by the examination procedures, on the lists of items documented in the waste safety analysis report, and on the list of items and materials required to implement the examination procedure, probable items can be listed that would be included in the waste. The following items are directly contaminated with radioactivity from fuel cutting and grinding operations:

- Hot cell materials contaminated by “swarf” generated by two cuts through the fuel element
- A reinforced abrasive cutoff wheel

- Rags or wipes used to clean element sections or wipe the shallow stainless steel pan used to catch swarf or cutting/grinding fluid
- A poly beaker with some unused green Bakelite powder
- Small containers with excess tin-bismuth alloy for making a conductive metallurgical mount
- Polyethylene sheet used under the epoxy mounting operation
- Copper-filled diallyl phthalate powder
- Conductive epoxy
- Black marker pen, white paint, and artist's brush.

In the event that a metallurgical specimen of fuel was prepared, the fuel specimen is separated to the extent possible from the mounting material and is also considered to be reusable fuel material and is saved. As a result, the used mounts, with removed fuel, may also form part of the stored waste.

WASTE PACKAGING: The waste will be placed directly into the RH-TRU canister. No layers of confinement will be present in the canister; all plastic bags acting to confine gases will be slashed or punctured.

METHOD(S) FOR ISOTOPIC DETERMINATION: The Gamma Spectrometer Scanning with acceptable knowledge (GSAK) technique will be used for the final waste stream characterization. This technique assays for key activation and fission product (by gamma spectroscopy) then correlates these results with the known irradiation history of the parent spent fuel material that generated the contamination to determine the total nuclide content. Analysis results are used to calculate Pu-239 fissile gram equivalents (plus error) and decay heat (plus error), if applicable.

FREE LIQUIDS: Liquid waste is prohibited in the drums. 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 and that other materials are not included.

EXPLOSIVES/COMPRESSED GASES: Explosives and compressed gases in the payload containers are prohibited by waste packaging procedures. If present, pressurized cans shall be punctured and emptied prior to packaging.

PYROPHORICS: Waste packaging procedures shall ensure that all pyrophoric radioactive and nonradioactive materials are present only in small residual amounts (less than 1 weight percent) in payload containers. Sodium in the waste has been reacted with ethyl alcohol, mixed with pelletized

clay, and dried. Nitrates and oxidizing agents are neutralized or reduced, mixed with pelletized clay, and dried to ferrous or ferric salts.

CORROSIVES: Corrosives are prohibited by waste packaging procedures in the payload container. Acids and bases that are potentially corrosive shall be neutralized and rendered noncorrosive prior to being a part of the waste. The physical forms 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% by weight) quantities. The chemicals found in this content code are identified in the attached list and are restricted to the allowable chemical lists determined by the methodology found in the RH-TRU 72-B Cask SAR.

ADDITIONAL CRITERIA: Each RH-TRU canister is fitted with a minimum of one filter vent. Waste canister filters will have a minimum filter diffusivity as specified in Appendix 1.3.5 of the RH-TRU 72-B Cask SAR.

MAXIMUM ALLOWABLE HYDROGEN GENERATION RATES - OPTION 1: The maximum allowable hydrogen generation rate limits are as follows:

Confinement Layer	Maximum Allowable Hydrogen Generation Rate Limits Fixed Lid Canister (moles/second)	Maximum Allowable Hydrogen Generation Rate Limits Removable Lid Canister (moles/second)
Can	N/A	N/A
Drum	N/A	N/A
Canister	1.8449E-07	1.3677E-07

MAXIMUM ALLOWABLE DECAY HEAT LIMITS - OPTION 2: The maximum allowable decay heat limits are as follows:

Confinement Layer	Maximum Allowable Decay Heat Limits Fixed Lid Canister (watts)		Maximum Allowable Decay Heat Limits Removable Lid Canister (watts)	
	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year ≥0.012)	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year ≥0.012)
Can	N/A	N/A	N/A	N/A
Drum	N/A	N/A	N/A	N/A
Canister	0.4190	1.4400	0.3650	1.2500

CONTENT CODE: ID 325D

CONTENT DESCRIPTION: Solid Organic and Inorganic Waste

GENERATING SITE: Argonne National Laboratory-East (ANL-E)

STORAGE SITE: Idaho National Engineering and Environmental Laboratory (INEEL)

WASTE DESCRIPTION: The waste consists of hot cell debris waste generated at the Argonne National Laboratory, which includes combustible and non-combustible wastes. Combustible wastes include paper, plastic, and polyvinyl chloride (PVC) containers, rubber O-rings and gloves, rags, cotton swabs, and other similar combustible items that are contaminated by fine particles of radiological material. Non-combustible wastes include lab equipment, tools, fixtures, glassware, used epoxy-contaminated containers, pipe, tubing, fitting, fasteners, firebrick, ferrous and nonferrous metal scraps and parts, used and worn out cutting wheels/saw blades that were used to section the fuel rod, stainless steel cladding for fuel rods, pieces of the mounting epoxy, and small electric motors.

GENERATING SOURCE(S): The waste was generated during operations that were carried out in alpha-gamma hot cells in the examination of many types of fuel rods/elements for different reactor types and reactor operations. The hot cell examinations involved the preparation of metallurgical mounts of fuel specimens for metallurgical analysis, photography, fission product migration studies, fuel phase transformation sites, etc. The preparation of these samples resulted in materials within the hot cell being contaminated with test fuel residue and eventually being discarded as waste. Hot cell operations are highly structured and proceduralized because of the material being handled within the cell.

WASTE FORM: Based on the operations governed by the examination procedures, on the lists of items documented in the waste safety analysis report, and on the list of items and materials required to implement the examination procedure, probable items can be listed that would be included in the waste. The following items are directly contaminated with radioactivity from fuel cutting and grinding operations:

- Hot cell materials contaminated by “swarf” generated by two cuts through the fuel element
- A reinforced abrasive cutoff wheel

- Rags or wipes used to clean element sections or wipe the shallow stainless steel pan used to catch swarf or cutting/grinding fluid
- A poly beaker with some unused green Bakelite powder
- Small containers with excess tin-bismuth alloy for making a conductive metallurgical mount
- Polyethylene sheet used under the epoxy mounting operation
- Copper-filled diallyl phthalate powder
- Conductive epoxy
- Black marker pen, white paint, and artist's brush.

In the event that a metallurgical specimen of fuel was prepared, the fuel specimen is separated to the extent possible from the mounting material and is also considered to be reusable fuel material and is saved. As a result, the used mounts, with removed fuel, may also form part of the stored waste.

WASTE PACKAGING: The waste items are placed in a 7.5-gallon metal waste can with an ungasketed cover. Two of these waste cans are placed in a fiber drum pouch spreader, which is placed in the first of two heat-sealed, filtered 20-mil PVC bags. The pouch spreader serves to ease the placement of cans in the PVC bag and provide puncture resistance. The first PVC bag is placed inside a 100-mil polyethylene drum liner, with a 1/16-inch polyethylene disk placed loosely on top of the PVC bag to provide puncture resistance from above. The drum liner is placed inside the second heat-sealed, filtered 20-mil PVC bag. The second PVC bag is placed into a 30-gallon (DOT 17H) steel drum. The drum lid gasket is replaced with a permeable tubular O-ring of styrene butadiene and is filter vented. A maximum of three drums are placed into the RH-TRU waste canister.

METHOD(S) FOR ISOTOPIC DETERMINATION: The final waste stream characterization will be through the use of acceptable knowledge, which will be verified through the peer review process in accordance with 40 CFR 194.22(b). Acceptable knowledge information is used to calculate Pu-239 fissile gram equivalents (plus error) and decay heat (plus error), if applicable. Gamma spectrometer scanning may be used for any additional confirmation, as necessary. This technique assays for key activation and fission product (by gamma spectroscopy) then correlates these results with the known irradiation history of the parent spent fuel material that generated the contamination to determine the total nuclide content.

FREE LIQUIDS: Liquid waste is prohibited in the drums. 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 and that other materials are not included.

EXPLOSIVES/COMPRESSED GASES: Explosives and compressed gases in the payload containers are prohibited by waste packaging procedures. If present, pressurized cans shall be punctured and emptied prior to packaging.

PYROPHORICS: Waste packaging procedures shall ensure that all pyrophoric radioactive and nonradioactive materials are present only in small residual amounts (less than 1 weight percent) in payload containers. Sodium in the waste has been reacted with ethyl alcohol, mixed with pelletized clay, and dried. Nitrates and oxidizing agents are neutralized or reduced, mixed with pelletized clay, and dried to ferrous or ferric salts.

CORROSIVES: Corrosives are prohibited by waste packaging procedures in the payload container. Acids and bases that are potentially corrosive shall be neutralized and rendered noncorrosive prior to being a part of the waste. The physical forms 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% by weight) quantities. The chemicals found in this content code are identified in the attached list and are restricted to the allowable chemical lists determined by the methodology found in the RH-TRU 72-B Cask SAR.

ADDITIONAL CRITERIA: Each drum is fitted with a minimum of one filter vent with a minimum hydrogen diffusivity of 3.7E-06 mole/second/mole fraction.

MAXIMUM ALLOWABLE HYDROGEN GENERATION RATES - OPTION 1: The maximum allowable hydrogen generation rate limits are as follows:

Confinement Layer	Maximum Allowable Hydrogen Generation Rate Limits Fixed Lid Canister (moles/second)	Maximum Allowable Hydrogen Generation Rate Limits Removable Lid Canister (moles/second)
Can	N/A	N/A
Drum	2.9289E-08	2.5859E-08
Canister	8.7867E-08	7.7577E-08

MAXIMUM ALLOWABLE DECAY HEAT LIMITS - OPTION 2: The maximum allowable decay heat limits are as follows:

Confinement Layer	Maximum Allowable Decay Heat Limits Fixed Lid Canister (watts)		Maximum Allowable Decay Heat Limits Removable Lid Canister (watts)	
	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year ≥0.012)	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year ≥0.012)
Can	N/A	N/A	N/A	N/A
Drum	0.1020	0.2516	0.0943	0.2223
Canister	0.3060	0.7548	0.2829	0.6669

IDAHO NATIONAL ENGINEERING AND ENVIRONMENTAL LABORATORY
CONTENT CODE ID 325
SOLID ORGANIC AND INORGANIC WASTE

MATERIALS AND CHEMICALS (>1% by weight)

COMBUSTIBLES

GLOVEPORT GLOVES AND O-RINGS, NEOPRENE

BOTTLES: polyethylene, polypropylene

TUBING: polyvinyl chloride, polyethylene, rubber, styrene, butadiene

BAGGING POUCHES: polyvinyl chloride, polyurethane, polyethylene

O-RINGS: neoprene, silicone, Teflon

PAPER PRODUCTS: tissues, cardboard, towels

RAGS: cotton, mixed synthetics

SHEETING: polyethylene, polyvinyl chloride

WOOD PRODUCTS: plywood, chipboard, masonite

GASKETS: neoprene, Koroseal, rubber

PLASTICS: epoxy, phthalates, phenol-formaldehyde, polystyrene, cellulose acetate, cellulosic materials

NONCOMBUSTIBLES

FERROUS METALS: carbon steel, stainless steel, iron, wrought and cast forms

NONFERROUS METALS: aluminum, brass, bronze, copper, lead, tin, wrought and cast forms

GLASS: bottles, tubing, beakers, plates

CERAMICS: firebrick, porcelain insulators, quartz, vycor, boron nitride

PASSIVATED CHEMICALS: Vermiculite and pelletized clay containing evaporation residues from alcohol dissolution.

MATERIALS AND CHEMICALS (<1% by weight)

ALCOHOLS AND GLYCOLS

NEUTRALIZED CAUSTICS

THIS PAGE INTENTIONALLY LEFT BLANK

CONTENT CODE: LA 325A

CONTENT DESCRIPTION: Solid Inorganic and Solid Organic Waste |

GENERATING SITE: Los Alamos National Laboratory (LANL) |

STORAGE SITE: LANL |

WASTE DESCRIPTION: Process waste from the examination of irradiated fuel pins consists mainly of cladding and hardware from the fuel pins. Included in this waste is fuel remnants from the preparation and examination of the fuel pins. The remaining waste is from the decommissioning of the hot cell facility. This waste includes experiment components, in-cell equipment, and decontamination residue.

GENERATING SOURCE(S): LANL solid inorganic and organic waste is generated in Wing 9, SM-29, CMR (LANL), with interim storage at LANL TA-54 (Area G). The waste is produced by the mechanical sectioning of reactor fuel, metallographic and destructive examination of that fuel, and analysis of irradiated materials. In addition, decommissioning and decontamination of the hot cells where that work was performed also generates this waste.

WASTE FORM: Metallographic examinations require small samples of fuel elements be cut, mounted, ground, polished, and etched, leaving some of the samples as solid and some as particulates. The main components of the fuel pin hardware are 304 and 316 stainless steel cladding cut into various length segments 8-inches and smaller. The additional fuel pin hardware components are 304 and 316 end fittings and other internal fuel pin components. The remnants of the fuel consists of segments, grindings, and stabilized particulate matter from the fuel pins. These are from uranium and plutonium oxides, carbides, and nitride fuels. Solidified inorganic process liquids from fuel pin sodium removal reaction, metallographic sample preparation, and wet chemical processes are also included in the waste. Process equipment and hardware consisting of carbon steel, stainless steel, aluminum, glass, and plastic, in various combinations, are present in this waste. The waste may also consist of decontamination residues including paint, rags, and aqueous based cleaning agents solidified in Portland cement.

WASTE PACKAGING: The waste will be placed in an optional one-gallon metal can placed inside an alpha transfer can with a lid that has been shown to leak gas freely. The alpha transfer can is then placed into a welded RH can which has a filter vent. A maximum of 10 RH cans will be |

placed into a vented drum. Combinations of loose waste and the welded RH cans may also be placed in the drum. Three drums will then be placed into the RH-TRU waste canister.

METHOD(S) FOR ISOTOPIC DETERMINATION: The following methods will be used to determine necessary isotopic information for the fissile content and decay heat (if applicable):

1. Material Accountability and Tracking System
2. Gamma dose rate measurements
3. Passive-Active Neutron (PAN) Assay System.

The method used will depend on the type of waste, availability of the systems, and the system providing the most accurate results.

FREE LIQUIDS: Waste packaging procedures shall ensure that free liquids are less than 1 volume percent in payload containers.

EXPLOSIVES/COMPRESSED GASES: Explosives and compressed gases are not used in the examination of irradiated fuel pins or in the decommissioning of the hot cell facility.

PYROPHORICS: Waste packaging procedures shall ensure that all pyrophoric radioactive and nonradioactive materials are present only in small residual amounts (less than 1 weight percent) in payload containers.

CORROSIVES: Corrosives are reacted to neutralize before packaging.

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 identified in the attached list and are restricted to the allowable chemical lists determined by the methodology found in the RH-TRU 72-B Cask SAR.

ADDITIONAL CRITERIA: The small welded RH cans contain a minimum of one sintered bronze filter with a minimum hydrogen diffusivity of 5.18E-06 mole/second/mole fraction. The drums contain a minimum of one filter with a minimum hydrogen diffusivity of 3.7E-06 mole/second/mole fraction.

MAXIMUM ALLOWABLE HYDROGEN GENERATION RATES - OPTION 1: The maximum allowable hydrogen generation rate limits are as follows:

Confinement Layer	Maximum Allowable Hydrogen Generation Rate Limits Fixed Lid Canister (moles/second)	Maximum Allowable Hydrogen Generation Rate Limits Removable Lid Canister (moles/second)
Can	6.4460E-09	4.9722E-09
Drum	6.4460E-08	4.9722E-08
Canister	1.9338E-07	1.4917E-07

MAXIMUM ALLOWABLE DECAY HEAT LIMITS - OPTION 2: The maximum allowable decay heat limits are as follows:

Confinement Layer	Maximum Allowable Decay Heat Limits Fixed Lid Canister (watts)		Maximum Allowable Decay Heat Limits Removable Lid Canister (watts)	
	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year $\geq$0.012)	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year $\geq$0.012)
Can	0.0207	0.0593	0.0177	0.0507
Drum	0.2073	0.5933	0.1770	0.5067
Canister	0.6220	1.7800	0.5310	1.5200

THIS PAGE INTENTIONALLY LEFT BLANK

CONTENT CODE: LA 325B

CONTENT DESCRIPTION: Solid Inorganic and Solid Organic Waste |

GENERATING SITE: Los Alamos National Laboratory (LANL) |

STORAGE SITE: LANL |

WASTE DESCRIPTION: Process waste from the examination of irradiated fuel pins consists mainly of cladding and hardware from the fuel pins. Included in this waste is fuel remnants from the preparation and examination of the fuel pins. The remaining waste is from the decommissioning of the hot cell facility. This waste includes experiment components, in-cell equipment, and decontamination residue.

GENERATING SOURCE(S): LANL solid inorganic and organic waste is generated in Wing 9, SM-29, CMR (LANL), with interim storage at LANL TA-54 (Area G). The waste is produced by the mechanical sectioning of reactor fuel, metallographic and destructive examination of that fuel, and analysis of irradiated materials. In addition, decommissioning and decontamination of the hot cells where that work was performed also generates this waste.

WASTE FORM: Metallographic examinations require small samples of fuel elements be cut, mounted, ground, polished, and etched, leaving some of the samples as solid and some as particulates. The main components of the fuel pin hardware are 304 and 316 stainless steel cladding cut into various length segments 8-inches and smaller. The additional fuel pin hardware components are 304 and 316 end fittings and other internal fuel pin components. The remnants of the fuel consists of segments, grindings, and stabilized particulate matter from the fuel pins. These are from uranium and plutonium oxides, carbides, and nitride fuels. Solidified inorganic process liquids from fuel pin sodium removal reaction, metallographic sample preparation, and wet chemical processes are also included in the waste. Process equipment and hardware consisting of carbon steel, stainless steel, aluminum, glass, and plastic, in various combinations, are present in this waste. The waste may also consist of decontamination residues including paint, rags, and aqueous based cleaning agents solidified in Portland cement.

WASTE PACKAGING: The waste will be placed directly into a vented drum. No layers of confinement will be present in the drums; all plastic bags acting to confine gases will be slashed or punctured. Three drums will then be placed into the RH-TRU waste canister.

METHOD(S) FOR ISOTOPIC DETERMINATION: The following methods will be used to determine necessary isotopic information for the fissile content and decay heat (if applicable):

1. Material Accountability and Tracking System
2. Gamma dose rate measurements
3. Passive-Active Neutron (PAN) Assay System.

The method used will depend on the type of waste, availability of the systems, and the system providing the most accurate results.

FREE LIQUIDS: Waste packaging procedures shall ensure that free liquids are less than 1 volume percent in payload containers.

EXPLOSIVES/COMPRESSED GASES: Explosives and compressed gases are not used in the examination of irradiated fuel pins or in the decommissioning of the hot cell facility.

PYROPHORICS: Waste packaging procedures shall ensure that all pyrophoric radioactive and nonradioactive materials are present only in small residual amounts (less than 1 weight percent) in payload containers.

CORROSIVES: Corrosives are reacted to neutralize before packaging.

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 identified in the attached list and are restricted to the allowable chemical lists determined by the methodology found in the RH-TRU 72-B Cask SAR.

ADDITIONAL CRITERIA: The drums contain a minimum of one filter with a minimum hydrogen diffusivity of 3.7E-06 mole/second/mole fraction.

MAXIMUM ALLOWABLE HYDROGEN GENERATION RATES - OPTION 1: The maximum allowable hydrogen generation rate limits are as follows:

Confinement Layer	Maximum Allowable Hydrogen Generation Rate Limits Fixed Lid Canister (moles/second)	Maximum Allowable Hydrogen Generation Rate Limits Removable Lid Canister (moles/second)
Can	N/A	N/A
Drum	6.9880E-08	5.2630E-08
Canister	2.0964E-07	1.5789E-07

MAXIMUM ALLOWABLE DECAY HEAT LIMITS - OPTION 2: The maximum allowable decay heat limits are as follows:

Confinement Layer	Maximum Allowable Decay Heat Limits Fixed Lid Canister (watts)		Maximum Allowable Decay Heat Limits Removable Lid Canister (watts)	
	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year ≥0.012)	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year ≥0.012)
Can	N/A	N/A	N/A	N/A
Drum	0.2250	0.6433	0.1893	0.5433
Canister	0.6750	1.9300	0.5680	1.6300

THIS PAGE INTENTIONALLY LEFT BLANK

CONTENT CODE: LA 325C

CONTENT DESCRIPTION: Solid Inorganic and Solid Organic Waste

GENERATING SITE: Los Alamos National Laboratory (LANL)

STORAGE SITE: LANL

WASTE DESCRIPTION: Process waste from the examination of irradiated fuel pins consists mainly of cladding and hardware from the fuel pins. Included in this waste is fuel remnants from the preparation and examination of the fuel pins. The remaining waste is from the decommissioning of the hot cell facility. This waste includes experiment components, in-cell equipment, and decontamination residue.

GENERATING SOURCE(S): LANL solid inorganic and organic waste is generated in Wing 9, SM-29, CMR (LANL), with interim storage at LANL TA-54 (Area G). The waste is produced by the mechanical sectioning of reactor fuel, metallographic and destructive examination of that fuel, and analysis of irradiated materials. In addition, decommissioning and decontamination of the hot cells where that work was performed also generates this waste.

WASTE FORM: Metallographic examinations require small samples of fuel elements be cut, mounted, ground, polished, and etched, leaving some of the samples as solid and some as particulates. The main components of the fuel pin hardware are 304 and 316 stainless steel cladding cut into various length segments 8-inches and smaller. The additional fuel pin hardware components are 304 and 316 end fittings and other internal fuel pin components. The remnants of the fuel consists of segments, grindings, and stabilized particulate matter from the fuel pins. These are from uranium and plutonium oxides, carbides, and nitride fuels. Solidified inorganic process liquids from fuel pin sodium removal reaction, metallographic sample preparation, and wet chemical processes are also included in the waste. Process equipment and hardware consisting of carbon steel, stainless steel, aluminum, glass, and plastic, in various combinations are present in this waste. The waste may also consist of decontamination residues including paint, rags, and aqueous based cleaning agents solidified in Portland cement.

WASTE PACKAGING: The waste will be placed directly into the RH-TRU waste canister. No layers of confinement will be present in the RH-TRU waste canister; all plastic bags acting to confine gases will be slashed or punctured.

METHOD(S) FOR ISOTOPIC DETERMINATION: The following methods will be used to determine necessary isotopic information for the fissile content and, if needed, decay heat:

1. Material Accountability and Tracking System
2. Gamma dose rate measurements
3. Passive-Active Neutron (PAN) Assay System.

The method used will depend on the type of waste, availability of the systems, and the system providing the most accurate results.

FREE LIQUIDS: Waste packaging procedures shall ensure that free liquids are less than 1 volume percent in payload containers.

EXPLOSIVES/COMPRESSED GASES: Explosives and compressed gases are not used in the examination of irradiated fuel pins or in the decommissioning of the hot cell facility.

PYROPHORICS: Waste packaging procedures shall ensure that all pyrophoric radioactive and nonradioactive materials are present only in small residual amounts (less than 1 weight percent) in payload containers.

CORROSIVES: Corrosives are reacted to neutralize before packaging.

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 identified in the attached list and are restricted to the allowable chemical lists determined by the methodology found in the RH-TRU 72-B Cask SAR.

ADDITIONAL CRITERIA: The RH-TRU waste canister contains a minimum of one filter. The waste canister filter will have a minimum hydrogen diffusivity as specified in Appendix 1.3.5 of the RH-TRU 72-B Cask SAR.

MAXIMUM ALLOWABLE HYDROGEN GENERATION RATES - OPTION 1: The maximum allowable hydrogen generation rate limits are as follows:

Confinement Layer	Maximum Allowable Hydrogen Generation Rate Limits Fixed Lid Canister (moles/second)	Maximum Allowable Hydrogen Generation Rate Limits Removable Lid Canister (moles/second)
Can	N/A	N/A
Drum	N/A	N/A
Canister	4.1500E-07	2.5950E-07

MAXIMUM ALLOWABLE DECAY HEAT LIMITS - OPTION 2: The maximum allowable decay heat limits are as follows:

Confinement Layer	Maximum Allowable Decay Heat Limits Fixed Lid Canister (watts)		Maximum Allowable Decay Heat Limits Removable Lid Canister (watts)	
	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year ≥0.012)	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year ≥0.012)
Can	N/A	N/A	N/A	N/A
Drum	N/A	N/A	N/A	N/A
Canister	0.9770	2.8000	0.7710	2.2000

THIS PAGE INTENTIONALLY LEFT BLANK

LOS ALAMOS NATIONAL LABORATORY CONTENT CODES 325A, 325B, AND 325C
IDC 007
SOLID ORGANICS AND SOLID INORGANICS

MATERIALS AND CHEMICALS >1 %

ALUMINUM
CARBON STEEL
COPPER
CONCRETE
GLASS, LABWARE |
NEOPRENE
POLYVINYL CHLORIDE
RAGS/CLOTH
STAINLESS STEEL

MATERIALS AND CHEMICALS <1 %

ALCOHOLS AND GLYCOLS
CAUSTICS
COMBUSTIBLE AND FLAMMABLE MATERIALS, MISCELLANEOUS |
HALOGENATED ORGANICS |

THIS PAGE INTENTIONALLY LEFT BLANK

CONTENT CODE: OR 311A

CONTENT DESCRIPTION: Solidified Aqueous Waste

GENERATING SITE: Oak Ridge National Laboratory (ORNL)

STORAGE SITE: ORNL

WASTE DESCRIPTION: The waste is sludge that has settled and separated from waste water that has been stored in large underground tanks at the ORNL. The sludge is a product of past operations at ORNL involving various nuclear research and radioisotope fabrication processes. The final waste form to be shipped is dried sludge with a defined water content.

GENERATING SOURCE(S): Liquid radioactive waste has been generated at ORNL since the inception of ORNL operation. Waste has been generated due to research and development on the nuclear fuel cycle, isotope production, reactor operations, and hot cell decontamination activities. This waste is comprised of sludges from the storage tanks at the Old Hydrofracture Facility, the Gunite and Associated Tanks, the Melton Valley Storage Tanks, and the storage tanks at the Evaporator Service Facility at the ORNL. The sludge will be removed from the storage tanks, treated as necessary (have additives in the form of sulfates or sulfites added to bind the hazardous metals), dried, and packaged.

WASTE FORM: The final waste form will primarily be a dried nitrate, carbonate, oxide precipitate. It will contain <1% free liquids (by volume in the drum or canister) and will have a defined water content. Trace amounts of organic materials, less than 1% by mass per compound or 5% by mass for all trace materials, may be present in the final sludge product.

WASTE PACKAGING: The dried sludge product will be loaded directly into 55-gallon drums with open-top drum liners and no layers of confinement. Three 55-gallon drums will be packaged in an RH-TRU waste canister.

METHOD(S) FOR ISOTOPIC DETERMINATION: Samples of sludge will be taken at various points during the process and subjected to radiochemical assay to determine the radionuclide content of the dried sludge product. Analysis results are used to calculate Pu-239 fissile gram equivalents (plus error) and decay heat (plus error).

FREE LIQUIDS: Waste packaging procedures shall ensure that free liquids are less than 1 volume percent in payload containers.

EXPLOSIVES/COMPRESSED GASES: The waste is produced in a closed system, which precludes the introduction of extraneous materials such as pressure vessels or explosives.

PYROPHORICS: No pyrophoric material is present in the dried sludge.

CORROSIVES: The dried sludge product will contain <1% free liquids (by volume) and therefore, no corrosive materials in excess of trace amounts.

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 identified in the attached list and are restricted to the allowable chemical lists determined by the methodology found in the RH-TRU 72-B Cask SAR.

ADDITIONAL CRITERIA: Each drum is fitted with a minimum of one filter vent with a minimum hydrogen diffusivity of 3.7E-06 mole/second/mole fraction.

MAXIMUM ALLOWABLE HYDROGEN GENERATION RATES - OPTION 1: The maximum allowable hydrogen generation rate limits are as follows:

Confinement Layer	Maximum Allowable Hydrogen Generation Rate Limits Fixed Lid Canister[1] (moles/second)	Maximum Allowable Hydrogen Generation Rate Limits Removable Lid Canister (moles/second)
Can	N/A	N/A
Drum	5.0020E-08	4.0878E-08
Canister	1.5006E-07	1.2263E-07

[1]If filter specifications for removable lid canisters are used, limits for the removable lid canister will apply.

MAXIMUM ALLOWABLE DECAY HEAT LIMITS - OPTION 2: The maximum allowable decay heat limits are as follows:

Confinement Layer	Maximum Allowable Decay Heat Limits Fixed Lid Canister[1] (watts)	Maximum Allowable Decay Heat Limits Removable Lid Canister (watts)
Can	N/A	N/A
Drum[2]	$30.667\ b^{-1.0}$	$25.4798\ b^{-1.0014}$
Canister[2]	$92.0\ b^{-1.0}$	$76.4394\ b^{-1.0014}$

[1]If filter specifications for removable lid canisters are used, limits for the removable lid canister will apply.
[2]The value of "b" in the equations represents the mass fraction of water.

THIS PAGE INTENTIONALLY LEFT BLANK

CONTENT CODE: OR 311B

CONTENT DESCRIPTION: Solidified Aqueous Waste

GENERATING SITE: Oak Ridge National Laboratory (ORNL)

STORAGE SITE: ORNL

WASTE DESCRIPTION: The waste is sludge that has settled and separated from waste water that has been stored in large underground tanks at the ORNL. The sludge is a product of past operations at ORNL involving various nuclear research and radioisotope fabrication processes. The final waste form to be shipped is dried, or may be mixed with grout, with a defined water content.

GENERATING SOURCE(S): Liquid radioactive waste has been generated at ORNL since the inception of ORNL operation. Waste has been generated due to research and development on the nuclear fuel cycle, isotope production, reactor operations, and hot cell decontamination activities. This waste is comprised of sludges from the storage tanks at the Old Hydrofracture Facility, the Gunite and Associated Tanks, the Melton Valley Storage Tanks, and the storage tanks at the Evaporator Service Facility at the ORNL. The sludge will be removed from the storage tanks, treated as necessary (have additives in the form of sulfates or sulfites added to bind the hazardous metals), dried, or mixed with grout and dried, and packaged.

WASTE FORM: The final waste form will primarily be a dried nitrate, carbonate, oxide precipitate. It will contain <1% free liquids (by volume in the drum or canister) and will have a defined water content. Trace amounts of organic materials, less than 1% by mass per compound or 5% by mass for all trace materials, may be present in the final sludge product.

WASTE PACKAGING: The dried sludge or sludge/grout product will be loaded directly into the 72-B canister with no layers of confinement.

METHOD(S) FOR ISOTOPIC DETERMINATION: Samples of sludge will be taken at various points during the process and subjected to radiochemical assay to determine the radionuclide content of the dried sludge product. Analysis results are used to calculate Pu-239 fissile gram equivalents (plus error) and decay heat (plus error).

FREE LIQUIDS: Waste packaging procedures shall ensure that free liquids are less than 1 volume percent in payload containers.

EXPLOSIVES/COMPRESSED GASES: The waste is produced in a closed system, which precludes the introduction of extraneous materials such as pressure vessels or explosives.

PYROPHORICS: No pyrophoric material is present in the dried sludge.

CORROSIVES: The dried sludge product will contain <1% free liquids (by volume) and therefore, no corrosive materials in excess of trace amounts.

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 identified in the attached list and are restricted to the allowable chemical lists determined by the methodology found in the RH-TRU 72-B Cask SAR.

ADDITIONAL CRITERIA: Each RH-TRU waste canister is fitted with a minimum of one filter vent. The waste canister filter will have a minimum hydrogen diffusivity as specified in Appendix 1.3.5 of the RH-TRU 72-B Cask SAR.

MAXIMUM ALLOWABLE HYDROGEN GENERATION RATES - OPTION 1: The maximum allowable hydrogen generation rate limits are as follows:

Confinement Layer	Maximum Allowable Hydrogen Generation Rate Limits Fixed Lid Canister[1] (moles/second)	Maximum Allowable Hydrogen Generation Rate Limits Removable Lid Canister (moles/second)
Can	N/A	N/A
Drum	N/A	N/A
Canister	1.8449E-07	1.3677E-07

[1]If filter specifications for removable lid canisters are used, limits for the removable lid canister will apply.

MAXIMUM ALLOWABLE DECAY HEAT LIMITS - OPTION 2: The maximum allowable decay heat limits are as follows:

Confinement Layer	Maximum Allowable Decay Heat Limits Fixed Lid Canister[1] (watts)	Maximum Allowable Decay Heat Limits Removable Lid Canister (watts)
Can	N/A	N/A
Drum	N/A	N/A
Canister[2]	$113.4450\ b^{-1.0006}$	$84.5853\ b^{-0.9989}$

[1]If filter specifications for removable lid canisters are used, limits for the removable lid canister will apply.
[2]The value of "b" in the equations represents the mass fraction of water.

THIS PAGE INTENTIONALLY LEFT BLANK

OAK RIDGE NATIONAL LABORATORY
CONTENT CODE OR 311
SOLIDIFIED AQUEOUS WASTE |

MATERIALS AND CHEMICALS >1 %

ALUMINUM SALTS/OXIDES
CALCIUM SALTS/OXIDES
MAGNESIUM OXIDE
POTASSIUM NITRATE
SODIUM NITRATE
URANIUM SALTS/OXIDES
WATER AND MIXTURES CONTAINING WATER |

MATERIALS AND CHEMICALS <1 %

IRON OXIDE
METALS AND METAL COMPOUNDS, TOXIC
OTHER INORGANIC MATERIALS (e.g., metallic phosphates, metallic sulfates) |
SAND
|

THIS PAGE INTENTIONALLY LEFT BLANK

CONTENT CODE: OR 325A

CONTENT DESCRIPTION: Solid Organic And Inorganic Waste

GENERATING SITE: Oak Ridge National Laboratory (ORNL)

STORAGE SITE: ORNL

WASTE DESCRIPTION: The waste consists of solid organic and inorganic debris waste from glovebox operations, laboratory operations, hot-cell clean-up operations, equipment repair and maintenance, sources and radiochemical processing for isotope separation and purification. The waste includes manipulator boots, miscellaneous glassware, polyethylene sample bottles, cloth wipes, radiation protection clothing, plastic bags, rubber gloves, stainless steel racks, filters and, among others, small tools, primarily generated from activities related to heavy-element research. In addition, small quantities of metal waste used as container, or lead shielding is included in the waste. All of this waste will be repackaged prior to shipment.

GENERATING SOURCE(S): The majority of the waste originates from the Radiochemical Engineering Development Center, Building 7920. A smaller amount of waste originates from a number of facilities including the Thorium-Uranium Recycle Facility, Building 7930, Radiochemical Processing Plant, Building 3019, Chemical Technology Alpha Laboratory, Building 3508, High-Radiation Level Chemical Development Laboratory, Building 4507, High-Radiation-Level Examination Laboratory, Building 3525, Isotope Production Area, Buildings 3033 and 3038, Radioisotope Production Laboratory A, Building 3028, and Isotopes Separation Facility, Building 9204-3. Additional waste materials may be shipped to Oak Ridge for storage and processing from other offsite DOE or DOE contractor facilities.

WASTE FORM: The waste will be unpackaged, inspected with RTR or direct visual inspection, sorted, segregated, and repackaged to be compliant with the requirements of the RH-TRU 72-B Cask SAR.

WASTE PACKAGING: Originally, the majority of the waste was placed in 1-gallon “paint cans” (a metal pail with a wire handle), which was in turn contained in a 3-gallon polyethylene bucket. A smaller amount of waste was packaged directly into plastic bags. The repackaging process will ensure that the polyethylene buckets will be breached so as not to be considered a layer of confinement. Bags of waste or waste containers > 4 liters in size shall be opened. The waste will

be inspected, size reduced as necessary, and repackaged into containers (approximately 5 gallons in size) for processing. The process containers will have unsealed slip lids so that they are not considered a layer of confinement. The process containers are directly loaded into drums (approximately 55 gallons in size) with no layers of confinement and three drums are loaded into the 72-B canister with no layers of confinement in the canister. Some containers may be compacted prior to loading into the drums.

METHOD(S) FOR ISOTOPIC DETERMINATION: The repackaged waste in the process containers will be subjected to gamma and Passive Active Neutron (PAN) assay. The assay techniques may be applied singly or in combination. The assay results are used to calculate Pu-239 fissile gram equivalents (plus error) and decay heat (plus error).

FREE LIQUIDS: Waste packaging procedures shall ensure that free liquids are less than 1 volume percent in payload containers.

EXPLOSIVES/COMPRESSED GASES: Facility operating procedures will require that the waste contains no explosives and intact cylinders of compressed gas when packaged into the 72-B canister. Compliance is determined by direct visual inspection or RTR and facility process controls.

PYROPHORICS: Facility operating procedures will require that the waste is free of pyrophorics when loaded into the 72-B canister. Compliance is determined by direct visual inspection or RTR and facility process controls.

CORROSIVES: Facility operating procedures will require that the waste is free of corrosives when loaded into the 72-B canister. Compliance is determined by direct visual inspection or RTR and facility process controls.

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 identified in the attached list and are restricted to the allowable chemical lists determined by the methodology found in the RH-TRU 72-B Cask SAR. The waste will be visually examined for compliance with the list.

ADDITIONAL CRITERIA: Each drum is fitted with a minimum of one filter vent with a minimum hydrogen diffusivity of 3.7E-06 mole/second/mole fraction.

MAXIMUM ALLOWABLE HYDROGEN GENERATION RATES - OPTION 1: The maximum allowable hydrogen generation rate limits are as follows:

Confinement Layer	Maximum Allowable Hydrogen Generation Rate Limits Fixed Lid Canister[1] (moles/second)	Maximum Allowable Hydrogen Generation Rate Limits Removable Lid Canister (moles/second)
Can	N/A	N/A
Drum	4.8140E-08	3.9515E-08
Canister	1.4442E-07	1.1855E-07

[1]If filter specifications for removable lid canisters are used, limits for the removable lid canister will apply.

MAXIMUM ALLOWABLE DECAY HEAT LIMITS - OPTION 2: The maximum allowable decay heat limits are as follows:

Confinement Layer	Maximum Allowable Decay Heat Limits Fixed Lid Canister[1] (watts)		Maximum Allowable Decay Heat Limits Removable Lid Canister (watts)	
	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year $\geq$0.012)	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year $\geq$0.012)
Can	N/A	N/A	N/A	N/A
Drum	0.1620	0.9567	0.1430	0.8433
Canister	0.4860	2.8700	0.4290	2.5300

[1]If filter specifications for removable lid canisters are used, limits for the removable lid canister will apply.

THIS PAGE INTENTIONALLY LEFT BLANK

CONTENT CODE: OR 325B

CONTENT DESCRIPTION: Solid Organic And Inorganic Waste

GENERATING SITE: Oak Ridge National Laboratory

STORAGE SITE: ORNL

WASTE DESCRIPTION: The waste consists of solid organic and inorganic debris waste from glovebox operations, laboratory operations, hot-cell clean-up operations, equipment repair and maintenance, sources and radiochemical processing for isotope separation and purification. The waste includes manipulator boots, miscellaneous glassware, polyethylene sample bottles, cloth wipes, radiation protection clothing, plastic bags, rubber gloves, stainless steel racks, filters and, among others, small tools, primarily generated from activities related to heavy-element research. In addition, small quantities of metal waste used as container, or lead shielding is included in the waste. All of this waste will be repackaged prior to shipment.

GENERATING SOURCE(S): The majority of the waste originates from the Radiochemical Engineering Development Center, Building 7920. A smaller amount of waste originates from a number of facilities including the Thorium-Uranium Recycle Facility, Building 7930, Radiochemical Processing Plant, Building 3019, Chemical Technology Alpha Laboratory, Building 3508, High-Radiation Level Chemical Development Laboratory, Building 4507, High-Radiation-Level Examination Laboratory, Building 3525, Isotope Production Area, Buildings 3033 and 3038, Radioisotope Production Laboratory A, Building 3028, and Isotopes Separation Facility, Building 9204-3. Additional waste materials may be shipped to Oak Ridge for storage and processing from other offsite DOE or DOE contractor facilities.

WASTE FORM: The waste will be unpackaged, inspected with RTR or direct visual inspection, sorted, segregated, and repackaged to be compliant with the requirements of the RH-TRU 72-B Cask SAR.

WASTE PACKAGING: Originally, the majority of the waste was placed in 1-gallon “paint cans” (a metal pail with a wire handle) which was in turn contained in a 3-gallon polyethylene bucket. A smaller amount of waste was packaged directly into plastic bags. The repackaging process will ensure that the polyethylene buckets will be breached so as not to be considered a layer of confinement. Bags of waste or waste containers > 4 liters in size shall be opened. The waste will

be inspected, size reduced as necessary, and repackaged into containers (approximately 5 gallons in size) for processing. The containers will have unsealed slip lids so that they are not considered a layer of confinement. The waste containers are directly loaded into the 72-B canister with no layers of confinement after processing. Some containers may be compacted prior to loading. Alternatively, the cans may be loaded into drums (approximately 55 gallons in size) with no layers of confinement. The drums will have open bungs with no filter vents (i.e., no confinement).

METHOD(S) FOR ISOTOPIC DETERMINATION: The repackaged waste in the process containers will be subjected to gamma and Passive Active Neutron (PAN) assay. The assay techniques may be applied singly or in combination. The assay results are used to calculate Pu-239 fissile gram equivalents (plus error) and decay heat (plus error).

FREE LIQUIDS: Waste packaging procedures shall ensure that free liquids are less than 1 volume percent in payload containers.

EXPLOSIVES/COMPRESSED GASES: Facility operating procedures will require that the waste contains no explosives and intact cylinders of compressed gas when packaged into the 72-B canister. Compliance is determined by direct visual inspection or RTR and facility process controls.

PYROPHORICS: Facility operating procedures will require that the waste is free of pyrophorics when loaded into the 72-B canister. Compliance is determined by direct visual inspection or RTR and facility process controls.

CORROSIVES: Facility operating procedures will require that the waste is free of corrosives when loaded into the 72-B canister. Compliance is determined by direct visual inspection or RTR and facility process controls.

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 identified in the attached list and are restricted to the allowable chemical lists determined by the methodology found in the RH-TRU 72-B Cask SAR. The waste will be visually examined for compliance with the list.

ADDITIONAL CRITERIA: Each RH-TRU waste canister is fitted with a minimum of one filter vent. The waste canister filters will have a minimum hydrogen diffusivity as specified in Appendix 1.3.5 of the RH-TRU 72-B Cask SAR.

MAXIMUM ALLOWABLE HYDROGEN GENERATION RATES - OPTION 1: The maximum allowable hydrogen generation rate limits are as follows:

Confinement Layer	Maximum Allowable Hydrogen Generation Rate Limits Fixed Lid Canister[1] (moles/second)	Maximum Allowable Hydrogen Generation Rate Limits Removable Lid Canister (moles/second)
Can	N/A	N/A
Drum	N/A	N/A
Canister	1.8449E-07	1.3677E-07

[1]If filter specifications for removable lid canisters are used, limits for the removable lid canister will apply.

MAXIMUM ALLOWABLE DECAY HEAT LIMITS - OPTION 2: The maximum allowable decay heat limits are as follows:

Confinement Layer	Maximum Allowable Decay Heat Limits Fixed Lid Canister[1] (watts)		Maximum Allowable Decay Heat Limits Removable Lid Canister (watts)	
	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year $\geq$0.012)	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year $\geq$0.012)
Can	N/A	N/A	N/A	N/A
Drum	N/A	N/A	N/A	N/A
Canister	0.4510	2.6700	0.4060	2.4000

[1]If filter specifications for removable lid canisters are used, limits for the removable lid canister will apply.

THIS PAGE INTENTIONALLY LEFT BLANK

OAK RIDGE NATIONAL LABORATORY
CONTENT CODE OR 325 |
SOLID ORGANIC AND INORGANIC WASTE |

MATERIALS AND CHEMICALS >1 %

ALUMINUM
CARBON STEEL
GLASS, LABWARE
HEPA FILTERS |
IRON |
LEAD
METAL CANS
PAPER
PLEXIGLAS
POLYETHYLENE
RAGS/CLOTH
RUBBER GLOVES
STAINLESS STEEL |
WOOD |

MATERIALS AND CHEMICALS <1 %

ALCOHOLS AND GLYCOLS (2-ethyl-1-hexanol, ethanol, isopropanol, methanol) |
AMIDES (Acetamide) |
AMINES, ALIPHATIC AND AROMATIC (Adogen-364-HP [trilaurylamine]) |
ASBESTOS
AZO COMPOUNDS, DIAZO COMPOUNDS, AND HYDRAZINES (Hydrazine) |
COMBUSTIBLE AND FLAMMABLE MATERIALS, MISCELLANEOUS (Cellulose, cork, cotton, deodorized mineral spirits, Ful-Flo filters [polypropylene], n-paraffin hydrocarbons [NPH], polypropylene, polystyrene, polyurethane, polyvinyl chloride, resins, synthetic rubber, Teflon, vacuum grease) | | | |
ESTERS (Amyl acetate) |
GLASS, RASCHIG RINGS
GRIT

OAK RIDGE NATIONAL LABORATORY
CONTENT CODE OR 325
SOLID ORGANIC AND INORGANIC WASTE
(Continued)

MATERIALS AND CHEMICALS <1%

HALOGENATED ORGANICS (Carbon tetrachloride)
HYDROCARBONS, ALIPHATIC, SATURATED (N-dodecane)
HYDROCARBONS, AROMATIC (Diethyl benzene [DEB], diisopropylbenzene, toluene)
INSULATION
KETONES (2-5-di-tert-butyl-hydroquinone [DBGQ], acetone, thenoylfluoroacetone [TFA]
LEADED GLASS
METALS, OTHER ELEMENTAL AND ALLOYS AS SHEETS, RODS, MOLDINGS, DROPS, ETC. (Copper, gold, hastelloy-C, nickel, platinum, tantalum, tungsten, uranium, zinc, zircalloy)
METALS AND METAL COMPOUNDS, TOXIC (Copper, nickel, zinc)
MOLDS AND CRUCIBLES, CERAMIC
ORGANOPHOSPHATES, PHOSPHOTHIOATES, AND PHOSPHODITHIOATES (Tributyl phosphate)
OTHER FILTERS
OTHER INORGANIC MATERIALS (e.g., metallic phosphates, metallic sulfates)
OTHER ORGANICS (EDTA)
OXIDIZING AGENTS, STRONG (Hydrogen peroxide)
SOLID ORGANICS
WATER AND MIXTURES CONTAINING WATER (Water)

CONTENT CODE: RH 311A

CONTENT DESCRIPTION: Homogeneous Solid Inorganic Waste

GENERATING SITE: Richland Hanford

STORAGE SITE: Richland Hanford

WASTE DESCRIPTION: The waste consists of sludge waste from the 105 F Fuel Storage Basin filled with potential fuel element pieces.

GENERATING SOURCES: This waste is generated from decontamination and decommissioning wastes during remediation.

WASTE FORM: The waste is homogeneous solid inorganic with unbound absorbed ambient moisture (between 6 and 10 percent). The waste was stored in pools and contains particulate matter, sand, and fuel element pieces.

WASTE PACKAGING: The waste will be placed directly into a 55-gallon drum with no layers of confinement. Three drums will then be placed in an RH-TRU waste canister.

METHOD FOR DETERMINATION OF ISOTOPIC CHARACTERIZATION: In addition to process knowledge, the following methods will be used to determine necessary isotopic information for the fissile content and decay heat (if applicable):

1. Alpha energy analysis
2. Chemical separation/liquid scintillation
3. Germanium-lithium/high performance germanium
4. Total rad strontium
5. Distillation/liquid separation.

The method used will depend on the type of waste, availability of the systems, and the system providing the most accurate results.

FREE LIQUIDS: Liquid waste, except for residual amounts in well-drained containers, is prohibited in the drums. 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. If present, pressurized cans shall be punctured and emptied prior to packaging.

PYROPHORICS: Process knowledge indicates that no non-radioactive pyrophoric material was generated in association with the waste. Waste packaging procedures shall ensure that all radioactive pyrophoric materials are present only in small residual amounts (less than 1 weight percent) in payload containers.

CORROSIVES: Corrosives are prohibited in the payload container. Acids and bases that are potentially corrosive shall be neutralized or 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% by weight) quantities. The chemicals found in this content code are identified in the attached list and are restricted to the allowable chemical lists determined by the methodology found in the RH-TRU 72-B Cask SAR.

ADDITIONAL CRITERIA: Each drum is fitted with a minimum of one filter vent. Drum filters have a minimum hydrogen diffusivity of 3.7E-06 mole/second/mole fraction. If present, rigid liners in 55-gallon drums shall be punctured with a $\geq$0.3-inch diameter hole for gas release.

MAXIMUM ALLOWABLE HYDROGEN GENERATION RATES - OPTION 1: The maximum allowable hydrogen generation rate limits are as follows:

Confinement Layer	Maximum Allowable Hydrogen Generation Rate Limits Fixed Lid Canister (moles/second)	Maximum Allowable Hydrogen Generation Rate Limits Removable Lid Canister (moles/second)
Can	N/A	N/A
Drum	4.8140E-08	3.9515E-08
Canister	1.4442E-07	1.1855E-07

MAXIMUM ALLOWABLE DECAY HEAT LIMITS - OPTION 2: The maximum allowable decay heat limits are as follows:

Confinement Layer	Maximum Allowable Decay Heat Limits Fixed Lid Canister (watts)	Maximum Allowable Decay Heat Limits Removable Lid Canister (watts)
Can	N/A	N/A
Drum	3.0500	2.5067
Canister	9.1500	7.5200

THIS PAGE INTENTIONALLY LEFT BLANK

CONTENT CODE: RH 311B

CONTENT DESCRIPTION: Homogeneous Solid Inorganic Waste

GENERATING SITE: Richland Hanford

STORAGE SITE: Richland Hanford

WASTE DESCRIPTION: The waste consists of sludge waste from the 105 F Fuel Storage Basin filled with potential fuel element pieces.

GENERATING SOURCES: This waste is generated from decontamination and decommissioning waste during remediation.

WASTE FORM: The waste is homogeneous solid inorganic with unbound absorbed ambient moisture (between 6 and 10 percent). The waste was stored in pools and contains particulate matter, sand, and fuel element pieces.

WASTE PACKAGING: The waste will be packaged directly into an RH-TRU waste canister.

METHOD FOR DETERMINATION OF ISOTOPIC CHARACTERIZATION: In addition to process knowledge, the following methods will be used to determine necessary isotopic information for the fissile content and decay heat (if applicable):

1. Alpha energy analysis
2. Chemical separation/liquid scintillation
3. Germanium-lithium/high performance germanium
4. Total rad strontium
5. Distillation/liquid separation.

The method used will depend on the type of waste, availability of the systems, and the system providing the most accurate results.

FREE LIQUIDS: Liquid waste, except for residual amounts in well-drained containers, is prohibited in the drums. 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. If present, pressurized cans shall be punctured and emptied prior to packaging.

PYROPHORICS: Process knowledge indicates that no non-radioactive pyrophoric material was generated in association with the waste. Waste packaging procedures shall ensure that all radioactive pyrophoric materials are present only in small residual amounts (less than 1 weight percent) in payload containers.

CORROSIVES: Corrosives are prohibited in the payload container. Acids and bases that are potentially corrosive shall be neutralized or 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% by weight) quantities. The chemicals found in this content code are identified in the attached list and are restricted to the allowable chemical lists determined by the methodology found in the RH-TRU 72-B Cask SAR.

ADDITIONAL CRITERIA: Each RH-TRU waste canister is fitted with a minimum of one filter vent. Waste canister filters have a minimum hydrogen diffusivity as specified in Appendix 1.3.5 of the 72-B Cask SAR.

MAXIMUM ALLOWABLE HYDROGEN GENERATION RATES - OPTION 1: The maximum allowable hydrogen generation rate limits are as follows:

Confinement Layer	Maximum Allowable Hydrogen Generation Rate Limits Fixed Lid Canister (moles/second)	Maximum Allowable Hydrogen Generation Rate Limits Removable Lid Canister (moles/second)
Can	N/A	N/A
Drum	N/A	N/A
Canister	1.8449E-07	1.3677E-07

MAXIMUM ALLOWABLE DECAY HEAT LIMITS - OPTION 2: The maximum allowable decay heat limits are as follows:

Confinement Layer	Maximum Allowable Decay Heat Limits Fixed Lid Canister (watts)	Maximum Allowable Decay Heat Limits Removable Lid Canister (watts)
Can	N/A	N/A
Drum	N/A	N/A
Canister	11.7000	8.6600

THIS PAGE INTENTIONALLY LEFT BLANK

RICHLAND HANFORD CONTENT CODES 311A AND 311B HOMOGENEOUS INORGANIC SOLID WASTE

MATERIALS/CHEMICALS >1%

ABSORBENTS/ADSORBENTS (Celite®, diatomaceous earth, diatomite, Florco®, Oil-Dri®, perlite, vermiculite)
AQUEOUS SLUDGES
AQUEOUS SOLUTIONS/WATER
ASH (ash bottoms, fly ash, soot)
CERAMICS (molds and crucibles)
CLAYS (bentonite)
CONCRETE
FIBERGLASS, INORGANIC
FILTER MEDIA, INORGANIC
FIREBRICK
GLASS (borosilicate glass, labware, leaded glass, Raschig rings)
GRAPHITE (molds and crucibles)
GRIT
HEEL (ash heel; soot heel; firebrick heel; sand, slag, and crucible heel)
INSULATION, INORGANIC
METAL HYDROXIDES
METAL OXIDES (slag)
METALS (arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver)
PETROSET® PRODUCTS (for aqueous solutions)
SAND/SOIL, INORGANIC
OTHER INORGANIC MATERIALS

THIS PAGE INTENTIONALLY LEFT BLANK

CONTENT CODE: RH 312A

CONTENT DESCRIPTION: Solidified Organic Waste

GENERATING SITE: Battelle Columbus Laboratories (BCL)

STORAGE SITE: Richland Hanford

WASTE DESCRIPTION: This waste consists of solidified organic and inorganic wastes.

GENERATING SOURCE(S): This waste is generated during research and development activities conducted in Building JN-1.

WASTE FORM: The waste consists primarily of inorganic and organic liquids that have been solidified using Floor Dry. The inorganic liquids include acids and acid solutions and elemental mercury. The organic liquids include hydraulic oil, waste water, sludge of sand and mixed fission products (dust, small fragments); small items such as tools; and nonhalogenated organic liquids such as glycols, oils, and alcohols.

WASTE PACKAGING: The waste will be placed directly into a 55-gallon drum with no layers of confinement. The drum is lined with a steel liner. Three drums will then be placed into the RH-TRU waste canister.

METHOD(S) FOR ISOTOPIC DETERMINATION: The isotopic information required to demonstrate compliance with the limits on fissile content, decay heat, and curie content will be determined based on the waste generation source and configuration, which establish the initial radionuclide compositions based on location and initial use. A combination of assaying samples and modeling of the isotopic generation processes results in the establishment of a mixture that characterizes the waste in the content code and the majority of waste at the Battelle Columbus Laboratories Decommissioning Project (BCLDP). Using shipping package modeling, dose rate and weight measurements based on the mixture then allow the BCLDP to determine the isotopic inventory. As required, additional radioassays (e.g., confirming gamma spectrometry) will be performed.

FREE LIQUIDS: Liquid waste, except for residual amounts in well-drained containers, is prohibited in the drums. 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. Absorbents such as Radsorb or diatomaceous earth (e.g., Floor Dry) will be added to any waste matrix that has the potential to dewater after packaging.

EXPLOSIVES/COMPRESSED GASES: Explosives and compressed gases in the payload containers are prohibited by waste packaging procedures. If present, pressurized cans shall be punctured and emptied prior to packaging.

PYROPHORICS: Waste packaging procedures shall ensure that all pyrophoric radioactive and nonradioactive materials are present only in small residual amounts (less than 1 weight percent) in payload containers.

CORROSIVES: Corrosives are prohibited in the payload container. 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% by weight) quantities. The chemicals found in this content code are identified in the attached list and are restricted to the allowable chemical lists determined by the methodology found in the RH-TRU 72-B Cask Safety Analysis Report (SAR).

ADDITIONAL CRITERIA: Each drum is fitted with a minimum of one filter vent with a minimum hydrogen diffusivity of 3.7E-06 mole/second/mole fraction. The steel liner is fitted with a filter with a minimum hydrogen diffusivity of 3.7E-06 mole/second/mole fraction.

MAXIMUM ALLOWABLE HYDROGEN GENERATION RATES - OPTION 1: The maximum allowable hydrogen generation rate limits are as follows:

Confinement Layer	Maximum Allowable Hydrogen Generation Rate Limits Fixed Lid Canister (moles/second)	Maximum Allowable Hydrogen Generation Rate Limits Removable Lid Canister (moles/second)
Can	N/A	N/A
Drum	3.8391E-08	3.2850E-08
Canister	1.1517E-07	9.8550E-08

MAXIMUM ALLOWABLE DECAY HEAT LIMITS - OPTION 2: There is no decay heat limit for this content code as no G values have been established. Waste cannot be transported under Option 2.

THIS PAGE INTENTIONALLY LEFT BLANK

RICHLAND HANFORD CONTENT CODE RH 312A
SOLIDIFIED ORGANIC WASTE

MATERIALS AND CHEMICALS >1%

DIATOMACEOUS EARTH (Floor Dry)
ACIDS AND ACID SOLUTIONS
MERCURY
HYDRAULIC OIL, GLYCOLS, OILS, AND ALCOHOLS
SAND
RADSORB
VERMICULITE
AQUA-SET/PETRO-SET

MATERIALS AND CHEMICALS <1%

METALS (including stainless steel, aluminum, iron, copper, lead, beryllium, and zirconium)

THIS PAGE INTENTIONALLY LEFT BLANK

CONTENT CODE: RH 314A

CONTENT DESCRIPTION: Cemented Inorganic Process Solids

GENERATING SITE: Battelle Columbus Laboratories (BCL)

STORAGE SITE: Richland Hanford

WASTE DESCRIPTION: This waste consists of slugs produced from dissolving fuel specimens in an acid solution that was then diluted several times and mixed with cement and allowed to solidify in foam cups.

GENERATING SOURCE(S): This waste is generated during repackaging of the waste materials generated from research and development activities conducted in Building JN-1.

WASTE FORM: The waste consists of slugs produced from dissolving fuel specimens in an acid solution, which was then diluted several times and mixed with cement and allowed to solidify in foam cups. The slugs will contain limited amounts of radionuclides from fuel because of this dilution. The waste matrix will also include Floor Dry added during repackaging to absorb any water from condensation or dewatering.

WASTE PACKAGING: The waste will be placed directly into a 55-gallon drum with no layers of confinement. The drum is lined with a steel liner. Three drums will then be placed into the RH-TRU waste canister.

METHOD(S) FOR ISOTOPIC DETERMINATION: The isotopic information required to demonstrate compliance with the limits on fissile content, decay heat, and curie content will be determined based on the waste generation source and configuration, which establish the initial radionuclide compositions based on location and initial use. A combination of assaying samples and modeling of the isotopic generation process used in the establishment of a mixture that characterizes the waste in the content code and the majority of waste at the Battelle Columbus Laboratories Decommissioning Project (BCLDP). Using shipping package modeling, dose rate and weight measurements based on the mixture then allow the BCLDP to determine the isotopic inventory. As required, additional radioassays (e.g., confirming gamma spectroscopy) will be performed.

FREE LIQUIDS: Liquid waste, except for residual amounts in well-drained containers, is prohibited in the drums. 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. Absorbents such as diatomaceous earth (e.g., Floor Dry) will be added to any waste matrix that has the potential to dewater after packaging.

EXPLOSIVES/COMPRESSED GASES: Explosives and compressed gases in the payload containers are prohibited by waste packaging procedures. If present, pressurized cans shall be punctured and emptied prior to packaging.

PYROPHORICS: Waste packaging procedures shall ensure that all pyrophoric radioactive and nonradioactive materials are present only in small residual amounts (less than 1 weight percent) in payload containers.

CORROSIVES: Corrosives are prohibited in the payload container. 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% by weight) quantities. The chemicals found in this content code are identified in the attached list and are restricted to the allowable chemical lists determined by the methodology found in the RH-TRU 72-B Cask SAR.

ADDITIONAL CRITERIA: Each drum is fitted with a minimum of one filter vent with a minimum hydrogen diffusivity of 3.7E-06 mole/second/mole fraction. The steel liner is fitted with a filter with a minimum hydrogen diffusivity of 3.7E-06 mole/second/mole fraction.

MAXIMUM ALLOWABLE HYDROGEN GENERATION RATES - OPTION 1: The maximum allowable hydrogen generation rate limits are as follows:

Confinement Layer	Maximum Allowable Hydrogen Generation Rate Limits Fixed Lid Canister (moles/second)	Maximum Allowable Hydrogen Generation Rate Limits Removable Lid Canister (moles/second)
Can	N/A	N/A
Drum	3.8391E-08	3.2850E-08
Canister	1.1517E-07	9.8550E-08

MAXIMUM ALLOWABLE DECAY HEAT LIMITS - OPTION 2: The maximum allowable decay heat limits are as follows:

Confinement Layer	Maximum Allowable Decay Heat Limits Fixed Lid Canister (watts)	Maximum Allowable Decay Heat Limits Removable Lid Canister (watts)
Can	N/A	N/A
Drum	0.6033	0.5170
Canister	1.8100	1.5500

THIS PAGE INTENTIONALLY LEFT BLANK

RICHLAND HANFORD CONTENT CODE RH 314A
CEMENTED INORGANIC PROCESS SOLIDS

MATERIALS AND CHEMICALS >1%

DIATOMACEOUS EARTH (Floor Dry)
CEMENT SLUGS

MATERIALS AND CHEMICALS <1%

NITRIC ACID
WATER

THIS PAGE INTENTIONALLY LEFT BLANK

CONTENT CODE: RH 321A

CONTENT DESCRIPTION: Solid Organic Waste

GENERATING SITE: Battelle Columbus Laboratories (BCL)

STORAGE SITE: Richland Hanford

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

GENERATING SOURCE(S): This waste is generated from activities supporting the decontamination and decommissioning of Building JN-1 under the Battelle Columbus Laboratories Decommissioning Project (BCLDP).

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. The waste may also include particulate and sludge-type organic process solids immobilized/solidified with Portland cement, vermiculite, Aqua-Set, or Petro-Set.

WASTE PACKAGING: The waste will be placed directly into a 55-gallon drum with no layers of confinement. The drum is lined with a steel liner. Three drums will then be placed into the RH-TRU waste canister.

METHOD(S) FOR ISOTOPIC DETERMINATION: The isotopic information required to demonstrate compliance with the limits on fissile content, decay heat, and curie content will be determined based on the waste generation source and configuration, which establish the initial radionuclide compositions based on location and initial use. A combination of assaying samples and modeling of the isotopic generation process, results in the establishment of a mixture that characterizes the waste in the content code and the majority of waste at the BCLDP. Using shipping package modeling, dose rate and weight measurement based on the mixture then allow the BCLDP

to determine the isotopic inventory. As required, additional radioassays (e.g., confirming gamma spectroscopy) will be performed.

FREE LIQUIDS: Liquid waste, except for residual amounts in well-drained containers, is prohibited in the drums. 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. Absorbents such as Radsorb or diatomaceous earth (e.g., Floor Dry) will be added to any waste matrix that has the potential to dewater after packaging.

EXPLOSIVES/COMPRESSED GASES: Explosives and compressed gases in the payload containers are prohibited by waste packaging procedures. If present, pressurized cans shall be punctured and emptied prior to packaging.

PYROPHORICS: Waste packaging procedures shall ensure that all pyrophoric radioactive and nonradioactive materials are present only in small residual amounts (less than 1 weight percent) in payload containers.

CORROSIVES: Corrosives are prohibited in the payload container. 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% by weight) quantities. The chemicals found in this content code are identified in the attached list and are restricted to the allowable chemical lists determined by the methodology found in the RH-TRU 72-B Cask SAR.

ADDITIONAL CRITERIA: Each drum is fitted with a minimum of one filter vent with a minimum hydrogen diffusivity of 3.7E-06 mole/second/mole fraction. The steel liner is fitted with a filter with a minimum hydrogen diffusivity of 3.7E-06 mole/second/mole fraction.

MAXIMUM ALLOWABLE HYDROGEN GENERATION RATES - OPTION 1: The maximum allowable hydrogen generation rate limits are as follows:

Confinement Layer	Maximum Allowable Hydrogen Generation Rate Limits Fixed Lid Canister (moles/second)	Maximum Allowable Hydrogen Generation Rate Limits Removable Lid Canister (moles/second)
Can	N/A	N/A
Drum	4.4110E-08	3.6380E-08
Canister	1.3233E-07	1.0914E-07

MAXIMUM ALLOWABLE DECAY HEAT LIMITS - OPTION 2: The maximum allowable decay heat limits are as follows:

Confinement Layer	Maximum Allowable Decay Heat Limits Fixed Lid Canister (watts)		Maximum Allowable Decay Heat Limits Removable Lid Canister (watts)	
	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year ≥0.012)	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year ≥0.012)
Can	N/A	N/A	N/A	N/A
Drum	0.1283	0.3263	0.1127	0.2710
Canister	0.3850	0.9790	0.3380	0.8130

THIS PAGE INTENTIONALLY LEFT BLANK

RICHLAND HANFORD CONTENT CODE RH 321A
SOLID ORGANIC WASTE

MATERIALS AND CHEMICALS >1%

BLACKTOP (Asphalt)
CELLULOSICS
RUBBER
DIATOMACEOUS EARTH (Floor Dry)
GLASS
IRON-BASED METAL/ALLOYS
PAPER
PLASTIC
RADSORB
CLOTH
CARDBOARD
WOOD
KIMWIPES
FILTERS
BENELEX
PLEXIGLAS
NEOPRENE
PORTLAND CEMENT
VERMICULITE
AQUA-SET/PETRO-SET
OTHER INORGANICS

MATERIALS AND CHEMICALS <1%

METALS (including aluminum, lead, zirconium, stainless steel, and carbon steel)
CONCRETE
SOIL

THIS PAGE INTENTIONALLY LEFT BLANK

CONTENT CODE: RH 321B

CONTENT DESCRIPTION: Solid Organic Waste

GENERATING SITE: Battelle Columbus Laboratories (BCL)

STORAGE SITE: Richland Hanford

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

GENERATING SOURCE(S): This waste is generated during the change-out of resins in the Transfer/Storage Pool filtering system in Building JN-1 (Hot Cell Laboratory).

WASTE FORM: The waste may include filter waste (e.g., pool filters); nuclear grade resin, resin bags, paper, rubber gloves, Floor Dry bags, seals, hoses, valves, and clamps.

WASTE PACKAGING: The waste will be placed directly into a 55-gallon drum with no layers of confinement. The drum may be lined with a steel or polyethylene liner. Three drums will then be placed into the RH-TRU waste canister.

METHOD(S) FOR ISOTOPIC DETERMINATION: The isotopic information required to demonstrate compliance with the limits on fissile content, decay heat, and curie content will be determined based on the waste generation source and configuration, which establish the initial radionuclide compositions based on location and initial use. A combination of assaying samples and modeling of the isotopic generation process results in the establishment of a mixture that characterizes the waste in the content code. Using shipping package modeling, dose rate and weight measurements based on the mixture then allow the Battelle Columbus Laboratories Decommissioning Project (BCLDP) to determine the isotopic inventory. As required, additional radioassays (e.g., confirming gamma spectrometry) will be performed.

FREE LIQUIDS: Liquid waste, except for residual amounts in well-drained containers, is prohibited in the drums. 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. Absorbents such as Radsorb or diatomaceous earth (e.g., Floor Dry) will be added to any waste matrix that has the potential to dewater after packaging.

EXPLOSIVES/COMPRESSED GASES: Explosives and compressed gases in the payload containers are prohibited by waste packaging procedures. If present, pressurized cans shall be punctured and emptied prior to packaging.

PYROPHORICS: Waste packaging procedures shall ensure that all pyrophoric radioactive and nonradioactive materials are present only in small residual amounts (less than 1 weight percent) in payload containers.

CORROSIVES: Corrosives are prohibited in the payload container. 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% by weight) quantities. The chemicals found in this content code are identified in the attached list and are restricted to the allowable chemical lists determined by the methodology found in the RH-TRU 72-B Cask SAR.

ADDITIONAL CRITERIA: Each drum is fitted with a minimum of one filter vent with a minimum hydrogen diffusivity of 3.7E-06 mole/second/mole fraction. The steel or polyethylene liner, if present, is either punctured or fitted with a filter with a minimum hydrogen diffusivity of 3.7E-06 mole/second/mole fraction.

MAXIMUM ALLOWABLE HYDROGEN GENERATION RATES - OPTION 1: The maximum allowable hydrogen generation rate limits are as follows:

Confinement Layer	Maximum Allowable Hydrogen Generation Rate Limits Fixed Lid Canister (moles/second)	Maximum Allowable Hydrogen Generation Rate Limits Removable Lid Canister (moles/second)
Can	N/A	N/A
Drum	4.4110E-08	3.6380E-08
Canister	1.3233E-07	1.0914E-07

MAXIMUM ALLOWABLE DECAY HEAT LIMITS - OPTION 2: The maximum allowable decay heat limit limits are as follows:

Confinement Layer	Maximum Allowable Decay Heat Limits Fixed Lid Canister (watts)		Maximum Allowable Decay Heat Limits Removable Lid Canister (watts)	
	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year ≥0.012)	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year ≥0.012)
Can	N/A	N/A	N/A	N/A
Drum	0.1557	0.2460	0.1370	0.2163
Canister	0.4670	0.7380	0.4110	0.6490

THIS PAGE INTENTIONALLY LEFT BLANK

RICHLAND HANFORD CONTENT CODE RH 321B
SOLID ORGANIC WASTE

MATERIALS AND CHEMICALS >1%

CELLULOSICS, PAPER, PLASTIC (≤12 weight %)
RUBBER
DIATOMACEOUS EARTH (Floor Dry)
ION EXCHANGE RESIN (≤80 weight %)
IRON-BASED METAL/ALLOYS
RADSORB
RESIN BAGS
FILTERS
OTHER INORGANICS

MATERIALS AND CHEMICALS <1%

METALS (including aluminum, lead, zirconium, stainless steel, and carbon steel)

THIS PAGE INTENTIONALLY LEFT BLANK

CONTENT CODE: RH 322A

CONTENT DESCRIPTION: Solid Inorganic Waste

GENERATING SITE: Battelle Columbus Laboratories (BCL)

STORAGE SITE: Richland Hanford

WASTE DESCRIPTION: This waste consists of a variety of glass and metal materials.

GENERATING SOURCE(S): This waste is generated during repackaging of the waste materials generated from research and development activities conducted in Building JN-1.

WASTE FORM: The waste consists primarily of glass and metal debris. Glass debris includes laboratory glassware, windows, leaded glass windows, and various glass apparatus. Metal items may include deteriorated berry cans, cable, wire, planchets, signs, valves, piping, strapping, tools, foils, sheeting, fixtures, equipment (e.g., pumps or motors that have had all oil or any other free liquids removed to <1%), hardware (e.g., nuts, bolts, brackets), specimen vials, fuel rod cladding, metallurgical mounts, and lead lined tubing. Metals of construction include stainless steel, aluminum, iron, copper, lead, beryllium, and zirconium.

WASTE PACKAGING: The waste will be placed directly into a 55-gallon drum with no layers of confinement. The drum is lined with a steel liner. Three drums will then be placed into the RH-TRU waste canister.

METHOD(S) FOR ISOTOPIC DETERMINATION: The isotopic information required to demonstrate compliance with the limits on fissile content, decay heat, and curie content will be determined based on the waste generation source and configuration, which establish the initial radionuclide compositions based on location and initial use. A combination of assaying samples and modeling of the isotopic generation process used in the establishment of a mixture that characterizes the waste in the content code and the majority of waste at the Battelle Columbus Laboratories Decommissioning Project (BCLDP). Using shipping package modeling, dose rate and weight measurements based on the mixture then allow the BCLDP to determine the isotopic inventory. As required, additional radioassays (e.g., confirming gamma spectroscopy) will be performed.

FREE LIQUIDS: Liquid waste, except for residual amounts in well-drained containers, is prohibited in the drums. 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. Absorbents such as diatomaceous earth (e.g., Floor Dry) will be added to any waste matrix that has the potential to dewater after packaging.

EXPLOSIVES/COMPRESSED GASES: Explosives and compressed gases in the payload containers are prohibited by waste packaging procedures. If present, pressurized cans shall be punctured and emptied prior to packaging.

PYROPHORICS: Waste packaging procedures shall ensure that all pyrophoric radioactive and nonradioactive materials are present only in small residual amounts (less than 1 weight percent) in payload containers.

CORROSIVES: Corrosives are prohibited in the payload container. 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% by weight) quantities. The chemicals found in this content code are identified in the attached list and are restricted to the allowable chemical lists determined by the methodology found in the RH-TRU 72-B Cask SAR.

ADDITIONAL CRITERIA: Each drum is fitted with a minimum of one filter vent with a minimum hydrogen diffusivity of 3.7E-06 mole/second/mole fraction. The steel liner is fitted with a filter with a minimum hydrogen diffusivity of 3.7E-06 mole/second/mole fraction.

MAXIMUM ALLOWABLE HYDROGEN GENERATION RATES - OPTION 1: The maximum allowable hydrogen generation rate limits are as follows:

Confinement Layer	Maximum Allowable Hydrogen Generation Rate Limits Fixed Lid Canister (moles/second)	Maximum Allowable Hydrogen Generation Rate Limits Removable Lid Canister (moles/second)
Can	N/A	N/A
Drum	3.8391E-08	3.2850E-08
Canister	1.1517E-07	9.8550E-08

MAXIMUM ALLOWABLE DECAY HEAT LIMITS - OPTION 2: The maximum allowable decay heat are as follows:

Confinement Layer	Maximum Allowable Decay Heat Limits Fixed Lid Canister (watts)	Maximum Allowable Decay Heat Limits Removable Lid Canister (watts)
Can	N/A	N/A
Drum	18.10	15.50
Canister	54.30	46.50

THIS PAGE INTENTIONALLY LEFT BLANK

RICHLAND HANFORD CONTENT CODE RH 322A
SOLID INORGANIC WASTE

MATERIALS AND CHEMICALS >1%

CEMENT
DIATOMACEOUS EARTH (Floor Dry)
GLASS
METALS (including stainless steel, aluminum, iron, copper, lead, beryllium, and zirconium)
IRON-BASED METAL/ALLOYS
OTHER INORGANICS

MATERIALS AND CHEMICALS <1%

CARBON TETRACHLORIDE
1,1,1-TRICHLOROETHANE
TRICHLOROETHYLENE

THIS PAGE INTENTIONALLY LEFT BLANK

CONTENT CODE: RH 325A

CONTENT DESCRIPTION: Solid Organic and Inorganic Waste

GENERATING SITE: Richland Hanford

STORAGE SITE: Richland Hanford

WASTE DESCRIPTION: The waste consists of T-Plant Miscellaneous D&D waste ranging from contaminated clothing to process equipment.

GENERATING SOURCES: The waste is generated as a result of D&D operations from remediation at the T-Plant.

WASTE FORM: The waste consists of any or all of the following items: surgical gloves, plastic bags and sheets, paper products, cloth, tape, rubber, leather, wood, glass, failed process equipment (various metals, teflon, various gasket materials, wiring, plastic, etc.), leaded glass, lead-lined hood gloves, lead blankets, light bulbs, fluorescent lamps, flashlight batteries, piping, conduit, wiring, glass and metal portions of gloveboxes, pumps, motors, standard laboratory equipment, air filters, small amounts of soil or rocks, various absorbents, and other miscellaneous debris.

WASTE PACKAGING: The waste will be placed into a 55-gallon drum with a vented 90-mil or 10-mil horsetail liner bag, and at least two filtered bagout bags. Three drums will then be placed in an RH-TRU waste canister.

METHOD FOR DETERMINATION OF ISOTOPIC CHARACTERIZATION: In addition to process knowledge, the following methods will be used to determine necessary isotopic information for the fissile content and decay heat (if applicable):

1. Alpha energy analysis
2. Chemical separation/liquid scintillation
3. Germanium-lithium/high performance germanium
4. Total rad strontium
5. Distillation/liquid separation.

The method used will depend on the type of waste, availability of the systems, and the system providing the most accurate results.

FREE LIQUIDS: Liquid waste, except for residual amounts in well-drained containers, is prohibited in the drums. 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. If present, pressurized cans shall be punctured and emptied prior to packaging.

PYROPHORICS: Process knowledge indicates that no non-radioactive pyrophoric material was generated in association with the waste. Waste packaging procedures shall ensure that all radioactive pyrophoric materials are present only in small residual amounts (less than 1 weight percent) in payload containers.

CORROSIVES: Corrosives are prohibited in the payload container. Acids and bases that are potentially corrosive shall be neutralized or 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% by weight) quantities. The chemicals found in this content code are identified in the attached list and are restricted to the allowable chemical lists determined by the methodology found in the RH-TRU 72-B Cask SAR.

ADDITIONAL CRITERIA: Each drum is fitted with a minimum of one filter vent. Drum filters have a minimum hydrogen diffusivity of 3.7E-06 mole/second/mole fraction. If present, rigid liners in 55-gallon drums shall be punctured with a $\geq$0.3-inch diameter hole for gas release.

MAXIMUM ALLOWABLE HYDROGEN GENERATION RATES - OPTION 1: The maximum allowable hydrogen generation rate limits are as follows:

Confinement Layer	Maximum Allowable Hydrogen Generation Rate Limits Fixed Lid Canister (moles/second)	Maximum Allowable Hydrogen Generation Rate Limits Removable Lid Canister (moles/second)
Can	N/A	N/A
Drum	3.3010E-08	2.8720E-08
Canister	9.9030E-08	8.6160E-08

MAXIMUM ALLOWABLE DECAY HEAT LIMITS - OPTION 2: The maximum allowable decay heat limit limits are as follows:

Confinement Layer	Maximum Allowable Decay Heat Limits Fixed Lid Canister (watts)		Maximum Allowable Decay Heat Limits Removable Lid Canister (watts)	
	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year $\geq$0.012)	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year $\geq$0.012)
Can	N/A	N/A	N/A	N/A
Drum	0.1023	0.2743	0.0950	0.2533
Canister	0.3070	0.8230	0.2840	0.7600

THIS PAGE INTENTIONALLY LEFT BLANK

CONTENT CODE: RH 325B

CONTENT DESCRIPTION: Solid Organic and Inorganic Waste

GENERATING SITE: Richland Hanford

STORAGE SITE: Richland Hanford

WASTE DESCRIPTION: The waste consists of T-Plant Miscellaneous D&D waste ranging from contaminated clothing to process equipment.

GENERATING SOURCES: The waste is generated as a result of D&D operations from remediation at the T-Plant.

WASTE FORM: The waste consists of any or all of the following items: surgical gloves, plastic bags and sheets, paper products, cloth, tape, rubber, leather, wood, glass, failed process equipment (various metals, teflon, various gasket materials, wiring, plastic, etc.), leaded glass, lead-lined hood gloves, lead blankets, light bulbs, fluorescent lamps, flashlight batteries, piping, conduit, wiring, glass and metal portions of gloveboxes, pumps, motors, standard laboratory equipment, air filters, small amounts of soil or rocks, various absorbents, and other miscellaneous debris.

WASTE PACKAGING: The waste will be placed directly into a 55-gallon drum with no confinement layers. Three drums will then be placed in an RH-TRU waste canister.

METHOD FOR DETERMINATION OF ISOTOPIC CHARACTERIZATION: In addition to process knowledge, the following methods will be used to determine necessary isotopic information for the fissile content and decay heat (if applicable):

1. Alpha energy analysis
2. Chemical separation/liquid scintillation
3. Germanium-lithium/high performance germanium
4. Total rad strontium
5. Distillation/liquid separation.

The method used will depend on the type of waste, availability of the systems, and the system providing the most accurate results.

FREE LIQUIDS: Liquid waste, except for residual amounts in well-drained containers, is prohibited in the drums. 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. If present, pressurized cans shall be punctured and emptied prior to packaging.

PYROPHORICS: Process knowledge indicates that no non-radioactive pyrophoric material was generated in association with the waste. Waste packaging procedures shall ensure that all radioactive pyrophoric materials are present only in small residual amounts (less than 1 weight percent) in payload containers.

CORROSIVES: Corrosives are prohibited in the payload container. Acids and bases that are potentially corrosive shall be neutralized or 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% by weight) quantities. The chemicals found in this content code are identified in the attached list and are restricted to the allowable chemical lists determined by the methodology found in the RH-TRU 72-B Cask SAR.

ADDITIONAL CRITERIA: Each drum is fitted with a minimum of one filter vent. Drum filters have a minimum hydrogen diffusivity of 3.7E-06 mole/second/mole fraction. If present, rigid liners in 55-gallon drums shall be punctured with a $\geq$0.3-inch diameter hole for gas release.

MAXIMUM ALLOWABLE HYDROGEN GENERATION RATES - OPTION 1: The maximum allowable hydrogen generation rate limits are as follows:

Confinement Layer	Maximum Allowable Hydrogen Generation Rate Limits Fixed Lid Canister (moles/second)	Maximum Allowable Hydrogen Generation Rate Limits Removable Lid Canister (moles/second)
Can	N/A	N/A
Drum	4.8140E-08	3.9515E-08
Canister	1.4442E-07	1.1855E-07

MAXIMUM ALLOWABLE DECAY HEAT LIMITS - OPTION 2: The maximum allowable decay heat limit limits are as follows:

Confinement Layer	Maximum Allowable Decay Heat Limits Fixed Lid Canister (watts)		Maximum Allowable Decay Heat Limits Removable Lid Canister (watts)	
	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year ≥0.012)	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year ≥0.012)
Can	N/A	N/A	N/A	N/A
Drum	0.1510	0.4000	0.1327	0.3533
Canister	0.4520	1.2000	0.3980	1.0600

THIS PAGE INTENTIONALLY LEFT BLANK

CONTENT CODE: RH 325C

CONTENT DESCRIPTION: Solid Organic and Inorganic Waste

GENERATING SITE: Richland Hanford

STORAGE SITE: Richland Hanford

WASTE DESCRIPTION: The waste consists of T-Plant Miscellaneous D&D waste ranging from contaminated clothing to process equipment.

GENERATING SOURCES: The waste is generated as a result of D&D operations from remediation at the T-Plant.

WASTE FORM: The waste consists of any or all of the following items: surgical gloves, plastic bags and sheets, paper products, cloth, tape, rubber, leather, wood, glass, failed process equipment (various metals, teflon, various gasket materials, wiring, plastic, etc.), leaded glass, lead-lined hood gloves, lead blankets, light bulbs, fluorescent lamps, flashlight batteries, piping, conduit, wiring, glass and metal portions of gloveboxes, pumps, motors, standard laboratory equipment, air filters, small amounts of soil or rocks, various absorbents, and other miscellaneous debris.

WASTE PACKAGING: The waste will be placed directly into an RH-TRU waste canister.

METHOD FOR DETERMINATION OF ISOTOPIC CHARACTERIZATION: In addition to process knowledge, the following methods will be used to determine necessary isotopic information for the fissile content and decay heat (if applicable):

1. Alpha energy analysis
2. Chemical separation/liquid scintillation
3. Germanium-lithium/high performance germanium
4. Total rad strontium
5. Distillation/liquid separation.

The method used will depend on the type of waste, availability of the systems, and the system providing the most accurate results.

FREE LIQUIDS: Liquid waste, except for residual amounts in well-drained containers, is prohibited in the drums. 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. If present, pressurized cans shall be punctured and emptied prior to packaging.

PYROPHORICS: Process knowledge indicates that no non-radioactive pyrophoric material was generated in association with the waste. Waste packaging procedures shall ensure that all radioactive pyrophoric materials are present only in small residual amounts (less than 1 weight percent) in payload containers.

CORROSIVES: Corrosives are prohibited in the payload container. Acids and bases that are potentially corrosive shall be neutralized or 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% by weight) quantities. The chemicals found in this content code are identified in the attached list and are restricted to the allowable chemical lists determined by the methodology found in the RH-TRU 72-B Cask SAR.

ADDITIONAL CRITERIA: Each RH-TRU waste canister is fitted with a minimum of one filter vent. Waste canister filters will have a minimum hydrogen diffusivity as specified in Appendix 1.3.5 of the 72-B Cask SAR.

MAXIMUM ALLOWABLE HYDROGEN GENERATION RATES - OPTION 1: The maximum allowable hydrogen generation rate limits are as follows:

Confinement Layer	Maximum Allowable Hydrogen Generation Rate Limits Fixed Lid Canister (moles/second)	Maximum Allowable Hydrogen Generation Rate Limits Removable Lid Canister (moles/second)
Can	N/A	N/A
Drum	N/A	N/A
Canister	3.5289E-07	2.3469E-07

MAXIMUM ALLOWABLE DECAY HEAT LIMITS - OPTION 2: The maximum allowable decay heat limit limits are as follows:

Confinement Layer	Maximum Allowable Decay Heat Limits Fixed Lid Canister (watts)		Maximum Allowable Decay Heat Limits Removable Lid Canister (watts)	
	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year ≥0.012)	Without Dose-Dependent G Values	With Dose-Dependent G Values (watt*year ≥0.012)
Can	N/A	N/A	N/A	N/A
Drum	N/A	N/A	N/A	N/A
Canister	0.8520	2.2700	0.6930	1.8500

THIS PAGE INTENTIONALLY LEFT BLANK

RICHLAND HANFORD CONTENT CODES 325A, 325B, AND 325C
SOLID ORGANIC AND INORGANIC WASTE

MATERIALS/CHEMICALS >1%

ALUMINUM
ASPHALT
BAKELITE
BATTERIES
BERYLLIUM
CADMIUM
CALCIUM FLUORIDE
CALCIUM HYDROXIDE
CARBON STEEL
CHROMIUM
CLAYS
CONCRETE
COPPER
CORK
DIATOMACEOUS EARTH
DI-BUTYL PHOSPHATE
GLASS
HEPA FILTERS
IRON
KITTY LITTER
LEAD
LEAD (Encapsulated)
LEAD CHROMATE
LEADED GLASS
LEATHER
LITHIUM
MERCURIC OXIDE
MERCURY
MONOBUTYL PHOSPHITE
NAPHTHA

RICHLAND HANFORD CONTENT CODES 325A, 325B, AND 325C
SOLID ORGANIC AND INORGANIC WASTE
(Continued)

MATERIALS/CHEMICALS >1%
(Continued)

OIL PRODUCTS
PAINT
PAPER PRODUCTS
PERLITE
PLASTIC
PLEXIGLAS/LUCITE
POLYAMIDES (Nylon)
POLYETHYLENE
POLYPROPYLENE
POLYURETHANE
POLYVINYL CHLORIDE
PORTLAND CEMENT
POTASSIUM HYDROXIDE
RAGS/CLOTH
ROPE
RUBBER PRODUCTS
RUBBER GLOVES, LEADED
SALTS
SAND
SILVER CHLORIDE
SILVER OXIDE
SODIUM HYDROXIDE
SOIL
STAINLESS STEEL
SYNTHETIC RUBBER
TAPE
TEFLON
TRIBUTYL PHOSPHATE

RICHLAND HANFORD CONTENT CODES 325A, 325B, AND 325C
SOLID ORGANIC AND INORGANIC WASTE
(Continued)

MATERIALS/CHEMICALS >1%
(Continued)

VERMICULITE
WATER (Absorbed)
WAXES AND GREASES
WOOD

MATERIALS/CHEMICALS <1%

1-BUTOXYL-2,3-EPOXY-PROPANE
1,1-DICHLOROETHYLENE
1,2-DICHLOROETHANE
1,1,1-TRICHLOROETHANE
1,2,4-TRIMETHYLBENZENE
2-BUTOXYETHANOL
4-METHYL-2-PENTANONE
ACETIC ACID
ACETONE
ALUMINUM OXIDE
AMMONIA (ammonium hydroxide)
AMMONIUM CHLORIDE
ARSENIC
ASBESTOS
BARIUM
BENZENE
BENZYL BUTYL ESTER PHTHALIC ACID
BIS(2-ETHYLHEXYL) PHTHALATE
BUTYL ALCOHOL
CALCIUM CHLOROFLUOROPHOSPHATE
CARBON TETRACHLORIDE

RICHLAND HANFORD CONTENT CODES 325A, 325B, AND 325C
SOLID ORGANIC AND INORGANIC WASTE
(Continued)

MATERIALS/CHEMICALS <1%
(Continued)

CHLOROFORM
CHLOROETHYLENE
CHROMIC OXIDE
COPPER SULFATE
CREOSOL
CUPROUS CYANIDE
CYANIDE
CYCLOHEXANE
DICHLOROMETHANE
DI-N-OCTYL PHTHALATE
DIPOTASSIUM DICHROMATE
ETHANOL
ETHANOLAMINE
FERROUS AMMONIUM SULFATE
FORMIC ACID
HEPTACHLOR
HEXACHLOROBUTADIENE
HEXACHLOROETHANE
HYDROCHLORIC ACID
ISOPROPYL ALCOHOL
KEROSENE
METHYL ESTER METHACRYLIC ACID
METHYL ETHYL KETONE
MOLYBDIC ACID
NITRIC ACID
OXALIC ACID
PHOSPHORIC ACID

RICHLAND HANFORD CONTENT CODES 325A, 325B, AND 325C
SOLID ORGANIC AND INORGANIC WASTE
(Continued)

MATERIALS/CHEMICALS <1%
(Continued)

POLYCHLORINATED BIPHENYLS*
POLYPROPYLENE
POTASSIUM CYANIDE
POTASSIUM FLUORIDE
SELENIUM
SILVER
SODIUM
SODIUM BISULFATE
SODIUM CARBONATE
SODIUM CHLORIDE
SODIUM CYANIDE
SODIUM FLUORIDE
SODIUM NITRATE
SODIUM SULFATE
SULFAMIC ACID
TETRACHLOROETHYLENE
TRENOYLTRIFLUOROACETONE
TRICHLOROETHENE
TRIHEPTYLAMINE
TRIOCTYLPHOSPHINIC OXIDE
VANADIUM PENTOXIDE
XYLENE

*Polychlorinated biphenyl concentration is less than 50 ppm.

THIS PAGE INTENTIONALLY LEFT BLANK