ATTACHMENT G3

RADIOLOGICAL SURVEYS TO INDICATE POTENTIAL HAZARDOUS WASTE RELEASES

ATTACHMENT G3

RADIOLOGICAL SURVEYS TO INDICATE POTENTIAL HAZARDOUS WASTE RELEASES

TABLE OF CONTENTS

LIST OF TABLES

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**), detection of radiological contamination on surfaces is used to indicate 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 Permit.

G3-2 Definition

This Permit Attachment describes the principle of co-detection. Co-detection is defined as the process of identifying hazardous waste releases from containers of transuranic (**TRU**) mixed waste by performing radiological surveys on surfaces and assuming the release of a radioactive constituent indicates the concurrent release of a hazardous waste constituent. Co-detection does not apply to the gaseous release of volatile organic compounds (**VOC**) from TRU mixed waste containers nor does it apply to the detection of radioactive constituents in water. Radiological surveys are used to indicate the potential presence or absence of hazardous waste constituents based on the presence or absence of radioactive constituents on surfaces. Radiological surveys do not provide an assessment with regard to the concentrations of hazardous waste constituents since these surveys do not actually detect hazardous waste constituents.

G3-3 Discussion

Radiological surveys provide the Permittees with a very sensitive method of indicating the potential spill or release of 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 spill or release. The sections below discuss each of these factors.

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

The hazardous waste constituents in TRU mixed waste are mainly U.S. Environmental Protection Agency (**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 and radioactive constituents. 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 fashion that distributes the hazardous and radioactive contaminants throughout the waste matrix.

2. Wastes generated when materials that contain metals that exhibit the toxicity characteristic become contaminated with radioactive constituents as the result of plutonium operations (leaded rubber, some glass, and metal waste are typical examples). These materials may also become contaminated with solvents during decontamination or plutonium recovery activities.

3. A class of processes where objects that are not metals are used in plutonium processes and become contaminated with radioactive constituents. They are subsequently cleaned with solvents to recover plutonium. Surfaces of these objects (such as graphite, filters, and glass) may be contaminated with both radioactive constituents and hazardous constituents.

4. Waste generating processes involving foundry operations where impurities are removed from plutonium. These impurities may result in the deposition of toxicity characteristic metals on the surfaces of objects, such as firebrick, ceramic crucibles, pyrochemical salts, and graphite, which are contaminated with residual quantities of radioactive constituents.

5. In all of the process waste categories in the second half of Table G3-1, the hazardous constituent and the radioactive constituents are physically mixed together as a result of the treatment process. In these wastes, the spill or release of the waste matrix may involve both the hazardous waste and the radioactive waste components, because the treatment process generates a relatively homogeneous waste form.

Based on the information in the attached table and the discussion above, hazardous constituent releases could potentially occur in either of two forms: 1) VOCs or 2) particulate resulting from the failure of the confinement capability of a container. Mechanisms that can initiate releases in these forms are discussed subsequently. Regardless of how the release occurs, the nature of the waste and the processes that generated it is such that the radioactive and hazardous components are assumed to be intimately mixed; a release of one without the other is not likely, except for releases of VOCs from containers.

G3-3b Nature of the TRU Mixed Waste

TRU mixed waste is defined as transuranic waste which is also a hazardous waste. The processes responsible for the radioactive constituents in the waste are, for the most part, the same processes responsible for making it a hazardous waste. Therefore, the TRU mixed waste forms are described in terms of both radioactive and hazardous waste. The Treatment, Storage, and Disposal Facility Waste Acceptance Criteria (**TSDF-WAC**) ~~in Permit Part 2~~ places limits on the characteristics of the waste that can be shipped to the WIPP facility based on the waste form. According to the TSDF-WAC, certain waste forms with specific characteristics are not allowed at the WIPP facility. Waste with liquid in excess of the TSDF-WAC limits is one waste form that is not allowed. Other limitations include, but are not limited to, a prohibition on pyrophoric materials, corrosive materials, ignitable waste, and compressed gases. Furthermore, payload containers of TRU waste must contain 100 nanocuries or more of transuranic elements per gram of waste, which means that the radioactive component of the waste will always be present within the waste in significant concentrations. The TSDF-WAC limitations and restrictions are provided to ensure that any waste form received at the WIPP facility is stable and can be managed safely.

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

G3-3c Nature of the Releases

The WIPP facility personnel will handle only sealed containers of TRU mixed waste and derived waste. The practice of handling sealed containers minimizes the opportunity for releases or spills. For the purposes of safety analysis (DOE 2018) [1], it was assumed that releases and spills during operations occur by either of two mechanisms: 1) surface contamination and 2) accidents.

Radioactive materials releases resulting from unique and representative hazard evaluation events are documented in the WIPP Documented Safety Analysis (**DSA**) (DOE 2018). Surface contamination of a waste container is considered to be a credible source of contamination external to the containers during normal operations. Surface contamination is assumed to be caused by waste management activities at the generator site that result in the contamination of the outside of a waste container. Contamination would most likely be particulates (dirt or dust) that would be deposited during generator-site handling/loading activities. This contamination may not be detected by visible inspections. Surface contamination is detected after arrival at the WIPP facility through the use of swipes and radiation surveying equipment, as specified in radiological control procedures pursuant to 10 CFR Part 835. Surveying for radioactive constituents allows for the detection of contamination that may not be visible on the surface of the container. This exceeds the capability required by the RCRA, which is generally limited to inspections that detect only visible evidence of spills or leaks. RCRA-required inspections are specified in Permit Attachment E.

Releases due to accidents are modeled in the WIPP DSA. For the purposes of co-detection, releases are detectable using surface-contamination detection techniques.

G3-4 Application of Radiological Surveys

Radiological surveys apply to many situations calling for surveying to indicate the potential for releases. This includes initial sampling for surface radiological contamination upon receipt, sampling for contamination during waste handling activities, sampling for contamination during decommissioning, sampling for contamination during packaging for off-site shipment, and sampling to demonstrate the effectiveness of decontamination activities that follow a release or spill and retrieval. Radiological surveying is mandated by DOE Orders and provide an immediate indication of a radiological release or spill, even when there are no visibly detectable indications. A release or spill involving hazardous constituents will also likely involve a release or spill of radioactive constituents, based on the processes that generated the waste and the physical form of the waste. These processes mixed the hazardous and radioactive components,

[1] DOE 2018, Waste Isolation Pilot Plant Documented Safety Analysis, DOE/WIPP 07-3372, REV. 6a, February 2018.

as described in Table G3-1, to the extent that detection of the radioactive component can indicate the potential that the hazardous component is also present on a contaminated surface. Radiological surveys to indicate the potential for hazardous waste releases will be performed as specified in the following sections.

G3-4a TRU Mixed Waste Processing

Tables G3-2, G3-2a, and G3-3 specify the various steps in the process of receiving and disposing containers of CH TRU mixed waste, including RH TRU mixed waste in shielded containers and RH TRU mixed waste, respectively, where radiological surveys will be performed by the Permittees in accordance with radiological control procedures pursuant to 10 CFR Part 835.

G3-4b TRU Mixed Waste Releases

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

G3-4c Decontamination Activities at Closure

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

TABLES

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

Waste Category	Hazardous Waste Codes	Description of Processes	Description of Waste Forms
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 leader 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.

Waste Category	Hazardous Waste Codes	Description of Processes	Description of Waste Forms
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.

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 [a]
Exterior of CH package after arrival at the WIPP facility	X	X	
CH package outer confinement assembly (**OCA**) lid interior and top of inner containment vessel (**ICV**) lid	X		X
CH 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**) and ten-drum overpack (**TDOP**) connecting devices	X		
As payload assembly is raised, including bottom of payload	X	X	
After placement of payload on facility pallet	X	X	X

[a] Surface contamination surveys of CH packages are performed in accordance with radiological control procedures pursuant to 10 CFR Part 835.

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

Step in CH TRU Mixed Waste Processing	Surface Contamination Survey	Dose Rate Survey	Large Area Wipes [a]
Exterior of TRUPACT-III after arrival at the WIPP facility	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

[a] Surface contamination surveys of CH packages are performed in accordance with radiological control procedures pursuant to 10 CFR Part 835.

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

Step in RH TRU Mixed Waste Processing	Surface Contamination Survey	Dose Rate Survey
Exterior of cask after arrival at the WIPP facility	X	X
After 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
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	
After 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	