APPENDIX I3

RADIOLOGICAL SURVEYS TO INDICATE POTENTIAL HAZARDOUS WASTE RELEASES

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APPENDIX I3

RADIOLOGICAL SURVEYS TO INDICATE POTENTIAL HAZARDOUS WASTE RELEASES

I3-1 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.

I3-2 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.

I3-3 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.

I3-3a Nature of the Hazardous Waste Portion of TRU Mixed Waste

Based on the waste codes listed in the Part A (Permit Attachment O) and discussed in the WIPP Waste Analysis Plan (Permit Attachment B), 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 I3-1 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 fashion that ensures that the hazardous and radioactive contaminants coexist throughout the waste matrix.

2. Wastes generated when materials that contain metals that are believed to exhibit the toxicity characteristic become contaminated with radioactivity 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 radioactivity. They are subsequently cleaned with solvents to recover plutonium. Surfaces of these objects (such as graphite, filters, and glass) are 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 radioactivity.

5. In all of the process waste categories in the second half of the attached table, the hazardous constituent and the radioactivity are physically mixed together as a result of the treatment process. In these wastes, the release of any portion of the waste matrix will involve both the hazardous waste and the radioactive waste components, because the treatment process generates a relatively homogeneous waste form.

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

Based on the information in the attached table and the discussion above, hazardous constituent releases could potentially occur in only one of two forms: 1) VOC and 2) particulate resulting from the catastrophic failure 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 intimately mixed. A release of one without the other is not likely, except for releases of VOCs from containers.

I3-3b 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 radioactivity 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 classes of waste (radioactive and hazardous). The Permit Treatment, Storage, and Disposal Facility Waste Acceptance Criteria (**TSDF-WAC**) in Module II places limits on the waste that can be shipped to the WIPP facility based on the characteristics of the waste form. According to the TSDF-WAC, certain waste forms with specific characteristics are not allowed at the WIPP facility. Liquid waste 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, 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 liquids, 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 radiation monitoring either locally or within the adjacent area to detect materials that have escaped from containers.

I3-3c Nature of the Releases

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

Surface contamination is documented in the WIPP Safety Analysis Report (**SAR**) (DOE 1997) to be the only 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 monitored upon arrival at the WIPP facility through the use of swipes and radiation monitoring equipment, as specified in WIPP Procedure WP 12-HP1100, "Radiological Surveys" (DOE, 1995) (included in Permit Attachment P). WP 12-HP1100 is a technical procedure that provides specific methods and guidance for performing surface contamination and dose rate surveys of items, equipment, and areas, but does not cover the monitoring of personnel. Detection using radioactivity is very sensitive and 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 Module III.

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

I3-4 Application of Radiological Surveys

Radiological surveys apply to many situations calling for sampling or monitoring to indicate the potential for nonvolatile 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. Radiation monitoring and sampling are mandated by DOE Orders and provide an immediate indication of a release or spill, even when they are not visibly detectable. A release or spill involving hazardous constituents (except VOCs) will also likely involve a release or spill of radioactivity, based on the processes that generated the waste and the physical form of the waste. These processes mixed the hazardous and radioactive components, as described in Table I3-1, to the extent that detection of the radioactive component can indicate the potential that the hazardous component is also present. Radiological surveys to indicate the potential for hazardous waste releases will be performed as specified in the following sections.

I3-4a TRU Mixed Waste Processing

Tables I3-2 and I3-3 specify the various steps in the process of receiving and disposing containers of CH and RH TRU mixed waste, respectively, where radiological surveys will be performed by the Permittees. WIPP Procedure WP 12-HP1100 (Permit Attachment P) provides the detailed description of methods and equipment used when performing surface contamination surveys, dose rate surveys, and large area wipes.

I3-4b TRU Mixed Waste Releases

The RCRA Contingency Plan (Permit Attachment F) 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.

I3-4c Decontamination Activities at Closure

The Closure Plan (Permit Attachment I, Section I-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.

1 TABLES

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TABLE I3-1
SUMMARY OF WASTE GENERATION PROCESSES AND WASTE FORMS

Waste Category	Hazardous Waste Codes	Description of Processes	Description of Waste Form
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	F001-F003, D006-D009,	Sludge is vacuum filtered and stabilized with cement or other	Traces of solvents and heavy metals may be contained in the

TABLE I3-1
SUMMARY OF WASTE GENERATION PROCESSES AND WASTE FORMS

Waste Category	Hazardous Waste Codes	Description of Processes	Description of Waste Form
Treatment Sludge	P015	appropriate sorbent prior to packaging.	treated sludge which is in the form of a solid dry monolith, highly viscous gel-like material, or dry crumbly solid.
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 I3-2
RADIOLOGICAL SURVEYS DURING CH TRU MIXED WASTE PROCESSING

Step in CH TRU Mixed Waste Processing	Surface Contamination Survey	Dose Rate Survey	Large Area Wipes [a]
Contact Handled Package Outer Containment 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

[a] Surface contamination surveys of Contact Handled Packages are performed in accordance with Procedure WP 12-1100 (Permit Attachment P), 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.

TABLE I3-3
RADIOLOGICAL SURVEYS DURING RH TRU MIXED WASTE PROCESSING

Step in RH TRU Mixed Waste Processing	Surface Contamination Survey	Dose Rate Survey
Exterior of cask 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	