

**ATTACHMENT G3**

**RADIOLOGICAL SURVEYS TO INDICATE POTENTIAL HAZARDOUS WASTE  
RELEASES**

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## ATTACHMENT G3

# RADIOLOGICAL SURVEYS TO INDICATE POTENTIAL HAZARDOUS WASTE RELEASES

### TABLE OF CONTENTS

G3-1	Purpose.....	1
G3-2	Definition .....	1
G3-3	Discussion.....	1
	G3-3a Nature of the Hazardous Waste Portion of TRU Mixed Waste .....	1
	G3-3b Nature of the TRU Mixed Waste .....	2
	G3-3c Nature of the Releases .....	3
G3-4	Application of Radiological Surveys.....	3
	G3-4a TRU Mixed Waste Processing .....	4
	G3-4b TRU Mixed Waste Releases .....	4
	G3-4c Decontamination Activities at Closure .....	4

## LIST OF TABLES

<b>Table</b>	<b>Title</b>
Table G3-1	Summary of Waste Generation Processes and Waste Forms
Table G3-2	Radiological Surveys During CH TRU Mixed Waste Processing
Table G3-3	Radiological Surveys During RH TRU Mixed Waste Processing

## ATTACHMENT G3

### RADIOLOGICAL SURVEYS TO INDICATE POTENTIAL HAZARDOUS WASTE RELEASES

#### G3-1 Purpose

Within the Resource Conservation and Recovery Act (**RCRA**) Permit for the Waste Isolation Pilot Plant (**WIPP**), radiological monitoring is used to determine whether a potential release of hazardous constituents has occurred. This method is used in addition to the visual examinations and container inspections mandated by the RCRA.

#### G3-2 Definition

This Permit Attachment describes procedures for performing radiological surveys to indicate the potential for hazardous waste releases from containers by virtue of detection of a radioactive constituent release. These procedures assume the potential co-release of hazardous and radioactive materials and applies to all releases except the release of volatile organic compounds (**VOC**) from transuranic (**TRU**) mixed waste containers. Radiological surveys are used to indicate the potential presence or absence of hazardous waste constituents based on the presence or absence of radioactivity. Radiological surveys do not provide any assessment with regard to concentration, since these surveys do not actually detect hazardous waste constituents.

#### G3-3 Discussion

Radiological surveys provide the WIPP facility with a very sensitive method of indicating the potential release of non-VOC hazardous waste constituents through the use of surface sampling (swipes) and radioactivity counting. This approach depends on the nature of the hazardous waste portion of the TRU mixed waste, the nature of the TRU mixed waste, and the nature of the spills. The sections below discuss each of these factors.

#### G3-3a Nature of the Hazardous Waste Portion of TRU Mixed Waste

Based on the waste codes listed in the Part A (Permit Attachment B) and discussed in the WIPP Waste Analysis Plan (Permit Attachment C), the hazardous waste constituents in WIPP TRU mixed waste consist mainly of EPA F-coded solvents and metals that exhibit the toxicity characteristic. The TRU mixed wastes that are to be shipped to the WIPP facility for disposal have been placed into waste categories based on their physical and chemical properties. Waste category information is summarized in Table G3-1 with emphasis on the process that generated the waste. The waste generating processes can be described in five general categories:

1. Wastes (such as combustible waste) that result from cleaning and decontamination activities in which items such as towels and rags become contaminated simultaneously with hazardous constituents and radioactivity. In these cases, the hazardous constituent and the radioactive constituent are intimately mixed, both on the rag or towel used for cleaning and as residuals on the surface of the object being cleaned. These waste forms are not homogeneous in nature; however, they are generated in a

1 fashion that ensures that the hazardous and radioactive contaminants coexist  
2 throughout the waste matrix.

- 3 2. Wastes generated when materials that contain metals that are believed to exhibit the  
4 toxicity characteristic become contaminated with radioactivity as the result of plutonium  
5 operations (leaded rubber, some glass, and metal waste are typical examples). These  
6 materials may also become contaminated with solvents during decontamination or  
7 plutonium recovery activities.
- 8 3. A class of processes where objects that are not metals are used in plutonium  
9 processes and become contaminated with radioactivity. They are subsequently  
10 cleaned with solvents to recover plutonium. Surfaces of these objects (such as  
11 graphite, filters, and glass) are contaminated with both radioactive constituents and  
12 hazardous constituents.
- 13 4. Waste generating processes involving foundry operations where impurities are  
14 removed from plutonium. These impurities may result in the deposition of toxicity  
15 characteristic metals on the surfaces of objects, such as firebrick, ceramic crucibles,  
16 pyrochemical salts, and graphite, which are contaminated with residual quantities of  
17 radioactivity.
- 18 5. In all of the process waste categories in the second half of the attached table, the  
19 hazardous constituent and the radioactivity are physically mixed together as a result of  
20 the treatment process. In these wastes, the release of any portion of the waste matrix  
21 will involve both the hazardous waste and the radioactive waste components, because  
22 the treatment process generates a relatively homogeneous waste form.

23 Some waste forms only contain radioactive contamination on the surface, because they are not  
24 the result of a treatment process or are not porous in form. These include glass, leaded rubber,  
25 metals, graphite, ceramics, firebricks, and plastics. In theory, a hazardous waste release could  
26 occur if the interiors of these materials became exposed and were involved in a release or spill.  
27 Such an occurrence is not likely during operations, because no activities are planned or  
28 anticipated that would result in the breaking of these materials to expose fresh surfaces.

29 Based on the information in the attached table and the discussion above, hazardous constituent  
30 releases could potentially occur in only one of two forms: 1) VOC and 2) particulate resulting  
31 from the catastrophic failure of a container. Mechanisms that can initiate releases in these forms  
32 are discussed subsequently. Regardless of how the release occurs, the nature of the waste and  
33 the processes that generated it is such that the radioactive and hazardous components are  
34 intimately mixed. A release of one without the other is not likely, except for releases of VOCs  
35 from containers.

### 36 G3-3b Nature of the TRU Mixed Waste

37 TRU mixed waste is defined as transuranic waste which is also a hazardous waste. The  
38 processes responsible for the radioactivity in the waste are, for the most part, the same  
39 processes responsible for making it a hazardous waste. Therefore, the TRU mixed waste forms  
40 are described in terms of both classes of waste (radioactive and hazardous). The Permit  
41 Treatment, Storage, and Disposal Facility Waste Acceptance Criteria (**TSDF-WAC**) in Permit  
42 Part 2 places limits on the waste that can be shipped to the WIPP facility based on the

1 characteristics of the waste form. According to the TSDF-WAC, certain waste forms with  
2 specific characteristics are not allowed at the WIPP facility. Waste with liquid in excess of the  
3 TSDF-WAC limits is one waste form that is not allowed. Other limitations include, but are not  
4 limited to, a prohibition on pyrophoric materials, corrosive materials, ignitable waste, and  
5 compressed gases. Furthermore, TRU waste must contain 100 nanocuries or more of  
6 transuranic elements per gram of waste, which means that the radioactive component of the  
7 waste will always be present within the waste in significant concentrations. The TSDF-WAC  
8 limitations and restrictions are provided to ensure that any waste form received at the WIPP  
9 facility is stable and can be managed safely.

10 One benefit of waste form restrictions, such as no liquid in excess of the TSDF-WAC limits, is  
11 that they limit the kinds of releases that could occur to those that would be readily detectable  
12 through visual inspection (i.e., large objects that fall out of ruptured containers) or through the  
13 use of radiation monitoring either locally or within the adjacent area to detect materials that have  
14 escaped from containers.

### 15 G3-3c Nature of the Releases

16 The WIPP facility will handle only sealed containers of waste and derived waste. The practice of  
17 handling sealed containers minimizes the opportunity for releases or spills. For the purposes of  
18 safety analysis (DOE 1997), it was assumed that releases and spills during operations occur by  
19 either of two mechanisms: 1) surface contamination and 2) accidents.

20 Surface contamination is documented in the WIPP Safety Analysis Report (**SAR**) (DOE 1997) to  
21 be the only credible source of contamination external to the containers during normal  
22 operations. Surface contamination is assumed to be caused by waste management activities at  
23 the generator site that result in the contamination of the outside of a waste container.  
24 Contamination would most likely be particulates (dirt or dust) that would be deposited during  
25 generator-site handling/loading activities. This contamination may not be detected by visible  
26 inspections. Surface contamination is monitored upon arrival at the WIPP facility through the  
27 use of swipes and radiation monitoring equipment, as specified in WIPP Procedure WP 12-  
28 HP1100, "Radiological Surveys" (DOE, 1995). WP 12-HP1100 is a technical procedure that  
29 provides specific methods and guidance for performing surface contamination and dose rate  
30 surveys of items, equipment, and areas, but does not cover the monitoring of personnel.  
31 Detection using radioactivity is very sensitive and allows for the detection of contamination that  
32 may not be visible on the surface of the container. This exceeds the capability required by the  
33 RCRA, which is generally limited to inspections that detect only visible evidence of spills or  
34 leaks. RCRA-required inspections are specified in Permit Part 3.

35 Releases due to accidents are modeled in the WIPP SAR. Significant accidents within the waste  
36 handling process are assumed to result in the release of radioactive contaminants and VOCs.  
37 Radioactive releases are detectable using surface-sampling (swipe) techniques.

### 38 G3-4 Application of Radiological Surveys

39 Radiological surveys apply to many situations calling for sampling or monitoring to indicate the  
40 potential for nonvolatile releases. This includes initial sampling for surface radiological  
41 contamination upon receipt, sampling for contamination during waste handling activities,  
42 sampling for contamination during decommissioning, sampling for contamination during  
43 packaging for off-site shipment, and sampling to demonstrate the effectiveness of

1 decontamination activities that follow a release or spill and retrieval. Radiation monitoring and  
2 sampling are mandated by DOE Orders and provide an immediate indication of a release or  
3 spill, even when they are not visibly detectable. A release or spill involving hazardous  
4 constituents (except VOCs) will also likely involve a release or spill of radioactivity, based on the  
5 processes that generated the waste and the physical form of the waste. These processes mixed  
6 the hazardous and radioactive components, as described in Table G3-1, to the extent that  
7 detection of the radioactive component can indicate the potential that the hazardous component  
8 is also present. Radiological surveys to indicate the potential for hazardous waste releases will  
9 be performed as specified in the following sections.

#### 10 G3-4a TRU Mixed Waste Processing

11 Tables G3-2 and G3-3 specify the various steps in the process of receiving and disposing  
12 containers of CH TRU mixed waste, including RH TRU mixed waste in shielded containers and  
13 RH TRU mixed waste, respectively, where radiological surveys will be performed by the  
14 Permittees. WIPP Procedure WP 12-HP1100 provides the detailed description of methods and  
15 equipment used when performing surface contamination surveys, dose rate surveys, and large  
16 area wipes.

#### 17 G3-4b TRU Mixed Waste Releases

18 The RCRA Contingency Plan (Permit Attachment D) specifies actions required by the  
19 Permittees in the event of spills or leaking or punctured containers of CH and RH TRU mixed  
20 waste. Following completion of decontamination efforts, the Permittees will perform hazardous  
21 material sampling to confirm the removal of hazardous waste constituents.

#### 22 G3-4c Decontamination Activities at Closure

23 The Closure Plan (Permit Attachment G, Section G-1e(2)) specifies decontamination activities  
24 required by the Permittees at closure. Following completion of decontamination efforts, the  
25 Permittees will perform hazardous material sampling to confirm removal of hazardous waste  
26 constituents.

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## **TABLES**

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**Table G3-1**  
**Summary of Waste Generation Processes and Waste Forms**

<b>Waste Category</b>	<b>Hazardous Waste Codes</b>	<b>Description of Processes</b>	<b>Description of Waste Form</b>
Combustibles	F001, F002, F003, D008, D019	Cloth and paper wipes are used to clean parts and wash down gloveboxes. Wood and plastic parts are removed from gloveboxes after they are cleaned. Lead may occur as shielding tape or as minor noncombustible waste in this category.	Materials such as metals may retain traces of organics left on surfaces that were cleaned. Waste may remain on the cloth and paper that was used for cleaning or for wiping up spills.
Graphite		Graphite molds, which may contain impurities of metals, are scraped and cleaned with solvents to remove the recoverable plutonium.	Surfaces may retain residual solvents. Lead may be used as shielding or may be an impurity in the graphite.
Filters	F001, F002	Filters are used to capture radioactive particulate in air streams associated with numerous plutonium operations and to filter particulate from aqueous streams.	Filter media may retain organic solvents that were present in the air or liquid streams.
Benelex® and Plexiglas®	F001, F002, D008	Materials are used in gloveboxes as neutron absorbers. The glovebox assembly often includes leaded glass. All surfaces may be wiped down with solvents to remove residual plutonium.	Surfaces may retain residual solvents from wiping operations. Leaded glass may also be present.
Firebrick and Ceramic Crucibles	F001, F002, F005, D006, D007, D008	Firebrick is used to line plutonium processing furnaces. Ceramic crucibles are used in plutonium analytical laboratories. Both may contain metals as surface contaminants.	Metals deposited during plutonium refining or analytical operations could remain as residuals on surfaces. Surfaces may retain residual solvents.
Leaded Rubber	D008	Leaded rubber includes lead oxide impregnated materials such as gloves and aprons.	The leaded rubber could potentially exhibit the toxicity characteristic.
Metal	F001, F002, D008	Metals range from large pieces removed from equipment and structures to nuts, bolts, wire, and small parts. Many times, metal parts will be cleaned with solvents to remove residual plutonium.	Solvents may exist on the surfaces of metal parts. The metals themselves potentially exhibit the toxicity characteristic.
Glass	F001, F002, D006, D007, D008, D009	Glass includes Raschig rings removed from processing tanks, leaded glass removed from gloveboxes, and miscellaneous laboratory glassware.	Solvents may exist as residuals on glass surfaces and in empty containers. The leaded glass may exhibit the toxicity characteristic.
Inorganic Wastewater Treatment Sludge	F001-F003, D006-D009, P015	Sludge is vacuum filtered and stabilized with cement or other appropriate sorbent prior to packaging.	Traces of solvents and heavy metals may be contained in the treated sludge which is in the form of a solid dry monolith, highly viscous gel-like material, or dry crumbly solid.

<b>Waste Category</b>	<b>Hazardous Waste Codes</b>	<b>Description of Processes</b>	<b>Description of Waste Form</b>
Organic Liquid and Sludge	F001, F003	Organic liquids such as oils, solvents, and lathe coolants are immobilized through the use of various solidification agents or sorbent materials.	Solvents and metals may be present within the matrix of the solids created through the immobilization process.
Solidified Liquid	F001, F003, D006, D008	Liquids that are not compatible with the primary treatment processes and have to be batched. Typically these liquids are solidified with portland or magnesium cement.	Solvents and metals may be present within the matrix of the solids created through the immobilization process.
Inorganic Process Solids and Soil	F001, F002, F003, D008	Solids that cannot be reprocessed or process residues from tanks, firebrick fines, ash, grit, salts, metal oxides, and filter sludge. Typically solidified with portland or gypsum-based cements.	Solvents and metals may be present within the matrix of the solids created through the immobilization process.
Pyrochemical Salts	D007	Molten salt is used to purify plutonium and americium. After the radioactive metals are removed, the salt is discarded.	Residual metals may exist in the salt depending on impurities in the feedstock.
Cation and Anion Exchange Resins	D008	Plutonium is sorbed on resins and is eluted and precipitated.	Feed solutions may contain traces of solvents or metals depending on the preceding process.

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**Table G3-2  
Radiological Surveys During CH TRU Mixed Waste Processing (TRUPACT-II/HalfPACT)**

Step in CH TRU Mixed Waste Processing	Surface Contamination Survey	Dose Rate Survey	Large Area Wipes <sup>a</sup>
Contact Handled Package Outer Confinement Assembly (OCA) lid interior and top of Inner Containment Vessel (ICV) lid	X		X
Contact Handled Package quick connect and vent port	X		
As ICV lid is raised		X	
ICV lid interior and top of payload	X		X
Payload assembly, guide tubes, standard waste box (SWB) connecting devices	X		
As payload assembly is raised, including bottom of payload		X	
After placement of payload on facility pallet	X		X

<sup>a</sup> Surface contamination surveys of Contact Handled Packages are performed in accordance with Procedure WP 12-HP1100, which stipulates that all such work be performed under a Radiation Work Permit (RWP). The RWP will only stipulate large area wipes when necessary and not as a routine measure.

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**Table G3-2a  
 Radiological Surveys During CH TRU Mixed Waste Processing (TRUPACT-III)**

<b>Step in CH TRU Mixed Waste Processing</b>	<b>Surface Contamination Survey</b>	<b>Dose Rate Survey</b>	<b>Large Area Wipes<sup>a</sup></b>
Exterior of TRUPACT-III on arrival at WIPP	X	X	
Interior of Overpack Cover and exterior of Containment Lid	X	X	X
TRUPACT-III Vent Port Tool Assembly quick connect	X		
Interior of Containment Lid and front of SLB2	X	X	X
As SLB2 is removed from TRUPACT-III		X	
After placement of SLB2 on facility pallet	X		X

<sup>a</sup> Surface contamination surveys of Contact Handled Packages are performed in accordance with Procedure WP 12-HP1100, which stipulates that all such work be performed under an RWP. The RWP will only stipulate large area wipes when necessary and not as a routine measure.

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**Table G3-3  
 Radiological Surveys During RH TRU Mixed Waste Processing**

<b>Step in RH TRU Mixed Waste Processing</b>	<b>Surface Contamination Survey</b>	<b>Dose Rate Survey</b>
Exterior of cask on arrival at WIPP	X	X
During removal of impact limiters on RH-TRU 72-B cask	X	X
During removal of outer lid closure from RH-TRU 72-B cask	X	X
During removal of inner lid closure from RH-TRU 72-B cask	X	
During removal of upper impact limiter on the CNS 10-160B cask	X	X
After removal of upper impact limiter on the CNS 10-160B cask	X	X
After removal of the CNS 10-160B cask from the lower impact limiter	X	X
After transfer of the CNS 10-160B cask lid into the Hot Cell	X	
During transfer of waste drum carriages into the Hot Cell	X	
During transfer of waste into the facility canister in the Hot Cell	X	
During transfer of the waste canister from the RH-TRU 72-B cask to the facility cask	X	
Interior of shipping cask inside the RH Bay after unloading of waste canister or drums	X	
Exterior of shield plug subsequent to final canister emplacement		X
Interior of facility cask after completion of waste emplacement	X	

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