Class 2 Permit Modification Request Package

Waste Isolation Pilot Plant
Carlsbad, New Mexico

WIPP HWFP #NM4890139088

May 12, 2003

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Item 1

Class 2 Permit Modification Request

Packaging-Specific Drum Age Criteria for New Approved Waste Containers

Waste Isolation Pilot Plant
Carlsbad, New Mexico

WIPP HWFP #NM4890139088-TSDF

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Acronyms and Abbreviations

CFR	Code of Federal Regulations
DAC	Drum Age Criteria
HWDU	Hazardous Waste Disposal Unit
HWFP	Hazardous Waste Facility Permit
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
PMR	Permit Modification Request
TDOP	Ten-Drum Overpack
WIPP	Waste Isolation Pilot Plant

Overview of the Permit Modification Request

This document contains a Class 2 Permit Modification Request (**PMR**) for the Waste Isolation Pilot Plant (**WIPP**) Hazardous Waste Facility Permit (**HWFP**), Number NM4890139088-TSDF, hereinafter referred to as the WIPP HWFP.

This PMR is being submitted by the U.S. Department of Energy, Carlsbad Field Office and Washington TRU Solutions, LLC, collectively referred to as the Permittees, in accordance with the WIPP HWFP, Condition I.B.1 (20.4.1.900 New Mexico Administrative Code (**NMAC**) incorporating Title 40, Code of Federal Regulations (**CFR**), §270.42(b)). The modification will establish packaging-specific drum age criteria (**DAC**) values for waste containers that have recently been added to the WIPP HWFP. The proposed changes will not reduce the ability of the Permittees to provide continued protection to human health and the environment.

The requested modifications to the WIPP HWFP and related supporting documents are provided in this PMR. The proposed modifications to the text of the WIPP HWFP have been identified using a double underline and a revision bar in the right hand margin for added information, and a ~~strikeout~~ font for deleted information. All direct quotations are indicated by italicized text. The following information specifically addresses how compliance has been achieved with the WIPP HWFP requirement, Permit Condition I.B.1 for submission of this Class 2 PMR. |

1. 20.4.1.900 NMAC (incorporating 40 CFR §270.42(b)(1)(i)) requires the applicant to describe the exact change to be made to the permit conditions and supporting documents referenced by the permit.

The modification proposes to establish packaging-specific DAC values for 85-gallon drums, 100-gallon drums, and ten-drum overpacks (**TDOPs**). The proposed packaging-specific DAC values have been determined using the methodology in *Determination of Drum Age Criteria and Prediction Factors Based on Packaging Configurations* (BWXT, 2000), which is the same methodology used to calculate currently permitted DAC values. This PMR has been prepared as directed by Section B1-1a(3) of Attachment B1 of the WIPP HWFP, which requires the following: *If additional packaging configurations are identified, an appropriate Permit Modification will be submitted to incorporate the DAC using the methodology in BWXT (2000)*.

The determination of packaging-specific DAC values for specific packaging configurations and filter hydrogen diffusivities using the BWXT (2000) methodology is described in a report entitled *Determination of Drum Age Criteria Values for Ten-Drum Overpacks, 85-Gallon Drums, and 100-Gallon Drums*. A copy of this report is provided as Attachment C of this PMR. The report documents how the BWXT (2000) methodology was used to determine the DAC values for 85-gallon drums, 100-gallon drums, and TDOPs that are proposed for addition to Tables B1-9 and B1-10 of Attachment B1 of the WIPP HWFP. The addition of the DAC values for 85-gallon drums, 100-gallon drums, and TDOPs also requires the revision of text in Sections B1-1a(1), B1-1a(2), and B1-1a(3) and Tables B1-5 and B1-8. Details of these revisions are summarized in Attachment A of this PMR.

The proposed changes to the WIPP HWFP text are presented in Attachment B of this PMR.

2. 20.4.1.900 NMAC (incorporating 40 CFR §270.42(b)(1)(ii)) requires the applicant to identify that the modification is a Class 2 modification.

The proposed modification is classified as a Class 2 permit modification because it is considered an *other change* to waste sampling and analysis methods in accordance with 20.4.1.900 NMAC incorporating 40 CFR §270.42 Appendix I, Item B.1.d. A Class 2 Permit Modification approved by the New Mexico Environment Department (**NMED**) on November 25, 2002, authorized the Permittees to dispose of transuranic mixed waste at WIPP that arrives in direct-loaded 85-gallon drums, 100-gallon drums, and direct-loaded TDOPs. A Class 3 Permit Modification approved by the NMED on December 31, 2002, established the BWXT (2000) methodology as the appropriate method for determining packaging-specific DAC values. The methodology used to determine the packaging-specific DAC values for new approved waste containers is the BWXT (2000) methodology, as directed by Section B1-1a(3) of Attachment B1 of the WIPP HWFP.

3. 20.4.1.900 NMAC (incorporating 40 CFR §270.42(b)(1)(iii)) requires the applicant to explain why the modification is needed.

As required by 20.4.1.500 NMAC incorporating 40 CFR §264.13(a), samples used to determine the characteristics of hazardous waste must be representative. The purpose of the DAC is to ensure that samples of gaseous volatile organic compounds collected from within a waste container have reached concentrations that are at least 90 percent of the equilibrium steady-state concentrations, after which the collection of a representative headspace gas sample is ensured. As stated in Section B1-1a(3) of Attachment B1 of the WIPP HWFP, *drum age criteria are to ensure that the container contents have reached 90 percent of steady state concentration within each layer of confinement*. The DAC values are implemented on a container basis in terms of the number of days required to reach 90 percent of steady-state.

The 85-gallon drum, 100-gallon drum, and TDOP have been added as permitted containers for waste management at the WIPP. Packaging-specific and default DAC values for these new approved containers are now required.

4. 20.4.1.900 NMAC (incorporating 40 CFR §270.42 (b)(1)(iv)) requires the applicant to provide the applicable information required by 40 CFR §§270.13 through 270.21, 270.62, and 270.63.

The regulatory crosswalk describes those portions of the WIPP HWFP that are affected by this PMR. Where applicable, regulatory citations in this modification reference Title 20, Chapter 4, Part 1, NMAC, revised June 14, 2000, incorporating the CFR, Title 40 (40 CFR Parts 264 and 270). 40 CFR §§270.16 through 270.22, 270.62, 270.63, and 270.66 are not applicable at WIPP. Consequently, they are not listed in the regulatory crosswalk table. 40 CFR §270.23 is applicable to the WIPP Hazardous Waste Disposal Units (**HWDUs**). This modification does not impact the conditions associated with the HWDUs.

5. 20.4.1.900 NMAC (incorporating 40 CFR §270.11(d)(1) and 40 CFR §270.30(k)) requires that any person signing under paragraph a and b must certify the document in accordance with 20.4.1.900 NMAC.

The transmittal letter for this PMR contains the signed certification statement in accordance with Module I.F of the WIPP HWFP.

Regulatory Crosswalk

Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the HWFP	Yes	No
§270.13		Contents of Part A permit application	Attachment O, Part A		T
§270.14(b)(1)		General facility description	Attachment A		T
§270.14(b)(2)	§264.13(a)	Chemical and physical analyses	Attachment B	T	
§270.14(b)(3)	§264.13(b)	Development and implementation of waste analysis plan	Attachment B	T	
	§264.13(c)	Off-site waste analysis requirements	Attachment B	T	
§270.14(b)(4)	§264.14(a-c)	Security procedures and equipment	Attachment C		T
§270.14(b)(5)	§264.15(a-d)	General inspection requirements	Attachment D		T
	§264.174	Container inspections	Attachment D		T
§270.23(a)(2)	§264.602	Miscellaneous units inspections	Attachment D		T
§270.14(b)(6)		Request for waiver from preparedness and prevention requirements of Part 264 Subpart C	NA		
§270.14(b)(7)	264 Subpart D	Contingency plan requirements	Attachment F		T
	§264.51	Contingency plan design and implementation	Attachment F		T
	§264.52 (a) & (c-f)	Contingency plan content	Attachment F		T
	§264.53	Contingency plan copies	Attachment F		T
	§264.54	Contingency plan amendment	Attachment F		T
	§264.55	Emergency coordinator	Attachment F		T
	§264.56	Emergency procedures	Attachment F		T
§270.14(b)(8)		Description of procedures, structures or equipment for:	Attachment E		T
§270.14(b)(8) (i)		Prevention of hazards in unloading operations (e.g., ramps and special forklifts)	Attachment E		T
§270.14(b)(8) (ii)		Runoff or flood prevention (e.g., berms, trenches, and dikes)	Attachment E		T
§270.14(b)(8) (iii)		Prevention of contamination of water supplies	Attachment E		T
§270.14(b)(8) (iv)		Mitigation of effects of equipment failure and power outages	Attachment E		T
§270.14(b)(8) (v)		Prevention of undue exposure of personnel (e.g., personal protective equipment)	Attachment E		T
§270.14(b)(8) (vi) §270.23(a)(2)	§264.601	Prevention of releases to the atmosphere	Module II Module IV Attachment M2 Attachment N		T
	264 Subpart C	Preparedness and Prevention	Attachment E		T
	§264.31	Design and operation of facility	Attachment E		T

Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the HWFP	Yes	No
	§264.32	Required equipment	Attachment E Attachment F		T
	§264.33	Testing and maintenance of equipment	Attachment D		T
	§264.34	Access to communication/alarm system	Attachment E		T
	§264.35	Required aisle space	Attachment E		T
	§264.37	Arrangements with local authorities	Attachment F		T
§270.14(b)(9)	§264.17(a-c)	Prevention of accidental ignition or reaction of ignitable, reactive, or incompatible wastes	Attachment E		T
§270.14(b) (10)		Traffic pattern, volume, and controls, for example: Identification of turn lanes Identification of traffic/stacking lanes, if appropriate Description of access road surface Description of access road load-bearing capacity Identification of traffic controls	Attachment G		T
§270.14(b) (11)(i) and (ii)	§264.18(a)	Seismic standard applicability and requirements	Part B, Rev. 6 Chapter B		T
§270.14(b) (11)(iii-v)	§264.18(b)	100-year floodplain standard	Part B, Rev. 6 Chapter B		T
	§264.18(c)	Other location standards	Part B, Rev. 6 Chapter B		T
§270.14(b) (12)	§264.16(a-e)	Personnel training program	Permit Module II Attachment H		T
§270.14(b) (13)	264 Subpart G	Closure and post-closure plans	Attachment I & J		T
§270.14(b)(13)	§264.111	Closure performance standard	Attachment I		T
§270.14(b)(13)	§264.112(a), (b)	Written content of closure plan	Attachment I		T
§270.14(b)(13)	§264.112(c)	Amendment of closure plan	Attachment I		T
§270.14(b)(13)	§264.112(d)	Notification of partial and final closure	Attachment I		T
§270.14(b)(13)	§264.112(e)	Removal of wastes and decontamination/dismantling of equipment	Attachment I		T
§270.14(b)(13)	§264.113	Time allowed for closure	Attachment I		T
§270.14(b)(13)	§264.114	Disposal/decontamination	Attachment I		T
§270.14(b)(13)	§264.115	Certification of closure	Attachment I		T
§270.14(b)(13)	§264.116	Survey plat	Attachment I		T
§270.14(b)(13)	§264.117	Post-closure care and use of property	Attachment J		T
§270.14(b)(13)	§264.118	Post-closure plan; amendment of plan	Attachment J		T

Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the HWFP	Yes	No
§270.14(b)(13)	§264.178	Closure/ containers	Attachment I		T
§270.14(b)(13)	§264.601	Environmental performance standards-Miscellaneous units	Attachment I		T
§270.14(b)(13)	§264.603	Post-closure care	Attachment I		T
§270.14(b)(14)	§264.119	Post-closure notices	Attachment J		T
§270.14(b)(15)	§264.142	Closure cost estimate	NA		T
	§264.143	Financial assurance	NA		T
§270.14(b)(16)	§264.144	Post-closure cost estimate	NA		T
	§264.145	Post-closure care financial assurance	NA		T
§270.14(b)(17)	§264.147	Liability insurance	NA		T
§270.14(b)(18)	§264.149-150	Proof of financial coverage	NA		T
§270.14(b)(19)(i), (vi), (vii), and (x)		Topographic map requirements Map scale and date Map orientation Legal boundaries Buildings Treatment, storage, and disposal operations Run-on/run-off control systems Fire control facilities	Attachment O Part A		T
§270.14(b)(19)(ii)	§264.18(b)	100-year floodplain	Attachment O Part A		T
§270.14(b)(19)(iii)		Surface waters	Attachment O Part A		T
§270.14(b)(19)(iv)		Surrounding Land use	Attachment O Part A		T
§270.14(b)(19)(v)		Wind rose	Attachment O Part A		T
§270.14(b)(19)(viii)	§264.14(b)	Access controls	Attachment O Part A		T
§270.14(b)(19)(ix)		Injection and withdrawal wells	Attachment O Part A		T
§270.14(b)(19)(xi)		Drainage on flood control barriers	Part B, Rev. 6 Chapter B, E, F		T

Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the HWFP	Yes	No
§270.14(b)(19)(xii)		Location of operational units	Part B, Rev. 6 Chapter B		T
§270.14(b)(20)		Other federal laws Wild and Scenic Rivers Act National Historic Preservation Act Endangered Species Act Coastal Zone Management Act Fish and Wildlife Coordination Act Executive Orders	Part B, Rev. 6 Chapter K		T
§270.15	§264 Subpart I	Containers	Attachment M1		T
	§264.171	Condition of containers	Attachment M1		T
	§264.172	Compatibility of waste with containers	Attachment M1		T
	§264.173	Management of containers	Attachment M1		T
	§264.174	Inspections	Attachment D Attachment M1		T
§270.15(a)	§264.175	Containment systems	Attachment M1		T
§270.15(c)	§264.176	Special requirements for ignitable or reactive waste	Attachment E Permit Module II		T
§270..15(d)	§264.177	Special requirements for incompatible wastes	Attachment E Permit Module II		T
	§264.178	Closure	Attachment I		T
§270.15(e)	§264.179	Air emission standards	Attachment E Attachment N		T
§270.23	264 Subpart X	Miscellaneous units	Attachment M2		T
§270.23(a)	§264.601	Detailed unit description	Attachment M2		T
§270.23(b)	§264.601	Hydrologic, geologic, and meteorologic assessments	Permit Module IV Attachment M2		T
§270.23(c)	§264.601	Potential exposure pathways	Permit Module IV Attachment M2 Attachment N		T
§270.23(d)		Demonstration of treatment effectiveness	Permit Module IV Attachment M2 Attachment N		T
	§264.602	Monitoring, analysis, inspection, response, reporting, and corrective action	Permit Module IV Attachment M2 Attachment N		T
	§264.603	Post-closure care	Attachment J Attachment J1		T
	264 Subpart E	Manifest system, record keeping, and reporting	Permit Module I Permit Module II Permit Module IV Attachment B		T

Attachment A

Table of Changes

Table of Changes

Affected Permit Section	Explanation for Change
a.1. Attachment B1, Section B1-1a(1) a.2. Attachment B1, Section B1-1a(2)	Text has been revised in Sections B1-1a(1) and B1-1a(2) as follows: • To specify the conservative default Packaging Configuration Group 3 for 85- and 100-gallon drums and Packaging Configuration Group 6 for ten-drum overpacks (TDOPs). • To indicate that Packaging Configuration Group 7 (which has been added for specific packaging configurations of 85- and 100-gallon drums) is not Summary Category Group dependent. • To clarify that the Packaging Configuration Group requirements apply when the 85-gallon drum, 100-gallon drum, or TDOP is used for the direct loading of waste. • To specify that compacted 55-gallon drums must have met the appropriate 55-gallon drum DAC.
a.3. Attachment B1, Section B1-1a(3)	Text has been revised as follows: • To specify the conservative default Packaging Configuration Group 3 for 85- and 100-gallon drums and Packaging Configuration Group 6 for TDOPs. • To expand the statement pertaining to the applicability of the DAC to include 85-gallon drums, 100-gallon drums, and TDOPs.
a.4. Attachment B1, Table B1-5	Table B1-5 has been revised as follows: • To clarify that the descriptions for Scenarios 1 and 2 apply to 55-gallon drums. • To clarify that Scenario 3 applies to 55-gallon drums, 85-gallon drums, 100-gallon drums, and TDOPs.
a.5. Attachment B1, Table B1-8	Table B1-8 has been revised as follows: • To add the TDOP configuration to Packaging Configuration Groups 5 and 6. • To add Packaging Configuration Group 7 to describe specific packaging configurations for 85- and 100-gallon drums that are directly loaded with waste. • To specify (in Footnote “a”) the conservative default Packaging Configuration Group 3 for 85- and 100-gallon drums and Packaging Configuration Group 6 for TDOPs.

<table>
<tr><th>Affected Permit Section</th><th>Explanation for Change</th></tr>
<tr><td>a.6. Attachment B1, Table B1-9</td><td rowspan="2">Tables B1-9 and B1-10 have been revised as follows:
• To specify TDOP DAC values for Packaging Configuration Groups 5 and 6 and 85- and 100-gallon drum DAC values for Packaging Configuration Group 7.
• To clarify (in Footnote “c”) that, similar to the standard waste box, the filter H_2 diffusivity specified for a TDOP is the sum of the diffusivities for all of the filters on the container.
• To add a new Footnote “d” for Packaging Configuration Group 7 (85- and 100-gallon drums) to clarify that the DAC values apply when the headspace gas sample is taken between the inner and outer drum lids. Footnote “d” specifies a DAC value of 2 days for an 85- or 100-gallon drum in which the headspace gas sample is taken inside the filtered inner drum lid.
• To add a new Footnote “e” to clarify that while a DAC value of 2 days may be determined, containers must also comply with the equilibrium requirements of Section B1-1a (i.e., 72 hours at 18EC or higher). Generator sites may comply with these requirements simultaneously.</td></tr>
<tr><td>a.7. Attachment B1, Table B1-10</td></tr>
</table>

Attachment B

Proposed Revised Permit Text

Proposed Revised Permit Text:

a.1. Attachment B1, Section B1-1a(1)

B1-1a(1) Summary Category S5000 Requirements

All waste containers or randomly selected containers from waste streams that meet the conditions for reduced headspace gas sampling listed in Permit Attachment B, Section B-3a(1), designated as summary category S5000 (Debris waste) shall be categorized under one of the sampling scenarios shown in Table B1-5 and depicted in Figure B1-1. If the container is categorized under Scenario 1, the applicable drum age criteria (**DAC**) from Table B1-6 must be met prior to headspace gas sampling. If the container is categorized under Scenario 2, the applicable Scenario 1 DAC from Table B1-6 must be met prior to venting the container and then the applicable Scenario 2 DAC from Table B1-7 must be met after venting the container. The DAC for Scenario 2 containers that contain filters or rigid liner vent holes other than those listed in Table B1-7 shall be determined using footnotes "a" and "b" in Table B1-7. Containers that have not met the Scenario 1 DAC at the time of venting must be categorized under Scenario 3. Containers categorized under Scenario 3 must be placed into one of the Packaging Configuration Groups listed in Table B1-8. If a specific packaging configuration cannot be determined based on the data collected during packaging and/or repackaging (Attachment B, Section B-3(d)1), a conservative default Packaging Configuration Group of 3 for 55-gallon, 85-gallon, and 100-gallon drums and 6 for Standard Waste Boxes (**SWBs**) and ten-drum overpacks (**TDOPs**) must be assigned, provided the drums do not contain pipe component packaging. If a container is designated as Packaging Configuration Group 4 (i.e., a pipe component), the headspace gas sample must be taken from the pipe component headspace. If a 100-gallon drum (i.e. Packaging Configuration Group 7) contains a compacted 55-gallon drum containing a rigid liner, the 55-gallon drum must meet the appropriate 55-gallon drum DAC listed in Table B1-6, B1-7 or B1-10 to ensure that VOC solubility associated with the presence of the 55-gallon rigid drum liner does not impact the DAC for the 100-gallon drum. The DAC for Scenario 3 containers that contain rigid liner vent holes that are undocumented during packaging (Attachment B, Section B-3(d)1), repackaging (Attachment B, Section B-3(d)1), and/or venting (Section B1-1a[6][ii]) shall be determined using the default conditions in footnote "b" in Table B1-9.The DAC for Scenario 3 containers that contain filters that are either undocumented or are other than those listed in Table B1-9 shall be determined using footnote 'a' in Table B1-9. Each of the Scenario 3 containers shall be sampled for headspace gas after waiting the DAC in Table B1-9 based on its packaging configuration (note: Packaging Configuration Groups 4, 5, ~~and~~ 6, and 7 are not summary category group dependent, and 85-gallon drum, 100-gallon drum, SWB, and TDOP requirements apply when the 85-gallon drum, 100-gallon drum, SWB, or TDOP ~~itself~~ is used for the direct loading of waste).

a.2. Attachment B1, Section B1-1a(2)

B1-1a(2) Summary Category S3000/S4000 Requirements

All waste containers or randomly selected containers from waste streams that meet the conditions for reduced headspace gas sampling listed in Permit Attachment B, Section B-3a(1), designated as summary categories S3000 (Homogenous solids) and S4000 (Soil/gravel) shall be categorized under one of the sampling scenarios shown in Table B1-5 and depicted in Figure B1-1. If the container is categorized under Scenario 1, the applicable DAC from Table B1-6 must be met prior to headspace gas sampling. If the container is categorized under Scenario 2, the applicable Scenario 1 DAC from Table B1-6 must be met prior to venting the container and then the applicable Scenario 2 DAC from Table B1-7 must be met after venting the container. The DAC for Scenario 2 containers that contain filters or rigid liner vent holes other than those listed in Table B1-7 shall be determined using footnotes “a” and “b” in Table B1-7. Containers that have not met the Scenario 1 DAC at the time of venting must be categorized under Scenario 3. Containers categorized under Scenario 3 must be placed into one of the Packaging Configuration Groups listed in Table B1-8. If a specific packaging configuration cannot be determined based on the data collected during packaging and/or repackaging (Attachment B, Section B-3(d)1), a conservative default Packaging Configuration Group of 3 for 55-gallon, 85-gallon, and 100-gallon drums and 6 for SWBs and TDOPs must be assigned, provided the drums do not contain pipe component packaging. If a container is designated as Packaging Configuration Group 4 (i.e., a pipe component), the headspace gas sample must be taken from the pipe component headspace. If a 100-gallon drum (i.e. Packaging Configuration Group 7) contains a compacted 55-gallon drum containing a rigid liner, the 55-gallon drum must meet the appropriate 55-gallon drum DAC listed in Table B1-6, B1-7 or B1-10 to ensure that VOC solubility associated with the presence of the 55-gallon rigid drum liner does not impact the DAC for the 100-gallon drum. The DAC for Scenario 3 containers that contain rigid liner vent holes that are undocumented during packaging (Attachment B, Section B-3(d)1), repackaging (Attachment B, Section B-3(d)1), and/or venting (Section B1-1a[6][ii]) shall be determined using the default conditions in footnote “b” in Table B1-10. The DAC for Scenario 3 containers that contain filters that are either undocumented or are other than those listed in Table B1-10 shall be determined using footnote ‘a’ in Table B1-10. Each of the Scenario 3 containers shall be sampled after waiting the DAC in Table B1-10 based on its packaging configuration (note: Packaging Configuration Groups 4, 5, ~~and~~ 6, and 7 are not summary category group dependent, and 85-gallon drum, 100-gallon drum, SWB, and TDOP requirements apply when the 85-gallon drum, 100-gallon drum, SWB, or TDOP ~~itself~~ is used for the direct loading of waste).

a.3. Attachment B1, Section B1-1a(3)

B1-1a(3) General Requirements

The determination of packaging configuration consists of identifying the number of confinement layers and the identification of rigid poly liners when present. Generator/storage sites shall use either the default conditions specified in Tables B1-7 through B1-10 for retrievably stored waste or the data documented during packaging (Attachment B, Section B-3(d)1), repackaging (Attachment B, Section B-3(d)1), and/or venting (Section B1-1a[6][ii]) for determining the appropriate DAC for each container from which a headspace gas sample is collected. These drum age criteria are to ensure that the container contents have reached 90 percent of steady state concentration within each layer of confinement (Lockheed, 1995; BWXT, 2000). The following information must be reported in the headspace gas sampling documents for each container from which a headspace gas sample is collected:

- sampling scenario from Table B1-5 and associated information from Tables B1-6 and/or Table B1-7;
- the packaging configuration from Table B1-8 and associated information from Tables B1-9 or B1-10, including the diameter of the rigid liner vent hole, the number of inner bags, the number of liner bags, the presence/absence of drum liner, and the filter hydrogen diffusivity,
- the permit-required equilibrium time, and
- the drum age.

For all retrievably stored waste containers, the rigid liner vent hole diameter must be assumed to be 0.3 inches unless a different size is documented during drum venting or repackaging. For all retrievably store waste containers, the filter hydrogen diffusivity must be assumed to be the most restrictive unless container-specific information clearly identifies a filter model and/or diffusivity characteristic that is less restrictive. For all retrievably stored waste containers that have not been repackaged, acceptable knowledge shall not be used to justify any packaging configuration less conservative than the default (i.e., Packaging Configuration Group 3 for 55-gallon, 85-gallon, and 100-gallon drums and 6 for SWBs and TDOPs). For information reporting purposes listed above, sites may report the default packaging configuration for retrievably stored waste without further confirmation.

All waste containers with unvented rigid containers greater than 4 liters (exclusive of rigid poly liners) shall be subject to innermost layer of containment sampling or shall be vented prior to initiating drum age and equilibrium criteria. When sampling the rigid poly liner under Scenario 1, the sampling device must form an airtight seal with the rigid poly liner to ensure that a representative sample is collected (using a sampling needle connected to the sampling head to pierce the rigid poly liner, and that allows for the collection of a representative sample, satisfies this requirement). The configuration of the containment area and remote-handling equipment at each sampling facility are expected to differ. Headspace-gas samples will be analyzed for the analytes listed in Table B3-2 of Permit

Attachment B3. If additional packaging configurations are identified, an appropriate Permit Modification will be submitted to incorporate the DAC using the methodology in BWXT (2000). Consistent with footnote “a” in Table B1-8, any waste container that cannot be assigned a packaging configuration specified in Table B1-8 shall not be shipped to or accepted for disposal at WIPP.

Drum age criteria apply only to 55-gallon drums, 85-gallon drums, 100-gallon drums, ~~and~~ standard waste boxes, and TDOPs. Drum age criteria for all other container types must be established through permit modification prior to acceptance of these containers at WIPP.

a.4. Attachment B1, Table B1-5

TABLE B1-5
HEADSPACE GAS DRUM AGE CRITERIA SAMPLING SCENARIOS

Scenario	Description
1	A. Unvented 55-gallon drums without rigid poly liners are sampled through the drum lid at the time of venting. B1. Unvented 55-gallon drums with unvented rigid poly liners are sampled through the rigid poly liner at the time of venting or prior to venting. B2. Vented 55-gallon drums with unvented rigid poly liners are sampled through the rigid poly liner at the time of venting or prior to venting. C. Unvented 55-gallon drums with vented rigid poly liners are sampled through the drum lid at the time of venting.
2	55-gallon dDrums that have met the criteria for Scenario 1 and then are vented, but not sampled at the time of venting. [a]
3	Containers (i.e., 55-gallon drums, 85-gallon drums, 100-gallon drums, SWBs, TDOPs, and pipe components) that are initially packaged in a vented condition and sampled in the container headspace and containers that are not sampled under Scenario 1 or 2.

[a] Containers that have not met the Scenario 1 DAC at the time of venting must be categorized under Scenario 3. This requires the additional information required of each container in Scenario 3 (i.e., determination of packaging configuration), and such containers can only be sampled after meeting the appropriate Scenario 3 DAC.

a.5. Attachment B1, Table B1-8

TABLE B1-8
SCENARIO 3 PACKAGING CONFIGURATION GROUPS

Packaging Configuration Group	Covered S3000/S4000 Packaging Configuration Groups	Covered S5000 Packaging Configuration Groups
Packaging Configuration Group 1, 55 gal. drums [a]	• No layers of confinement, filtered inner lid [b] • No inner bags, no liner bags (bounding case)	• No layers of confinement, filtered inner lid [b] • No inner bags, no liner bags (bounding case)
Packaging Configuration Group 2, 55 gal. drums [a]	• 1 inner bag • 1 filtered inner bag • 1 liner bag (bounding case) • 1 filtered liner bag	• 1 inner bag • 1 filtered inner bag • 1 liner bag • 1 filtered liner bag • 1 inner bag, 1 liner bag • 1 filtered inner bag, 1 filtered liner bag • 2 inner bags • 2 filtered inner bags • 2 inner bags, 1 liner bag • 2 filtered inner bags, 1 filtered liner bag • 3 inner bags • 3 filtered inner bags • 3 filtered inner bags, 1 filtered liner bag • 3 inner bags, 1 liner bag (bounding case)
Packaging Configuration Group 3, 55 gal. drums [a]	• 1 inner bag, 1 liner bag • 1 filtered inner bag, 1 filtered liner bag • 2 inner bags • 2 filtered inner bags • 2 liner bags (bounding case) • 2 filtered liner bags	• 2 liner bags • 2 filtered liner bags • 1 inner bag, 2 liner bags • 1 filtered inner bag, 2 filtered liner bags • 2 inner bags, 2 liner bags • 2 filtered inner bags, 2 filtered liner bags • 3 filtered inner bags, 2 filtered liner bags • 4 inner bags • 3 inner bags, 2 liner bags • 4 inner bags, 2 liner bags (bounding case)

Packaging Configuration Group	**Covered S3000/S4000 Packaging Configuration Groups**	**Covered S5000 Packaging Configuration Groups**
Packaging Configuration Group 4, pipe components	• No layers of confinement inside a pipe component • 1 filtered inner bag, 1 filtered metal can inside a pipe component • 2 inner bags inside a pipe component • 2 filtered inner bags inside a pipe component • 2 filtered inner bags, 1 filtered metal can inside a pipe component • 2 inner bags, 1 filtered metal can inside a pipe component (bounding case)	• No layers of confinement inside a pipe component • 1 filtered inner bag, 1 filtered metal can inside a pipe component • 2 inner bags inside a pipe component • 2 filtered inner bags inside a pipe component • 2 filtered inner bags, 1 filtered metal can inside a pipe component • 2 inner bags, 1 filtered metal can inside a pipe component (bounding case)
Packaging Configuration Group 5, Standard Waste Box or Ten-Drum Overpack [a]	• No layers of confinement • 1 SWB liner bag (bounding case)	• No layers of confinement • 1 SWB liner bag (bounding case)
Packaging Configuration Group 6, Standard Waste Box or Ten-Drum Overpack [a]	• any combination of inner and/or liner bags that is less than or equal to 6 • 5 inner bags, 1 SWB liner bag (bounding case)	• any combination of inner and/or liner bags that is less than or equal to 6 • 5 inner bags, 1 SWB liner bag (bounding case)
Packaging Configuration Group 7, 85-gal. drums and 100-gal. drums [a]	• No inner bags, no liner bags, no rigid liner, filtered inner lid (bounding case) [b] • No inner bags, no liner bags, no rigid liner	• No inner bags, no liner bags, no rigid liner, filtered inner lid (bounding case) [b] • No inner bags, no liner bags, no rigid liner

[a] If a specific Packaging Configuration Groups cannot be determined based on the data collected during packaging (Attachment B, Section B-3(d)1) and/or repackaging (Attachment B, Section B-3(d)1), a conservative default Packaging Configuration Group of 3 for 55-gallon, 85-gallon, and 100-gallon drums and 6 for SWBs and TDOPs must be assigned provided the drums do not contain pipe component packaging. If pipe components are present as packaging in the drums, the pipe components must be sampled following the requirements for Packaging Configuration Group 4.

[b] A “filtered inner lid” is the inner lid on a double lid drum that contains a filter.

Definitions:

Liner Bags: One or more optional plastic bags that are used to control radiological contamination. Liner bags for drums have a thickness of approximately 11 mils. SWB/TDOP liner bags have a thickness of approximately 14 mils. Liner bags are typically similar in size to the container.

Inner Bags: One or more optional plastic bags that are used to control radiological contamination. Inner bags have a thickness of approximately 5 mils and are typically smaller than liner bags.

a.6. Attachment B1, Table B1-9

TABLE B1-9
SCENARIO 3 DRUM AGE CRITERIA (in days) MATRIX FOR S5000 WASTE BY PACKAGING CONFIGURATION GROUP

Packaging Configuration Group 1

Filter H_2 Diffusivity [a] (mol/s/mol fraction)	Rigid Liner Vent Hole Diameter [b] 0.3-inch Diameter Hole	0.375-inch Diameter Hole	0.75-inch Diameter Hole	1-inch Diameter Hole	No Liner Lid	No Liner
1.9×10^{-6}	131	95	37	24	4	4
3.7×10^{-6}	111	85	36	24	4	4
3.7×10^{-5}	28	28	23	19	4	4

Packaging Configuration Group 2

Filter H_2 Diffusivity [a] (mol/s/mol fraction)	Rigid Liner Vent Hole Diameter [b] 0.3-inch Diameter Hole	0.375-inch Diameter Hole	0.75-inch Diameter Hole	1-inch Diameter Hole	No Liner Lid	No Liner
1.9×10^{-6}	175	138	75	60	30	11
3.7×10^{-6}	152	126	73	59	30	11
3.7×10^{-5}	58	57	52	47	28	8

Packaging Configuration Group 3

Filter H_2 Diffusivity [a] (mol/s/mol fraction)	Rigid Liner Vent Hole Diameter [b] 0.3-inch Diameter Hole	0.375-inch Diameter Hole	0.75-inch Diameter Hole	1-inch Diameter Hole	No Liner Lid	No Liner
1.9×10^{-6}	199	161	96	80	46	16
3.7×10^{-6}	175	148	93	79	46	16
3.7×10^{-5}	72	72	67	62	42	10

Packaging Configuration Group 4

Filter H_2 Diffusivity [a] (mol/s/mol fraction)	Headspace Sample Taken Inside Pipe Component

> 1.9 x 10^{-6}	152

Packaging Configuration Group 5	
Filter H_2 Diffusivity [a, c] (mol/s/mol fraction)	**Headspace Sample Taken Inside SWB/TDOP**
> 7.4 x 10^{-6} (SWB)	15
> 3.33 x 10^{-5} (TDOP)	15

Packaging Configuration Group 6	
Filter H_2 Diffusivity [a, c] (mol/s/mol fraction)	**Headspace Sample Taken Inside SWB/TDOP**
> 7.4 x 10^{-6} (SWB)	56
> 3.33 x 10^{-5} (TDOP)	56

Packaging Configuration Group 7[d]			
Filter H_2 Diffusivity [a] (mol/s/mol fraction)	**Inner Lid Filter Vent Minimum H_2 Diffusivity (mol/s/mol fraction) [a]**		
	7.4 x 10^{-6}	**1.85 x 10^{-5}**	**9.25 x 10^{-5} [e]**
3.7 x 10^{-6}	13	7	2
7.4 x 10^{-6}	10	6	2
1.85 x 10^{-5}	6	4	2

[a] The documented filter H_2 diffusivity must be greater than or equal to the listed value to use the DAC for the listed filter H_2 diffusivity (e.g., a container with a filter H_2 diffusivity of 4.2 x 10^{-6} must use a DAC for a filter with a 3.7 x 10^{-6} filter H_2 diffusivity). If a filter H_2 diffusivity for a container is undocumented or unknown or is less than 1.9 x 10^{-6} filter H_2 diffusivity, a filter of known H_2 diffusivity that is greater than or equal to 1.9 x 10^{-6} filter H_2 diffusivity must be installed prior to initiation of the relevant DAC period.

[b] The documented rigid liner vent hole diameter must be greater than or equal to the listed value to use the DAC for the listed rigid liner vent hole diameter (e.g., a container with a rigid liner vent hole of 0.5 in. must use a DAC for a rigid liner vent hole of 0.375 in.). If the rigid liner vent hole diameter for a container is undocumented during packaging (Attachment B, Section B-3(d)1), repackaging (Attachment B, Section B-3(d)1), and/or venting (Section B1-1a[6][ii]), that container must use a DAC for a rigid liner vent hole diameter of 0.30 in.

[c] The filter H_2 diffusivity for SWBs or TDOPs is the sum of the diffusivities for all of the filters on the container because SWBs and TDOPs have more than 1 filter.

[d] Headspace sample taken between inner and outer drum lids. If headspace sample is taken inside the filtered inner drum lid prior to placement of the outer drum lid, then a DAC value of 2 days may be used. Footnote e is also applicable.

[e] While a DAC value of 2 days may be determined, containers must comply with the equilibrium requirements specified in Section B1-1a (i.e., 72 hours at 18EC or higher). Generator sites may comply with these requirements simultaneously.

a.7. Attachment B1, Table B1-10

TABLE B1-10
SCENARIO 3 DRUM AGE CRITERIA (in days) MATRIX FOR S3000 AND S4000 WASTE BY PACKAGING CONFIGURATION GROUP

Packaging Configuration Group 1						
Filter H_2 Diffusivity [a] (mol/s/mol fraction)	**Rigid Liner Vent Hole Diameter [b]**				**No Liner Lid**	**No Liner**
	0.3-inch Diameter Hole	**0.375-inch Diameter Hole**	**0.75-inch Diameter Hole**	**1-inch Diameter Hole**		
1.9×10^{-6}	131	95	37	24	4	4
3.7×10^{-6}	111	85	36	24	4	4
3.7×10^{-5}	28	28	23	19	4	4

Packaging Configuration Group 2						
Filter H_2 Diffusivity [a] (mol/s/mol fraction)	**Rigid Liner Vent Hole Diameter [b]**				**No Liner Lid**	**No Liner**
	0.3-inch Diameter Hole	**0.375-inch Diameter Hole**	**0.75-inch Diameter Hole**	**1-inch Diameter Hole**		
1.9×10^{-6}	213	175	108	92	56	18
3.7×10^{-6}	188	161	105	90	56	17
3.7×10^{-5}	80	80	75	71	49	10

Packaging Configuration Group 3						
Filter H_2 Diffusivity [a] (mol/s/mol fraction)	**Rigid Liner Vent Hole Diameter [b]**				**No Liner Lid**	**No Liner**
	0.3-inch Diameter Hole	**0.375-inch Diameter Hole**	**0.75-inch Diameter Hole**	**1-inch Diameter Hole**		

1.9×10^{-6}	283	243	171	154	107	34
3.7×10^{-6}	253	225	166	151	106	31
3.7×10^{-5}	121	121	115	110	84	13

Packaging Configuration Group 4	
Filter H_2 Diffusivity [a] (mol/s/mol fraction)	**Headspace Sample Taken Inside Pipe Component**
> 1.9×10^{-6}	152

Packaging Configuration Group 5	
Filter H_2 Diffusivity [a, c] (mol/s/mol fraction)	**Headspace Sample Taken Inside SWBS/TDOP**
> 7.4×10^{-6} (SWB)	15
> 3.33×10^{-5} (TDOP)	15

Packaging Configuration Group 6	
Filter H_2 Diffusivity [a, c] (mol/s/mol fraction)	**Headspace Sample Taken Inside SWBS/TDOP**
> 7.4×10^{-6} (SWB)	56
> 3.33×10^{-5} (TDOP)	56

Packaging Configuration Group 7[d]			
Filter H_2 Diffusivity [a] (mol/s/mol fraction)	**Inner Lid Filter Vent Minimum H_2 Diffusivity (mol/s/mol fraction) [a]**		
	7.4×10^{-6}	**1.85×10^{-5}**	**9.25×10^{-5} [e]**
3.7×10^{-6}	13	7	2
7.4×10^{-6}	10	6	2
1.85×10^{-5}	6	4	2

[a] The documented filter H_2 diffusivity must be greater than or equal to the listed value to use the DAC for the listed filter H_2 diffusivity (e.g., a container with a filter H_2 diffusivity of 4.2×10^{-6} must use a DAC for a filter with a 3.7×10^{-6} filter H_2 diffusivity). If a filter H_2 diffusivity for a container is undocumented or unknown or is less than 1.9×10^{-6} filter H_2 diffusivity, a filter of known H_2 diffusivity that is greater than or equal to 1.9×10^{-6} filter H_2 diffusivity must be installed prior to initiation of the relevant DAC period.

[b] The documented rigid liner vent hole diameter must be greater than or equal to the listed value to use the DAC for the listed rigid liner vent hole diameter (e.g., a container with a rigid liner vent hole of 0.5. in must use a DAC for a rigid liner vent hole of 0.375 in.). If the rigid liner vent hole diameter for a container is

undocumented during packaging (Attachment B, Section B-3(d)1), repackaging (Attachment B, Section B-3(d)1), and/or venting (Section B1-1a[6][ii]), that container must use a DAC for a rigid liner vent hole diameter of 0.30 in.

[c] The filter H_2 diffusivity for SWBs or TDOPs is the sum of the diffusivities for all of the filters on the container because SWBs and TDOPs have more than 1 filter.

[d] Headspace sample taken between inner and outer drum lids. If headspace sample is taken inside the filtered inner drum lid prior to placement of the outer drum lid, then a DAC value of 2 days may be used. Footnote e is also applicable.

[e] While a DAC value of 2 days may be determined, containers must comply with the equilibrium requirements specified in Section B1-1a (i.e., 72 hours at 18EC or higher). Generator sites may comply with these requirements simultaneously.

Attachment C

Determination of Drum Age Criteria Values for Ten-Drum Overpacks, 85-Gallon Drums, and 100-Gallon Drums

DETERMINATION OF DRUM AGE CRITERIA VALUES FOR TEN-DRUM OVERPACKS, 85-GALLON DRUMS, AND 100-GALLON DRUMS

REVISION 0

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Background and Purpose

Containers of transuranic (TRU) waste must meet a minimum age criterion before a gas sample collected from the waste container is considered representative of the gas within the container headspace. The drum age criterion (DAC) is the time required after container closure, or after container closure and container venting, before a headspace gas sample can be collected. The methodology described in "Determination of Drum Age Criteria and Prediction Factors Based on Packaging Configurations" (Bechtel BWXT Idaho, LLC [BWXT], 2000) [1] is the basis for the packaging-specific DAC values currently approved in the Hazardous Waste Facility Permit for the Waste Isolation Pilot Plant (WIPP) ("Permit") [2].

The following three new waste containers have been approved in the Permit for disposal at the WIPP: direct-loaded ten-drum overpack (TDOP), 100-gallon drum, and direct-loaded 85-gallon drum.

The purpose of this report is to document packaging-specific DAC values for the TDOP, 100-gallon drum, and 85-gallon drum as determined using the BWXT (2000) methodology [1]. The application of the BWXT (2000) methodology [1] to the TDOP, 100-gallon drum, and 85-gallon drum is consistent with the direction provided by Section B1-1a (3) of Attachment B1 of the Permit [2], which requires the following: "If additional packaging configurations are identified, an appropriate Permit Modification will be submitted to incorporate the DAC using the methodology in BWXT (2000)." Model parameters and assumptions used in determining the DAC values are also documented in this report.

Assumptions

The BWXT (2000) report documents all parameters and assumptions used in previous DAC calculations [1]. Parameter values specific to the TDOP, 100-gallon drum, and 85-gallon drum are listed in the input and output files included in Appendix A. Additional assumptions used in determining the DAC values for the TDOP, 100-gallon drum, and 85-gallon drum are presented in this section.

TDOP

The TDOP packaging configurations consist of (1) up to one SWB liner bag and (2) up to six bag layers total, up to one of which may be an SWB liner bag. The TDOP has nine filter vents with minimum hydrogen diffusivity values of 3.7E-6 moles per second per mole fraction (mol/s/mol fraction). All other configuration parameters for the TDOP are assumed to be the same as those used for determining the packaging-specific DAC values for the SWB [1]. The inner bags and SWB liner bags used in the TDOP packaging configurations are of the same dimensions as those used in an SWB.

100-Gallon Drum

The modeled 100-gallon drum packaging configuration includes one filtered non-polymeric (e.g., steel) inner drum lid, no layers of confinement, and no rigid drum liner. The DAC values are calculated for the case in which the headspace gas sample is collected between the inner and outer drum lids, as well as for the case in which the headspace gas sample is collected inside the inner drum lid. The DAC values for this 100-gallon drum packaging configuration were determined for three hydrogen diffusion values for the inner drum lid filter vent (i.e., 7.4E-6 mol/s/mol fraction, 1.85E-5 mol/s/mol fraction, and 9.25E-5 mol/s/mol fraction) in combination with three hydrogen diffusion values for the outer drum lid filter vent (i.e., 3.7E-6 mol/s/mol fraction, 7.4E-6 mol/s/mol fraction, and 1.85E-5 mol/s/mol fraction).

In some cases, 55-gallon drums may be supercompacted and packaged as "pucks" directly into 100-gallon drums. Compacted 55-gallon drums containing rigid drum liners placed inside the 100-gallon drum must meet the appropriate 55-gallon drum DAC value established by the Permit [2] prior to compaction. This ensures that VOC solubility associated with the presence of the 55-gallon rigid drum liner does not impact the calculated DAC for a 100-gallon drum.

85-Gallon Drum

The packaging configuration and possible sampling locations with respect to the inner and outer drum lids for the 85-gallon drum are assumed to be the same as the 100-gallon drum.

Defining DAC Values for TDOP, 100-Gallon Drum, and 85-Gallon Drum

The DAC values calculated using the methodology described in BWXT (2000) [1] for the TDOP, 100-gallon drum, and 85-gallon drum packaging configurations are documented in the output files included in Appendix A. In some cases, a more conservative DAC value than that shown in the output files was selected to simplify and facilitate implementation at the generator sites. These differences are summarized, with explanations as needed, in Table A-1 of Appendix A. Table 1 presents the DAC values applicable to the TDOP, 100-gallon drum, and 85-gallon drum packaging configurations.

As shown in Table 1, the DAC values for the TDOP are the same as those determined for the SWB [1]. Except for the total hydrogen diffusivity of the TDOP filters, all input parameters are the same as the SWB. The minimum total hydrogen diffusivity of the TDOP filters (nine filters, each with a hydrogen diffusivity value of 3.7E-6 mol/s/mol fraction) is 4.5 times greater than the minimum total hydrogen diffusivity of the SWB filters (two filters, each with a hydrogen diffusivity value of 3.7E-6 mol/s/mol fraction). As shown in the output files in Appendix A, the difference in the total hydrogen diffusivity values between the TDOP and the SWB filters results in the calculation of shorter DAC values for the TDOP. The SWB DAC values bound the DAC values for the modeled TDOP packaging configurations.

Table 1
DAC Values (in days) for Summary Category Groups S3000, S4000, and S5000

TDOP with Up to One Liner Bag	
TDOP Minimum Total Filter Diffusivity[a] (mol/s/mol fraction)	Headspace Sample Taken Inside Direct Load TDOP
3.33E-5	15

TDOP with Up to Five Inner Bags and One Liner Bag	
TDOP Minimum Total Filter Diffusivity[a] (mol/s/mol fraction)	Headspace Sample Taken Inside Direct Load TDOP
3.33E-5	56

100-Gallon Drum and 85-Gallon Drum with Headspace Samples Taken between Inner and Outer Drum Lids[b]			
Outer Lid Minimum Filter Diffusivity (mol/s/mol fraction)	Inner Lid Filter Minimum Diffusivity (mol/s/mol fraction)		
	7.4E-6	1.85E-5	9.25E-5
3.7E-6	13	7	2
7.4E-6	10	6	2
1.85E-5	6	4	2

[a] Sum of all filters in the lid of the TDOP.
[b] If headspace sample is taken inside the non-polymeric (e.g., steel) inner drum lid with a filter vent of hydrogen diffusivity value equal to or greater than 7.4E-6 mol/s/mol fraction prior to placement of the outer drum lid, then a DAC value of 2 days is applicable.

The DAC values calculated for 85-gallon drums are less than the DAC values for the 100-gallon drum as shown in the output files included in Appendix A due to the smaller void volume in the 85-gallon drum. As documented in Table A-1 of Appendix A, the 100-gallon drum DAC values bound the DAC values for the 85-gallon drum packaging configurations that were modeled.

For the case in which the 100-gallon drum or 85-gallon drum headspace gas sample is taken inside the inner drum lid, the highest DAC value determined was one day for a drum with an inner drum lid filter vent with a hydrogen diffusivity value equal to or greater than 7.4E-6 mol/s/mol fraction. As documented in Appendix A, a 2-day DAC value bounds the 100-gallon drum and 85-gallon drum packaging configurations sampled inside the inner drum lid.

References

32 Liekhus, K.J., Djordjevic, S.M., Devarakonda, M., and Connolly, M.J., October 2000, "Determination of Drum Age Criteria and Prediction Factors Based on Packaging Configurations," INEEL/EXT-2000-01207, Bechtel BWXT Idaho, LLC, Idaho Falls, Idaho.

33 New Mexico Environment Department, "Waste Isolation Pilot Plant Hazardous Waste Facility Permit," NM4890139088-TSDF, New Mexico Environment Department, Santa Fe, New Mexico.

1.18
Input and Output Files Associated with DAC Value Determination for the TDOP, 85-Gallon Drum, and 100-Gallon Drum

This appendix includes the input and output files for the TDOP, 85-gallon drum, and 100-gallon drum that document the calculation of DAC values using the methodology described in BWXT (2000) [1]. In some cases, a more conservative DAC value than that shown in the output files was selected to simplify and facilitate implementation at the generator sites. These differences are summarized, with explanations as needed, in Table A-1.

Table A-1
Correlation between Calculated DAC Values and DAC Values Selected for Use for the TDOP, 100-Gallon Drum, and 85-Gallon Drum

Input/Output Filename	Waste Container Type and Packaging	DAC Value Calculated by VDRUM	DAC Value Selected for Use	Justification for Difference (if applicable)
TDOP				
tdop02/ tdop02.out	TDOP with one SWB liner bag and nine 3.7E06 mol/s/mf filters	13	15	Bounded by DAC value for SWB configuration with one SWB liner bag [1]
tdop01/ tdop01.out	TDOP with five inner bags and one SWB liner bag and nine 3.7E06 mol/s/mf filters	40	56	Bounded by DAC value for SWB configuration with five inner bags and one SWB liner bag [1]
100-Gallon Drum – Headspace Sample Taken between Inner and Outer Drum Lids				
t7037074/ t7037074.out	100-gallon drum outer lid filter = 3.7E-06 mol/s/mf inner lid filter = 7.4E06 mol/s/mf	13	13	NA
t7037185/ t7037185.out	100gallon drum outer lid filter = 3.7E-06 mol/s/mf inner lid filter = 1.85E05 mol/s/mf	7	7	NA
t7037925/ t7037925.out	100-gallon drum outer lid filter = 3.7E-06 mol/s/mf inner lid filter = 9.25E05 mol/s/mf	2	2	NA
t7074074/ t7074074.out	100-gallon drum outer lid filter = 7.4E-06 mol/s/mf inner lid filter = 7.4E06 mol/s/mf	10	10	NA
t7074185/ t7074185.out	100gallon drum outer lid filter = 7.4E06 mol/s/mf inner lid filter = 1.85E05 mol/s/mf	6	6	NA

Input/Output Filename	Waste Container Type and Packaging	DAC Value Calculated by VDRUM	DAC Value Selected for Use	Justification for Difference (if applicable)
t7074925/ t7074925.out	100gallon drum outer lid filter = 7.4E06 mol/s/mf inner lid filter = 9.25E05 mol/s/mf	2	2	NA
t7185074/ t7185074.out	100gallon drum outer lid filter = 1.85E05 mol/s/mf inner lid filter = 7.4E06 mol/s/mf	6	6	NA
t7185185/ t7185185.out	100gallon drum outer lid filter = 1.85E05 mol/s/mf inner lid filter = 1.85E05 mol/s/mf	4	4	NA

Table A-1
Correlation between Calculated DAC Values and DAC Values Selected for Use for the TDOP, 100-Gallon Drum, and 85-Gallon Drum (continued)

Input/Output Filename	Waste Container Type and Packaging	DAC Value Calculated by VDRUM	DAC Value Selected for Use	Justification for Difference (if applicable)
t7185925/ t7185925.out	100gallon drum outer lid filter = 1.85E05 mol/s/mf inner lid filter = 9.25E05 mol/s/mf	2	2	NA
100-Gallon Drum – Headspace Sample Taken Inside Inner Drum Lid				
t7000074/ t7000074.out	100gallon drum inner lid filter = 7.4E6 mol/s/mf	1	2	Bounded by DAC value for 100gallon drum with two lids (t7185925/t7185925.out)
t7000185/ t7000185.out	100gallon drum inner lid filter = 1.85E5 mol/s/mf	1	2	Bounded by DAC value for 100gallon drum with two lids (t7185925/t7185925.out)
t7000925/ t7000925.out	100gallon drum inner lid filter = 9.25E-5 mol/s/mf	1	2	Bounded by DAC value for 100-gallon drum with two lids (t7185925/t7185925.out)

Table A-1
Correlation between Calculated DAC Values and DAC Values Selected for Use for the TDOP, 100-Gallon Drum, and 85-Gallon Drum (continued)

Input/Output Filename	Waste Container Type and Packaging	DAC Value Calculated by VDRUM	DAC Value Selected for Use	Justification for Difference (if applicable)
85-Gallon Drum – Headspace Sample Taken between Inner and Outer Drum Lids				
t8037074/ t8037074.out	85gallon drum outer lid filter = 3.7E6 mol/s/mf inner lid filter = 7.4E6 mol/s/mf	9	13	Bounded by DAC value for corresponding 100-gallon drum configuration
t8037185/ t8037185.out	85gallon drum outer lid filter = 3.7E6 mol/s/mf inner lid filter = 1.85E5 mol/s/mf	5	7	Bounded by DAC value for corresponding 100-gallon drum configuration
t8037925/ t8037925.out	85gallon drum outer lid filter = 3.7E6 mol/s/mf inner lid filter = 9.25E5 mol/s/mf	2	2	Bounded by DAC value for corresponding 100-gallon drum configuration
t8074074/ t8074074.out	85-gallon drum outer lid filter = 7.4E6 mol/s/mf inner lid filter = 7.4E6 mol/s/mf	7	10	Bounded by DAC value for corresponding 100-gallon drum configuration
t8074185/ t8074185.out	85gallon drum outer lid filter = 7.4E6 mol/s/mf inner lid filter = 1.85E5 mol/s/mf	4	6	Bounded by DAC value for corresponding 100-gallon drum configuration
t8074925/ t8074925.out	85gallon drum outer lid filter = 7.4E6 mol/s/mf inner lid filter = 9.25E5 mol/s/mf	2	2	Bounded by DAC value for corresponding 100-gallon drum configuration
t8185074/ t8185074.out	85gallon drum outer lid filter = 1.85E5 mol/s/mf inner lid filter = 7.4E6 mol/s/mf	4	6	Bounded by DAC value for corresponding 100-gallon drum configuration
t8185185/ t8185185.out	85gallon drum outer lid filter = 1.85E5 mol/s/mf inner lid filter = 1.85E5 mol/s/mf	3	4	Bounded by DAC value for corresponding 100-gallon drum configuration
t8185925/ t8185925.out	85gallon drum outer lid filter = 1.85E5 mol/s/mf inner lid filter = 9.25E5 mol/s/mf	2	2	Bounded by DAC value for corresponding 100-gallon drum configuration
85-Gallon Drum – Headspace Sample Taken Inside Inner Drum Lid				
t8000074/ t8000074.out	85gallon drum No outer lid inner lid filter = 7.4E6 mol/s/mf	1	2	Bounded by DAC value for corresponding 100-gallon drum configuration
t8000185/ t8000185.out	85gallon drum No outer lid inner lid filter = 1.85E-5 mol/s/mf	1	2	Bounded by DAC value for corresponding 100-gallon drum configuration
t8000925/ t8000925.out	85gallon drum No outer lid inner lid filter = 9.25E5 mol/s/mf	1	2	Bounded by DAC value for corresponding 100-gallon drum configuration

mol/s/mf = mole per second per mole fraction
NA = Not applicable

The computer program VDRUM used for deriving DAC values in BWXT (2000) [1] employs input files of required data and reports the time for volatile organic compounds (VOCs) to reach at least 90 percent of their steady state concentrations. The input file for each packaging configuration includes the same data structure beginning with the input and output file names and the number of VOCs evaluated. Each VOC included in the analysis has two lines of input data, the initial concentrations in the layers of confinement and the physical and chemical properties. The physical characteristics, such as thickness and surface area, of each type of confinement layer are entered. Specific information about data input includes the following:

- For the 100-gallon drum in which the headspace sample is taken between the filtered inner and outer drum lids, the configuration modeled by VDRUM includes one filtered non-polymeric (e.g., steel) inner drum lid and one filtered outer lid. The packaging configuration has no plastic layers of confinement (i.e., no inner bags and no liner bags) or rigid drum liner. The hydrogen release rate across the inner drum lid is defined by the hydrogen diffusivity of the filter vent. The DAC value was calculated for three hydrogen diffusivity values for the inner drum lid (i.e., 7.4E-6 mol/s/mol fraction, 1.85E-5 mol/s/mol fraction, and 9.25E-5 mol/s/mol fraction).
- For the 100-gallon drum in which the headspace sample is taken inside the filtered non-polymeric (e.g., steel) inner drum lid prior to placement of the outer drum lid, VDRUM models this packaging configuration with a hypothetical innermost layer that is very thin. By making the innermost layers very thin as shown in the input files, their resistance to the release of hydrogen is removed from the analysis.
- T_c, P_c are required if D = 0. (See input file format for parameter definitions.)
- T_c, P_c, D_v* are required if D* = 0 and drum is vented.
- If D > 0 and D* > 0, T_c and P_c can equal zero.
- In case of VOCs, gas generation does not occur (g = 0) at all times.
- Only gas permeation across bags is considered, so $A_d = x_d = 0$ (for bags only).
- Although gas permeation across drum liner is not considered, specification of A_p and x_p is required to estimate the volume of liner material. x_p is set to a small, non-zero value as shown in the input files.
- TDOP packaging configuration parameter values are assumed to be the same as those for the SWB [1] given the normal packaging of large items (e.g., gloveboxes) directly in the TDOP. These values are shown in the corresponding input files.
- Assumptions for 100-gallon drum and 85-gallon drum headspace void volumes are based on 20% of the container volume outside of the waste packaging. Assumptions for the void volumes between the drum lids (if two lids are used) are determined based on 100-gallon drum dimensions and by scaling the 100-gallon drum dimensions for the 85-gallon drum.
- When the headspace sample is taken between inner and outer drum lids, D_v^*, the release rate of the outermost layer of confinement, is set to the diffusivity of the outer lid filter. Because VDRUM only allows entry of one filtered layer of confinement, the filter on the inner lid can be accounted for by adjusting the parameter values for the rigid liner. The dimensions of the drum liner are adjusted so the effective release rate equals the inner lid filter vent (Given $A_d = (D^*)(x_d)/(D_{c0})$, where D^* = diffusivity of the inner lid filter vent, x_d =

1.0, and D_{c0} = hydrogen diffusivity at standard temperature and pressure). The resulting drum liner dimensions are shown in the corresponding input files.

- When headspace sample is taken inside inner drum lid, D_v^*, the release rate of the outermost layer of confinement, is set to the diffusivity of the inner lid filter.

To determine the drum age criteria from each analysis, the greatest time in days is selected from the VOCs (shown in bold in the output data listing). The data structures for the input and output files are shown in the following sections.

Input File Format

Line 1: Input file name, output file name, number of VOCs evaluated

Line 2: Name of VOC #1, $[IB]_0$, $[LB]_0$, $[LHS]_0$, $[DHS]_0$

Where:

- $[IB]_0$ – Initial VOC concentration (ppmv) in inner bags
- $[LB]_0$ – Initial VOC concentration (ppmv) in liner bags
- $[LHS]_0$ – Initial VOC concentration (ppmv) in drum liner headspace
- $[DHS]_0$ – Initial VOC concentration (ppmv) in drum headspace

Line 3: MW, ?, D, T_c, P_c, D*, H, k, G (see Reference 1 for VOC-specific values)

Where:

- MW – VOC molecular weight (g/gmol)
- ? – VOC permeability in polyethylene @ 25ºC, Ba x (1.e-10)
- D – VOC diffusivity in air @ 25ºC, $cm^2\ s^{-1}$
- T_c – VOC critical temperature, K
- P_c – VOC critical pressure, atm
- D* – VOC diffusivity across filter vent, mol/s/mol fraction
- H – VOC Henrys constant for polyethylene drum liner, (cm3 polymer) atm/(cm3 (STP) gas)
- k – VOC mass transfer coefficient at drum liner surface, s^{-1}
- G – VOC generate rate (always set to 0 (zero)).

Lines (2n, 2n+1): Information for n^{th} (last) VOC

Line (2n+2): $A_p(1)$, $A_d(1)$, V(1), $x_p(1)$, $x_d(1)$
Line (2n+3): $A_p(2)$, $A_d(2)$, V(2), $x_p(2)$, $x_d(2)$
Line (2n+4): $A_p(3)$, $A_d(3)$, V(3), $x_p(3)$, $x_d(3)$
Line (2n+5): $A_p(4)$, $A_d(4)$, V(4), $x_p(4)$, $x_d(4)$

Where:

- A_p – permeable surface area, cm^2
- A_d – diffusional cross-sectional area, cm^2
- V – void volume inside layer of confinement, cm^3
- x_p – layer thickness, cm
- x_d – length of diffusional path length, cm
- 1 – inner bag
- 2 – drum liner bag
- 3 – drum liner headspace
- 4 – drum headspace

Line (2n+6): T, P, D_v*

Where:

- T – gas temperature = 25°C

P – gas pressure = 76 cm Hg

D_v* – hydrogen diffusion characteristic across drum filter vent, mol/s/mol fraction

Output File Format

Line 1: Input file name

Lines 2, n+1: VOC, DAC, [DAC], [SS]

Where:

- VOC – name of VOC
- DAC – drum age criterion, days
- [DAC] – VOC concentration at the time of the DAC value, ppmv
- [SS] – VOC concentration at steady-state conditions, ppmv

TDOP with Up to One SWB Liner Bag

TDOP02 Input File

```
'tdop02','tdop02.out',12
'carbon tetrachloride',0.,1000.,0.,0.
153.82,193.e-10,0.0828,556.4,45.0,0.,0.0217,6.e-5,0.
'methanol',0.,1000.,0.,0.
32.0,135.e-10,0.152,513.2,78.5,0.,0.0272,2.4e-7,0.
'dichloromethane',0.,1000.,0.,0.
84.9,263.e-10,0.104,510.,62.2,0.,0.0431,2.e-6,0.
'toluene',0.,1000.,0.,0.
92.1,669.e-10,0.0849,591.8,40.5,0.,0.002857,7.e-6,0.
'trichloroethylene',0.,1000.,0.,0.
131.4,583.e-10,0.0875,572.0,49.8,0.,0.00640,6.e-5,0.
'butanol',0.,1000.,0.,0.
74.1,300.e-10,0.,563.1,43.6,0.,0.02273,8.e-6,0.
'chloroform',0.,1000.,0.,0.
119.4,260.e-10,0.,536.4,53.0,0.,0.04545,8.e-6,0.
'1,1-dichloroethene',0.,1000.,0.,0.
96.9,110.e-10,0.,513.0,47.5,0.,0.09091,8.e-6,0.
'methyl ethyl ketone',0.,1000.,0.,0.
72.1,165.e-10,0.,536.8,41.5,0.,0.03704,8.e-6,0.
'methyl isobutyl ketone',0.,1000.,0.,0.
100.2,130.e-10,0.,571.0,32.3,0.,0.01724,8.e-6,0.
'1,1,2,2-tetrachloroethane',0.,1000.,0.,0.
167.9,2300.e-10,0.,661.2,57.6,0.,0.003846,8.e-6,0.
'chlorobenzene',0.,1000.,0.,0.
112.6,600.e-10,0.,632.4,44.6,0.,0.007692,8.e-6,0.
0.,0.,0.,0.,0.
1.4e4,0.,0.,0.036,0.
1.4e4,150.,1.e5,0.0001,1.4
0.,0.,1.e5,0.,0.
25.,76.,333.e-7

c    Case 02: Ten-drum overpack (TDOP)
c    One liner bag (xp=0.036 cm)
c    No rigid liner (estimated by Ad=150 cm2, xp = 0.0001, xd=1.4 cm)
c    Void volume in layers of confinement same as in case of SWB
c    Void volume in headspace = 100000 cm3
c    D*H2 = total H2 diffusivity characteristic across (9) TDOP vents = 333.e-7 mol/s/mol fr
c    VOC diffusivity characteristic estimated knowing D*H2, VOC Tc, VOC Pc
```

TDOP02 Output File

tdop02

carbon tetrachloride	8	793.7534	873.4544
methanol	10	694.2427	760.2239
dichloromethane	6	804.3660	883.2648
toluene	3	889.4951	954.5489
trichloroethylene	3	860.2493	947.2747
butanol	6	843.0952	906.8333
chloroform	6	807.2958	892.3996
1,1-dichloroethene	**13**	**720.5433**	**785.3380**
methyl ethyl ketone	9	768.9844	847.1186
methyl isobutyl ketone	11	755.0751	836.7894

1,1,2,2-tetrachloroethane	1	891.8437	979.1128
chlorobenzene	3	865.7315	950.6065

TDOP with up to Five Inner Bags and One SWB Liner Bag

TDOP01 Input File

```
'tdop01','tdop01.out',12
'carbon tetrachloride',1000.,0.,0.,0.
153.82,193.e-10,0.0828,556.4,45.0,0.,0.0217,6.e-5,0.
'methanol',1000.,0.,0.,0.
32.0,135.e-10,0.152,513.2,78.5,0.,0.0272,2.4e-7,0.
'dichloromethane',1000.,0.,0.,0.
84.9,263.e-10,0.104,510.,62.2,0.,0.0431,2.e-6,0.
'toluene',1000.,0.,0.,0.
92.1,669.e-10,0.0849,591.8,40.5,0.,0.002857,7.e-6,0.
'trichloroethylene',1000.,0.,0.,0.
131.4,583.e-10,0.0875,572.0,49.8,0.,0.00640,6.e-5,0.
'butanol',1000.,0.,0.,0.
74.1,300.e-10,0.,563.1,43.6,0.,0.02273,8.e-6,0.
'chloroform',1000.,0.,0.,0.
119.4,260.e-10,0.,536.4,53.0,0.,0.04545,8.e-6,0.
'1,1-dichloroethene',1000.,0.,0.,0.
96.9,110.e-10,0.,513.0,47.5,0.,0.09091,8.e-6,0.
'methyl ethyl ketone',1000.,0.,0.,0.
72.1,165.e-10,0.,536.8,41.5,0.,0.03704,8.e-6,0.
'methyl isobutyl ketone',1000.,0.,0.,0.
100.2,130.e-10,0.,571.0,32.3,0.,0.01724,8.e-6,0.
'1,1,2,2-tetrachloroethane',1000.,0.,0.,0.
167.9,2300.e-10,0.,661.2,57.6,0.,0.003846,8.e-6,0.
'chlorobenzene',1000.,0.,0.,0.
112.6,600.e-10,0.,632.4,44.6,0.,0.007692,8.e-6,0.
1.4e4,0.,0.,0.063,0.
1.4e4,0.,1.9e5,0.036,0.
1.4e4,150.,1.e5,0.0001,1.4
0.,0.,1.e5,0.,0.
25.,76.,333.e-7

c    Case 01: Ten-drum overpack (TDOP)
c    Small bags, 5 polymer bags, xp=0.063 cm, Asb=Alb=14,000 cm2
c    One liner bag (xp=0.036 cm)
c    No rigid liner (estimated by Ad=150 cm2, xp=0.0001 cm, xd=1.4 cm)
c    Assume same void volumes between layers of confinement as in SWB
c    Void volume in headspace = 100000 cm3
c    D*H2 = total H2 diffusivity characteristic across 9 TDOP vents = 333.e-7 mol/s/mol fr
c    VOC diffusivity characteristic estimated knowing D*H2, VOC Tc, VOC Pc
```

TDOP01 Output File

tdop01

carbon tetrachloride	28	656.5827	723.6465
methanol	31	489.2478	539.6707
dichloromethane	21	673.3795	742.2752
toluene	10	815.8182	896.8104
trichloroethylene	11	795.8295	879.5875
butanol	19	712.1110	790.4583
chloroform	22	692.4474	760.9515
1,1-dichloroethene	**40**	**521.8710**	**576.6337**
methyl ethyl ketone	30	608.8997	676.2224

methyl isobutyl ketone	38	596.2039	658.3813
1,1,2,2-tetrachloroethane	4	912.9481	960.4730
chlorobenzene	11	807.3900	888.5585

100-Gallon Drum with Headspace Sample Taken between Inner and Outer Drum Lids

T7037074: Input File

```
't7037074','t7037074.out',12
'carbon tetrachloride',0.,1000.,0.,0.
153.82,193.e-10,0.0,556.4,45.0,0.,0.0217,0.,0.
'methanol',0.,1000.,0.,0.
32.0,135.e-10,0.,513.2,78.5,0.,0.0272,0.,0.
'dichloromethane',0.,1000.,0.,0.
84.9,263.e-10,0.,510.,62.2,0.,0.0431,0.,0.
'toluene',0.,1000.,0.,0.
92.1,669.e-10,0.0,591.8,40.5,0.,0.002857,7.e-6,0.
'trichloroethylene',0.,1000.,0.,0.
131.4,583.e-10,0.0,572.0,49.8,0.,0.00640,6.e-5,0.
'butanol',0.,1000.,0.,0.
74.1,300.e-10,0.,563.1,43.6,0.,0.02273,8.e-6,0.
'chloroform',0.,1000.,0.,0.
119.4,260.e-10,0.,536.4,53.0,0.,0.04545,0.,0.
'1,1-dichloroethene',0.,1000.,0.,0.
96.9,110.e-10,0.,513.0,47.5,0.,0.09091,0.,0.
'methyl ethyl ketone',0.,1000.,0.,0.
72.1,165.e-10,0.,536.8,41.5,0.,0.03704,0.,0.
'methyl isobutyl ketone',0.,1000.,0.,0.
100.2,130.e-10,0.,571.0,32.3,0.,0.01724,0.,0.
'1,1,2,2-tetrachloroethane',0.,1000.,0.,0.
167.9,2300.e-10,0.,661.2,57.6,0.,0.003846,0.,0.
'chlorobenzene',0.,1000.,0.,0.
112.6,600.e-10,0.,632.4,44.6,0.,0.007692,0.,0.
0.,0.,0.,0.,0.
1.e5,150.,1.e4,0.1,0.3
1.e3,0.241,3000.,0.0001,1.0
0.,0.,12400.,0.,0.
25.,76.,3.7e-6

c    100-gallon, w/inner and outer lids, each w/ filter vent
c    Only two void volumes: Below inner lid and between inner and outer lids
c    Value for volume underneath inner lid not required.
c    Void volume between lids: 12,400 cm3
c    Inner lid exhibits no solubility for VOCs
c    Effective surface area across liner (xd= 1.0 cm): Ad = 0.241 cm2
c    so effectiveH2 release rate equals inner lid filter vent, D*(H2)=7.4e-6 mol/s/mol fraction
c    D*H2 = total H2 diffusivity characteristic across outer filter vent = 3.7e-6 mol/s/mol fr
c    VOC diffusivity characteristic estimated knowing D*H2, VOC Tc, VOC Pc
```

T7037074: Output File

t7037074

carbon tetrachloride	12	601.8119	666.0402
methanol	8	605.2756	662.7805
dichloromethane	10	606.5364	666.2781
toluene	12	601.9334	667.8255
trichloroethylene	12	609.1254	667.6917
butanol	12	611.9651	666.8453
chloroform	11	603.7357	666.5099
1,1-dichloroethene	11	600.6257	663.6120

methyl ethyl ketone	12	611.3821	665.3754
methyl isobutyl ketone	**13**	**599.9965**	**665.0985**
1,1,2,2-tetrachloroethane	12	603.7464	668.0729
chlorobenzene	13	610.4804	667.7682

100-Gallon Drum with Headspace Sample Taken between Inner and Outer Drum Lids (continued)

T7037185: Input File

```
't7037185','t7037185.out',12
'carbon tetrachloride',0.,1000.,0.,0.
153.82,193.e-10,0.0,556.4,45.0,0.,0.0217,0.,0.
'methanol',0.,1000.,0.,0.
32.0,135.e-10,0.,513.2,78.5,0.,0.0272,0.,0.
'dichloromethane',0.,1000.,0.,0.
84.9,263.e-10,0.,510.,62.2,0.,0.0431,0.,0.
'toluene',0.,1000.,0.,0.
92.1,669.e-10,0.0,591.8,40.5,0.,0.002857,7.e-6,0.
'trichloroethylene',0.,1000.,0.,0.
131.4,583.e-10,0.0,572.0,49.8,0.,0.00640,6.e-5,0.
'butanol',0.,1000.,0.,0.
74.1,300.e-10,0.,563.1,43.6,0.,0.02273,8.e-6,0.
'chloroform',0.,1000.,0.,0.
119.4,260.e-10,0.,536.4,53.0,0.,0.04545,0.,0.
'1,1-dichloroethene',0.,1000.,0.,0.
96.9,110.e-10,0.,513.0,47.5,0.,0.09091,0.,0.
'methyl ethyl ketone',0.,1000.,0.,0.
72.1,165.e-10,0.,536.8,41.5,0.,0.03704,0.,0.
'methyl isobutyl ketone',0.,1000.,0.,0.
100.2,130.e-10,0.,571.0,32.3,0.,0.01724,0.,0.
'1,1,2,2-tetrachloroethane',0.,1000.,0.,0.
167.9,2300.e-10,0.,661.2,57.6,0.,0.003846,0.,0.
'chlorobenzene',0.,1000.,0.,0.
112.6,600.e-10,0.,632.4,44.6,0.,0.007692,0.,0.
0.,0.,0.,0.,0.
1.e5,150.,1.e4,0.1,0.3
1.e3,0.603,3000.,0.0001,1.0
0.,0.,12400.,0.,0.
25.,76.,3.7e-6

c    100-gallon, w/inner and outer lids, each w/ filter vent
c    Only two void volumes: Below inner lid and between inner and outer lids
c    Value for volume underneath inner lid not required.
c    Void volume between lids: 12,400 cm3
c    Inner lid exhibits no solubility for VOCs
c    Effective surface area across liner (xd= 1.0 cm): Ad = 0.603 cm2
c    so effective H2 release rate equals inner lid filter vent, D*(H2)=1.85e-5 mol/s/mol fraction
c    D*H2 = total H2 diffusivity characteristic across outer filter vent = 3.7e-6 mol/s/mol fr
c    VOC diffusivity characteristic estimated knowing D*H2, VOC Tc, VOC Pc
```

T7037185: Output File

t7037185

carbon tetrachloride	7	773.9869	830.6156
methanol	4	746.8693	825.5425
dichloromethane	5	753.8060	830.9875
toluene	6	750.5147	833.4372
trichloroethylene	6	759.3613	833.2187
butanol	6	761.6123	831.8758
chloroform	6	766.0889	831.3501

100-Gallon Drum with Headspace Sample Taken between Inner and Outer Drum Lids (continued)

1,1-dichloroethene	6	757.9824	826.8342
methyl ethyl ketone	6	758.6458	829.5781
methyl isobutyl ketone	**7**	**757.3309**	**829.1470**
1,1,2,2-tetrachloroethane	6	753.7183	833.9962
chlorobenzene	7	773.5806	833.3430

100-Gallon Drum with Headspace Sample Taken between Inner and Outer Drum Lids (continued)

T7037925: Input File

```
't7037925','t7037925.out',12
'carbon tetrachloride',0.,1000.,0.,0.
153.82,193.e-10,0.0,556.4,45.0,0.,0.0217,0.,0.
'methanol',0.,1000.,0.,0.
32.0,135.e-10,0.,513.2,78.5,0.,0.0272,0.,0.
'dichloromethane',0.,1000.,0.,0.
84.9,263.e-10,0.,510.,62.2,0.,0.0431,0.,0.
'toluene',0.,1000.,0.,0.
92.1,669.e-10,0.0,591.8,40.5,0.,0.002857,7.e-6,0.
'trichloroethylene',0.,1000.,0.,0.
131.4,583.e-10,0.0,572.0,49.8,0.,0.00640,6.e-5,0.
'butanol',0.,1000.,0.,0.
74.1,300.e-10,0.,563.1,43.6,0.,0.02273,8.e-6,0.
'chloroform',0.,1000.,0.,0.
119.4,260.e-10,0.,536.4,53.0,0.,0.04545,0.,0.
'1,1-dichloroethene',0.,1000.,0.,0.
96.9,110.e-10,0.,513.0,47.5,0.,0.09091,0.,0.
'methyl ethyl ketone',0.,1000.,0.,0.
72.1,165.e-10,0.,536.8,41.5,0.,0.03704,0.,0.
'methyl isobutyl ketone',0.,1000.,0.,0.
100.2,130.e-10,0.,571.0,32.3,0.,0.01724,0.,0.
'1,1,2,2-tetrachloroethane',0.,1000.,0.,0.
167.9,2300.e-10,0.,661.2,57.6,0.,0.003846,0.,0.
'chlorobenzene',0.,1000.,0.,0.
112.6,600.e-10,0.,632.4,44.6,0.,0.007692,0.,0.
0.,0.,0.,0.,0.
1.e5,150.,1.e4,0.1,0.3
1.e3,3.01,3000.,0.0001,1.0
0.,0.,12400.,0.,0.
25.,76.,3.7e-6

c	100-gallon, w/inner and outer lids, each w/ filter vent
c	Only two void volumes: Below inner lid and between inner and outer lids
c	Value for volume underneath inner lid not required.
c	Void volume between lids = 12,400 cm3
c	Inner lid exhibits no solubility for VOCs
c	Effective surface area across liner (xd= 1.0 cm): Ad = 3.01 cm2
c	so effective H2 release rate equals inner lid filter vent, D*(H2)=9.25e-5 mol/s/mol fraction
c	D*H2 = total H2 diffusivity characteristic across outer filter vent = 3.7e-6 mol/s/mol fr
c	VOC diffusivity characteristic estimated knowing D*H2, VOC Tc, VOC Pc
```

T7037925: Output File

t7037925

carbon tetrachloride	2	906.2675	956.4536
methanol	2	932.0639	949.7148
dichloromethane	2	933.2397	956.9498
toluene	2	921.7203	960.2800
trichloroethylene	2	926.4282	959.9716
butanol	2	922.3661	958.1394
chloroform	2	923.1623	957.4349

100-Gallon Drum with Headspace Sample Taken between Inner and Outer Drum Lids (continued)

1,1-dichloroethene	**2**	**898.1718**	**951.4270**
methyl ethyl ketone	2	910.4037	955.0713
methyl isobutyl ketone	2	881.8886	954.4978
1,1,2,2-tetrachloroethane	2	927.2952	961.3068
chlorobenzene	2	918.4125	960.1464

100-Gallon Drum with Headspace Sample Taken between Inner and Outer Drum Lids (continued)

T7074074: Input File

```
't7074074','t7074074.out',12
'carbon tetrachloride',0.,1000.,0.,0.
153.82,193.e-10,0.0,556.4,45.0,0.,0.0217,0.,0.
'methanol',0.,1000.,0.,0.
32.0,135.e-10,0.,513.2,78.5,0.,0.0272,0.,0.
'dichloromethane',0.,1000.,0.,0.
84.9,263.e-10,0.,510.,62.2,0.,0.0431,0.,0.
'toluene',0.,1000.,0.,0.
92.1,669.e-10,0.0,591.8,40.5,0.,0.002857,7.e-6,0.
'trichloroethylene',0.,1000.,0.,0.
131.4,583.e-10,0.0,572.0,49.8,0.,0.00640,6.e-5,0.
'butanol',0.,1000.,0.,0.
74.1,300.e-10,0.,563.1,43.6,0.,0.02273,8.e-6,0.
'chloroform',0.,1000.,0.,0.
119.4,260.e-10,0.,536.4,53.0,0.,0.04545,0.,0.
'1,1-dichloroethene',0.,1000.,0.,0.
96.9,110.e-10,0.,513.0,47.5,0.,0.09091,0.,0.
'methyl ethyl ketone',0.,1000.,0.,0.
72.1,165.e-10,0.,536.8,41.5,0.,0.03704,0.,0.
'methyl isobutyl ketone',0.,1000.,0.,0.
100.2,130.e-10,0.,571.0,32.3,0.,0.01724,0.,0.
'1,1,2,2-tetrachloroethane',0.,1000.,0.,0.
167.9,2300.e-10,0.,661.2,57.6,0.,0.003846,0.,0.
'chlorobenzene',0.,1000.,0.,0.
112.6,600.e-10,0.,632.4,44.6,0.,0.007692,0.,0.
0.,0.,0.,0.,0.
1.e5,150.,1.e4,0.1,0.3
1.e3,0.241,3000.,0.0001,1.0
0.,0.,12400.,0.,0.
25.,76.,7.4e-6

c    100-gallon, w/inner and outer lids, each w/ filter vent
c    Only two void volumes: Below inner lid and between inner and outer lids
c    Value for volume underneath inner lid not required.
c    Void volume between lids: 12,400 cm3
c    Inner lid exhibits no solubility for VOCs
c    Effective surface area across liner (xd= 1.0 cm): Ad = 0.241 cm2
c    so effectiveH2 release rate equals inner lid filter vent, D*(H2)=7.4e-6 mol/s/mol fraction
c    D*H2 = total H2 diffusivity characteristic across outer filter vent = 7.4e-6 mol/s/mol fr
c    VOC diffusivity characteristic estimated knowing D*H2, VOC Tc, VOC Pc
```

T7074074: Output File

t7074074

carbon tetrachloride	9	451.1305	499.3073
methanol	6	452.7901	495.6459
dichloromethane	8	461.4175	499.5759
toluene	9	451.7497	501.3458
trichloroethylene	9	457.1228	501.1881
butanol	9	458.9934	500.2180
chloroform	9	461.8291	499.8379

100-Gallon Drum with Headspace Sample Taken between Inner and Outer Drum Lids (continued)

1,1-dichloroethene	9	458.6552	496.5774
methyl ethyl ketone	9	458.1097	498.5578
methyl isobutyl ketone	**10**	**452.3305**	**498.2465**
1,1,2,2-tetrachloroethane	9	453.2619	501.7290
chlorobenzene	10	460.7854	501.2778

100-Gallon Drum with Headspace Sample Taken between Inner and Outer Drum Lids (continued)

T7074185: Input File

```
't7074185','t7074185.out',12
'carbon tetrachloride',0.,1000.,0.,0.
153.82,193.e-10,0.0,556.4,45.0,0.,0.0217,0.,0.
'methanol',0.,1000.,0.,0.
32.0,135.e-10,0.,513.2,78.5,0.,0.0272,0.,0.
'dichloromethane',0.,1000.,0.,0.
84.9,263.e-10,0.,510.,62.2,0.,0.0431,0.,0.
'toluene',0.,1000.,0.,0.
92.1,669.e-10,0.0,591.8,40.5,0.,0.002857,7.e-6,0.
'trichloroethylene',0.,1000.,0.,0.
131.4,583.e-10,0.0,572.0,49.8,0.,0.00640,6.e-5,0.
'butanol',0.,1000.,0.,0.
74.1,300.e-10,0.,563.1,43.6,0.,0.02273,8.e-6,0.
'chloroform',0.,1000.,0.,0.
119.4,260.e-10,0.,536.4,53.0,0.,0.04545,0.,0.
'1,1-dichloroethene',0.,1000.,0.,0.
96.9,110.e-10,0.,513.0,47.5,0.,0.09091,0.,0.
'methyl ethyl ketone',0.,1000.,0.,0.
72.1,165.e-10,0.,536.8,41.5,0.,0.03704,0.,0.
'methyl isobutyl ketone',0.,1000.,0.,0.
100.2,130.e-10,0.,571.0,32.3,0.,0.01724,0.,0.
'1,1,2,2-tetrachloroethane',0.,1000.,0.,0.
167.9,2300.e-10,0.,661.2,57.6,0.,0.003846,0.,0.
'chlorobenzene',0.,1000.,0.,0.
112.6,600.e-10,0.,632.4,44.6,0.,0.007692,0.,0.
0.,0.,0.,0.,0.
1.e5,150.,1.e4,0.1,0.3
1.e3,0.603,3000.,0.0001,1.0
0.,0.,12400.,0.,0.
25.,76.,7.4e-6

c	100-gallon, w/inner and outer lids, each w/ filter vent
c	Only two void volumes: Below inner lid and between inner and outer lids
c	Value for volume underneath inner lid not required.
c	Void volume between lids: 12,400 cm3
c	Inner lid exhibits no solubility for VOCs
c	Effective surface area across liner (xd= 1.0 cm): Ad = 0.603 cm2
c	so effective H2 release rate equals inner lid filter vent, D*(H2)=1.85e-5 mol/s/mol fraction
c	D*H2 = total H2 diffusivity characteristic across outer filter vent = 7.4e-6 mol/s/mol fr
c	VOC diffusivity characteristic estimated knowing D*H2, VOC Tc, VOC Pc
```

T7074185: Output File

t7074185

carbon tetrachloride	6	662.1140	710.3344
methanol	4	658.4371	702.9286
dichloromethane	5	666.6730	710.8815
toluene	6	666.0765	714.5515
trichloroethylene	5	646.4292	714.2118
butanol	5	647.8604	712.1941
chloroform	5	651.6139	711.4163

100-Gallon Drum with Headspace Sample Taken between Inner and Outer Drum Lids (continued)

1,1-dichloroethene	5	642.5233	704.8059
methyl ethyl ketone	5	644.2461	708.8116
methyl isobutyl ketone	**6**	**647.2314**	**708.1803**
1,1,2,2-tetrachloroethane	6	668.8201	715.6432
chlorobenzene	6	663.0890	714.4037

100-Gallon Drum with Headspace Sample Taken between Inner and Outer Drum Lids (continued)

T7074925: Input File

```
't7074925','t7074925.out',12
'carbon tetrachloride',0.,1000.,0.,0.
153.82,193.e-10,0.0,556.4,45.0,0.,0.0217,0.,0.
'methanol',0.,1000.,0.,0.
32.0,135.e-10,0.,513.2,78.5,0.,0.0272,0.,0.
'dichloromethane',0.,1000.,0.,0.
84.9,263.e-10,0.,510.,62.2,0.,0.0431,0.,0.
'toluene',0.,1000.,0.,0.
92.1,669.e-10,0.0,591.8,40.5,0.,0.002857,7.e-6,0.
'trichloroethylene',0.,1000.,0.,0.
131.4,583.e-10,0.0,572.0,49.8,0.,0.00640,6.e-5,0.
'butanol',0.,1000.,0.,0.
74.1,300.e-10,0.,563.1,43.6,0.,0.02273,8.e-6,0.
'chloroform',0.,1000.,0.,0.
119.4,260.e-10,0.,536.4,53.0,0.,0.04545,0.,0.
'1,1-dichloroethene',0.,1000.,0.,0.
96.9,110.e-10,0.,513.0,47.5,0.,0.09091,0.,0.
'methyl ethyl ketone',0.,1000.,0.,0.
72.1,165.e-10,0.,536.8,41.5,0.,0.03704,0.,0.
'methyl isobutyl ketone',0.,1000.,0.,0.
100.2,130.e-10,0.,571.0,32.3,0.,0.01724,0.,0.
'1,1,2,2-tetrachloroethane',0.,1000.,0.,0.
167.9,2300.e-10,0.,661.2,57.6,0.,0.003846,0.,0.
'chlorobenzene',0.,1000.,0.,0.
112.6,600.e-10,0.,632.4,44.6,0.,0.007692,0.,0.
0.,0.,0.,0.,0.
1.e5,150.,1.e4,0.1,0.3
1.e3,3.01,3000.,0.0001,1.0
0.,0.,12400.,0.,0.
25.,76.,7.4e-6

c    100-gallon, w/inner and outer lids, each w/ filter vent
c    Only two void volumes: Below inner lid and between inner and outer lids
c    Value for volume underneath inner lid not required.
c    Void volume between lids = 12,400 cm3
c    Inner lid exhibits no solubility for VOCs
c    Effective surface area across liner (xd= 1.0 cm): Ad = 3.01 cm2
c    so effective H2 release rate equals inner lid filter vent, D*(H2)=9.25e-5 mol/s/mol fraction
c    D*H2 = total H2 diffusivity characteristic across outer filter vent = 7.4e-6 mol/s/mol fr
c    VOC diffusivity characteristic estimated knowing D*H2, VOC Tc, VOC Pc
```

T7074925: Output File

t7074925

carbon tetrachloride	2	874.2328	916.5488
methanol	2	890.4756	904.2483
dichloromethane	2	898.0670	917.4614
toluene	2	890.9562	923.6190
trichloroethylene	2	894.8422	923.0439
butanol	2	889.7288	919.6536
chloroform	2	889.8145	918.3541

100-Gallon Drum with Headspace Sample Taken between Inner and Outer Drum Lids (continued)

1,1-dichloroethene	**2**	**863.1685**	**907.3582**
methyl ethyl ketone	2	876.7394	914.0121
methyl isobutyl ketone	2	851.1620	912.9617
1,1,2,2-tetrachloroethane	2	896.7982	925.5728
chlorobenzene	2	887.9434	923.3690

100-Gallon Drum with Headspace Sample Taken between Inner and Outer Drum Lids (continued)

T7185074: Input File

```
't7185074','t7185074.out',12
'carbon tetrachloride',0.,1000.,0.,0.
153.82,193.e-10,0.0,556.4,45.0,0.,0.0217,0.,0.
'methanol',0.,1000.,0.,0.
32.0,135.e-10,0.,513.2,78.5,0.,0.0272,0.,0.
'dichloromethane',0.,1000.,0.,0.
84.9,263.e-10,0.,510.,62.2,0.,0.0431,0.,0.
'toluene',0.,1000.,0.,0.
92.1,669.e-10,0.0,591.8,40.5,0.,0.002857,7.e-6,0.
'trichloroethylene',0.,1000.,0.,0.
131.4,583.e-10,0.0,572.0,49.8,0.,0.00640,6.e-5,0.
'butanol',0.,1000.,0.,0.
74.1,300.e-10,0.,563.1,43.6,0.,0.02273,8.e-6,0.
'chloroform',0.,1000.,0.,0.
119.4,260.e-10,0.,536.4,53.0,0.,0.04545,0.,0.
'1,1-dichloroethene',0.,1000.,0.,0.
96.9,110.e-10,0.,513.0,47.5,0.,0.09091,0.,0.
'methyl ethyl ketone',0.,1000.,0.,0.
72.1,165.e-10,0.,536.8,41.5,0.,0.03704,0.,0.
'methyl isobutyl ketone',0.,1000.,0.,0.
100.2,130.e-10,0.,571.0,32.3,0.,0.01724,0.,0.
'1,1,2,2-tetrachloroethane',0.,1000.,0.,0.
167.9,2300.e-10,0.,661.2,57.6,0.,0.003846,0.,0.
'chlorobenzene',0.,1000.,0.,0.
112.6,600.e-10,0.,632.4,44.6,0.,0.007692,0.,0.
0.,0.,0.,0.,0.
1.e5,150.,1.e4,0.1,0.3
1.e3,0.241,3000.,0.0001,1.0
0.,0.,12400.,0.,0.
25.,76.,1.85e-5

c    100-gallon, w/inner and outer lids, each w/ filter vent
c    Only two void volumes: Below inner lid and between inner and outer lids
c    Value for volume underneath inner lid not required.
c    Void volume between lids: 12,400 cm3
c    Inner lid exhibits no solubility for VOCs
c    Effective surface area across liner (xd= 1.0 cm): Ad = 0.241 cm2
c    so effectiveH2 release rate equals inner lid filter vent, D*(H2)=7.4e-6 mol/s/mol fraction
c    D*H2 = total H2 diffusivity characteristic across outer filter vent = 1.85e-5 mol/s/mol fr
c    VOC diffusivity characteristic estimated knowing D*H2, VOC Tc, VOC Pc
```

T7185074: Output File

t7185074

carbon tetrachloride	6	266.4749	285.1615
methanol	4	265.9663	282.1786
dichloromethane	5	268.1931	285.3818
toluene	6	267.4534	286.8574
trichloroethylene	5	259.6295	286.7212
butanol	5	260.5563	285.9102
chloroform	5	262.1724	285.5971

100-Gallon Drum with Headspace Sample Taken between Inner and Outer Drum Lids (continued)

1,1-dichloroethene	5	259.6579	282.9348
methyl ethyl ketone	5	259.7001	284.5482
methyl isobutyl ketone	**6**	**260.9685**	**284.2940**
1,1,2,2-tetrachloroethane	6	268.3491	287.2862
chlorobenzene	6	266.2579	286.7982

100-Gallon Drum with Headspace Sample Taken between Inner and Outer Drum Lids (continued)

T7185185: Input File

```
't7185185','t7185185.out',12
'carbon tetrachloride',0.,1000.,0.,0.
153.82,193.e-10,0.0,556.4,45.0,0.,0.0217,0.,0.
'methanol',0.,1000.,0.,0.
32.0,135.e-10,0.,513.2,78.5,0.,0.0272,0.,0.
'dichloromethane',0.,1000.,0.,0.
84.9,263.e-10,0.,510.,62.2,0.,0.0431,0.,0.
'toluene',0.,1000.,0.,0.
92.1,669.e-10,0.0,591.8,40.5,0.,0.002857,7.e-6,0.
'trichloroethylene',0.,1000.,0.,0.
131.4,583.e-10,0.0,572.0,49.8,0.,0.00640,6.e-5,0.
'butanol',0.,1000.,0.,0.
74.1,300.e-10,0.,563.1,43.6,0.,0.02273,8.e-6,0.
'chloroform',0.,1000.,0.,0.
119.4,260.e-10,0.,536.4,53.0,0.,0.04545,0.,0.
'1,1-dichloroethene',0.,1000.,0.,0.
96.9,110.e-10,0.,513.0,47.5,0.,0.09091,0.,0.
'methyl ethyl ketone',0.,1000.,0.,0.
72.1,165.e-10,0.,536.8,41.5,0.,0.03704,0.,0.
'methyl isobutyl ketone',0.,1000.,0.,0.
100.2,130.e-10,0.,571.0,32.3,0.,0.01724,0.,0.
'1,1,2,2-tetrachloroethane',0.,1000.,0.,0.
167.9,2300.e-10,0.,661.2,57.6,0.,0.003846,0.,0.
'chlorobenzene',0.,1000.,0.,0.
112.6,600.e-10,0.,632.4,44.6,0.,0.007692,0.,0.
0.,0.,0.,0.,0.
1.e5,150.,1.e4,0.1,0.3
1.e3,0.603,3000.,0.0001,1.0
0.,0.,12400.,0.,0.
25.,76.,1.85e-5

c	100-gallon, w/inner and outer lids, each w/ filter vent
c	Only two void volumes: Below inner lid and between inner and outer lids
c	Value for volume underneath inner lid not required.
c	Void volume between lids: 12,400 cm3
c	Inner lid exhibits no solubility for VOCs
c	Effective surface area across liner (xd= 1.0 cm): Ad = 0.603 cm2
c	so effective H2 release rate equals inner lid filter vent, D*(H2)=1.85e-5 mol/s/mol fraction
c	D*H2 = total H2 diffusivity characteristic across outer filter vent = 1.85e-5 mol/s/mol fr
c	VOC diffusivity characteristic estimated knowing D*H2, VOC Tc, VOC Pc
```

T7185185: Output File

t7185185

carbon tetrachloride	4	457.1677	495.1866
methanol	3	461.6198	486.2546
dichloromethane	3	450.1259	495.8524
toluene	4	461.6954	500.3499
trichloroethylene	4	466.0166	499.9299
butanol	4	465.7081	497.4536
chloroform	4	467.3599	496.5041

100-Gallon Drum with Headspace Sample Taken between Inner and Outer Drum Lids (continued)

1,1-dichloroethene	**4**	**458.6048**	**488.5053**
methyl ethyl ketone	4	461.7789	493.3380
methyl isobutyl ketone	4	445.2887	492.5736
1,1,2,2-tetrachloroethane	4	464.1890	501.7484
chlorobenzene	4	459.3393	500.1672

100-Gallon Drum with Headspace Sample Taken between Inner and Outer Drum Lids (continued)

T7185925: Input File

```
't7185925','t7185925.out',12
'carbon tetrachloride',0.,1000.,0.,0.
153.82,193.e-10,0.0,556.4,45.0,0.,0.0217,0.,0.
'methanol',0.,1000.,0.,0.
32.0,135.e-10,0.,513.2,78.5,0.,0.0272,0.,0.
'dichloromethane',0.,1000.,0.,0.
84.9,263.e-10,0.,510.,62.2,0.,0.0431,0.,0.
'toluene',0.,1000.,0.,0.
92.1,669.e-10,0.0,591.8,40.5,0.,0.002857,7.e-6,0.
'trichloroethylene',0.,1000.,0.,0.
131.4,583.e-10,0.0,572.0,49.8,0.,0.00640,6.e-5,0.
'butanol',0.,1000.,0.,0.
74.1,300.e-10,0.,563.1,43.6,0.,0.02273,8.e-6,0.
'chloroform',0.,1000.,0.,0.
119.4,260.e-10,0.,536.4,53.0,0.,0.04545,0.,0.
'1,1-dichloroethene',0.,1000.,0.,0.
96.9,110.e-10,0.,513.0,47.5,0.,0.09091,0.,0.
'methyl ethyl ketone',0.,1000.,0.,0.
72.1,165.e-10,0.,536.8,41.5,0.,0.03704,0.,0.
'methyl isobutyl ketone',0.,1000.,0.,0.
100.2,130.e-10,0.,571.0,32.3,0.,0.01724,0.,0.
'1,1,2,2-tetrachloroethane',0.,1000.,0.,0.
167.9,2300.e-10,0.,661.2,57.6,0.,0.003846,0.,0.
'chlorobenzene',0.,1000.,0.,0.
112.6,600.e-10,0.,632.4,44.6,0.,0.007692,0.,0.
0.,0.,0.,0.,0.
1.e5,150.,1.e4,0.1,0.3
1.e3,3.01,3000.,0.0001,1.0
0.,0.,12400.,0.,0.
25.,76.,1.85e-5

c    100-gallon, w/inner and outer lids, each w/ filter vent
c    Only two void volumes: Below inner lid and between inner and outer lids
c    Value for volume underneath inner lid not required.
c    Void volume between lids = 12,400 cm3
c    Inner lid exhibits no solubility for VOCs
c    Effective surface area across liner (xd= 1.0 cm): Ad = 3.01 cm2
c    so effective H2 release rate equals inner lid filter vent, D*(H2)=9.25e-5 mol/s/mol fraction
c    D*H2 = total H2 diffusivity characteristic across outer filter vent = 1.85e-5 mol/s/mol fr
c    VOC diffusivity characteristic estimated knowing D*H2, VOC Tc, VOC Pc
```

T7185925: Output File

t7185925

carbon tetrachloride	2	788.9644	814.5905
methanol	1	716.1101	790.6883
dichloromethane	2	805.6757	816.3956
toluene	2	808.6757	828.7056
trichloroethylene	2	810.6393	827.5430
butanol	2	803.0712	820.7515
chloroform	2	801.5262	818.1659

100-Gallon Drum with Headspace Sample Taken between Inner and Outer Drum Lids (continued)

1,1-dichloroethene	**2**	**771.0909**	**796.6581**
methyl ethyl ketone	2	787.7059	809.5967
methyl isobutyl ketone	2	769.0125	807.5389
1,1,2,2-tetrachloroethane	2	815.1512	832.7104
chlorobenzene	2	806.3532	828.1990

100-Gallon Drum with Headspace Sample Taken Inside Inner Drum Lid

T7000074: Input File

```
't7000074','t7000074.out',12
'carbon tetrachloride',0.,1000.,0.,0.
153.82,193.e-10,0.0828,556.4,45.0,0.,0.0217,6.e-5,0.
'methanol',0.,1000.,0.,0.
32.0,135.e-10,0.152,513.2,78.5,0.,0.0272,2.4e-7,0.
'dichloromethane',0.,1000.,0.,0.
84.9,263.e-10,0.104,510.,62.2,0.,0.0431,2.e-6,0.
'toluene',0.,1000.,0.,0.
92.1,669.e-10,0.0849,591.8,40.5,0.,0.002857,7.e-6,0.
'trichloroethylene',0.,1000.,0.,0.
131.4,583.e-10,0.0875,572.0,49.8,0.,0.00640,6.e-5,0.
'butanol',0.,1000.,0.,0.
74.1,300.e-10,0.,563.1,43.6,0.,0.02273,8.e-6,0.
'chloroform',0.,1000.,0.,0.
119.4,260.e-10,0.,536.4,53.0,0.,0.04545,8.e-6,0.
'1,1-dichloroethene',0.,1000.,0.,0.
96.9,110.e-10,0.,513.0,47.5,0.,0.09091,8.e-6,0.
'methyl ethyl ketone',0.,1000.,0.,0.
72.1,165.e-10,0.,536.8,41.5,0.,0.03704,8.e-6,0.
'methyl isobutyl ketone',0.,1000.,0.,0.
100.2,130.e-10,0.,571.0,32.3,0.,0.01724,8.e-6,0.
'1,1,2,2-tetrachloroethane',0.,1000.,0.,0.
167.9,2300.e-10,0.,661.2,57.6,0.,0.003846,8.e-6,0.
'chlorobenzene',0.,1000.,0.,0.
112.6,600.e-10,0.,632.4,44.6,0.,0.007692,8.e-6,0.
0.,0.,0.,0.,0.
3000.,0.,20000.,0.0005,0.
12800.,150.,40000.,0.00005,1.4
0.,0.,40000.,0.,0.
25.,76.,74.e-7

c	100-gallon drum w/inner lid only w/ filter vent
c	No plastic liner bag (xp=0.0005 cm)
c	No liner (estimated by Ad=150 cm2, xd=1.4 cm, xp=0.00005)
c	Void volume under inner lid = 80,000 cm3, equally divided between
c	"liner" and outer headspace
c	H2 diffusion characteristic across drum filter vent = 74.e-7 mol/s/mol fr
```

T7000074: Output File

t7000074

carbon tetrachloride	1	995.4536	995.9554
methanol	1	992.2009	993.7885
dichloromethane	1	996.1278	996.1657
toluene	1	997.3411	997.4221
trichloroethylene	1	997.2678	997.2731
butanol	1	996.3918	996.4465
chloroform	1	996.1041	996.1917
1,1-dichloroethene	**1**	**987.1293**	**994.0134**
methyl ethyl ketone	1	994.2435	995.3361
methyl isobutyl ketone	1	990.8757	995.1285
1,1,2,2-tetrachloroethane	1	997.5544	997.6054

chlorobenzene	1	997.1347	997.1719

100-Gallon Drum with Headspace Sample Taken Inside Inner Drum Lid (continued)

T7000185: Input File

```
't7000185','t7000185.out',12
'carbon tetrachloride',0.,1000.,0.,0.
153.82,193.e-10,0.0828,556.4,45.0,0.,0.0217,6.e-5,0.
'methanol',0.,1000.,0.,0.
32.0,135.e-10,0.152,513.2,78.5,0.,0.0272,2.4e-7,0.
'dichloromethane',0.,1000.,0.,0.
84.9,263.e-10,0.104,510.,62.2,0.,0.0431,2.e-6,0.
'toluene',0.,1000.,0.,0.
92.1,669.e-10,0.0849,591.8,40.5,0.,0.002857,7.e-6,0.
'trichloroethylene',0.,1000.,0.,0.
131.4,583.e-10,0.0875,572.0,49.8,0.,0.00640,6.e-5,0.
'butanol',0.,1000.,0.,0.
74.1,300.e-10,0.,563.1,43.6,0.,0.02273,8.e-6,0.
'chloroform',0.,1000.,0.,0.
119.4,260.e-10,0.,536.4,53.0,0.,0.04545,8.e-6,0.
'1,1-dichloroethene',0.,1000.,0.,0.
96.9,110.e-10,0.,513.0,47.5,0.,0.09091,8.e-6,0.
'methyl ethyl ketone',0.,1000.,0.,0.
72.1,165.e-10,0.,536.8,41.5,0.,0.03704,8.e-6,0.
'methyl isobutyl ketone',0.,1000.,0.,0.
100.2,130.e-10,0.,571.0,32.3,0.,0.01724,8.e-6,0.
'1,1,2,2-tetrachloroethane',0.,1000.,0.,0.
167.9,2300.e-10,0.,661.2,57.6,0.,0.003846,8.e-6,0.
'chlorobenzene',0.,1000.,0.,0.
112.6,600.e-10,0.,632.4,44.6,0.,0.007692,8.e-6,0.
0.,0.,0.,0.,0.
3000.,0.,20000.,0.0005,0.
12800.,150.,40000.,0.00005,1.4
0.,0.,40000.,0.,0.
25.,76.,1.85e-5

c    100-gallon drum w/inner lid only w/ filter vent
c    No plastic liner bag (xp=0.0005 cm)
c    No liner (estimated by Ad=150 cm2, xd=1.4 cm, xp=0.00005)
c    Void volume under inner lid = 80,000 cm3, equally divided between
c    fictional "liner" and outer headspace
c    H2 diffusion characteristic across drum filter vent = 1.85e-5 mol/s/mol fr
```

T7000185: Output File

t7000185

carbon tetrachloride	1	989.4744	989.9521
methanol	1	983.1256	984.6177
dichloromethane	1	990.4398	990.4753
toluene	1	993.5066	993.5869
trichloroethylene	1	993.2097	993.2147
butanol	1	991.1147	991.1666
chloroform	1	990.4536	990.5367
1,1-dichloroethene	**1**	**978.6265**	**985.1689**
methyl ethyl ketone	1	987.3871	988.4250
methyl isobutyl ketone	1	983.8448	987.9128
1,1,2,2-tetrachloroethane	1	993.9983	994.0485

100-Gallon Drum with Headspace Sample Taken Inside Inner Drum Lid (continued)

chlorobenzene	1	992.9288	992.9655

100-Gallon Drum with Headspace Sample Taken Inside Inner Drum Lid (continued)

T7000925: Input File

't7000925','t7000925.out',12
'carbon tetrachloride',0.,1000.,0.,0.
153.82,193.e-10,0.0828,556.4,45.0,0.,0.0217,6.e-5,0.
'methanol',0.,1000.,0.,0.
32.0,135.e-10,0.152,513.2,78.5,0.,0.0272,2.4e-7,0.
'dichloromethane',0.,1000.,0.,0.
84.9,263.e-10,0.104,510.,62.2,0.,0.0431,2.e-6,0.
'toluene',0.,1000.,0.,0.
92.1,669.e-10,0.0849,591.8,40.5,0.,0.002857,7.e-6,0.
'trichloroethylene',0.,1000.,0.,0.
131.4,583.e-10,0.0875,572.0,49.8,0.,0.00640,6.e-5,0.
'butanol',0.,1000.,0.,0.
74.1,300.e-10,0.,563.1,43.6,0.,0.02273,8.e-6,0.
'chloroform',0.,1000.,0.,0.
119.4,260.e-10,0.,536.4,53.0,0.,0.04545,8.e-6,0.
'1,1-dichloroethene',0.,1000.,0.,0.
96.9,110.e-10,0.,513.0,47.5,0.,0.09091,8.e-6,0.
'methyl ethyl ketone',0.,1000.,0.,0.
72.1,165.e-10,0.,536.8,41.5,0.,0.03704,8.e-6,0.
'methyl isobutyl ketone',0.,1000.,0.,0.
100.2,130.e-10,0.,571.0,32.3,0.,0.01724,8.e-6,0.
'1,1,2,2-tetrachloroethane',0.,1000.,0.,0.
167.9,2300.e-10,0.,661.2,57.6,0.,0.003846,8.e-6,0.
'chlorobenzene',0.,1000.,0.,0.
112.6,600.e-10,0.,632.4,44.6,0.,0.007692,8.e-6,0.
0.,0.,0.,0.,0.
3000.,0.,20000.,0.0005,0.
12800.,150.,40000.,0.00005,1.4
0.,0.,40000.,0.,0.
25.,76.,9.25e-5

c 100-gallon drum w/inner lid only w/ filter vent
c No plastic liner bag (xp=0.0005 cm)
c No liner (estimated by Ad=150 cm2, xd=1.4 cm, xp=0.00005)
c Void volume under inner lid = 80,000 cm3, equally divided between
c fictional "liner" and outer headspace
c H2 diffusion characteristic across drum filter vent = 9.25e-5 mol/s/mol fr

T7000925: Output File

t7000925

carbon tetrachloride	1	951.3634	951.7078
methanol	1	926.5816	927.5541
dichloromethane	1	954.1159	954.1395
toluene	1	968.6768	968.7536
trichloroethylene	1	966.9766	966.9810
butanol	1	957.3126	957.3516
chloroform	1	954.3596	954.4175
1,1-dichloroethene	**1**	**925.3331**	**930.0065**
methyl ethyl ketone	1	943.9569	944.6948
methyl isobutyl ketone	1	939.3307	942.3590
1,1,2,2-tetrachloroethane	1	970.9238	970.9720

100-Gallon Drum with Headspace Sample Taken Inside Inner Drum Lid (continued)

chlorobenzene	1	965.7707	965.8041

85-Gallon Drum with Headspace Sample Taken between Inner and Outer Drum Lids

T8037074: Input File

```
't8037074','t8037074.out',12
'carbon tetrachloride',0.,1000.,0.,0.
153.82,193.e-10,0.0,556.4,45.0,0.,0.0217,0.,0.
'methanol',0.,1000.,0.,0.
32.0,135.e-10,0.,513.2,78.5,0.,0.0272,0.,0.
'dichloromethane',0.,1000.,0.,0.
84.9,263.e-10,0.,510.,62.2,0.,0.0431,0.,0.
'toluene',0.,1000.,0.,0.
92.1,669.e-10,0.0,591.8,40.5,0.,0.002857,7.e-6,0.
'trichloroethylene',0.,1000.,0.,0.
131.4,583.e-10,0.0,572.0,49.8,0.,0.00640,6.e-5,0.
'butanol',0.,1000.,0.,0.
74.1,300.e-10,0.,563.1,43.6,0.,0.02273,8.e-6,0.
'chloroform',0.,1000.,0.,0.
119.4,260.e-10,0.,536.4,53.0,0.,0.04545,0.,0.
'1,1-dichloroethene',0.,1000.,0.,0.
96.9,110.e-10,0.,513.0,47.5,0.,0.09091,0.,0.
'methyl ethyl ketone',0.,1000.,0.,0.
72.1,165.e-10,0.,536.8,41.5,0.,0.03704,0.,0.
'methyl isobutyl ketone',0.,1000.,0.,0.
100.2,130.e-10,0.,571.0,32.3,0.,0.01724,0.,0.
'1,1,2,2-tetrachloroethane',0.,1000.,0.,0.
167.9,2300.e-10,0.,661.2,57.6,0.,0.003846,0.,0.
'chlorobenzene',0.,1000.,0.,0.
112.6,600.e-10,0.,632.4,44.6,0.,0.007692,0.,0.
0.,0.,0.,0.,0.
1.e5,150.,1.e4,0.1,0.3
1.e3,0.241,3000.,0.0001,1.0
0.,0.,8600.,0.,0.
25.,76.,3.7e-6

c	85-gallon, w/inner and outer lids, each w/ filter vent
c	Only two void volumes: Below inner lid and between inner and outer lids
c	Value for volume underneath inner lid not required.
c	Void volume between lids: 8600 cm3
c	Inner lid exhibits no solubility for VOCs
c	Effective surface area across liner (xd= 1.0 cm): Ad = 0.241 cm2
c	so effective release rate equals inner lid filter vent, D*(H2)=7.4e-6 mol/s/mol fraction
c	D*H2 = total H2 diffusivity characteristic across outer filter vent = 3.7e-6 mol/s/mol fr
c	VOC diffusivity characteristic estimated knowing D*H2, VOC Tc, VOC Pc
```

T8037074: Output File

t8037074

carbon tetrachloride	9	612.8494	666.0497
methanol	6	615.4465	662.7847
dichloromethane	7	607.7523	666.2886
toluene	9	613.1368	667.8586
trichloroethylene	8	603.2639	667.7193
butanol	8	606.2864	666.8591
chloroform	8	610.4658	666.5215
1,1-dichloroethene	8	607.2196	663.6169

methyl ethyl ketone	8	605.6772	665.3828
methyl isobutyl ketone	**9**	**599.5219**	**665.1055**
1,1,2,2-tetrachloroethane	9	614.9422	668.1911
chlorobenzene	9	610.1865	667.7986

85-Gallon Drum with Headspace Sample Taken between Inner and Outer Drum Lids (continued)

T8037185: Input File

```
't8037185','t8037185.out',12
'carbon tetrachloride',0.,1000.,0.,0.
153.82,193.e-10,0.0,556.4,45.0,0.,0.0217,0.,0.
'methanol',0.,1000.,0.,0.
32.0,135.e-10,0.,513.2,78.5,0.,0.0272,0.,0.
'dichloromethane',0.,1000.,0.,0.
84.9,263.e-10,0.,510.,62.2,0.,0.0431,0.,0.
'toluene',0.,1000.,0.,0.
92.1,669.e-10,0.0,591.8,40.5,0.,0.002857,7.e-6,0.
'trichloroethylene',0.,1000.,0.,0.
131.4,583.e-10,0.0,572.0,49.8,0.,0.00640,6.e-5,0.
'butanol',0.,1000.,0.,0.
74.1,300.e-10,0.,563.1,43.6,0.,0.02273,8.e-6,0.
'chloroform',0.,1000.,0.,0.
119.4,260.e-10,0.,536.4,53.0,0.,0.04545,0.,0.
'1,1-dichloroethene',0.,1000.,0.,0.
96.9,110.e-10,0.,513.0,47.5,0.,0.09091,0.,0.
'methyl ethyl ketone',0.,1000.,0.,0.
72.1,165.e-10,0.,536.8,41.5,0.,0.03704,0.,0.
'methyl isobutyl ketone',0.,1000.,0.,0.
100.2,130.e-10,0.,571.0,32.3,0.,0.01724,0.,0.
'1,1,2,2-tetrachloroethane',0.,1000.,0.,0.
167.9,2300.e-10,0.,661.2,57.6,0.,0.003846,0.,0.
'chlorobenzene',0.,1000.,0.,0.
112.6,600.e-10,0.,632.4,44.6,0.,0.007692,0.,0.
0.,0.,0.,0.,0.
1.e5,150.,1.e4,0.1,0.3
1.e3,0.603,3000.,0.0001,1.0
0.,0.,8600.,0.,0.
25.,76.,3.7e-6

c    85-gallon, w/inner and outer lids, each w/ filter vent
c    Only two void volumes: Below inner lid and between inner and outer lids
c    Value for volume underneath inner lid not required.
c    Void volume between lids: 8600 cm3
c    Inner lid exhibits no solubility for VOCs
c    Effective surface area across liner (xd= 1.0 cm): Ad=0.603 cm2
c    so effective release rate equals inner lid filter vent, D*(H2)=1.85e-5 mol/s/mol fraction
c    D*H2 = total H2 diffusivity characteristic across outer filter vent = 3.7e-6 mol/s/mol fr
c    VOC diffusivity characteristic estimated knowing D*H2, VOC Tc, VOC Pc
```

T8037185: Output File

t8037185

carbon tetrachloride	5	778.1249	830.6254
methanol	3	759.9813	825.5470
dichloromethane	4	777.2415	830.9981
toluene	5	781.1744	833.4702
trichloroethylene	4	751.9364	833.2465
butanol	4	754.3072	831.8897
chloroform	4	759.0244	831.3619

85-Gallon Drum with Headspace Sample Taken between Inner and Outer Drum Lids (continued)

1,1-dichloroethene	4	750.2961	826.8392
methyl ethyl ketone	4	751.0662	829.5859
methyl isobutyl ketone	**5**	**761.9965**	**829.1541**
1,1,2,2-tetrachloroethane	5	783.9984	834.1088
chlorobenzene	5	778.0529	833.3735

85-Gallon Drum with Headspace Sample Taken between Inner and Outer Drum Lids (continued)

T8037925: Input File

```
't8037925','t8037925.out',12
'carbon tetrachloride',0.,1000.,0.,0.
153.82,193.e-10,0.0,556.4,45.0,0.,0.0217,0.,0.
'methanol',0.,1000.,0.,0.
32.0,135.e-10,0.,513.2,78.5,0.,0.0272,0.,0.
'dichloromethane',0.,1000.,0.,0.
84.9,263.e-10,0.,510.,62.2,0.,0.0431,0.,0.
'toluene',0.,1000.,0.,0.
92.1,669.e-10,0.0,591.8,40.5,0.,0.002857,7.e-6,0.
'trichloroethylene',0.,1000.,0.,0.
131.4,583.e-10,0.0,572.0,49.8,0.,0.00640,6.e-5,0.
'butanol',0.,1000.,0.,0.
74.1,300.e-10,0.,563.1,43.6,0.,0.02273,8.e-6,0.
'chloroform',0.,1000.,0.,0.
119.4,260.e-10,0.,536.4,53.0,0.,0.04545,0.,0.
'1,1-dichloroethene',0.,1000.,0.,0.
96.9,110.e-10,0.,513.0,47.5,0.,0.09091,0.,0.
'methyl ethyl ketone',0.,1000.,0.,0.
72.1,165.e-10,0.,536.8,41.5,0.,0.03704,0.,0.
'methyl isobutyl ketone',0.,1000.,0.,0.
100.2,130.e-10,0.,571.0,32.3,0.,0.01724,0.,0.
'1,1,2,2-tetrachloroethane',0.,1000.,0.,0.
167.9,2300.e-10,0.,661.2,57.6,0.,0.003846,0.,0.
'chlorobenzene',0.,1000.,0.,0.
112.6,600.e-10,0.,632.4,44.6,0.,0.007692,0.,0.
0.,0.,0.,0.,0.
1.e5,150.,1.e4,0.1,0.3
1.e3,3.01,3000.,0.0001,1.0
0.,0.,8600.,0.,0.
25.,76.,3.7e-6

c    85-gallon, w/inner and outer lids, each w/ filter vent
c    Only two void volumes: Below inner lid and between inner and outer lids
c    Value for volume underneath inner lid not required.
c    Void volume between lids = 8600 cm3
c    Inner lid exhibits no solubility for VOCs
c    Effective surface area across liner (xd= 1.0 cm): Ad = 3.01 cm2
c    so effective H2 release rate equals inner lid filter vent, D*(H2)=9.25e-5 mol/s/mol fraction
c    D*H2 = total H2 diffusivity characteristic across outer filter vent = 3.7e-6 mol/s/mol fr
c    VOC diffusivity characteristic estimated knowing D*H2, VOC Tc, VOC Pc
```

T8037925: Output File

t8037925

carbon tetrachloride	2	942.6307	956.4561
methanol	1	892.5570	949.7159
dichloromethane	1	888.6439	956.9526
toluene	1	865.2738	960.2883
trichloroethylene	1	873.6000	959.9783
butanol	1	867.0313	958.1431
chloroform	1	868.5789	957.4379

85-Gallon Drum with Headspace Sample Taken between Inner and Outer Drum Lids (continued)

1,1-dichloroethene	**2**	**936.0296**	**951.4285**
methyl ethyl ketone	2	943.3093	955.0734
methyl isobutyl ketone	2	930.8121	954.4996
1,1,2,2-tetrachloroethane	1	874.5450	961.3323
chlorobenzene	2	949.6926	960.1537

85-Gallon Drum with Headspace Sample Taken between Inner and Outer Drum Lids (continued)

T8074074: Input File

```
't8074074','t8074074.out',12
'carbon tetrachloride',0.,1000.,0.,0.
153.82,193.e-10,0.0,556.4,45.0,0.,0.0217,0.,0.
'methanol',0.,1000.,0.,0.
32.0,135.e-10,0.,513.2,78.5,0.,0.0272,0.,0.
'dichloromethane',0.,1000.,0.,0.
84.9,263.e-10,0.,510.,62.2,0.,0.0431,0.,0.
'toluene',0.,1000.,0.,0.
92.1,669.e-10,0.0,591.8,40.5,0.,0.002857,7.e-6,0.
'trichloroethylene',0.,1000.,0.,0.
131.4,583.e-10,0.0,572.0,49.8,0.,0.00640,6.e-5,0.
'butanol',0.,1000.,0.,0.
74.1,300.e-10,0.,563.1,43.6,0.,0.02273,8.e-6,0.
'chloroform',0.,1000.,0.,0.
119.4,260.e-10,0.,536.4,53.0,0.,0.04545,0.,0.
'1,1-dichloroethene',0.,1000.,0.,0.
96.9,110.e-10,0.,513.0,47.5,0.,0.09091,0.,0.
'methyl ethyl ketone',0.,1000.,0.,0.
72.1,165.e-10,0.,536.8,41.5,0.,0.03704,0.,0.
'methyl isobutyl ketone',0.,1000.,0.,0.
100.2,130.e-10,0.,571.0,32.3,0.,0.01724,0.,0.
'1,1,2,2-tetrachloroethane',0.,1000.,0.,0.
167.9,2300.e-10,0.,661.2,57.6,0.,0.003846,0.,0.
'chlorobenzene',0.,1000.,0.,0.
112.6,600.e-10,0.,632.4,44.6,0.,0.007692,0.,0.
0.,0.,0.,0.,0.
1.e5,150.,1.e4,0.1,0.3
1.e3,0.241,3000.,0.0001,1.0
0.,0.,8600.,0.,0.
25.,76.,7.4e-6

c	85-gallon, w/inner and outer lids, each w/ filter vent
c	Only two void volumes: Below inner lid and between inner and outer lids
c	Value for volume underneath inner lid not required.
c	Void volume between lids: 8,600 cm3
c	Inner lid exhibits no solubility for VOCs
c	Effective surface area across liner (xd= 1.0 cm): Ad = 0.241 cm2
c	so effectiveH2 release rate equals inner lid filter vent, D*(H2)=7.4e-6 mol/s/mol fraction
c	D*H2 = total H2 diffusivity characteristic across outer filter vent = 7.4e-6 mol/s/mol fr
c	VOC diffusivity characteristic estimated knowing D*H2, VOC Tc, VOC Pc
```

T8074074: Output File

t8074074

carbon tetrachloride	7	462.9562	499.3145
methanol	4	448.1745	495.6491
dichloromethane	5	450.2094	499.5838
toluene	7	463.8074	501.3706
trichloroethylene	6	452.7051	501.2088
butanol	6	454.7096	500.2283
chloroform	6	457.7333	499.8467

85-Gallon Drum with Headspace Sample Taken between Inner and Outer Drum Lids (continued)

1,1-dichloroethene	6	454.4194	496.5810
methyl ethyl ketone	6	453.7969	498.5635
methyl isobutyl ketone	**7**	**453.1532**	**498.2517**
1,1,2,2-tetrachloroethane	7	465.2824	501.8274
chlorobenzene	7	461.6931	501.3006

85-Gallon Drum with Headspace Sample Taken between Inner and Outer Drum Lids (continued)

T8074185: Input File

```
't8074185','t8074185.out',12
'carbon tetrachloride',0.,1000.,0.,0.
153.82,193.e-10,0.0,556.4,45.0,0.,0.0217,0.,0.
'methanol',0.,1000.,0.,0.
32.0,135.e-10,0.,513.2,78.5,0.,0.0272,0.,0.
'dichloromethane',0.,1000.,0.,0.
84.9,263.e-10,0.,510.,62.2,0.,0.0431,0.,0.
'toluene',0.,1000.,0.,0.
92.1,669.e-10,0.0,591.8,40.5,0.,0.002857,7.e-6,0.
'trichloroethylene',0.,1000.,0.,0.
131.4,583.e-10,0.0,572.0,49.8,0.,0.00640,6.e-5,0.
'butanol',0.,1000.,0.,0.
74.1,300.e-10,0.,563.1,43.6,0.,0.02273,8.e-6,0.
'chloroform',0.,1000.,0.,0.
119.4,260.e-10,0.,536.4,53.0,0.,0.04545,0.,0.
'1,1-dichloroethene',0.,1000.,0.,0.
96.9,110.e-10,0.,513.0,47.5,0.,0.09091,0.,0.
'methyl ethyl ketone',0.,1000.,0.,0.
72.1,165.e-10,0.,536.8,41.5,0.,0.03704,0.,0.
'methyl isobutyl ketone',0.,1000.,0.,0.
100.2,130.e-10,0.,571.0,32.3,0.,0.01724,0.,0.
'1,1,2,2-tetrachloroethane',0.,1000.,0.,0.
167.9,2300.e-10,0.,661.2,57.6,0.,0.003846,0.,0.
'chlorobenzene',0.,1000.,0.,0.
112.6,600.e-10,0.,632.4,44.6,0.,0.007692,0.,0.
0.,0.,0.,0.,0.
1.e5,150.,1.e4,0.1,0.3
1.e3,0.603,3000.,0.0001,1.0
0.,0.,8600.,0.,0.
25.,76.,7.4e-6

c   85-gallon, w/inner and outer lids, each w/ filter vent
c   Only two void volumes: Below inner lid and between inner and outer lids
c   Value for volume underneath inner lid not required.
c   Void volume between lids: 8,600 cm3
c   Inner lid exhibits no solubility for VOCs
c   Effective surface area across liner (xd= 1.0 cm): Ad = 0.603 cm2
c   so effective H2 release rate equals inner lid filter vent, D*(H2)=1.85e-5 mol/s/mol fraction
c   D*H2 = total H2 diffusivity characteristic across outer filter vent = 7.4e-6 mol/s/mol fr
c   VOC diffusivity characteristic estimated knowing D*H2, VOC Tc, VOC Pc
```

T8074185: Output File

t8074185

carbon tetrachloride	4	656.5002	710.3384
methanol	3	666.9961	702.9305
dichloromethane	3	646.2015	710.8859
toluene	4	660.5712	714.5654
trichloroethylene	4	666.9238	714.2237
butanol	4	667.6109	712.2000
chloroform	4	670.3872	711.4213

85-Gallon Drum with Headspace Sample Taken between Inner and Outer Drum Lids (continued)

1,1-dichloroethene	**4**	**661.5505**	**704.8081**
methyl ethyl ketone	4	663.8907	708.8149
methyl isobutyl ketone	4	640.6293	708.1833
1,1,2,2-tetrachloroethane	4	663.5662	715.6915
chlorobenzene	4	657.4636	714.4169

85-Gallon Drum with Headspace Sample Taken between Inner and Outer Drum Lids (continued)

T8074925: Input File

```
't8074925','t8074925.out',12
'carbon tetrachloride',0.,1000.,0.,0.
153.82,193.e-10,0.0,556.4,45.0,0.,0.0217,0.,0.
'methanol',0.,1000.,0.,0.
32.0,135.e-10,0.,513.2,78.5,0.,0.0272,0.,0.
'dichloromethane',0.,1000.,0.,0.
84.9,263.e-10,0.,510.,62.2,0.,0.0431,0.,0.
'toluene',0.,1000.,0.,0.
92.1,669.e-10,0.0,591.8,40.5,0.,0.002857,7.e-6,0.
'trichloroethylene',0.,1000.,0.,0.
131.4,583.e-10,0.0,572.0,49.8,0.,0.00640,6.e-5,0.
'butanol',0.,1000.,0.,0.
74.1,300.e-10,0.,563.1,43.6,0.,0.02273,8.e-6,0.
'chloroform',0.,1000.,0.,0.
119.4,260.e-10,0.,536.4,53.0,0.,0.04545,0.,0.
'1,1-dichloroethene',0.,1000.,0.,0.
96.9,110.e-10,0.,513.0,47.5,0.,0.09091,0.,0.
'methyl ethyl ketone',0.,1000.,0.,0.
72.1,165.e-10,0.,536.8,41.5,0.,0.03704,0.,0.
'methyl isobutyl ketone',0.,1000.,0.,0.
100.2,130.e-10,0.,571.0,32.3,0.,0.01724,0.,0.
'1,1,2,2-tetrachloroethane',0.,1000.,0.,0.
167.9,2300.e-10,0.,661.2,57.6,0.,0.003846,0.,0.
'chlorobenzene',0.,1000.,0.,0.
112.6,600.e-10,0.,632.4,44.6,0.,0.007692,0.,0.
0.,0.,0.,0.,0.
1.e5,150.,1.e4,0.1,0.3
1.e3,3.01,3000.,0.0001,1.0
0.,0.,8600.,0.,0.
25.,76.,7.4e-6

c	85-gallon, w/inner and outer lids, each w/ filter vent
c	Only two void volumes: Below inner lid and between inner and outer lids
c	Value for volume underneath inner lid not required.
v	Void volume between lids = 8,600 cm3
c	Inner lid exhibits no solubility for VOCs
c	Effective surface area across liner (xd= 1.0 cm): Ad = 3.01 cm2
c	so effective H2 release rate equals inner lid filter vent, D*(H2)=9.25e-5 mol/s/mol fraction
c	D*H2 = total H2 diffusivity characteristic across outer filter vent = 7.4e-6 mol/s/mol fr
c	VOC diffusivity characteristic estimated knowing D*H2, VOC Tc, VOC Pc
```

T8074925: Output File

t8074925

carbon tetrachloride	2	905.5261	916.5511
methanol	1	856.9254	904.2494
dichloromethane	1	858.9792	917.4639
toluene	1	840.2369	923.6269
trichloroethylene	1	847.6193	923.0502
butanol	1	840.4010	919.6570
chloroform	1	841.2959	918.3570

85-Gallon Drum with Headspace Sample Taken between Inner and Outer Drum Lids (continued)

1,1-dichloroethene	**2**	**895.3182**	**907.3596**
methyl ethyl ketone	2	904.7638	914.0140
methyl isobutyl ketone	2	893.7937	912.9636
1,1,2,2-tetrachloroethane	1	849.4408	925.5973
chlorobenzene	1	834.5157	923.3759

85-Gallon Drum with Headspace Sample Taken between Inner and Outer Drum Lids (continued)

T8185074: Input File

```
't8185074','t8185074.out',12
'carbon tetrachloride',0.,1000.,0.,0.
153.82,193.e-10,0.0,556.4,45.0,0.,0.0217,0.,0.
'methanol',0.,1000.,0.,0.
32.0,135.e-10,0.,513.2,78.5,0.,0.0272,0.,0.
'dichloromethane',0.,1000.,0.,0.
84.9,263.e-10,0.,510.,62.2,0.,0.0431,0.,0.
'toluene',0.,1000.,0.,0.
92.1,669.e-10,0.0,591.8,40.5,0.,0.002857,7.e-6,0.
'trichloroethylene',0.,1000.,0.,0.
131.4,583.e-10,0.0,572.0,49.8,0.,0.00640,6.e-5,0.
'butanol',0.,1000.,0.,0.
74.1,300.e-10,0.,563.1,43.6,0.,0.02273,8.e-6,0.
'chloroform',0.,1000.,0.,0.
119.4,260.e-10,0.,536.4,53.0,0.,0.04545,0.,0.
'1,1-dichloroethene',0.,1000.,0.,0.
96.9,110.e-10,0.,513.0,47.5,0.,0.09091,0.,0.
'methyl ethyl ketone',0.,1000.,0.,0.
72.1,165.e-10,0.,536.8,41.5,0.,0.03704,0.,0.
'methyl isobutyl ketone',0.,1000.,0.,0.
100.2,130.e-10,0.,571.0,32.3,0.,0.01724,0.,0.
'1,1,2,2-tetrachloroethane',0.,1000.,0.,0.
167.9,2300.e-10,0.,661.2,57.6,0.,0.003846,0.,0.
'chlorobenzene',0.,1000.,0.,0.
112.6,600.e-10,0.,632.4,44.6,0.,0.007692,0.,0.
0.,0.,0.,0.,0.
1.e5,150.,1.e4,0.1,0.3
1.e3,0.241,3000.,0.0001,1.0
0.,0.,8600.,0.,0.
25.,76.,1.85e-5

c	85-gallon, w/inner and outer lids, each w/ filter vent
c	Only two void volumes: Below inner lid and between inner and outer lids
c	Value for volume underneath inner lid not required.
c	Void volume between lids: 8600 cm3
c	Inner lid exhibits no solubility for VOCs
c	Effective surface area across liner (xd= 1.0 cm): Ad = 0.241 cm2
c	so effectiveH2 release rate equals inner lid filter vent, D*(H2)=7.4e-6 mol/s/mol fraction
c	D*H2 = total H2 diffusivity characteristic across outer filter vent = 1.85e-5 mol/s/mol fr
c	VOC diffusivity characteristic estimated knowing D*H2, VOC Tc, VOC Pc
```

T8185074: Output File

t8185074

carbon tetrachloride	4	264.2713	285.1635
methanol	3	269.1919	282.1795
dichloromethane	3	260.1237	285.3840
toluene	4	265.2476	286.8644
trichloroethylene	4	267.8394	286.7272
butanol	4	268.3908	285.9131
chloroform	4	269.5879	285.5996

85-Gallon Drum with Headspace Sample Taken between Inner and Outer Drum Lids (continued)

1,1-dichloroethene	**4**	**266.9504**	**282.9358**
methyl ethyl ketone	4	267.3745	284.5498
methyl isobutyl ketone	4	258.3938	284.2955
1,1,2,2-tetrachloroethane	4	266.2293	287.3104
chlorobenzene	4	263.9991	286.8047

85-Gallon Drum with Headspace Sample Taken between Inner and Outer Drum Lids (continued)

T8185185: Input File

```
't8185185','t8185185.out',12
'carbon tetrachloride',0.,1000.,0.,0.
153.82,193.e-10,0.0,556.4,45.0,0.,0.0217,0.,0.
'methanol',0.,1000.,0.,0.
32.0,135.e-10,0.,513.2,78.5,0.,0.0272,0.,0.
'dichloromethane',0.,1000.,0.,0.
84.9,263.e-10,0.,510.,62.2,0.,0.0431,0.,0.
'toluene',0.,1000.,0.,0.
92.1,669.e-10,0.0,591.8,40.5,0.,0.002857,7.e-6,0.
'trichloroethylene',0.,1000.,0.,0.
131.4,583.e-10,0.0,572.0,49.8,0.,0.00640,6.e-5,0.
'butanol',0.,1000.,0.,0.
74.1,300.e-10,0.,563.1,43.6,0.,0.02273,8.e-6,0.
'chloroform',0.,1000.,0.,0.
119.4,260.e-10,0.,536.4,53.0,0.,0.04545,0.,0.
'1,1-dichloroethene',0.,1000.,0.,0.
96.9,110.e-10,0.,513.0,47.5,0.,0.09091,0.,0.
'methyl ethyl ketone',0.,1000.,0.,0.
72.1,165.e-10,0.,536.8,41.5,0.,0.03704,0.,0.
'methyl isobutyl ketone',0.,1000.,0.,0.
100.2,130.e-10,0.,571.0,32.3,0.,0.01724,0.,0.
'1,1,2,2-tetrachloroethane',0.,1000.,0.,0.
167.9,2300.e-10,0.,661.2,57.6,0.,0.003846,0.,0.
'chlorobenzene',0.,1000.,0.,0.
112.6,600.e-10,0.,632.4,44.6,0.,0.007692,0.,0.
0.,0.,0.,0.,0.
1.e5,150.,1.e4,0.1,0.3
1.e3,0.603,3000.,0.0001,1.0
0.,0.,8600.,0.,0.
25.,76.,1.85e-5

c	85-gallon, w/inner and outer lids, each w/ filter vent
c	Only two void volumes: Below inner lid and between inner and outer lids
c	Value for volume underneath inner lid not required.
c	Void volume between lids: 8,600 cm3
c	Inner lid exhibits no solubility for VOCs
c	Effective surface area across liner (xd= 1.0 cm): Ad = 0.603 cm2
c	so effective H2 release rate equals inner lid filter vent, D*(H2)=1.85e-5 mol/s/mol fraction
c	D*H2 = total H2 diffusivity characteristic across outer filter vent = 1.85e-5 mol/s/mol fr
c	VOC diffusivity characteristic estimated knowing D*H2, VOC Tc, VOC Pc
```

T8185185: Output File

t8185185

carbon tetrachloride	3	464.1280	495.1895
methanol	2	458.0754	486.2559
dichloromethane	3	479.8765	495.8555
toluene	3	468.8475	500.3598
trichloroethylene	3	472.6285	499.9384
butanol	3	471.9816	497.4577
chloroform	3	473.2405	496.5075

85-Gallon Drum with Headspace Sample Taken between Inner and Outer Drum Lids (continued)

1,1-dichloroethene	**3**	**464.3555**	**488.5069**
methyl ethyl ketone	3	467.8936	493.3403
methyl isobutyl ketone	3	453.1476	492.5757
1,1,2,2-tetrachloroethane	3	471.3279	501.7823
chlorobenzene	3	466.8141	500.1764

85-Gallon Drum with Headspace Sample Taken between Inner and Outer Drum Lids (continued)

T8185925: Input File

```
't8185925','t8185925.out',12
'carbon tetrachloride',0.,1000.,0.,0.
153.82,193.e-10,0.0,556.4,45.0,0.,0.0217,0.,0.
'methanol',0.,1000.,0.,0.
32.0,135.e-10,0.,513.2,78.5,0.,0.0272,0.,0.
'dichloromethane',0.,1000.,0.,0.
84.9,263.e-10,0.,510.,62.2,0.,0.0431,0.,0.
'toluene',0.,1000.,0.,0.
92.1,669.e-10,0.0,591.8,40.5,0.,0.002857,7.e-6,0.
'trichloroethylene',0.,1000.,0.,0.
131.4,583.e-10,0.0,572.0,49.8,0.,0.00640,6.e-5,0.
'butanol',0.,1000.,0.,0.
74.1,300.e-10,0.,563.1,43.6,0.,0.02273,8.e-6,0.
'chloroform',0.,1000.,0.,0.
119.4,260.e-10,0.,536.4,53.0,0.,0.04545,0.,0.
'1,1-dichloroethene',0.,1000.,0.,0.
96.9,110.e-10,0.,513.0,47.5,0.,0.09091,0.,0.
'methyl ethyl ketone',0.,1000.,0.,0.
72.1,165.e-10,0.,536.8,41.5,0.,0.03704,0.,0.
'methyl isobutyl ketone',0.,1000.,0.,0.
100.2,130.e-10,0.,571.0,32.3,0.,0.01724,0.,0.
'1,1,2,2-tetrachloroethane',0.,1000.,0.,0.
167.9,2300.e-10,0.,661.2,57.6,0.,0.003846,0.,0.
'chlorobenzene',0.,1000.,0.,0.
112.6,600.e-10,0.,632.4,44.6,0.,0.007692,0.,0.
0.,0.,0.,0.,0.
1.e5,150.,1.e4,0.1,0.3
1.e3,3.01,3000.,0.0001,1.0
0.,0.,8600.,0.,0.
25.,76.,1.85e-5

c    85-gallon, w/inner and outer lids, each w/ filter vent
c    Only two void volumes: Below inner lid and between inner and outer lids
c    Value for volume underneath inner lid not required.
c    Void volume between lids = 8600 cm3
c    Inner lid exhibits no solubility for VOCs
c    Effective surface area across liner (xd= 1.0 cm): Ad = 3.01 cm2
c    so effective H2 release rate equals inner lid filter vent, D*(H2)=9.25e-5 mol/s/mol fraction
c    D*H2 = total H2 diffusivity characteristic across outer filter vent = 1.85e-5 mol/s/mol fr
c    VOC diffusivity characteristic estimated knowing D*H2, VOC Tc, VOC Pc
```

T8185925: Output File

t8185925

carbon tetrachloride	1	745.0896	814.5927
methanol	1	763.4553	790.6893
dichloromethane	1	779.3246	816.3979
toluene	1	771.8720	828.7120
trichloroethylene	1	776.8860	827.5488
butanol	1	768.1018	820.7542
chloroform	1	767.4163	818.1684

85-Gallon Drum with Headspace Sample Taken between Inner and Outer Drum Lids (continued)

1,1-dichloroethene	1	725.8295	796.6593
methyl ethyl ketone	1	747.1299	809.5983
methyl isobutyl ketone	**2**	**797.2639**	**807.5405**
1,1,2,2-tetrachloroethane	1	780.8831	832.7335
chlorobenzene	1	767.2780	828.2053

85-Gallon Drum with Headspace Sample Taken Inside Inner Drum Lid

T8000074: Input File

```
't8000074','t8000074.out',12
'carbon tetrachloride',0.,1000.,0.,0.
153.82,193.e-10,0.0828,556.4,45.0,0.,0.0217,6.e-5,0.
'methanol',0.,1000.,0.,0.
32.0,135.e-10,0.152,513.2,78.5,0.,0.0272,2.4e-7,0.
'dichloromethane',0.,1000.,0.,0.
84.9,263.e-10,0.104,510.,62.2,0.,0.0431,2.e-6,0.
'toluene',0.,1000.,0.,0.
92.1,669.e-10,0.0849,591.8,40.5,0.,0.002857,7.e-6,0.
'trichloroethylene',0.,1000.,0.,0.
131.4,583.e-10,0.0875,572.0,49.8,0.,0.00640,6.e-5,0.
'butanol',0.,1000.,0.,0.
74.1,300.e-10,0.,563.1,43.6,0.,0.02273,8.e-6,0.
'chloroform',0.,1000.,0.,0.
119.4,260.e-10,0.,536.4,53.0,0.,0.04545,8.e-6,0.
'1,1-dichloroethene',0.,1000.,0.,0.
96.9,110.e-10,0.,513.0,47.5,0.,0.09091,8.e-6,0.
'methyl ethyl ketone',0.,1000.,0.,0.
72.1,165.e-10,0.,536.8,41.5,0.,0.03704,8.e-6,0.
'methyl isobutyl ketone',0.,1000.,0.,0.
100.2,130.e-10,0.,571.0,32.3,0.,0.01724,8.e-6,0.
'1,1,2,2-tetrachloroethane',0.,1000.,0.,0.
167.9,2300.e-10,0.,661.2,57.6,0.,0.003846,8.e-6,0.
'chlorobenzene',0.,1000.,0.,0.
112.6,600.e-10,0.,632.4,44.6,0.,0.007692,8.e-6,0.
0.,0.,0.,0.,0.
3000.,0.,20000.,0.0005,0.
12800.,150.,32500.,0.00005,1.4
0.,0.,32500.,0.,0.
25.,76.,74.e-7

c    85-gallon drum w/inner lid only w/ filter vent
c    No plastic liner bag (xp=0.0005 cm)
c    No liner (estimated by Ad=150 cm2, xd=1.4 cm, xp=0.00005)
c    Void volume under inner lid = 65,000 cm3, equally divided between
c    "liner" and outer headspace
c    H2 diffusion characteristic across drum filter vent = 74.e-7 mol/s/mol fr
```

T8000074: Output File

t8000074

carbon tetrachloride	1	995.8677	995.9557
methanol	1	993.4168	993.7886
dichloromethane	1	996.1627	996.1661
toluene	1	997.3427	997.4229
trichloroethylene	1	997.2693	997.2736
butanol	1	996.4285	996.4465
chloroform	1	996.1760	996.1920
1,1-dichloroethene	**1**	**991.8830**	**994.0137**
methyl ethyl ketone	1	995.1074	995.3364
methyl isobutyl ketone	1	993.9341	995.1288
1,1,2,2-tetrachloroethane	1	997.5565	997.6067
chlorobenzene	1	997.1373	997.1726

T8000185: Input File

```
't8000185','t8000185.out',12
'carbon tetrachloride',0.,1000.,0.,0.
153.82,193.e-10,0.0828,556.4,45.0,0.,0.0217,6.e-5,0.
'methanol',0.,1000.,0.,0.
32.0,135.e-10,0.152,513.2,78.5,0.,0.0272,2.4e-7,0.
'dichloromethane',0.,1000.,0.,0.
84.9,263.e-10,0.104,510.,62.2,0.,0.0431,2.e-6,0.
'toluene',0.,1000.,0.,0.
92.1,669.e-10,0.0849,591.8,40.5,0.,0.002857,7.e-6,0.
'trichloroethylene',0.,1000.,0.,0.
131.4,583.e-10,0.0875,572.0,49.8,0.,0.00640,6.e-5,0.
'butanol',0.,1000.,0.,0.
74.1,300.e-10,0.,563.1,43.6,0.,0.02273,8.e-6,0.
'chloroform',0.,1000.,0.,0.
119.4,260.e-10,0.,536.4,53.0,0.,0.04545,8.e-6,0.
'1,1-dichloroethene',0.,1000.,0.,0.
96.9,110.e-10,0.,513.0,47.5,0.,0.09091,8.e-6,0.
'methyl ethyl ketone',0.,1000.,0.,0.
72.1,165.e-10,0.,536.8,41.5,0.,0.03704,8.e-6,0.
'methyl isobutyl ketone',0.,1000.,0.,0.
100.2,130.e-10,0.,571.0,32.3,0.,0.01724,8.e-6,0.
'1,1,2,2-tetrachloroethane',0.,1000.,0.,0.
167.9,2300.e-10,0.,661.2,57.6,0.,0.003846,8.e-6,0.
'chlorobenzene',0.,1000.,0.,0.
112.6,600.e-10,0.,632.4,44.6,0.,0.007692,8.e-6,0.
0.,0.,0.,0.,0.
3000.,0.,20000.,0.0005,0.
12800.,150.,32500.,0.00005,1.4
0.,0.,32500.,0.,0.
25.,76.,1.85e-5

c    85-gallon drum w/inner lid only w/ filter vent
c    No plastic liner bag (xp=0.0005 cm)
c    No liner (estimated by Ad=150 cm2, xd=1.4 cm, xp=0.00005)
c    Void volume under inner lid = 65,000 cm3, equally divided between
c    fictional "liner" and outer headspace
c    H2 diffusion characteristic across drum filter vent = 1.85e-5 mol/s/mol fr
```

T8000185: Output File

t8000185

carbon tetrachloride	1	989.8693	989.9524
methanol	1	984.2750	984.6179
dichloromethane	1	990.4725	990.4758
toluene	1	993.5079	993.5881
trichloroethylene	1	993.2111	993.2153
butanol	1	991.1495	991.1669
chloroform	1	990.5217	990.5371
1,1-dichloroethene	**1**	**983.1649**	**985.1692**
methyl ethyl ketone	1	988.2098	988.4253
methyl isobutyl ketone	1	986.7792	987.9132
1,1,2,2-tetrachloroethane	1	994.0003	994.0502
chlorobenzene	1	992.9312	992.9661

T8000925: Input File

't8000925','t8000925.out',12
'carbon tetrachloride',0.,1000.,0.,0.
153.82,193.e-10,0.0828,556.4,45.0,0.,0.0217,6.e-5,0.
'methanol',0.,1000.,0.,0.
32.0,135.e-10,0.152,513.2,78.5,0.,0.0272,2.4e-7,0.
'dichloromethane',0.,1000.,0.,0.
84.9,263.e-10,0.104,510.,62.2,0.,0.0431,2.e-6,0.
'toluene',0.,1000.,0.,0.
92.1,669.e-10,0.0849,591.8,40.5,0.,0.002857,7.e-6,0.
'trichloroethylene',0.,1000.,0.,0.
131.4,583.e-10,0.0875,572.0,49.8,0.,0.00640,6.e-5,0.
'butanol',0.,1000.,0.,0.
74.1,300.e-10,0.,563.1,43.6,0.,0.02273,8.e-6,0.
'chloroform',0.,1000.,0.,0.
119.4,260.e-10,0.,536.4,53.0,0.,0.04545,8.e-6,0.
'1,1-dichloroethene',0.,1000.,0.,0.
96.9,110.e-10,0.,513.0,47.5,0.,0.09091,8.e-6,0.
'methyl ethyl ketone',0.,1000.,0.,0.
72.1,165.e-10,0.,536.8,41.5,0.,0.03704,8.e-6,0.
'methyl isobutyl ketone',0.,1000.,0.,0.
100.2,130.e-10,0.,571.0,32.3,0.,0.01724,8.e-6,0.
'1,1,2,2-tetrachloroethane',0.,1000.,0.,0.
167.9,2300.e-10,0.,661.2,57.6,0.,0.003846,8.e-6,0.
'chlorobenzene',0.,1000.,0.,0.
112.6,600.e-10,0.,632.4,44.6,0.,0.007692,8.e-6,0.
0.,0.,0.,0.,0.
3000.,0.,20000.,0.0005,0.
12800.,150.,32500.,0.00005,1.4
0.,0.,32500.,0.,0.
25.,76.,9.25e-5

c 85-gallon drum w/inner lid only w/ filter vent
c No plastic liner bag (xp=0.0005 cm)
c No liner (estimated by Ad=150 cm2, xd=1.4 cm, xp=0.00005)
c Void volume under inner lid = 65,000 cm3, equally divided between
c fictional "liner" and outer headspace
c H2 diffusion characteristic across drum filter vent = 9.25e-5 mol/s/mol fr

T8000925: Output File

t8000925

carbon tetrachloride	1	951.6512	951.7082
methanol	1	927.3497	927.5541
dichloromethane	1	954.1380	954.1399
toluene	1	968.6779	968.7537
trichloroethylene	1	966.9775	966.9815
butanol	1	957.3364	957.3524
chloroform	1	954.4067	954.4180
1,1-dichloroethene	**1**	**928.6652**	**930.0061**
methyl ethyl ketone	1	944.5496	944.6951
methyl isobutyl ketone	1	941.5576	942.3600
1,1,2,2-tetrachloroethane	1	970.9257	970.9733
chlorobenzene	1	965.7715	965.8041

Item 2

Class 2 Permit Modification Request

Removal of Booster Fans

Waste Isolation Pilot Plant
Carlsbad, New Mexico

WIPP HWFP #NM4890139088-TSDF

Table of Contents

Acronyms and Abbreviations

AIS	Air Intake Shaft
DOE	U. S. Department of Energy
EFB	Exhaust Filtration Building
EPA	United States Environmental Protection Agency
ES	Exhaust Shaft
HEPA	high-efficiency particulate air
HWFP	Hazardous Waste Facility Permit
MOU	Memoranda of Understanding
MSHA	Mine Safety and Health Administration
MVS	Mine Ventilation Services, Inc.
NMAC	New Mexico Administrative Code
NMBMI	New Mexico Bureau of Mine Inspection
NMED	New Mexico Environment Department
PMR	Permit Modification Request
RCRA	Resource Conservation and Recovery Act
SHS	Salt Handing Shaft
TRU	Transuranic
TSDF	Treatment, Storage and Disposal Facility
WIPP	Waste Isolation Pilot Plant
WS	Waste Shaft

Overview of the Permit Modification Request

This document contains one Class 2 Permit Modification Request (**PMR**) for the Hazardous Waste Facility Permit (**HWFP**) at the Waste Isolation Pilot Plant (**WIPP**), Permit Number NM4890139088-TSDF hereinafter referred to as the WIPP HWFP.

This PMR is being submitted by the U.S. Department of Energy (**DOE**), Carlsbad Field Office (**CBFO**) and Washington TRU Solutions LLC (**WTS**), collectively referred to as the Permittees, in accordance with the WIPP HWFP, Condition I.B.1 (20.4.1.900 New Mexico Administrative Code (**NMAC**) incorporating Title 40 Code of Federal Regulations (**CFR**) §270.42(b)). This modification seeks to remove from the WIPP HWFP all references to airflow reversal mode of operation of the underground ventilation system, and all references to booster fans. If this PMR is approved by the NMED, WIPP personnel will physically remove the booster fans and their ancillary equipment and controls. These changes do not reduce the ability of the Permittees to provide continued protection to human health and the environment.

The supporting documents relative to this request are provided in this PMR. The proposed modification to the text of the WIPP HWFP has been identified using a double underline and a revision bar in the right hand margin for added information, and a ~~strikeout~~ font for deleted information. All direct quotations are indicated by italicized text. The following information specifically addresses how compliance has been achieved with the WIPP HWFP requirement, Permit Condition I.B.1 for submission of this Class 2 PMR.

13. 20.4.1.900 NMAC (incorporating 40 CFR §270.42(b)(1)(i)), requires the applicant to describe the exact change to be made to the permit conditions and supporting documents referenced by the permit.

Specifically, this PMR seeks to modify language in Section F-4d of Attachment F to the WIPP HWFP, and in Section M2-2 of Attachment M2 to the WIPP HWFP. The exact wording of the proposed changes to Attachment F and M2 of the WIPP HWFP is included in Item 1, Section 9 of this PMR.

2. 20.4.1.900 NMAC (incorporating 40 CFR §270.42(b)(1)(ii)), requires the applicant to identify that the modification is a Class 2 modification.

This PMR is classified as a Class 2 because it involves changes related to emergency procedures described in WIPP's Contingency Plan related to operation of the booster fans[1]. The applicable regulation in 40 CFR Part 270, Appendix I, for Classification of Permit Modifications states:

> *"B. General Facility Standards...6. Contingency plan: a. Changes in emergency procedures (i.e., spill or release response procedures)".*

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[1]letter from J. Bearzi of the New Mexico Environment Department (NMED) to I. Triay of the Waste Isolation Pilot Plant (WIPP), July 15, 2002, "...*NMED concurs with the Permittees' decision to revise the modification request and submit it for public comment as a Class 2 modification. NMED recommends classifying it under 40 CFR §270.42 Appendix I, Item B.6.a. This item is intended for changes to emergency procedures in RCRA contingency plans, such as this proposal to eliminate the options to reverse air flow in the event of a fire as currently specified in Attachment F, RCRA Contingency Plan*..."

3. 20.4.1.900 NMAC (incorporating 40 CFR §270.42(b)(1)(iii)), requires the applicant to explain why the modification is needed.

The WIPP is seeking to modify the WIPP HWFP because:

- The booster fans are not needed to supply ventilation air to the WIPP underground;
- The spread of fire, smoke, or toxic gases in the event of a fire can be more safely controlled using devices other than the booster fans - namely control doors;
- Use of the booster fans to control the spread of fire, smoke, or toxic gases in an actual emergency could pose unintentional adverse consequences for workers attempting to escape the underground;
- Various experts in mine ventilation engineering and safety, including those at the Mine Safety and Health Administration (**MSHA**) and the New Mexico Bureau of Mine Inspection (**NMBMI**) have determined that the booster fans are not needed to protect the health and safety of WIPP workers; and,
- The booster fans are not necessary to protect the environment, or otherwise satisfy any Resource Conservation and Recovery Act (**RCRA**) hazardous waste regulation, or any requirement under the New Mexico Hazardous Waste Act.

4. 20.4.1.900 NMAC (incorporating 40 CFR §270.42 (b)(1)(iv)), requires the applicant to provide the applicable information required by 40 CFR §§270.13 through 270.21, 270.62 and 270.63.

The regulatory crosswalk in the following section describes those portions of the WIPP HWFP that are affected by this PMR. Where applicable, regulatory citations in this modification reference Title 20, Chapter 4, Part 1, NMAC, revised June 14, 2000, incorporating the CFR, Title 40 (40 CFR Parts 264 and 270). 40 CFR §§270.16 through 270.22, 270.62, 270.63 and 270.66 are not applicable at WIPP. Consequently, they are not listed in the regulatory crosswalk table. 40 CFR §270.23 is applicable to the WIPP Hazardous Waste Disposal Units.

5. 20.4.1.900 NMAC (incorporating 40 CFR §270.11(d)(1) and 40 CFR §270.30(k)), requires any person signing under paragraph a and b must certify the document in accordance with 20.4.1.900 NMAC.

The transmittal letter for this PMR contains the signed certification statement in accordance with Module I.F of the WIPP HWFP.

Regulatory Crosswalk

Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the HWFP or Permit Application	Yes	No
§270.13		Contents of Part A permit application	Attachment O, Part A		%
§270.14(b)(1)		General facility description	Attachment A		%
§270.14(b)(2)	§264.13(a)	Chemical and physical analyses	Attachment B		%
§270.14(b)(3)	§264.13(b)	Development and implementation of waste analysis plan	Attachment B		%
	§264.13(c)	Off-site waste analysis requirements	Attachment B		%
§270.14(b)(4)	§264.14(a-c)	Security procedures and equipment	Attachment C		%
§270.14(b)(5)	§264.15(a-d)	General inspection requirements	Attachment D		%
	§264.174	Container inspections	Attachment D		%
§270.23(a)(2)	§264.602	Miscellaneous units inspections	Attachment D		%
§270.14(b)(6)		Request for waiver from preparedness and prevention requirements of Part 264 Subpart C	NA		
§270.14(b)(7)	264 Subpart D	Contingency plan requirements	Attachment F		%
	§264.51	Contingency plan design and implementation	Attachment F	%	
	§264.52 (a) & (c-f)	Contingency plan content	Attachment F	%	
	§264.53	Contingency plan copies	Attachment F		%
	§264.54	Contingency plan amendment	Attachment F		%
	§264.55	Emergency coordinator	Attachment F		%
	§264.56	Emergency procedures	Attachment F	%	
§270.14(b)(8)		Description of procedures, structures or equipment for:	Attachment E		%
§270.14(b)(8)(i)		Prevention of hazards in unloading operations (e.g., ramps and special forklifts)	Attachment E		%
§270.14(b)(8)(ii)		Runoff or flood prevention (e.g., berms, trenches, and dikes)	Attachment E		%
§270.14(b)(8)(iii)		Prevention of contamination of water supplies	Attachment E		%

Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the HWFP or Permit Application	Yes	No
§270.14(b)(8) (iv)		Mitigation of effects of equipment failure and power outages	Attachment E		%
§270.14(b)(8) (v)		Prevention of undue exposure of personnel (e.g., personal protective equipment)	Attachment E		%
§270.14(b)(8) (vi) §270.23(a)(2)	§264.601	Prevention of releases to the atmosphere	Module II Module IV Attachment M2 Attachment N		%
	264 Subpart C	Preparedness and Prevention	Attachment E		%
	§264.31	Design and operation of facility	Attachment E		%
	§264.32	Required equipment	Attachment E Attachment F		%
	§264.33	Testing and maintenance of equipment	Attachment D		%
	§264.34	Access to communication/alarm system	Attachment E		%
	§264.35	Required aisle space	Attachment E		%
	§264.37	Arrangements with local authorities	Attachment F		%
§270.14(b)(9)	§264.17(a-c)	Prevention of accidental ignition or reaction of ignitable, reactive, or incompatible wastes	Attachment E		%
§270.14(b) (10)		Traffic pattern, volume, and controls, for example: Identification of turn lanes Identification of traffic/stacking lanes, if appropriate Description of access road surface Description of access road load-bearing capacity Identification of traffic controls	Attachment G		%
§270.14(b) (11)(i) and (ii)	§264.18(a)	Seismic standard applicability and requirements	Part B, Rev. 6 Chapter B		%
§270.14(b) (11)(iii-v)	§264.18(b)	100-year floodplain standard	Part B, Rev. 6 Chapter B		%
	§264.18(c)	Other location standards	Part B, Rev. 6 Chapter B		%
§270.14(b) (12)	§264.16(a-e)	Personnel training program	Attachment H		%
§270.14(b) (13)	264 Subpart G	Closure and post-closure plans	Attachment I & J		%

Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the HWFP or Permit Application	Yes	No
§270.14(b)(13)	§264.111	Closure performance standard	Attachment I		%
§270.14(b)(13)	§264.112(a) (b)	Written content of closure plan	Attachment I		%
§270.14(b)(13)	§264.112(c)	Amendment of closure plan	Attachment I		%
§270.14(b)(13)	§264.112(d)	Notification of partial and final closure	Attachment I		%
§270.14(b)(13)	§264.112(e)	Removal of wastes and decontamination/dismantling of equipment	Attachment I		%
§270.14(b)(13)	§264.113	Time allowed for closure	Attachment I		%
§270.14(b)(13)	§264.114	Disposal/decontamination	Attachment I		%
§270.14(b)(13)	§264.115	Certification of closure	Attachment I		%
§270.14(b)(13)	§264.116	Survey plat	Attachment I		%
§270.14(b)(13)	§264.117	Post-closure care and use of property	Attachment J		%
§270.14(b)(13)	§264.118	Post-closure plan; amendment of plan	Attachment J		%
§270.14(b)(13)	§264.178	Closure/ containers	Attachment I		%
§270.14(b)(13)	§264.601	Environmental performance standards-Miscellaneous units	Attachment I		%
§270.14(b)(13)	§264.603	Post-closure care	Attachment I		%
§270.14(b) (14)	§264.119	Post-closure notices	Attachment J		%
§270.14(b)(15)	§264.142	Closure cost estimate	NA		%
	§264.143	Financial assurance	NA		%
§270.14(b) (16)	§264.144	Post-closure cost estimate	NA		%
	§264.145	Post-closure care financial assurance	NA		%
§270.14(b) (17)	§264.147	Liability insurance	NA		%
§270.14(b) (18)	§264.149-150	Proof of financial coverage	NA		%
§270.14(b) (19)(i), (vi), (vii), and (x)		Topographic map requirements Map scale and date Map orientation Legal boundaries Buildings Treatment, storage, and disposal operations Run-on/run-off control systems Fire control facilities	Attachment O Part A Part B, Rev. 6 Chapter B, E		%

Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the HWFP or Permit Application	Yes	No
§270.14(b)(19)(ii)	§264.18(b)	100-year floodplain	Attachment O Part A Part B, Rev. 6 Chapter B, E		%
§270.14(b)(19)(iii)		Surface waters	Attachment O Part A Part B, Rev. 6 Chapter B, E		%
§270.14(b)(19)(iv)		Surrounding Land use	Attachment O Part A Part B, Rev. 6 Chapter B, E		%
§270.14(b)(19)(v)		Wind rose	Attachment O Part A Part B, Rev. 6 Chapter B, E		%
§270.14(b)(19)(viii)	§264.14(b)	Access controls	Attachment O Part A Part B, Rev. 6 Chapter B, E, F		%
§270.14(b)(19)(ix)		Injection and withdrawal wells	Attachment O Part A Part B, Rev. 6 Chapter B, E, F		%
§270.14(b)(19)(xi)		Drainage on flood control barriers	Part B, Rev. 6 Chapter B, E, F		%
§270.14(b)(19)(xii)		Location of operational units	Part B, Rev. 6 Chapter B		%
§270.14(b)(20)		Other federal laws Wild and Scenic Rivers Act National Historic Preservation Act Endangered Species Act Coastal Zone Management Act Fish and Wildlife Coordination Act Executive Orders	Part B, Rev. 6 Chapter K		%
§270.15	§264 Subpart I	Containers	Attachment M1		%
	§264.171	Condition of containers	Attachment M1		%
	§264.172	Compatibility of waste with containers	Attachment M1		%
	§264.173	Management of containers	Attachment M1		%
	§264.174	Inspections	Attachment D Attachment M1		%
§270.15(a)	§264.175	Containment systems	Attachment M1		%
§270.15(c)	§264.176	Special requirements for ignitable or reactive waste	Attachment E Permit Module II		%
§270..15(d)	§264.177	Special requirements for incompatible wastes	Attachment E Permit Module II		%
	§264.178	Closure	Attachment I		%
§270.15(e)	§264.179	Air emission standards	Attachment E Attachment N		%
§270.23	264 Subpart X	Miscellaneous units	Attachment M2	%	
§270.23(a)	§264.601	Detailed unit description	Attachment M2	%	
§270.23(b)	§264.601	Hydrologic, geologic, and meteorologic assessments	Permit Module IV Attachment M2		%

Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	**Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)**	**Description of Requirement**	**Added or Clarified Information**		
			Section of the HWFP or Permit Application	**Yes**	**No**
§270.23(c)	§264.601	Potential exposure pathways	Permit Module IV Attachment M2 Attachment N		%
§270.23(d)		Demonstration of treatment effectiveness	Permit Module IV Attachment M2 Attachment N		%
	§264.602	Monitoring, analysis, inspection, response, reporting, and corrective action	Permit Module IV Attachment M2 Attachment N		%
	§264.603	Post-closure care	Attachment J Attachment J1		%
	264 Subpart E	Manifest system, record keeping, and reporting	Permit Module I Permit Module II Permit Module IV Attachment B		%

Attachment A

Description of the Class 2 Permit Modification Request

Table 1. Class 2 Hazardous Waste Facility Permit Modification

No.	Affected Permit Section	Item	Category	Attachment 1 Page #
1	a.1. Permit Attachment F b.1. Permit Attachment M2	Eliminate airflow reversal mode of operation of the underground ventilation system and remove three booster fans from the WIPP underground ventilation system.	A.8	A-3

1.0 Introduction

There are fans in the WIPP underground called booster fans. The booster fans were originally installed in the WIPP underground in the early 1980s to provide ventilation air during the early construction activities.

In 1988, the WIPP's underground ventilation system was upgraded with the construction of the Air Intake Shaft (**AIS**) and installation of two additional main fans at the surface. In 1999, a third main fan was added to the system. With these upgrades, the booster fans were no longer needed to ventilate the WIPP underground.

A re-examination of the role and function of the booster fans, as well as the applicable MSHA regulations, by mine ventilation and safety experts has resulted in a new conclusion that the booster fans and associated airflow reversal mode of operation: 1) are unnecessary, 2) do not contribute to WIPP safety, 3) could potentially result in adverse consequences for workers escaping the underground in the event of a fire, and 4) should be removed. The MSHA and NMBMI have also concluded that the use of the booster fans is not necessary.

The remainder of this PMR: 1) describes how the WIPP underground ventilation system works, 2) explains the evolution of WIPP's underground ventilation system, 3) reviews mine safety and health regulations related to ventilation and evacuation, and 4) demonstrates why removal of the booster fans will improve WIPP safety.

1.1 Why is the WIPP Requesting this Permit Modification?

The WIPP is seeking these changes to the HWFP because:

- The booster fans are not needed to supply ventilation air to the WIPP underground;
- The spread of fire, smoke, or toxic gases in the event of a fire can be more safely controlled using devices other than the booster fans - namely control doors;
- Use of the booster fans to control the spread of fire, smoke, or toxic gases in an actual emergency could result in unintentional adverse consequences for workers attempting to escape the underground;
- Various experts in mine ventilation engineering and safety, including those at the MSHA and the NMBMI, have determined that the booster fans are not needed to protect the health and safety of WIPP workers; and,
- The booster fans are not necessary to protect the environment, or otherwise satisfy any RCRA hazardous waste regulation, or any requirement under the New Mexico Hazardous Waste Act.

1.2 Classification of this Permit Modification Request

This PMR is classified as Class 2 because it involves changes related to emergency procedures described in WIPP's Contingency Plan related to operation of the booster fans[2]. The applicable regulation in 40 CFR Part 270, Appendix I, for Classification of Permit Modifications states:

> "*B. General Facility Standards… 6. Contingency plan: a. Changes in emergency procedures (i.e., spill or release response procedures)*".

This PMR seeks to remove from the HWFP all references to booster fans and airflow reversal mode of operation of the underground ventilation system. If this PMR is approved by the NMED, WIPP personnel will physically remove the booster fans and their ancillary equipment and controls.

[2] letter from J. Bearzi of New Mexico Environment Department (NMED) to I. Triay of Waste Isolation Pilot Plant (WIPP), July 15, 2002, "…*NMED concurs with the Permittees' decision to revise the modification request and submit it for public comment as a Class 2 modification. NMED recommends classifying it under 40 CFR §270.42 Appendix I, Item B.6.a. This item is intended for changes to emergency procedures in RCRA contingency plans, such as this proposal to eliminate the options to reverse air flow in the event of a fire as currently specified in Attachment F, RCRA Contingency Plan*…"

2.0 Underground Ventilation Systems and How They Work

Underground mines have systems that provide fresh air to the mine workings. These underground ventilation systems have features that provide the necessary airflow to the mine. A simple, three-dimensional diagram of an underground ventilation system and its features is shown in Figure 1.

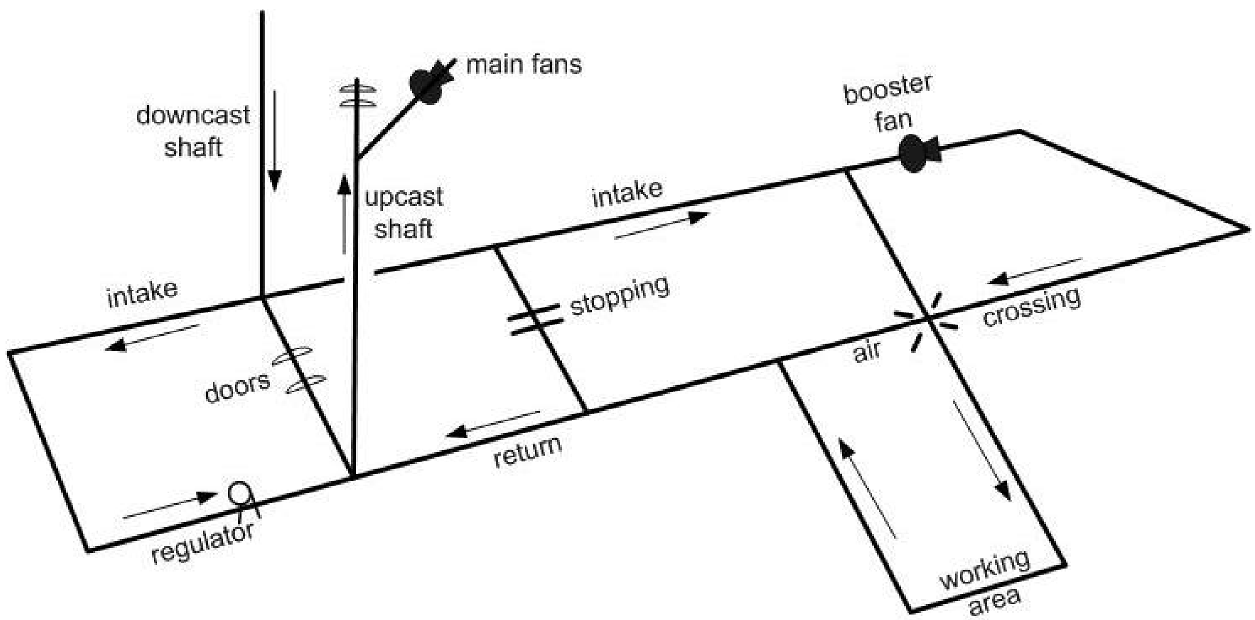

Figure 1, Features of Underground Ventilation Systems[3]

2.1 Features of Underground Mine Ventilation Systems

The mining industry worldwide uses various standard terms to describe the features of underground ventilation systems[4]. Many of these standard terms are incorporated into the MSHA regulations applicable to underground mining activities.

Main Fans: Most underground mines are equipped with one or more main fans[5], usually located at the surface in association with upcast shafts, that provide ventilation airflow to the mine. Main fans typically provide airflow to the mine workings by applying a suction to the upcast shafts.

Booster Fans: Some mines are equipped with one or more booster fans[6] in the underground area of the mine to augment the airflow provided by the main fans. Unlike main fans, booster

---

[3] from Subsurface Ventilation and Environmental Engineering, Malcolm J. McPherson, 1993, Chapman & Hall Press, Chapter 4, Figure 4.1

[4] *Ibid.*, Chapter 4

[5] MSHA Safety and Health Standards, Underground Metal and Nonmetal Mines, 33 CFR §57.2 Definitions, "***Main fan*** *means a fan that controls the entire airflow of the mine, or the airflow of one of the major air circuits*"

[6] *Ibid.*, "***Booster fan*** *means a fan installed in the main airstream or a split of the main airstream to increase airflow through a section or sections of a mine*"

fans only handle airflows in localized areas of a mine. In some mines, booster fans are only used temporarily during construction and initial development of the mine - i.e. until such time as the mine's ventilation system is fully developed with main fans capable of ventilating all underground areas.

Downcast Shafts: Underground mines have airways, called shafts, that convey the intake ventilation airflow to the underground areas of the mine. These shafts are called downcast or intake shafts.

Upcast Shafts: Underground mines have airways, called shafts, that convey the return (sometimes referred to as "exhaust") ventilation airflow from the underground areas of the mine to the surface.

Ventilation Control Devices: In addition to fans and shafts, underground mines are equipped with a variety of devices that allow the airflow in the mine to be controlled and directed. These devices can take several standard forms, including:

> **Doors, or "Control Doors":** There are several types of control doors, including ventilation doors, isolation doors, fire doors, and man doors. Control doors can be selectively opened and closed to control airflow in underground areas of mines. As explained in more detail in Sections 3.4 and 5.2.1 below, the term "control door" is a term that has special meaning under MSHA regulations applicable to underground mine ventilation systems.
>
> **Regulators:** Underground mines can also be equipped with regulators - control doors fitted with one or more adjustable orifices to control airflow through the door.
>
> **Stoppings:** When a mine is being developed, sometimes connections between intakes and returns must be sealed to prevent short-circuiting the ventilation airflow. These barriers, called stoppings, or bulkheads, are put in place to stop the air flow. Stoppings can be temporary or permanent, and can be constructed with a variety of materials, including steel and concrete. Temporary stoppings are often constructed using brattice[7] cloth or curtains.

---

[7] from Subsurface Ventilation and Environmental Engineering, Malcolm J. McPherson, 1993, Chapman & Hall Press, Chapter 4, pg. 93, "…*brattice curtains may be tacked to roof, sides, and floor to provide temporary stoppings where pressure differentials are low such as in locations close to the working areas*…"

3.0 The WIPP's Underground Ventilation System

The underground ventilation system at the WIPP includes many of the features described in Section 2, above. A simplified, three-dimensional diagram of the WIPP underground ventilation system, including its major features, is shown in Figure 2.

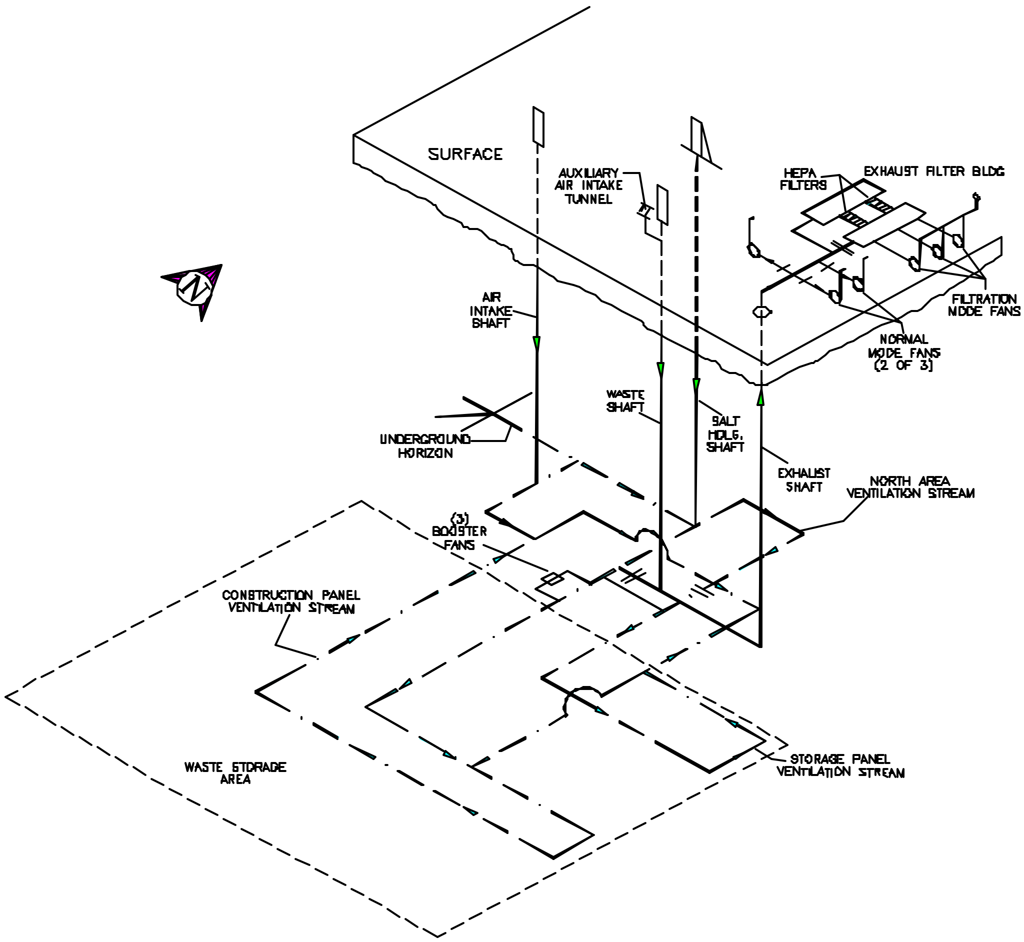

Figure 2, The WIPP's Underground Ventilation System[8]
(Note: this diagram is a simplified depiction for illustration purposes only, for a detailed depiction of the WIPP's Underground Ventilation System, see Drawing No. 54-W-001-W in Attachment B)

[8] from U.S. Department of Energy Waste Isolation Pilot Plant Underground Ventilation System (VU00) System Design Description (SDD), Rev. 3, June, 1997, Figure VU-G-2

3.1 The Main Fans

There are three main fans located on the surface that provide airflow to the WIPP underground during normal operating mode (see Photo 1 below). These main fans are known as the 700 A, -B, and -C fans. Two of these fans are normally operated with a third serving as a backup. There are also three fans located on the surface that can provide airflow to the WIPP underground during filtration mode (i.e., the mode of operation used to contain a radiological release, see Attachment C). These fans are known as the Exhaust Filtration Building (**EFB**) Fans or 860 fans and are associated with the high-efficiency particulate air (**HEPA**) filtration system at the EFB. The EFB fans and main fans are depicted on the schematic at the bottom of Drawing 54-W-001-W in Attachment B.

Photo 1, Main Fan Installation at the Surface
Near the Exhaust Shaft, 700-A and 700-B Fans

3.2 The Booster Fans

The booster fans are located in the WIPP underground at the W-30 drift between the S-1000 and S-1300 drifts, and consist of three axial vane type fan units (see note regarding “Fan Equipment #14" on Drawing 54-W-001-W in Attachment B, and Photo 2, below).

Photo 2, Booster Fan Installation Above Bulkhead
at W-30 between S-1000 and S-1300 - looking South

The booster fans were installed in the 1980s to provide ventilation to the WIPP underground during the early mining and construction activities. With the addition of the 700 fans, and construction of the fourth shaft (i.e., the AIS, see Section 3.3 below), the booster fans were no longer needed for general ventilation purposes. A more detailed discussion of the evolution of the WIPP's underground ventilation system is included in Section 4 below, and Attachment C to this PMR.

3.3 The Shafts

Airflow in the WIPP underground is accomplished with four separate shafts - three function as downcast, or intake shafts, and the fourth acts as an upcast, or exhaust shaft. The four shafts are the:

- AIS;
- Salt Handling Shaft (SHS);
- Waste Shaft (WS); and,
- Exhaust Shaft (ES).

The AIS is the primary fresh air supply to the WIPP underground (see Drawing 54-W-001-W in Attachment B). The AIS also serves as a secondary means of hoisting personnel from the underground to the surface in the event of an emergency. The AIS is approximately 16 feet in diameter near the surface, and about 20 feet in diameter over most of its length. A single-deck working platform comprises a part of the hoist system for the AIS (defined by MSHA as a conveyance). This conveyance is used for routine inspection and maintenance of the shaft. The AIS conveyance is normally positioned at the base of the shaft.

The SHS is the secondary fresh air supply to the WIPP underground (see Drawing No. 54-W-001-W in Attachment B). The SHS is also used to transport salt to the surface, to transport personnel and non-radiological materials, and as a conduit for various power, control, and communications cables. The SHS is approximately ten feet in diameter near the surface, and about 12 feet in diameter over most of its length. The SHS conveyance is a two-deck work platform used for transporting personnel and salt, as well as for routine inspection and maintenance of the shaft. The SHS is one of the primary escapeways used to evacuate the WIPP underground.

The WS is the fresh air supply for the underground WS Station (see Drawing 54-W-001-W in Attachment B). The airflow in the WS is drawn from the Waste Handling Building, and is only used for ventilation of the WS Station at the base of the shaft. From the WS Station at the base of the WS, the airflow is routed directly to the ES. The WS conveyance is used as the primary transport for radioactive waste, underground mining equipment, materials, and personnel to and from the WIPP underground. The WS is approximately 19 feet in diameter near the surface, and about 20 feet in diameter over most of its length. The WS is one of the primary escapeways used to evacuate the WIPP underground - the other is the SHS.

The ES is used exclusively for exhausting the return air from the WIPP underground to the surface (see Drawing 54-W-001-W in Attachment B). The ES is approximately 14 feet in diameter near the surface, and about 15 feet in diameter over most of its length. There is no conveyance in the ES.

3.4 Ventilation Control Devices

The WIPP underground is equipped with a variety of ventilation control devices that allow the airflow to be regulated and directed to and from different portions of the underground. These ventilation control devices take several forms, including bulkheads, fire doors, shaft isolation doors, vehicle doors, and regulators, and are shown on Drawing 54-W-001-W in Attachment B. These ventilation control devices are referred to in the MSHA regulations as control doors. Photo 3 below shows an open set of control doors near the SHS Station (in the event of a fire, these control doors can be closed to isolate the SHS and SHS Station).

Photo 3, Control Doors Adjacent to SHS Station
at the W-30 and N-150 Drifts - looking South

In addition to regulating and directing ventilation airflow during normal mining operations, the control doors at the WIPP can be configured in a variety of ways to control the spread of smoke, fire, or toxic gases in the event of a fire in the underground (see Section 5.2.1 below, and Attachment C to this PMR).

4.0 Evolution of the WIPP Underground Ventilation System

This section describes how the underground ventilation system at the WIPP has evolved since construction began in the early 1980s. Attachment C to this PMR contains more details with respect to the evolutionary history of the WIPP's underground ventilation system.

4.1 Original Purpose of the Booster Fans

The WIPP's underground ventilation system originally consisted of three main exhaust fans at the surface (now known as the 860 fans, see Section 3.1 above), booster fans in the underground, and a network of ventilation control doors. In the early- to mid- 1980s there were only three shafts at the WIPP - the SHS, the WS and the ES. At the time, because there were only three shafts, and because the 860 fans could not supply all of the needed air, the booster fans were needed to supply air to all areas of the mine. With the early underground ventilation system, based on the availability of air, WIPP personnel would not have been able to perform waste disposal activities and mining/construction activities simultaneously.

4.2 Expansion of the Ventilation System

In the late 1980s, the WIPP made significant upgrades to the underground ventilation system. These upgrades included the construction of a fourth shaft (the AIS), and the installation of new, larger main fans on the surface (i.e., the 700 fans). These changes allowed mining/construction and waste handling activities to occur simultaneously. With these upgrades, the booster fans were no longer needed to ventilate areas of the WIPP underground, because the 700 fans provided all necessary ventilation air.

4.3 Airflow Reversal Mode Using the Booster Fans

In the early 1990s, it was determined that the booster fans, although no longer needed for general ventilation, could be used to reverse airflow in portions of the WIPP underground in case of a fire. It was believed at the time that such reversal capability was necessary for compliance with MSHA regulations for ventilation control (see more detailed discussion of these MSHA requirements and their current applicability to WIPP in Section 5, below). As a result, WIPP adopted procedures to utilize the booster fans to reverse airflow in the underground in case of a fire.

4.4 Present Conclusions Regarding the Protective Value of the Booster Fans

In light of the evolutionary advances in the WIPP's underground ventilation system, mine ventilation experts, including those with the MSHA, have re-examined the role of the booster fans in controlling the spread of fire, smoke, or toxic gases in the event of a fire underground. This re-examination has resulted in new conclusions regarding the protective value of the booster fans and associated airflow reversal mode of operation - namely that the booster fans: 1) are unnecessary, 2) do not contribute to WIPP safety, 3) could cause adverse consequences to workers attempting to escape the underground in the event of fire, and 4) should be removed (see Section 6 below, and Attachment C to this PMR).

5.0 Review of the MSHA Regulations Related to Underground Ventilation and Evacuation

This section examines two key mine safety regulations relevant to the removal of the booster fans - one deals with ventilation, the other with evacuation. These regulations are not only important to understanding the context in which this PMR is being sought, but also to evaluating the rationale in Section 6 below supporting elimination of the airflow reversal mode and removal of the booster fans.

The Mine Safety and Health Act[9] of 1977 established the MSHA within the U.S. Department of Labor. The MSHA develops and enforces safety and health rules that apply to U.S. mines. Pursuant to Section 11 of the Land Withdrawal Act[10], the MSHA is authorized to inspect the WIPP no less than four times annually and provide its inspection results to the DOE for appropriate response.

5.1 Mine Ventilation Plans

The DOE implements numerous MSHA regulations at the WIPP. For example, the MSHA regulations address the development and annual update of Mine Ventilation Plans[11]. The WIPP Mine Ventilation Plan[12] explains how the underground ventilation system works, describes the principal air flows within the mine, and identifies the various ventilation system components.

Although the current Mine Ventilation Plan includes language referencing the booster fans and airflow reversal mode, the latest revision also includes a note referencing elimination of this language in connection with this PMR[13]. If this PMR is approved, the WIPP Mine Ventilation Plan will be revised to eliminate references to the booster fans and reversal mode.

5.2 Ventilation Control Measures

The MSHA regulations specify that nonmetal mines must be able to control the ventilation in the event of an underground fire. This regulation, in 30 CFR §57.4760(a) says:

> "(a) *Shaft mines shall be provided with at least one of the following means to control the spread of fire, smoke, and toxic gases underground in the event of a fire: control doors,*

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[9] Federal Mine Safety & Health Act of 1977, Public Law 91-173, as amended by Public Law 95-164, http://www.msha.gov/REGS/ACT/ACTTC.HTM

[10] The Waste Isolation Pilot Plant Land Withdrawal Act, Public Law 102-579, Sec. 11. MINE SAFETY. " *(a) MINE SAFETY AND HEALTH ADMINISTRATION: The Mine Safety and Health Administration of the Department of Labor shall inspect WIPP not less than 4 times each year and in the same manner as it evaluates mine sites under the Federal Mine Safety and Health Act of 1977 (30 U.S.C. 801 et seq.), and shall provide the results of its inspections to the Secretary. The Secretary shall make the results of such inspections publicly available and shall take necessary actions to ensure the prompt and effective correction of any deficiency, including suspending specific activities as necessary to address identified health and safety deficiencies*", http://www.emnrd.state.nm.us/wipp/lwa.htm

[11] 33 CFR §57.8520, Ventilation Plan, "*A plan of the mine ventilation system shall be set out by the operator in written form…The plan shall…contain the following:…Locations of all main, booster and auxiliary fans…Locations of air regulators and stoppings and ventilation doors*…", http://www.msha.gov/regdata/msha/57.8520.htm

[12] Waste Isolation Pilot Plant Mine Ventilation Plan, July 16, 2002, Westinghouse TRU Solutions, LLC

[13] *Ibid*., pg. 11, "…*Note: There is currently an action in process which will eliminate reversal mode and remove these fans from the underground*…"

reversal of mechanical ventilation, or effective evacuation procedures…"[14]

The intent of this particular regulation is not to provide a means of extinguishing fire, but rather to ensure that mines provide at least one of the three means to allow for the safe evacuation of persons underground in case of fire[15].

5.2.1 Control Doors

The first method of controlling the spread of fire, smoke, and toxic gases in case of fire, as described in the MSHA ventilation control measures regulation, is the use of control doors. This regulation, in 30 CFR §57.4760(a)(1), says:

"… *(1)* ***Control Doors****. If used as an alternative, control doors shall be --*

(a)(1)(i) Installed at or near shaft stations of intake shafts and any shaft designated as an emergency escapeway under §57.11053 or at other locations that provide equivalent protection;

(a)(1)(ii) Constructed and maintained according to Table C-3;

(a)(1)(iii) Provided with a means of remote closure at landings of timbered intake shafts unless a person specifically designated to close each door in the event of a fire can reach the door within three minutes;

(a)(1)(iv) Closed or opened only according to predetermined conditions and procedures;

(a)(1)(v) Constructed so that once closed they will not reopen as a result of a differential in air pressure;

(a)(1)(vi) Constructed so that they can be opened from either side by one person, or be provided with a personnel door that can be opened from either side; and

(a)(1)(vii) Clear of obstructions…."[16]

Control doors are the means by which the WIPP satisfies the ventilation control regulation in 30 CFR §57.4760(a). The network of control doors in the WIPP underground (including the bulkheads, shaft isolation doors, man doors, fire doors, and regulators), used in conjunction with the main fans on the surface, allow the WIPP great flexibility to control and direct the spread of fire, smoke, and toxic gases underground in the event of a fire (see Attachments C and E to this PMR).

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[14] 30 CFR §57.4760 , Ventilation Control Measures, http://www.msha.gov/regdata/msha/57.4760.htm

[15] Safety Standards for Fire Prevention and Control at Metal and Nonmetal Mines, Mine Safety and Health Administration Proposed Rule, Federal Register, October 4, 1983, 48 FR 45345, "*Ventilation Control Measures…the intent of the standard* [is] *to provide for the safe evacuation of persons in the event of a fire underground…this standard would function to prevent spread of smoke and toxic gases in order to permit the safe escape of persons underground,* ***not extinguish fires****…*", emphasis added

[16] 30 CFR §57.4760(a)(1) , Ventilation Control Measures, http://www.msha.gov/regdata/msha/57.4760.htm

5.2.2 Mechanical Ventilation Reversal

The second method of controlling the spread of fire, smoke, and toxic gases in case of fire, as described in the MSHA ventilation control measures regulation, is the use of mechanical ventilation reversal. This regulation, at 30 CFR §57.4760(a)(2), says:

> "…*(2)* ***Mechanical ventilation reversal****. If used as an alternative, reversal of mechanical ventilation shall -*
>
> *(a)(2)(i) Provide at all times at least the same degree of protection to persons underground as would be afforded by the installation of control doors;*
>
> *(a)(2)(ii) Be accomplished by a main fan. If the main fan is located underground-*
>
> *(a)(2)(ii)(A) The cable or conductors supplying power to the fan shall be routed through areas free of fire hazards; or*
>
> *(a)(2)(ii)(B) The main fan shall be equipped with a second, independent power cable or set of conductors from the surface. The power cable or conductors shall be located so that an underground fire disrupting power in one cable or set of conductors will not affect the other; or*
>
> *(a)(2)(ii)(C) A second fan capable of accomplishing ventilation reversal shall be available for use in the event of failure of the main fan;*
>
> *(a)(2)(iii) Provide rapid air reversal that allows persons underground time to exit in fresh air by the second escapeway or find a place of refuge; and*
>
> *(a)(2)(iv) Be done according to predetermined conditions and procedures*…"[17]

The WIPP's underground ventilation system does not satisfy the three specific criteria of this portion of the regulation because: reversal mode using the booster fans does not provide the same degree of protection as control doors; the booster fans are not main fans; and the booster fans cannot provide for rapid air reversal (see more detailed discussion in Section 6 below and Attachments C and E to this PMR).

5.2.3 Evacuation

The third method of controlling the spread of fire, smoke, and toxic gases in case of fire, as described in the MSHA ventilation control measures regulation, is evacuation. This regulation, in 30 CFR §57.4760(a)(3), says:

> "…*(3)* ***Evacuation****. If used as an alternative,* ***effective*** [emphasis added] *evacuation shall be demonstrated by actual evacuation of all persons underground to the surface in ten minutes or less through routes that will not expose persons to heat, smoke, or toxic fumes in the event of a fire"*[18]

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[17] 30 CFR §57.4760(a)(2) , Ventilation Control Measures, http://www.msha.gov/regdata/msha/57.4760.htm
[18] 30 CFR §57.4760(a)(3) , Ventilation Control Measures, http://www.msha.gov/regdata/msha/57.4760.htm

5.2.3.1 Origin of the Ten-Minute Evacuation Standard

The MSHA regulation states that to be "effective" for purposes of satisfying the ventilation control requirement, evacuation must occur in less than ten minutes. The ten-minute evacuation standard in 30 CFR §57.4760 is geared toward small mining operations where it is actually possible to evacuate all persons from the underground within 10 minutes. It is not physically possible to evacuate all persons from the WIPP underground in less than ten minutes, and as explained in detail below, the WIPP applies a one-hour evacuation standard.

5.2.3.2 Why Does it Take Longer Than Ten Minutes to Evacuate Persons from the WIPP Underground to the Surface?

There are several factors that constrain the evacuation time of mines (e.g. aerial extent of mine workings, depth of shafts, working speed of conveyances, etc.). Many of these factors are present at the WIPP and constrain the time it takes to evacuate personnel from the underground.

One factor is the areal extent of the underground area at the WIPP. The WIPP's underground workings span more than half a mile in a North-South direction (see Drawing No. 54-W-001-W in Attachment B). A time-distance calculation illustrates how areal extent of the WIPP underground affects evacuation time. Consider the following:

Assumptions

Distance: An underground worker is located at the extreme Southeast corner of Panel 2. If such a worker were to travel directly west along the S-2520 drift to the E-140 drift, and then directly north along the E-140 drift to the WS Station, the worker would travel a distance of approximately 3,450 linear feet (obtained from Drawing 54-W-001-W in Attachment B).

Rate: At a fast walk a person travels at an average speed of 2.82 miles per hour[19], or about 248 feet per minute.

Using the standard equation of *distance = rate x time*, how long would it take for the worker to walk from the Southeast corner of Panel 2 to the Waste Shaft?

Answer: rearranging the standard equation to *time = distance/rate*

time = 3,450 feet/248 feet per minute = ***13.91 minutes***

Note: This calculation does not account for the time it takes to open and close control doors along the route of travel.

This calculation shows that it can take a worker approximately 14 minutes to walk from a distant

[19] The Carnegie Mellon University Motion of Body (MoBo) Database, R. Gross and J. Shi, June 2001, Section 2.2, pg. 4, http://rincewind.hid.ri.cmu.edu/ralph/Publications/CMU-RI-TR-01-18.pdf

area of the underground to the WS Station.

Another constraint on the minimum time it takes WIPP personnel to evacuate the underground is the depth of the shafts and working speed of the conveyances in those shafts. As stated in Section 3.3 above, the WS and SHS are the primary escapeways from the WIPP underground. The WIPP underground is approximately 2,150 feet below the surface. The working speed of the conveyance in the WS is 510 feet per minute[20]. A simple time-distance calculation illustrates how the shaft depth and conveyance speed constrain the minimum evacuation time. Consider the following:

<u>Assumptions</u>

Distance: 2,150 feet from the base of the WS to the surface.

Rate (or Speed) of Conveyance: 510 feet per minute.

Using the standard equation of *distance = rate x time*, how long would it take for the conveyance to travel from the base of the WS to the surface?

<u>Answer:</u> rearranging the standard equation to *time = distance/rate*

time = 2,150 feet/510 feet per minute = ***4.22 minutes***

Note: this calculation does not account for 1) the time it would take to load workers onto the conveyance, 2) the time to offload workers from the conveyance, or 3) the fact that it may take more than one round-trip of the conveyance to evacuate personnel to the surface.

Given these two constraints, the minimum amount of time it would take to safely evacuate a hypothetical worker from the most distant reaches of Panel 2, via the WS conveyance, is 18.13 minutes (i.e. 13.91 minutes plus 4.22 minutes). This shows that the ten-minute evacuation standard at 30 CFR §57.4760(a)(3) is neither appropriate nor achievable in the WIPP's case. As explained in Section 5.3.1 below, rather than meet this ten-minute evacuation standard, the WIPP, like most medium to large scale underground mines, satisfies a <u>one-hour</u> MSHA evacuation standard.

5.2.4 The WIPP Uses Control Doors to Satisfy the Ventilation Control Measures Requirement

Of the three options available under the MSHA ventilation control measures regulation, the WIPP uses control doors in the underground to control the spread of fire, smoke, or toxic gases in the event of a fire. Of the three options, control doors afford the greatest degree of protection because they offer the most flexibility to direct - and even contain in the case of the shaft isolation doors - the flow of fire, smoke, and toxic gases in case of fire. As explained in Section 6 below and Attachment C to this PMR, mechanical ventilation reversal in the WIPP's case using the booster fans has inherent dangers and time limitations that speak strongly for elimination of the reversal mode of operation and removal of the booster fans.

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[20] <u>Waste Handling Hoist Operation, Normal Operating Procedure, Revision 7</u>, WP04-HO1003, 6/6/01, Section 5.3.30[B], pg. 15

5.3 Evacuation Requirements

Another key MSHA regulation relevant to elimination of the airflow reversal mode of operation and removal of the booster fans is that which deals with evacuation of personnel from underground mines in the event of an emergency.

5.3.1 Escapeways and Refuges

A MSHA regulation requires that underground mines have at least two separate escapeways to the surface that allow workers to exit the underground. This regulation, in 30 CFR §57.11050(a), says:

> "*(a)* ***Every mine shall have two or more separate, properly maintained escapeways to the surface from the lowest levels*** *which are so positioned that damage to one shall not lessen the effectiveness of the others. A method of refuge shall be provided while a second opening to the surface is being developed. A second escapeway is recommended, but not required, during the exploration or development of an ore body*" [21], emphasis added

In the WIPP's case, there are <u>three</u> escapeways with conveyances that could be used to evacuate workers from the underground - the WS, SHS, and the AIS. The primary escapeways are the WS and SHS.

5.3.1.1 The One-Hour Evacuation Standard

In addition to two or more escapeways, MSHA specifies a one-hour evacuation standard. This regulation, 30 CFR §57.11050(b), says:

> "*(b) In addition to separate escapeways, a method of refuge shall be provided for every employee who cannot reach the surface from his working place through at least two separate escapeways* ***within a time limit of one hour when using the normal exit method****. These refuges must be positioned so that the employee can reach one of them within 30 minutes from the time he leaves his workplace*" [22], emphasis added

The WIPP applies this standard.

5.3.1.2 Origin of the One-Hour Evacuation Standard

The one-hour evacuation standard derives from international mining industry practices related to the use of self-rescuers. Self-rescuers are small, self-contained breathing devices that allow personnel to escape through contaminated atmospheres in mines[23]. The internationally accepted one-hour evacuation standard is reflected in the MSHA regulation in 30 CFR

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[21] <u>30 CFR §57.11050(a)</u>, Escapeways and Refuges, http://www.msha.gov/regdata/msha/57.11050.htm

[22] <u>30 CFR §57.11050(b)</u>, Escapeways and Refuges, http://www.msha.gov/regdata/msha/57.11050.htm

[23] <u>Subsurface Ventilation and Environmental Engineering</u>, Malcolm J. McPherson, 1993, Chapman & Hall Press, pg. 881 - 882, "*…In many countries, it is mandatory for all persons who enter an underground mine to carry a self-rescuer…The purpose of self-rescuers is to allow the wearers to escape from or through contaminated atmospheres…The period of operation is, typically, about 1 h for saturated conditions and carbon monoxide concentrations of up to 1.5%…*"

§57.15030 which says:

> "*Provisions and maintenance of self-rescue devices. A* ***1-hour*** [emphasis added] *self-rescue device approved by MSHA and NIOSH under 42 CFR part 84 shall be made available by the operator to all personnel underground. Each operator shall maintain self-rescue devices in good condition*"[24]

Every person working in or visiting the WIPP underground is trained in the use of self rescue devices, and such persons carry a self-rescue device at all times when underground.

5.3.2 Underground Evacuation Drills

The WIPP performs underground evacuation drills consistent with the MSHA regulations to demonstrate that personnel can be evacuated from the underground in less than one hour. The MSHA regulation, in 30 CFR §57.4361, says:

> "***Underground evacuation drills.***
>
> *(a) At least once every six months, mine evacuation drills shall be held to assess the ability of all persons underground to reach the surface or other designated points of* ***safety within the time limits of the self-rescue devices*** *that would be used during an actual emergency.*
>
> *(b) The evacuation drills shall--*
> *(1) Be held for each shift at some time other than a shift change and involve all persons underground;*
> *(2) Involve activation of the fire alarm system; and*
> *(3) Include evacuation of all persons from their work areas to the surface or to designated central evacuation points.*
>
> *(c) At the completion of each drill, the mine operator shall certify the date and the time the evacuation began and ended. Certifications shall be retained for at least one year after each drill*"[25], emphasis added

5.3.3 The WIPP Complies with the One-Hour Evacuation Standard

Every six months, consistent with the MSHA regulations, the WIPP performs evacuation drills of the underground to assess the ability to evacuate the underground in less than one hour. The results of these drills demonstrate that the WIPP consistently satisfies the one-hour standard. Table A-1 below is a summary of recent evacuation drills of the WIPP underground.

Table A-1, Summary of the WIPP Underground Evacuation Times[26]
(Note: copies of records documenting these evacuation times are included in this PMR in Attachment D)

[24] 30 CFR §57.15030, Provisions and maintenance of self-rescue devices, http://www.msha.gov/regdata/msha/57.15030.htm

[25] 30 CFR §57.4361, Underground evacuation drills, http://www.msha.gov/regdata/msha/57.4361.htm

[26] Records documenting WIPP Underground Evacuation Drills are kept by the Radiation and Safety Management Group for purposes of MSHA compliance

Date	Drill/Exercise Number	Length of Time to Evacuate WIPP Underground
January 12, 1999	FY2000-06	22 minutes
November 28, 2000	FY2001-01	20 minutes
January 18, 2001	FY2001-06	27 minutes
March 14, 2001	FY2001-18	26 minutes
July 27, 2001	FY2001-21	30 minutes
December 4, 2001	FY2002-06	30 minutes
December 4, 2001	FY2002-076	15 minutes
May 22, 2002	D2002-21	20 minutes

6.0 Rationale for Removal of the Booster Fans

The role of the booster fans to control the spread of fire, smoke, and toxic gases has been re-examined by mine ventilation and safety experts. Mine Ventilation Services, Inc. (**MVS**), a consulting firm specializing in engineering, health and safety aspects of mine ventilation systems, has assessed the role and function of the booster fans in reversing airflow in the event of a fire. Included as Attachment C to this PMR is a letter report from MVS titled "Removal of the Underground Booster Fans at the WIPP Facility".

6.1 Problems Associated With Ventilation Reversal in the Event of Fire

Among other things, the report included in Attachment C examines the problems associated with airflow reversal to control ventilation in the event of a fire. The report concludes that removal of the booster fans will improve safety by eliminating reversal modes of operation that could potentially have unintended, adverse consequences for workers attempting to escape the underground in the event of a fire. The problems associated with ventilation reversal as a method of controlling the spread of fire, smoke, and toxic gases, include:

- Confusion of workers attempting to escape the underground;
- Potential re-circulation and risk of leakage of air from the disposal ventilation circuit to the mining ventilation circuit;
- Length of time needed to effectuate reversal; and,
- Potential exposure of underground workers executing reversal procedures to control the spread of fire, smoke, or toxic gases.

These problems, and why the booster fans should be removed and the reversal mode of operation eliminated, are described in detail in Attachment C to this PMR.

6.2 Presence of a Better and Safer Method of Controlling Ventilation in the Event of Fire

As described in Sections 3.4, and 5.2.1, WIPP utilizes control doors to control the spread of fire, smoke, and toxic gases in the event of a fire. This method of ventilation control is safer because it does not have the inherent dangers associated with the airflow reversal via the booster fans (i.e., re-circulation, confusion of escaping workers, etc.). Control doors provide the greatest degree of protection to persons underground, and afford the needed flexibility to control ventilation in specific areas of the WIPP underground in the event of fire.

6.3 Evaluation of Removal of the Booster Fans by Mine Safety and Health Regulators

As set forth in Section 5.2 above, the MSHA regulations require that mines utilize at least one of three methods to control the spread of fire, smoke, and toxic gases in the event of an underground fire. In 2001, officials from the Ventilation Division[27] of the MSHA's Pittsburgh Safety and Health Technology Center conducted an investigation of the WIPP's underground

[27] Web site for Ventilation Division of MSHA's Safety and Health Technology Center, "…*Mission: Conduct field evaluations of plant and mine ventilation systems…Investigate the causes and means to prevent future accidents, including mine fires and explosions. Train mining industry personnel in plant and mine ventilation, gas detection, and prevention and control of fires and explosions*…", http://www.msha.gov/techsupp/pshtcweb/ventilat.htm

ventilation system. The purpose of this investigation was to assess the WIPP's proposal to remove the booster fans with respect to mine health and safety. As a result of the investigation, MSHA issued a report concluding that the WIPP's control doors could be used as an alternative to the booster fans[28]. A copy of the MSHA's investigation report is included in this PMR as Attachment E.

The NMBMI has also examined the WIPP's underground ventilation system and proposal to remove the booster fans. Like the MSHA, the NMBMI has determined that removal of the booster fans will not affect the WIPP's ability to provide a safe and healthy workplace, or the WIPP's ability to safely and effectively evacuate underground personnel in the event of an emergency. A copy of the NMBMI's determination letter is included in this PMR as Attachment F.

[28] Mine Ventilation Investigation, Investigative Report No. P434-V339-Revised, March, 1989, W. Francart and G. Aul, pg. 4, "…*The control doors are constructed as defined by the above criteria* [30 CFR §57.4760(a)(1)] *and could be used as an alternative to comply with 57.4760(a). They are in proximity of each of the shafts and are operated either remotely or can be reached within the 3 minute requirement. Doors are operated pneumatically and can be opened and closed from either side of the door by one person…The intake shafts can be isolated by closing the doors at underground locations in an event of fire in the mine*…"

7.0 Operational Aspects of Removal of the Booster Fans

As described in Section 4.2 above, the addition of the AIS and the main 700 fans on the surface negated the need for the booster fans to provide ventilation air to the underground areas of the WIPP. Main surface fan capacity at the WIPP is sufficient for all current activities and those of the foreseeable future. If this PMR is approved by the NMED, the WIPP will initiate the process to physically remove the booster fans and all associated controls. The WIPP will also update non-HWFP related documents to reflect elimination of the reversal mode operation and the removal of the booster fans (e.g., the WIPP Mine Ventilation Plan referenced in Section 5.1 above). There are no anticipated impacts to current or future WIPP operations as a result of removal of the booster fans or elimination of the reversal mode of operation.

8.0 Conclusion

In the 1990s, it was believed that the booster fans were needed to demonstrate airflow reversal in the event of a fire in the WIPP underground. A re-examination of the role and function of the booster fans, as well as the applicable MSHA regulations, by mine ventilation and safety experts has resulted in the conclusion that the airflow reversal mode of operation and the booster fans: 1) are unnecessary, 2) do not contribute to WIPP safety, 3) could potentially result in adverse consequences for workers escaping the underground if ever used, and 4) should be eliminated from the WIPP's underground ventilation system.

The WIPP's proposal to remove the booster fans has also been evaluated by federal and state regulators charged with ensuring the health and safety of mine workers, and the safe operation of underground mines. These agencies have concluded that removal of the booster fans will not hinder the WIPP's ability to protect its workers, or to maintain safe underground operations. Both the MSHA and the NMBMI have also concluded that the booster fans and associated airflow reversal mode of operation are not necessary.

Therefore, the Permittees respectfully request that the NMED modify the HWFP to remove references to 1) the booster fans and 2) ventilation reversal mode of operation. The following section contains proposed revisions to the text of the WIPP's HWFP.

9.0 Revised Permit Text

a. 1. Permit Attachment F, Section F-4d, Fire

Fire

The incident level emergency response identified in Section F-3 includes fire/explosion potential. WIPP fire response includes incipient, exterior structure fires, and internal structure fires. The RCRA Emergency Coordinator can implement the Memoranda of Understanding (**MOU**) for additional support.

The first option in mine fire response will be to apply mechanical methods to stop fires (e.g., cut electrical power). The last option in mine fire response will be to reconfigure ventilation using control doors associated with the underground ventilation system. The following actions are implemented in the event of a fire:

1. All emergency response personnel at an incident will wear appropriate PPE.

2. Only fire extinguishing materials that are compatible with the materials involved in the fire will be used to extinguish fires. Compatibility with materials involved in a fire are determined by pre-fire plans, Emergency Response Guide Book (DOT, 1993), DOT labeling, and site-specific knowledge of the emergency response personnel. Water and dry chemical materials have been determined to be compatible with all components of the TRU mixed waste. Pre-fire plans for the WHB are included in Figures F-10 and F-11.

   Fires in areas of the WHB Unit should not propagate, due to limited amount of combustibles, and the concrete and steel construction of the structures. Administrative controls, such as landlord inspections and EST/FPT inspections, help to insure good housekeeping is maintained. Combustible material and TRU mixed waste will be isolated, if possible. Firewater drain trenches collect the water and channel it into a sump. In areas not adjacent to the trenches, portable absorbent dikes (pigs) will be used to retain as much as possible, until it can be transferred to containers or sampled and analyzed for hazardous constituents.

   ~~In a mine fire, if reconfiguring ventilation is necessary, a set of three booster fans will allow selective reversal of airflow in the mining area, the Air Intake Shaft and its associated station, and the Salt Handling Shaft and its associated station. In these modes, airflow can be reversed by opening and closing certain ventilation doors and air regulators and by operating the underground booster fans (in either the forward or the reverse direction). These fans will normally be turned off and will be isolated, with air bypassing the fans and flowing through the air lock. The surface fans will be stopped before attempting any underground air reversals. These~~

~~modes of ventilation will only be implemented under manual control for off-normal conditions (such as a fire).~~

b.1. Permit Attachment M2, Section M2-2a(3), Underground Ventilation Modes of Operation

Overall, there are six ~~seven~~ possible modes of exhaust fan operation:

- 2 main fans in operation
- 1 main fan in operation
- 1 filtration fan in filtered operation
- ~~Reversal~~
- 1 filtration fan in unfiltered operation
- 2 filtration fans in unfiltered operation
- 1 main and 1 filtration fan (unfiltered) in operation

Under some circumstances (such as power outages and maintenance activities, etc.), all mine ventilation may be discontinued for short periods of time.

In the normal mode, two main surface exhaust fans, located near the Exhaust Shaft, will provide continuous ventilation of the underground areas. All underground flows join at the bottom of the Exhaust Shaft before discharge to the atmosphere.

Outside air will be supplied to the mining areas and the waste disposal areas through the Air Intake Shaft, the Salt Handling Shaft, and access entries. A small quantity of outside air will flow down the Waste Shaft to ventilate the Waste Shaft station. The ventilation system is designed to operate with the Air Intake Shaft as the primary source of fresh air. Under these circumstances, sufficient air will be available to simultaneously conduct all underground operations (e.g., waste handling, mining, experimentation, and support). Ventilation may be supplied by operating one main exhaust fan, or one or two filtration exhaust fans, or an combination of the three.

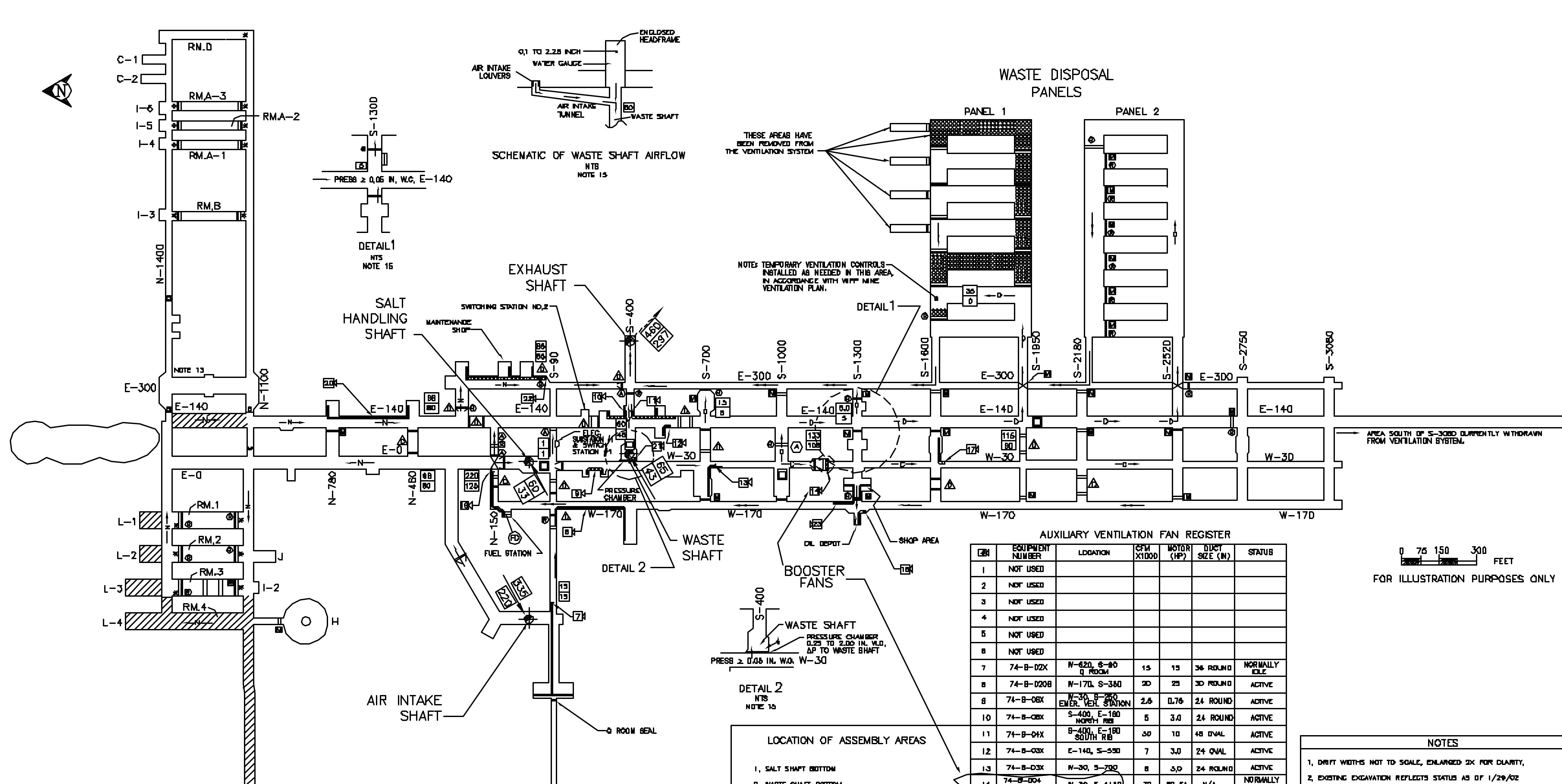
If the nominal flow of 425,000 cfm (12,028 m^3/min) is not available (i.e., only one of the main ventilation fans is available) underground operations may proceed, but the number of activities that can be performed in parallel may be limited depending on the quantity of air available. Ventilation may be supplied by operating one or two of the filtration exhaust fans. To accomplish this, the isolation dampers will be opened, which will permit air to flow from the main exhaust duct to the filter outlet plenum. The filtration fans may also be operated to bypass the HEPA plenum. The isolation dampers of the filtration exhaust fan(s) to be employed will be opened, and the selected fan(s) will be switched on. In this mode, underground operations will be limited, because filtration exhaust fans cannot provide sufficient airflow to support the use of diesel equipment.

In the filtration mode, the exhaust air will pass through two identical filter assemblies, with only one of the three Exhaust Filter Building filtration fans operating (all other fans are stopped). This system provides a means for removing the airborne particulates that may contain radioactive and hazardous waste contaminants in the reduced exhaust flow before they are discharged through the exhaust stack to the atmosphere. The filtration mode is activated manually or automatically if the radiation monitoring system detects abnormally high concentrations of airborne radioactive particulates (an alarm is received from the continuous air monitor in the exhaust drift of the active waste panel) or a waste handling incident with the potential for a waste container breach is observed. The filtration mode is not initiated by the release of gases such as VOCs.

~~A set of three booster fans will allow selective reversal of airflow in the mining area, the Air Intake Shaft and its associated station, and the Salt Handling Shaft and its associated station. In these modes, airflow can be reversed by opening and closing certain ventilation doors and air regulators and by operating the underground booster fans (in either the forward or the reverse direction). These fans will normally be turned off and will be isolated, with air bypassing the fans and flowing through the air lock. The surface fans will be stopped before attempting any underground air reversals. These modes of ventilation will only be implemented under manual control for off-normal conditions (such as a fire).~~

Attachment B

Drawing No. 54-W-001-W, Underground Mine Ventilation System



AUXILIARY VENTILATION FAN REGISTER

[illegible]	EQUIPMENT NUMBER	LOCATION	CFM X1000	MOTOR (HP)	DUCT SIZE (IN)	STATUS
1	NOT USED					
2	NOT USED					
3	NOT USED					
4	NOT USED					
5	NOT USED					
6	NOT USED					
7	74-B-02X	W-620, S-90 Q ROOM	15	15	36 ROUND	NORMALLY IDLE
8	74-B-0208	W-170, S-350	20	25	30 ROUND	ACTIVE
9	74-B-06X	W-30, S-250 EMER. VEH. STATION	2.6	0.75	24 ROUND	ACTIVE
10	74-B-08X	S-400, E-160 NORTH RIB	5	3.0	24 ROUND	ACTIVE
11	74-B-04X	S-400, E-160 SOUTH RIB	30	10	45 OVAL	ACTIVE
12	74-B-03X	E-140, S-550	7	3.0	24 OVAL	ACTIVE
13	74-B-03X	W-30, S-700	8	3.0	24 ROUND	ACTIVE
14	74-B-004 A, B, & C	W-30, S-1150	70	50 EA.	N/A	NORMALLY IDLE
15	NOT USED					
16	74-B-09X	W-170, S-1300 OIL STORAGE	7.5	3	24 ROUND	ACTIVE
17	74-B-09X	W-30, S-1600	8	10	24 ROUND	NORMALLY IDLE
18	NOT USED					
19	74-B-12X	N-150 AT O.C. NO. 2 FUEL BAY	–	2.0	24 ROUND	ACTIVE
20	74-B-09X	E-140, N-620	–	10	32 ROUND	ACTIVE
21	74-B-05X	WASTE SHAFT SUMP	5	5	18 ROUND	NORMALLY IDLE
22	74-B-02X	E-300 MAINT. SHOP	17	50	42 OVAL	NORMALLY IDLE
23	74-B-02X	W-70, S-1300 SHOP AREA	15	15	30 ROUND	NORMALLY IDLE

NOTE: THE FANS IDENTIFIED ON THE DWG WITH AN "X" DESIGNATOR WILL BE LABELED IN THE FIELD WITH A SPECIFIC NUMBER WITHIN THE NUMBERING SEQUENCE OUTLINED IN TABLE 3 ON DWG 54-A-160-V1. THE HAND SWITCH (HS) LABEL WILL CORRESPOND TO THE FAN NUMBER.

LOCATION OF ASSEMBLY AREAS

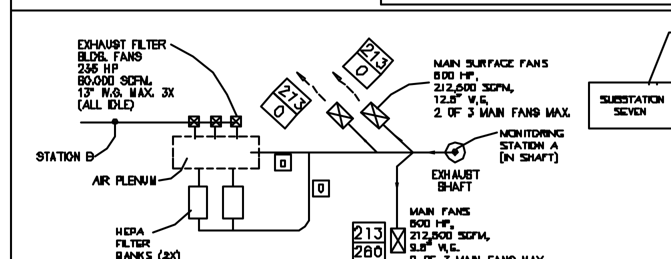
1. SALT SHAFT BOTTOM
2. WASTE SHAFT BOTTOM
3. S-1000 (W-30/W-170) TOOL CRIB
4. E-140/S-2000

DIAL PHONE EXTENSION NUMBERS

SALT SHAFT BOTTOM	8574
WASTE SHAFT BOTTOM	8448
S-1000 TOOL CRIB	8220
CMR EMERGENCY NUMBER	8111
UNDERGROUND FACILITY OPERATOR	8553

LEGEND

- INTAKE SUPPLY AIR
- RETURN AIR
- WASTE HANDLING AIR
- NORTH AREA AIR
- CONSTRUCTION AIR
- DISPOSAL AIR
- BARRICADE
- BULKHEAD
- NORMALLY OPEN
- UNPASSABLE BULKHEAD (PROHIBITED AREA)
- EB EMERGENCY BARRICADED AREA
- AIRFLOW IN KCFM: TWO (OF 3) MINE FANS NOTE 14; ONE MINE FAN NOTE 14
- ASSEMBLY AREA
- VENTILATION DUCT
- WASTE DRUMS
- BACKFILL SALT AREA
- BULKHEAD W/MANDOOR AIRLOCK
- MANDOOR
- VEHICLE DOOR W/MAN DOOR (TWO DOORS FORM AN AIRLOCK)
- REGULATOR
- FIRE DOOR
- CHECK CURTAIN
- CRIBSET
- VERTICAL SHAFT
- OVERCAST
- FAN
- EXISTING EXCAVATION



SURFACE LOCATED PRIMARY MINE FAN & CONTROL SCHEMATIC

NOTES

1. DRIFT WIDTHS NOT TO SCALE, ENLARGED 2X FOR CLARITY.
2. EXISTING EXCAVATION REFLECTS STATUS AS OF 1/29/02
3. REMOVED
4. REMOVED
5. REMOVED
6. REMOVED
7. REMOVED
8. SANDIA SHOP FIRE DOORS AND DUCT SYSTEM TO BE INSTALLED.
9. ALL DESIGNATED ASSEMBLY AREAS ARE EQUIPPED WITH A DIAL PHONE, PAGER PHONE, AND MINER'S AID STATION. EXTENSION NUMBERS FOR DIAL PHONES ARE PROVIDED UNDER HEADING "LOCATION OF ASSEMBLY AREAS".
10. NORMAL AND ALTERNATE AIRFLOWS IN '000 OF CFM.
11. DRAWING WAS REVED FROM AA TO BB. THERE ARE NO REV'S IN BETWEEN. THE CORRECT REVISION PROCESS WILL BE FOLLOWED FROM HERE ON, BC, BD, BE ETC.
12. REMOVED
13. CHAIN-LINK INSTALLED IN BULKHEAD 74-B-518 DOOR OPENING TO FORM BARRICADE.
14. AIRFLOWS ARE NOMINAL AS OF THE MOST RECENT TEST & BALANCE COMPUTER CORRELATED MODEL. UNDERGROUND FACILITY OPS HAS THE AUTHOURIZATION TO RECONFIGURE THE UNDERGROUND AIRFLOWS TO SUPPORT OPERATIONAL NEEDS.
15. TAKEN FROM DRAWING 54-W-002-W PER ECO 10330.

REV	ISSUE DESCRIPTION	DFTR / DATE	CHKR / DATE	COG / DATE	DITG MGR / DATE	ECO	PWR
CN	REVISED PER ECO	AM 8/05/02	PA 8/22/02	KM 8/27/02	BB 8/28/02	9889	[illegible]
CM	REVISED PER ECO/FD	RS 7/23/02	PA 7/24/02	KM 7/24/02	BB 7/24/02	10238	N/A

THIS DRAWING CREATED BY ENGINEERING CHANGE ORDER (ECO): 2390 PWR: N/A

DFTR: R.MAYNARD 2/12/88
CHKR: TONY ALSTON 12/06/90
COG: J.LOOMIS 12/06/90
CM: H.L.LUCAS 1/13/90
QA: R.YOUNGMAN 1/11/90
SFTY: D.RIPLEY 1/09/90
DM: B.ALLEN 12/06/90
DOE: JACK E GILBERT 1/17/91

U.S. DEPARTMENT OF ENERGY

TRU Solutions
Westinghouse TRU Solutions LLC
Waste Isolation Pilot Plant
Carlsbad, New Mexico

UNDERGROUND MINE VENTILATION SYSTEM

INDEX CODE NUMBER				
SYSTEM	WBS	DWG TYPE	QL	VENDOR
VU00	54	U0125	25	24D

SIZE: E SYS: VU00 DWG NO: 54-W-001-W REV: CN
SCALE:
INTERPRET DWG PER ANSI Y14
THIS DRAWING TAKEN FROM: N/A
VENDOR: N/A

Attachment C

Letter Report - Removal of Underground Booster Fan at the WIPP Facility

Mine Ventilation Services, Inc.
4946 E. Yale Ave., Suite 103, Fresno, CA 93727 U.S.A.
Telephone: (559) 452-0182, Facsimile (559) 452-0184, e-mail:support@mvsengineering.com

November 12, 2002

Mr. Subhash Sethi
Manager of Repository Development Projects
Westinghouse TRU Solutions, LLC
P.O. Box 2078
Carlsbad, NM 88220

Re: Removal of Underground Booster Fans at the WIPP Facility

Dear Mr. Sethi:

Mine Ventilation Services, Inc. (MVS) has been involved in the testing and operation of the ventilation system at the Waste Isolation Pilot Plant (WIPP) since 1988. Over the past 14 years many improvements and enhancements have been designed and installed to enhance the underground ventilation system. However, one component of the system that has been in place since the early 1980s that does not contribute to enhancing safety at the facility is the use of booster fans to reverse the airflow in the underground. This letter describes the history of the fans, their original intent, and their present function at the WIPP facility. This letter also discusses why MVS believes these fans should be removed from the facility.

Historical Information

The ventilation system at WIPP is designed with the goal of protecting the health and safety of all individuals working or visiting the underground facility. This goal is achieved by providing sufficient airflow to all areas of the underground where personnel work or travel to ensure that any contaminants, such as diesel engine emissions, are adequately diluted. The system is also designed to protect personnel working in the underground living or working on the surface in the unlikely event of an airborne release of radioactive material. Underground worker exposure is minimized by designing the ventilation system such that all air leakage is from the construction and north circuit to the disposal circuit. To protect personnel and the public on surface, the ventilation system is designed such that the exhaust air can be diverted through a series of high efficiency particulate air (HEPA) filters should a radioactive release be detected. Figure 1 illustrates the four main air routes in the present underground facility layout. Figure 2 shows the present, generalized configuration of the main (700 series) fans, the exhaust filter building and the filtration (860 series) fans.

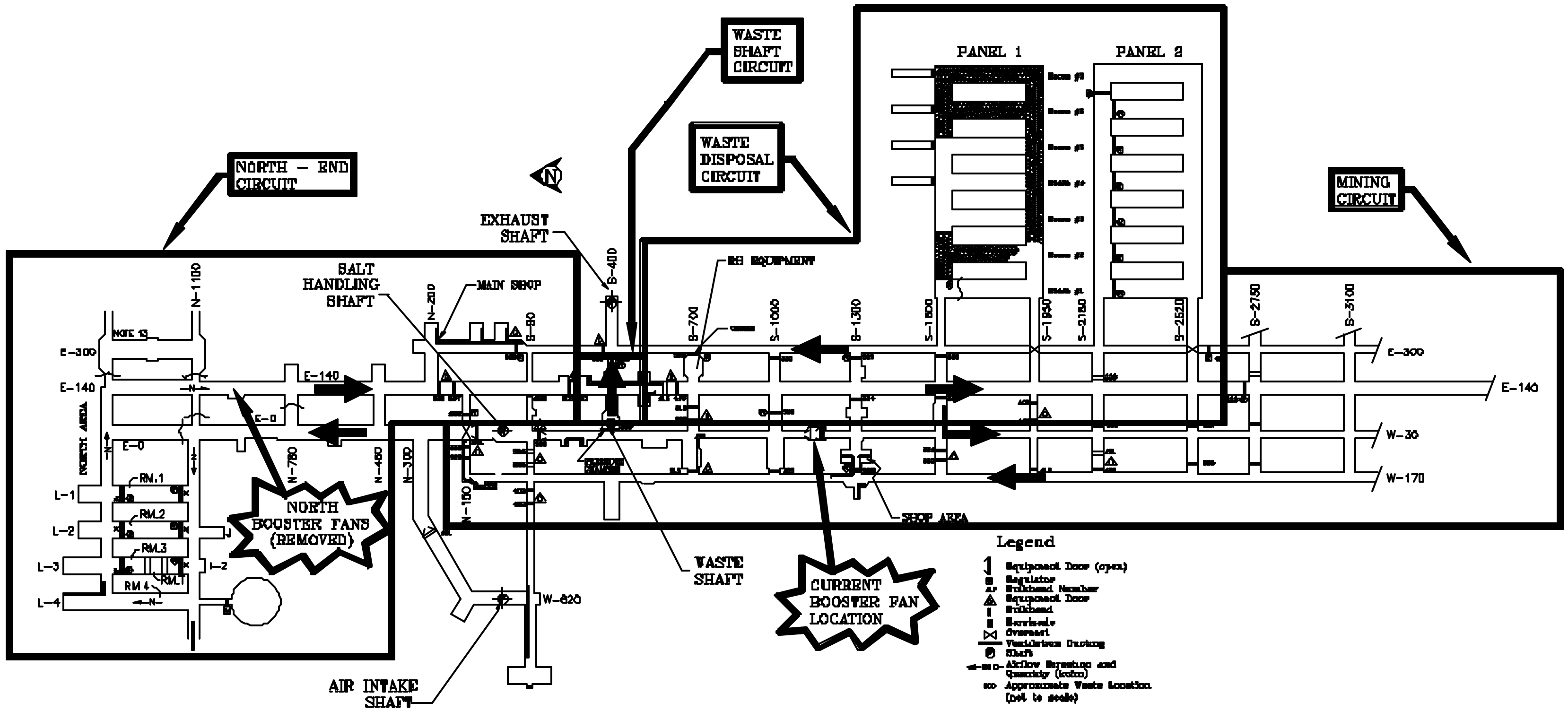


Figure 1. Ventilation system at the WIPP facility (showing booster fan locations and main circuits).

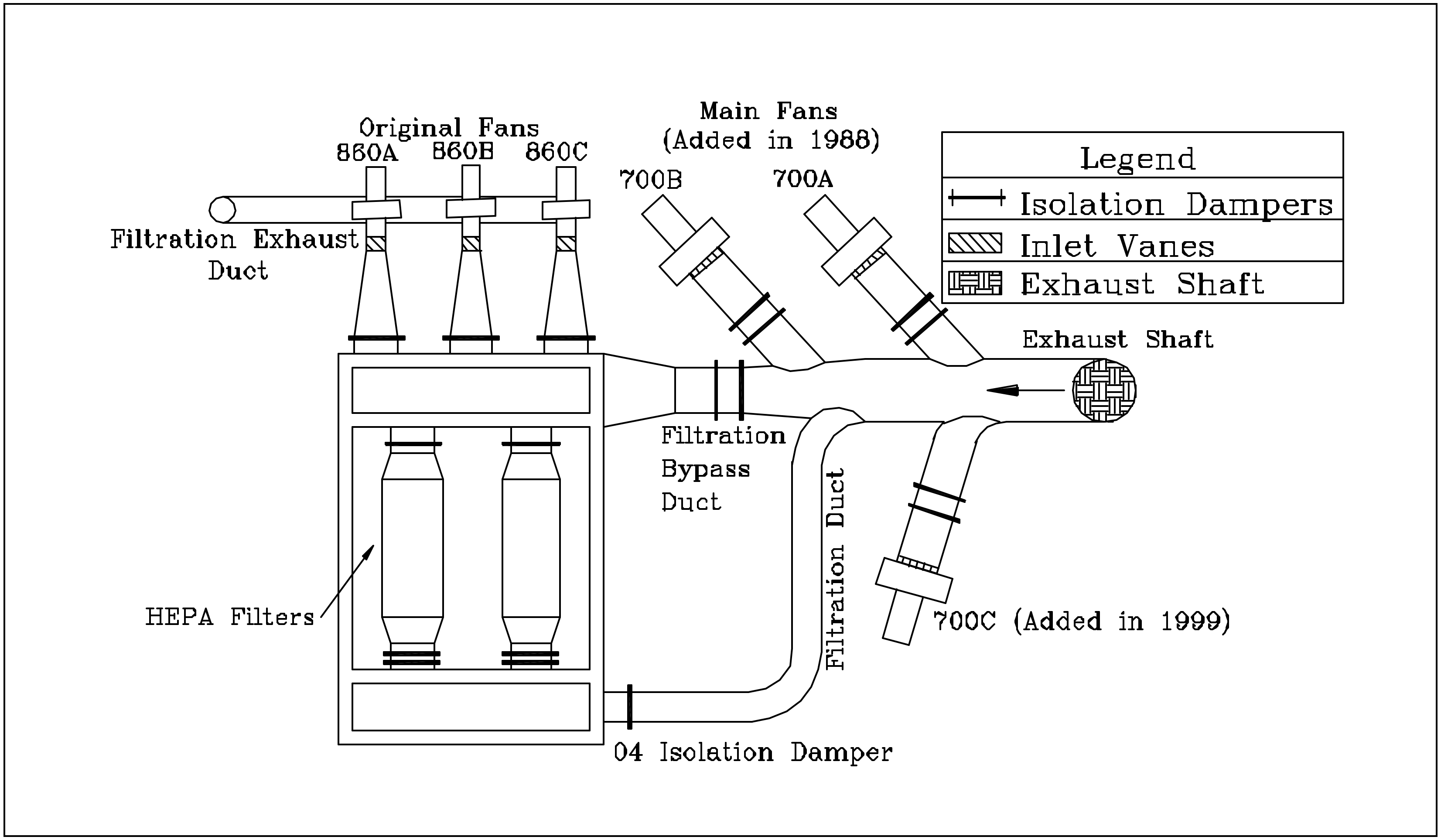


Figure 2. Main fan configuration.

When the facility was first constructed there were only three shafts in the system. These were the small diameter (10 ft) Salt Handling Shaft, the Waste Shaft and the Exhaust Shaft. The three fans attached to the filter building were used to ventilate the underground (called the 860 fans). With only a small intake shaft it was necessary to add pressure to the system with a "booster fan". Booster fans are installed in underground mines when the main fans are not capable of providing the pressure necessary to push air in the desired amount to certain areas of the facility. This was accomplished by installing booster fans in W-30 between S-1000 and S-1300 and in the north in E-140 between N-780 and N-1100. The 860 fans, operating in by-pass mode (that is not through the HEPA filters) did not generate sufficient pressure to pass air to all areas of the underground; hence, the booster fans were necessary. The three 860 fans could generate about 210,000 cubic feet per minute (cfm) at a pressure of approximately 7 inches water gauge (in. w.g.)

The original design was to operate all three 860 fans and divert the air in the underground as needed to achieve the necessary flows to the construction, disposal, and north side of the facility. Because, at the time, there was insufficient air to ventilate all areas of the underground simultaneously, the design philosophy was to ventilate each main area on different shifts during the day. For example, waste handling could be ventilated on day shift, construction on an afternoon shift and the north side on night shift. The underground booster fans were necessary at this time to force sufficient air to the mining or north side of the facility.

In the 1980s, as WIPP construction progressed, the ventilation operating philosophy changed. It was decided that the facility could operate more efficiently by having airflow available to all circuits in the underground simultaneously. This is when a major upgrade to the system was proposed. The upgrade necessary to achieve airflow in all areas of the facility included a new intake shaft and the addition of two new main exhaust fans on the surface. This new infrastructure was installed in 1988. When MVS conducted the first ventilation testing of the underground ventilation system in 1988 both sets of booster fans were in operation. During this testing it became obvious that the two new main fans did not require the booster fans to ventilate the north or the construction circuits. MVS recommended removing the north booster fans and not operating the construction circuit booster fans. The north booster fans were removed in late 1988.

In the early 1990s WIPP determined that the construction booster fans in W-30 between S-1000 and S-1300 could be used to demonstrate air reversal capabilities in both the underground construction and north ends of the facility and the intake shafts. This determination was based on the understanding at the time of a Mine Safety and Health Administration (MSHA) regulation that states:

> *"Shaft mines shall be provided with at least one of the following means to control the spread of fire, smoke, and toxic gases underground in the event of a fire: control doors, reversal of mechanical ventilation, or effective evacuation procedures (30CFR57.4760)."*

Since the mid 1990s reversal capabilities of the booster fans in W-30 between S-1000 and S-1300 were kept in the operational procedures as a means, in theory, of reversing airflow in the facility. Reversal modes were established for upcasting air in the Salt Handling Shaft, upcasting air in the Air Intake Shaft and to reverse the airflow direction in the north side of the facility. However, as shown by actual field testing, there are significant problems with the booster fans being used for this purpose. Because of these problems, and because WIPP has other, safer and more effective ventilation control methods to control the spread of fire, smoke, and toxic gases in the underground in the event of an emergency, MVS recommends the that the booster fans be removed.

Airflow Reversal Requirement

MSHA has historically required the capability to reverse airflow in the event of a mine fire. This requirement is based on the logic that in the event of an underground or intake shaft fire, reversing the airflow direction could enhance safety since personnel who were downstream of the fire would now be in fresh intake air. However, in practice airflow reversal has rarely been attempted. The reasons that mine management teams have very rarely decided to reverse ventilation during an emergency are directly related to the safety of underground personnel in the event of a fire. The textbook[1] by Dr. Malcolm McPherson describes the problems associated with airflow reversal very succinctly:

> *"During the trauma of a major emergency involving changing condition in air quality and possibly disruptions of ventilation structures and communications, it may be impossible to know with certainty the locations, movements and dispersal of the workforce. Reversal of the airflows could then result in smoke and toxic gases being drawn over personnel who had assembled in a previously unpolluted zone. It may be expected that people who work routinely in a section of the mine will be familiar with the local ventilation system and, in case of an emergency, will act in accordance with that knowledge. Reversing the airflow could create additional uncertainty and confusion in their actions. In many mines, the doors between intake and return airways are designed to be self closing, assisted by the mine ventilating pressure. In the event of air reversal these doors could be blown open resulting in a short circuit (unless the doors are fitted with self locking devises)"*.

The inherent dangers described above are the major reason why actual case studies involving the reversal of air are so rare. In reviewing literature for actual case studies involving fan reversal, MVS could not find a single reference. In fact, the National Mine Rescue Association's web site[2] does not make a single comment on reversing airflow during a rescue attempt.

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[1] McPherson, M. J. (1982) *Subsurface Ventilation and Environmental Engineering* Chapman and Hall
[2] http://www.miningorganizations.org/nmra.htm

Airflow Reversal Procedure at WIPP

To enter a reversal mode requires the opening and closing of certain ventilation control doors throughout the underground facility. Because not all underground doors in the WIPP facility can be controlled from surface, this function is a manual operation. It takes time to configure the system for reversal mode. For example, to reverse air to upcast the Salt Handling Shaft requires the following procedure:

1. Turn off all main surface fans.
2. Close the isolation doors to the north of the Salt Handling Shaft and in the primary intake from the Air Intake Shaft.
3. Open the airlock doors on the back side of the Air Intake Shaft (in S-90).
4. Close both regulators that allow air into the disposal side of the facility.
5. Close the regulator that controls the exhaust air from the return on the mining circuit.
6. Close the doors under the booster fans.
7. Start the booster fans to operate in the reverse (backward) direction.

To force air up the Air Intake Shaft, the same configuration is required except that the booster fans are operated in the forward direction.

To reverse the airflow on the north side of the facility the following procedure is necessary:

1. Turn off all main surface fans.
2. Close the isolation doors to the north of the Salt Handling Shaft.
3. Keep the airlock doors on the back side of the Air Intake Shaft closed and the isolation door open.
4. Close both regulators that allow air into the disposal side of the facility.
5. Fully open the regulator that controls the exhaust air from the return on the mining circuit.
6. Fully open the regulator exhausting the main shop on the north side of the facility.
7. Close the door in E-300 isolating the exhaust airflow from the exhaust shaft access drift.
8. Close the doors under the booster fans.
9. Start up the booster fans in the forward direction.

Under this configuration (reversal on the north side of the facility) air will enter the mine through the salt handling shaft move to the booster fans, pass around the mining circuit through the mining control regulator and back through the north shop. The air will then course backwards around the north area of the facility and exhaust up the air intake shaft. Figure 3 shows the location of the various regulators and isolation doors that are adjusted to implement the reversal modes. MVS testing of the reversal modes indicates that it takes between 20 and 30 minutes to configure the system and start the booster fans.

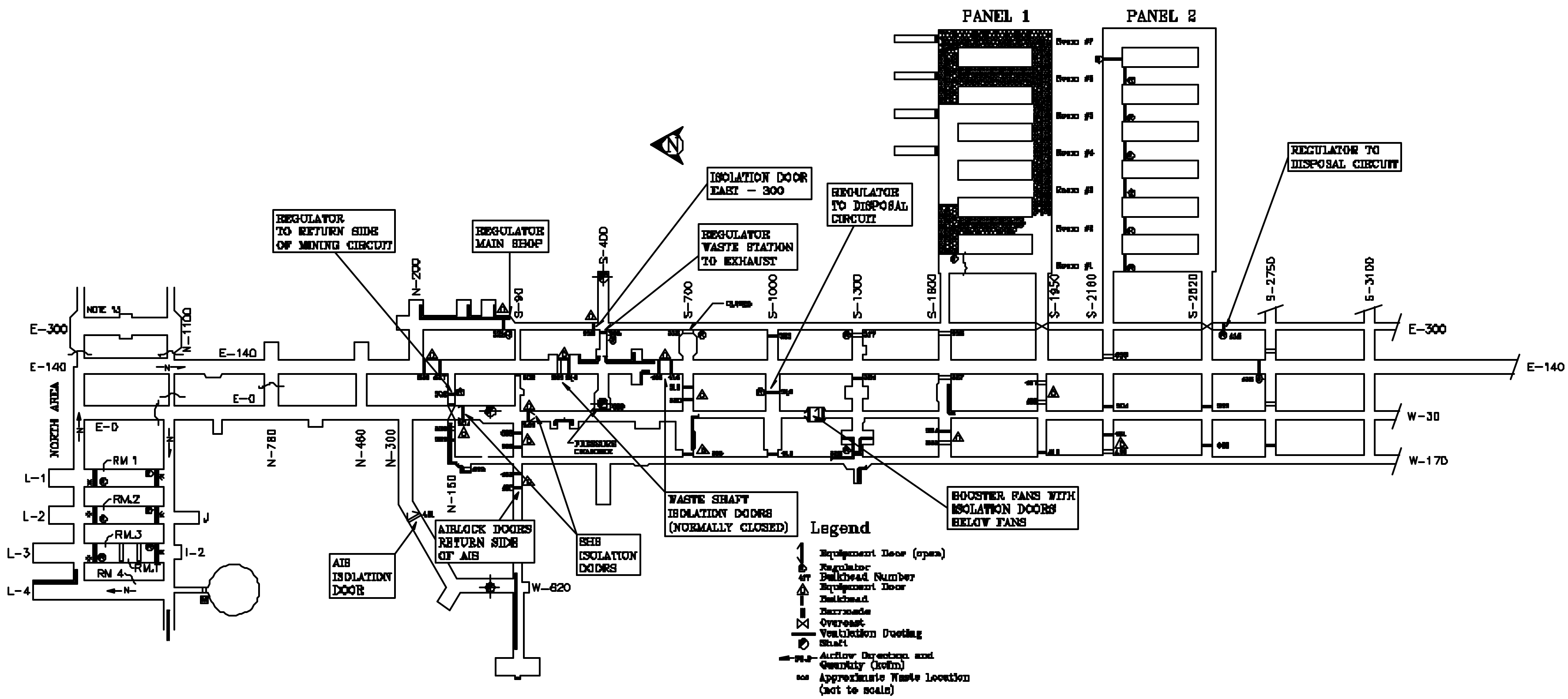

Figure 3. Main infrastructure locations for air reversal modes.

Problems with Air Reversal at WIPP

Requiring underground personnel to manually configure the ventilation system and the time required to make the system operational are two significant problems with the reversal modes. First, in a real emergency, the personnel responsible for opening and closing the doors are likely to be placed in a hazardous condition since they could be exposed to any fumes of a fire while trying to reconfigure the system. Second, given the egress time from the most remote area of the facility is under 30 minutes by the time the reversal mode was established most personnel could have already been evacuated from the underground (making reversing the air a moot point).

Another major concern with airflow reversal is the fact that the total air passing through the booster fans is not the total air intaking and exhausting the facility. The underground booster fans will push air in a circle around their location. This is called recirculation. Recirculation is a significant hazard if smoke is already entrained in the underground. Testing of the various reversal modes has shown that between 50 and 75% of the air passing through the fans is going in and out of the facility from surface. In other words, 25 to 50% of the fan airflow is recirculating in the underground. Figure 4 shows actual survey data observed during a reversal mode test conducted in October 2002. As can be seen from the data of the 81,100 cfm passing through the booster fans, only 63,000 is actually entering through the Air Intake Shaft. Over 18,000 cfm is recirculating around the underground (28.7%). Furthermore, from the figure it is noted that air leakage is from the disposal circuit to the mining circuit for all bulkheads (walls) to the south of the booster fans. <u>This recirculation breaches one of WIPPs ventilation safety tenets</u> - that is that air must always leak from the mining circuit to the disposal circuit.

The Effect of Removing the Booster Fans from the WIPP Facility

Removing the booster fans from the WIPP ventilation system will **not** compromise any safety requirements in the underground. To the contrary, removal of the booster fans will improve safety by eliminating a potentially dangerous airflow configuration that could have life-threatening and unintended consequences in an emergency. MSHA mandates that a mine must have **one** of the following capabilities: reversal of airflow, isolation doors at each intake shaft, **or** an evacuation plan where personnel can be withdrawn from the mine in less than 10 minutes. These regulations protect underground miners in the event of a mine fire.

Three components make up a fire; heat, oxygen and fuel. With the exception of mobile diesel equipment, there is minimal combustible material (fuel) in the underground (including the host rock – salt). The only exception to this is the wood guides in the Salt Handling Shaft. These guides are used to steer the conveyance as it moves up and down the shaft. The guides were treated with a fire retardant prior to installation in the shaft. The other hoisting shafts at the facility have steel rope guides for the conveyances.

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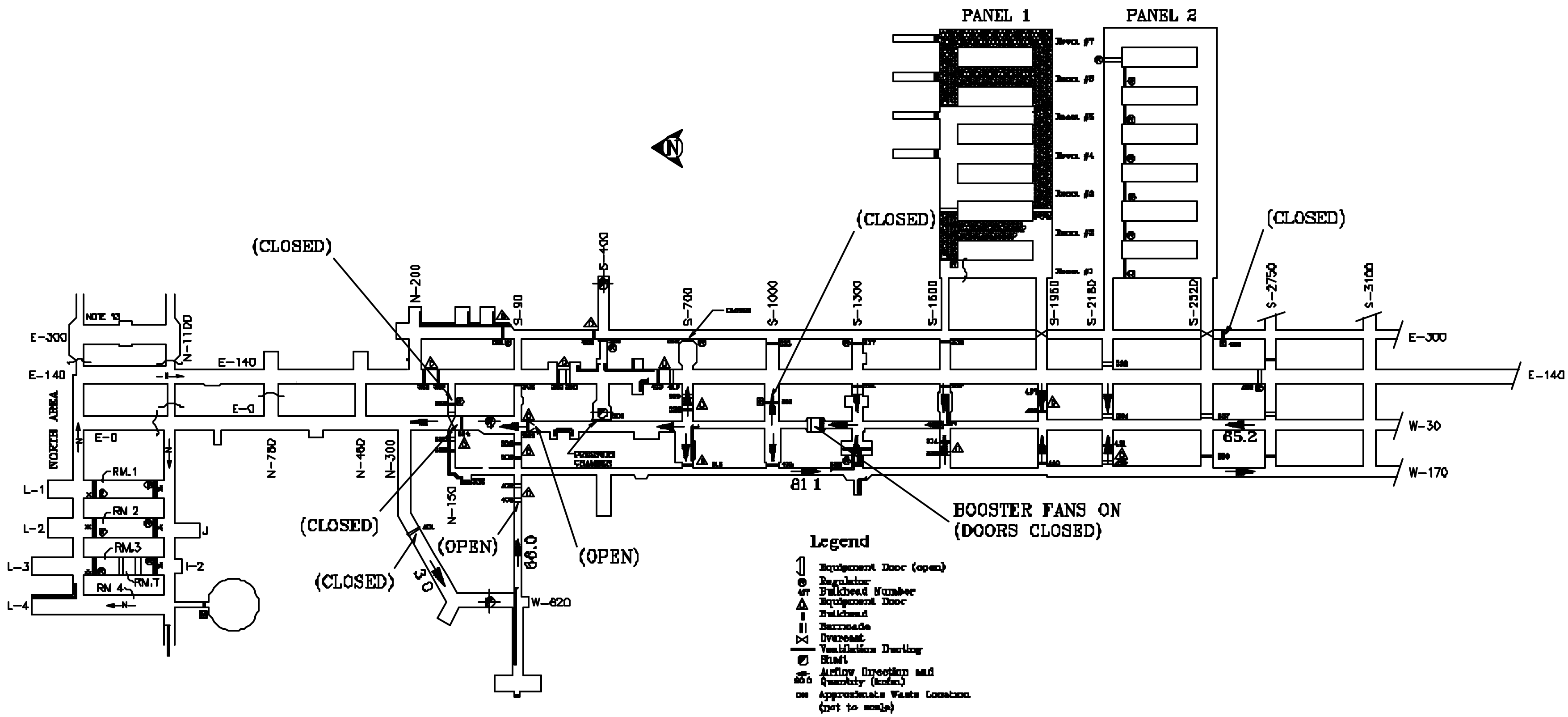


Figure 4. Airflow measurements during actual reversal mode testing.

The risk of these guides catching on fire is remote because they are treated with a fire retardant. However, to ensure underground employees are protected from such an event, every intake shaft at the facility, including the Salt Handling Shaft, is equipped with isolation doors at its base. These doors can be closed in the event of a fire with the result being the complete isolation of this shaft from the ventilation system. These doors meet the MSHA requirement.

Although personnel cannot be withdrawn from the underground facility at WIPP in less than 10 minutes, there is an excellent evacuation/communication plan in place at the facility. Should there be a mine fire personnel are instructed via both mine pager phones and site wide communication systems where to assemble for evacuation. The size of the facility results in all personnel being able to assemble at an evacuation location in about 20 minutes.

Furthermore, a significant benefit of the WIPP ventilation system is that the Waste Shaft provides intake air that is sent directly to the Exhaust Shaft. This means that unless the fire is in the Waste Shaft or station, this area will be free of smoke and toxic fumes. Thus, in the event of a fire in the mining, north end or disposal circuit, a fresh air assembly area will be available at the Waste Shaft Station.

Conclusion

The reversal modes of operation at the WIPP facility do not enhance safety in the event of a shaft or mine fire – to the contrary, the reversal modes, if used, could potentially have unintended, and life-threatening consequences for workers attempting to escape the underground. The time required to implement the system is too long and the risk imposed on the underground operators required to configure the system are significant problems. In addition, airflow re-circulating around the booster fans has the predicament of potentially entraining hazardous smoke and gas in the underground and breaches the WIPP requirement that air leak from the mining circuit to the disposal circuit.

Given that the facility has isolation doors on each intake shaft, the requirement for air reversal is not necessary. MVS strongly recommends that the booster fans be removed from service for the purpose of airflow reversal.

Sincerely,

Keith G. Wallace
Vice President

cc. Mr. Sean White, Westinghouse TRU Solutions, LLC.

Attachment D

Documentation of WIPP Underground Evacuation Times

WASTE ISOLATION DIVISION

INTER-OFFICE CORRESPONDENCE

DA:99:01529
UFC:4400.00

DATE: December 20, 1999

TO: G. L. Young

FROM: A. J. Hill

LOCATION: ES&H Integration

LOCATION: ES&H Integration

SUBJECT: UNDERGROUND EVACUATION DRILL FY2000-06 CRITIQUE

The ability of Underground personnel to evacuate and be accounted for was evaluated on January 12, 1999.

The main objective of this drill was to demonstrate the ability of Underground personnel to evacuate the Underground and be accounted for within 60 minutes. The scenario was the following:

> The Central Monitoring Room Operator (CMRO) will be requested to make the necessary site announcements to evacuate the underground. The drill will terminate when all personnel have been brought to the surface and the Underground Controller notifies the CMRO that all personnel have been accounted for.

The drill commenced at and was completed at. The following were the objectives per assigned area:

Objective 1: Demonstrate the ability of underground personnel to evacuate the Underground in accordance with the requirements of 30 CFR 57.4361, *Underground Evacuation Drills*.

Objective 2: Demonstrate the ability of Facility personnel to perform appropriate actions for an Emergency Event in accordance with WP04-CO Conduct of Operations

Objective 3: Demonstrate the ability of the Drill team to perform appropriate actions for a Radiological event in accordance with WP 12-ES3004, *WIPP Evolutions/Drills and Exercises?*

There were areas of strong performances, Observations, Findings, and recommendations observed. The following are the observations:

Strong Performances:

1 Personnel evacuated the Underground within 22 minutes.

2. Personnel demonstrated a high level of team work in effective and efficiently evacuating the Underground

3. Personnel gathered brass away from the shaft to prevent accidental dropping of brass down shaft (recommendation from prior evacuation drill).

<u>Minor Weakness</u>:

None

<u>Findings:</u>

1 Underground Exercise package needs to include a limitation to ensure that the Salt Skip pocket is empty before conducting a drill that would run several days, or make provisions to ensure personnel are available after the drill (i.e., incoming shift) to empty the Salt Skip pocket so that the salt doesn't sit for several days and harden. This finding will posted on the STAR and tracked until closure (Cognizant Manager, G. Young, Responsible Person, A. J. Hill).

2. Underground drill evacuation package needs to have message adjusted to include, "Report to Hoist Egress Station" in announcement to be consistent with WP 12-ER4907, *Underground Evacuation.* This finding will posted on the STAR and tracked until closure (Cognizant Manager, G. Young, Responsible Person, A. J. Hill).

<u>Recommendations:</u>

Underground personnel suggested running this drill in the middle of a shift.

Overall the drill was rated satisfactory in meeting the underground evacuation requirements of 30 CFR 57.4361, *Underground Evacuation Drills*.

eh

Attachment

*cc:	H. W. Bellows	E. L. Bostick
	N. Cox	M. G. Daniels
	K. S. Donovan	D. H. Haar
	R. F. Kirby	D. P. Reber
	S. Sethi	FSM Distribution

*Electronically Distributed

DRAFT

WASTE ISOLATION DIVISION

INTER-OFFICE CORRESPONDENCE

DA:01:01407
UFC:5500.00

DATE: January 22, 2001

TO: D. J. Harward 452-06

LOCATION: Radiation Safety and Emergency Management

FROM: A. J. Hill, WIPP Emergency Preparedness Coordinator *(Original signature on file)*

LOCATION: Radiation Safety and Emergency Management

SUBJECT: UNDERGROUND EVACUATION DRILL FY2001-01 CRITIQUE

The ability of underground personnel to evacuate and be accounted for was evaluated on November 28, 2000.

The main objective of this drill was to demonstrate the ability of underground personnel to evacuate the underground and be accounted for within 60 minutes. The scenario was the following:

> The Central Monitoring Room Operator (CMRO) will be requested to make the necessary site announcements to evacuate the underground. The drill will terminate when all personnel have been brought to the surface and the Underground Controller notifies the CMRO that all personnel have been accounted for.

The drill commenced at 1655 and was completed at 1722. The following were the objectives per assigned area:

Objective #1: Demonstrate the ability of underground personnel to evacuate the underground in accordance with the requirements of 30 CFR 57.4361, *Underground Evacuation Drills*.

There were areas of strong performances, observations, findings, and recommendations observed. The following are the observations:

Strong Performances:

1. All underground personnel were evacuated from the WIPP underground within 20 minutes.
2. Personnel evacuated the underground in an orderly and timely manner.

Minor Weakness:

None

Findings:

None

Recommendations:

None

Observations

1. Circuit # 2 and Public Address were tagged for construction work on North end of the mine, and as a result the alarms didn't activate. However, the interim actions taken as a result of these alarms being tagged out were satisfactory in notifying personnel and evacuating the underground in 20 minutes (40 minutes below the requirements).

Overall the drill was rated satisfactory in meeting the underground evacuation requirements of 30 CFR 57.4361, *Underground Evacuation Drills*.

If you have any questions, please contact me at Extension 8223.

bd

cc: H. W. Bellows	ED	R. F. Kirby	ED
E. L. Bostick	ED	R. Marshall	ED
N. R. Bowering	ED	J. Neatherlin	ED
G. A. Burns	ED	D. P. Reber	ED
N. G. Cox	ED	M. Rosenthal	ED
G. M. Daniels	ED	S. C. Sethi	ED
K. S. Donovan	ED	R. C. Stroble	ED
J. D. Eastham	ED	M. L. Winans	ED
D. H. Haar	ED		

DRAFT

WASTE ISOLATION DIVISION

INTER-OFFICE CORRESPONDENCE

DA:01:01406
UFC:5500.00

DATE: January 24, 2001

TO: D. J. Harward 452-06

LOCATION: Radiation Safety and Emergency Management

FROM: A. J. Hill, WIPP Emergency Preparedness Coordinator *(Original signature on file)*

LOCATION: Radiation Safety and Emergency Management

SUBJECT: UNDERGROUND EVACUATION DRILL FY2001-06 CRITIQUE

The ability of Underground personnel to evacuate and be accounted for was evaluated on January 18, 2001.

The main objective of this drill was to demonstrate the ability of underground personnel to evacuate the underground and be accounted for within 60 minutes. The scenario was the following:

> The Central Monitoring Room Operator (CMRO) will be requested to make the necessary site announcements to evacuate the underground. The drill will terminate when all personnel have been brought to the surface and the Underground Controller notifies the CMRO that all personnel have been accounted for.

The drill commenced at 1630 and was completed at 1650. The following were the objectives per assigned area:

Objective #1: Demonstrate the ability of underground personnel to evacuate the underground in accordance with the requirements of 30 CFR 57.4361, *Underground Evacuation Drills*.

There were areas of strong performances, observations, findings, and recommendations observed. The following are the observations:

Strong Performances:

1. All underground personnel were evacuated from the WIPP underground within 27 minutes.
2. Personnel evacuated the underground in an orderly and timely manner.
3. Strong Performance by Underground Services and Mine Managers to locate and evacuate all personnel.

Minor Weakness:

None

Findings:

None

Recommendations:

None

Observations

1. Circuit #2 and Public Address were tagged for construction work on North end of the mine, and as a result the alarms didn't activate. However, the interim actions taken as a result of these alarms being tagged out were satisfactory in notifying personnel and evacuating the underground in 20 minutes (40 minutes below the requirements).

Overall the drill was rated satisfactory in meeting the underground evacuation requirements of 30 CFR 57.4361, *Underground Evacuation Drills*.

If you have any questions, please contact me at Extension 8223.

bd

cc: H. W. Bellows ED
E. L. Bostick ED
N. R. Bowering ED
G. A. Burns ED
N. G. Cox ED
G. M. Daniels ED
K. S. Donovan ED
J. D. Eastham ED
D. H. Haar ED
R. F. Kirby ED
R. Marshall ED
J. Neatherlin ED
D. P. Reber ED
M. Rosenthal ED
S. C. Sethi ED
R. C. Stroble ED
M. L. Winans ED

WESTINGHOUSE TRU SOLUTIONS, LLC
EMERGENCY MANAGEMENT
DRILL CRITIQUE

Drill/Exercise Number: FY 2001-18
Surface and Underground Site Evacuation

Date Conducted: March 14, 2001

Lead Controller: Mickey Lovell

Purpose, Scope, Objectives:

Provide training and to demonstrate the ability of personnel to evacuate the site and underground in accordance with 30 CFR requirements.

DRILL RESULTS SUMMARY:

The personnel evacuated in an orderly manner. All personnel were accounted for in twenty-six minutes. Security personnel were efficient in directing employees.

DRILL FINDINGS AND OBSERVATIONS

FINDINGS:

None

OBSERVATIONS:

None

Mickey V. Lovell
M. Lovell, Lead Controller

5-9-02
Date

Approved by:

D. R. Kump
D. R. Kump, Manager
Radiation Safety and Emergency Management

5/9/02
Date

DRAFT

WESTINGHOUSE TRU SOLUTIONS, LLC
EMERGENCY MANAGEMENT
DRILL CRITIQUE

Drill/Exercise Number: FY 2001-21
Underground Evacuation

Date Conducted: July, 27, 2001

Lead Controller: Mickey Lovell

Purpose, Scope, Objectives:

Provide training and to demonstrate the ability of all personnel to evacuate the Underground in accordance with 30 CFR requirements.

DRILL RESULTS SUMMARY:

All personnel were accounted for in thirty minutes, which is satisfactory to meet the 30 CFR requirements.

DRILL FINDINGS AND OBSERVATIONS

FINDINGS:
Responses to findings are to be provided to the Emergency Management Lead Controller within 10 working days from the transmittal date.

None

OBSERVATIONS:
Observations that are noted as such will require responses to be provided to the Emergency Management Lead Controller within 10 working days from the transmittal date.

Observation D2001-21-001

There was some confusion as to the proper method for activating the evacuation notification for the Underground. This was discussed with Operations Management. As a result, clarification for the correct method for notification was placed in the Operations Standing Instructions. No further action is necessary.

M. V. Lovell 5-14-02
M. Lovell, Lead Controller — Date

Approved by:

D. R. Kump 5/9/02
D. R. Kump, Manager — Date
Radiation Safety and Emergency Management

TRU Solutions
Westinghouse TRU Solutions LLC

DA:01:01469
UFC:5500.00

INTER-OFFICE CORRESPONDENCE

DATE: December 11, 2001

FROM: J. E. Eastham, Emergency Preparedness Coordinator

LOCATION: Radiation Safety and Emergency Management

TO: D. R. Kump 452-06

LOCATION: Radiation Safety and Emergency Management

SUBJECT: DRILL FY 2002-06 AND FY 2002-07 UNDERGROUND EVACUATION CRITIQUE

WTS Emergency Planning conducted drills on December 4, 2001, to determine the ability of underground personnel to evacuate and be accounted for. The main objective of this drill was to demonstrate the ability of underground personnel to evacuate the underground and complete accountability within sixty minutes. The completed drills demonstrated that both underground crew were aware of the importance of a timely underground evacuation.

The scenario and Objective were the following:

Scenario: The Central Monitoring Room Operator (CMRO) will be requested to make the necessary site announcements to evacuate the underground. The drill will terminate when all personnel have been brought to the surface and the Underground Controller notifies the CMRO that all personnel have been accounted for.

Objective: Demonstrate the ability of underground personnel to evacuate the Underground in accordance with the requirements of 30 CFR 57.4361, Underground Evacuation Drills.

The results of the drills include areas of three strong performances, and no observations, findings, or recommendations observed.

Strong Performances:

1. Sixty miners were evacuated from the WIPP Underground in FY 2002-06 within thirty minutes.

2. Thirteen miners were evacuated from the WIPP Underground in FY 2002-076 within fifteen minutes.

3. Personnel evacuated the underground in an orderly and timely manner.

Emergency Management reviewed the drill package and determined the rating of "Satisfactory" for meeting the underground evacuation requirements of 30 CFR 57.4361, Underground Evacuation Drills.

If you have any questions, please contact me at Extension 8588.

bd

cc:	E. L. Bostick	486-02
	G. A. Burns	451-13
	J. R. Franco	950-28
	C. C. Jierree	452-07
	R. F. Kirby	451-19
	R. Marshall	451-13
	D. P. Reber	451-12
	S. C. Sethi	486-02
	R. C. Stroble	451-13
	M. L. Winans	451-13
	S. P. Youngerman	950-28

WESTINGHOUSE TRU SOLUTIONS, LLC
EMERGENCY MANAGEMENT
DRILL CRITIQUE

Drill/Exercise/Event Number: D2002-21

Date Conducted: May 22, 2002

Lead Controller: Jim Eastham

PURPOSE, SCOPE, AND OBJECTIVES:

On May 22, 2002, WIPP Emergency Management conducted a site evacuation drill. The drill was started by a controller providing a message to the CMR operator and advising them to evacuate the site, to include the underground personnel

The Objectives used for this drill were the following:

Objective # 1 To demonstrate the ability of personnel to performance evacuation and accountability in accordance with OSHA Regulation 29 CFR 1910.38.

DRILL RESULTS SUMMARY

Personnel evacuated the site in a timely and orderly fashion. The underground and the surface facilities were evacuated within twenty minutes and accountability of all personnel was obtained within twenty-five minutes. This drill demonstrated satisfactory performance.

FINDINGS AND OBSERVATIONS

<u>Strong Performances:</u>

- Personnel evacuated the surface facilities in an orderly manner.
- Personnel evacuated the underground in an orderly manner.
- Office Wardens performed as intended and had accountability of personnel within twenty-five minutes of the announcement.

<u>Findings:</u>

None

Observations:

Observation D2002-21-O01
Some office wardens do not have the correct vests. Emergency Management needs to order more vests for the office wardens.

Responsible Manager:
Dave Kump
ES&H

6/18/02

Lead Controller

Date

Approved by:

6/19/02

D. R. Kump, Manager
Radiation Safety and Emergency Management

Date

Attachment E

MSHA Mine Ventilation Investigation Report No. P434-V339 Dated June 12, 2001

U.S. Department of Labor

Mine Safety and Health Administration
Pittsburgh Safety & Health Technology Center
P.O. Box 18233
Pittsburgh, PA 15236

VENTILATION DIVISION

June 12, 2001

MEMORANDUM FOR DOYLE D. FINK
District Manager, M&NMS&H, South Central District
Dallas, Texas

THROUGH: EDWARD J. MILLER
Chief, Pittsburgh Safety and Health Technology Center

FROM: JOHN E. UROSEK
Chief, Ventilation Division

SUBJECT: Report of Investigation - Waste Isolation Pilot Plant

Attached is the final report of the investigation conducted at the Waste Isolation Pilot Plant (WIPP) from March 6-7, 2001. Please replace the text previously released. The operator has requested clarification to some minor inaccuracies in the description of operation portion of the report.

An additional copy of the report is attached for distribution to the plant operator. If you have any questions concerning the report, please contact this office at 412-386-6936.

Attachments

cc: Westinghouse True Solutions(Kirk McDaniel)

bcc: VENT(W. Francart)
(G. Aul)
(D. Beiter)
Vent. Files SUB-D75
MSHA:TS:WFrancart:05/29/01:Rm 205:B38:412-386-6913:T\Vent\-ghwipp2

UNITED STATES DEPARTMENT OF LABOR
MINE SAFETY AND HEALTH ADMINISTRATION
TECHNICAL SUPPORT

MINE VENTILATION INVESTIGATION

Investigative Report No. P434-V339-Revised

Waste Isolation Pilot Plant (WIPP)

March 6-7, 2001

William J. Francart, P.E.
Mining Engineer

and

George N. Aul
Mining Engineer

Originating Office

Pittsburgh Safety and Health Technology Center
Ventilation Division
John E. Urosek, Chief
Cochrans Mill Road, P.O. Box 18233
Pittsburgh, Pennsylvania 15236

MINE VENTILATION INVESTIGATION

Investigative Report No. P434-V339

Waste Isolation Pilot Plant (WIPP)
Carlsbad, Lea County, New Mexico

March 6-7, 2001

by

William J. Francart[1] and George N. Aul[1]

INTRODUCTION

On March 6-7, 2001, an investigation was conducted at the Waste Isolation Pilot Plant (WIPP), requested through the Assistant District Manager, Metal and Nonmetal Mine Safety and Health, South Central District. The operator of the facility requested to remove three 50-horsepower (hp) fans installed in a underground bulkhead. These fans were previously used as booster fans, but were no longer used for ventilation of the mine. At the time of the study, the fans provided the capability to reverse airflow in the shafts. The objective of the study was to evaluate the proposed change to the ventilation system with regard to the Code of Federal Regulations, Title 30.

DESCRIPTION OF OPERATION

The operation was designed and operated to permanently isolate transuranic waste produced by the United States defense programs. This waste consists of rags, tools, clothing, and other such articles, which contain trace amounts of radioactive isotopes with atomic numbers higher than uranium. The underground mine, plant, and storage area was developed in the Salado Formation. The storage areas and associated mine areas were developed using continuous mining methods. Waste was concurrently being stowed in the previously developed rooms as mining development advanced. The mining operation was classified as a Category VI mine under 30 CFR, 57.22003. The facility operated two shifts per day.

The use of three intake shafts and one return shaft accomplished ventilation of the underground operation. The Waste Shaft is isolated from the remainder of the mine by bulkheads. A portion of the air entering the mine through the Air Intake Shaft ventilates the North (Experimental) Area of the mine. The remainder of the airflow joins the air coming down the Salt Handling Shaft and subsequently ventilates the waste storage and development (mining) areas of the facility. A variety of ventilation "modes" can be provided to support underground activities depending on day-to-day needs. The desired mode is achieved by running the surface fans in various parallel

---

[1] Mining Engineer, Pittsburgh Safety and Health Technology Center, Ventilation Division

combinations. The underground airflow achieved in these modes ranges from approximately 66,000 cubic feet per minute (cfm) (termed Minimum Mode) to approximately 460,000 cfm (termed Normal Mode).

Prior to 1988, ventilation was achieved through the use of three 260-hp centrifugal fans located on the surface. At this time, normal airflow capacity underground was limited to approximately 190,000 cfm and entered the mine through either the Salt Shaft or the Waste Handling Shaft. In addition to providing normal daily ventilation requirements, these fans could also be arranged to provide Filtration Mode. In the event of an accidental radiological release, the exhaust airflow would be reduced to 66,000 cfm induced by a single 260-hp fan, which is routed through a series of High Efficiency Particulate Air (HEPA) filters prior to release into the environment.

The ventilation configurations achievable with the three 260-hp fans would limit the underground activity to either development or waste emplacement (although waste was not being received at this time). In addition, three 50-hp axial fans were installed underground as booster fans to support the mine development activities. They were installed in a bulkhead in the mine entry at the location shown on Figure 1. A set of bulkhead doors was used to close the entry beneath the fan installation when booster fan operation was required as shown in Figure 2.

In 1988, two 600-hp centrifugal fans were installed in parallel with the 260-hp fans and the Air Intake Shaft was installed. This increased the ventilation capacity of the mine to approximately 460,000 cfm. The 600-hp fans became the primary ventilating fans and the 260-hp fan use became secondary for daily ventilation needs as well as providing for the Filtration Mode. This increased airflow allowed for simultaneous development and waste disposal activities. It also eliminated the need to operate the booster fans since adequate airflow could be achieved in all areas of the mine without them. However, the booster fans were retained so that mechanical reversal of the Air Intake and Salt Handling Shafts could be achieved in the event of a shaft fire. Air reversal is not permitted in the Waste Disposal area due to the radiological considerations.

In 1998, a third 600-hp main fan was installed. While it did not increase overall ventilating capacity of the mine, it did improve the operational readiness and availability of the main fans. The main fans are electrically interlocked such that only two of the three 600-hp fans can be operated at any given time.

REVIEW OF VENTILATION SYSTEM DATA

The pressure loss across the underground axial fans bulkhead on March 6, 2001, was measurable with tubing and a magnehelic gauge. A pressure loss of 0.03 to 0.04 inches of water was measured. The pressure differential for a length of open entry with the same air quantity was not measurable. Although the bulkhead does increase pressure losses in the ventilation system slightly, it is negligible as compared to 4.28 inches water in the Exhaust Shaft, 0.84 inches in the Intake Shaft, and 1.45 inches in the Salt Handling Shaft as measured in a previous ventilation survey.

Ventilation measurements were made at a number of locations underground. They are included in the schematic depicted in Figure 3. These readings were obtained using a calibrated vane anemometer by traversing the surveyed cross-sectional areas. Additional data was obtained from velocity sensors installed at specific locations underground. A comparison between the velocity sensors and anemometer traverses showed the sensors to be very accurate, with differences between the readings within the margin of error for vane anemometer traverse measurements.

DISCUSSION

Title 30 Section 57.4760 states that shaft mines shall be provided with at least one of the following means to control the spread of fire, smoke and toxic gases underground in the event of a fire: control doors, reversal of mechanical ventilation, or effective evacuation procedures.

Evacuation Procedures

If evacuation is used as an alternative for compliance with Section 57.4760(a), effective evacuation shall be demonstrated by actual evacuation of all persons underground to the surface in 10 minutes or less through routes that will not expose persons to heat, smoke, or toxic fumes in the event of a fire.

The last recorded evacuation drill, which complied with Section 57.4361, was held on January 22, 2001. According to the records maintained on site, evacuation was demonstrated on the two operating shifts. Evacuation was completed to the surface in 20 and 27 minutes. Exit from the mining unit was through the use of the salt shaft hoist. The length of time required for evacuation was greater than that allowed for use of evacuation as an alternative for compliance with Section 57.4760(a).

Mechanical Ventilation Reversal

If mechanical ventilation reversal is used as an alternative, Title 30 CFR requires that reversal of mechanical ventilation shall (i) provide at all times at least the same degree of protection to persons underground as would be afforded by the installation of control doors; (ii) be accomplished by a main fan; (iii) provide rapid air reversal that allows persons underground time to exit in fresh air by the second escapeway or find a place of refuge; (iv) be done according to pre-determined conditions and procedures.

Three modes of air reversal using the axial fans were identified. These modes reverse the airflow in either the Salt Handling Shaft or the Air Intake Shaft. These air reversal modes using the axial fans were intended to prevent air reversal in the waste disposal air split. The reversal modes included the operation of the axial fans in combination with the opening and closing isolation doors in the entries and crosscuts and shutting down the main fans. It is reported that some areas underground are unventilated in the reversal mode.

The reversal modes have been physically tested, however they have not been implemented due to any emergency. Reportedly, implementation of the individual reversal modes could require approximately one hour to complete.

The main fans on the surface cannot be reversed. Air reversals underground can be accomplished by a series of bulkhead changes (opening and closing bulkhead doors). Air reversal in the shaft is not possible using this method.

Control Doors

If control doors are used as the alternative for compliance with 57.4760(a). These requirements are: (i) they must be installed at or near shaft stations of intake shafts and any other shaft designated as an escapeway under 57.11053, or at other locations that provide equivalent protection;(ii) constructed and maintained according to Table C-3; (iii) provided with means of remote closure at landings of timbered intake shafts unless a person specifically designated to close each door in the event of a fire can reach the door within 3 minutes; (iv) closed or open only according to pre-determined conditions and procedures; (v) constructed so that once closed they will not reopen as a result of differential air pressure; (vi) constructed so that they can be opened from either side by one person or be provided with a personnel door that can be opened from either side; (vii) clear of obstructions.

The control doors are constructed as defined by the above criteria and could be used as an alternative to comply with 57.4760(a). They are in proximity of each of the shafts and are operated either remotely or can be reached within the 3 minute requirement. Doors are operated pneumatically and can be opened and closed from either side of the door by one person.

CONCLUSION

The purpose of this investigation was to evaluate the proposed change to remove the three 50-hp axial fans formerly used as booster fans. These fans are no longer needed to meet ventilation requirements for either mine development or waste isolation air splits and therefore are not normally operated.

While the axial fans can be used to reverse airflow in the intake shafts, the practical implementation of this action seems unlikely. MSHA regulations do not require the use of the air reversal fans if control doors are provided in accordance with 57.4760(a)(1). The intake shafts can be isolated by closing doors at underground locations in an event of fire in the mine.

APPENDIX

List of persons participating in the investigation:

Westinghouse True Solutions

Kirk McDaniel, Ventilation Engineer
David Loring, Ventilation Engineer
AJ Hill, Safety, Engineer

Department of Energy

Don Galbraith, Facility Representative

Mine Safety and Health Administration

William J. Francart, Mining Engineer, P.E.
George N. Aul, Mining Engineer

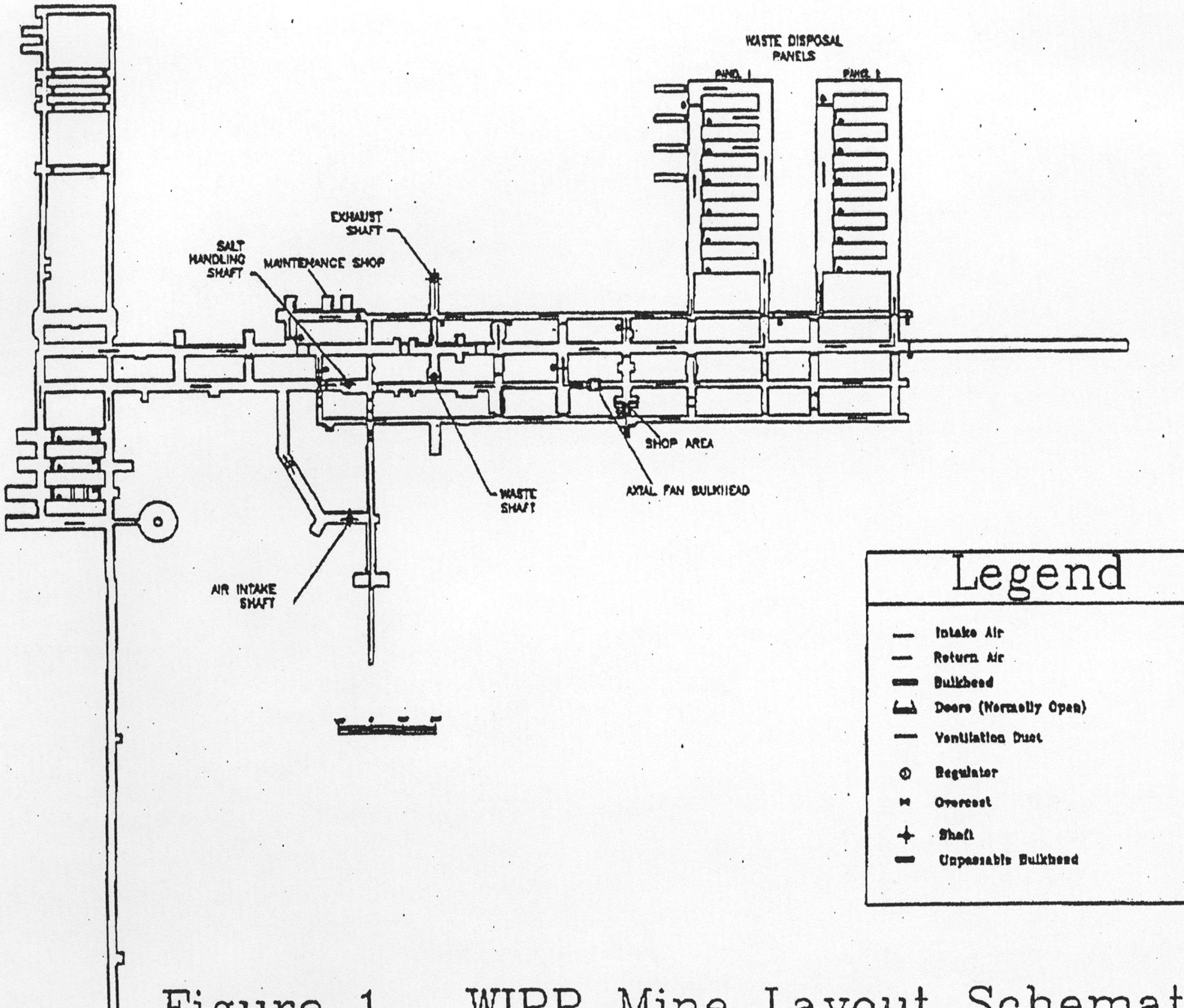


Figure 1. WIPP Mine Layout Schematic

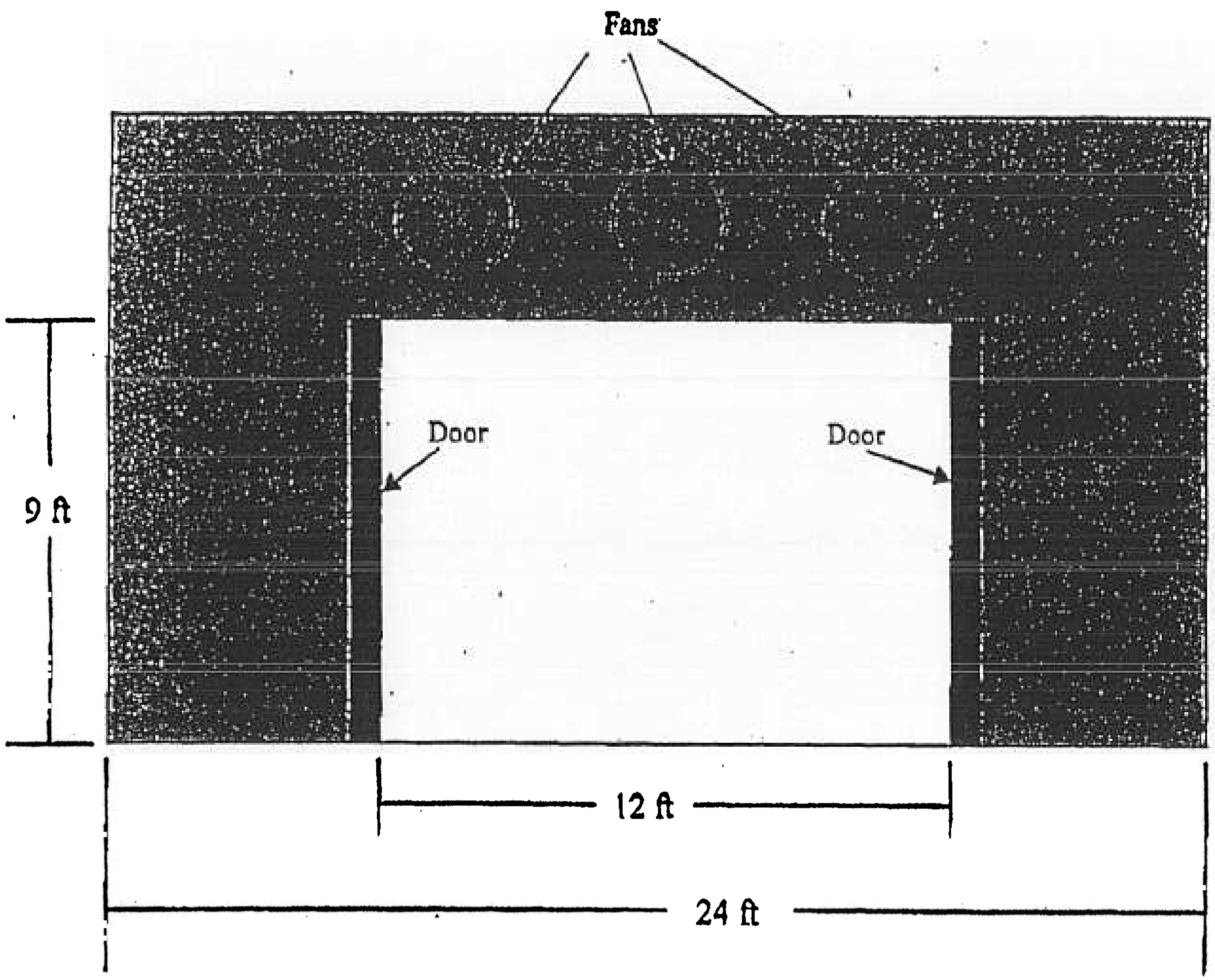
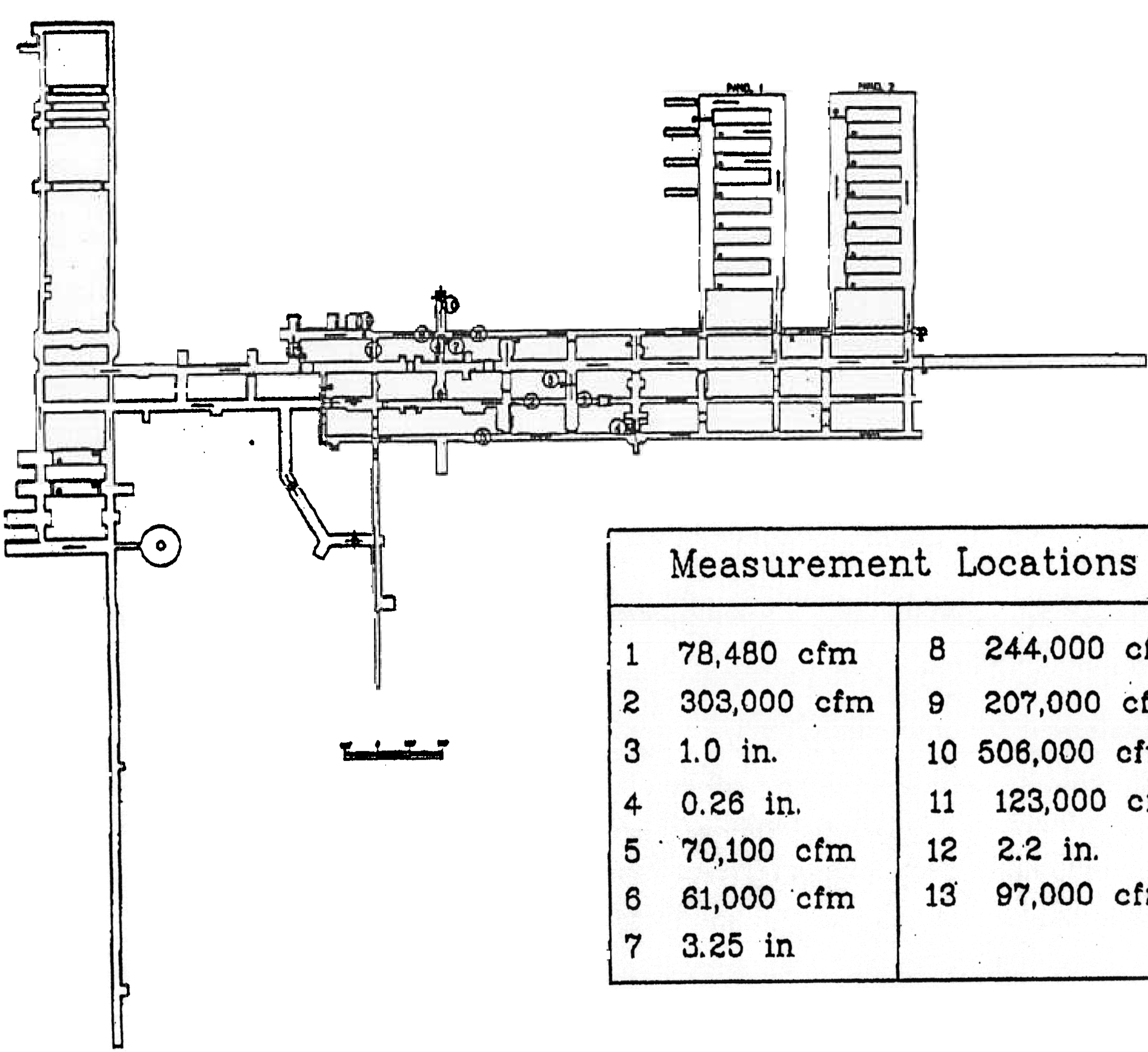


Figure 2 Axial Fan Bulkhead Installation - End View



Measurement Locations

1	78,480 cfm	8	244,000 cfm
2	303,000 cfm	9	207,000 cfm
3	1.0 in.	10	506,000 cfm
4	0.26 in.	11	123,000 cfm
5	70,100 cfm	12	2.2 in.
6	61,000 cfm	13	97,000 cfm
7	3.25 in		

Figure 3. WIPP Mine Ventilation Scematic

Attachment F

New Mexico Bureau of Mine Inspection Letter Dated January 17, 2001

NM Bureau of Mine Inspection
801 Leroy Place
Socorro, New Mexico 87801

New Mexico Tech

(505) 835-5460
fax: (505) 835-5430
email: bmi@nmt.edu

January 17, 2001

Mr. Bruce Lilly
Assistant Manager of Office of Safety and Operation
Department of Energy – Carlsbad Field Office
P.O. Box 3090
Carlsbad, NM 88221

Dear Mr. Lilly,

I have reviewed the attachments sent to my office in Socorro, New Mexico that addresses the removal of the underground booster fans and I also visited the WIPP underground facility on October 31, 2000. The intent of adequate ventilation in an underground mine is to provide a safe and healthy work environment for the persons working underground. It has been my experience after visiting the WIPP site for the last twelve (12) years that this project has always met and exceeded the mandated ventilation and safety regulations for an underground mine.

Treatment of fires: The one shaft of the total three shafts is equipped with wooden shaft guides. These guides are treated with fire retarding substance. The other two shafts have steel cable guides. These shafts are inspected weekly and deficiencies, if any, are corrected immediately.

Ventilation Controls: All three shafts are equipped with doors. Ventilation can be directed and controlled with the use of these doors, providing state required ventilation for employees and diesel equipment used.

Evacuation Procedures: Holding periodic evacuation drills tests the effectiveness of the personnel evacuation procedures. WIPP has in place an effective, documented evacuation program.

The change proposed by the U.S. Department of Energy and Westinghouse Governmental Environmental Service, in my opinion as a mine safety professional with over 30 years of experience in underground operation, will not in any way limit or impede the operators from providing a safe and healthy environment for their employees, nor would it affect their ability to effectively evacuate underground personnel in the event of an emergency.

Sincerely,

G. E. Miera
New Mexico State Mine Inspector

Item 3

Class 2 Permit Modification Request

LANL Sealed Sources Waste Streams
Headspace Gas Sampling and Analysis Requirements

Waste Isolation Pilot Plant
Carlsbad, New Mexico

WIPP HWFP #NM4890139088-TSDF

Table of Contents

Acronyms and Abbreviations

AK	Acceptable Knowledge
CFR	Code of Federal Regulations
DOE	U. S. Department of Energy
DOT	U. S. Department of Transportation
HWDU	Hazardous Waste Disposal Unit
HWFP	Hazardous Waste Facility Permit
LANL	Los Alamos National Laboratory
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
OSRP	Off-Site Source Recovery Project
PMR	Permit Modification Request
VE	Visual Examination
VOC	Volatile Organic Compound
WIPP	Waste Isolation Pilot Plant

Overview of the Permit Modification Request

This document contains a Class 2 Permit Modification Request (**PMR**) for the Hazardous Waste Facility Permit (**HWFP**) at the Waste Isolation Pilot Plant (**WIPP**), Number NM4890139088-TSDF hereinafter referred to as the WIPP HWFP.

This PMR is being submitted by the U.S. Department of Energy (**DOE**), Carlsbad Field Office and Washington TRU Solutions LLC, collectively referred to as the Permittees, in accordance with the WIPP HWFP, Condition I.B.1 (20.4.1.900 New Mexico Administrative Code (**NMAC**) incorporating Title 40, Code of Federal Regulations (**CFR**), §270.42(b)). The modification will establish specific criteria for the assignment of headspace gas volatile organic compound (**VOC**) concentration values in lieu of headspace gas sampling and analysis for the characterization of waste containers belonging to Los Alamos National Laboratory (**LANL**) sealed sources waste streams. These changes do not reduce the ability of the Permittees to provide continued protection to human health and the environment.

The requested modification to the WIPP HWFP and related supporting documents are provided in this PMR. The proposed modification to the text of the WIPP HWFP has been identified using a double underline and a revision bar in the right hand margin for added information, and a ~~strikeout~~ font for deleted information. All direct quotations are indicated by italicized text. The following information specifically addresses how compliance has been achieved with the WIPP HWFP requirement, Permit Condition I.B.1 for submission of this Class 2 PMR.

1. 20.4.1.900 NMAC (incorporating 40 CFR §270.42(b)(1)(i)), requires the applicant to describe the exact change to be made to the permit conditions and supporting documents referenced by the permit.

The LANL sealed sources waste streams are generated by the activities of the DOE Off-Site Source Recovery Project (**OSRP**) managed by LANL. The mission of the OSRP is defined by the U.S. Congress in Conference Report 107-593, to accompany House Resolution 4775, *Making Supplemental Appropriations for Further Recovery from and Response to Terrorist Attacks on the United States For the Fiscal Year Ending September 30, 2002, and for Other Purposes,* http://www.cfo.doe.gov/budget/billrept/fy02/02supp_conf_hrpt_107-593.pdf). House Resolution 4775 subsequently became Public Law 107-206. The OSRP mission is funded by Public Law 107-206, *Making Supplemental Appropriations for Further Recovery from and Response to Terrorist Attacks on the United States For the Fiscal Year Ending September 30, 2002*, *and for Other Purposes*, http://www.cfo.doe.gov/budget/billrept/fy02/02supp_PL_107-206.pdf). Conference Report 107-593 (page 142) shows $10,000,000 for the "Return of Domestic Sealed Sources" under the heading of "Defense Nuclear Nonproliferation". Public Law 107-206 shows $100,000,000 for "Defense Nuclear Nonproliferation" (page 32) of which $10,000,000 is designated by Conference Report 107-593 for the "Return of Domestic Sealed Sources". The scope of the OSRP is to recover, transport, and store at LANL radioactive sealed sources that are not currently being used. A sealed source is defined by 10 CFR §30.4 and 10 CFR §70.4 as any special nuclear material or byproduct material that is encased in a capsule designed to prevent leakage or escape of the special nuclear material or byproduct material.

Under the existing WIPP HWFP these sources would be required to undergo the same characterization activities as other contact handled transuranic mixed waste. Specifically of importance to this PMR are the headspace gas requirements. These requirements dictate that every mixed waste container or statistically selected containers from waste streams that meet the conditions for reduced headspace gas sampling listed in Section B-3 will be sampled and analyzed to determine the concentrations of VOCs in headspace gases.

This PMR proposes to assign headspace gas VOC concentration values which are attributable to the packaging material, in lieu of headspace gas sampling and analysis, to radioactive sources that are sealed, certified as U.S. Department of Transportation (**DOT**) special form radioactive material, and do not contain VOCs in the source material. The PMR delineates criteria for the assignment of headspace gas VOC concentration values in lieu of headspace gas sampling and analysis for the characterization of qualifying containers of sealed sources. Compliance with the defined criteria must be determined and documented as part of the LANL acceptable knowledge (**AK**) record and the LANL visual examination (**VE**) technique.

The assignment of packaging specific headspace gas VOC concentration values in lieu of headspace gas sampling and analysis is proposed for LANL sealed sources containers based primarily on the following key criteria:

- The LANL inventory under consideration consists only of sealed sources that are certified as DOT special form Class 7 (radioactive) material, or equivalent, which is defined by 49 CFR §173.403 as Class 7 (radioactive) material which satisfies the following conditions: (1) It is either a single solid piece or is contained in a sealed capsule that can be opened only by destroying the capsule; (2) The piece or capsule has at least one dimension not less than 5 millimeters (0.2 inch); and (3) It satisfies the test requirements of 49 CFR §173.469. Among other test requirements, 49 CFR §173.469 specifies that the special form radioactive material may not break or shatter when subjected to the impact, percussion, or bending test, may not melt or disperse when subjected to the heat test, and after each test, leaktightness or indispersibility of the specimen must be determined.

- The sealed sources do not include VOCs or VOC-bearing materials and the outermost casings of the sealed sources are metal or similar non-VOC bearing material. The sealed sources are subject to the same hazardous waste determinations and associated hazardous waste number assignments as other waste characterized under the HWFP.

- The determination of the impact of packaging materials on the VOCs in the headspace gas from containers of sealed sources is detailed in Attachment D entitled: "*Headspace Gas Sampling and Analysis Evaluation for LANL Sealed Sources*".

The addition of a new Section B-3a(1)(iii) is proposed to specify the criteria for assignment of headspace gas VOC concentration values in lieu of headspace gas sampling and analysis for the characterization of containers belonging to LANL sealed sources waste streams. These criteria require that compliance be determined and documented as part of the LANL AK record and the LANL VE technique. The use of the LANL VE technique at the time of packaging is proposed for the verification and documentation that sealed sources are the only non-packaging items in the container, each sealed source is no greater than four liters in size, and the outer casing of each sealed source is of a non-VOC bearing material. The use of the LANL AK record is proposed for the evaluation and documentation that the contents of each container meet the definition of sealed sources, each sealed source is certified as DOT special form radioactive material, the integrity of each sealed source has been validated by contamination survey results, and no VOCs or VOC bearing materials are constituents of the sealed sources. Such information is easily known for sealed sources, which were manufactured according to a strict set of procedures. Attachment C of this PMR describes the types of AK documentation available for use in demonstrating compliance with the proposed criteria for LANL sealed sources containers.

Because no VOCs are present in the sealed sources, a headspace gas sample of a container with sealed sources would represent only the VOCs resulting from the packaging materials. These VOCs are not related to the sealed sources in the container, however, they could potentially contribute to VOC emissions from the disposal unit. To identify and quantify these VOCs, headspace gas samples were collected from ten empty 55-gallon drums containing only the materials used to package the sealed sources. These drums contained no sealed sources. The evaluation of the headspace gas sampling and analysis results is provided in a report entitled *Headspace Gas Sampling and Analysis Evaluation for LANL Sealed Sources*, a copy of which is provided as Attachment D of this PMR. This report also presents data on other potential sources of VOCs from the packaging materials including radiolysis. The report documents the determination of VOC concentration values for assignment to the LANL sealed sources containers for reporting target analytes as required by WIPP HWFP Module II, Section II.C.3.i and for tracking compliance with the room-based VOC emissions limits established in WIPP HWFP Module IV, Table IV.D.1 for protection of human health and the environment.

A new Section B-3a(1)(iii) has been added to specify criteria for the contents of a container belonging to a LANL sealed sources waste stream that must be met for assignment of headspace gas VOC concentration values in lieu of headspace gas sampling and analysis for characterization of that container. Section B-3a(1)(iii) also specifies requirements for the determination of the VOC source term to be assigned to qualifying containers. For consistency, the addition of Section B-3a(1)(iii) requires the revision of the Attachment B Table of Contents; revision of text in Sections B-3a(1), B-3d, B-3d(1), B-3d(2), B1-1a(1), B1-1a(2), B3-2, and B4-3d; and revision of Tables B-6, B3-12, and B3-13. In addition, Sections B3-10b(1) and B3-10b(2) have been revised to require the Site Project Quality Assurance Officer and the Site Project Manager to ensure that the VOC source term is properly developed and/or used in accordance with Section B-3a(1)(iii) for LANL sealed sources waste streams. Text has been added to Section B3-12b(2) to require the inclusion in the Characterization Information Summary of the VOC source term determination data for LANL sealed sources waste streams. Section B4-2c has been revised to specify the additional AK documentation requirements for LANL sealed sources containers meeting the criteria of Section B-3a(1)(iii). Attachment B6 has been revised to reflect revisions to these sections, as appropriate. Details of these revisions are summarized in Attachment A of this PMR.

The proposed changes to the WIPP HWFP text are presented in Attachment B of this PMR.

2. 20.4.1.900 NMAC (incorporating 40 CFR §270.42(b)(1)(ii)), requires the applicant to identify that the modification is a Class 2 modification.

The proposed modification is classified as a Class 2 permit modification because it is considered an *other change* to waste sampling and analysis methods in accordance with 20.4.1.900 NMAC incorporating 40 CFR §270.42 Appendix I, Item B.1.d. This classification is consistent with a similar PMR submitted to the New Mexico Environment Department (**NMED**) in April 2000, and approved in August 2000, concerning reduced headspace gas sampling for waste streams that meet criteria now established in Sections B-3a(1)(i) and B-3a(1)(ii).

3. 20.4.1.900 NMAC (incorporating 40 CFR §270.42(b)(1)(iii)), requires the applicant to explain why the modification is needed.

The proposed modification is needed to obtain relief from characterization requirements that should not be applied to the LANL sealed sources waste streams. These changes to the headspace gas characterization requirements are requested because these are non-VOC bearing waste streams and it is therefore, unnecessary to perform this characterization technique.

The WIPP HWFP issued by the NMED in October 1999 required headspace gas sampling and analysis of 100 percent of mixed contact-handled transuranic waste containers (WIPP HWFP Module II, Section II.C.3.i) and that non-mixed TRU waste will be characterized to the same degree as mixed TRU waste (WIPP HWFP Module IV, Section IV.B.2.b). The WIPP HWFP was modified via Class 2 Modifications on August 8, 2000, to allow reduced headspace gas sampling for waste streams that do not contain VOC's. The HWFP currently allows for the application of statistical headspace gas sampling and analysis requirements when characterizing waste streams that have no VOC-related hazardous waste numbers assigned or which have undergone thermal processing. Sections B-3a(1)(i) and B-3a(1)(ii) establish criteria for qualifying such waste streams for statistical sampling and analysis.

This PMR proposes a headspace gas characterization process for a specific debris waste stream (sealed sources) that is very similar to those allowances previously approved. This PMR establishes specific criteria for the assignment of headspace gas VOC concentration values in lieu of headspace gas sampling and analysis for the characterization of containers belonging to LANL sealed sources waste streams. In addition, the PMR establishes additional AK and VE technique requirements that must be met by LANL for qualifying sealed sources containers under these criteria.

An urgency based on issues of homeland security is associated with the characterization and permanent disposal of the LANL sealed sources waste streams. Subsequent to the events of September 11, 2001, and based on homeland security concerns the DOE and the U.S. Congress have identified significant risk associated with the large number of excess and unsecured sealed sources remaining in the environment and have directed the DOE to accelerate recovery and disposition of the known backlog of sealed sources (Conference Report 107-593 to accompany House Resolution 4775,*Making Supplemental Appropriations for Further Recovery from and Response to Terrorist Attacks on the United States For the Fiscal Year Ending September 30, 2002*, *and for Other Purposes*,). This recovery is to be completed by the OSRP in an 18-month period that began in October 2002. Disposition of these recovered sources in a timely manner is essential to national security. It is estimated that the OSRP activities could result in approximately 1,000 sources being shipped from LANL to WIPP for disposal.

4. 20.4.1.900 NMAC (incorporating 40 CFR §270.42 (b)(1)(iv)), requires the applicant to provide the applicable information required by 40 CFR §§270.13 through 270.21, 270.62 and 270.63.

The regulatory crosswalk describes those portions of the WIPP HWFP that are affected by this PMR. Where applicable, regulatory citations in this modification reference Title 20, Chapter 4, Part 1, NMAC, revised June 14, 2000, (incorporating 40 CFR Parts 264 and 270). 40 CFR §§270.16 through 270.21, 270.62 and 270.63 are not applicable at WIPP. Consequently, they are not listed in the regulatory crosswalk table. 40 CFR §270.23 is applicable to the WIPP Hazardous Waste Disposal Units (**HWDUs**). This modification does not impact the conditions associated with the HWDUs.

5. 20.4.1.900 NMAC (incorporating 40 CFR §270.11(d)(1) and 40 CFR §270.30(k)), requires any person signing under paragraph a and b must certify the document in accordance with 20.4.1.900 NMAC.

The transmittal letter for this PMR contains the signed certification statement in accordance with Module I.F of the WIPP HWFP.

Regulatory Crosswalk

Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the HWFP	Yes	No
§270.13		Contents of Part A permit application	Attachment O, Part A		T
§270.14(b)(1)		General facility description	Attachment A		T
§270.14(b)(2)	§264.13(a)	Chemical and physical analyses	Attachment B	T	
§270.14(b)(3)	§264.13(b)	Development and implementation of waste analysis plan	Attachment B	T	
	§264.13(c)	Off-site waste analysis requirements	Attachment B	T	
§270.14(b)(4)	§264.14(a-c)	Security procedures and equipment	Attachment C		T
§270.14(b)(5)	§264.15(a-d)	General inspection requirements	Attachment D		T
	§264.174	Container inspections	Attachment D		T
§270.23(a)(2)	§264.602	Miscellaneous units inspections	Attachment D		T
§270.14(b)(6)		Request for waiver from preparedness and prevention requirements of Part 264 Subpart C	NA		
§270.14(b)(7)	264 Subpart D	Contingency plan requirements	Attachment F		T
	§264.51	Contingency plan design and implementation	Attachment F		T
	§264.52 (a) & (c-f)	Contingency plan content	Attachment F		T
	§264.53	Contingency plan copies	Attachment F		T
	§264.54	Contingency plan amendment	Attachment F		T
	§264.55	Emergency coordinator	Attachment F		T
	§264.56	Emergency procedures	Attachment F		T
§270.14(b)(8)		Description of procedures, structures or equipment for:	Attachment E		T
§270.14(b)(8)(i)		Prevention of hazards in unloading operations (e.g., ramps and special forklifts)	Attachment E		T
§270.14(b)(8)(ii)		Runoff or flood prevention (e.g., berms, trenches, and dikes)	Attachment E		T
§270.14(b)(8)(iii)		Prevention of contamination of water supplies	Attachment E		T
§270.14(b)(8)(iv)		Mitigation of effects of equipment failure and power outages	Attachment E		T
§270.14(b)(8)(v)		Prevention of undue exposure of personnel (e.g., personal protective equipment)	Attachment E		T
§270.14(b)(8)(vi) §270.23(a)(2)	§264.601	Prevention of releases to the atmosphere	Module II Module IV Attachment M2 Attachment N		T
	264 Subpart C	Preparedness and prevention	Attachment E		T
	§264.31	Design and operation of facility	Attachment E		T
	§264.32	Required equipment	Attachment E Attachment F		T

Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the HWFP	Yes	No
	§264.33	Testing and maintenance of equipment	Attachment D		T
	§264.34	Access to communication/alarm system	Attachment E		T
	§264.35	Required aisle space	Attachment E		T
	§264.37	Arrangements with local authorities	Attachment F		T
§270.14(b)(9)	§264.17(a-c)	Prevention of accidental ignition or reaction of ignitable, reactive, or incompatible wastes	Attachment E		T
§270.14(b)(10)		Traffic pattern, volume, and controls, for example: Identification of turn lanes Identification of traffic/stacking lanes, if appropriate Description of access road surface Description of access road load-bearing capacity Identification of traffic controls	Attachment G		T
§270.14(b)(11)(i) and (ii)	§264.18(a)	Seismic standard applicability and requirements	Part B, Rev. 6 Chapter B		T
§270.14(b)(11)(iii-v)	§264.18(b)	100-year floodplain standard	Part B, Rev. 6 Chapter B		T
	§264.18(c)	Other location standards	Part B, Rev. 6 Chapter B		T
§270.14(b)(12)	§264.16(a-e)	Personnel training program	Permit Module II Attachment H		T
§270.14(b)(13)	264 Subpart G	Closure and post-closure plans	Attachment I & J		T
§270.14(b)(13)	§264.111	Closure performance standard	Attachment I		T
§270.14(b)(13)	§264.112(a), (b)	Written content of closure plan	Attachment I		T
§270.14(b)(13)	§264.112(c)	Amendment of closure plan	Attachment I		T
§270.14(b)(13)	§264.112(d)	Notification of partial and final closure	Attachment I		T
§270.14(b)(13)	§264.112(e)	Removal of wastes and decontamination/dismantling of equipment	Attachment I		T
§270.14(b)(13)	§264.113	Time allowed for closure	Attachment I		T
§270.14(b)(13)	§264.114	Disposal/decontamination	Attachment I		T
§270.14(b)(13)	§264.115	Certification of closure	Attachment I		T
§270.14(b)(13)	§264.116	Survey plat	Attachment I		T
§270.14(b)(13)	§264.117	Post-closure care and use of property	Attachment J		T
§270.14(b)(13)	§264.118	Post-closure plan; amendment of plan	Attachment J		T
§270.14(b)(13)	§264.178	Closure/containers	Attachment I		T
§270.14(b)(13)	§264.601	Environmental performance standards-Miscellaneous units	Attachment I		T
§270.14(b)(13)	§264.603	Post-closure care	Attachment I		T
§270.14(b)(14)	§264.119	Post-closure notices	Attachment J		T
§270.14(b)(15)	§264.142	Closure cost estimate	NA		T
	§264.143	Financial assurance	NA		T

Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the HWFP	Yes	No
§270.14(b)(16)	§264.144	Post-closure cost estimate	NA		T
	§264.145	Post-closure care financial assurance	NA		T
§270.14(b)(17)	§264.147	Liability insurance	NA		T
§270.14(b)(18)	§264.149-150	Proof of financial coverage	NA		T

Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the HWFP	Yes	No
§270.14(b)(19)(i), (vi), (vii), and (x)		Topographic map requirements Map scale and date Map orientation Legal boundaries Buildings Treatment, storage, and disposal operations Run-on/run-off control systems Fire control facilities	Attachment O Part A Part B, Rev. 6 Chapter B, E		T
§270.14(b)(19)(ii)	§264.18(b)	100-year floodplain	Attachment O Part A Part B, Rev. 6 Chapter B, E		T
§270.14(b)(19)(iii)		Surface waters	Attachment O Part A Part B, Rev. 6 Chapter B, E		T
§270.14(b)(19)(iv)		Surrounding Land use	Attachment O Part A Part B, Rev. 6 Chapter B, E		T
§270.14(b)(19)(v)		Wind rose	Attachment O Part A Part B, Rev. 6 Chapter B, E		T
§270.14(b)(19)(viii)	§264.14(b)	Access controls	Attachment O Part A Part B, Rev. 6 Chapter B, E, F		T
§270.14(b)(19)(ix)		Injection and withdrawal wells	Attachment O Part A Part B, Rev. 6 Chapter B, E, F		T
§270.14(b)(19)(xi)		Drainage on flood control barriers	Part B, Rev. 6 Chapter B, E, F		T
§270.14(b)(19)(xii)		Location of operational units	Part B, Rev. 6 Chapter B		T
§270.14(b)(20)		Other federal laws Wild and Scenic Rivers Act National Historic Preservation Act Endangered Species Act Coastal Zone Management Act Fish and Wildlife Coordination Act Executive Orders	Part B, Rev. 6 Chapter K		T
§270.15	§264 Subpart I	Containers	Attachment M1		T
	§264.171	Condition of containers	Attachment M1		T
	§264.172	Compatibility of waste with containers	Attachment M1		T
	§264.173	Management of containers	Attachment M1		T
	§264.174	Inspections	Attachment D Attachment M1		T
§270.15(a)	§264.175	Containment systems	Attachment M1		T
§270.15(c)	§264.176	Special requirements for ignitable or reactive waste	Attachment E Permit Module II		T

Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the HWFP	Yes	No
§270.15(d)	§264.177	Special requirements for incompatible wastes	Attachment E Permit Module II		T

Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the HWFP	Yes	No
	§264.178	Closure	Attachment I		T
§270.15(e)	§264.179	Air emission standards	Attachment E Attachment N		T
§270.23	264 Subpart X	Miscellaneous units	Attachment M2		T
§270.23(a)	§264.601	Detailed unit description	Attachment M2		T
§270.23(b)	§264.601	Hydrologic, geologic, and meteorologic assessments	Permit Module IV Attachment M2		T
§270.23(c)	§264.601	Potential exposure pathways	Permit Module IV Attachment M2 Attachment N		T
§270.23(d)		Demonstration of treatment effectiveness	Permit Module IV Attachment M2 Attachment N		T
	§264.602	Monitoring, analysis, inspection, response, reporting, and corrective action	Permit Module IV Attachment M2 Attachment N		T
	§264.603	Post-closure care	Attachment J Attachment J1		T
	264 Subpart E	Manifest system, record keeping, and reporting	Permit Module I Permit Module II Permit Module IV Attachment B		T

Attachment A

Table of Changes

Table of Changes

Affected Permit Section	Explanation for Change
a.1. Attachment B, Table of Contents	The Table of Contents has been revised to reflect the addition of the new Section B-3a(1)(iii), Sampling Requirements for Waste Containers of LANL Sealed Sources Waste Streams.
a.2. Attachment B, Section B-3a(1)	Text has been added to require that LANL sealed sources waste containers that meet specified conditions must be assigned headspace gas VOC concentration values in accordance with Section B-3a(1)(iii) in lieu of headspace gas sampling and analysis.
a.3. Attachment B, Section B-3a(1)(iii)	Section B-3a(1)(iii) has been added to specify the following: • Criteria for the contents of a container belonging to a LANL sealed sources waste stream that must be met for assignment of headspace gas VOC concentration values in lieu of headspace gas sampling and analysis for characterization of that container. Compliance with each criterion must be determined and documented as part of the LANL AK record and the LANL VE technique as specified by the criteria. • Determination of a packaging VOC source term for containers meeting the criteria.
a.4. Attachment B, Section B-3d	Text has been added to Sections B-3d, B-3d(1), and B-3d(2) to require that LANL sealed sources waste containers that meet specified conditions must be assigned headspace gas VOC concentration values in accordance with Section B-3a(1)(iii) in lieu of headspace gas sampling and analysis.
a.5. Attachment B, Section B-3d(1)	
a.6. Attachment B, Section B-3d(2)	
a.7. Attachment B, Table B-6	Table B-6 has been revised to add references to sampling requirements for LANL sealed sources waste containers described in Section B-3a(1)(iii) using the existing Footnote "a," which refers to Section B-3a(1).
b.1. Attachment B1, Section B1-1a(1)	Text has been added to Sections B1-1a(1) and B3-2 to require that LANL sealed sources waste containers that meet specified conditions must be assigned headspace gas VOC concentration values in accordance with Section B-3a(1)(iii) in lieu of headspace gas sampling and analysis.
c.1. Attachment B3, Section B3-2	
c.2. Attachment B3, Section B3-10b(1)	Text has been added to require the Site Project Quality Assurance Officer to ensure by signature release that for LANL sealed sources waste streams the quality control provisions for VOC source term development were properly implemented in accordance with Section B-3a(1)(iii).
c.3. Attachment B3, Section B3-10b(2)	Text has been added to require the Site Project Manager to ensure by signature release that for LANL sealed sources waste streams the VOC source term was properly developed and used in accordance with Section B-3a(1)(iii).
c.4. Attachment B3, Section B3-12b(2)	Text has been added to require the inclusion of VOC source term determination data for LANL sealed sources waste streams in the Characterization Information Summary that accompanies the Waste Stream Profile Form.
c.5. Attachment B3, Table B3-12	Table B3-12 has been revised to add a new Footnote “a” to indicate that the headspace gas sampling batch data report is not required for LANL sealed sources waste containers that meet specific conditions and are assigned headspace gas VOC concentration values in accordance with Section B-3a(1)(iii).
c.6. Attachment B3, Table B3-13	Table B3-13 has been revised to add a new Footnote “a” to indicate that the headspace gas analytical batch data report is not required for LANL sealed sources waste containers that meet specific conditions and are assigned headspace gas VOC concentration values in accordance with Section B-3a(1)(iii).

Affected Permit Section	Explanation for Change
d.1. Attachment B4, Section B4-2c	Text has been added to specify additional AK documentation requirements for LANL sealed sources waste containers meeting the criteria established in Section B-3a(1)(iii).
d.2. Attachment B4, Section B4-3d	Text has been added to require that LANL sealed sources waste containers that meet specified conditions must be assigned headspace gas VOC concentration values in accordance with Section B-3a(1)(iii) in lieu of headspace gas sampling and analysis.
e.1. Attachment B6, Table B6-1	• Items 27, 28, and 29 have been revised to reflect revisions to Sections B-3a(1), B-3d, B-3d(1), and B-3d(2) to clarify that the LANL sealed sources waste containers that meet specified conditions must be assigned VOC concentration values in accordance with Section B-3a(1)(iii) in lieu of headspace gas sampling and analysis. • Items 40 and 41 have been revised to reflect revisions to Sections B3-10b(1) and B3-10b(2) to require that the Site Project Manager and the Site Project Quality Assurance Officer ensure that for LANL sealed sources waste streams the VOC source term was properly developed and/or used in accordance with Section B-3a(1)(iii). • Item 56a has been revised to reflect the revision to Section B3-12b(2) to require the inclusion of VOC source term determination data for LANL sealed sources waste streams in the Characterization Information Summary that accompanies the Waste Stream Profile Form.
e.2. Attachment B6, Table B6-3	New Item 145a has been added to reflect the revision to Section B4-2c to require the verification that procedures are in place to assure the collection of supplemental AK as defined in Section B4-2c for containers that belong to LANL sealed sources waste streams and meet the criteria specified in Section B-3a(1)(iii).
e.3. Attachment B6, Table B6-4	• Items 182 and 183 have been revised to reflect the revision to Section B1-1a(1) to indicate that headspace gas sampling and analysis is not required for waste containers that belong to LANL sealed sources waste streams and meet the criteria specified in Section B-3a(1)(iii). • New Item 182a has been added to require the verification that the LANL Quality Assurance Project Plan directs the assignment of VOC concentration values to waste containers that belong to LANL sealed sources waste streams and meet the criteria specified in Section B-3a(1)(iii). • Item 223 has been revised to reflect the revision to Section B3-2 to indicate that headspace gas sampling and analysis is not required for waste containers that belong to LANL sealed sources waste streams and meet the criteria specified in Section B-3a(1)(iii).

Attachment B

Proposed Revised Permit Text

Proposed Revised Permit Text:

a.1. Attachment B , Table of Contents

a.2. Attachment B, Section B-3a(1)

B-3a(1) Headspace Gas Sampling and Analysis

Headspace-gas samples are used to determine the types and concentrations of VOCs in the void volume of waste containers. Measured headspace VOC concentrations in waste containers received at the WIPP facility will be compared routinely and in accordance with requirements of Permit Attachment N to ensure that, on an annual basis, there are no associated adverse worker or public-health impacts. In addition, VOC constituents will be compared to those assigned by acceptable knowledge, and the Permittees will assign hazardous waste codes, as warranted. This comparison may include an analysis of radiolytically derived VOCs. The Permittees may also consider radiolysis when assessing the presence of listed waste, and whether radiolysis would generate wastes which exhibit the toxicity characteristic. Refer to Permit Attachment B4 for additional clarification regarding hazardous waste code assignment and headspace gas results.

With the exception of qualifying LANL sealed sources waste containers, eEvery TRU mixed waste container or statistically selected containers from waste streams that meet the conditions for reduced headspace gas sampling listed in this section will be sampled and analyzed to determine the concentrations of VOCs (presented in Table B-3) in headspace gases. Los Alamos National Laboratory (**LANL**) sealed sources waste containers that meet specified conditions must be assigned VOC concentration values in accordance with Section B-3a(1)(iii). If composite samples are used, containers used in the composite sample must be from the same waste stream with no more than 20 containers being included in a single composite sample. Sampling protocols, equipment, and QA/QC methods for headspace-gas sampling are provided in Permit Attachment B1. In accordance with EPA convention, identification of hazardous constituents detected by gas chromatography/mass spectrometry methods that are not on the list of target analytes shall be reported. These compounds are reported as tentatively identified compounds (**TICs**) in the analytical batch data report and shall be added to the target analyte list if detected in a given waste stream, if they appear in the 20.4.1.200 NMAC (incorporating 40 CFR §261) Appendix VIII, and if they are reported in 25% of the waste containers sampled from a given waste stream. The headspace gas analysis method Quality Assurance Objectives (**QAOs**) are specified in Permit Attachment B3.

a.3. Attachment B, Section B-3a(1)(iii)

Section B-3a(1)(iii) Sampling Requirements for Waste Containers of LANL Sealed Sources Waste Streams

Headspace gas sampling and analysis of a waste container belonging to a LANL sealed sources waste stream is not required if compliance with the following criteria has been determined and documented by LANL for its individual contents:

- The waste container contents meet the definition of sealed sources per 10 CFR §30.4 or 10 CFR §70.4, evidence of which must be assembled as part of the AK documentation.
- Sealed sources must be the only non-packaging items in the waste container, which must be verified using the VE technique at the time of packaging.
- The sealed sources must be U.S. Department of Transportation Special Form Class 7 (Radioactive) Material, or equivalent, per 49 CFR §173.403, the certification of which must be assembled as part of the AK documentation.

- The integrity of each sealed source must be validated by documented contamination survey results, which must be assembled as part of the AK documentation.

- Each sealed source must be, or be contained in, a rigid sealed container less than or equal to 4 liters in size, which must be verified using the VE technique at the time of packaging.

- AK documentation does not indicate the use of VOCs or VOC-bearing materials as constituents of the sealed sources.

- The outer casing of each sealed source must be of a non-VOC bearing material, which must be verified using the VE technique at the time of packaging.

A packaging VOC source term for waste containers meeting these criteria must be established on a waste-stream basis for each headspace target analyte listed in Table B-3 as follows:

- Samples must be collected from the headspace of a minimum of five containers, each containing only packaging materials typical and representative of the packaging materials used in containers belonging to the LANL sealed sources waste stream under consideration. In no case is this sampling required to occur on containers that hold sealed sources. Each headspace gas sample must be analyzed for the target analytes listed in Table B-3. Using the statistical approach in Permit Attachment B2, Section B2-3b, VOC concentration values shall be calculated. For each result that is nondetectable, the value calculated as one-half the method detection limit shall be used. For all detectable results, the mean values shall be used. The calculated VOC concentration values shall be assigned to each waste container meeting the criteria of this section.

- Sampling and analysis must be managed in accordance with the approved LANL headspace gas sampling and analysis program.

- The VOC source term also must be re-evaluated if any significant change is made to the packaging materials used in the sealed sources waste stream.

If a waste container meets these criteria, concentrations for the headspace gas target analytes (Table B-3) must be assigned based on the VOC source term developed as described above. The assignment of VOC concentration values for qualifying waste containers belonging to LANL sealed sources waste streams must be directed as documented and approved in the LANL QAPjP.

a.4. Attachment B, Section B-3d

B-3d Characterization Techniques and Frequency for Newly Generated and Retrievably Stored Waste

With the exception of qualifying LANL sealed sources waste containers, aAll waste containers (retrievably stored and newly generated) or randomly selected containers from waste streams that meet the conditions for reduced headspace gas sampling listed in Section B-3a(1) are sampled and analyzed for VOCs in the headspace gas. The LANL sealed sources waste containers that meet specified conditions must be assigned VOC concentration values in accordance with Section B-3a(1)(iii). A statistically selected portion of each homogeneous solids and soil/gravel waste stream is sampled and analyzed for RCRA-regulated total VOCs, SVOCs, and metals (see Permit Attachment B2). Sampling and analysis methods used for waste characterization are discussed in Section B-3a. In the process of performing organic headspace and solid sample analyses, nontarget compounds may be identified. These compounds will be reported as TICs. TICs reported in 25% of the samples and listed in 20.4.1.200 NMAC (incorporating 40 CFR §261) Appendix VIII, will be compared with acceptable knowledge data to determine if the TIC is in a listed hazardous waste in the waste stream. TICs identified through headspace gas analyses that meet the Appendix VIII list criteria and the 25 percent reporting criteria for a waste stream will be added to the headspace gas waste stream target list, regardless of the hazardous waste listing associated with the waste stream. TICs subject to inclusion on the target analyte list that are toxicity characteristic parameters shall be added to the target analyte list regardless of origin because the hazardous waste designation for these codes is not based on source. However, for toxicity characteristic and non-toxic F003 constituents, the site may take concentration into account when assessing whether to add a hazardous waste code. TICs reported from the Totals VOC or SVOC analyses may be excluded from the target analyte list for a waste stream if the TIC is a constituent in an F-listed waste whose presence is attributable to waste packaging materials or radiolytic degradation from acceptable knowledge documentation. If the TIC associated with a total VOC or SVOC analysis cannot be identified as a component of waste packaging materials or as a product of radiolysis, the Permittees will add these TICs to the list of hazardous constituents for the waste stream (and assign additional EPA listed hazardous waste codes, if appropriate). A permit modification will be submitted to NMED for their approval to add these constituents (and waste codes), if necessary. For toxicity characteristic compounds and non-toxic F003 constituents, the Permittees may consider waste concentration when determining whether to change a hazardous waste code. Refer to Permit Attachment B3 for additional information on TIC identification.

a.5. Attachment B, Section B-3d(1)

B-3d(1) Newly Generated Waste

With the exception of qualifying LANL sealed sources waste containers, aAll containers of newly generated waste or newly generated waste containers randomly selected from waste streams that meet the conditions for reduced headspace gas sampling listed in Section B-3a(1) will undergo headspace-gas analysis for VOC concentrations prior to shipment. The LANL sealed sources waste containers that meet specified conditions must be assigned

VOC concentration values in accordance with Section B-3a(1)(iii). If the Permittees believe the frequency can be reduced in the future based on trends in analytical results, they may provide technical arguments for such a reduction and request a permit modification from NMED. The headspace-gas sampling method is provided in Permit Attachment B1. Headspace gas data will be used to confirm acceptable knowledge waste characterization, as specified in Permit Attachment B4.

a.6. Attachment B, Section B-3d(2)

B-3d(2) Retrievably Stored Waste

With the exception of qualifying LANL sealed sources waste containers, a~~A~~ll retrievably stored containers or retrievably stored containers randomly selected from waste streams that meet the conditions for reduced headspace gas sampling listed in Section B-3a(1) will undergo headspace gas analysis for VOC concentrations. The LANL sealed sources waste containers that meet specified conditions must be assigned VOC concentration values in accordance with Section B-3a(1)(iii). Retrievably stored waste that is repackaged will be subject to the DAC determination specified in Section B-3d(1). The headspace gas sampling method is provided in Permit Attachment B1. All headspace gas data will be used to confirm acceptable knowledge waste characterization, as specified in Permit Attachment B4.

A statistically selected portion of retrievably stored homogeneous solids and soil/gravel wastes will be sampled and analyzed for total VOCs, SVOCs, and metals. The approach used to statistically select drums for homogeneous solids and soil/gravel wastes is different than the method used to select waste containers for visual examination. This method is also included in Permit Attachment B2. The sampling methods for these wastes are provided in Permit Attachment B1.

a.7. Attachment B, Table B-6

TABLE B-6
SUMMARY OF PARAMETERS, CHARACTERIZATION METHODS, AND RATIONALE FOR CH TRANSURANIC MIXED WASTE (STORED WASTE)

Waste Matrix Code Summary Categories	Waste Matrix Code Groups	Characterization Parameter	Method	Rationale
S3000-Homogeneous Solids S4000-Soil/Gravel	C Solidified inorganics C Salt waste C Solidified organics C Contaminated soil/debris	Physical waste form	100% radiography or visual examination	C Verify waste matrix C Demonstrate compliance with waste acceptance criteria (e.g., no free liquids, no incompatible wastes, no compressed gases)
		Headspace gases C Gas volatile organic compounds (VOC)	100% gas sampling and analysis or statistical sampling[a, b] (see Table B-3)	C Quantify concentration of flammable VOCs C Determine potential flammability of transuranic (TRU) mixed waste headspace gases C Quantify concentrations of VOC constituents in headspace of containers C Ensure that environmental performance standards are not exceeded
		Hazardous constituents C TCLP/total metals C TCLP/total VOCs C TCLP/total semi-VOCs	Statistical sampling[a] (see Tables B-4 and B-5)	C Determine characteristic metals and organics C Determine total quantity of metals, VOCs, and semi-VOCs

TABLE B-6 (CONTINUED)
SUMMARY OF PARAMETERS, CHARACTERIZATION METHODS, AND RATIONALE
FOR CH TRANSURANIC MIXED WASTE (STORED WASTE)

Waste Matrix Code Summary Categories	Waste Matrix Code Groups	Characterization Parameter	Method	Rationale
S5000–Debris Waste	C Uncategorized metal (metal waste other than lead/ cadmium) C Lead/cadmium waste C Inorganic nonmetal waste C Combustible waste C Graphite waste C Heterogeneous waste C Composite filter waste	Physical waste form	100% Radiography Visual examination (statistical sample)[a] or visual examination	C Verify waste matrix C Demonstrate compliance with waste acceptance (e.g., no free liquids, no incompatible wastes, no compressed gases)
		Headspace gases C Gas VOCs	100% gas sampling and analysis , statistical sampling or assignment of VOC concentrations[a] (see Table B-3)	C Quantify concentration of flammable VOCs C Determine potential flammability of TRU mixed waste headspace gases C Quantify concentrations of VOC constituents in headspace of containers C Ensure that environmental performance standards are not exceeded C Verify acceptable knowledge
		Hazardous constituents C TCLP/total metals C TCLP/total VOCs C TCLP/total semi-VOCs	Acceptable knowledge	C Determine characteristic metals and organics C Determine total quantity of metals, VOCs, and semi-VOCs

TABLE B-6 (CONTINUED)
SUMMARY OF PARAMETERS, CHARACTERIZATION METHODS, AND RATIONALE
FOR CH TRANSURANIC MIXED WASTE (NEWLY GENERATED WASTE)

Waste Matrix Code Summary Categories	Waste Matrix Code Groups	Characterization Parameter	Method	Rationale
S3000-Homogeneous Solids S4000-Soil/Gravel	C Solidified inorganics C Salt waste C Solidified organics C Contaminated soil/debris	Physical waste form	Documentation and verification[b] or radiography. Applies to 100% of containers	C Verify waste matrix C Demonstrate compliance with waste acceptance criteria (e.g., no free liquids, no incompatible wastes, no compressed gases)
		Headspace gases C Gas VOCs (VOCs)	100% gas sampling and analysis or statistical sampling[a, b] (see Table B-3)	C Quantify concentration of flammable VOCs C Determine potential flammability of TRU mixed waste headspace gases C Quantify concentrations of VOC constituents in headspace of containers C Ensure that environmental performance standards are not exceeded
		Hazardous constituents C TCLP/total metals C TCLP/total VOCs C TCLP/total semi-VOCs	Statistical sampling[a] (see Tables B-4 and B-5)	C Determine characteristic metals and organics C Determine total quantity of metals, VOCs, and semi-VOCs

TABLE B-6 (CONTINUED)
SUMMARY OF PARAMETERS, CHARACTERIZATION METHODS, AND RATIONALE
FOR CH TRANSURANIC MIXED WASTE (NEWLY GENERATED WASTE)

Waste Matrix Code Summary Categories	Waste Matrix Code Groups	Characterization Parameter	Method	Rationale
S5000–Debris Waste	C Uncategorized metal (metal waste other than lead/ cadmium) C Lead/cadmium waste C Inorganic nonmetal waste C Combustible waste C Graphite waste C Heterogeneous waste C Composite filter waste	Physical waste form	Documentation and verification[b] or radiography. Applies to 100% of containers	C Verify waste matrix C Demonstrate compliance with waste acceptance (e.g., no free liquids, no incompatible wastes, no compressed gases)
		Headspace gases C Gas VOCs	100% gas sampling and analysis, statistical sampling or assignment of VOC concentrations[a] (see Table B-3)	C Quantify concentration of flammable VOCs C Determine potential flammability of TRU mixed waste headspace gases C Quantify concentrations of VOC constituents in headspace of containers C Ensure that environmental performance standards are not exceeded C Verify acceptable knowledge
		Hazardous constituents C TCLP/total metals C TCLP/total VOCs C TCLP/total semi-VOCs	Acceptable knowledge	C Determine characteristic metals and organics C Determine total quantity of metals, VOCs, and semi-VOCs

[a] Applies to certain waste streams that meet the conditions in Section B-3a(1).

[b] Number determined as specified in Permit Attachment B2.
[c] See discussion in Permit Attachment B4.

b.1. Attachment B1, Section B1-1a(1)

B1-1a(1) Summary Category S5000 Requirements

With the exception of qualifying LANL sealed sources waste containers, a~~A~~ll waste containers or randomly selected containers from waste streams that meet the conditions for reduced headspace gas sampling listed in Permit Attachment B, Section B-3a(1), designated as summary category S5000 (Debris waste) shall be categorized under one of the sampling scenarios shown in Table B1-5 and depicted in Figure B1-1. The LANL sealed sources waste containers that meet specified conditions must be assigned VOC concentration values in accordance with Section B-3a(1)(iii). If the container is categorized under Scenario 1, the applicable drum age criteria (**DAC**) from Table B1-6 must be met prior to headspace gas sampling. If the container is categorized under Scenario 2, the applicable Scenario 1 DAC from Table B1-6 must be met prior to venting the container and then the applicable Scenario 2 DAC from Table B1-7 must be met after venting the container. The DAC for Scenario 2 containers that contain filters or rigid liner vent holes other than those listed in Table B1-7 shall be determined using footnotes “a” and “b” in Table B1-7. Containers that have not met the Scenario 1 DAC at the time of venting must be categorized under Scenario 3. Containers categorized under Scenario 3 must be placed into one of the Packaging Configuration Groups listed in Table B1-8. If a specific packaging configuration cannot be determined based on the data collected during packaging and/or repackaging (Attachment B, Section B-3(d)1), a conservative default Packaging Configuration Group of 3 for drums and 6 for Standard Waste Boxes (**SWBs**) must be assigned, provided the drums do not contain pipe component packaging. If a container is designated as Packaging Configuration Group 4 (i.e., a pipe component), the headspace gas sample must be taken from the pipe component headspace. The DAC for Scenario 3 containers that contain rigid liner vent holes that are undocumented during packaging (Attachment B, Section B-3(d)1), repackaging (Attachment B, Section B-3(d)1), and/or venting (Section B1-1a[6][ii]) shall be determined using the default conditions in footnote “b” in Table B1-9.The DAC for Scenario 3 containers that contain filters that are either undocumented or are other than those listed in Table B1-9 shall be determined using footnote ‘a’ in Table B1-9. Each of the Scenario 3 containers shall be sampled for headspace gas after waiting the DAC in Table B1-9 based on its packaging configuration (note: Packaging Configuration Groups 4, 5, and 6 are not summary category group dependent, and SWB requirements apply when the SWB itself is used for the direct loading of waste).

c.1. Attachment B3, Section B3-2

B3-2 Headspace-Gas Sampling

Quality Assurance Objectives

With the exception of qualifying LANL sealed sources waste containers, h~~H~~eadspace-gas sampling will occur from the headspace within each drum of transuranic (**TRU**) mixed waste or randomly selected containers from waste streams that meet the conditions for reduced headspace gas sampling listed in Attachment B, Section B-3a(1). The LANL sealed sources waste containers that meet specified conditions must be assigned VOC concentration values in accordance with Section B-3a(1)(iii).

The precision and accuracy of the drum headspace-gas sampling operations must be assessed by analyzing field QC headspace-gas samples. These samples must include equipment blanks, field reference standards, field blanks, and field duplicates. If the QAOs described below are not met, a nonconformance report must be prepared, submitted, and resolved (Section B3-13).

c.2. Attachment B3, Section B3-10b(1)

B3-10b(1) Site Project QA Officer

The Site Project QA Officer review ensures that the Batch Data Reports received from the data generation level is complete, validates and verifies that the QC checks were done properly and meet program criteria, and ensures that the QAOs have been met.

One hundred percent of the Batch Data Reports must receive Site Project QA Officer signature release. The Site Project QA Officer signature release must occur as soon as practicably possible in order to determine and correct negative quality trends in the sampling or analytical process. However at a minimum, the Site Project QA Officer signature release must be performed before any waste associated with the data reviewed is managed, stored, or disposed at WIPP. This signature release must ensure the following:

- Batch Data Reports are complete and data are properly reported (i.e., data are reported in correct units, with correct significant figures, and with correct qualifying flags).

- Sampling batch QC checks (e.g., equipment blanks, field duplicates, field reference standards) were properly performed, and meet the established QAOs and are within established data useability criteria.

- Testing batch QC checks (e.g., replicate scans, measurement system checks) were properly performed. Radiography data are complete and acceptable based on evidence of videotape review of one waste container per day or once per testing batch, whichever is less frequent, as specified in B1-3b(2).

- Analytical batch QC checks (e.g., laboratory duplicates, laboratory blanks, matrix spikes, matrix spike duplicates, laboratory control samples) were properly performed and meet the established QAOs and are within established data useability criteria.

- On-line batch QC checks (e.g., field blanks, on-line blanks, on-line duplicates, on-line control samples) were properly performed and meet the established QAOs and are within established data useability criteria.

- Proper procedures were followed to ensure representative samples of headspace gas and homogenous solids and soil/gravel were taken.

- For LANL sealed sources waste streams, the quality control provisions for VOC source term development were properly implemented in accordance with Permit Attachment B, Section B-3a(1)(iii).

c.3. Attachment B3, Section B3-10b(2)

B3-10b(2) Site Project Manager

The Site Project Manager Review is the final validation that all of the data contained in Batch Data Reports have been properly reviewed as evidenced by signature release and completed checklists.

One hundred percent of the Batch Data Reports must have Site Project Manager signature release. The Site Project Manager signature release must occur as soon as practicably possible after the Site Project QA officer signature release in order to determine and correct negative quality trends in the sampling or analytical process. However at a minimum, the Site Project Manager signature release must be performed before any waste associated with the data reviewed is managed, stored, or disposed at WIPP. This signature release must ensure the following:

- The Site Project Manager or designee shall determine the validity of the drum age criteria (**DAC**) assignment made at the data generation level based upon an assessment of the data collection and evaluation necessary to make the assignment.

- For LANL sealed sources waste streams, the VOC source term was properly developed and used in accordance with Permit Attachment B, Section B-3a(1)(iii).

- Data generation level independent technical, technical supervisory, and QA officer (or designee) review, validation, and verification have been performed as evidenced by the completed review checklists and appropriate signature releases.

- Batch data review checklists are complete.

- Batch Data Reports are complete and data are properly reported (e.g., data are reported in the correct units, with the correct number of significant figures, and with qualifying flags).

- Verify that data are within established data assessment criteria and meet all applicable QAOs (Section B3-11).

c.4. Attachment B3, Section B3-12b(2)

B3-12b(2) Characterization Information Summary

The Characterization Information Summary shall include the following elements:

- Data reconciliation with DQOs

- Headspace gas summary data listing the identification numbers of samples used in the statistical reduction, the maximum, mean, standard deviation, UCL_{90}, RTL, and associated EPA hazardous waste codes that must be applied to the waste stream.

- For LANL sealed sources waste streams, the VOC source term determination data (as defined by Attachment B, Section B-3a(1)(iii)) listing the identification numbers of samples used in the statistical reduction, one-half the method detection limits, mean, standard deviation, UCL_{90}, and RTL used to assign concentrations for the headspace gas target analytes.

- Total metal, VOC, and SVOC analytical results for homogeneous solids and soil/gravel (if applicable), and demonstration that control charting cannot be applied effectively, if this option is implemented.

- TIC listing and evaluation, and verification that acceptable knowledge (**AK**) was confirmed.

- Radiography and visual examination summary to document that all prohibited items are absent in the waste and to confirm AK, and documentation and justification for the use of radiography in lieu of or in combination with visual examination/visual examination technique for newly generated waste.

- A complete listing of all container identification numbers used to generate the WSPF, cross-referenced to each Batch Data Report

- Complete AK summary, including stream name and number, point of generation, waste stream volume (current and projected), generation dates, TRUCON codes, Summary Category Group, Waste Matrix Code(s) and Waste Matrix Code Group, other TWBIR information, waste stream description, areas of operation, generating processes, RCRA determinations, radionuclide information, all references used to generate the AK summary, and any other information required by Permit Attachment B4, Section B4-2b.

- Certification through acceptable knowledge or testing and/or analysis that any waste assigned the hazardous waste number of U134 (hydrofluoric acid) no longer exhibits the characteristic of corrosivity. This is confirmed by assuring that no liquid is present in U134 waste.

c.5. Attachment B3, Table B3-12

TABLE B3-12
SAMPLING BATCH DATA REPORT CONTENTS

Required Information	Headspace Gas[a]	Solid Sampling	Comment
Batch Data Report Date	X	X	
Batch number	X	X	
Waste stream name and/or number	O	O	
Waste Matrix Code		X	Summary Category Group included in Waste Matrix Code
Procedure (specific version used)	X	X	If procedure cited contains more than one method, the method used must also be cited. Can use revision number, date, or other means to track specific version used.
Container number	X	X	
Container type	O	O	Drums, Standard Waste Box, Ten Drum Overpack, etc.
Sample matrix and type	X	X	
Analyses requested and laboratory	X	X	
Point of origin for sampling	X	X	Location where sample was taken (e.g., building number, room)
Sample number	X	X	
Sample size	X	X	
Sample location	X	X	Location within container where sample is taken. (For HSG, specify what layer of confinement was sampled. For solids, physical location within container.)
Sample preservation	X	X	

Required Information	Headspace Gas[a]	Solid Sampling	Comment
Person collecting sample	X	X	
Person attaching custody seal	O	O	May or may not be the same as the person collecting the sample
Chain of custody record	X	X	Original or copy is allowed
Sampling equipment numbers	X	X	For disposable equipment, a reference to the lot
Drum age	X		Must include all supporting determinative information, including but not limited to packaging date, equilibrium start time, storage temperature, and sampling date/time. If Scenario 3 is used, the packaging configuration, filter diffusivity, liner presence/absence, and rigid liner vent hole diameter used in determining the DAC must be documented. If Scenario 1 and 2 are used together, the filter diffusivity and rigid liner vent hole diameter used in determining the DAC must be documented. If default values are used for retrievably stored waste, these values must clearly be identified as such.
Cross-reference of sampling equipment numbers with associated cleaning batch numbers	O	X	As applicable to the equipment used for the sampling. For disposable equipment, a reference to the lot and procurement records to support cleanliness is sufficient
Drum age	X		
Equilibration time	X		
Verification of rigid liner venting	X		Only applicable to containers with rigid liners
Verification that sample volume taken is small in comparison to the available volume	X		Must include headspace gas volume when it can be estimated
Scale Calibration		O	
Depth of waste		X	For newly generated waste, if a sampling method other than coring is used, this is replaced by documentation that a representative sample has been taken.
Calculation of core recovery		X	For newly generated waste, if a sampling method other than coring is used, this is replaced by documentation that a representative sample has been taken.

Required Information	Headspace Gas[a]	Solid Sampling	Comment
Co-located core description		X	For newly generated waste, if a sampling method other than coring is used, this is replaced by documentation that a QC sample has been taken.
Time between coring and subsampling		X	Only applicable to coring.
OVA calibration and reading	O		Only applicable to manifold systems. Must be done in accordance with manufacturer's specifications
Field Records	X	X	Must contain the following as applicable to the sampling method used: Collection problems, Sequence of sampling collection, Inspection of the solids sampling area, Inspection of the solids sampling equipment, Coring tool test, random location of sub-sample, canister pressure, and ambient temperature and pressure.
Reference to or copy of associated NCRs, if any	X	X	Copies of associated NCRs must be available.
Operator Signature and date and time of sampling	X	X	
Data review checklists	X	X	All data review checklists will be identified

[a] The headspace gas sampling batch data report is not required for the LANL sealed sources waste containers that meet specified conditions and are assigned VOC concentration values in accordance with Section B-3a(1)(iii).

LEGEND:

X - Required in batch data report.
O - Information must be documented and traceable; inclusion in batch data report is optional.

c.6. Attachment B3, Table B3-13

TABLE B3-13
ANALYTICAL BATCH DATA REPORT CONTENTS

Required Information	Headspace Gas [a]	Solid Sampling	Comment
Batch Data Report Date	X	X	
Batch number	X	X	
Sample numbers	X	X	
QC designation for sample	X	X	
Implementing procedure (specific version used)	X	X	If procedure cited contains more than one method, the method used must also be cited. Can use revision number, date, or other means to track specific version used.
QC sample results	X	X	
Sample data forms	X	X	Form should contain reduced data for target analytes and TICs
Chain of custody	X	X	Original or copy
Gas canister tags	X		Original or copy
Sample preservation	X	X	
Holding time		X	
Cross-reference of field numbers to laboratory sample numbers	X	X	
Date and time analyzed	X	X	
Confirmation of spectra used for results	O	O	Analyst must qualitatively evaluate the validity of the results based on the spectra, can be implemented as a check box for each sample
TIC evaluation	X	X	
Reporting flags, if any	X	X	Table B3-14 lists applicable flags
Case narrative	X	X	
Reference to or copy of associated NCRs, if any	X	X	Copies of associated NCRs must be available.
Operator signature and analysis date	X	X	
Data review checklists	X	X	All data review checklists will be identified

[a] The headspace gas analytical batch data report is not required for the LANL sealed sources waste containers that meet specified conditions and are assigned VOC concentration values in accordance with Section B-3a(1)(iii).

LEGEND:

X - Required in batch data report.

O - Information must be documented and traceable; inclusion in batch data report is optional.

d.1. Attachment B4, Section B4-2c

B4-2c Supplemental Acceptable Knowledge Information

The generator/storage sites shall obtain supplemental acceptable knowledge information. The amount and type of supplemental information is site-specific and cannot be mandated, but sites shall collect information as appropriate to support required information. Adequacy of supplemental information shall be assessed by the Permittees during audits (Section B4-3f). Sites will use this information to compile the acceptable knowledge written record. Supplemental acceptable knowledge documentation that may be used (if available) in addition to the required information specified above include, but are not limited to, the following information:

- Process design documents (e.g., Title II Design)
- Standard operating procedures that may include a list of raw materials or reagents, a description of the process or experiment generating the waste, and a description of wastes generated and how the wastes are managed at the point of generation
- Preliminary and final safety analysis reports and technical safety requirements
- Waste packaging logs
- Test plans or research project reports that describe reagents and other raw materials used in experiments
- Site databases (e.g., chemical inventory database for Superfund Amendments and Reauthorization Act Title III requirements)
- Information from site personnel (e.g., documented interviews)
- Standard industry documents (e.g., vendor information)
- Analytical data relevant to the waste stream, including results from fingerprint analyses, spot checks, or routine verification sampling. This may also include new information acquired apart from the confirmatory process which supplements required information (e.g., visual examination not performed in compliance with the WAP)
- Material Safety Data Sheets, product labels, or other product package information
- Sampling and analysis data from comparable or surrogate waste streams (e.g., equivalent nonradioactive materials)

- Laboratory notebooks that detail the research processes and raw materials used in an experiment

For waste containers that belong to LANL sealed sources waste streams and meet the criteria of Permit Attachment B, Section B-3a(1)(iii), the following information is required as part of the AK documentation:

- Documentation that the waste container contents meet the definition of sealed sources per 10 CFR §30.4 or 10 CFR §70.4.

- Documentation of the certification of the sealed sources as U.S. Department of Transportation Special Form Class 7 (Radioactive) Material or equivalent per 49 CFR §173.403,.

- Documentation of contamination survey results that validate the integrity of each sealed source.

- AK documentation does not indicate the use of VOCs or VOC-bearing materials as constituents of the sealed sources.

- The outer casing of each sealed source must be of a non-VOC bearing material, which must be verified using the VE technique at the time of packaging.

All specific, relevant supplemental acceptable knowledge documentation assembled and used in the acceptable knowledge process, whether it supports or contradicts any required acceptable knowledge documentation, shall be identified and an explanation provided for its use (e.g., identification of a toxicity characteristic). Supplemental documentation may be used to further document the rationale for the hazardous characterization results. The collection and use of supplemental information shall be assessed by the Permittees during site audits to ensure that hazardous waste characterization is supported, as necessary, by supplemental information. Similar to required information, if discrepancies exist between supplemental information and the required information, then sites shall apply all hazardous waste codes indicated by the supplemental information to the subject waste stream unless the sites choose to justify an alternative assignment and document the justification in the auditable record.

d.2. Attachment B4, Section B4-3d

B4-3d Requirements for Confirmation of Acceptable Knowledge Information

With the exception of qualifying LANL sealed sources waste containers, hHeadspace-gas sampling and analysis shall be conducted on all TRU mixed waste or randomly selected containers from waste streams that meet the conditions for reduced headspace gas sampling listed in Permit Attachment B, Section B-3a(1), to be sent to the WIPP facility. (The LANL sealed sources waste containers that meet specified conditions must be assigned VOC concentration values in accordance with Section B-3a(1)(iii).) Headspace-gas data will be used to confirm the presence or absence of volatile organic compounds (**VOCs**) identified using acceptable knowledge.

e.1. Attachment B6, Table B6-1

27	Are procedures in place to ensure that the following characterization activities shall occur for newly generated wastes: C Acceptable Knowledge for all wastes, with confirmatory: - Either visual examination during packaging or radiography (or VE in lieu of radiography) after packaging for all waste containers, ensuring this occurs prior to any treatment designed to supercompact waste - Headspace gas analysis for all waste containers or randomly selected containers from waste streams that meet the conditions for reduced headspace gas sampling listed in Section B-3a(1), except for qualifying waste containers belonging to LANL sealed sources waste streams as specified in Section B-3a(1)(iii) - Total VOC, SVOC, and Metals analyses for a selected number of homogeneous solids and soil/gravel waste containers for control charting purposes (annually thereafter), as specified in Attachment B2 - Evaluation of any TICs found in headspace gas and totals analyses (Section B-3d(1))

28	Are procedures in place to ensure that the following characterization activities shall occur for retrievably stored wastes: C Acceptable Knowledge for all wastes, with confirmatory: - Visual examination or radiography for all waste containers - Confirmatory visual examination of a statistically determined number of waste containers as specified in Attachment B2 (when radiography is performed) - Headspace gas analysis for all waste containers or randomly selected containers from waste streams that meet the conditions for reduced headspace gas sampling listed in Section B-3a(1), except for qualifying waste containers belonging to LANL sealed sources waste streams as specified in Section B-3a(1)(iii) - Total VOC, SVOC, and Metals analyses for a statistically selected number of homogeneous solids and soil/gravel waste containers as specified in Attachment B2 (containers opened for sampling may be used to fulfill the visual examination requirements) - Evaluation of any TICs found in headspace gas and totals analyses (Section B-3d(2))

29	Are procedures in place to ensure that the following characterization activities shall occur for repackaged waste: C Acceptable Knowledge, with confirmatory: - Either visual examination during repackaging or radiography (or VE in lieu of radiography) after repackaging for all waste containers, ensuring this occurs prior to any treatment designed to supercompact waste - Headspace gas analysis for all waste containers or randomly selected containers from waste streams that meet the conditions for reduced headspace gas sampling listed in Section B-3a(1), except for qualifying waste containers belonging to LANL sealed sources waste streams as specified in Section B-3a(1)(iii) - Total VOC, SVOC, and Metals analyses following either the retrievably stored or newly generated waste characterization process, whichever results in greater sampling requirements, unless it is demonstrated that control charting cannot be applied effectively. - Evaluation of any TICs found in headspace gas and totals analyses (Section B-3d, B-3d(1))

40	Are procedures in place to ensure that 100 percent of all batch data reports receive a Site Project Manager signature release with an associated review checklist prior to characterization of the associated waste and shipment to the WIPP. This release shall ensure the following: C The Site Project Manager or designee shall determine the validity of the drum age criteria (**DAC**) assignment made at the data generation level based upon an assessment of the data collection and evaluation necessary to make the assignment. • For LANL sealed sources waste streams, the VOC source term was properly developed and used in accordance with Permit Attachment B, Section B-3a(1)(iii). C Non-programmatic technical reviews, technical supervisory reviews, and QA Officer reviews have been performed and documented through signature C Data have been verified to be within established data assessment criteria and meet all applicable QAOs C Sampling, testing, and analytical batches are complete and data are reported to the correct units, qualifier flags, and significant figures. C The testing, sampling, and QA data review checklists are complete (Section B3-10b(2))

41	At the project level, are procedures in place to ensure that 100 percent of all batch data reports shall have a Site Project QA Officer signature release with an associated review checklist prior to characterization of the associated waste and shipment to the WIPP. This release shall ensure the following: C Sampling batch field QC checks were properly performed and meet established QAOs and data usability criteria C Testing batch QC checks were properly performed C Analytical batch and on-line QC Checks were properly performed and meet established QAOs and data usability criteria C Radiography data are complete and acceptable C Data are properly reported (i.e., correct units, correct significant figures, and appropriate qualifier flags) C Proper procedures were used to ensure that representative headspace gas and core samples were collected • For LANL sealed sources waste streams, the quality control provisions for VOC source term development were properly implemented in accordance with Permit Attachment B, Section B-3a(1)(iii). (Section B3-10b(1))

56a	Are procedures in place to ensure that hard copy or electronic Characterization Information Summary will include the following: C Data reconciliation with DQOs C Headspace gas summary data listing the identification numbers of samples used in the statistical reduction, the maximum, mean, standard deviation, UCL_{90}, RTL, and associated EPA hazardous waste codes that must be applied to the waste stream. • For LANL sealed sources waste streams, the VOC source term determination data must comply with Attachment B, Section B-3a(1)(iii). C Total metal, VOC, and SVOC analytical results for homogeneous solids and soil/gravel (if applicable), and demonstration that control charting cannot be applied effectively, if this option is implemented. C TIC listing and evaluation, and verification that acceptable knowledge (**AK**) was confirmed. C Radiography and visual examination summary to document that all prohibited items are absent in the waste and to confirm AK, and documentation and justification for the use of radiography in lieu of or in combination with visual examination/visual examination technique for newly generated waste. C A complete listing of all container identification numbers used to generate the Waste Stream Profile Form, cross-referenced to each Batch Data Report C Complete AK summary, including stream name and number, point of generation, waste stream volume (current and projected), generation dates, TRUCON codes, Summary Category Group, Waste Matrix Code(s) and Waste Matrix Code Group, other TWBIR information, waste stream description, areas of operation, generating processes, RCRA determinations, radionuclide information, all references used to generate the AK summary, and any other information required by Permit Attachment B4, Section B4-2b. C Certification through acceptable knowledge or testing and/or analysis that any waste assigned the hazardous waste number of U134 (hydrofluoric acid) no longer exhibits the characteristic of corrosivity. This is confirmed by assuring that no liquid is present in U134 waste. (Section B3-12b(2))

e.2. Attachment B6, Table B6-3

145	Does the generator provide procedures or written commitment to collect supplemental acceptable knowledge information, as available and as necessary to supplement mandatory information? (Section B4-2c)
145a	For waste containers that belong to LANL sealed sources waste streams and meet the criteria of Section B-3a(1)(iii) are there procedures in place to assure the collection of the following supplemental AK: • Documentation that the waste container contents meet the definition of sealed sources per 10 CFR §30.4 or 10 CFR §70.4, • Documentation of the certification of the sealed sources as U.S. Department of Transportation Special Form Class 7 (Radioactive) Material per 49 CFR §173.403, or equivalent. • Documentation of contamination survey results that validate the integrity of each sealed source. • AK documentation does not indicate the use of VOCs or VOC-bearing materials as constituents of the sealed sources. • The outer casing of each sealed source must be of a non-VOC bearing material, which must be verified using the VE technique at the time of packaging. (Section B4-2c)

e.3. Attachment B6, Table B6-4

182	Are procedures in place to ensure that every retrievably stored and newly generated waste containers or randomly selected containers from waste streams that meet the conditions for reduced headspace gas sampling listed in Section B-3a(1), except for waste containers belonging to LANL sealed sources waste streams as specified in Section B-3a(1)(iii), will undergo headspace gas sampling and analysis? (Section B-3a, -3b)
182a	Are procedures in place or is a program described in the LANL QAPjP to assure that VOC concentrations are determined and assigned in accordance with Permit Attachment B, Section B-3a(1)(iii) for waste containers that belong to LANL sealed sources waste streams and meet the criteria specified in Section B-3a(1)(iii)? (Section B-3a(1)(iii))
183	Are procedures in place to ensure that all waste containers or randomly selected containers from waste streams that meet the conditions for reduced headspace gas sampling listed in Section B-3a(1) (except for qualifying waste containers belonging to LANL sealed sources waste streams as specified in Section B-3a(1)(iii)) will be allowed to equilibrate to sampling room temperature for 72 hours prior to sampling (18º C or higher) and that the drum ages specified in accordance with Section B1-1a(1) and B1-1a(2) are met? All information necessary to determine drum age criteria must be determined, including but not limited to: C Scenario Determination C Packaging Configuration C Filter Diffusivity C Liner/Lid Opening Diameter Are procedures in place to ensure that equilibrium time and drum ages are documented for each container from which a headspace gas sample is collected as specified in Section B1-1a(3)? (Section B1-1a)

223	Are procedures in place to ensure that headspace gas sampling will occur from the drum headspace for all drums or randomly selected containers from waste streams that meet the conditions for reduced headspace gas sampling listed in Section B-3a(1) (except for qualifying waste containers belonging to LANL sealed sources waste streams as specified in Section B-3a(1)(iii))? (Section B3-2)

Attachment C

Example - LANL Sealed Sources Waste Streams Acceptable Knowledge Documentation

Example - LANL Sealed Sources Waste Streams
Acceptable Knowledge Documentation

This permit modification request proposes criteria for the assignment of headspace gas volatile organic compound (**VOC**) concentration values in lieu of headspace gas sampling and analysis for the characterization of specific waste containers belonging to the Los Alamos National Laboratory (**LANL**) sealed sources waste streams. In order the meet these criteria, the following information must be part of the LANL acceptable knowledge (**AK**) record:

- Documentation that the waste container contents meet the definition of sealed sources per Title 10, Code of Federal Regulations (**CFR**), Section 30.4 (10 CFR §30.4) or 10 CFR §70.4

- Documentation of the certification of the sealed sources as U.S. Department of Transportation (**DOT**) Special Form Class 7 (Radioactive) Material or equivalent per 49 CFR §173.403.

- Documentation of contamination survey results that validate the integrity of each sealed source.

- AK documentation does not indicate the use of VOCs or VOC-bearing materials as constituents of the sealed sources.

- Documentation that the outer casing of each sealed source is of a non-VOC bearing material, which must be verified using the VE technique at the time of packaging.

Such information exists for the sealed sources because they are manufactured as precision tools with a well-defined pedigree. They have a design history and have been manufactured to a rigid set of specifications. There are only a finite number of sealed sources manufacturers, models, and sizes. Commonly, an individual serial number uniquely defines each sealed source. Often only the specific source serial number differentiates it from other identical sealed sources of a particular model or series. The sealed source containment materials are well defined, and the sealing procedures used are a matter of documented record. LANL compiles all such records as part of the AK documentation for sealed sources.

For a specific sealed source, documentation is compiled on the content and design/construction from the U.S. Nuclear Regulatory Commission (**NRC**) registry of sealed sources, the manufacturer, the original shipping paper and specification sheet, and data from the NRC/ U.S. Department of Energy (**DOE**) Nuclear Material Management and Safeguards System (**NMMSS**), as well as other physical information about the sealed source. Records are accumulated for the individual sealed sources, typically identified by unique serial number, and tracked over the years in organizational records starting with manufacturers' records, records associated with the control of special nuclear materials, or NRC licensing and device registries. Such records provide a complete history of the sealed source from the cradle to its acquisition and management at LANL.

The following list provides examples of the types of AK documentation (followed by the current LANL Transuranic Waste Characterization/Certification Program [TWCP] AK record identification number) that exist for the LANL sealed sources waste streams:

- Source manufacturers' sales catalogues identify sealed source models, isotopes, activity, neutron/gamma emission rates, and dimensional drawings (TWCP-03759, TWCP-09462).

- Original purchase records identify design information for a specific source (identified by a unique serial number). This information may include encapsulation requirements; source loading information, source model used, American National Standards Institute test conducted, and DOT Special Form Class 7 (Radioactive) Material qualifications (TWCP-06723).

- Source manufacturers' fabrication documents identify activity, neutron/gamma emission rates, radioactive source materials, source configuration, source loading, and source testing (TWCP-05462).

- Source manufacturers' drawings provide dimensional information, containment materials, and shape of sources (TWCP-10565).

- Source manufacturers' fuel capsule assembly reports identify material batch number, weight percent of the isotope, isotope powder weight, welding documentation, leak test information, and neutron emission rates (TWCP-05611).

- Source manufacturers' operational procedures identify cleanliness requirements, testing methods, and acceptance criteria (TWCP-06723).

- Source manufacturers' shipping documents identify by unique serial number the isotope, activity, loading, containment material, dimensions, method of sealing, neutron/gamma emission, and special form qualification for a specific sealed source (TWCP-05760).

- Source manufacturers' welding records provide information regarding cleaning agents and welding procedures (TWCP-09293, TWCP-09299).

- Transuranic batch material records trace the radioactive material from the originator (Atomic Energy Commission/DOE) to the source manufacture and, in some cases, to source owners (TWCP-09268, TWCP-09269, TWCP-09267, TWCP-09356).

- National database, NMMSS, identifies the source owner, material type, date of manufacture, and isotopic grams of the nuclide by unique serial number for a specific sealed source. The database provides a listing of sealed sources manufactured containing Pu^{238} and Pu^{239} special nuclear material. The last report issued was in 1985. Additions to the database are now made using NRC/DOE Form 741 (e.g., Am^{241} is treated as special nuclear material by the DOE and is being added to this database) (TWCP-05463).

- NRC/DOE Form 741 defines where radioactive material originated, material type, and batch material information (TWCP-05602, TWCP-05752, TWCP-05630, TWCP-05445, TWCP-05662).

- National database, NRC Registry of Radioactive Sealed Sources and Device Registry, identifies source device, isotope, activity, source marking, source or device diagram, and testing conducted on the source (TWCP-03758).

- DOT Special Form Class 7 (Radioactive) Material documentation identifies if the source has a special form certificate and if the certificate is current (TWCP-05465).

Attachment D

Headspace Gas Sampling and Analysis Evaluation for LANL Sealed Sources

HEADSPACE GAS SAMPLING AND ANALYSIS EVALUATION FOR LANL SEALED SOURCES LAUR-03-0917

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INTRODUCTION

Since 1999, the Los Alamos National Laboratory (LANL), Off-Site Source Recovery (OSR) Project has been identifying and collecting radioactive sealed sources that are no longer needed. There is an existing backlog of sealed sources in known locations that are not secure. The OSR Project's mission is to secure and safely dispose of these sealed sources. The basis for this action is to eliminate the homeland security issues associated with this excess material while it remains unsecured. The vast majority of these sources contain transuranic (TRU) isotopes. Most of the TRU sealed sources are beyond the activity limits for acceptance at low-level waste disposal facilities. However, these sealed sources are candidates for disposal at the Waste Isolation Pilot Plant (WIPP). Many of these sources are the result of "atomic energy defense activity." Many more may be determined to meet this WIPP eligibility requirement at some time in the future.

In all cases, the excess unwanted TRU materials are considered to be of high attractiveness, which presents a homeland security risk if not appropriately secured and safeguarded. The Department of Energy (DOE) and the National Nuclear Security Administration have determined that the maximum level of risk reduction will occur only when the recovered sealed sources are dispositioned as TRU waste by permanent isolation. The objective, therefore, is to recover, package as waste, and transfer all eligible-sealed sources to WIPP as expeditiously as possible. To achieve this objective it is necessary to characterize the sealed source waste stream to WIPP requirements resulting in WIPP-certifiable waste.

Among other requirements, the characterization requirements of the Waste Analysis Plan (WAP) of the WIPP Hazardous Waste Facility Permit (HWFP; No. NM4890139088-TSDF) (Ref. 1) must be met in order to certify TRU waste for disposal at WIPP. Of particular interest for sealed sources is the WAP requirement for headspace gas sampling and analysis. The data quality objectives (DQOs) established by the WAP for headspace gas sampling and analysis are as follows:

- To confirm hazardous waste identification by acceptable knowledge (AK)
- To identify volatile organic compounds (VOCs) and quantify the concentrations of VOC constituents in the total waste inventory to ensure compliance with the performance standards of 20.4.1.500 NMAC (New Mexico Administrative Code; incorporating Title 40, Code of Federal Regulations, §264.601(c)) (Ref. 1).

Based on *Acceptable Knowledge Summary Report for Off-Site Source Recovery Sealed Sources* (OSR-MISC-03) (Ref. 2), the LANL sealed sources do not contain VOCs. However, packaging materials are a potential source for VOCs. The WAP does not require the assignment of hazardous waste codes for organic constituents associated with packaging materials. As such, no hazardous waste codes are assigned to the LANL sealed sources waste stream. Therefore, with respect to the first DQO, because AK assigns no hazardous waste codes and demonstrates that the sealed sources meet the stringent criteria for qualification as U.S. Department of Transportation (DOT) *special form* and comply with the associated leak test requirement, headspace gas sampling and analysis confirmation is not necessary.

The objective of this report is to demonstrate that the second DQO can be fulfilled without headspace gas sampling and analysis of the waste containers comprising the LANL sealed sources waste stream. Because the TRU sealed sources do not contain VOCs, a headspace gas sample collected from a waste container packaged with the sealed sources would only represent the characterization of the packaging materials. The bounding quantification of potential VOCs from materials to be used for packaging the LANL sealed sources is the subject of this report.

PURPOSE

Headspace gas sampling and analysis was performed for the purpose of quantifying VOCs, hydrogen, and methane present in the headspace of waste containers packaging LANL sealed sources. The purpose of this report is as follows:

- To summarize the results obtained from the analysis of headspace gas samples collected from waste containers including only the materials used to package LANL sealed sources

- To present a justification for assigning VOC concentration values for each waste container of LANL sealed sources in lieu of performing headspace gas sampling and analysis

- To determine the VOC concentrations of the target analytes that will be used to satisfy the reporting requirement of the WIPP HWFP (Module II.C.3.i): “Any waste container that does not have VOC concentration values reported for the headspace is not acceptable at WIPP” (Ref. 1).

QUANTIFICATION OF POTENTIAL VOCs FROM PACKAGING MATERIALS

Drum Preparation

In accordance with *OSR Project Drum Test-VOC Evolutions From Packaging Material* (Ref. 3) the LANL OSR Project prepared ten (10) standard pipe overpack containers. As directed by the procedure, each drum was prepared with an identical configuration. These drums contained only the packaging materials that are used in OSR Project drums. No sealed sources were present in any of the drums.

Each empty standard pipe overpack container was initially inspected by performing the following steps:

- Open 55-gallon drum and inspect lid, locking ring, and gasket
- Remove rigid liner lid and fiberboard disk shim. Inspect rigid liner lid to ensure vent hole is open.
- Remove fiberboard packing top and fiberboard flange shims
- Loosen all bolts in pipe component cap and hoist lid vertically off of the pipe component
- Inspect pipe component O-ring for damage
- Verify serial numbers on pipe component lid matches pipe component body.

Each container was prepared for evaluation as follows:

- Place the poly shield insert into the payload cavity of the pipe component.
- The flanged lid of the pipe component was not installed to allow equilibration of VOCs throughout the pipe overpack container.

- Replace cane fiberboard flange shims, matching flange areas with cutouts in fiberboard
- Replace cane fiberboard packing top
- Install spacer(s) on top of cane fiberboard liner top
- Install rigid liner lid, verifying vent hole with a minimum 0.3 in. diameter
- Measure vertical distance between the bottom of the rigid liner lid and the upper surface of the top fiberboard shim. Verify distance is less than or equal to 0.5 in.
- Install drum lid (with filter previously installed) and closure ring, orient bolt closure ends downward and over the drum seam
- Ensure ring is properly seated on drum, thread drum closure bolt through the threaded drum closure ring lug and lightly tighten drum closure bolt. Torque to 40 ft-lb using calibrated torque wrench.
- Tighten lock nut against unthreaded drum closure ring lug
- Apply Tamper Indication Device (TID) to drum.

Table 1 presents the materials included in each standard pipe overpack container.

Table 1 Packaging Materials *

Packaging Components	**Material of Construction**	**Weight (kg)**
Poly Shield Insert	High density polyethylene	29.5
12" Pipe Component, without lid	Stainless Steel, 12-7/8 in. bolts	82.6
Dunnage	Cane Fiberboard	28.6
Rigid Liner and Liner Lid	High density polyethylene	7.7
DOT Type 7A 55 Gallon Drum, including lid and bolt ring	Steel	27.2
Drum gasket	Type I—tubular styrene-butadiene Type II—foam styrene-butadiene	
Drum Filter (NucFil-013)	Carbon composite 3.70E-6 mol/s/mol fraction	

*The packaging components used in this evaluation are compliant with the transportation specifications of the TRUPACT-II Authorized Methods for Payload Control (TRAMPAC), Revision 19a.

As required by *OSR Project Drum Test-VOC Evolutions From Packaging Material,* (Ref. 3) a LANL Record of Drum Closure was completed for each drum. Table 2 summarizes the information recorded on the LANL Record of Drum Closure Forms.

Table 2 Drum Information

Drum Serial #	**Drum Vent Type**	**Drum Vent Serial #**	**TID #**	**Date Closed**
DB4342	NucFil-013	RFP-6798	0000019	11/21/01
DB4340	NucFil-013	RFP-6782	0000063	11/21/01
DB4339	NucFil-013	RFP-6781	0000043	11/21/01
DB3724	NucFil-013	RFP-6779	0000037	11/21/01
DB4345	NucFil-013	RFP-6796	0000001	11/21/01
DB3725	NucFil-013	RFP-6784	0000024	11/21/01
DB3726	NucFil-013	RFP-6800	0000066	11/21/01
DB3723	NucFil-013	RFP-6795	0000071	11/21/01
DB3721	NucFil-013	RFP-6777	0000039	11/21/01
DB3720	NucFil-013	RFP-6778	0000202	11/21/01

The packaged drums were placed in a secure storage location at LANL.

Headspace Gas Sampling and Analysis

The drums were removed and transported to the LANL Headspace Gas sampling area. Sampling was conducted on September 9, 2002, in accordance with *Manual Headspace Gas Sampling for Analysis by INEEL* (TWCP-DTP-1.2-074*)* (Ref. 4). A 250-milliliter sample was collected in a SUMMA® canister from each drum and transported to the Idaho National Engineering and Environmental Laboratory (INEEL) for analysis for VOCs, hydrogen and methane with chain-of-custody (COC) forms. None of the samples were composited before analysis.

In accordance with *Manual Headspace Gas Sampling for Analysis by INEEL* (TWCP-DTP-1.2-074) (Ref. 4) a field blank, field duplicate, and field reference standard were collected during sampling and were included in the sampling batch sent to INEEL for analysis. The analysis was conducted in accordance with *Analysis of Gas Samples for VOCs by GC/MS* (ACMM-9930) (Ref. 5) and *Analysis of Gas Samples for VOCs by GC/FID* (ACMM-9910) (Ref. 6). The analytical batch data report (BDR) LA02-HGAS/IA-006 was subject to INEEL data generation verification and validation in accordance with *RWMC Data Generation Level Data Validation* (MCP-1850) (Ref. 7). The sampling BDR LA02-HGAS/IS-006 and the analytical BDR were validated and verified by LANL in accordance with *Project Level Data Validation and Verification* (TWCP-QP-1.1-010) (Ref. 8). The sampling and analytical quality control samples met acceptance criteria and the headspace gas sampling and analysis quality assurance objectives specified by the WAP were met.

Analytical Results

The analytical results for the headspace gas samples collected from the 10 standard pipe overpack containers are tabulated in Table 3. The program required quantitation limit (PRQL) for the alcohols and ketones is 100 parts per million by volume (ppmv) and 10 ppmv for the remaining VOCs. With the exception of three out of 32 analytes measured, the concentrations are reported at the method detection limit (MDL). For acetone, cyclohexane, and toluene, the results are just slightly above detectable. The analytical results identified no tentatively identified compounds (TICs) as determined in accordance with *Analysis of Gas Samples for VOCs by GC/MS* (ACMM-9930) (Ref. 5). As shown in Table 3, the results are clearly orders of magnitude below the PRQL for the regulated VOCs. The concentrations of regulated and flammable VOCs and hydrogen and methane are very small and, in most cases, not detectable. Therefore, VOC contributions from packaging materials are insignificant for the sealed sources waste stream.

Table 3 Analyte Concentrations Resulting from Packaging Materials

DRUM		DB4345	DB4340	DB3721	DB4339	DB3726	DB3723	DB3724	DB3725	DB3720	DB4342
Lab sample ID (INEEL)		02262002	02262005	02262006	02262007	02262008	02262009	02262010	02262011	02262012	02262013
Acetone	ppmv	1.1 J	1.5 J	1.7 J	1.2 J	1.2 J	1.5 J	1.7 J	0.80 J	1.6 J	0.86 J
Benzene	ppmv	0.055 U	0.056 U	0.055 U	0.054 U	0.056 U	0.054 U	0.056 U	0.057 U	0.055 U	0.058 U
Bromoform	ppmv	0.018 U	0.018 U	0.018 U	0.017 U	0.018 U	0.017 U	0.018 U	0.018 U	0.018 U	0.019 U
Butanol	ppmv	0.059 U	0.060 U	0.060 U	0.058 U	0.060 U	0.058 U	0.060 U	0.062 U	0.060 U	0.062 U
Carbon tetrachloride	ppmv	0.033 U	0.034 U	0.034 U	0.033 U	0.034 U	0.033 U	0.034 U	0.035 U	0.034 U	0.035 U
Chlorobenzene	ppmv	0.031 U	0.032 U	0.032 U	0.031 U	0.032 U	0.031 U	0.032 U	0.033 U	0.032 U	0.033 U
Chloroform	ppmv	0.030 U	0.031 U	0.031 U	0.030 U	0.031 U	0.030 U	0.031 U	0.032 U	0.031 U	0.032 U
Cyclohexane	ppmv	1.9 J	2.1 J	2.6 J	2.2 J	1.8 J	2.4 J	2.2 J	1.7 J	1.9 J	1.0 J
1,1-Dichloroethane	ppmv	0.047 U	0.048 U	0.048 U	0.047 U	0.048 U	0.047 U	0.048 U	0.049 U	0.048 U	0.050 U
1,2-Dichloroethane	ppmv	0.052 U	0.053 U	0.052 U	0.051 U	0.053 U	0.051 U	0.052 U	0.054 U	0.052 U	0.054 U
1,1-Dichloroethylene	ppmv	0.074 U	0.075 U	0.075 U	0.073 U	0.076 U	0.073 U	0.075 U	0.077 U	0.075 U	0.078 U
cis-1,2-Dichloroethylene	ppmv	0.038 U	0.039 U	0.039 U	0.038 U	0.039 U	0.038 U	0.039 U	0.040 U	0.039 U	0.040 U
trans-1,2-Dichloroethylene	ppmv	0.052 U	0.053 U	0.052 U	0.051 U	0.053 U	0.051 U	0.053 U	0.054 U	0.052 U	0.055 U
Ethyl benzene	ppmv	0.045 U	0.046 U	0.046 U	0.045 U	0.047 U	0.045 U	0.046 U	0.048 U	0.046 U	0.048 U
Ethyl ether	ppmv	0.079 U	0.080 U	0.080 U	0.078 U	0.081 U	0.078 U	0.080 U	0.083 U	0.080 U	0.083 U
Methyl ethyl ketone	ppmv	0.098 U	0.10 U	0.099 U	0.097 U	0.10 U	0.097 U	0.099 U	0.10 U	0.099 U	0.10 U
Methyl isobutyl ketone	ppmv	0.040 U	0.041 U	0.040 U	0.040 U	0.041 U	0.040 U	0.040 U	0.042 U	0.040 U	0.042 U
Methylene chloride	ppmv	0.082 U	0.084 U	0.083 U	0.081 U	0.084 U	0.081 U	0.083 U	0.086 U	0.083 U	0.087 U
1,1,2,2-Tetrachloroethane	ppmv	0.030 U	0.031 U	0.031 U	0.030 U	0.031 U	0.030 U	0.031 U	0.032 U	0.031 U	0.032 U
Tetrachloroethylene	ppmv	0.028 U	0.029 U	0.028 U	0.028 U	0.029 U	0.028 U	0.028 U	0.029 U	0.028 U	0.030 U
Toluene	ppmv	0.052 J	0.062 J	0.054 J	0.061 J	0.062 J	0.047 J	0.092 J	0.075 J	0.063 J	0.038 J
1,1,1-Trichloroethane	ppmv	0.032U	0.033 U	0.032 U	0.032 U	0.033 U	0.032 U	0.033 U	0.034 U	0.032 U	0.034 U
Trichloroethylene	ppmv	0.028 U	0.029 U	0.029 U	0.028 U	0.029 U	0.028 U	0.029 U	0.030 U	0.029 U	0.030 U
1,1,2-Trichloro-1,2,2-trifluoroethane	ppmv	0.021 U	0.022 U	0.022 U	0.021 U	0.022 U	0.021 U	0.022 U	0.022 U	0.022 U	0.022 U
1,3,5-Trimethylbenzene	ppmv	0.032 U	0.032 U	0.032 U	0.031 U	0.032 U	0.031 U	0.032 U	0.033 U	0.032 U	0.033 U
1,2,4-Trimethylbenzene	ppmv	0.036 U	0.036 U	0.036 U	0.035 U	0.036 U	0.035 U	0.036 U	0.037 U	0.036 U	0.038 U
p/m-Xylene	ppmv	0.045 U	0.046 U	0.046 U	0.045 U	0.047 U	0.045 U	0.046 U	0.048 U	0.046 U	0.048 U
o-Xylene	ppmv	0.033 U	0.034 U	0.034 U	0.033 U	0.034 U	0.033 U	0.034 U	0.035 U	0.034 U	0.035 U
Hydrogen	Vol%	0.011 U	0.012 U	0.012 U	0.011 U	0.012 U	0.011 U	0.012 U	0.012 U	0.012 U	0.012 U
Methane	Vol%	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U
Methanol	ppmv	2.6 U	2.7 U	2.7 U	2.5 U	2.7 U	2.6 U	2.7 U	2.7 U	2.6 U	2.8 U

POTENTIAL VOCs FROM RADIOLYSIS

Sealed radioactive sources, as packaged by the OSR Project, are not capable of significant hydrogen or VOC generation from radiolytic interaction. The AK documentation available demonstrates that sources meet DOT *special form*, and comply with the requirement for a leak test (Ref. 2). In addition, physical inspection during the visual examination assures that no VOC-bearing materials are associated with the TRU sealed source waste. Thus the *sealed* barrier prevents any possible interaction between alpha radiation and the compounds present in the packaging. By definition, no radiolytic gas generation is possible from the alpha and beta energy contained by the sealed sources.

The release of VOCs and hydrogen from the interactions of gamma radiation or neutron particles is zero or nearly zero as shown by the following analysis. Six hydrogen generation test vessels, or canisters, were loaded with a variety of materials, including the high density polyethylene used for packaging sealed sources, and were exposed to a neutron source loaded in each canister in the center of the material. The headspace gas in the canisters was sampled and subjected to gas chromatography measurements. With the exception of some residual hydrogen being released from packaging materials observed during curing, there was no hydrogen detected from radiolysis. The results from the tests are given in Table 4.

Table 4 Empirical Measurement Results of H_2 Released From Irradiated Packaging Materials

Canister #	Material	H_2 Concentration After 114 Days	Effective "G" Value*
1	Concrete and Polybeads	<1.29 ppmv**	<0.012
2	High Density Polyethylene	<1.29 ppmv**	<0.045
3	Borated Polyethylene	<1.29 ppmv**	<0.017
4	Water-Extended Polyethylene	<1.29 ppmv** (H_2 evolution from residual curing = 35 ppmv)	<0.026
5	Poly Cast	<1.29 ppmv** (H_2 evolution from residual curing = 41 ppmv)	<0.024

* The units for the effective "G" value are molecules of H_2 released per 100 electron volts of energy absorbed.
** 1.29 ppm is the lower limit of detection for the gas chromatograph.

As shown in Table 4, the effective G values (gas generation release potential) measured in this test are insignificant for all tested materials. A low G value indicates low gas generation release and is associated with low hydrogen concentration also presented in Table 4. Low hydrogen generation has been correlated to low VOC generation. The G values for VOCs observed in previous studies (Ref. 9) were consistently more than a factor of 200 below those observed for hydrogen generation. Therefore, the generation of VOCs from non-alpha radiolysis is inconsequential for these packaging materials.

CONCLUSIONS

The analytical results listed in Table 3 for the packaging materials alone demonstrate that VOC, hydrogen, and methane concentrations are well below the PRQLs for those compounds. The headspace gas analysis taken from the combination of packaging materials and neutron sources provide confirmation that radiolytic generation of headspace gas from alpha, beta, gamma, and neutron emissions is inconsequential.

Therefore, the WAP DQO for identifying VOCs and quantifying the concentrations of VOC constituents can be fulfilled without headspace gas sampling and analysis of the waste containers comprising the LANL sealed source waste stream.

For the purpose of assigning headspace gas VOC concentration values to the OSR Project sealed source waste stream, UCL_{90} calculations were performed in accordance with *Calculation of UCL_{90} Values* (TWCP-DTP-1.2-006) (Ref. 10) using the results listed in Table 3. The resulting concentrations are presented in Table 5.

Table 5 Proposed LANL Sealed Sources Waste Container Headspace Gas VOC Concentration Values

Compound	**Concentration (ppmv)**
Acetone	1.46
Benzene	0.03
Bromoform	0.01
Butanol	0.03
Carbon Tetrachloride	0.02
Chlorobenzene	0.02
Chloroform	0.02
Cyclohexane	2.17
1,1-Dichloroethane	0.02
1,2-Dichloroethane	0.03
1,1-Dichloroethylene	0.04
cis-1,2-Dichloroethylene	0.02
trans-1,2-Dichloroethylene	0.03
Ethyl Benzene	0.02
Ethyl Ether	0.04
Methanol	1.35
Methyl ethyl ketone	0.05
Methyl isobutyl ketone	0.02
Methylene Chloride	0.04
1,1,2,2-Tetrachloroethane	0.02
Tetrachloroethylene	0.01
Toluene	0.07
1,1,1-Trichloroethane	0.02
Trichloroethylene	0.02
1,1,2-Trichloro-1,2,2-trifluoroethane	0.01
1,3,5-Trimethylbenzene	0.02
1,2,4-Trimethylbenzene	0.02
p/m-Xylene	0.02
o-Xylene	0.02
Hydrogen	0.01 (vol %)
Methane	0.002 (vol %)

REFERENCES

1. Waste Isolation Pilot Plant Hazardous Waste Facility Permit, NM 4890139088-TSDF

2. *Acceptable Knowledge Summary Report for Off-Site Source Recovery Sealed Sources* (OSR-MISC-03)

3. *OSR Project Drum Test-VOC Evolutions From Packaging Material*

4. *Manual Headspace Gas Sampling for Analysis by INEEL* (TWCP-DTP-1.2-074)

5. *Analysis of Gas Samples for VOCs by GC/MS* (ACMM-9930)

6. *Analysis of Gas Samples for VOCs by GC/FID* (ACMM-9910)

7. *RWMC Data Generation Level Data Validation* (MCP-1850)

8. *Project Level Data Validation and Verification* (TWCP-QP-1.1-010)

9. *Calculations by S.T. Kosiewicz*, June 1998

10. *Calculation of* UCL_{90} *Values* (TWCP-DTP-1.2-006)

Item 4

Class 2 Permit Modification Request

Remove Formaldehyde as a Required Analytical Parameter for LANL

Waste Isolation Pilot Plant
Carlsbad, New Mexico

WIPP HWFP #NM4890139088-TSDF

Table of Contents

Acronyms and Abbreviations

AK	Acceptable Knowledge
CFR	Code of Federal Regulations
DOE	U. S. Department of Energy
EPA	Environmental Protection Agency
HWDU	Hazardous Waste Disposal Unit
HWFP	Hazardous Waste Facility Permit
INEEL	Idaho National Engineering and Environmental Laboratory
LANL	Los Alamos National Laboratory
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
PMR	Permit Modification Request
RCRA	Resource Conservation and Recovery Act
TRU	Transuranic
TWBIR	TRU Waste Baseline Inventory Report
TRUCON	TRU Waste Content Code
WIPP	Waste Isolation Pilot Plant

Overview of the Permit Modification Request

This document contains a Class 2 Permit Modification Request (**PMR**) for the Hazardous Waste Facility Permit (**HWFP**) at the Waste Isolation Pilot Plant (**WIPP**), Number NM4890139088-TSDF, hereinafter referred to as the WIPP HWFP.

This PMR is being submitted by the U.S. Department of Energy (**DOE**), Carlsbad Field Office and Washington TRU Solutions LLC, collectively referred to as the Permittees, in accordance with the WIPP HWFP, Condition I.B.1 (20.4.1.900 New Mexico Administrative Code (**NMAC**) incorporating Title 40, Code of Federal Regulations (**CFR**), §270.42(b)). The modification will remove formaldehyde from the HWFP as a required analyte at the Los Alamos National Laboratory (**LANL**) for summary category groups S3000 and S4000 transuranic (**TRU**) waste. These changes do not reduce the ability of the Permittees to provide continued protection to human health and the environment.

The requested modification to the WIPP HWFP and related supporting documents are provided in this PMR. The proposed modification to the text of the WIPP HWFP has been identified using a double underline and a revision bar in the right hand margin for added information, and a ~~strikeout~~ font for deleted information. All direct quotations are indicated by italicized text. The following information specifically addresses how compliance has been achieved with the WIPP HWFP requirement, Permit Condition I.B.1 for submission of this Class 2 PMR. |

1. 20.4.1.900 NMAC (incorporating 40 CFR §270.42(b)(1)(i)), requires the applicant to describe the exact change to be made to the permit conditions and supporting documents referenced by the permit.

The current HWFP requires LANL to perform analysis for formaldehyde on its homogenous solids (S3000) and soil/gravel (S4000) TRU waste streams. The requirement for LANL to perform analysis of samples for formaldehyde was included during the initial permitting process. During the public comment period on the draft HWFP, LANL formally requested that this requirement be removed from the HWFP (Attachment C). This request was made since no LANL homogenous solids nor soils/gravels TRU waste streams contain formaldehyde as a hazardous waste constituent. With this PMR the Permittees request the removal of formaldehyde as a target analyte for those LANL TRU waste streams.

This PMR will provide information described below as justification for the requested change:

- formaldehyde is a listed hazardous waste
- why formaldehyde was initially reported by LANL for inclusion in the permit application
- what documents have been generated to ensure that no formaldehyde is present in the LANL TRU waste being sent to WIPP

Formaldehyde is a Listed Waste

Formaldehyde, as a constituent of a hazardous waste, is not assigned a “D”, “F”, “K” or “P” hazardous waste number. However, under some circumstances formaldehyde can be a listed waste designated as U122. In order to be a “U” listed waste the waste must result from discarded commercial chemical products , manufacturing chemical intermediates, off-specification commercial chemical products and container residues (20.4.1.200 NMAC incorporating 40 CFR §261.33).

The determination as to whether a waste is a "U" listed waste is made through knowledge of the materials or the processes that generated the waste (20.4.1.300 NMAC incorporating 40 CFR §262.11(c)(2)). The United States Environmental Protection Agency (**USEPA**) has provided numerous positions, examples and interpretations as shown below to support this method of waste determination.

Hazardous waste listings are identified by the sources of the wastes rather than by the concentrations of hazardous constituents; therefore, analytical testing alone, without information on the wastes source will not produce information that will conclusively indicate whether a given waste is a listed waste. This has been EPA's longstanding policy as indicated in the 1992 EPA letter.

> "*If the waste in question cannot be traced back to an original process that would generate a waste meeting any listing description, then it is exempt from regulation providing that it does not fail a hazardous waste characteristic test.*" (USEPA Letter from Sylvia Lowrance, Director OSW to Jackie Noles, December 24, 1992)

According to EPA, the mere presence of contaminants in an environmental media does not automatically make the media a hazardous waste. The origin of the contaminants must be known in order for the media to require management as a listed waste.

> "*...the presence of these toxicants in the soil does not automatically make the soil a RCRA hazardous waste. The **origin** of the toxicants must be known in order to determine that they are derived from a listed hazardous waste(s). If the exact origins of the toxicants is not known, then the soils **cannot** be considered RCRA hazardous waste unless they exhibit one or more of the characteristics of hazardous waste*." (emphasis added)(USEPA Memorandum from John Skinner, Director to David Wagoner, January 6, 1984)

This position was further enhanced and reaffirmed in 1998 as indicated in an excerpt from the EPA memorandum shown below.

> "*Where a facility owner/operator makes a good faith effort to determine if a material is a listed hazardous waste but cannot make such a determination because documentation regarding a source of contamination, contaminant, or waste is unavailable or inconclusive, EPA has stated that one may assume the source, contaminant or waste is not listed hazardous waste, and therefore, provided the material in question does not exhibit a characteristic of hazardous waste, RCRA Requirements do not apply*." (USEPA Memorandum from Timothy Fields, Jr. and Steven Herman to RCRA Senior Policy Managers and Regional Counsels, October 14, 1998)

As stated and intended by the USEPA, if a waste generator has Acceptable Knowledge (**AK**) information or through a good faith effort has determined that the generated waste was not derived from a listed hazardous waste (formaldehyde in this particular case) or a process that would generate a listed waste, then such information is sufficient to make the determination that the waste is not a U122 listed waste. Since the LANL AK information is available that shows that no unused or off-specification formaldehyde was disposed at LANL, this is sufficient to determine that no mixed TRU waste at LANL would be listed for formaldehyde as U122. Therefore, no sampling and analysis of S3000 and S4000 mixed TRU wastes for formaldehyde at LANL should be required.

Copies of these EPA letters and memoranda are enclosed with this PMR.

The Addition of Formaldehyde to the HWFP

During the initial permitting process for the WIPP HWFP it was necessary to determine which hazardous waste numbers should be included in the Part A Application (Attachment E). The original WIPP Part A was prepared in 1988 and included information from the generator sites regarding their hazardous waste and hazardous waste constituents. The generator sites did not indicate formaldehyde as a hazardous waste constituent at that time. The original waste analysis plan was prepared to satisfy the requirements of 40 CFR §268.6 (Petitions to allow land disposal of a waste prohibited under Subpact C of Part 268) in 1990 and was used in the No-Migration Variance Petition, Volume II, March, 1990. It indicated that a waste stream having TRU Waste Content Code (**TRUCON**) Code LA 125 and LA 125A may contain formaldehyde as a RCRA regulated constituent. This waste stream consists of Mixed Metal Scrap & Incidental Combustibles and does not correspond to a S3000 or S4000 TRU waste stream. These documents are included in Attachment D. There are no S3000 and S4000 waste streams shown to contain formaldehyde or which have had the formaldehyde waste number applied nor does the formaldehyde hazardous waste number apply to any debris waste stream at LANL as shown on the initial TRU Waste Baseline Inventory Report (**TWBIR**) prepared in 1995 nor in the subsequent revision entitled TRU Waste Inventory Report, Update 2003 (Attachment E).

Los Alamos recognized that the permit requirement to sample LANL S3000 and S4000 waste for formaldehyde was inappropriate and attempted to correct this issue during the public comment period. Dr. Ines Triay commented for LANL during the public comment period that "*Formaldehyde is not present in LANL wastes. It has been removed from Table V.D, so deleting it from Table B-3 would be consistent.*" (Comment X.1-87, NMED's Responses to Written Public Comment Submitted on the Revised Draft Permit, Module II). The New Mexico Environment Department (**NMED**) response was that the Permittees did not comment on the removal of formaldehyde as an analyte for LANL and therefore no changes were made. This comment is included in Attachment C.

LANL Acceptable Knowledge

The LANL currently has the U122 hazardous waste number assigned to their Hazardous Waste Facility Permit but this number does not apply to TRU waste destined for disposal at WIPP. The waste number has never been assigned to any TRU waste container or TRU waste stream at LANL but has been applied to non-TRU hazardous waste. Copies of the original LANL Part A Application from 1994 as well as a list of the non-TRU hazardous waste containers to which the U122 hazardous waste number has been applied are included as Attachment F.

The LANL has completed a comprehensive review to determine if any unused or off-specification formaldehyde was disposed into any wastewater treatment system which generated TRU waste or if any unused or off-specification formaldehyde was spilled and resulted in contaminated homogenous solids or soils/gravels (S3000 or S4000) wastes. From all the documents reviewed which included procedures, personal interviews, and logbooks LANL has determined that no unused or off-specification formaldehyde was ever disposed in a manner which would cause the U122 hazardous waste number to be applied to any TRU waste destined to be disposed at WIPP.

A report entitled "*Investigation Into the Use and Disposal of Formaldehyde at LANL*" is included in Attachment G.

Details of the proposed revisions are summarized in Attachment A.

The proposed changes to the WIPP HWFP text are presented in Attachment B of this PMR.

2. 20.4.1.900 NMAC (incorporating 40 CFR §270.42(b)(1)(ii)), requires the applicant to identify that the modification is a Class 2 modification.

The proposed modification is classified as a Class 2 permit modification because it is considered an *other change* to waste sampling and analysis methods in accordance with 20.4.1.900 NMAC incorporating 40 CFR §270.42 Appendix I, Item B.1.d. Specifically, LANL related footnotes are being removed from the tables in the HWFP that specifiy sampling and analysis methods.

3. 20.4.1.900 NMAC (incorporating 40 CFR §270.42(b)(1)(iii)), requires the applicant to explain why the modification is needed.

Acceptable knowledge research (Included as Attachments D and G of the PMR) shows that no formaldehyde contaminated TRU solids were generated at LANL. The recent inventory completed by LANL indicates that no TRU waste streams at LANL currently carry the hazardous waste number (U122) for formaldehyde (TRU Waste Inventory Report Update, 2003). At the Idaho National Engineering and Environmental Laboratory (**INEEL**), coring of solids is about to begin for the first time on LANL homogenous TRU wastes. The analytical procedure is difficult, costly and time consuming and unnecessary since the available AK, the TWBIR and the revised inventory report indicate that no TRU waste streams carry the formaldehyde waste number (U122).

4. 20.4.1.900 NMAC (incorporating 40 CFR §270.42 (b)(1)(iv)), requires the applicant to provide the applicable information required by 40 CFR §§270.13 through 270.21, 270.62 and 270.63.

The regulatory crosswalk describes those portions of the WIPP HWFP that are affected by this PMR. Where applicable, regulatory citations in this modification reference Title 20, Chapter 4, Part 1, NMAC, revised June 14, 2000, (incorporating 40 CFR Parts 264 and 270). 40 CFR §§270.16 through 270.21, 270.62 and 270.63 are not applicable at WIPP. Consequently, they are not listed in the regulatory crosswalk table. 40 CFR §270.23 is applicable to the WIPP Hazardous Waste Disposal Units (**HWDUs**). This modification does not impact the conditions associated with the HWDUs.

5. 20.4.1.900 NMAC (incorporating 40 CFR §270.11(d)(1) and 40 CFR §270.30(k)), requires any person signing under paragraph a and b must certify the document in accordance with 20.4.1.900 NMAC.

The transmittal letter for this PMR contains the signed certification statement in accordance with Module I.F of the WIPP HWFP.

Regulatory Crosswalk

Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the HWFP	Yes	No
§270.13		Contents of Part A permit application	Attachment O, Part A		T
§270.14(b)(1)		General facility description	Attachment A		T
§270.14(b)(2)	§264.13(a)	Chemical and physical analyses	Attachment B	T	
§270.14(b)(3)	§264.13(b)	Development and implementation of waste analysis plan	Attachment B	T	
	§264.13(c)	Off-site waste analysis requirements	Attachment B	T	
§270.14(b)(4)	§264.14(a-c)	Security procedures and equipment	Attachment C		T
§270.14(b)(5)	§264.15(a-d)	General inspection requirements	Attachment D		T
	§264.174	Container inspections	Attachment D		T
§270.23(a)(2)	§264.602	Miscellaneous units inspections	Attachment D		T
§270.14(b)(6)		Request for waiver from preparedness and prevention requirements of Part 264 Subpart C	NA		
§270.14(b)(7)	264 Subpart D	Contingency plan requirements	Attachment F		T
	§264.51	Contingency plan design and implementation	Attachment F		T
	§264.52 (a) & (c-f)	Contingency plan content	Attachment F		T
	§264.53	Contingency plan copies	Attachment F		T
	§264.54	Contingency plan amendment	Attachment F		T
	§264.55	Emergency coordinator	Attachment F		T
	§264.56	Emergency procedures	Attachment F		T
§270.14(b)(8)		Description of procedures, structures or equipment for:	Attachment E		T
§270.14(b)(8)(i)		Prevention of hazards in unloading operations (e.g., ramps and special forklifts)	Attachment E		T
§270.14(b)(8)(ii)		Runoff or flood prevention (e.g., berms, trenches, and dikes)	Attachment E		T
§270.14(b)(8)(iii)		Prevention of contamination of water supplies	Attachment E		T
§270.14(b)(8)(iv)		Mitigation of effects of equipment failure and power outages	Attachment E		T
§270.14(b)(8)(v)		Prevention of undue exposure of personnel (e.g., personal protective equipment)	Attachment E		T
§270.14(b)(8)(vi) §270.23(a)(2)	§264.601	Prevention of releases to the atmosphere	Module II Module IV Attachment M2 Attachment N		T
	264 Subpart C	Preparedness and prevention	Attachment E		T
	§264.31	Design and operation of facility	Attachment E		T
	§264.32	Required equipment	Attachment E Attachment F		T
	§264.33	Testing and maintenance of equipment	Attachment D		T
	§264.34	Access to communication/alarm	Attachment E		T

Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the HWFP	Yes	No
		system			
	§264.35	Required aisle space	Attachment E		T
	§264.37	Arrangements with local authorities	Attachment F		T
§270.14(b)(9)	§264.17(a-c)	Prevention of accidental ignition or reaction of ignitable, reactive, or incompatible wastes	Attachment E		T
§270.14(b)(10)		Traffic pattern, volume, and controls, for example: Identification of turn lanes Identification of traffic/stacking lanes, if appropriate Description of access road surface Description of access road load-bearing capacity Identification of traffic controls	Attachment G		T
§270.14(b)(11)(i) and (ii)	§264.18(a)	Seismic standard applicability and requirements	Part B, Rev. 6 Chapter B		T
§270.14(b)(11)(iii-v)	§264.18(b)	100-year floodplain standard	Part B, Rev. 6 Chapter B		T
	§264.18(c)	Other location standards	Part B, Rev. 6 Chapter B		T
§270.14(b)(12)	§264.16(a-e)	Personnel training program	Permit Module II Attachment H		T
§270.14(b)(13)	264 Subpart G	Closure and post-closure plans	Attachment I & J		T
§270.14(b)(13)	§264.111	Closure performance standard	Attachment I		T
§270.14(b)(13)	§264.112(a), (b)	Written content of closure plan	Attachment I		T
§270.14(b)(13)	§264.112(c)	Amendment of closure plan	Attachment I		T
§270.14(b)(13)	§264.112(d)	Notification of partial and final closure	Attachment I		T
§270.14(b)(13)	§264.112(e)	Removal of wastes and decontamination/dismantling of equipment	Attachment I		T
§270.14(b)(13)	§264.113	Time allowed for closure	Attachment I		T
§270.14(b)(13)	§264.114	Disposal/decontamination	Attachment I		T
§270.14(b)(13)	§264.115	Certification of closure	Attachment I		T
§270.14(b)(13)	§264.116	Survey plat	Attachment I		T
§270.14(b)(13)	§264.117	Post-closure care and use of property	Attachment J		T
§270.14(b)(13)	§264.118	Post-closure plan; amendment of plan	Attachment J		T
§270.14(b)(13)	§264.178	Closure/containers	Attachment I		T
§270.14(b)(13)	§264.601	Environmental performance standards-Miscellaneous units	Attachment I		T
§270.14(b)(13)	§264.603	Post-closure care	Attachment I		T
§270.14(b)(14)	§264.119	Post-closure notices	Attachment J		T
§270.14(b)(15)	§264.142	Closure cost estimate	NA		T
	§264.143	Financial assurance	NA		T
§270.14(b)(16)	§264.144	Post-closure cost estimate	NA		T
	§264.145	Post-closure care financial assurance	NA		T
§270.14(b)(17)	§264.147	Liability insurance	NA		T

Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the HWFP	Yes	No
§270.14(b)(18)	§264.149-150	Proof of financial coverage	NA		T

Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the HWFP	Yes	No
§270.14(b)(19)(i), (vi), (vii), and (x)		Topographic map requirements Map scale and date Map orientation Legal boundaries Buildings Treatment, storage, and disposal operations Run-on/run-off control systems Fire control facilities	Attachment O Part A Part B, Rev. 6 Chapter B, E		T
§270.14(b)(19)(ii)	§264.18(b)	100-year floodplain	Attachment O Part A Part B, Rev. 6 Chapter B, E		T
§270.14(b)(19)(iii)		Surface waters	Attachment O Part A Part B, Rev. 6 Chapter B, E		T
§270.14(b)(19)(iv)		Surrounding Land use	Attachment O Part A Part B, Rev. 6 Chapter B, E		T
§270.14(b)(19)(v)		Wind rose	Attachment O Part A Part B, Rev. 6 Chapter B, E		T
§270.14(b)(19)(viii)	§264.14(b)	Access controls	Attachment O Part A Part B, Rev. 6 Chapter B, E, F		T
§270.14(b)(19)(ix)		Injection and withdrawal wells	Attachment O Part A Part B, Rev. 6 Chapter B, E, F		T
§270.14(b)(19)(xi)		Drainage on flood control barriers	Part B, Rev. 6 Chapter B, E, F		T
§270.14(b)(19)(xii)		Location of operational units	Part B, Rev. 6 Chapter B		T
§270.14(b)(20)		Other federal laws Wild and Scenic Rivers Act National Historic Preservation Act Endangered Species Act Coastal Zone Management Act Fish and Wildlife Coordination Act Executive Orders	Part B, Rev. 6 Chapter K		T
§270.15	§264 Subpart I	Containers	Attachment M1		T
	§264.171	Condition of containers	Attachment M1		T
	§264.172	Compatibility of waste with containers	Attachment M1		T
	§264.173	Management of containers	Attachment M1		T
	§264.174	Inspections	Attachment D Attachment M1		T
§270.15(a)	§264.175	Containment systems	Attachment M1		T
§270.15(c)	§264.176	Special requirements for ignitable or	Attachment E		T

Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the HWFP	Yes	No
		reactive waste	Permit Module II		
§270.15(d)	§264.177	Special requirements for incompatible wastes	Attachment E Permit Module II		T

Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the HWFP	Yes	No
	§264.178	Closure	Attachment I		T
§270.15(e)	§264.179	Air emission standards	Attachment E Attachment N		T
§270.23	264 Subpart X	Miscellaneous units	Attachment M2		T
§270.23(a)	§264.601	Detailed unit description	Attachment M2		T
§270.23(b)	§264.601	Hydrologic, geologic, and meteorologic assessments	Permit Module IV Attachment M2		T
§270.23(c)	§264.601	Potential exposure pathways	Permit Module IV Attachment M2 Attachment N		T
§270.23(d)		Demonstration of treatment effectiveness	Permit Module IV Attachment M2 Attachment N		T
	§264.602	Monitoring, analysis, inspection, response, reporting, and corrective action	Permit Module IV Attachment M2 Attachment N		T
	§264.603	Post-closure care	Attachment J Attachment J1		T
	264 Subpart E	Manifest system, record keeping, and reporting	Permit Module I Permit Module II Permit Module IV Attachment B		T

Attachment A

Table of Changes

Table of Changes

Affected Permit Section	Explanation for Change
a.1. Table B-1	Revise footnote “b” to remove reference to Los Alamos National Laboratory
a.2. Table B-3	Revise footnote “b” to remove reference to Los Alamos National Laboratory
a.3. Table B3-2	Revise footnote “c” to remove reference to Los Alamos National Laboratory
a.4. Table B3-4	Revise footnote “f” to remove reference to Los Alamos National Laboratory

Attachment B

Proposed Revised Permit Text

Proposed Revised Permit Text:

a.1. Attachment B, Table B-1

TABLE B-1
SUMMARY OF HAZARDOUS WASTE CHARACTERIZATION REQUIREMENTS FOR TRANSURANIC MIXED WASTE [a]

Parameter	Techniques and Procedure
Physical Waste Form Summary Category Names S3000 Homogeneous Solid S4000 Soil/Gravel S5000 Debris Wastes	**Waste Inspection Procedures** Radiography Visual Examination (Permit Attachment B1-3)
Headspace Gases **Volatile Organic Compounds** Benzene Bromoform Carbon tetrachloride Chlorobenzene Chloroform 1,1-Dichloroethane 1,2-Dichloroethane 1,1-Dichloroethylene (cis)-1,2-Dichloroethylene (trans)-1,2-Dichloroethylene Ethyl benzene Ethyl ether Formaldehyde[b] Hydrazine[c] Methylene chloride 1,1,2,2-Tetrachloroethane Tetrachloroethylene Toluene 1,1,1-Trichloroethane Trichloroethylene 1,1,2-Trichloro-1,2,2-trifluoroethane Xylenes Alcohols and Ketones Acetone Butanol Methanol Methyl ethyl ketone Methyl isobutyl ketone	**Gas Analysis** Gas Chromatography /Mass Spectroscopy (GC/MS), EPA TO-14 or modified SW-846 8240/8260 (Permit Attachment B3) GC/Flame Ionization Detector (FID), for alcohols and ketones, SW-846 8015 (Permit Attachment B3) Fourier Transform Infrared Spectroscopy (FTIRS), SW-846

TABLE B-1
SUMMARY OF HAZARDOUS WASTE CHARACTERIZATION REQUIREMENTS FOR TRANSURANIC MIXED WASTE [a]

<table>
<tr><th colspan="2">Parameter</th><th>Techniques and Procedure</th></tr>
<tr><td colspan="2"><u>Total Volatile Organic Compounds</u></td><td rowspan="2"><u>Total Volatile Organic Compound Analysis</u>

TCLP, SW-846 1311
GC/MS, SW-846 8260 or 8240
GC/FID, SW-846 8015
(Permit Attachment B3)

Acceptable Knowledge for Summary Category S5000 (Debris Wastes)</td></tr>
<tr><td>Acetone
Benzene
Bromoform
Butanol
Carbon disulfide
Carbon tetrachloride
Chlorobenzene
Chloroform
1,4-Dichlorobenzene[d]
1,2-Dichlorobenzene[d]
1,2-Dichloroethane
1,1-Dichloroethylene
Ethyl benzene
Ethyl ether
Formaldehyde[b]
Hydrazine[c]</td><td>Isobutanol
Methanol
Methyl ethyl ketone
Methylene chloride
Pyridine[d]
1,1,2,2-Tetrachloroethane
Tetrachloroethylene
Toluene
1,1,2-Trichloro-1,2,2-trifluoroethane
Trichlorofluoromethane
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloroethylene
Vinyl chloride
Xylenes
(trans)-1,2-Dichloroethylene</td></tr>
<tr><td colspan="2"><u>Total Semivolatile Organic Compounds</u>

Cresols
1,4-Dichlorobenzene[e]
1,2-Dichlorobenzene[e]
2,4-Dinitrophenol
2,4-Dinitrotoluene
Hexachlorobenzene
Hexachloroethane
Nitrobenzene
Polychlorinated biphenyls
Pentachlorophenol
Pyridine[e]</td><td><u>Total Semivolatile Organic Compound Analysis</u>

TCLP, SW-846 1311
GC/MS, SW-846 8250 or 8270
GC/ECD for PCBs , SW-846 8082
(Permit Attachment B3)

Acceptable Knowledge for Summary Category S5000 (Debris Wastes)</td></tr>
<tr><td colspan="2"><u>Total Metals</u></td><td rowspan="2"><u>Total Metals Analysis</u>

TCLP, SW-846 1311
ICP- MS, SW-846 6020 ,
ICP Emission Spectroscopy, SW-846 6010
Atomic Absorption Spectroscopy , SW-846 7000
(Permit Attachment B3)

Acceptable Knowledge for Summary Category S5000 (Debris Wastes)</td></tr>
<tr><td>Antimony
Arsenic
Barium
Beryllium
Cadmium
Chromium
Lead</td><td>Mercury
Nickel
Selenium
Silver
Thallium
Vanadium
Zinc</td></tr>
</table>

[a] Permit Attachment B
[b] Required only for homogeneous solids and soil/gravel waste from ~~Los Alamos National Laboratory and~~ Savannah River Site.
[c] Required only for homogeneous solids and soil/gravel waste from Oak Ridge National Laboratory and Savannah River Site.
[d] Can also be analyzed as a semi-volatile organic compound.
[e] Can also be analyzed as a volatile organic compound.

a.2. Attachment B, Table B-3

TABLE B-3
HEADSPACE TARGET ANALYTE LIST AND METHODS

Parameter	EPA Specified Analytical Method
Benzene Bromoform Carbon tetrachloride Chlorobenzene Chloroform 1,1-Dichloroethane 1,2-Dichloroethane 1,1-Dichloroethylene (cis)-1,2-Dichloroethylene (trans)-1,2-Dichloroethylene Ethyl benzene Ethyl ether Formaldehyde[b] Hydrazine[c] Methylene chloride 1,1,2,2-Tetrachloroethane Tetrachloroethylene Toluene 1,1,1-Trichloroethane Trichloroethylene 1,1,2-Trichloro-1,2,2-trifluoroethane Xylenes	EPA: Modified TO-14[a]; Modified 8240/8260 EPA - Approved FTIRS
Acetone Butanol Methanol Methyl ethyl ketone Methyl isobutyl ketone	EPA: Modified TO-14[a]; Modified 8240/8260 Method 8015 EPA - Approved FTIRS

[a] U.S. Environmental Protection Agency (EPA), 1988, "Compendium Method TO-14, the Determination of Volatile Organic Compounds (VOC) in Ambient Air Using SUMMA® Passivated Canister Sampling and Gas Chromatographic Analysis," in Compendium of Methods for the Determination of Toxic Organic Compounds on Ambient Air. Research Triangle Park, North Carolina, Quality Assurance Division, Monitoring System Laboratory, U.S. EPA. The most current revision of the specified methods may be used.
[b] Required only for containers of homogeneous solids and soil/gravel waste from ~~Los Alamos National Laboratory and~~ Savannah River Site.
[c] Required only for containers of homogeneous solids and soil/gravel waste from Oak Ridge National Laboratory and Savannah River Site.

b.1 Attachment B3, Table B3-2

TABLE B3-2
GAS VOLATILE ORGANIC COMPOUNDS TARGET ANALYTE LIST AND QUALITY ASSURANCE OBJECTIVES

Compound	CAS Number	Precision[a] (%RSD or RPD)	Accuracy[a] (%R)	MDL[b,f] (ng)	FTIRS MDL[b] (ppmv)	PRQL (ppmv)	Completeness (%)
Benzene	71-43-2	#25	70-130	10	5	10	90
Bromoform	75-25-2	#25	70-130	10	5	10	90
Carbon tetrachloride	56-23-5	#25	70-130	10	5	10	90
Chlorobenzene	108-90-7	#25	70-130	10	5	10	90
Chloroform	67-66-3	#25	70-130	10	5	10	90
1,1-Dichloroethane	75-34-3	#25	70-130	10	5	10	90
1,2-Dichloroethane	107-06-2	#25	70-130	10	5	10	90
1,1-Dichloroethylene	75-35-4	#25	70-130	10	5	10	90
cis-1,2-Dichloroethylene	156-59-2	#25	70-130	10	5	10	90
trans-1,2-Dichloroethylene	156-60-5	#25	70-130	10	5	10	90
Ethyl benzene [f]	100-41-4	#25	70-130	10	10	10	90
Ethyl ether	60-29-7	#25	70-130	10	5	10	90
Formaldehyde[c]	50-00-0	#25	70-130	10	10	10	90
Hydrazine[d]	302-01-2	#25	70-130	10	10	10	90
Methylene chloride	75-09-2	#25	70-130	10	5	10	90
1,1,2,2-Tetrachloroethane	79-34-5	#25	70-130	10	5	10	90
Tetrachloroethylene	127-18-4	#25	70-130	10	5	10	90
Toluene	108-88-3	#25	70-130	10	5	10	90
1,1,1-Trichloroethane	71-55-6	#25	70-130	10	5	10	90
Trichloroethylene	79-01-6	#25	70-130	10	5	10	90
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	#25	70-130	10	5	10	90
m-Xylene[e]	108-38-3	#25	70-130	10	5	10	90
o-Xylene	95-47-6	#25	70-130	10	5	10	90
p-Xylene[e]	106-42-3	#25	70-130	10	5	10	90
Acetone	67-64-1	#25	70-130	150	50	100	90
Butanol	71-36-3	#25	70-130	150	50	100	90
Methanol	67-56-1	#25	70-130	150	50	100	90
Methyl ethyl ketone	78-93-3	#25	70-130	150	50	100	90
Methyl isobutyl ketone	108-10-1	#25	70-130	150	50	100	90

[a] Criteria apply to PRQL concentrations.
[b] Values based on delivering 10 mL to the analytical system.
[c] Required only for homogenous solids and soil/gravel waste from ~~Los Alamos National Laboratory and~~ Savannah River Site.
[d] Required only for homogenous solids and soil/gravel waste from Oak Ridge National Laboratory and Savannah River Site.
[e] These xylene isomers cannot be resolved by GC/MS.
[f] The ethyl benzene PRQL for FTIRS is 20 ppm

CAS	=	Chemical Abstract Service
%RSD	=	Percent relative standard deviation
RPD	=	Relative percent difference
%R	=	Percent recovery
MDL	=	Method detection limit (maximum permissible value), for GC/MS and GC/FID; total number of nanograms delivered to the analytical system per sample (nanograms); for FTIRS based on 1 m sample cell
PRQL	=	Program required quantitation limit (parts per million/volume basis)

b.2 Attachment B3, Table B3-4

TABLE B3-4
VOLATILE ORGANIC COMPOUNDS TARGET ANALYTE LIST AND QUALITY ASSURANCE OBJECTIVES

Compound	CAS Number	Precision[a] (%RSD or RPD)	Accuracy[a] (%R)	MDL[b] (mg/kg)	PRQL[b] (mg/kg)	Completeness (%)
Benzene	71-43-2	#45	37-151	1	10	90
Bromoform	75-25-2	#47	45-169	1	10	90
Carbon disulfide	75-15-0	#50	60-150	1	10	90
Carbon tetrachloride	56-23-5	#30	70-140	1	10	90
Chlorobenzene	108-90-7	#38	37-160	1	10	90
Chloroform	67-66-3	#44	51-138	1	10	90
1,4-Dichlorobenzene[c]	106-46-7	#60	18-190	1	10	90
ortho-Dichlorobenzene[c]	95-50-1	#60	18-190	1	10	90
1,2-Dichloroethane	107-06-2	#42	49-155	1	10	90
1,1-Dichloroethylene	75-35-4	#250	D-234[d]	1	10	90
trans-1,2-Dichloroethylene	156-60-5	#50	60-150	1	10	90
Ethyl benzene	100-41-4	#43	37-162	1	10	90
Methylene chloride	75-09-2	#50	D-221[d]	1	10	90
1,1,2,2-Tetrachloroethane	79-34-5	#55	46-157	1	10	90
Tetrachloroethylene	127-18-4	#29	64-148	1	10	90
Toluene	108-88-3	#29	47-150	1	10	90
1,1,1-Trichloroethane	71-55-6	#33	52-162	1	10	90
1,1,2-Trichloroethane	79-00-5	#38	52-150	1	10	90
Trichloroethylene	79-01-6	#36	71-157	1	10	90
Trichlorofluoromethane	75-69-4	#110	17-181	1	10	90
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	#50	60-150	1	10	90
Vinyl chloride	75-01-4	#200	D-251[d]	1	4	90
m-xylene	108-38-3	#50	60-150	1	10	90
o-xylene	95-47-6	#50	60-150	1	10	90
p-xylene	106-42-3	#50	60-150	1	10	90
Acetone	67-64-1	#50	60-150	10[e]	100	90
Butanol	71-36-3	#50	60-150	10[e]	100	90
Ethyl ether	60-29-7	#50	60-150	10[e]	100	90
Formaldehyde[f]	50-00-0	#50	60-150	10[e]	100	90
Hydrazine[g]	302-01-2	#50	60-150	10[e]	100	90
Isobutanol	78-83-1	#50	60-150	10[e]	100	90
Methanol	67-56-1	#50	60-150	10[e]	100	90
Methyl ethyl ketone	78-93-3	#50	60-150	10[e]	100	90
Pyridine[c]	110-86-1	#50	60-150	10[e]	100	90

[a] Applies to laboratory control samples and laboratory matrix spikes. If a solid laboratory control sample material which has established statistical control limits is used, then the established control limits for that material should be used for accuracy requirements.
[b] TCLP MDL and PRQL values are reported in units of mg/l and limits are reduced by a factor of 20.
[c] Can also be analyzed as a semi-volatile organic compound. If analyzed as a semi-volatile compound, the QAOs of Table B3-6 apply.
[d] Detected; result must be greater than zero.
[e] Estimate, to be determined.
[f] Required only for homogenous solids and soil/gravel waste from ~~Los Alamos National Laboratory and~~ Savannah River Site.
[g] Required only for homogenous solids and soil/gravel waste from Oak Ridge National Laboratory and Savannah River Site.

CAS	=	Chemical Abstract Service
%RSD	=	Percent relative standard deviation
RPD	=	Relative percent difference
%R	=	Percent recovery
MDL	=	Method detection limit (maximum permissible value) (milligrams per kilogram)
PRQL	=	Program required quantitation limit; calculated from the toxicity characteristic level for benzene assuming a 0.9 oz (25-gram [g]) sample, 0.1 gal (0.5 liter [L]) of extraction fluid, and 100 percent analyte extraction (milligrams per kilogram)

Attachment C

Comment Received During Public Comment on Permit Application

DRAFT

NMED's Response to Written Public Comment Submitted on Revised Draft Permit
MODULE II

Commentor Key: E.1-DOE/CAO G.1-NFT/Brassell H.1-EPA&Neleigh N.1-NMAG/Fettus S/DD.1-SWRIC/CCNS W.1-INEEL/Fritz X.1-LANL-Trisy AA.1-EEG/Neill BB.1-CARD/Reed,Phillips EE.1-Rempe FF.1-Lawless GG.1-Kopenen HH.1-Lozano II.1-Rockefeller JJ.1-Bonneau KK.1-Doran

Module No.	Condition No.	Attach. No.	Comm. No. (pg & para)	Comment Subject	Summary of Comment	NMED Response	Include in Permit? y/n
II	C	Attachment B, Table B-3	X.1-67	Analytical methods	Formaldehyde is not present in LANL wastes. It has been deleted from Table V.D, so deleting it from Table B-3 would be consistent.	The requirement to include formaldehyde was originally specified by the Permittees. The Permittees have maintained this requirement and have not commented on the inclusion of formaldehyde. Therefore, NMED concludes that no changes should be made based on this comment.	No
II	C	Attachment B, page B-45, line 5	X.1-101	Analytical methods	Change title of 3rd column to: "Suggested EPA-Specified Analytical Methods"	See the response to comment X.1-36.	No
II	C	Attachment B, page B-46, line 5	X.1-102	Analytical methods	Add to footnote a: "Any [EPA-approved] analytical method is allowed to be used to meet waste analysis requirements provided required Data Quality Objectives are met."	See the response to comment X.1-36.	No
II	C	Attachment B, page B-45, line 11	X.1-103	Analytical methods	Omit requirements for use of methods 3620 and/or 3550. Any sample preparation method that meets required DQOs should be allowed for use.	See the response to comment X.1-36.	No
II	C	Attachment B, section B-1c	BB.1-15	Prohibited wastes	Wastes incompatible with container and packaging materials are prohibited. Waste packaged with plastic bags and liners should be specifically prohibited.	It is assumed that the commentor is referring to the potential reactions of plastics with radionuclides via radiolysis. See response to comment S/DD.1-3.	

Attachment D

LANL Inventory Information

Initial TRU Waste Baseline Inventory Report

TRU WASTE BASELINE INVENTORY WASTE PROFILE

HQ ID:	LA-W047	Handling:	CH	NMVP #:	LA 111A; 211A	Stream Name:	Cemented Process Sludge	Inventory Date:	12/31/94
Local ID:	LA-M002	Type:	MTRU	Generator Site:	LA	Final Waste Form:	Solidified Inorganics	Waste Matrix Code:	S3000

AS-GENERATED EPA CODES

F005, F002, F001, D009, D008, D007

WASTE MATERIAL PARAMETERS (kg/m3)

	Avg	Min	Max
Iron-base Metal/Alloys:	0.0	0.0	0.0
Aluminum-base Metal/Alloys:	0.0	0.0	0.0
Other Metals/Alloys:	0.0	0.0	0.0
Other Inorganic Material:	0.0	0.0	0.0
Vitrified:	0.0	0.0	0.0
Cellulosics:	0.0	0.0	0.0
Rubber:	0.0	0.0	0.0
Plastics:	0.0	0.0	0.0
Solidified Inorganic Material:	603.0	507.0	1014.0
Solidified Organic Material:	0.0	0.0	0.0
Cement (solidified):	693.0	583.0	1166.0
Soils:	0.0	0.0	0.0
Packaging Material Steel:	149.3		
Packaging Material Plastic:	8.5		
Packaging Material Lead:	0.0		
Packaging Material Steel Plug:	0.0		

FINAL WASTE FORM DESCRIPTORS

Category:	Defense TRU Waste
Residues:	No
Asbestos:	No
PCBs:	No
Source:	Facility/Equipment Operation and Maintenance Waste

TRUCON CODE

LA 111A; 211A

FINAL FORM RADIONUCLIDES

Isotope (Ci/m3)	
Y-90	3.10E-03
U-238	2.50E-06
U-235	7.86E-06
U-234	1.16E-06
U-233	6.55E-06
Th	3.57E-08
Sr-90	3.10E-0'
Pu-241	8.94E-04
Pu-239	2.73E-01
Pu-238	4.75E-02
Cs-137	3.10E-03
AM240	2.09E-06
Am-241	4.55E+00

WASTE VOLUME DETAIL (cu. meters)

As-Generated Waste Form Volumes

Container	Stored	Pre-97	98-02	03-12	13-22	Totals
Drum / 55-gallon	181.0	59.3	98.8	197.6	197.6	734.2
Drum ' 85-gallon	ı.7	0.0	0.0	0.0	0.0	
Metal Pipe	2870.6	0.0		0.0	0.0	2870.6
otals	3053.3	59.3	98.8	197	197.6	3606.5

Final Waste Form Volumes

Container	Stored	Pre-97	98-02	03-12	13-22	Totals
55 Gallon Drum	182.6	59.3	98.8	197.6	197.6	735.9
Standard Waste Box	2870.9	0.0	0.0	0.0	0.0	2870.9
Totals	3053.5	59.3	98.8	197.6	197	3606.8

-Generated Form:	Stored: 3053.3	Projected: 553.3	otal: 3606.5		
Final Waste Form:	Stored: 3053.5	Projected: 553.3	Total: 3606.8		

TRU WASTE BASELINE INVENTORY WASTE PROFILE

HQ ID:	LA-W065	Handling:	CH	NMVP #:	LA 111A; 211A	Stream Name:	Cemented Process Sludge	Inventory Date:	12/31/94
Local ID:	LA-T002	Type:	TRU	Generator Site:	LA	Final Waste Form:	Solidified Organics	Waste Matrix Code:	S3000

AS-GENERATED EPA CODES

N/A

WASTE MATERIAL PARAMETERS (kg/m3)

	Avg	Min	Max
Iron-base Metal/Alloys:	0.0	0.0	0.0
Aluminum-base Metal/Alloys:	0.0	0.0	0.0
Other Metals/Alloys:	0.0	0.0	0.0
Other Inorganic Material:	0.0	0.0	0.0
Vitrified:	0.0	0.0	0.0
Cellulosics:	0.0	0.0	0.0
Rubber:	0.0	0.0	0.0
Plastics:	0.0	0.0	0.0
Solidified Inorganic Material:	603.0	507.0	1014.0
Solidified Organic Material:	0.0	0.0	0.0
Cement (solidified):	693.0	583.0	1166.0
Soils:	0.0	0.0	0.0
Packaging Material Steel:	131.0		
Packaging Material Plastic:	37.0		
Packaging Material Lead:	0.0		
Packaging Material Steel Plug:	0.0		

FINAL WASTE FORM DESCRIPTORS

Category: Defense TRU Waste

Residues: No

Asbestos: No

PCBs: No

Source: Materials Production/Recovery Effluents

TRUCON CODE

LA 111A
LA 211A

FINAL FORM RADIONUCLIDES

Isotope (Ci/m3)	
U-235	2.17E-06
Pu-239	1.78E+00
Pu-238	9.13E-02
Am-241	2.62E+00

WASTE VOLUME DETAIL (cu. meters)

As-Generated Waste Form Volumes

Container	Stored	Pre-97	98-02	03-12	13-22	Totals
Drum / 55 gallon drum	1.5	3.1	5.2	10.4	10.4	30.6
Totals	1.5	3.1	5.2	10.4	10.4	30.6

Final Waste Form Volumes

Container	Stored	Pre-97	98-02	03-12	13-22	Totals
55 Gallon Drum	1.5	3.1	5.2	10.4	10.4	30.6
Totals	1.5	3.1	5.2	10.4	10.4	30.6

As-Generated Form: Stored: 1.5 Projected: 29.1 Total: 30.6

Final Waste Form: Stored: 1.5 Projected: 29.1 Total: 30.6

TRU WASTE BASELINE INVENTORY WASTE PROFILE

HQ ID:	LA-W058	Handling:	CH	NMVP #:	LA 114A; LA 126	Stream Name:	Solidified inorganic process solids	Inventory Date:	12/31/94
Local ID:	LA-T006.	Type:	TRU	Generator Site:	LA	Final Waste Form:	Solidified Inorganics	Waste Matrix Code:	S3000

AS-GENERATED EPA CODES

N/A

WASTE MATERIAL PARAMETERS (kg/m3)

	Avg	Min	Max
Iron-base Metal/Alloys:	0.0	0.0	0.0
Aluminum-base Metal/Alloys:	0.0	0.0	0.0
Other Metals/Alloys:			0.0
Other Inorganic Material:			48.1
Vitrified:			
Cellulosics:			0.0
Rubber:			
Plastics:	0.0	0.0	0.0
Solidified Inorganic Material:	447.1	335.3	491.8
Solidified Organic Material:	0.0	0.0	0.0
Cement (solidified):	514.4	385.7	565.9
Soils:	0.0	0.0	0.0
Packaging Material Steel:	131.0		
Packaging Material Plastic:	37.0		
Packaging Material Lead:	0.0		
Packaging Material Steel Plug:	0.0		

FINAL WASTE FORM DESCRIPTORS

Category: Defense TRU Waste

Residues: No

Asbestos: No

PCBs: No

Source: Facility/Equipment Operation and Maintenance Waste

TRUCON CODE

LA 114A

FINAL FORM RADIONUCLIDES

Isotope (Ci/m3)	
U-238	1.33E-05
U-236	6.18E-08
U-235	4.53E-07
U-234	1.45E-05
U-233	1.90E-04
Pu-244	2.19E-10
Pu-242	2.69E-.
Pu-241	6.43E+00
Pu-240	3.10E-01
Pu-239	1.26E+00
Pu-238	1.20E+02
Np-237	1.41E-06
Am-241	8.63E-01

WASTE VOLUME DETAIL (cu. meters)

As-Generated Waste Form Volumes

Container	Stored	Pre-97	98-02	03-12	13-22	Totals
Cardboard Box	0.2	0.0	0.0	0.0	0.0	0.2
Drum / 30-gallon	0.3	0.0	0.0	0.0	0.0	0.3
Drum / 55-gallon	4.2	8.7	14.6	29.1	29.1	85.7
Totals	4.7	8.7	14.6	29.1	29.1	86.3

Final Waste Form Volumes

Container	Stored	Pre-97	98-02	03-12	13-22	Totals
55 Gallon Drum	5.0	8.7	14.6	29.1	29.1	86.5
Totals	5.0	8.7	14.6	29.1	29.1	86.5

As-Generated Form: Stored: 4.7 Projected: 81.5 Total: 86.3

Final Waste Form: Stored: 5.0 Projected: 81.5 Total: 86.5

TRU WASTE BASELINE INVENTORY WASTE PROFILE

HQ ID:	LA-W051	Handling:	CH	NMVP #:	LA 114A; LA 126	Stream Name:	Solidified inorganic process solids
Inventory Date:	12/31/94						
Local ID:	LA-M006	Type:	MTRU	Generator Site:	LA	Final Waste Form:	Solidified Inorganics
Waste Matrix Code:	S3000						

AS-GENERATED EPA CODES

F003, F002, F001, D039, D021, D019, D008, D007, D006

WASTE MATERIAL PARAMETERS (kg/m3)

	Avg	Min	Max
Iron-base Metal/Alloys:	0.0	0.0	0.0
Aluminum-base Metal/Alloys:	0.0	0.0	0.0
Other Metals/Alloys:	0.0	0.0	0.0
Other Inorganic Material:	43.3	38.5	48.1
Vitrified:	0.0	0.0	0.0
Cellulosics:	0.0	0.0	0.0
Rubber:	0.0	0.0	0.0
Plastics:	0.0	0.0	0.0
Solidified Inorganic Material:	453.4	340.0	498.7
Solidified Organic Material:	0.0	0.0	0.0
Cement (solidified):	506.1	381.0	559.0
Soils:	0.0	0.0	0.0
Packaging Material Steel:	131.3		
Packaging Material Plastic:	36.6		
Packaging Material Lead:	0.0		
Packaging Material Steel Plug:	0.0		

FINAL WASTE FORM DESCRIPTORS

Category:	Defense TRU Waste
Residues:	No
Asbestos:	No
PCBs:	No
Source:	Facility/Equipment Operation and Maintenance Waste

TRUCON CODE

LA 114A

FINAL FORM RADIONUCLIDES

Isotope (Ci/m3)	
Pu-241	2.87E+01
Am-243	2.67E+01
Bk-249	2.72E-06
Cf-249	1.77E-07
Cm-246	2.46E-05
Pu-238	5.17E+00
Am-241	2.94E+(
Pu-240	1.69E+00
U-238	3.47E-04
Pu-242	3.14E-03
Pu-244	2.85E-09
Th	4.16E-06
U-233	1.71E-04
U-234	1.53E-04
U-235	1.19E-05
U-236	6.99E-08
Pu-239	6.92E+00

WASTE VOLUME DETAIL (cu. meters)

As-Generated Waste Form Volumes

Container	Stored	Pre-97	98-02	03-12	13-22	Totals
Drum / 30-gallon	27.8	0.0	0.0	0.0	0.0	27.8
Drum / 55-gallon	435.6	89.9	149.8	299.5	300.8	1275.5
Drum / 85-gallon	48.5	0.0	0.0	0.0	0.0	48.5
Other	15.8	0.0	0.0	0.0	0.0	15.8
Totals	527.7	89.9	149.8	299.5	300.8	1367.6

Final Waste Form Volumes

Container	Stored	Pre-97	98-02	03-12	13-22	Totals
55 Gallon Drum	535.2	89.9	149.8	299.5	300.8	1375.1
Standard Waste Box	17.0	0.0	0.0	0.0	0.0	17.0
Totals	552.2	89.9	149.8	299.5	300.8	1392.1

	Stored:		Projected:		Total:	
As-Generated Form:	Stored:	527.7	Projected:	839.9	Total:	1367.6
Final Waste Form:	Stored:	552.2	Projected:	839.9	Total:	1392.1

TRU WASTE BASELINE INVENTORY WASTE PROFILE

HQ ID: LA-W048	Handling: CH	NMVP #: LA 111B; 211B	Stream Name: Solidified aqueous waste			Inventory Date: 12/31/94	
Local ID: LA-M003	Type: MTRU	Generator Site: LA	Final Waste Form: Solidified Inorganics			Waste Matrix Code: S3121	

AS-GENERATED EPA CODES

F001

WASTE MATERIAL PARAMETERS (kg/m3)

	Avg	Min	Max
Iron-base Metal/Alloys:	0.0	0.0	0.0
Aluminum-base Metal/Alloys:	0.0	0.0	0.0
Other Metals/Alloys:	0.0	0.0	0.0
Other Inorganic Material:	43.3	38.5	48.1
Vitrified:	0.0	0.0	0.0
Cellulosics:	0.0	0.0	0.0
Rubber:	0.0	0.0	0.0
Plastics:	0.0	0.0	0.0
Solidified Inorganic Material:	650.1	546.6	1093.2
Solidified Organic Material:	0.0	0.0	0.0
Cement (solidified):	645.9	543.4	1086.8
Soils:	0.0	0.0	0.0
Packaging Material Steel:	132.6		
Packaging Material Plastic:	34.6		
Packaging Material Lead:	0.0		
Packaging Material Steel Plug:	0.0		

FINAL WASTE FORM DESCRIPTORS

Category: Defense TRU Waste

Residues: No

Asbestos: No

PCBs: No

Source: Facility/Equipment Operation and Maintenance Waste

TRUCON CODE

LA 111B; 211B

FINAL FORM RADIONUCLIDES

Isotope (Ci/m3)	
Y-90	2.49E-05
U-235	8.53E-08
Sr-90	2.49E-05
Pu-241	4.06E-05
Pu-239	3.36E-01
Pu-238	1.04E-01
Cs-137	2.49E-
Am-241	3.33E-01

WASTE VOLUME DETAIL (cu. meters)

As-Generated Waste Form Volumes

Container	Stored	Pre-97	98-02	03-12	13-22	Totals
Drum / 55 gallon drum	1151.9	59.9	99.8	199.7	199.7	1711.0
Drum / 85-gallon	0.8	0.0	0.0	0.0	0.0	0.8
Other	124.7	0.0	0.0	0.0	0.0	124.7
Totals	1277.4	59.9	99.8	199.7	199.7	1836.5

Final Waste Form Volumes

Container	Stored	Pre-97	98-02	03-12	13-22	Totals
55 Gallon Drum	1152.7	59.9	99.8	199.7	199.7	1711.8
Standard Waste Box	124.7	0.0	0.0	0.0	0.0	124.7
Totals	1277.5	59.9	99.8	199.7	199.7	1836.6

As-Generated Form: Stored: 1277.4 Projected: 559.1 Total: 1836.5

Final Waste Form: Stored: 1277.5 Projected: 559.1 Total: 1836.6

TWBIR ID: LA-T008

TRU WASTE BASELINE INVENTORY WASTE PROFILE

HQ ID:	LA-W060	Handling:	CH	NMVP #:	unknown	Stream Name:	Soils	Inventory Date:	12/31/94
Local ID:	LA-T008	Type:	TRU	Generator Site:	LA	Final Waste Form:	Soils	Waste Matrix Code:	S3000

AS-GENERATED EPA CODES

N/A

WASTE MATERIAL PARAMETERS (kg/m3)

	Avg	Min	Max
Iron-base Metal/Alloys:	0.0	0.0	0.0
Aluminum-base Metal/Alloys:	0.0	0.0	0.0
Other Metals/Alloys:	0.0	0.0	0.0
Other Inorganic Material:	0.0	0.0	0.0
Vitrified:	0.0	0.0	0.0
Cellulosics:	0.0	0.0	0.0
Rubber:	0.0	0.0	0.0
Plastics:	0.0	0.0	0.0
Solidified Inorganic Material:	0.0	0.0	0.0
Solidified Organic Material:	0.0	0.0	0.0
Cement (solidified):	0.0	0.0	0.0
Soils:	1200.0	1000.0	1600.0
Packaging Material Steel:	147.5		
Packaging Material Plastic:	11.3		
Packaging Material Lead:	0.0		
Packaging Material Steel Plug:	0.0		

FINAL WASTE FORM DESCRIPTORS

Category: Defense TRU Waste

Residues: No

Asbestos: No

PCBs: No

Source: Facility/Equipment Operation and Maintenance Waste

TRUCON CODE

Unassigned

FINAL FORM RADIONUCLIDES

Isotope (Ci/m3)	
Pu-242	2.67E-07
Pu-241	2.29E-02
Pu-240	3.73E-04
Pu-239	2.49E-01
Pu-238	1.90E+00
Am-241	5.43E-05

WASTE VOLUME DETAIL (cu. meters)

As-Generated Waste Form Volumes

Container	Stored	Pre-97	98-02	03-12	13-22	Totals
Drum / 55-gallon	10.4	3.1	5.2	10.4	10.4	39.5
fiberglass Reinfocre Plywood	98.8	0.0	0.0	0.0	0.0	98.8
Totals	109.2	3.1	5.2	10.4	10.4	138.3

Final Waste Form Volumes

Container	Stored	Pre-97	98-02	03-12	13-22	Totals
55 Gallon Drum	10.4	3.1	5.2	10.4	10.4	39.5
Standard Waste Box	100.2	0.0	0.0	0.0	0.0	100.2
Totals	110.6	3.1	5.2	10.4	10.4	139.7

As-Generated Form: Stored: 109.2 Projected: 29.1 Total: 138.3

Final Waste Form: Stored: 110.6 Projected: 29.1 Total: 139.7

TRU Waste Inventory Report. Update 2003

LANL Waste Streams with S3000 & S4000 Matrix Codes Scheduled to Come to WIPP

WIPP_ID	Handling	MWIR_matrix_code	TRUCON_Code	Volumes in m3 FFStoredVol	FFProjectedVol	FFTotalVol	EPACodes
LA-TA-03	CH	S3		5.84E+	0.00E+	5.84E+0	
LA-TA-03-30	CH	S3200		7.37E-01	0.00E+00	7.37E-01	
LA-TA-03-31	CH	S3100		2.06E-01	0.00E+00	2.06E-01	
LA-TA-21-13	CH	S3100		1.62E+01	0.00E+00	1.62E+01	
LA-TA-21-14	CH	S4100		7.90E+00	0.00E+00	7.90E+00	
LA-TA-21-15	CH	S3200		3.44E+00	0.00E+00	3.44E+00	
LA-TA-21-16	CH	S3100		5.24E+01	0.00E+00	5.24E+01	
LA-TA-21-41	CH	S4100		2.73E+01	0.00E+00	2.73E+01	
LA-TA-21-43	CH	S3100		2.53E+03	0.00E+00	2.53E+03	
LA-TA-21-44	CH	S4100		9.65E+01	0.00E+00	9.65E+01	
LA-TA-50-10	CH	S3100		1.04E+00	0.00E+00	1.04E+00	
LA-TA-50-17	CH	S3100		7.16E+01	6.86E+01	1.40E+02	
LA-TA-50-18	CH	S3100		9.84E+01	0.00E+00	9.84E+01	
LA-TA-50-19	CH	S3120		1.18E+03	0.00E+00	1.18E+03	
LA-TA-50-20	CH	S4100		6.24E-01	0.00E+00	6.24E-01	
LA-TA-55-32	CH	S3100		4.78E+00	0.00E+00	4.78E+00	D007, D008, D009, D011, D022, D035, D040, F001, F002, F005
LA-TA-55-33	CH	S3200		6.66E+00	0.00E+00	6.66E+00	D004, D005, D006, D007, D008, D009, D010, D011, D019, D039, F002
LA-TA-55-34	CH	S3100		5.10E+01	1.03E+02	1.54E+02	D006, D007, D008, D009
LA-TA-55-38	CH	S3100		4.85E+02	1.72E+02	6.57E+02	D004, D005, D006, D007, D008, D009, D011, D019, D021, D022, D035, D039, D040, F001, F002, F003, F005
LA-TA-55-39	CH	S3100		2.91E+00	0.00E+00	2.91E+00	
LA-TA-55-41	CH	S3200		1.48E+01	1.37E+01	2.85E+01	D004, D005, D006, D007, D008, D009, D011, D018, D019, D021, D022, D035, D038, D039, D040, F002, F003, F005
LA-TA-55-48	CH	S3200		2.08E+00	1.37E+01	1.58E+01	D005, D006, D007, D008, D009, D011
LA-TA-55-49	CH	S3100		1.71E+01	0.00E+00	1.71E+01	D005, D006, D007, D008, D009, D011
LA-TA-55-53	CH	S3100		7.16E+01	6.86E+01	1.40E+02	D005, D006, D007, D008, D009, D011, D019, D021, D022, D039, F002, F003

Data extracted from Transuranic Waste Baseline Inventory Database, Revision 2.1, v.3.10 by Gregory D. Van Soest on April 4, 2003

Criteria used:
site_code = "LA"
AppendixO=false
MWIR_matrix_code like "S4" or "S3*"*

Attachment E

No-Migration Variance Petition

1988 WIPP Part A Permit Application

WESTINGHOUSE CERTIFICATION

1. To be signed by preparer of application:

   I certify that I have personally examined and am familiar with the information submitted in this and all attached documents. I believe that the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

   ROBERT KEHEMAN   [signature]   7/1/88
   NAME (TYPE OR PRINT)   SIGNATURE   DATE SIGNED

2. To be signed by Plant or General Manager:

   I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals responsible for obtaining the information, I believe that the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

   M

   W C MOFFITT   [signature]   7/5/88
   NAME (TYPE OR PRINT)   DATE SIGNED

3. For comments and recommended approval of Corporate Environmental Control:

   S. A. GREEN   [signature]   6/29/88
   NAME (TYPE OR PRINT)   SIGNATURE   DATE SIGNED

4. For comments and recommended approval of Westinghouse Law Department:

   C.J. FLYNN   [signature]   6/29/88
   NAME (TYPE OR PRINT)   SIGNATURE   DATE SIGNED

DOE-WIPP 88-019

Waste Isolation Pilot Plant RCRA Part A Permit Application

U.S. Department of Energy

United States
Environmental Protection
Agency

Office of
Enforcement
Washington, DC 20460

EPA Form 3510-1
June 1980

Permits Division

EPA

Application Form 1 - General Information

Consolidated Permits Program

M

This form must be completed by all persons applying for a permit under EPA's Consolidated Permits Program. See the general instructions to Form 1 to determine which other application forms you will need.

(fill—in areas are spaced for elite type, i.e., 12 characters/inch). Form Approved OMB No. 158-R0175

FORM 1 GENERAL

EPA

U.S. ENVIRONMENTAL PROTECTION AGENCY

GENERAL INFORMATION

Consolidated Permits Program

(Read the "General Instructions" before starting.)

I. EPA I.D. NUMBER

F NMD982285488

LABEL ITEMS

I. EPA I.D. NUMBER

III. FACILITY NAME

V. FACILITY MAILING ADDRESS

VI. FACILITY LOCATION

PLEASE PLACE LABEL IN THIS SPACE

M

GENERAL INSTRUCTIONS

If a preprinted label has been provided, affix it in the designated space. Review the information carefully; if any of it is incorrect, cross through it and enter the correct data in the appropriate fill—in area below. Also, if any of the preprinted data is absent *(the area to the left of the label space lists the information that should appear)*, please provide it in the proper fill—in area(s) below. If the label is complete and correct, you need not complete Items I, III, V, and VI *(except VI-B which must be completed regardless)*. Complete all items if no label has been provided. Refer to the instructions for detailed item descriptions and for the legal authorizations under which this data is collected.

II. POLLUTANT CHARACTERISTICS

INSTRUCTIONS: Complete A through J to determine whether you need to submit any permit application forms to the EPA. If you answer "yes" to any questions, you must submit this form and the supplemental form listed in the parenthesis following the question. Mark "X" in the box in the third column if the supplemental form is attached. If you answer "no" to each question, you need not submit any of these forms. You may answer "no" if your activity is excluded from permit requirements; see Section C of the instructions. See also, Section D of the instructions for definitions of bold—faced terms.

SPECIFIC QUESTIONS	YES	NO	FORM ATTACHED	SPECIFIC QUESTIONS	YES	NO	FORM ATTACHED
A. Is this facility a publicly owned treatment works which results in a discharge to waters of the U.S.? (FORM 2A)		X		B. Does or will this facility *(either existing or proposed)* include a concentrated animal feeding operation or aquatic animal production facility which results in a discharge to waters of the U.S.? (FORM 2B)		X	
C. Is this a facility which currently results in discharges to waters of the U.S. other than those described in A or B above? (FORM 2C)		X		D. Is this a proposed facility *(other than those described in A or B above)* which will result in a discharge to waters of the U.S.? (FORM 2D)		X	
E. Does or will this facility treat, store, or dispose of hazardous wastes? (FORM 3)	X		X	F. Do you or will you inject at this facility industrial or municipal effluent below the lowermost stratum containing, within one quarter mile of the well bore, underground sources of drinking water? (FORM 4)		X	
G. Do you or will you inject at this facility any produced water or other fluids which are brought to the surface in connection with conventional oil or natural gas production, inject fluids used for enhanced recovery of oil or natural gas, or inject fluids for storage of liquid hydrocarbons? (FORM 4)		X		H. Do you or will you inject at this facility fluids for special processes such as mining of sulfur by the Frasch process, solution mining of minerals, in situ combustion of fossil fuel, or recovery of geothermal energy? (FORM 4)		X	
I. Is this facility a proposed stationary source which is one of the 28 industrial categories listed in the instructions and which will potentially emit 100 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)		X		J. Is this facility a proposed stationary source which is NOT one of the 28 industrial categories listed in the instructions and which will potentially emit 250 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)		X	

III. NAME OF FACILITY

1 SKIP WASTE ISOLATION PILOT PLANT

IV. FACILITY CONTACT

A. NAME & TITLE (last, first, & title)	B. PHONE (area code & no.)
TILLMAN, JACK, MGR.	505 887 8101

V. FACILITY MAILING ADDRESS

A. STREET OR P.O. BOX

PO BOX 3090

B. CITY OR TOWN	C. STATE	D. ZIP CODE
CARLSBAD	NM	88221

VI. FACILITY LOCATION

A. STREET, ROUTE NO. OR OTHER SPECIFIC IDENTIFIER

JAL HWY. 30 MILES EAST

B. COUNTY NAME

EDDY

C. CITY OR TOWN	D. STATE	E. ZIP CODE	F. COUNTY CODE (if known)
CARLSBAD	NM	88220	

EPA Form 3510-1 (6-80)

CONTINUE ON REVERSE

BEST COPY

TINUED FROM THE FRONT

CODES (4-digit, in order of priority)

A. FIRST		B. SECOND	
4953	(specify) REFUSE SYSTEMS	7	(specify)
C. THIRD		D. FOURTH	
	(specify)	7	(specify)

OPERATOR INFORMATION

A. NAME

ESTINGHOUSE ELECTR C CORP FOR US DOE

B. Is the name listed in Item VIII-A also the owner? ☐ YES ☒ NO

(Enter the appropriate letter into the answer box; if "Other", specify.) P/F (specify)

D. PHONE (area code & no.) A 505 887 8200

E. STREET OR P.O. BOX: BOX 2078

F. CITY OR TOWN: ARLSBAD

G. STATE: NM

H. ZIP CODE: 88221

IX. INDIAN LAND

Is the facility located on Indian lands? ☐ YES ☒ NO

(from Proposed Sources)

E. OTHER (specify) — (specify) See Appendix A

E. OTHER (specify) — (specify)

...extending to at least one mile beyond property boundaries. The map must show ... each of its existing and proposed intake and discharge structures, each of its hazardous waste ... and each well where it injects fluids underground. Include all springs, rivers and other surface ... instructions for precise requirements.

(provide a brief description)

The Waste Isolation Pilot Plant (WIPP) is a U.S. Department of Energy facility intended to demonstrate the technical and operational principles involved in the permanent isolation of defense-generated transuranic waste. WIPP operations entail receiving, unloading, and transferring radioactive-mixed waste from the surface of the site to the underground rooms. Waste will be emplaced in a horizon located in a deep-bedded salt formation approximately 2,150 feet beneath the surface.

M

...personally examined and am familiar with the information submitted in this application and all ... of those persons immediately responsible for obtaining the information contained in the ... true, accurate and complete. I am aware that there are significant penalties for submitting ... fine and imprisonment.

A. NAME & OFFICIAL TITLE (type or print)	B. SIGNATURE	C. DATE SIGNED
ck B. Tillman oject Manager	[signature]	7/6/88

BEST COPY

United States
Environmental Protection
Agency

Office of Water and
Hazardous Waste
Washington, DC 20460

EPA Form 3510-3
June 1980

Solid Waste

EPA

Application Form 3 - Hazardous Waste Information

Consolidated Permits Program

M

This form must be completed by all persons applying for an EPA hazardous waste permit.

(fill–in areas are spaced for elite type, i.e., 12 characters/inch).

Form Approved OMB No. 158-S80004

FORM 3 RCRA

EPA

U.S. ENVIRONMENTAL PROTECTION AGENCY

HAZARDOUS WASTE PERMIT APPLICATION

Consolidated Permits Program

(This information is required under Section 3005 of RCRA.)

I. EPA I.D. NUMBER

F | N M D 9 8 2 2 8 5 4 8 8

FOR OFFICIAL USE ONLY

APPLICATION APPROVED	DATE RECEIVED (yr., mo., & day)	COMMENTS

II. FIRST OR REVISED APPLICATION

Place an "X" in the appropriate box in A or B below (mark one box only) to indicate whether this is the first application you are submitting for your facility or a revised application. If this is your first application and you already know your facility's EPA I.D. Number, or if this is a revised application, enter your facility's EPA I.D. Number in Item I above.

A. FIRST APPLICATION (place an "X" below and provide the appropriate date)

[X] 1. EXISTING FACILITY (See instructions for definition of "existing" facility. Complete item below.)

[ ] 2. NEW FACILITY (Complete item below.)

C 8 | YR. 79 | MO. 12 | DAY 29 — FOR EXISTING FACILITIES, PROVIDE THE DATE (yr., mo., & day) OPERATION BEGAN OR THE DATE CONSTRUCTION COMMENCED (use the boxes to the left)

YR. | MO. | DAY — FOR NEW FACILITIES, PROVIDE THE DATE (yr., mo., & day) OPERATION BEGAN OR IS EXPECTED TO BEGIN

B. REVISED APPLICATION (place an "X" below and complete Item I above)

[ ] 1. FACILITY HAS INTERIM STATUS

[ ] 2. FACILITY HAS A RCRA PERMIT

III. PROCESSES – CODES AND DESIGN CAPACITIES

A. PROCESS CODE – Enter the code from the list of process codes below that best describes each process to be used at the facility. Ten lines are provided for entering codes. If more lines are needed, enter the code(s) in the space provided. If a process will be used that is not included in the list of codes below, then describe the process (including its design capacity) in the space provided on the form (Item III-C).

B. PROCESS DESIGN CAPACITY – For each code entered in column A enter the capacity of the process.
1. AMOUNT – Enter the amount.
2. UNIT OF MEASURE – For each amount entered in column B(1), enter the code from the list of unit measure codes below that describes the unit of measure used. Only the units of measure that are listed below should be used.

PROCESS	PROCESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
Storage:		
CONTAINER (barrel, drum, etc.)	S01	GALLONS OR LITERS
TANK	S02	GALLONS OR LITERS
WASTE PILE	S03	CUBIC YARDS OR CUBIC METERS
SURFACE IMPOUNDMENT	S04	GALLONS OR LITERS
Disposal:		
INJECTION WELL	D79	GALLONS OR LITERS
LANDFILL	D80	ACRE-FEET (the volume that would cover one acre to a depth of one foot) OR HECTARE-METER
LAND APPLICATION	D81	ACRES OR HECTARES
OCEAN DISPOSAL	D82	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	D83	GALLONS OR LITERS
Treatment:		
TANK	T01	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	T02	GALLONS PER DAY OR LITERS PER DAY
INCINERATOR	T03	TONS PER HOUR OR METRIC TONS PER HOUR; GALLONS PER HOUR OR LITERS PER HOUR
OTHER (Use for physical, chemical, thermal or biological treatment processes not occurring in tanks, surface impoundments or incinerators. Describe the processes in the space provided; Item III-C.)	T04	GALLONS PER DAY OR LITERS PER DAY

UNIT OF MEASURE	UNIT OF MEASURE CODE
GALLONS	G
LITERS	L
CUBIC YARDS	Y
CUBIC METERS	C
GALLONS PER DAY	U
LITERS PER DAY	V
TONS PER HOUR	D
METRIC TONS PER HOUR	W
GALLONS PER HOUR	E
LITERS PER HOUR	H
ACRE-FEET	A
HECTARE-METER	F
ACRES	B
HECTARES	Q

EXAMPLE FOR COMPLETING ITEM III (shown in line numbers X-1 and X-2 below): A facility has two storage tanks, one tank can hold 200 gallons and the other can hold 400 gallons. The facility also has an incinerator that can burn up to 20 gallons per hour.

C | DUP | T/A | C 1

LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT (specify)	2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY	LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT	2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY
X-1	S 0 2	600	G		5				
X-2	T 0 3	20	E		6				
1	*	178,290	C		7				
2					8				
3		*See EPA Form 3510-3 Section III.C.			9				
4					10				

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II. PROCESSES *(continued)*

C. SPACE FOR ADDITIONAL PROCESS CODES OR FOR DESCRIBING OTHER PROCESSES *(code "T04")*. FOR EACH PROCESS ENTERED HERE INCLUDE DESIGN CAPACITY.

The Waste Isolation Pilot Plant (WIPP) is defined as a "Miscellaneous unit" under 40 CFR Part 260.10. "Miscellaneous unit" means a hazardous waste management unit where hazardous waste is treated, stored, or disposed of, and that is not a container, tank, surface impoundment, waste pile, land treatment unit, landfill, incinerator, boiler, industrial furnace, or underground injection well with appropriate technical standards under 40 CFR Part 146. WIPP is a geologic repository designed for the disposal of defense-generated transuranic waste. Some of the transuranic wastes disposed of at the WIPP contain hazardous wastes as co-contaminants. WIPP will be permitted as a "miscellaneous unit" under 40CFR Part 264, Subpart X. The Part A permit application (EPA Form 3510-3) does not include a code for "miscellaneous unit," and therefore, no code has been included in Sections IIIA and IV D. of the form.

M

IV. DESCRIPTION OF HAZARDOUS WASTES

A. EPA HAZARDOUS WASTE NUMBER — Enter the four–digit number from 40 CFR, Subpart D for each listed hazardous waste you will handle. If you handle hazardous wastes which are not listed in 40 CFR, Subpart D, enter the four–digit number*(s)* from 40 CFR, Subpart C that describes the characteristics and/or the toxic contaminants of those hazardous wastes.

B. ESTIMATED ANNUAL QUANTITY — For each listed waste entered in column A estimate the quantity of that waste that will be handled on an annual basis. For each characteristic or toxic contaminant entered in column A estimate the total annual quantity of all the non–listed waste*(s)* that will be handled which possess that characteristic or contaminant.

C. UNIT OF MEASURE — For each quantity entered in column B enter the unit of measure code. Units of measure which must be used and the appropriate codes are:

ENGLISH UNIT OF MEASURE	CODE	METRIC UNIT OF MEASURE	CODE
POUNDS	P	KILOGRAMS	K
TONS	T	METRIC TONS	M

If facility records use any other unit of measure for quantity, the units of measure must be converted into one of the required units of measure taking into account the appropriate density or specific gravity of the waste.

D. PROCESSES

1. PROCESS CODES:
For listed hazardous waste: For each listed hazardous waste entered in column A select the code*(s)* from the list of process codes contained in Item III to indicate how the waste will be stored, treated, and/or disposed of at the facility.
For non–listed hazardous wastes: For each characteristic or toxic contaminant entered in column A, select the code*(s)* from the list of process codes contained in Item III to indicate all the processes that will be used to store, treat, and/or dispose of all the non–listed hazardous wastes that possess that characteristic or toxic contaminant.
Note: Four spaces are provided for entering process codes. If more are needed: (1) Enter the first three as described above; (2) Enter "000" in the extreme right box of Item IV-D(1); and (3) Enter in the space provided on page 4, the line number and the additional code*(s)*.

2. PROCESS DESCRIPTION: If a code is not listed for a process that will be used, describe the process in the space provided on the form.

NOTE: HAZARDOUS WASTES DESCRIBED BY MORE THAN ONE EPA HAZARDOUS WASTE NUMBER — Hazardous wastes that can be described by more than one EPA Hazardous Waste Number shall be described on the form as follows:

1. Select one of the EPA Hazardous Waste Numbers and enter it in column A. On the same line complete columns B,C, and D by estimating the total annual quantity of the waste and describing all the processes to be used to treat, store, and/or dispose of the waste.
2. In column A of the next line enter the other EPA Hazardous Waste Number that can be used to describe the waste. In column D(2) on that line enter "included with above" and make no other entries on that line.
3. Repeat step 2 for each other EPA Hazardous Waste Number that can be used to describe the hazardous waste.

EXAMPLE FOR COMPLETING ITEM IV *(shown in line numbers X-1, X-2, X-3, and X-4 below)* — A facility will treat and dispose of an estimated 900 pounds per year of chrome shavings from leather tanning and finishing operation. In addition, the facility will treat and dispose of three non–listed wastes. Two wastes are corrosive only and there will be an estimated 200 pounds per year of each waste. The other waste is corrosive and ignitable and there will be an estimated 100 pounds per year of that waste. Treatment will be in an incinerator and disposal will be in a landfill.

LINE NO.	A. EPA HAZARD. WASTE NO *(enter code)*	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE *(enter code)*	D. PROCESSES 1. PROCESS CODES *(enter)*				D. PROCESSES 2. PROCESS DESCRIPTION *(if a code is not entered in D(1))*
X-1	K 0 5 4	900	P	T 0 3	D 8 0			
X-2	D 0 0 2	400	P	T 0 3	D 8 0			
X-3	D 0 0 1	100	P	T 0 3	D 8 0			
X-4	D 0 0 2							*included with above*

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CONTINUE ON PAGE 3

Continued from page 2.
NOTE: Photocopy this page before completing if you have more than 26 wastes to list.

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EPA I.D. NUMBER (enter from page 1)	T/A	C	FOR OFFICIAL USE ONLY	T/A	C	
W N M D 9 8 2 2 8 5 4 8 8		1	W DUP		2	DUP

IV. DESCRIPTION OF HAZARDOUS WASTES (continued)

LINE NO.	A. EPA HAZARD. WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)	D. PROCESSES 2. PROCESS DESCRIPTION (if a code is not entered in D(1))
1	F001	10.1	M		Miscellaneous unit - See Section III.C.
2	F002				Included with above
3	F003				Included with above
4	D008				Included with above
5	F001	289.1	M		
6	F002				Included with above
7	D008				Included with above
8	F002	21.1	M		
9	F003				Included with above
10	F005				Included with above
11	F001	21.4	M		
12	F002				Included with above
13	P015				Included with above
14	D004	83.9	M		
15	D006				Included with above
16	D007				Included with above
17	D008				Included with above
18	D006	112.2	M		
19	D007				Included with above
20	D008				Included with above
21	D008	0.1	M		
22	P015				Included with above
23	D005	42.7	M		
24	D007				Included with above
25	D008				Included with above
26					

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Continued from page 2.
NOTE: Photocopy this page before completing if you have more than 26 wastes to list.

Form Approved OMB No. 158-S80004

EPA I.D. NUMBER *(enter from page 1)*	T/A C	FOR OFFICIAL USE ONLY			
W N M D 9 8 2 2 8 5 4 8 8	1	W	DUP	2	DUP

IV. DESCRIPTION OF HAZARDOUS WASTES *(continued)*

LINE NO.	A. EPA HAZARD. WASTE NO. *(enter code)*	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE *(enter code)*	D. PROCESSES 1. PROCESS CODES *(enter)*	2. PROCESS DESCRIPTION *(if a code is not entered in D(1))*
1	D008	81.8	M		
2	F001	104.5	M		
3	F001	335.2	M		
4	F002				Included with above
5	F001	0.7	M		
6	F003				Included with above
7	F001	0.2	M		
8	F002				Included with above
9	F003				Included with above
10	F004				Included with above
11	F005				Included with above
12	F001	7.1	M		
13	F002				Included with above
14	F003				Included with above
15	F004				Included with above
16	F005				Included with above
17	D008				Included with above
18	P015				Included with above
19	F001	4.2	M		
20	F002				Included with above
21	F003				Included with above
22	F001	329.9	M		
23	F002				Included with above
24	F003				Included with above
25	D006				Included with above
26	D008				Included with above

Continued from page 2.
NOTE: Photocopy this page before completing if you have more than 26 wastes to list.

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EPA I.D. NUMBER (enter from page 1)	T/A	C	FOR OFFICIAL USE ONLY	T/A	C	
W N M D 9 8 2 2 8 5 4 8 8		1	W DUP		2	DUP

IV. DESCRIPTION OF HAZARDOUS WASTES *(continued)*

LINE NO.	A. EPA HAZARD. WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)	2. PROCESS DESCRIPTION (if a code is not entered in D(1))
1	D006	0.1	M		
2	D008				Included with above
3	D006	0.2	M		
4	D008	0.6	M		
5	D009				Included with above
6	D006	0.2	M		
7	D007				Included with above
8	D008				Included with above
9	D009				Included with above
10	D011				Included with above
11	F002	0.3	M		
12	F003				Included with above
13	D008				Included with above
14	D002	1.4	M		
15	D002	1.5	M		
16	D008				Included with above
17	D003	1.4	M		
18	D006				Included with above
19	D008				Included with above
20	D009				Included with above
21	F001	12.5	M		
22	F003				Included with above
23	D006				Included with above
24	D008				Included with above
25					
26					

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CONTINUE ON REVERSE

Continued from page 2.

NOTE: Photocopy this page before completing if you have more than 26 wastes to list.

Form Approved OMB No. 158-S80004

EPA I.D. NUMBER (enter from page 1)	T/A C	FOR OFFICIAL USE ONLY		T/A C	
W N M D 9 8 2 2 8 5 4 8 8	1	W	DUP	2	DUP

IV. DESCRIPTION OF HAZARDOUS WASTES (continued)

LINE NO.	A. EPA HAZARD. WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES: 1. PROCESS CODES (enter)	D. PROCESSES: 2. PROCESS DESCRIPTION (if a code is not entered in D(1))
1	F 0 0 1	51.8	M		
2	F 0 0 2				Included with above
3	F 0 0 3				Included with above
4	D 0 0 6				Included with above
5	D 0 0 8				Included with above
6	D 0 0 9				Included with above
7	D 0 0 3				Included with above
8	F 0 0 1	54.1	M		
9	F 0 0 2				Included with above
10	F 0 0 3				Included with above
11	D 0 0 6				Included with above
12	D 0 0 8				Included with above
13	D 0 0 9				Included with above
14	F 0 0 1	38.4	M		
15	F 0 0 2				Included with above
16	F 0 0 3				Included with above
17	D 0 0 6				Included with above
18	D 0 0 8				Included with above
19	D 0 0 9				Included with above
20	P 0 1 5				Included with above
21					
22					
23					
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26					

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CONTINUE ON REVERSE

Continued from page 2.
NOTE: *Photocopy this page before completing if you have more than 26 wastes to list.*

Form Approved OMB No. 158-S80004

EPA I.D. NUMBER (enter from page 1): W N M D 9 8 2 2 8 5 4 8 8 — T/A C: 1

FOR OFFICIAL USE ONLY: W DUP — T/A C: 2 — DUP

IV. DESCRIPTION OF HAZARDOUS WASTES *(continued)*

LINE NO.	A. EPA HAZARD. WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)	D. PROCESSES 2. PROCESS DESCRIPTION (if a code is not entered in D(1))
1	F001	0.2	M		
2	F002				Included with above
3	F003				Included with above
4	F004				Included with above
5	F005				Included with above
6	D008				Included with above
7	D009				Included with above
8	F001	6.7	M		
9	F002				Included with above
10	F003				Included with above
11	F004				Included with above
12	F005				Included with above
13	D005				Included with above
14	D006				Included with above
15	D007				Included with above
16	D008				Included with above
17	D009				Included with above
18	D010				Included with above
19	D011				Included with above
20					
21					
22					
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24					
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(enter "A", "B", "C", etc. behind the "3" to identify photocopied pages)

Continued from page 2.
NOTE: Photocopy this page before completing if you have more than 26 wastes to list.

Form Approved OMB No. 158-S80004

EPA I.D. NUMBER (enter from page 1)	T/A	C	FOR OFFICIAL USE ONLY	T/A	C	
W NMD982285488		1	W DUP		2	DUP

IV. DESCRIPTION OF HAZARDOUS WASTES *(continued)*

LINE NO.	A. EPA HAZARD. WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)	D. PROCESSES 2. PROCESS DESCRIPTION (if a code is not entered in D(1))
1	F001	6.0	M		
2	F002				Included with above
3	F003				Included with above
4	F004				Included with above
5	F005				Included with above
6	D006				Included with above
7	D007				Included with above
8	D008				Included with above
9	D009				Included with above
10	D010				Included with above
11	D011				Included with above
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CONTINUE ON REVERS

(enter "A", "B", "C", etc. behind the "3" to identify photocopied pages)

Continued from the front.

IV. DESCRIPTION OF HAZARDOUS WASTES *(continued)*

E. USE THIS SPACE TO LIST ADDITIONAL PROCESS CODES FROM ITEM D(1) ON PAGE 3.

Note: ALL WASTES LISTED IN SECTION IV ARE RADIOACTIVE MIXED WASTES

(M)

EPA I.D. NO. *(enter from page 1)*

NMD982285488   T/A C   6

V. FACILITY DRAWING

All existing facilities must include in the space provided on page 5 a scale drawing of the facility *(see instructions for more detail)*.

VI. PHOTOGRAPHS

All existing facilities must include photographs *(aerial or ground—level)* that clearly delineate all existing structures; existing storage, treatment and disposal areas; and sites of future storage, treatment or disposal areas *(see instructions for more detail)*.

VII. FACILITY GEOGRAPHIC LOCATION

LATITUDE *(degrees, minutes, & seconds)*	LONGITUDE *(degrees, minutes, & seconds)*
32 22 30 N	103 47 30 W

VIII. FACILITY OWNER

☐ A. If the facility owner is also the facility operator as listed in Section VIII on Form 1, "General Information", place an "X" in the box to the left and skip to Section IX below.

B. If the facility owner is not the facility operator as listed in Section VIII on Form 1, complete the following items:

1. NAME OF FACILITY'S LEGAL OWNER	2. PHONE NO. *(area code & no.)*
U.S. Department of Energy	505-887-8101

3. STREET OR P.O. BOX	4. CITY OR TOWN	5. ST.	6. ZIP CODE
P.O. Box 3090	G Carlsbad	NM	88221

IX. OWNER CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME *(print or type)*	B. SIGNATURE	C. DATE SIGNED
Jack B. Tillman	[signature]	7/6/88

X. OPERATOR CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME *(print or type)*	B. SIGNATURE	C. DATE SIGNED
Jack B. Tillman (US DOE) James S. Moore (Westinghouse)	[signatures]	7/6/88 6/29/88

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<u>CONTENT CODE</u>: LA 111A

<u>CONTENT DESCRIPTION</u>: Concreted Aqueous Waste

<u>GENERATING SITE</u>: Los Alamos National Laboratory

<u>WASTE DESCRIPTION</u>: Aqueous effluent from the processing of plutonium at the Los Alamos Plutonium Facility (TA-55) is treated in Room 60 of TA-50-1. The resultant sludge is packaged as content code LA 111A. The final waste product is obtained by mixing the TRU sludge with portland cement.

<u>GENERATING SOURCE</u>: The waste originates from Technical Area 50-1 (TA-50-1) at LANL.

<u>WASTE FORM</u>: Solidified aqueous waste is the residue from treating blended acidic and caustic aqueous liquid radioactive waste by use of calcium hydroxide, ferric sulfate and a flocculation aid. This treatment produces a thin caustic sludge (approximately 25% solids) that is always alkaline and compatible with portland cement. The final cemented waste monolith is produced by tumbling 55-gallon drums containing empirically determined quantities of sludge, portland cement, vermiculite and sodium silicate.

<u>WASTE PACKAGING</u>: The waste is placed into a 55-gallon drum. A 5-mil polyethylene sleeve is installed in the drum for contamination control while adding the sludge. This sleeve is not considered to be part of the packaging because the bottom of the sleeve is open, and the top is folded over and not taped.

If drums are overpacked in Standard Waste Boxes (SWB), no sealed liner bags are used in the SWB.

<u>ASSAY</u>: A sample of the sludge from each batch is taken to determine the amount and identity of the radionuclides in the sludge. The sludge sample is analyzed using a radiochemical assay method. The results of the analysis are expressed in terms of curies of each radionuclide present. Assay results are used to calculate Pu-239 fissile equivalent (plus error) and decay heat (plus error).

FREE LIQUIDS: The TRU sludge is cast into a solid monolith by mixing portland cement and sludge in a controlled process per written procedures. The final concrete waste form contains no free liquids. Inspected drums have demonstrated all liquid is fixed in the concrete. A sample of drums from each batch will be real-time radiographed to ensure the absence of free liquids prior to shipment to WIPP.

EXPLOSIVE/COMPRESSED GASES: The waste is produced in a closed system which precludes any mechanism in the process from producing compressed gas or the introduction of extraneous material such as pressure vessels or explosives. In addition, neither the ingredients nor the finished concrete is explosive. Explosives are prohibited at the TA-50-1 that generates this waste form.

PYROPHORIC: No pyrophoric materials have been identified in this waste form and are prohibited by TRU waste packaging procedures.

CORROSIVES: The waste exhibits none of the characteristics specified in 40 CFR 261 (Subpart C) and is not listed in Subpart D. Ferric sulfate and sodium hydroxide are corrosive when in solution but the final form of the waste is a dry, solid concrete monolith.

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 listed and restricted to the tables found in Appendix 1.3.7 of the SAR.

ADDITIONAL CRITERIA: Each drum will be fitted with a carbon composite filter, and the rigid liner will be punctured (if present). Each SWB is fitted with at least two and up to four carbon composite filters.

SHIPPING CATEGORY: This content code is packaged in 55-gallon drums with only an open plastic sleeve which is not taped. This content code is assigned to the shipping categories I.2A0 (drums) and I.2B0 (SWB overpack).

ANALYTICAL CATEGORY - MAXIMUM ALLOWABLE WATTAGE: The maximum allowable wattage is 0.2536 for a single drum and 0.1793 for an overpacked drum. (See Table 6-1.) The maximum wattage per TRUPACT-II is 3.5504 for drums and 1.4344 for overpacked drums. (See Table 6-2.)

TEST CATEGORY - MAXIMUM ALLOWABLE WATTAGE: The maximum allowable wattage is 10 per drum and per TRUPACT-II. (See Table 6-3.)

CORRELATION TABLE: This content code has previously been identified as the following IDC:

IDC	DESCRIPTION	WASTE GENERATOR
002	Solidified Aqueous Waste	Los Alamos National Lab

CONTENT CODE: LA 111B

CONTENT DESCRIPTION: Solidified Aqueous Waste

GENERATING SITE: Los Alamos National Laboratory

WASTE DESCRIPTION: Aqueous effluent from plutonium processing activities at the Los Alamos Plutonium Facility (TA-55) is treated in building TA-50-1. The resultant sludge is packaged as content code LA 111B.

GENERATING SOURCE: The waste originates from TA-50-1 (Los Alamos National Laboratory Liquid Waste Treatment Facility).

WASTE FORM: The sludge is produced by vacuum filtration of solids from pretreated aqueous waste slurry. The filter agent is an inert diatomaceous earth medium that accumulates on a rotation drum. Solids are trapped on the surfaces of the filter medium as the pretreated solution passes through. The surface of the filter medium with entrapped filtrate is skimmed off as wet sludge. The precipitated solids are chiefly metallic hydroxide with a ph of 10-12.

WASTE PACKAGING: The waste is placed into a 55-gallon drum which is lined with a 90-mil thick HDPE liner (lid has a one-inch diameter hole) and a 5-mil polyethylene bag. The 5-mil polyethylene bag is not considered as part of the waste packaging but is used for contamination control. In addition, this bag is not sealed with tape.

If drums are overpacked in Standard Waste Boxes (SWB). no sealed liner bags are used in the SWB.

ASSAY: A sample of the sludge from each batch is taken to determine the amount and identity of the radionuclides in the sludge. The sludge sample is analyzed using a radiochemical assay method. The results of the analysis are expressed in terms of curies of each radionuclide present. Assay results are used to calculate Pu-239 fissile equivalent (plus error) and decay heat (plus error).

FREE LIQUIDS: The prepared drum is initially filled with approximately 6-8 pounds of portland cement. The sludge is then placed into the drum, and an additional six to eight pounds of cement is then added on top of the sludge. The portland cement is used to absorb any free liquids that may come out of the sludge during storage at LANL and transportation to WIPP. Recent studies conducted at LANL on these drums have shown the absence of any free liquids as defined by the WIPP WAC. A sample of drums from each batch will be examined by real-time radiography (RTR) to ensure the continued absence of any free liquids prior to shipment to WIPP.

EXPLOSIVES/COMPRESSED GASES: The waste is produced in a closed system which precludes the introduction of extraneous materials such as pressure vessels or explosives. No explosives, explosive mixtures, or compressed gases have been identified in this waste. Explosives are prohibited at TA-50-1 that generates this waste form.

PYROPHORIC: No pyrophoric materials have been identified in this waste form Pyrophorics are prohibited by TRU Waste Procedures.

CORROSIVES: No corrosives materials have been identified in this waste. Precipitated sludges are chiefly hydroxides with a ph of 10-12. Using the WIPP WAC for corrosivity in 40 CFR 261, this waste form is not considered a corrosive.

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 listed and restricted to the tables found in Appendix 1.3.7 of the SAR.

ADDITIONAL CRITERIA: Each drum will be fitted with a carbon composite filter, and the rigid liner will be punctured (if present). Each SWB is fitted with at least two and up to four carbon composite filters.

SHIPPING CATEGORY: This content code is packaged in 55-gallon drums with only one plastic bag that is not taped, but folded over the waste. This content code is assigned to the shipping categories I.2A0 (drums) and I.2B0 (SWB overpack).

ANALYTICAL CATEGORY - MAXIMUM ALLOWABLE WATTAGE: The maximum allowable wattage is 0.2536 for a single drum and 0.1793 for an overpacked drum. (See Table 6-1.) The maximum wattage per TRUPACT-II is 3.5504 for drums and 1.4344 for overpacked drums. (See Table 6-2.)

TEST CATEGORY - MAXIMUM ALLOWABLE WATTAGE: The maximum allowable wattage is 10 per drum and per TRUPACT-II. (See Table 6-3.)

CORRELATION TABLE: This content code has previously been identified as the following IDC:

IDC	DESCRIPTION	WASTE GENERATOR
003	Dewatered Sludge	Los Alamos National Lab

CONTENT CODE: LA 114A

CONTENT DESCRIPTION: Solidified Inorganic Process Solids

GENERATING SITE: Los Alamos National Laboratory

WASTE DESCRIPTION: Aqueous effluent and leached solids are from the processing of plutonium at the Los Alamos Plutonium Facility (TA-55). The resultant waste is immobilized in gypsum cement as content code LA 114A.

GENERATING SOURCE: The waste originates from Technical Area 55 (TA-55) at LANL.

WASTE FORM: Solidified process solids (process residue from evaporator bottom and other discardable solutions, process leached solids, ash, filter cakes, salts, metal oxides, fines, etc.) are immobilized in gypsum cement to form a noncorrosive solid matrix in a 55-gallon drum or one-gallon cans.

WASTE PACKAGING: This content code is placed into a 55-gallon drum prepared as described below:

May 1987 - September 1988: One-Gallon Cement Fixation Process

In the one-gallon cement fixation process, the waste was mixed with a cement powder in one-gallon cans to form a noncorrosive solid matrix. The one-gallon cans served only as mixing containers for the cement parts and not as the ultimate packaging confinement. The one-gallon cans were then packaged in a 55-gallon drum. The packaging within the drum included a 1/16-inch thick lead sheet, a 5-mil polyethylene bag, and a 12-mil PVC vinyl bag that contains the cans. The lead serves as a shielding material for gamma radiation to reduce personnel exposure during drum mixing and subsequent drum handling. The lead shielding consists of two disks, placed at the top and bottom of a 1/16-inch thick lead sheet fitted to the inside circumference of the drum wall. All bag closures are by the twist and tape method.

July 1988 - Present: 55-Gallon Cement Fixation Process

In the 55-gallon cement fixation process, the waste is mixed with a cement powder in a 1/8-inch thick polyethylene mixing container to form a noncorrosive solid monolith. The mixing container is used only as a container for the cement paste and is not considered as an integral part of the packaging. The packaging within the drum includes a 1/16-inch thick lead sheet and two 12-mil PVC vinyl bags. The inner 12-mil bag contains the 1/8-inch poly mixing container. One or more two-inch thick styrofoam disks are placed on top of the 12-mil outer bag as bracing for the top lead disk. The lead serves as a shielding material for gamma radiation to reduce personnel exposure during drum mixing and subsequent drum handling. The lead shielding consists of two disks, placed at the top and bottom of a 1/16-inch thick lead sheet fitted to the inside circumference of the drum wall. All bag closures are by the twist and tape method.

If drums are overpacked in Standard Waste Boxes (SWB), no sealed liner bags are used in the SWB.

ASSAY: Aqueous effluent and other discardable solutions are sampled for analysis by radiochemical assay methods. Process leached solids, ash, filter cake, salts, metal oxides and other leachable solids are assayed by means of a thermal neutron coincidence counter or segmented gamma scan counter according to written procedures. The results of the assays are expressed in the terms of grams of each radionuclide present. Assay results are used to calculate Pu-239 fissile equivalent (plus error) and decay heat (plus error).

FREE LIQUIDS: The TRU aqueous effluent is cast into a solid monolith by mixing with gypsum cement in a controlled process per written procedures. Each monolith drum is inspected for hardness and the absence of free liquids prior to drum closure. The final concrete waste form contains no free liquids.

EXPLOSIVE/COMPRESSED GASES: Neither the ingredients nor the finished cement are explosive. Explosives are neither used nor permitted within TA-55. All materials entering TA-55 are inspected by Protective Force personnel at the front gate. No pressure vessels or spray cans that can contain gases under pressure enter these waste streams. Strong acids that might react with other materials to generate gases are neutralized so that reaction is no longer possible waste packages are vented.

PYROPHORIC: All pyrophorics will be passivated prior to mixing with aqueous solution-cement powder combinations. Any pyrophorics placed in this aqueous system would react with the water. Immobilization in cement renders pyrophorics non-reactive.

CORROSIVES: All aqueous effluents and other discardable solutions are neutralized to a pH between 2 and 6 with a caustic solution per written procedures. This neutralized solution is then mixed with gypsum cement to form a noncorrosive solid monolith.

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 listed and restricted to the tables found in Appendix 1.3.7 of the SAR.

ADDITIONAL CRITERIA: Each drum will be fitted with a carbon composite filter, and the rigid liner will be punctured (if present). Each SWB is fitted with at least two and up to four carbon composite filters.

SHIPPING CATEGORY: This content code has the waste packaged in a maximum of two layers of twist and taped plastic bags in 55-gallon drums or drums overpacked in a SWB. In a drum, at least one layer of plastic is a drum liner bag. This content code has been assigned shipping categories I.1A2 (drums) and I.1B2 (SWB overpack).

ANALYTICAL CATEGORY - MAXIMUM ALLOWABLE WATTAGE: The maximum allowable wattage is 0.1594 for a single drum and 0.1207 for an overpacked drum. (See Table 6-1.) The maximum wattage per TRUPACT-II is 2.2316 for drums and 0.9656 for overpacked drums. (See Table 6-2.)

TEST CATEGORY - MAXIMUM ALLOWABLE WATTAGE: The maximum allowable wattage is 10 per drum and per TRUPACT-II. (See Table 6-3.)

CORRELATION TABLE: This content code has previously been identified as the following IDC:

IDC	DESCRIPTION	WASTE GENERATOR
006	Solidified Process Solids	Los Alamos National Lab

CONTENT CODE: LA 115A

CONTENT DESCRIPTION: TRU Graphite Waste

GENERATING SITE: Los Alamos National Laboratory

WASTE DESCRIPTION: Graphite TRU waste is generated from plutonium processing activities at the Los Alamos Plutonium Facility (TA-55). The resultant graphite TRU waste is packaged as content code LA 115A.

GENERATING SOURCE: The waste originates from Technical Area-55 (TA-55) at LANL.

WASTE FORM: TRU graphite waste consists of discarded graphite mold and furnace equipment from plutonium casting operations, etc., which may contain some small fraction of combustible waste such as plastics (mainly packaging), etc.

WASTE PACKAGING: Graphite waste is placed in tin or stainless steel cans which are placed in two to three layers of plastic bags in a 55-gallon drum. The drum liner bags are 5-mil PVC. Each bag is sealed by the twist and tape method.

If drums are overpacked in Standard Waste Boxes (SWB), no sealed liner bags are used in the SWB.

ASSAY: Each waste item is assayed prior to placement into a drum. The filled drum is then assayed. All assays are performed by means of a thermal neutron coincidence counter or segmented gamma scan counter according to written procedures. Which instrument is used depends on the matrix and nuclide content of the drum. The results of the assay are expressed in terms of grams of each radionuclide present. Assay results are used to calculate Pu-239 fissile equivalent (plus error) and decay heat (plus error).

FREE LIQUIDS: Visual inspections of each waste item for free liquids are performed by certified TRU waste inspectors in accordance with written and approved procedures. Special emphasis during waste inspection is always applied to containers such as bottles and cans. Real-time radiography (RTR) examination

of a sample of these drums will be performed to verify that free liquids are not present.

EXPLOSIVE/COMPRESSED GASES: Explosives are prohibited at TA-55. Only used pressure vessels or spray cans could potentially contain gases under pressure, and they are blocked open by certified TRU waste inspectors in accordance with written and approved procedures.

PYROPHORIC: No pyrophoric materials will be present as determined by visual inspection of each waste item by certified TRU waste inspectors in accordance with written and approved procedures.

CORROSIVES: Visual inspections of each waste item for corrosives materials are performed by certified TRU waste inspectors in accordance with written and approved procedures. Corrosive materials identified during this inspection are either neutralized or diverted from the waste stream.

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 listed and restricted to the tables found in Appendix 1.3.7 of the SAR.

ADDITIONAL CRITERIA: Each drum will be fitted with a carbon composite filter, and the rigid liner will be punctured (if present). Each SWB is fitted with at least two and up to four carbon composite filters.

SHIPPING CATEGORY: This content code has been packaged with a metal can as the innermost layer of confinement in a 55-gallon drum or drums overpacked in a SWB. This content code has been assigned shipping categories II.2AM (drums) and II.2BM (SWB overpack).

ANALYTICAL CATEGORY - MAXIMUM ALLOWABLE WATTAGE: The maximum allowable wattage is 40.0 for a single drum and 40.0 for an overpacked drum. (See Table 6-1.) The maximum wattage per TRUPACT-II is 40.0 for drums and 40.0 for overpacked drums. (See Table 6-2.)

CORRELATION TABLE: This content code has previously been identified as the following IDC:

IDC	DESCRIPTION	WASTE GENERATOR
005 P2G	TRU Graphite Waste	Los Alamos National Lab

CONTENT CODE: LA 116A

CONTENT DESCRIPTION: Combustible Waste

GENERATING SITE: Los Alamos National Laboratory

WASTE DESCRIPTION: Combustible TRU waste is generated from plutonium processing activities at the Los Alamos Plutonium Facility (TA-55). The resultant combustible TRU waste is packaged as content code LA 116A.

GENERATING SOURCE: The waste originates from Technical Area-55 (TA-55) at LANL

WASTE FORM: Combustible solids consist of paper, rags, plastic, rubber, etc. which may contain some small fraction of noncombustible solids as scrap metals etc

WASTE PACKAGING: Waste is placed either directly in the drum or with a maximum of two layers of plastic bags. The waste is placed into a 55-gallon drum that is lined with two 5-mil polyethylene bags. All bag closures are by the twist and tape method.

If drums are overpacked in Standard Waste Boxes (SWB), no sealed liner bags are used in the SWB.

ASSAY: Drums are assayed by means of a thermal neutron coincidence counter or segmented gamma scan counter according to written procedures. The instrument used depends on the matrix and nuclide content of the drum. The results of the assay are expressed in terms of grams of each radionuclide present. Assay results are used to calculate Pu-239 fissile equivalent (plus error) and decay heat (plus error).

FREE LIQUIDS: Visual inspections of each waste item for free liquids are performed by certified TRU waste inspectors in accordance with written and approved procedures. Special emphasis during waste inspection is always applied to containers such as bottles and cans. Real-time radiography (RTR) examination

of a sample of these drums will be performed to verify that free liquids are not present.

EXPLOSIVE/COMPRESSED GASES: Explosives are prohibited at TA-55. Only used pressure vessels or spray cans could potentially contain gases under pressure, and they are blocked open by certified TRU waste inspectors in accordance with written and approved procedures.

PYROPHORIC: No pyrophoric materials will be present as determined by visual inspection of each waste item by certified TRU waste inspectors in accordance with written and approved procedures.

CORROSIVES: Visual inspections of each waste item for corrosives materials are performed by certified TRU waste inspectors in accordance with written and approved procedures. Corrosive materials identified during this inspection are either neutralized or diverted from the waste stream.

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 listed and restricted to the tables found in Appendix 1.3.7 of the SAR.

ADDITIONAL CRITERIA: Each drum will be fitted with a carbon composite filter, and the rigid liner will be punctured (if present). Each SWB is fitted with at least two and up to four carbon composite filters.

SHIPPING CATEGORY: This content code is packaged with a maximum of four layers of plastic bags in a 55-gallon drum or drums overpacked in a SWB. In a drum, at least one layer of plastic is a drum liner bag. This content code is assigned to the shipping categories III.1A4 (drums) and III.1B4 (SWB overpack).

ANALYTICAL CATEGORY - MAXIMUM ALLOWABLE WATTAGE: The maximum allowable wattage is 0.0207 for a single drum and 0.0196 for an overpacked drum. (See Table 6-1.) The maximum wattage per TRUPACT-II is 0.2898 for drums and 0.1568 for overpacked drums. (See Table 6-2.)

TEST CATEGORY - MAXIMUM ALLOWABLE WATTAGE: The maximum allowable wattage is 20 per drum and per TRUPACT-II. (See Table 6-3.)

CORRELATION TABLE: This content code has previously been identified as the following IDC:

IDC	DESCRIPTION	WASTE GENERATOR
004	Combustible Waste	Los Alamos National Lab

CONTENT CODE: LA 117A

CONTENT DESCRIPTION: TRU Metal Waste

GENERATING SITE: Los Alamos National Laboratory

WASTE DESCRIPTION: TRU metal waste is generated from plutonium processing activities at the Los Alamos Plutonium Facility (TA-55). The resultant TRU metal waste is packaged as content code LA 117B.

GENERATING SOURCE: The waste originates from Technical Area-55 (TA-55) at LANL.

WASTE FORM: TRU metal waste consists of motors, pumps, tools, process equipment, etc., which may contain some small fraction of combustible waste, such as plastics (mainly packaging), etc.

WASTE PACKAGING: The waste is packaged in a maximum of four layers of plastic bagging prior to placement in the Standard Waste Box (SWB). A 12-mil vinyl (PVC) sleeve is used as a bag-out bag with one end sealed directly to the inside of the SWB body. After the SWB is filled, the vinyl sleeve is gathered with a hose clamp and cut to form a horsetail. This sleeve is not considered to be part of the packaging. All bag liners are sealed by taping along the folds.

ASSAY: SWBs are assayed by means of portable nondestructive assay hold-up system according to written procedures. The results of the assay are expressed in terms of grams of each radionuclide present. Prior to shipment to WIPP, each SWB will then be assayed by a passive-active neutron (PAN) assay system. Assay results are used to calculate Pu-239 fissile equivalent (plus error) and decay heat (plus error).

FREE LIQUIDS: Visual inspections of each waste item for free liquids are performed by certified TRU waste inspectors in accordance with written and approved procedures. Special emphasis during waste inspection is always applied to motors and pumps to assure that all liquids are properly drained and/or solidified.

EXPLOSIVE/COMPRESSED GASES: Explosives are prohibited at TA-55. Only used pressure vessels or spray cans could potentially contain gases under pressure, and they are blocked open by certified TRU waste inspectors in accordance with written and approved procedures.

PYROPHORIC: No pyrophoric materials will be present as determined by visual inspection of each waste item by certified TRU waste inspectors in accordance with written and approved procedures.

CORROSIVE: Visual inspections of each waste item for corrosives materials are performed by certified TRU waste inspectors in accordance with written and approved procedures. Corrosive materials identified during this inspection are either neutralized or diverted from the waste stream.

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 listed and restricted to the tables found in Appendix 1.3.7 of the SAR.

ADDITIONAL CRITERIA: Each SWB is fitted with at least two and up to four carbon composite filters.

SHIPPING CATEGORY: This content code has the waste packaged in a maximum of four layers of plastic bags in a SWB. This content code has been assigned shipping category II.1C4 (SWB).

ANALYTICAL CATEGORY - MAXIMUM ALLOWABLE WATTAGE: The maximum allowable wattage is 0.0690 for a single Standard Waste Box. (See Table 6-1.) The maximum wattage per TRUPACT-II is 0.1380 for Standard Waste Boxes. (See Table 6-2.)

CORRELATION TABLE: This content code has previously been identified as the following IDCs:

IDC	DESCRIPTION	WASTE GENERATOR
005 LM	TRU Metal Waste	Los Alamos National Lab

CONTENT CODE: LA 118A

CONTENT DESCRIPTION: TRU Glass Waste

GENERATING SITE: Los Alamos National Laboratory

WASTE DESCRIPTION: TRU glass waste is generated from plutonium processing activities at the Los Alamos Plutonium Facility (TA-55). The resultant TRU glass waste is packaged as content code LA 118A.

GENERATING SOURCE: The waste originates from Technical Area-55 (TA-55) at LANL.

WASTE FORM: TRU glass waste consists of discarded labware, windows, bottles, etc., which may contain some small fraction of combustible waste, such as plastics (mainly packaging), etc.

WASTE PACKAGING: The waste is packaged in tin or stainless steel cans and bagged out in one layer of plastic bagging prior to placement in the drum. The drum used is a 55-gallon drum lined with two 5-mil polyethylene bags. All bag closures are by the twist and tape method.

If drums are overpacked in Standard Waste Boxes (SWB), no sealed liner bags are used in the SWB.

ASSAY: Each waste item is assayed prior to placement into a drum. The filled drum is then assayed. All assays are performed by means of a thermal neutron coincidence counter or segmented gamma scan counter according to written procedures. Which instrument is used depends on the matrix and nuclide content of the drum. The results of the assay are expressed in terms of grams of each radionuclide present. Assay results are used to calculate Pu-239 fissile equivalent (plus error) and decay heat (plus error).

FREE LIQUIDS: Visual inspections of each waste item for free liquids are performed by certified TRU waste inspectors in accordance with written and approved procedures. Special emphasis during waste inspection is always applied to containers such as bottles and cans. Real-time radiography (RTR) examination

of a sample of these drums will be performed to verify that free liquids are not present

EXPLOSIVE/COMPRESSED GASES: Explosives are prohibited at TA-55. Only used pressure vessels or spray cans could potentially contain gases under pressure, and they are blocked open by certified TRU waste inspectors in accordance with written and approved procedures.

PYROPHORIC: No pyrophoric materials will be present as determined by visual inspection of each waste item by certified TRU waste inspectors in accordance with written and approved procedures.

CORROSIVES: Visual inspections of each waste item for corrosives materials are performed by certified TRU waste inspectors in accordance with written and approved procedures. Corrosive materials identified during this inspection are either neutralized or diverted from the waste stream.

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 listed and restricted to the tables found in Appendix 1.3.7 of the SAR.

ADDITIONAL CRITERIA: Each drum will be fitted with a carbon composite filter, and the rigid liner will be punctured (if present). Each SWB is fitted with at least two and up to four carbon composite filters.

SHIPPING CATEGORY: This content code has been packaged with a metal can as the innermost layer of confinement in a 55-gallon drum or drums overpacked in a SWB. This content code has been assigned shipping categories II.2AM (drums) and II.2BM (SWB overpack).

ANALYTICAL CATEGORY - MAXIMUM ALLOWABLE WATTAGE: The maximum allowable wattage is 40.0 for a single drum and 40.0 for an overpacked drum. (See Table 6-1.) The maximum wattage per TRUPACT-II is 40.0 for drums and 40.0 for overpacked drums. (See Table 6-2.)

CORRELATION TABLE: This content code has previously been identified as the following IDC:

IDC	DESCRIPTION	WASTE GENERATOR
005 LG	TRU Glass Waste	Los Alamos National Lab

CONTENT CODE: LA 123A

CONTENT DESCRIPTION: TRU Leaded Rubber Waste and TRU Metal

GENERATING SITE: Los Alamos National Laboratory

WASTE DESCRIPTION: TRU leaded rubber and metal wastes are generated from plutonium processing activities at the Los Alamos Plutonium Facility (TA-55). The resultant TRU leaded rubber and metal wastes are packaged as content code LA 123A.

GENERATING SOURCE: The waste originates from Technical Area-55 (TA-55) at LANL.

WASTE FORM: Lead-lined glovebox gloves are discarded along with metal waste (discarded metals, motors, tools, etc.)

WASTE PACKAGING: The waste is double bagged prior to placement in 55-gallon drums. The drum is lined with two 5-mil polyethylene bags. Occasionally a 1/8-inch poly liner is used in the packaging of heavy, bulky, sharp-edged metal items (liner is used without a lid). All bag closures are by the twist and tape method.

If drums are overpacked in Standard Waste Boxes (SWB), no sealed liner bags are used in the SWB.

ASSAY: Each waste item is assayed prior to placement into a drum. The filled drum is then assayed. All assays are performed by means of a thermal neutron coincidence counter or segmented gamma scan counter according to written procedures. Which instrument is used depends on the matrix and nuclide content of the drum. The results of the assay are expressed in terms of grams of each radionuclide present. Assay results are used to calculate Pu-239 fissile equivalent (plus error) and decay heat (plus error).

FREE LIQUIDS: Visual inspections of each waste item for free liquids are performed by certified TRU waste inspectors in accordance with written and approved procedures. Special emphasis during waste inspection is always applied to containers such as bottles and cans. Real-time radiography (RTR) examination of a sample of these drums will be performed to verify that free liquids are not present

EXPLOSIVE/COMPRESSED GASES: Explosives are prohibited at TA-55. Only used pressure vessels or spray cans could potentially contain gases under pressure, and they are blocked open by certified TRU waste inspectors in accordance with written and approved procedures.

PYROPHORIC: No pyrophoric materials will be present as determined by visual inspection of each waste item by certified TRU waste inspectors in accordance with written and approved procedures.

CORROSIVES: Visual inspections of each waste item for corrosives materials are performed by certified TRU waste inspectors in accordance with written and approved procedures. Corrosive materials identified during this inspection are either neutralized or diverted from the waste stream.

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 listed and restricted to the tables found in Appendix 1.3.7 of the SAR.

ADDITIONAL CRITERIA: Each drum will be fitted with a carbon composite filter, and the rigid liner will be punctured (if present). Each SWB is fitted with at least two and up to four carbon composite filters.

SHIPPING CATEGORY: This content code has the waste packaged in a maximum of four layers of plastic bags in 55-gallon drums or drums overpacked in a SWB. In a drum, at least one layer of plastic is a drum liner bag. This content code has been assigned shipping categories III.1A4 (drums) and III.1B4 (SWB overpack).

ANALYTICAL CATEGORY - MAXIMUM ALLOWABLE WATTAGE: The maximum allowable wattage is 0.0207 for a single drum and 0.0196 for an overpacked drum. (See Table 6-1.) The maximum wattage per TRUPACT-II is 0.2898 for drums and 0.1568 for overpacked drums. (See Table 6-2.)

TEST CATEGORY - MAXIMUM ALLOWABLE WATTAGE: The maximum allowable wattage is 20 per drum and per TRUPACT-II. (See Table 6-3.)

CORRELATION TABLE: This content code has previously been identified as the following IDC:

IDC	DESCRIPTION	WASTE GENERATOR
005 P1	TRU Leaded Rubber and Metal Waste	Los Alamos National Lab

CONTENT CODE: LA 124A

CONTENT DESCRIPTION: TRU Pyrochemical Salt

GENERATING SITE: Los Alamos National Laboratory

WASTE DESCRIPTION: TRU pyrochemical salt waste is generated from plutonium processing activities at the Los Alamos Plutonium Facility (TA-55). The resultant TRU pyrochemical salt waste is packaged as content code LA 124A.

GENERATING SOURCE: The waste originates from Technical Area-55 (TA-55) at LANL.

WASTE FORM: TRU pyrochemical salt waste consists of used chloride salts from pyrochemical processes such as electrorefining, molten salt extraction, salt stripping, fluoride reduction, direct oxide reduction, etc., which may contain some small fraction of combustible waste such as plastics (mainly packaging), etc.

WASTE PACKAGING: The waste is packaged in tin or stainless steel cans and bagged-out in one layer of plastic prior to placement in the 55-gallon drum. The drum is lined with two 5-mil polyethylene bags. All bag closures are by the twist and tape method.

If drums are overpacked in Standard Waste Boxes (SWB), no sealed liner bags are used in the SWB.

ASSAY: Each waste item is assayed prior to placement into a drum. The filled drum is then assayed. All assays are performed by means of a thermal neutron coincidence counter or segmented gamma scan counter according to written procedures. Which instrument is used depends on the matrix and nuclide content of the drum. The results of the assay are expressed in terms of grams of each radionuclide present. Assay results are used to calculate Pu-239 fissile equivalent (plus error) and decay heat (plus error).

FREE LIQUIDS: Visual inspections of each waste item for free liquids are performed by certified TRU waste inspectors in accordance with written and approved procedures. Special emphasis during waste inspection is always applied to containers such as bottles and cans. Real-time radiography (RTR) examination of a sample of these drums will be performed to verify that free liquids are not present.

EXPLOSIVE/COMPRESSED GASES: Explosives are prohibited at TA-55. Only used pressure vessels or spray cans could potentially contain gases under pressure, and they are blocked open by certified TRU waste inspectors in accordance with written and approved procedures.

PYROPHORIC: No pyrophoric materials will be present as determined by visual inspection of each waste item by certified TRU waste inspectors in accordance with written and approved procedures. Any small amounts of pyrophoric materials that could be present in the content code are oxidized at high temperatures in the presence of oxygen.

CORROSIVES: Visual inspections of each waste item for corrosives materials are performed by certified TRU waste inspectors in accordance with written and approved procedures. Corrosive materials identified during this inspection are either neutralized or diverted from the waste stream.

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 listed and restricted to the tables found in Appendix 1.3.7 of the SAR.

ADDITIONAL CRITERIA: Each drum will be fitted with a carbon composite filter, and the rigid liner will be punctured (if present). Each SWB is fitted with at least two and up to four carbon composite filters.

SHIPPING CATEGORY: This content code has been packaged with a metal can as the innermost layer of confinement in a 55-gallon drum or drums overpacked in a SWB. This content code has been assigned shipping categories II.2AM (drums) and II.2BM (SWB overpack).

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ANALYTICAL CATEGORY - MAXIMUM ALLOWABLE WATTAGE: The maximum allowable wattage is 40.0 for a single drum and 40.0 for an overpacked drum. (See Table 6-1.) The maximum wattage per TRUPACT-II is 40.0 for drums and 40.0 for overpacked drums. (See Table 6-2.)

CORRELATION TABLE: This content code has previously been identified as the following IDC:

IDC	DESCRIPTION	WASTE GENERATOR
005 P2S	TRU Pyrochemical Salt Waste	Los Alamos National Lab

CONTENT CODE: LA 125A

CONTENT DESCRIPTION: Mixed Metal Scrap and Incidental Combustibles

GENERATING SITE: Los Alamos National Laboratory - Size Reduction Facility (SRF).

WASTE DESCRIPTION: The waste contains metal equipment, either whole or sectioned, along with its combustible components, and the small volumes of combustibles generated during decommissioning, sectioning and packaging.

GENERATING SOURCE: The waste originates from Technical Area-54 (TA-54) at LANL.

WASTE FORM: Input to the SRF is mostly gloveboxes, process equipment, and ductwork from decommissioning operations. Gloveboxes may come complete with gloves, wiring, plastic or glass windows, plastic wrapping and lead shielding.

WASTE PACKAGING: The waste is placed into a Standard Waste Box (SWB). A 12-mil vinyl (PVC) sleeve is used with as a bag-out bag with one end sealed directly to the inside of the SWB body. After the SWB is filled, the vinyl sleeve is gathered with a hose clamp and cut to form a horsetail. This sleeve is not considered to be part of the packaging.

ASSAY: Input radionuclide content is based on a completed Radioactive Solid Waste Disposal Record (RSWDR), which contains the weight, volume, a description of the waste, and the radionuclide content. Each SWB will then be assayed by a passive-active neutron (PAN) assay system to determine the radionuclide content prior to shipment to WIPP. Assay results are used to calculate Pu-239 fissile equivalent (plus error) and decay heat (plus error).

FREE LIQUIDS: The input waste to the SRF is normally dry. The input waste is visually inspected for free liquids during disassembly. Nothing in the size reduction process produces sludges, pyrophoric material, compressed gases or explosives. However, if any free liquids are detected, they are collected and solidified in one-gallon tin cans by stirring with either gypsum or portland cement. The resulting container(s) of concrete is tested for proper solidification by probing with a rod; then it is placed into the output SWB with the waste it came from.

EXPLOSIVES/COMPRESSED GASES: Explosives and compressed gases are prohibited in this input waste. Absence of forbidden materials is visually verified by the SRF operator in accordance with written and approved procedures.

PYROPHORIC: Pyrophorics are prohibited in this input waste. Absence of forbidden materials is visually verified by the SRF operator in accordance with written and approved procedures. No pyrophoric materials have ever been identified in the material. Pyrophorics are prohibited by SRF TRU Waste Operating Procedures.

CORROSIVES: SRF procedural controls require the SRF operators to bring to the attention of the TRU Waste Operation Section Leader any unusual chemical material found during inspection/disassembly of the input waste. The TRU Waste Operations Section Leader will identify whether the material meets the criteria for corrosivity in 40 CFR 261 and specify its disposition (e.g., neutralization/solidification).

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 listed and restricted to the tables found in Appendix 1.3.7 of the SAR.

ADDITIONAL CRITERIA: The SWB is fitted with at least two and up to four carbon composite filters.

SHIPPING CATEGORY: This content code has only a plastic sleeve attached to the inside walls of the SWB at the bottom and gathered with a hose clamp at the top. This content code is assigned to shipping category III.1C1.

ANALYTICAL CATEGORY - MAXIMUM ALLOWABLE WATTAGE: The maximum allowable wattage is 0.3515 for a single Standard Waste Box. (See Table 6-1.) The maximum wattage per TRUPACT-II is 0.7030 for Standard Waste Boxes. (See Table 6-2.)

CORRELATION TABLE: This content code has previously been identified as the following IDC:

IDC	DESCRIPTION	WASTE GENERATOR
001	Mixed Metal Scrap and Incidental Combustibles	Los Alamos National Lab

CONTENT CODE: LA 126A

CONTENT DESCRIPTION: Solidified Organic Process Solids

GENERATING SITE: Los Alamos National Laboratory

WASTE DESCRIPTION: Aqueous effluent and leached solids are from the processing of plutonium at the Los Alamos Plutonium Facility (TA-55). The resultant waste is immobilized in gypsum cement as content code LA 114A.

GENERATING SOURCE: The waste originates from Technical Area 55 (TA-55) at LANL.

WASTE FORM: Solidified process solids (process residue from evaporator bottom and other discardable solutions, process leached solids, ash, filter cakes, salts, metal oxides, fines, etc.) are immobilized in gypsum cement to form a noncorrosive solid matrix in a 55-gallon drum or one-gallon cans.

WASTE PACKAGING: This content code is placed into a 55-gallon drum prepared as described below:

May 1987 - September 1988: One-Gallon Cement Fixation Process

In the one-gallon cement fixation process, the waste was mixed with a cement powder in one-gallon cans to form a noncorrosive solid matrix. The one-gallon cans served only as mixing containers for the cement parts and not as the ultimate packaging confinement. The one-gallon cans were then packaged in a 55-gallon drum. The packaging within the drum included a 1/16-inch thick lead sheet, a 5-mil polyethylene bag, and a 12-mil PVC vinyl bag that contains the cans. The lead serves as a shielding material for gamma radiation to reduce personnel exposure during drum mixing and subsequent drum handling. The lead shielding consists of two disks, placed at the top and bottom of a 1/16-inch thick lead sheet fitted to the inside circumference of the drum wall. All bag closures are by the twist and tape method.

July 1983 - Present: 55-Gallon Cement Fixation Process

In the 55-gallon cement fixation process, the waste is mixed with a cement powder in a 1/8-inch thick polyethylene mixing container to form a noncorrosive solid monolith. The mixing container is used only as a container for the cement paste and is not considered as an integral part of the packaging. The packaging within the drum includes a 1/16-inch thick lead sheet and two 12-mil PVC vinyl bags. The inner 12-mil bag contains the 1/8-inch poly mixing container. One or more 2-inch thick styrofoam disks are placed on top of the 12-mil outer bag as bracing for the top lead disk. The lead serves as a shielding material for gamma radiation to reduce personnel exposure during drum mixing and subsequent drum handling. The lead shielding consists of two disks, placed at the top and bottom of a 1/16-inch thick lead sheet fitted to the inside circumference of the drum wall. All bag closures are by the twist and tape method.

If drums are overpacked in Standard Waste Boxes (SWB), no sealed liner bags are used in the SWB.

ASSAY: Aqueous effluent and other discardable solutions are sampled for analysis by radiochemical assay methods. Process leached solids, ash, filter cake, salts, metal oxides and other leachable solids are assayed by means of a thermal neutron coincidence counter or segmented gamma scan counter according to written procedures. The results of the assays are expressed in the terms of grams of each radionuclide present. Assay results are used to calculate Pu-239 fissile equivalent (plus error) and decay heat (plus error).

FREE LIQUIDS: The TRU aqueous effluent is cast into a solid monolith by mixing with gypsum cement in a controlled process per written procedures. Each monolith drum is inspected for hardness and the absence of free liquids prior to drum closure. The final concrete waste form contains no free liquids.

EXPLOSIVE/COMPRESSED GASES: Neither the ingredients nor the finished cement are explosive. Explosives are neither used nor permitted within TA-55. All materials entering TA-55 are inspected by Protective Force personnel at the front gate. No pressure vessels or spray cans that can contain gases under pressure enter these waste streams. Strong acids that might react with other materials to generate gases are neutralized so that reaction is no longer possible. All waste packages are vented.

PYROPHORIC: All pyrophorics will be passivated prior to mixing with aqueous solution-cement powder combinations. Any pyrophorics placed in this aqueous system would react with the water. Immobilization in cement renders pyrophorics non-reactive.

CORROSIVES: All aqueous effluents and other discardable solutions are neutralized to a pH between 2 and 6 with a caustic solution per written procedures. This neutralized solution is then mixed with gypsum cement to form a noncorrosive solid monolith.

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 listed and restricted to the tables found in Appendix 1.3.7 of the SAR.

ADDITIONAL CRITERIA: Each drum will be fitted with a carbon composite filter, and the rigid liner will be punctured (if present). Each SWB is fitted with at least two and up to four carbon composite filters.

SHIPPING CATEGORY: This content code has the waste packaged in a maximum of two layers of plastic bags in 55-gallon drums or drums overpacked in a SWB. In a drum, at least one layer of plastic is a drum liner bag. This content code has been assigned shipping categories III.1A2 (drums) and III.1B2 (SWB overpack).

ANALYTICAL CATEGORY - MAXIMUM ALLOWABLE WATTAGE: The maximum allowable wattage is 0.0434 for a single drum and 0.0387 for an overpacked drum. (See Table 6-1.) The maximum wattage per TRUPACT-II is 0.6076 for drums and 0.3096 for overpacked drums. (See Table 6-2.)

TEST CATEGORY - MAXIMUM ALLOWABLE WATTAGE: The maximum allowable wattage is 20 per drum and per TRUPACT-II. (See Table 6-3.)

CORRELATION TABLE: This content code has previously been identified as the following IDC:

IDC	DESCRIPTION	WASTE GENERATOR
006	Solidified Organic Process Solids	Los Alamos National Lab

CONTENT CODE: LA 211A

CONTENT DESCRIPTION: Cemented Aqueous Waste

GENERATING SITE: Los Alamos National Laboratory

WASTE DESCRIPTION: Aqueous effluent from the processing of plutonium at the Los Alamos Plutonium Facility (TA-55) was treated in room 60 of TA-50-1. The resultant sludge was packaged as content code LA 211A. The final waste product was obtained by mixing the TRU sludge with portland cement.

GENERATING SOURCE: The waste originates from Technical Area 50-1 (TA-50-1) at LANL.

WASTE FORM: Solidified aqueous waste was the residue from treating blended acidic and caustic aqueous liquid radioactive waste by use of calcium hydroxide, ferric sulfate, and a flocculation aid. This treatment produced a thin caustic sludge (approximately 25% solids) that was always alkaline and compatible with portland cement. The final cemented waste monolith was produced by tumbling 55-gallon drums containing empirically determined quantities of sludge, portland cement, vermiculite and sodium silicate.

WASTE PACKAGING: The waste was placed into a 55-gallon drum. A 5-mil polyethylene sleeve was installed in the drum for contamination control while adding the sludge. This sleeve is not considered to be part of the packaging because the bottom of the sleeve is open, and the top is simply folded over and not taped.

If drums are overpacked in Standard Waste Boxes (SWB), no sealed liner bags are used in the SWB.

ASSAY: A sample of the sludge from each batch was taken to determine the amount and identity of the radionuclides in the sludge. The sludge sample was analyzed using a radiochemical assay method. The results of the analysis were expressed in terms of curies of each radionuclide present. Assay results are used to calculate Pu-239 fissile equivalent (plus error) and decay heat (plus error).

FREE LIQUIDS: The TRU sludge was cast into a solid monolith by mixing portland cement and sludge in a controlled process per written procedures. The final concrete waste form contains no free liquids. Inspected drums have demonstrated that all liquid is fixed in the concrete. Each drum will be real-time radiographed to assure the absence of free liquids prior to shipment to WIPP.

EXPLOSIVE/COMPRESSED GASES: The waste was produced in a closed system which precluded any mechanism in the process for producing compressed gas or the introduction of extraneous material such as pressure vessels or explosives. In addition, neither the ingredients nor the finished concrete are explosives. Explosives are prohibited at the TA-50-1 where this waste form was generated.

PYROPHORIC: No pyrophoric materials have been identified in this waste form. Pyrophorics were prohibited by waste packaging procedures.

CORROSIVES: This waste exhibits none of the characteristics specified in 40 CFR 261 (Subpart C) and is not listed in Subpart D. Ferric sulfate and sodium hydroxide are corrosive when in solution, but the final form of the waste is a dry, solid concrete monolith.

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 listed and restricted to the tables found in Appendix 1.3.7 of the SAR.

PAYLOAD CONTAINER VENTING AND ASPIRATION: The payload containers in this content code will be aspirated using one of the three options described in Appendix 3.6.11 of the SAR. Aspiration times are shown in Table 7 for Option 1 (the headspace is not sampled for gases), Table 8 for Option 2 (the headspace is sampled at time of venting), and Table 9 for Option 3 (the headspace is sampled at least two weeks after venting).

ADDITIONAL CRITERIA: Upon retrieval from storage, each drum will be fitted with a carbon composite filter, and the rigid liner will be punctured (if present). Each SWB is fitted with at least two and up to four carbon composite filters.

SHIPPING CATEGORY: This content code is packaged in 55-gallon drums with only an open plastic sleeve which is not taped. This content code is assigned to the shipping categories I.2A0 (drums) and I.2B0 (SWB overpack).

ANALYTICAL CATEGORY - MAXIMUM ALLOWABLE WATTAGE: The maximum allowable wattage is 0.2536 for a single drum and 0.1793 for an overpacked drum. (See Table 6-1.) The maximum wattage per TRUPACT-II is 3.5504 for drums and 1.4344 for overpacked drums. (See Table 6-2.)

TEST CATEGORY - MAXIMUM ALLOWABLE WATTAGE: The maximum allowable wattage is 10 per drum and per TRUPACT-II. (See Table 6-3.)

CORRELATION TABLE: This content code has previously been identified as the following IDC:

IDC	DESCRIPTION	WASTE GENERATOR
002	Solidified Aqueous Waste	Los Alamos National Lab

CONTENT CODE: LA 211B

CONTENT DESCRIPTION: Solidified Aqueous Waste

GENERATING SITE: Los Alamos National Laboratory

WASTE DESCRIPTION: Aqueous effluent from plutonium processing activities at the Los Alamos Plutonium Facility (TA-55) was treated in building TA-50-1. The resultant sludge was packaged as content code LA 211B.

GENERATING SOURCE: The waste originates from TA-50-1 (LANL Liquid Waste Treatment Facility)

WASTE FORM: The sludge was produced by vacuum filtration of solids from pretreated aqueous waste slurry. The filter agent was an inert diatomaceous earth medium that accumulates on a rotation drum. Solids were trapped on the surfaces of the filter medium as the pretreated solution passed through. The surface of the filter medium with entrapped filtrate was skimmed off as wet sludge. The precipitated solids were chiefly metallic hydroxides with a ph of 10-12.

WASTE PACKAGING: The waste was placed into a 55-gallon drum. As stored from 1979-1987, the drum was lined with a 90-mil thick HDPE liner and a 5-mil polyethylene bag. The 5-mil polyethylene bag was not considered as a part of the waste packaging but was used for contamination control. In addition, this bag was not sealed with tape.

If drums are overpacked in Standard Waste Boxes (SWB), no sealed liner bags are used in the SWB.

ASSAY: A sample of the sludge from each batch was taken to determine the amount and identity of the radionuclides in the sludge. The sludge sample was analyzed using a radiochemical assay method. The results of the analysis were expressed in terms of curies of each radionuclide present. Assay results are used to calculate Pu-239 fissile equivalent (plus error) and decay heat (plus error).

FREE LIQUIDS: The prepared drum was initially filled with approximately 6-8 pounds of portland cement. The sludge was then placed into the drum and an additional 6-8 pounds of cement was then added on top of the sludge. The portland cement was used to absorb any free liquids that may have come out of the sludge during storage at LANL. Recent studies conducted at LANL on these drums have shown the absence of any free liquids as defined by the WIPP WAC. Each drum will be examined by real-time radiography (RTR) to ensure the continued absence of any free liquids prior to shipment to WIPP.

EXPLOSIVES/COMPRESSED GASES: The waste was produced in a closed system which precluded the introduction of extraneous materials such as pressure vessels or explosives. No explosives, explosive mixture or compressed gases have been identified in this waste. Explosives are prohibited at TA-50-1 where this waste form was generated.

PYROPHORIC: No pyrophoric materials have been identified in this waste form. Pyrophorics are prohibited by waste procedures.

CORROSIVES: No corrosives materials have been identified in this waste. Precipitated sludges are chiefly hydroxides with a ph of 10-12. Using the WIPP WAC for corrosivity in 40 CFR 261, this waste form is not considered a corrosive.

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 listed and restricted to the tables found in Appendix 1.3.7 of the SAR.

PAYLOAD CONTAINER VENTING AND ASPIRATION: The payload containers in this content code will be aspirated using one of the three options described in Appendix 3.6.11 of the SAR. Aspiration times are shown in Table 7 for Option 1 (aspiration time based on date of drum closure), Table 8 for Option 2 (headspace gas sampling at the time of venting), and Table 9 for Option 3 (headspace gas sampling during aspiration.)

ADDITIONAL CRITERIA: Upon retrieval from storage, each drum will be fitted with a carbon composite filter, and the rigid liner will be punctured (if present). Each SWB is fitted with at least two and up to four carbon composite filters.

SHIPPING CATEGORY: This content code is packaged in 55-gallon drums with only one plastic bag that is not taped, but only folded over the waste. This content code is assigned to the shipping categories I.2A0 (drums) and I.2B0 (SWB overpack).

ANALYTICAL CATEGORY - MAXIMUM ALLOWABLE WATTAGE: The maximum allowable wattage is 0.2536 for a single drum and 0.1793 for an overpacked drum. (See Table 6-1.) The maximum wattage per TRUPACT-II is 3.5504 for drums and 1.4344 for overpacked drums. (See Table 6-2.)

TEST CATEGORY - MAXIMUM ALLOWABLE WATTAGE: The maximum allowable wattage is 10 per drum and per TRUPACT-II. (See Table 6-3.)

CORRELATION TABLE: This content code has previously been identified as the following IDC:

IDC	DESCRIPTION	WASTE GENERATOR
003	Dewatered Sludge	Los Alamos National Lab

LANL TRUCON Code Chemical Compositions

Los Alamos National Laboratory
List of Chemicals and Materials
in TRU Waste Content Codes

Content Codes LA 111A, LA 211A
IDC 002

CEMENTED AQUEOUS WASTE

GROUP 4: ALCOHOLS AND GLYCOLS

ETHANOL	T3
METHANOL	T3

GROUP 10: CAUSTICS
(Constituents reacted prior to loading in payload containers.)

AMMONIUM HYDROXIDE	T2
BARIUM HYDROXIDE	T3
BERYLLIUM HYDROXIDE	T2
CALCIUM OXIDE	T2
POTASSIUM HYDROXIDE	T2
SODIUM CARBONATE	T2
SODIUM HYDROXIDE	T2

GROUP 15: FLUORIDES, INORGANIC
(Constituents reacted prior to loading in payload containers.)

AMMONIUM FLUORIDE	T2
CALCIUM FLUORIDE	T2
POTASSIUM FLUORIDE	T2

GROUP 19: KETONES

METHYL ETHYL KETONE	T3

GROUP 24: METALS AND METAL COMPOUNDS, TOXIC

ARSENIC	T3
BARIUM CHLORIDE	T3
BARIUM HYDROXIDE	T3
BERYLLIUM	T3
BERYLLIUM HYDROXIDE	T2
CADMIUM	T3
LEAD	T3

D - Dominant Component (>10 % by wt.)
M - Minor Component (1 - 10 % by wt.)
T - Trace Component (<1 % by wt.)
T1 - Trace Component (<0.1 % by wt.)
T2 - Trace Component (low PPM range)
T3 - Trace Component (<1 PPM range)

Los Alamos National Laboratory
List of Chemicals and Materials
in TRU Waste Content Codes

Content Codes LA 111A, LA 211A
(Continued)
IDC 002

CEMENTED AQUEOUS WASTE

GROUP 24: METALS AND METAL COMPOUNDS, TOXIC (CONTINUED)

MERCURY	T3

GROUP 101: COMBUSTIBLE AND FLAMMABLE MATERIALS, MISCELLANEOUS

RUBBER GLOVES	T2

GROUP 102: EXPLOSIVES
(Constituents reacted prior to loading in payload containers.)

AMMONIUM NITRATE	T2

GROUP 104: OXIDIZING AGENTS, STRONG
(Constituents reacted prior to loading in payload containers.)

SODIUM NITRATE	T2

GROUP 106: WATER AND MIXTURES CONTAINING WATER

AQUEOUS SOLUTIONS AND MIXTURES	T1
WATER	T1

GROUP 107: WATER REACTIVE SUBSTANCES
(Constituents reacted prior to loading in payload containers.)

CALCIUM OXIDE	T2

OTHER SOLIDIFICATION MATERIAL/ABSORBENTS

CALCIUM SILICATE (Water glass - Na silicate)	M
PORTLAND CEMENT (Hydrated)	D
VERMICULITE	M

D - Dominant Component (>10 % by wt.)
M - Minor Component (1 - 10 % by wt.)
T - Trace Component (<1 % by wt.)
T1 - Trace Component (<0.1 % by wt.)
T2 - Trace Component (low PPM range)
T3 - Trace Component (<1 PPM range)

Los Alamos National Laboratory
List of Chemicals and Materials
in TRU Waste Content Codes

Content Codes LA 111B, LA 211B
IDC 003

SOLIDIFIED AQUEOUS WASTE

GROUP - ALCOHOLS AND GLYCOLS

ETHANOL	T3
ISOPROPANOL	T3

GROUP 10: CAUSTICS
(Constituents reacted prior to loading in payload containers.)

AMMONIUM HYDROXIDE	T2
BARIUM HYDROXIDE	T3
BERYLLIUM HYDROXIDE	T3
CALCIUM OXIDE	T2
POTASSIUM HYDROXIDE	T2
SODIUM CARBONATE	T2
SODIUM HYDROXIDE	T2

GROUP 15: FLUORIDES, INORGANIC
(Constituents reacted prior to loading in payload containers.)

AMMONIUM FLUORIDE	T2
CALCIUM FLUORIDE	T2
POTASSIUM FLUORIDE	T2

GROUP 19: KETONES

ACETONE	T3
METHYL ACETONE	T3
METHYL ETHYL KETONE	T3

GROUP 24 METALS AND METAL COMPOUNDS, TOXIC

ARSENIC	T3
BARIUM CHLORIDE	T3
BARIUM HYDROXIDE	T3
BERYLLIUM	T3
BERYLLIUM HYDROXIDE	T3

D - Dominant Component (>10 % by wt.)
M - Minor Component (1 - 10 % by wt.)
T - Trace Component (<1 % by wt.)
T1 - Trace Component (<0.1 % by wt.)
T2 - Trace Component (low PPM range)
T3 - Trace Component (<1 PPM range)

Los Alamos National Laboratory
List of Chemicals and Materials
in TRU Waste Content Codes

Content Codes LA 111B, LA 211B
(Continued)
IDC 003

SOLIDIFIED AQUEOUS WASTE

GROUP 24: METALS AND METAL COMPOUNDS, TOXIC (CONTINUED)

CADMIUM	T3
LEAD	T3
MERCURY	T3

GROUP 29: HYDROCARBON, ALIPHATIC, SATURATED

OILS (C6 TO C20)	T2

GROUP 101: COMBUSTIBLE AND FLAMMABLE MATERIALS, MISCELLANEOUS

GREASE	T2
OIL	T2
POLYETHYLENE (Packaging Material)	T3
RESINS	T2

GROUP 102: EXPLOSIVES
(Constituents reacted prior to loading in payload containers.)

AMMONIUM NITRATE	T2

GROUP 104: OXIDIZING AGENTS, STRONG
(Constituents reacted prior to loading in payload containers.)

SODIUM NITRATE	T2

GROUP 106: WATER AND MIXTURES CONTAINING WATER

AQUEOUS SOLUTIONS AND MIXTURES	T1
WATER	T1

D - Dominant Component (>10 % by wt.)
M - Minor Component (1 - 10 % by wt.)
T - Trace Component (<1 % by wt.)
T1 - Trace Component (<0.1 % by wt.)
T2 - Trace Component (low PPM range)
T3 - Trace Component (<1 PPM range)

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Los Alamos National Laboratory
List of Chemicals and Materials
in TRU Waste Content Codes

Content Codes LA 111B, LA 211B
(Continued)
IDC 003

SOLIDIFIED AQUEOUS WASTE

GROUP 107: WATER REACTIVE SUBSTANCES
(Constituents reacted prior to loading in payload containers.)

CALCIUM OXIDE	T2

OTHER INORGANICS

CALCIUM CARBONATE	M
FERRIC HYDROXIDE	M
PERLITE	M
SALT	T2

OTHER SOLIDIFICATION MATERIAL/ABSORBENTS

PERLITE	M
PORTLAND CEMENT (Hydrated)	M

D - Dominant Component (>10 % by wt.)
M - Minor Component (1 - 10 % by wt.)
T - Trace Component (<1 % by wt.)
T1 - Trace Component (<0.1 % by wt.)
T2 - Trace Component (low PPM range)
T3 - Trace Component (<1 PPM range)

Los Alamos National Laboratory
List of Chemicals and Materials
in TRU Waste Content Codes

Content Code LA 114A
IDC 006

SOLIDIFIED INORGANIC PROCESS SOLIDS

GROUP 1: ACIDS, MINERAL, NON-OXIDIZING
(Constituents reacted prior to loading in payload containers.)

HYDROCHLORIC ACID	T2
HYDROFLUORIC ACID	T2
NITRIC ACID	T2
PHOSPHORIC ACID	T2
SULFURIC ACID (<70%)	T2

GROUP 2: ACIDS, MINERAL, OXIDIZING
(Constituents reacted prior to loading in payload containers.)

NITRIC ACID	T2
PERCHLORIC ACID	T2

GROUP 3: ACIDS, ORGANIC
(Constituents reacted prior to loading in payload containers.)

OXALIC ACID	T2

GROUP 4: ALCOHOLS AND GLYCOLS

ETHANOL	T2
METHANOL	T2

GROUP 7: AMINES, ALIPHATIC AND AROMATIC

HYDROXYLAMINE	T2

GROUP 10: CAUSTICS
(Constituents reacted prior to loading in payload containers.)

CALCIUM OXIDE	T1
POTASSIUM HYDROXIDE	T2
SODIUM HYDROXIDE	T2

D = Dominant Component (>10 % by wt.)
M = Minor Component (1 - 10 % by wt.)
T = Trace Component (<1 % by wt.)
T1 = Trace Component (<0.1 % by wt.)
T2 = Trace Component (low PPM range)
T3 = Trace Component (<1 PPM range)

Los Alamos National Laboratory
List of Chemicals and Materials
in TRU Waste Content Codes

Content Code LA 114A
(Continued)
IDC 006

SOLIDIFIED INORGANIC PROCESS SOLIDS

GROUP 15: FLUORIDES, INORGANIC
(Constituents reacted prior to loading in payload containers

CALCIUM FLUORIDE	T1
HYDROFLUORIC ACID	T2

GROUP 17: HALOGENATED ORGANICS

1,1,1-TRICHLOROETHANE	T2
BROMOFORM	T2
CARBON TETRACHLORIDE	T2
DICHLOROETHANE	T2
TRICHLOROETHYLENE	T2

GROUP 21: METALS, ALKALI AND ALKALINE EARTH, ELEMENTAL AND ALLOYS
(Constituents reacted prior to loading in payload containers

CALCIUM	T

GROUP 23: METALS, OTHER ELEMENTAL AND ALLOYS, AS SHEETS, RODS, MOLDINGS, DROPS, ETC.

IRON	T3
STAINLESS STEEL	T3
TANTALUM	T2

GROUP 24: METALS AND METAL COMPOUNDS, TOXIC

ARSENIC	T2
BERYLLIUM	T2
CADMIUM	T2
LEAD	T1
MERCURY	T2

D = Dominant Component (>10 % by wt.)
M = Minor Component (1 - 10 % by wt.)
T = Trace Component (<1 % by wt.)
T1 = Trace Component (<0.1 % by wt.)
T2 = Trace Component (low PPM range)
T3 = Trace Component (<1 PPM range)

Los Alamos National Laboratory
List of Chemicals and Materials
in TRU Waste Content Codes

Content Code LA 114A
(Continued)
IDC 006

SOLIDIFIED INORGANIC PROCESS SOLIDS

GROUP 27: NITRO COMPOUNDS
(Constituents reacted prior to loading in payload containers.)

NITROCELLULOSE	T2
UREA NITRATE	T2

GROUP 29: HYDROCARBON, ALIPHATIC, SATURATED

OILS (C6 TO C20)	T2

GROUP 101: COMBUSTIBLE AND FLAMMABLE MATERIALS, MISCELLANEOUS

CELLULOSE	T1
OIL	T2
POLYETHYLENE (Packaging Material)	T1
POLYPROPYLENE (Ful-Flo Filters)	T
POLYVINYL CHLORIDE (Packaging Material)	T1
RESINS	T1
RUBBER GLOVES, LEADED	T1
SYNTHETIC RUBBER	T2
WOOD	T2

GROUP 102: EXPLOSIVES
(Constituents reacted prior to loading in payload containers.)

AMMONIUM NITRATE	T
NITROCELLULOSE	T2

GROUP 104: OXIDIZING AGENTS, STRONG
(Constituents reacted prior to loading in payload containers.)

HYDROGEN PEROXIDE	T2
OTHER NITRATE SALTS	M
SODIUM NITRATE	D

D - Dominant Component (>10 % by wt.)
M - Minor Component (1 - 10 % by wt.)
T - Trace Component (<1 % by wt.)
T1 - Trace Component (<0.1 % by wt.)
T2 - Trace Component (low PPM range)
T3 - Trace Component (<1 PPM range)

Los Alamos National Laboratory
List of Chemicals and Materials
in TRU Waste Content Codes

Content Code LA 114A
(Continued)
IDC 006

SOLIDIFIED INORGANIC PROCESS SOLIDS

GROUP 106: WATER AND MIXTURES CONTAINING WATER

AQUEOUS SOLUTIONS AND MIXTURES	T1
WATER	T1

GROUP 107: WATER REACTIVE SUBSTANCES
(Constituents reacted prior to loading in payload containers.)

CALCIUM OXIDE	T1

OTHER ORGANICS

MOLDS AND CRUCIBLES, GRAPHITE	T

OTHER INORGANICS

ASH	M
FIREBRICK	T1
GLASS, LABWARE	T
GRIT	T1
INSULATION	T2
MOLDS AND CRUCIBLES, CERAMIC	T
SALT (Calcium Fluoride and Calcium Chloride)	T1
SAND	T1
SLAG	T1
SOOT	T2

OTHER SOLIDIFICATION MATERIAL/ABSORBENTS

ENVIROSTONE	D
OXALATE SALTS	M
SURFACTANTS	T1
VERMICULITE	T1

D - Dominant Component (>10 % by wt.)
M - Minor Component (1 - 10 % by wt.)
T - Trace Component (<1 % by wt.)
T1 - Trace Component (<0.1 % by wt.)
T2 - Trace Component (low PPM range)
T3 - Trace Component (<1 PPM range)

Los Alamos National Laboratory
List of Chemicals and Materials
in TRU Waste Content Codes

Content Code LA 115A
IDC 005 P2G

GRAPHITE WASTE

GROUP 22: METALS, OTHER ELEMENTAL AND ALLOYS IN THE FORM OF POWDERS, VAPORS OR SPONGES	
MERCURY (VAPOR)	T2
NICKEL	T2
ZIRCONIUM	T2
GROUP 23: METALS, OTHER ELEMENTAL AND ALLOYS, AS SHEETS, RODS, MOLDINGS, DROPS, ETC.	
ALUMINUM	T1
COPPER	T1
IRON	T2
LEAD	T2
STAINLESS STEEL	T1
TANTALUM	T1
ZIRCONIUM	T2
GROUP 24: METALS AND METAL COMPOUNDS, TOXIC	
ARSENIC	T2
BERYLLIUM	T2
BERYLLIUM HYDROXIDE	T2
CADMIUM	T2
COPPER	T1
LEAD	T2
MERCURY	T2
ZIRCONIUM	T2
GROUP 101: COMBUSTIBLE AND FLAMMABLE MATERIALS, MISCELLANEOUS	
BAKELITE	T1
BENELEX	T1
PLEXIGLAS	T1
POLYETHYLENE (Packaging Material)	T1
POLYPROPYLENE	T1

D = Dominant Component (>10 % by wt.)
M = Minor Component (1 - 10 % by wt.)
T = Trace Component (<1 % by wt.)
T1 = Trace Component (<0.1 % by wt.)
T2 = Trace Component (low PPM range)
T3 = Trace Component (<1 PPM range)

Los Alamos National Laboratory
List of Chemicals and Materials
in TRU Waste Content Codes

Content Code LA 115A
(Continued)
IDC 005 P2G

GRAPHITE WASTE

GROUP 101: COMBUSTIBLE AND FLAMMABLE MATERIALS, MISCELLANEOUS (CONTINUED

POLYVINYL CHLORIDE (Packaging Material)	T1

OTHER ORGANICS

MOLDS AND CRUCIBLES, GRAPHITE	D

OTHER INORGANICS

ASH	T1
FIREBRICK	T
GLASS, LABWARE	T1
GRIT	T1
SLAG	T1
SOOT	T1

D - Dominant Component (>10 % by wt.)
M - Minor Component (1 - 10 % by wt.)
T - Trace Component (<1 % by wt.)
T1 - Trace Component (<0.1 % by wt.)
T2 - Trace Component (low PPM range)
T3 - Trace Component (<1 PPM range)

Los Alamos National Laboratory
List of Chemicals and Materials
in TRU Waste Content Codes

Content Code LA 116A
IDC 004

COMBUSTIBLE WASTE

GROUP 1: ACIDS, MINERAL, NON-OXIDIZING
(Constituents reacted prior to loading in payload containers.)

BORIC ACID	T2
HYDROBROMIC ACID	T2
HYDROCHLORIC ACID	T1
HYDROFLUORIC ACID	T1
NITRIC ACID	T1
PHOSPHORIC ACID	T2

GROUP 2: ACIDS, MINERAL, OXIDIZING
(Constituents reacted prior to loading in payload containers.)

NITRIC ACID	T1
PERCHLORIC ACID	T2

GROUP 3: ACIDS, ORGANIC
(Constituents reacted prior to loading in payload containers.)

ACETIC ACID	T2
ASCORBIC ACID	T
CITRIC ACID	T
OXALIC ACID	T1

GROUP 4: ALCOHOLS AND GLYCOLS

ETHANOL	T1
ISOPROPANOL	T2
METHANOL	T2

GROUP 7: AMINES, ALIPHATIC AND AROMATIC

HYDROXYLAMINE	T1

D = Dominant Component (>10 % by wt.
M = Minor Component (1 - 10 % by wt.
T = Trace Component (<1 % by wt.)
T1 = Trace Component (<0.1 % by wt.)
T2 = Trace Component (low PPM range)
T3 = Trace Component (<1 PPM range)

Los Alamos National Laboratory
List of Chemicals and Materials
in TRU Waste Content Codes

Content Code LA 116A
(Continued)
IDC 004

COMBUSTIBLE WASTE

GROUP 10: CAUSTICS
(Constituents reacted prior to loading in payload containers

AMMONIUM HYDROXIDE	T2
BARIUM HYDROXIDE	T2
BERYLLIUM HYDROXIDE	T1
CALCIUM OXIDE	T
POTASSIUM HYDROXIDE	T1
SODIUM CARBONATE	T1
SODIUM HYDROXIDE	T1
SODIUM HYPOCHLORITE	T2

GROUP 15: FLUORIDES, INORGANIC
(Constituents reacted prior to loading in payload containers.)

CALCIUM FLUORIDE	T
HYDROFLUORIC ACID	T2
POTASSIUM FLUORIDE	T2

GROUP 16: HYDROCARBONS, AROMATIC

TOLUENE	T2

GROUP 17: HALOGENATED ORGANICS

1,1,1-TRICHLOROETHANE	T1
BROMOFORM	T2
CARBON TETRACHLORIDE	T2
DICHLOROETHANE	T2
TRICHLOROETHYLENE	T1

GROUP 19: KETONES

ACETONE	T2
THENOYL TRIFLUOROACETONE (TTA)	T

D = Dominant Component (>10 % by wt.)
M = Minor Component (1 - 10 % by wt.)
T = Trace Component (<1 % by wt.)
T1 = Trace Component (<0.1 % by wt.)
T2 = Trace Component (low PPM range)
T3 = Trace Component (<1 PPM range)

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Los Alamos National Laboratory
List of Chemicals and Materials
in TRU Waste Content Codes

Content Code LA 116A
(Continued)
IDC 004

COMBUSTIBLE WASTE

GROUP 102: EXPLOSIVES (CONTINUED)

NITROCELLULOSE	T2

GROUP 104: OXIDIZING AGENTS, STRONG
(Constituents reacted prior to loading in payload containers.)

AMMONIUM PERCHLORATE	T2
BROMINE	T2
HYDROGEN PEROXIDE	T2
SODIUM HYPOCHLORITE	T2
SODIUM NITRATE	T1

GROUP 106: WATER AND MIXTURES CONTAINING WATER

AQUEOUS SOLUTIONS AND MIXTURES	T1
WATER	T1

GROUP 107: WATER REACTIVE SUBSTANCES
(Constituents reacted prior to loading in payload containers.)

ALUMINUM CHLORIDE	T2
CALCIUM OXIDE	T
HYDROBROMIC ACID	T2

OTHER ORGANICS

EDTA	T2
MOLDS AND CRUCIBLES, GRAPHITE	T1

OTHER INORGANICS

ASH	T1
FIREBRICK	T1

D - Dominant Component (>10 % by wt.)
M - Minor Component (1 - 10 % by wt.)
T - Trace Component (<1 % by wt.)
T1 - Trace Component (<0.1 % by wt.)
T2 - Trace Component (low PPM range)
T3 - Trace Component (<1 PPM range)

Los Alamos National Laboratory
List of Chemicals and Materials
in TRU Waste Content Codes

Content Code LA 116A
(Continued)
IDC 004

COMBUSTIBLE WASTE

OTHER INORGANICS (CONTINUED)

GLASS, LABWARE	T1
GRIT	T1
INSULATION	T1
MOLDS AND CRUCIBLES, CERAMIC	T1
OTHER FILTERS	T1
SALT (Nitrates)	T1
SAND	T1
SLAG	T1
SOOT	T2

OTHER SOLIDIFICATION MATERIAL/ABSORBENTS

EMULSIFIERS	T2
ENVIROSTONE	T1
SURFACTANTS	T2
VERMICULITE	T2

D = Dominant Component (>10 % by wt.)
M = Minor Component (1 - 10 % by wt.)
T = Trace Component (<1 % by wt.)
T1 = Trace Component (<0.1 % by wt.)
T2 = Trace Component (low PPM range)
T3 = Trace Component (<1 PPM range)

Los Alamos National Laboratory
List of Chemicals and Materials
in TRU Waste Content Codes

Content Code LA 117A
IDC 005 LM

METAL WASTE

GROUP 1: ACIDS, MINERAL, NON-OXIDIZING
(Constituents reacted prior to loading in payload containers.)

HYDROBROMIC ACID	T2
HYDROCHLORIC ACID	T2
HYDROFLUORIC ACID	T2
NITRIC ACID	T2
PHOSPHORIC ACID	T2
SULFURIC ACID (<70%)	T2

GROUP 2: ACIDS, MINERAL, OXIDIZING
(Constituents reacted prior to loading in payload containers.)

PERCHLORIC ACID	T2

GROUP 3: ACIDS, ORGANIC
(Constituents reacted prior to loading in payload containers.)

ACETIC ACID	T2
OXALIC ACID	T2

GROUP 4: ALCOHOLS AND GLYCOLS

ETHANOL	T2
ISOPROPANOL	T2
METHANOL	T2

GROUP 10: CAUSTICS
(Constituents reacted prior to loading in payload containers.)

AMMONIUM HYDROXIDE	T2
BARIUM HYDROXIDE	T2
CALCIUM OXIDE	T2
POTASSIUM HYDROXIDE	T2
SODIUM CARBONATE	T2
SODIUM HYDROXIDE	T2

D - Dominant Component (>10 % by wt.)
M - Minor Component (1 - 10 % by wt.)
T - Trace Component (<1 % by wt.)
T1 - Trace Component (<0.1 % by wt.)
T2 - Trace Component (low PPM range)
T3 - Trace Component (<1 PPM range)

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Los Alamos National Laboratory
List of Chemicals and Materials
in TRU Waste Content Codes

Content Code LA 117A
(Continued)
IDC 005 LM

METAL WASTE

GROUP 10: CAUSTICS (CONTINUED)
(Constituents reacted prior to loading in payload containers

SODIUM HYPOCHLORITE	T2

GROUP 15: FLUORIDES, INORGANIC
(Constituents reacted prior to loading in payload containers.)

CALCIUM FLUORIDE	T2
HYDROFLUORIC ACID	T2
POTASSIUM FLUORIDE	T2

GROUP 17: HALOGENATED ORGANICS

CARBON TETRACHLORIDE	T2

GROUP 19: KETONES

ACETONE	T2
METHYL ISOBUTYL KETONE	T2

GROUP 23: METALS, OTHER ELEMENTAL AND ALLOYS, AS SHEETS, RODS, MOLDINGS DROPS, ETC.

ALUMINUM	M
COPPER	T
IRON	M
LEAD	T
STAINLESS STEEL	M

GROUP 24: METALS AND METAL COMPOUNDS, TOXIC

BARIUM CHLORIDE	T2
BARIUM HYDROXIDE	T2
COPPER	T

D - Dominant Component (>10 % by wt.)
M - Minor Component (1 - 10 % by wt.)
T - Trace Component (<1 % by wt.)
T1 - Trace Component (<0.1 % by wt.)
T2 - Trace Component (low PPM range)
T3 - Trace Component (<1 PPM range)

Los Alamos National Laboratory
List of Chemicals and Materials
in TRU Waste Content Codes

Content Code LA 117A
(Continued)
IDC 005 LM

METAL WASTE

GROUP 24 METALS AND METAL COMPOUNDS, TOXIC (CONTINUED)

LEAD	T

GROUP 32: ORGANOPHOSPHATES, PHOSPHOTHIOATES AND PHOSPHODITHIOATES

TRIBUTYL PHOSPHATE	T2

GROUP 101: COMBUSTIBLE AND FLAMMABLE MATERIALS, MISCELLANEOUS

BAKELITE	T2
GREASE	T2
OIL	T2
PAPER	T2
POLYETHYLENE (Packaging Material)	T1
POLYPROPYLENE	T2
POLYSTYRENE	T2
POLYURETHANE	T2
POLYVINYL CHLORIDE (Packaging Material)	T2
RESINS	T2
RUBBER GLOVES	T2
SYNTHETIC RUBBER	T2
WAXES	T2
WOOD	T2

GROUP 104: OXIDIZING AGENTS, STRONG
(Constituents reacted prior to loading in payload containers.)

AMMONIUM PERCHLORATE	T2
BROMINE	T2
SODIUM NITRATE	T2

D - Dominant Component (>10 % by wt.)
M - Minor Component (1 - 10 % by wt.)
T - Trace Component (<1 % by wt.)
T1 - Trace Component (<0.1 % by wt.)
T2 - Trace Component (low PPM range)
T3 - Trace Component (<1 PPM range)

Los Alamos National Laboratory
List of Chemicals and Materials
in TRU Waste Content Codes

Content Code LA 117A
(Continued)
IDC 005 LM

METAL WASTE

GROUP 106: WATER AND MIXTURES CONTAINING WATER

AQUEOUS SOLUTIONS AND MIXTURES	T2
WATER	T2

GROUP 107: WATER REACTIVE SUBSTANCES
(Constituents reacted prior to loading in payload containers.)

ALUMINUM CHLORIDE	T2
CALCIUM OXIDE	T2
HYDROBROMIC ACID	T2

OTHER INORGANICS

GLASS, LABWARE	D
MOLDS AND CRUCIBLES, CERAMIC	T

OTHER SOLIDIFICATION MATERIAL/ABSORBENTS

PORTLAND CEMENT (Hydrated)	T1
VERMICULITE	T1

D - Dominant Component (>10 % by wt.)
M - Minor Component (1 - 10 % by wt.)
T - Trace Component (<1 % by wt.)
T1 - Trace Component (<0.1 % by wt.)
T2 - Trace Component (low PPM range)
T3 - Trace Component (<1 PPM range)

Los Alamos National Laboratory
List of Chemicals and Materials in TRU Waste Content Codes

Content Code LA 118A
IDC 005 LG

GLASS WASTE

GROUP 1: ACIDS, MINERAL, NON-OXIDIZING
(Constituents reacted prior to loading in payload containers.)

HYDROBROMIC ACID	T2
HYDROCHLORIC ACID	T2
HYDROFLUORIC ACID	T2
NITRIC ACID	T2
PHOSPHORIC ACID	T2
SULFURIC ACID (<70%)	T2

GROUP 2: ACIDS, MINERAL, OXIDIZING
(Constituents reacted prior to loading in payload containers.)

PERCHLORIC ACID	T2

GROUP 3: ACIDS, ORGANIC
(Constituents reacted prior to loading in payload containers.)

ACETIC ACID	T2
OXALIC ACID	T2

GROUP 4: ALCOHOLS AND GLYCOLS

ETHANOL	T2
ISOPROPANOL	T2
METHANOL	T2

GROUP 10: CAUSTICS
(Constituents reacted prior to loading in payload containers.)

AMMONIUM HYDROXIDE	T2
BARIUM HYDROXIDE	T2
CALCIUM OXIDE	T2
POTASSIUM HYDROXIDE	T2
SODIUM CARBONATE	T2
SODIUM HYDROXIDE	T2

D - Dominant Component (>10 % by wt.)
M - Minor Component (1 - 10 % by wt.)
T - Trace Component (<1 % by wt.)
T1 - Trace Component (<0.1 % by wt.)
T2 - Trace Component (low PPM range)
T3 - Trace Component (<1 PPM range)

Los Alamos National Laboratory
List of Chemicals and Materials
in TRU Waste Content Codes

Content Code LA 118A
(Continued)
IDC 005 LG

GLASS WASTE

GROUP 10: CAUSTICS (CONTINUED)
(Constituents reacted prior to loading in payload containers.)

SODIUM HYPOCHLORITE	T2

GROUP 15: FLUORIDES, INORGANIC
(Constituents reacted prior to loading in payload containers.)

CALCIUM FLUORIDE	T2
HYDROFLUORIC ACID	T2
POTASSIUM FLUORIDE	T2

GROUP 17: HALOGENATED ORGANICS

CARBON TETRACHLORIDE	T2

GROUP 19: KETONES

ACETONE	T2
METHYL ISOBUTYL KETONE	T2

GROUP 23: METALS, OTHER ELEMENTAL AND ALLOYS, AS SHEETS, RODS, MOLDINGS, DROPS, ETC.

ALUMINUM	M
COPPER	T
IRON	M
LEAD	T
STAINLESS STEEL	M

GROUP 24: METALS AND METAL COMPOUNDS, TOXIC

BARIUM CHLORIDE	T2
BARIUM HYDROXIDE	T2
COPPER	T

D - Dominant Component (>10 % by wt.)
M - Minor Component (1 - 10 % by wt.)
T - Trace Component (<1 % by wt.)
T1 - Trace Component (<0.1 % by wt.)
T2 - Trace Component (low PPM range)
T3 - Trace Component (<1 PPM range)

Los Alamos National Laboratory
List of Chemicals and Materials
in TRU Waste Content Codes

Content Code LA 123A
(Continued)
IDC 005 P1

LEADED RUBBER WASTE AND METAL

GROUP 23: METALS, OTHER ELEMENTAL AND ALLOYS, AS SHEETS, RODS, MOLDINGS, DROPS, ETC. (CONTINUED)

LEAD	M
STAINLESS STEEL	D
TANTALUM	M
ZIRCONIUM	T2

GROUP 24: METALS AND METAL COMPOUNDS, TOXIC

ARSENIC	T2
BERYLLIUM HYDROXIDE	T1
CADMIUM	T1
COPPER	T
LEAD	M
MERCURY	T2
ZIRCONIUM	T2

GROUP 27: NITRO COMPOUNDS
(Constituents reacted prior to loading in payload containers

NITROCELLULOSE	T2

GROUP 32: ORGANOPHOSPHATES, PHOSPHOTHIOATES AND PHOSPHODITHIOATES

TRIBUTYL PHOSPHATE	T1

GROUP 101: COMBUSTIBLE AND FLAMMABLE MATERIALS, MISCELLANEOUS

BAKELITE	T1
BENELEX	T1
CARBON, SPENT, ACTIVATED	T1
CELLULOSE	T1
GREASE	T1
OIL	T1

D = Dominant Component (>10 % by wt.)
M = Minor Component (1 - 10 % by wt.)
T = Trace Component (<1 % by wt.)
T1 = Trace Component (<0.1 % by wt.)
T2 = Trace Component (low PPM range)
T3 = Trace Component (<1 PPM range)

Los Alamos National Laboratory
List of Chemicals and Materials
in TRU Waste Content Codes

Content Code LA 123A
(Continued)
IDC 005 P1

LEADED RUBBER WASTE AND METAL

GROUP 101: COMBUSTIBLE AND FLAMMABLE MATERIALS, MISCELLANEOUS (CONTINUED)

PAPER	T1
PLEXIGLAS	T1
POLYETHYLENE	T1
POLYPROPYLENE	T1
POLYSTYRENE	T1
POLYURETHANE	T1
POLYVINYL CHLORIDE	T1
RESINS	T1
RUBBER GLOVES, LEADED	D
SYNTHETIC RUBBER	T1
WAXES	T1
WOOD	T1

GROUP 102: EXPLOSIVES
(Constituents reacted prior to loading in payload containers.)

AMMONIUM NITRATE	T2
NITROCELLULOSE	T2

GROUP 104: OXIDIZING AGENTS, STRONG
(Constituents reacted prior to loading in payload containers

SODIUM NITRATE	T1

GROUP 106: WATER AND MIXTURES CONTAINING WATER

AQUEOUS SOLUTIONS AND MIXTURES	T2
WATER	T2

OTHER ORGANICS

MOLDS AND CRUCIBLES, GRAPHITE	T1

D = Dominant Component (>10 % by wt.)
M = Minor Component (1 - 10 % by wt.)
T = Trace Component (<1 % by wt.)
T1 = Trace Component (<0.1 % by wt.)
T2 = Trace Component (low PPM range)
T3 = Trace Component (<1 PPM range)

Los Alamos National Laboratory
List of Chemicals and Materials
in TRU Waste Content Codes

Content Code LA 123A
(Continued)
IDC 005 P1

LEADED RUBBER WASTE AND METAL

OTHER INORGANICS

ASH	T1
BATTERIES (Alkaline)	T1
FIREBRICK	T
GLASS, LABWARE	T1
GRIT	T2
HEPA FILTERS	T3
INSULATION	T1
MOLDS AND CRUCIBLES, CERAMIC	T1
OTHER FILTERS	T1
SALT (Calcium Fluoride and Calcium Chloride)	T1
SAND	T1
SLAG	T2

OTHER SOLIDIFICATION MATERIAL/ABSORBENTS

ENVIROSTONE	T1
SURFACTANTS	T2
VERMICULITE	T2

D = Dominant Component (>10 % by wt.)
M = Minor Component (1 - 10 % by wt.)
T = Trace Component (<1 % by wt.)
T1 = Trace Component (<0.1 % by wt.)
T2 = Trace Component (low PPM range)
T3 = Trace Component (<1 PPM range)

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Los Alamos National Laboratory
List of Chemicals and Materials
in TRU Waste Content Codes

Content Code LA 124A
IDC 005 P2S

PYROCHEMICAL SALT WASTE

GROUP 1: ACIDS, MINERAL, NON-OXIDIZING
(Constituents reacted prior to loading in payload containers

HYDROFLUORIC ACID	T1

GROUP 10: CAUSTICS
(Constituents reacted prior to loading in payload containers.)

BERYLLIUM HYDROXIDE	T1
CALCIUM OXIDE	D
POTASSIUM HYDROXIDE	T1
SODIUM HYDROXIDE	T1

GROUP 15: FLUORIDES, INORGANIC
(Constituents reacted prior to loading in payload containers.)

CALCIUM FLUORIDE	D
HYDROFLUORIC ACID	T1
POTASSIUM FLUORIDE	T2

GROUP 21: METALS, ALKALI AND ALKALINE EARTH, ELEMENTAL AND ALLOYS
(Constituents reacted prior to loading in payload containers.)

CALCIUM	T

GROUP 22: METALS, OTHER ELEMENTAL AND ALLOYS IN THE FORM OF POWDERS, VAPORS, OR SPONGES

MERCURY (VAPOR)	T2
NICKEL	T2
ZIRCONIUM	T2

GROUP 23: METALS, OTHER ELEMENTAL AND ALLOYS, AS SHEETS, RODS, MOLDINGS, DROPS, ETC.

ALUMINUM	T1

D = Dominant Component (>10 % by wt.)
M = Minor Component (1 - 10 % by wt.)
T = Trace Component (<1 % by wt.)
T1 = Trace Component (<0.1 % by wt.)
T2 = Trace Component (low PPM range)
T3 = Trace Component (<1 PPM range)

Rev. 2, June 1989

Los Alamos National Laboratory
List of Chemicals and Materials
in TRU Waste Content Codes

Content Code LA 125A
IDC 001

MIXED METAL SCRAP AND INCIDENTAL COMBUSTIBLES

GROUP 4 ALCOHOLS AND GLYCOLS

POLYETHYLENE GLYCOL	T2

GROUP 5: ALDEHYDES

FORMALDEHYDE	T2

GROUP 23: METALS, OTHER ELEMENTAL AND ALLOYS, AS SHEETS, RODS, MOLDINGS DROPS, ETC.

ALUMINUM	M
COPPER	M
IRON	M
LEAD	D
STAINLESS STEEL	D
TANTALUM	T

GROUP 24: METALS AND METAL COMPOUNDS, TOXIC

CADMIUM	T
COPPER	M
LEAD	D
MERCURY	T2

GROUP 101 COMBUSTIBLE AND FLAMMABLE MATERIALS, MISCELLANEOUS

BAKELITE	T
BENELEX (Polymethyl methacrylate)	M
CARBON, SPENT, ACTIVATED	T
CELLULOSE	T
GREASE	T
OIL	T
PAPER	T
PLEXIGLAS (Polymethyl methacrylate)	M
POLYETHYLENE	M

D - Dominant Component (>10 % by wt.)
M - Minor Component (1 - 10 % by wt.)
T - Trace Component (<1 % by wt.)
T1 - Trace Component (<0.1 % by wt.)
T2 - Trace Component (low PPM range)
T3 - Trace Component (<1 PPM range)

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Los Alamos National Laboratory
List of Chemicals and Materials
in TRU Waste Content Codes

Content Code LA 125A
(Continued)
IDC 001

MIXED METAL SCRAP AND INCIDENTAL COMBUSTIBLES

GROUP 101: COMBUSTIBLE AND FLAMMABLE MATERIALS, MISCELLANEOUS (CONTINUED)

POLYPROPYLENE	T
POLYSTYRENE	M
POLYURETHANE	M
POLYVINYL CHLORIDE	M
RESINS	T
RUBBER GLOVES	M
RUBBER GLOVES, LEADED	T
SYNTHETIC RUBBER	M
WAXES	T
WOOD	D

GROUP 106: WATER AND MIXTURES CONTAINING WATER

AQUEOUS SOLUTIONS AND MIXTURES	T2
WATER	T2

OTHER INORGANICS

ASH (Burned gaskets, etc.)	T2
BATTERIES (Carbon/Zinc and Alkaline)	T2
FIREBRICK	T
GLASS, LABWARE (Glove Box Windows)	M
HEPA FILTERS	T
INSULATION	T
OTHER FILTERS (Glass fiber, furnace)	T
SLAG (Dross from plasma arc cutting)	T

OTHER SOLIDIFICATION MATERIAL/ABSORBENTS

CONCRETE	M
ENVIROSTONE	M
OIL-DRI	T

D - Dominant Component (>10 % by wt.)
M - Minor Component (1 - 10 % by wt.)
T - Trace Component (<1 % by wt.)
T1 - Trace Component (<0.1 % by wt.)
T2 - Trace Component (low PPM range)
T3 - Trace Component (<1 PPM range)

Attachment F

LANL Part A information

Contract 9-XV2-139-EE1
Project No. 301608.14
September 1994

RCRA Part A Permit Application for Mixed Waste

Revision 2.0

Prepared by:

Los Alamos National Laboratory
Environmental Protection Group ESH-8
Los Alamos, New Mexico 87545

Controlled Copy No. 9

EPA ID Number (enter from Page 1) NM0890010515

Secondary ID Number (enter from Page 1)

IV. Description of Hazardous Wastes (Continued)

Line Number	A. EPA Hazardous Waste No. (enter code)	B. Estimated Annual Quantity of Waste	C. Unit of Measure (enter code)	D. Processes (1) Process Codes (enter)			(2) Process Description (if a code is not entered in D(1))
294	U002	100	P	S01			TRUMW
295	U003	100	P	S01			TRUMW
296	U012	100	P	S01			TRUMW
297	U019	100	P	S01			TRUMW
298	U022	100	P	S01			TRUMW
299	U029	100	P	S01			TRUMW
300	U031	100	P	S01			TRUMW
301	U037	100	P	S01			TRUMW
302	U044	100	P	S01			TRUMW
303	U045	100	P	S01			TRUMW
304	U052	100	P	S01			TRUMW
305	U056	100	P	S01			TRUMW
306	U057	100	P	S01			TRUMW
307	U075	100	P	S01			TRUMW
308	U077	100	P	S01			TRUMW
309	U080	100	P	S01			TRUMW
310	U108	100	P	S01			TRUMW
311	U112	100	P	S01			TRUMW
312	U115	100	P	S01			TRUMW
313	U117	100	P	S01			TRUMW
314	U121	100	P	S01			TRUMW
315	U122	100	P	S01			TRUMW
316	U123	100	P	S01			TRUMW
317	U131	100	P	S01			TRUMW
318	U133	100	P	S01			TRUMW
319	U134	100	P	S01			TRUMW
320	U135	100	P	S01			TRUMW
321	U140	100	P	S01			TRUMW
322	U144	100	P	S01			TRUMW
323	U151	100	P	S01			TRUMW
324	U154	100	P	S01			TRUMW
325	U159	100	P	S01			TRUMW
328	U160	100	P	S01			TRUMW

LANL List of Hazardous Wastes That Have Been Assigned the U122 Hazardous Waste Number

CON_ID	ITEM_ID	WASTE_TYPE	EPA_CD	IRCV_DATE	GEN_CONV_VOL	GEN_CONV_WGT	TA	BLDG	DESCRP
C95051437	2022377	C	U122	6/6/1995 10:00:00 AM	0.0005	1.3608	21	000150	FORMALDEHYDE, 37%
C95051437	2022376	C	U122	6/6/1995 10:00:00 AM	0.0005	1.3608	21	000150	FORMALDEHYDE, 37%
C95059163	2022155	C	U122	7/20/1995 10:00:00 AM	0.00045	1.3608	21	000003	FORMALDEHYDE, 37%
C96071058	2014650	C	U122	8/19/1996 11:00:00 AM	0.00003	0.4536	03	000016	FORMALDEHYDE 37%
C97077331	2063276	C	U122	1/27/1997 10:00:00 AM	0.0003	0.4536	43	000001	FORMALDEHYDE, 37% SOLUTION
C97078629	2067002	C	U122	2/21/1997 2:00:00 AM	0.004	3.6288	43	000001	FORMALDEHYDE, 37% SOLUTION
C97078629	2067003	C	U122	2/21/1997 2:00:00 AM	0.0005	0.4536	43	000001	FORMALDEHYDE, 37% SOLUTION
C97080876	2044600	C	U122	5/1/1997 10:00:00 AM	0.00045	0.45	21	000005	FORMALDEHYDE
C97081297	2068034	C	U122	5/14/1997 1:30:00 AM	0.002	1.8144	43	000001	FORMALDEHYDE, 37% SOLUTION
C97081297	2068035	C	U122	5/14/1997 1:30:00 AM	0.002	1.8144	43	000001	FORMALDEHYDE, 37% SOLUTION
C97097287	2069348	C	U122	11/25/1997 10:00:00 AM	0.0005	0.752	35	000002	FORMALDEHYDE SOLUTION IN ITS ORIGINAL CONTAINER. MSDS IS ATTACHED
C97097776	2081554	C	U122	12/17/1997 10:00:00 AM	0.0004	0.4536	43	000001	FORMALDEHYDE SOLUTION
C97097776	2081555	C	U122	12/17/1997 10:00:00 AM	0.0002	0.2268	43	000001	FORMALDEHYDE SOLUTION
C98100382	2087093	C	U122	1/23/1998 11:45:00 AM	0.00025	0.085048581	46	000024	FORMALDEHYDE IMAGE REAGENT
C98106265	2118781	C	U122	7/20/1998	0.004	3.6288	50	37	10956; 50-00-0; OHSLP130; FORMALDEHYDE; 37-40%
C98108719	2120816	C	U122	8/28/1998	0.0004732	0.4536	48	1	10956; 50-00-0; OHSLP130; FORMALDEHYDE; FORMALDEHYDE SOLUTION 37% METHANOL PRESERVATION 11.1%. LIQUID.
C99116297	2126823	C	U122	5/12/1999	0.001	1	59	000001	EXPIRED IH STANDARDS
C99116297	2126824	C	U122	5/12/1999	0.001	1	59	000001	EXPIRED IH STANDARDS

CON_ID	ITEM_ID	WASTE_TYPE	EPA_CD	RCV_DATE	GEN_CONV_VOL	GEN_CONV_WGT	TA	BLDG	DESCRP
C99116297	2126825	C	U122	5/12/1999	0.001	1	59	000001	EXPIRED IH STANDARDS
C01140557	2179649	C	U122	11/1/2000	0.0018925	1.8144	43	000001	FORMALDEHYDE 37%
C01139353	2208269	C	U122	7/12/2001	0.0005	0.4536	35	000000	FORMALDEHYDE 37% SOLUTION
C01139394	2194069	C	U122	8/1/2001	0.0005	0.4536	59	000001	FORMALDEHYDE
C01139394	2194188	C	U122	8/1/2001	0.0001183	0.1134	59	000001	FORMALDEHYDE
C02146005	2217145	C	U122	3/12/2002	0.004	3.6288	35	000002	FORMALDEHYDE 37%, SOLUTION
C02147197	2183677	C	U122	3/13/2002	0.000075	0.04536	43	000001	FORMALDEHYDE
C02147197	2183746	C	U122	3/13/2002	0.0005	0.2268	43	000001	FORMALDEHYDE
C02151187	2234817	C	U122	7/15/2002	0.0005	1.3608	03	000000	FORMALDEHYDE SOLUTION, 37% (15% METHANOL)
C02155082	2244236	C	U122	11/21/2002	0.0005	0.2268	43	000001	FORMALDEHYDE

Attachment G

Investigation into the Use and Disposal of Formaldehyde at LANL

Investigation Into the Presence of Formaldehyde in LANL TRU Waste

Dr. S. Kosiewicz
Los Alamos National Laboratory

Introduction

The Los Alamos National Laboratory (LANL) is required to analyze its homogeneous solids (S3000) and soils/gravels (S4000) transuranic (TRU) waste streams for specific analytes. Formaldehyde is currently one of the required analytes. However, the acceptable knowledge (AK) information collected on TRU waste has not revealed any evidence that formaldehyde was present in any of the LANL TRU waste streams as a listed waste.

The U122 hazardous waste number is currently shown on the LANL Part A Permit. LANL uses formaldehyde in their daily operations and has the potential to generate hazardous waste with the U122 hazardous waste number assigned. This waste is not TRU waste.

The objective of this report is to provide adequate AK documentation to indicate that no unused, off-specification or spill residues of formaldehyde are present in any LANL TRU waste streams.

Discussion

LANL has produced homogenous wastes (cemented and non-cemented homogeneous TRU wastes) which are categorized as S3000 wastes between the late 1970s and the present. The primary generator of LANL homogeneous TRU wastes has been the Radioactive Liquid Waste Treatment Facility (RLWTF) at TA-50, Building 1. It received waste liquids from facilities that process radioactive materials throughout the LANL facility.

The largest volume of TRU homogeneous waste was vacuum filter cake sludge produced at the RLWTF in the years just after TA-55 began operations in 1979. Vacuum filter cake sludge accounts for about 4,500 drums of the LANL homogeneous wastes. This is approximately 47% of the total S3000 waste generated at LANL. Operating engineers and managers of the RLWTF state that there has never been any formaldehyde processed at the RLWTF (Personal Communication--Dave Moss to Stan Kosiewicz via e-mail - TWCP-12408). TA-55 is a secondary generator of S3000 wastes and has produced cemented and non-cemented homogeneous wastes. However, formaldehyde was not used at TA-55 for any operations.

Consequently, TA-55 operations did not produce any formaldehyde-contaminated homogeneous wastes nor formaldehyde-contaminated effluents that became influents of the RLWTF.

Although, small quantities of formaldehyde were used at LANL, no unused or off-specification formaldehyde nor formaldehyde spill residues were ever disposed at the RLWTF. Two of the larger LANL users of formaldehyde were the Tissue Analysis Project at TA-59, Building 1, and various groups in the LANL Life Sciences Division. Neither of these users produced an effluent that could be contaminated with formaldehyde and subsequently treated at the RLWTF. Formaldehyde-contaminated wastes from projects in the Life Sciences Division were collected in carboys and disposed directly into shafts at TA-21 (Personal Communication--Dave Moss to Stan Kosiewicz via e-mail - TWCP-12408 and Personal Communication--Dave Moss to Stan Kosiewicz--interview – TWCP- 12404). Neither used or unused formaldehyde was treated in a flocculation process at TA-21. Further, there is no drain line or direct connection between the Health Research Laboratory (HRL) and the RLWTF. Consequently, the LANL Life Sciences Division did not produce any formaldehyde-contaminated effluents that became influents of the RLWTF.

The analytical procedure for the Tissue Analysis Project required ashing of the tissues and their associated formaldehyde. This was done to assure complete recovery of any trace radionuclides that might have leached out of the tissues and into their formaldehyde preservative (Personal Communication--Ed Gonzales interview with Stan Kosiewicz– TWCP-12405, and Analytical Method RT100 for Tissue Analysis – TWCP-12407). The ashing process thermally destroyed the formaldehyde.

Formaldehyde was also used by the Project to preserve tissue specimens from cadavers from the Transuranium Registry for off-site analyses. In this case, the specimens were shipped off the LANL site. Consequently, the Tissue Analysis Project did not produce any formaldehyde-contaminated effluents that became influents of the RLWTF.

Conclusions

AK research leads to the conclusion that no formaldehyde-contaminated homogeneous TRU wastes were generated at LANL.

Removing formaldehyde from the list of compounds that LANL must analyze would save an estimated $1M per 3 year period in reduced headspace gas analysis (HGAS) costs alone (Personal Communication--Geoff Miller with Stan Kosiewicz). Additional savings would be realized since formaldehyde would not have to be analyzed from solid coring samples.

References

Dave Moss (LANL) e-mail to Stan Kosiewicz dated 28 March 2003, “Formaldehyde” - TWCP-12408.

Dave Moss (LANL) AK interview dated 25 March 2003 – TWCP- 12404.

Ed Gonzales (LANL) AK interview dated 24 March 2003 – TWCP-12405.

Geoff Miller (LANL), personal communication, March 2003.

Juan Corpion (LANL) e-mail to Stan Kosiewicz dated 27 March 2003, “FFCA 180-Day Report TRU Waste Classification” – TWCP-12406.

LANL Group EM-9 Analytical Method RT100, “Tissue Ashing, Sample Dissolution, Sample Aliquot Selection, and Tracer Addition for Anion Exchange Isolation of Radionuclides,” Sept. 1987 – TWCP-12407

Item 5

Class 2 Permit Modification Request

Add New Hazardous Waste Numbers

Waste Isolation Pilot Plant
Carlsbad, New Mexico

WIPP HWFP #NM4890139088-TSDF

Table of Contents

Acronyms and Abbreviations

CFR	Code of Federal Regulations
CH	Contact Handled
DOE	U. S. Department of Energy
EPA	U.S. Environmental Protection Agency
HWDU	Hazardous Waste Disposal Units
HWFP	Hazardous Waste Facility Permit
LDR	Land Disposal Restrictions
MSDS	Material Safety Data Sheet
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
PMR	Permit Modification Request
RFETS	Rocky Flats Environmental Technology Site
TRU	Transuranic
UV	Ultraviolet
WIPP	Waste Isolation Pilot Plant

Overview of the Permit Modification Request

This document contains a Class 2 Permit Modification Request (**PMR**) for the Hazardous Waste Facility Permit (**HWFP**) at the Waste Isolation Pilot Plant (**WIPP**), Number NM4890139088-TSDF hereinafter referred to as the WIPP HWFP.

This PMR is being submitted by the U.S. Department of Energy (**DOE**), Carlsbad Field Office and Washington TRU Solutions LLC, collectively referred to as the Permittees, in accordance with the WIPP HWFP, Condition I.B.1 (20.4.1.900 New Mexico Administrative Code (**NMAC**) incorporating Title 40, Code of Federal Regulations (**CFR**), §270.42(b)). The modification will add new hazardous waste numbers to the HWFP which have been identified by various generator/storage sites throughout the DOE complex. These changes do not reduce the ability of the Permittees to provide continued protection to human health and the environment.

The requested modification to the WIPP HWFP and related supporting documents are provided in this PMR. The proposed modification to the text of the WIPP HWFP has been identified using a double underline and a revision bar in the right hand margin for added information, and a ~~strikeout~~ font for deleted information. All direct quotations are indicated by italicized text. The following information specifically addresses how compliance has been achieved with the WIPP HWFP requirement, Permit Condition I.B.1 for submission of this Class 2 PMR.

1. 20.4.1.900 NMAC (incorporating 40 CFR §270.42(b)(1)(i)), requires the applicant to describe the exact change to be made to the permit conditions and supporting documents referenced by the permit.

The WIPP facility is permitted to accept containers of transuranic (**TRU**) waste which have been assigned only specific hazardous waste numbers previously approved by the New Mexico Environment Department (**NMED**). Module II.C.4 of the WIPP HWFP states "*The Permittees shall accept containers which contain only those TRU mixed wastes listed in the Hazardous Waste Permit Application Part A, Permit Attachment O*." These numbers are included in the HWFP in Module II, Table II.C.4 and in the previously referenced Attachment O (Part A Application). These portions of the HWFP must be modified to reflect the new hazardous waste numbers which are required. Since the Part A must be revised as part of this PMR, the Permittees will update the entire Part A at this time as well. This will include revisions to Table O1-1 (Active Environmental Permits).

New hazardous waste numbers have been identified on contact handled (**CH**) TRU waste which is destined for disposal at the WIPP facility. These are based on acceptable knowledge and the application of the derived-from rule in the Resource Conservation and Recovery Act.

These new numbers must be added to the HWFP so that this waste may be disposed at WIPP.

These new hazardous waste numbers are:

D033 Hexachlorobutadiene
P030 Cyanides (soluble cyanide salts), not otherwise specified
P098 Potassium Cyanide
P099 Potassium Silver Cyanide
P106 Sodium Cyanide
U003 Acetonitrile
U103 Dimethyl Sulfate
U108 1,4-Dioxane

U and P Listed Numbers

With the exception of the D033 number, the additional hazardous waste numbers requested have been assigned to TRU waste as a result of the derived-from rule as defined in 20.4.1.200 NMAC (incorporating 40 CFR §261.3[c and d]). The derived-from rule states that any solid waste generated from the treatment, storage or disposal of a listed waste remains regulated as a hazardous waste with the same listed hazardous waste number(s) and that residues resulting from treating, storing or disposing of a listed hazardous waste are themselves listed hazardous wastes.

This holds true even if the resulting residues contain only very small amounts of listed waste and/or very low concentrations of hazardous constituents as indicated in an excerpt from an Environmental Protection Agency (**EPA**) memorandum which states, "*there is no de minimis amount below which a listed waste need not be identified*." (Memorandum from Jeffery Denit, Acting Director, OSW to Phillip Bobel, Chief, Waste Programs, Region IX, February 22, 1988). This memorandum is included as an enclosure to this document.

EPA listed hazardous wastes which were treated in a hazardous waste treatment system must be carried forward on the resultant treated waste residue as indicated in the following, "*Under 40 CFR §261.3(c)(2)(i), any waste derived-from treating a hazardous waste is itself a hazardous waste. Such "derived-from" wastes are assigned the waste code(s) of the incoming (i.e., treated) wastes. Thus, if more than one listed waste was treated, the treated residue would be identified by all of the listed wastes treated*." (Letter from Sylvia Lowrance, Acting Director to Neil Gingold, General Counsel, August 31, 1987). This letter is included as an enclosure to this document.

The WIPP HWFP also requires that hazardous waste numbers be carried forward after treatment. Section B-3d states "*Treated waste shall retain the original waste stream's listed hazardous waste code designation*."

Between 1995 and 1997, the U- and P-listed excess chemicals including soluble cyanide salts, potassium cyanide, potassium silver cyanide, sodium cyanide, acetonitrile, dimethyl sulfate, and 1,4-dioxane (EPA hazardous waste numbers P030, P098, P099, P106, U003, U103, and U108) at the Rocky Flats Environmental Technology Site (**RFETS**) were treated in Building 881 using ultraviolet (**UV**) oxidation or alkaline chlorination techniques.

The UV oxidation process used an UV lamp and concentric flow reaction chamber to convert organic compounds into carbon dioxide and water. The materials used in the process included the chemical to be treated, deionized water, and hydrogen peroxide. A measured volume of the selected organic compound was mixed with deionized water in a holding tank. The solution was recirculated for 30 minutes before collecting a sample to determine the initial concentration of organic material in solution. An UV lamp and hydrogen peroxide metering pump were turned on while the solution continued to recirculate. Samples for organic analysis were collected periodically to monitor the destruction rate. Once the organic levels were below the land disposal restrictions (**LDR**) treatment standards, the process was stopped and samples for final analysis were collected. Those LDR levels are indicated below:

- Cyanides (soluble cyanide salts),0.86 milligrams/liter (**mg/l**)
- Potassium Cyanide0.86 mg/l
- Potassium Silver Cyanide0.86 mg/l
- Sodium Cyanide0.86 mg/l
- Acetonitrile5.6 mg/l
- Dimethyl SulfateCHOXD
- 1,4-DioxaneCHOXD

For chemical compounds which have a technology based standard (dimethyl sulfate and 1,4-dioxane), the LDR treatment is expressed as a specific technology rather than a concentration level. For these two parameters the technology based standard includes chemical or electrolytic oxidation (CHOXD). This treatment process specifically includes alkaline chlorination.

The resulting process water was either re-used for the next process run or placed in permitted storage prior to final treatment by cementation.

The alkaline chlorination process destroyed reactive chemical cyanide compounds by converting them to carbon dioxide and nitrogen. The materials used in the process included the reactive cyanide chemical to be treated, deionized water, sodium hydroxide, and sodium hypochlorite. The reactive cyanide chemical was dissolved in approximately 100 milliliters of caustic solution (water and sodium hydroxide at a pH of 8 to 10). Approximately 5%, by weight, sodium hypochlorite was added to initiate the reaction. Additional sodium hydroxide was added as necessary to maintain the pH above 8. Additional sodium hypochlorite and/or agitation were also added/performed as necessary to enhance the reaction. Samples were collected for analysis when no further reaction was observed. The process was stopped once the cyanide levels were below the LDR treatment standards. The precipitate containing precious metals (i.e., gold, silver) was managed as part of the DOE precious metals inventory while the precipitate containing other heavy metals was immobilized in cement or polymer. The residual solution produced by the process was sent to the Building 374 radioactive aqueous waste treatment facility (if the EPA hazardous waste numbers were accepted in Building 374). Otherwise, the solution was immobilized in cement.

All of this information will become part of the auditable acceptable knowledge record.

The treatment of organic compounds and cyanides employing UV oxidation and/or alkaline chlorination resulted in the organic compounds or cyanides being treated sufficiently to meet the LDR treatment standards but continued to carry EPA hazardous waste numbers P030, P098, P099, P106, U003, U103, and U108 because of the RCRA derived-from rule. Any liquids will be solidified prior to shipment to WIPP to meet the WIPP Waste Acceptance Criteria.[29,30,31,32]

The inventory report update for 2003 (Attachment C) shows that a number of waste streams from RFETS require the addition of these U and P hazardous waste numbers. The waste streams requiring these new hazardous waste numbers are indicated in bold underline within Attachment C.

Since these waste streams have undergone treatment to remove the U and P listed chemicals by proven technologies and have verified that the resultant liquids remaining after treatment met the LDR standards the concentration of those compounds is in less than trace amounts and will have no impact on container compatibility.

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[29]Letter from Ms. Karen North of Kaiser-Hill Company, LLC and Mr. Joseph A. Legare of the U.S. Department of Energy Rocky Flats Field Office to Mr. James Hindman of the Colorado Department of Public Health and Environment. Response to Request for Additional Information on Environmental Protection Agency (EPA) Hazardous Waste “P” and “U” Codes Relative to B374 Operations. KN-111-01. August 29, 2001.

[30]Waste Stream and Residue Identification and Characterization Building 881, Version 7.0. Process 881-66, U.V. Oxidation/Reactive Chemical Destruction. Rocky Flats Environmental Technology Site. May 21, 2002.

[31]Waste Stream and Residue Identification and Characterization Building 881, Version 7.0. Process 881-76, Alkaline Chlorination-Cyanide/Sulfide Destruction. Rocky Flats Environmental Technology Site. May 21, 2002.

[32]Waste Stream and Residue Identification and Characterization Building 374, Version 7.0. Process 374-06, General Building Operations and Deactivation. Rocky Flats Environmental Technology Site. March 27, 2003.

No changes to any management practices are necessary to accept these U and P listed waste numbers at WIPP.

D033 - Hexachlorobutadiene

D033 (hexachlorobutadiene) is a toxicity characteristic hazardous waste number. It is currently required by RFETS for a variety of waste streams (Attachment C). This chemical has been identified in wastes at RFETS and must be added to the HWFP so that these wastes may be shipped to WIPP. These wastes do not contain hexachlorobutadiene as a discarded commercial chemical product, off-specification species, container residue, or spill residue thereof; therefore, the U128 hazardous waste number does not apply to the wastes.

Hexachlorobutadiene is a colorless liquid which is chemically stable but is harmful to humans via, inhalation, ingestion and skin contact. A Material Safety Data Sheet (**MSDS**) for this compound is included as Attachment D.

Similar halogenated semivolatile organics such as hexachlorobenzene and hexachloroethane have been evaluated with respect to chemical compatibility and performance of the underground repository in the Permit Application Appendix C1 (Attachment E). No incompatibility was found. No adverse impact from the acceptance of hexachlorobutadiene is anticipated. No changes to any management practices are necessary to accept hexachlorobutadiene at WIPP.

The proposed changes to the WIPP HWFP text are presented in Attachment B of this PMR.

2. 20.4.1.900 NMAC (incorporating 40 CFR §270.42(b)(1)(ii)), requires the applicant to identify that the modification is a Class 2 modification.

The proposed modification is classified as a Class 2 permit modification because it is considered storage of different wastes in containers that do not require additional or different management practices from those authorized in the permit in accordance with 20.4.1.900 NMAC (incorporating 40 CFR §270.42 Appendix I, Item F.3.b). Since these wastes are either not volatile organic compounds or have been treated to a level that their concentration will not impact the repository and they will meet the TSDF-WAC requirements, no changes are necessary to the HWFP regarding container management, storage or disposal. Therefor, no other classification in 40 CFR §270.42 applies. The classification (F.3.b) is consistent with a similar PMR submitted to the New Mexico Environment Department (**NMED**) in March, 2001, and approved in July, 2001, concerning the addition of new hazardous waste numbers.

3. 20.4.1.900 NMAC (incorporating 40 CFR §270.42(b)(1)(iii)), requires the applicant to explain why the modification is needed.

The WIPP may accept only waste containers that have been assigned EPA hazardous waste numbers that are included in the HWFP. RFETS has identified additional hazardous waste numbers which must be assigned to mixed CH TRU waste. This PMR is required so that this waste may be shipped to WIPP. If these numbers are not added to the HWFP this waste will have no avenue for disposal.

The HWFP Section B-1b (Waste Summary Category Groups and Hazardous Waste Accepted at the WIPP Facility) states that: "*If during the characterization process, new EPA hazardous waste codes are identified, those wastes will be prohibited for disposal at the WIPP facility until a permit modification has been submitted to and approved by the NMED for those new EPA hazardous waste codes.*" This permit modification request will satisfy that requirement.

4. 20.4.1.900 NMAC (incorporating 40 CFR §270.42 (b)(1)(iv)), requires the applicant

to provide the applicable information required by 40 CFR §§270.13 through 270.21, 270.62 and 270.63.

The regulatory crosswalk describes those portions of the WIPP HWFP that are affected by this PMR. Where applicable, regulatory citations in this modification reference Title 20, Chapter 4, Part 1, NMAC, revised June 14, 2000, (incorporating 40 CFR Parts 264 and 270). 40 CFR §§270.16 through 270.21, 270.62 and 270.63 are not applicable at WIPP. Consequently, they are not listed in the regulatory crosswalk table. 40 CFR §270.23 is applicable to the WIPP Hazardous Waste Disposal Units (**HWDUs**). This modification does not impact the conditions associated with the HWDUs.

5. 20.4.1.900 NMAC (incorporating 40 CFR §270.11(d)(1) and 40 CFR §270.30(k)), requires any person signing under paragraph a and b must certify the document in accordance with 20.4.1.900 NMAC.

The transmittal letter for this PMR contains the signed certification statement in accordance with Module I.F of the WIPP HWFP.

Regulatory Crosswalk

Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the HWFP	Yes	No
§270.13		Contents of Part A permit application	Attachment O, Part A	T	
§270.14(b)(1)		General facility description	Attachment A Module II		T
§270.14(b)(2)	§264.13(a)	Chemical and physical analyses	Attachment B Module II	T	
§270.14(b)(3)	§264.13(b)	Development and implementation of waste analysis plan	Attachment B		T
	§264.13(c)	Off-site waste analysis requirements	Attachment B		T
§270.14(b)(4)	§264.14(a-c)	Security procedures and equipment	Attachment C		T
§270.14(b)(5)	§264.15(a-d)	General inspection requirements	Attachment D		T
	§264.174	Container inspections	Attachment D		T
§270.23(a)(2)	§264.602	Miscellaneous units inspections	Attachment D		T
§270.14(b)(6)		Request for waiver from preparedness and prevention requirements of Part 264 Subpart C	NA		
§270.14(b)(7)	264 Subpart D	Contingency plan requirements	Attachment F		T
	§264.51	Contingency plan design and implementation	Attachment F		T
	§264.52 (a) & (c-f)	Contingency plan content	Attachment F		T
	§264.53	Contingency plan copies	Attachment F		T
	§264.54	Contingency plan amendment	Attachment F		T
	§264.55	Emergency coordinator	Attachment F		T
	§264.56	Emergency procedures	Attachment F		T
§270.14(b)(8)		Description of procedures, structures or equipment for:	Attachment E		T
§270.14(b)(8)(i)		Prevention of hazards in unloading operations (e.g., ramps and special forklifts)	Attachment E		T
§270.14(b)(8)(ii)		Runoff or flood prevention (e.g., berms, trenches, and dikes)	Attachment E		T
§270.14(b)(8)(iii)		Prevention of contamination of water supplies	Attachment E		T
§270.14(b)(8)(iv)		Mitigation of effects of equipment failure and power outages	Attachment E		T
§270.14(b)(8)(v)		Prevention of undue exposure of personnel (e.g., personal protective equipment)	Attachment E		T
§270.14(b)(8)(vi) §270.23(a)(2)	§264.601	Prevention of releases to the atmosphere	Module II Module IV Attachment M2 Attachment N		T
	264 Subpart C	Preparedness and prevention	Attachment E		T
	§264.31	Design and operation of facility	Attachment E		T
	§264.32	Required equipment	Attachment E Attachment F		T
	§264.33	Testing and maintenance of equipment	Attachment D		T

Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the HWFP	Yes	No
	§264.34	Access to communication/alarm system	Attachment E		T
	§264.35	Required aisle space	Attachment E		T
	§264.37	Arrangements with local authorities	Attachment F		T
§270.14(b)(9)	§264.17(a-c)	Prevention of accidental ignition or reaction of ignitable, reactive, or incompatible wastes	Attachment E		T
§270.14(b)(10)		Traffic pattern, volume, and controls, for example: Identification of turn lanes Identification of traffic/stacking lanes, if appropriate Description of access road surface Description of access road load-bearing capacity Identification of traffic controls	Attachment G		T
§270.14(b)(11)(i) and (ii)	§264.18(a)	Seismic standard applicability and requirements	Part B, Rev. 6 Chapter B		T
§270.14(b)(11)(iii-v)	§264.18(b)	100-year floodplain standard	Part B, Rev. 6 Chapter B		T
	§264.18(c)	Other location standards	Part B, Rev. 6 Chapter B		T
§270.14(b)(12)	§264.16(a-e)	Personnel training program	Permit Module II Attachment H		T
§270.14(b)(13)	264 Subpart G	Closure and post-closure plans	Attachment I & J		T
§270.14(b)(13)	§264.111	Closure performance standard	Attachment I		T
§270.14(b)(13)	§264.112(a), (b)	Written content of closure plan	Attachment I		T
§270.14(b)(13)	§264.112(c)	Amendment of closure plan	Attachment I		T
§270.14(b)(13)	§264.112(d)	Notification of partial and final closure	Attachment I		T
§270.14(b)(13)	§264.112(e)	Removal of wastes and decontamination/dismantling of equipment	Attachment I		T
§270.14(b)(13)	§264.113	Time allowed for closure	Attachment I		T
§270.14(b)(13)	§264.114	Disposal/decontamination	Attachment I		T
§270.14(b)(13)	§264.115	Certification of closure	Attachment I		T
§270.14(b)(13)	§264.116	Survey plat	Attachment I		T
§270.14(b)(13)	§264.117	Post-closure care and use of property	Attachment J		T
§270.14(b)(13)	§264.118	Post-closure plan; amendment of plan	Attachment J		T
§270.14(b)(13)	§264.178	Closure/containers	Attachment I		T
§270.14(b)(13)	§264.601	Environmental performance standards-Miscellaneous units	Attachment I		T
§270.14(b)(13)	§264.603	Post-closure care	Attachment I		T
§270.14(b)(14)	§264.119	Post-closure notices	Attachment J		T
§270.14(b)(15)	§264.142	Closure cost estimate	NA		T
	§264.143	Financial assurance	NA		T
§270.14(b)(16)	§264.144	Post-closure cost estimate	NA		T
	§264.145	Post-closure care financial assurance	NA		T
§270.14(b)(17)	§264.147	Liability insurance	NA		T

Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the HWFP	Yes	No
§270.14(b)(18)	§264.149-150	Proof of financial coverage	NA		T

Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the HWFP	Yes	No
§270.14(b)(19)(i), (vi), (vii), and (x)		Topographic map requirements Map scale and date Map orientation Legal boundaries Buildings Treatment, storage, and disposal operations Run-on/run-off control systems Fire control facilities	Attachment O Part A Part B, Rev. 6 Chapter B, E		T
§270.14(b)(19)(ii)	§264.18(b)	100-year floodplain	Attachment O Part A Part B, Rev. 6 Chapter B, E		T
§270.14(b)(19)(iii)		Surface waters	Attachment O Part A Part B, Rev. 6 Chapter B, E		T
§270.14(b)(19)(iv)		Surrounding Land use	Attachment O Part A Part B, Rev. 6 Chapter B, E		T
§270.14(b)(19)(v)		Wind rose	Attachment O Part A Part B, Rev. 6 Chapter B, E		T
§270.14(b)(19)(viii)	§264.14(b)	Access controls	Attachment O Part A Part B, Rev. 6 Chapter B, E, F		T
§270.14(b)(19)(ix)		Injection and withdrawal wells	Attachment O Part A Part B, Rev. 6 Chapter B, E, F		T
§270.14(b)(19)(xi)		Drainage on flood control barriers	Part B, Rev. 6 Chapter B, E, F		T
§270.14(b)(19)(xii)		Location of operational units	Part B, Rev. 6 Chapter B		T
§270.14(b)(20)		Other federal laws Wild and Scenic Rivers Act National Historic Preservation Act Endangered Species Act Coastal Zone Management Act Fish and Wildlife Coordination Act Executive Orders	Part B, Rev. 6 Chapter K		T
§270.15	§264 Subpart I	Containers	Attachment M1		T
	§264.171	Condition of containers	Attachment M1		T
	§264.172	Compatibility of waste with containers	Attachment M1		T
	§264.173	Management of containers	Attachment M1		T
	§264.174	Inspections	Attachment D Attachment M1		T
§270.15(a)	§264.175	Containment systems	Attachment M1		T
§270.15(c)	§264.176	Special requirements for ignitable or reactive waste	Attachment E Permit Module II		T
§270.15(d)	§264.177	Special requirements for	Attachment E		T

Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the HWFP	Yes	No
		incompatible wastes	Permit Module II		

Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the HWFP	Yes	No
	§264.178	Closure	Attachment I		T
§270.15(e)	§264.179	Air emission standards	Attachment E Attachment N		T
§270.23	264 Subpart X	Miscellaneous units	Attachment M2		T
§270.23(a)	§264.601	Detailed unit description	Attachment M2		T
§270.23(b)	§264.601	Hydrologic, geologic, and meteorologic assessments	Permit Module IV Attachment M2		T
§270.23(c)	§264.601	Potential exposure pathways	Permit Module IV Attachment M2 Attachment N		T
§270.23(d)		Demonstration of treatment effectiveness	Permit Module IV Attachment M2 Attachment N		T
	§264.602	Monitoring, analysis, inspection, response, reporting, and corrective action	Permit Module IV Attachment M2 Attachment N		T
	§264.603	Post-closure care	Attachment J Attachment J1		T
	264 Subpart E	Manifest system, record keeping, and reporting	Permit Module I Permit Module II Permit Module IV Attachment B		T

Attachment A

Table of Changes

Table of Changes

Affected Permit Section	**Explanation for Change**
a.1. Module II, Table II.C.4	Table II.C.4 has been revised to add additional hazardous waste numbers
b.1 Attachment O, Part A Application	The Part A application has been revised to add new hazardous waste numbers and to update Table O1-1

Attachment B

Proposed Revised Permit Text

Proposed Revised Permit Text:

a.1. Module II, Table II.C.4

Table II.C.4 - Permitted TRU Mixed Wastes		
EPA Hazardous Waste Code	**Hazardous Waste[1]**	**Chemical Abstract Number**
F001	Spent halogenated solvents:	
	Tetrachloroethylene	127-18-4
	Trichloroethylene	79-01-6
	Methylene chloride	75-09-2
	1,1,1-Trichloroethane	71-55-6
	Carbon tetrachloride	56-23-5
	Chlorinated fluorocarbons	NA
F002	Spent halogenated solvents:	
	Tetrachloroethylene	127-18-4
	Methylene chloride	75-09-2
	Trichloroethylene	79-01-6
	1,1,1-Trichloroethane	71-55-6
	Chlorobenzene	108-90-7
	1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1
	Ortho-dichlorobenzene	95-50-1
	Trichlorofluoromethane	75-69-4
	1,1,2-Trichloroethane	79-00-5
F003	Spent non-halogenated solvents:	
	Xylene	1330-20-7
	Acetone	67-64-1
	Ethyl acetate	141-78-6
	Ethyl benzene	100-41-4
	Ethyl ether	60-29-7
	Methyl isobutyl ketone	108-10-1
	n-Butyl alcohol	71-36-3
	Cyclohexanone	108-94-1
	Methanol	67-56-1
F004	Spent non-halogenated solvents:	
	Cresols and cresylic acid	1319-77-3
	Nitrobenzene	98-95-3
F005	Spent non-halogenated solvents:	
	Toluene	108-88-3
	Methyl ethyl ketone	78-93-3
	Carbon disulfide	75-15-0
	Isobutanol	78-83-1
	Pyridine	110-86-1
	Benzene	71-43-2
	2-Ethoxyethanol	110-80-5
	2-Nitropropane	79-46-9

Table II.C.4 - Permitted TRU Mixed Wastes		
EPA Hazardous Waste Code	**Hazardous Waste[1]**	**Chemical Abstract Number**
F006	Wastewater treatment sludges from electroplating operations: Cadmium Chromium Cyanide Lead Nickel Silver	 7440-43-9 7440-47-3 57-12-5 7439-92-1 7440-02-0 7440-22-4
F007	Spent cyanide plating bath solutions from electroplating operations: See F006	
F009	Spent stripping and cleaning bath solutions from electroplating operations where cyanides are used in the process: See F006	
D004	Arsenic	7440-38-2
D005	Barium	7440-39-3
D006	Cadmium	7440-43-9
D007	Chromium	7440-47-3
D008	Lead	7439-92-1
D009	Mercury	7439-97-6
D010	Selenium	7782-49-2
D011	Silver	7440-22-4
D018	Benzene	71-43-2
D019	Carbon Tetrachloride	56-23-5
D021	Chlorobenzene	108-90-7
D022	Chloroform	67-66-3
D026	Cresol	1319-77-3
D027	1,4-Dichlorobenzene	106-46-7
D028	1,2-Dichloroethane	107-06-2
D029	1,1-Dichloroethylene	75-35-4
D030	2,4-Dinitrotoluene	121-14-2
D032	Hexachlorobenzene	118-74-1
D033	Hexachlorobutadiene	87-68-3
D034	Hexachloroethane	67-72-1
D035	Methyl ethyl ketone	78-93-3
D036	Nitrobenzene	98-95-3
D037	Pentachlorophenol	87-86-5
D038	Pyridine	110-86-1
D039	Tetrachloroethylene	127-18-4
D040	Trichloroethylene	79-01-6

Table II.C.4 - Permitted TRU Mixed Wastes		
EPA Hazardous Waste Code	**Hazardous Waste[1]**	**Chemical Abstract Number**
D043	Vinyl chloride	75-01-4
P015	Beryllium powder (H)	7440-41-7
P030	Cyanides (soluble cyanides salts), not otherwise specified	NA
P098	Potassium Cyanide	151-50-8
P099	Potassium Silver Cyanide	506-61-6
P106	Sodium Cyanide	143-33-9
P120	Vanadium Pentoxide (H)	1314-62-1
U002	Acetone (I)	67-64-1
U003	Acetonitrile	75-05-8
U019	Benzene (I,T)	71-43-2
U037	Chlorobenzene (T)	108-90-7
U043	Vinyl Chloride (T)	75-01-4
U044	Chloroform (T)	67-66-3
U052	Cresol (T)	1319-77-3
U070	1,2-Dichlorobenzene (T)	95-50-1
U072	1,4-Dichlorobenzene (T)	106-46-7
U078	1,1-Dichloroethylene (T)	75-35-4
U079	1,2-Dichloroethylene (T)	156-60-5
U103	Dimethyl Sulfate	77-78-1
U105	2,4-Dinitrotoluene (T)	121-14-2
U108	1,4-Dioxane	123-91-1
U122	Formaldehyde (T)	50-00-0
U133	Hydrazine (R,T)	302-01-2
U134	Hydrofluoric Acid (C,T)	7664-39-3
U151	Mercury (T)	7439-97-6
U154	Methanol (I)	67-56-1
U159	Methyl Ethyl Ketone (I,T)	78-93-3
U196	Pyridine (T)	110-86-1
U209	1,1,2,2-Tetrachloroethane (T)	79-34-5
U210	Tetrachloroethylene (T)	127-18-4
U220	Toluene (T)	108-88-3
U226	1,1,1-Trichloroethane (T)	71-55-6
U228	Trichloroethylene (T)	79-01-6
U239	Xylene (I,T)	1330-20-7

[1] Designations in parentheses for P- and U-coded wastes reflect the basis for the listing and are as follows:

H - acute toxicity
T - toxicity

R - reactivity
I - ignitability
C - corrosivity

Acceptance of U-coded wastes listed for reactivity, ignitability, or corrosivity characteristics is contingent upon a demonstration that the wastes meet the requirements specified in Permit Condition II.C.3.g b.1. Attachment O, Part A Application

ATTACHMENT O

HAZARDOUS WASTE PERMIT APPLICATION PART A

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ATTACHMENT O

HAZARDOUS WASTE PERMIT APPLICATION PART A

TABLE OF CONTENTS

NOTE: The "Part A - Hazardous Waste Permit Application" is the document submitted by the Permittees. It refers to management, storage, and disposal of remote-handled (**RH**) transuranic waste. This Permit does not authorize these activities and they have been included only to indicate what the Permittees submitted to NMED. However, maps, facility drawings, and photographs in Appendices O2, O3, and O4 which depicted RH waste activities have been edited or removed.

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For EPA Regional Use Only

Date Received

Month	Day	Year

EPA

United States Environmental Protection Agency
Washington, DC 20460

Hazardous Waste Permit Application Part A

(Read the Instructions before starting)

I. Facility's EPA ID Number *(Mark 'X' in the appropriate box)*

[ ] A. First Part A Submission

[X] B. Revised Part A Submission (Amendment # 15)

C. Facility's EPA ID Number	D. Secondary ID Number *(If applicable)*
NM4890139088	

II. Name of Facility

WASTE ISOLATION PILOT PLANT

III. Facility Location *(Physical address not P.O. Box or Route Number)*

A. Street: 30 MILES EAST OF CARLSBAD ON

Street *(Continued)*: JAL HIGHWAY

City or Town	State	Zip Code
CARLSBAD	NM	88221—

County Code *(If known)*	County Name
03	EDDY

B. Land Type (Enter code)	C. Geographic Location LATITUDE *(Degrees, minutes, & seconds)*	LONGITUDE *(Degrees, minutes & seconds)*	D. Facility Existence Date (Month Day Year)
F	32 22 30 N	103 47 30 W	05 18 1981

IV. Facility Mailing Address

Street or P.O. Box: PO BOX 3090

City or Town	State	Zip Code
CARLSBAD	NM	88221—3090

V. Facility Contact *(Person to be contacted regarding waste activities at facility)*

Name *(Last)*	*(First)*
TRIAY	INÈS

Job Title	Phone Number *(Area Code and Number)*
MANAGER	505—234—7300

VI. Facility Contact Address *(See instructions)*

A. Contact Address: Location	Mailing	Other	B. Street or P.O. Box
	X		PO BOX 3090

City or Town	State	Zip Code
CARLSBAD	NM	88221—3090

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EPA ID Number *(Enter from page 1)*: N M 4 8 9 0 1 3 9 0 8 8

Secondary ID Number *(Enter from page 1)*:

VII. Operator Information *(See instructions)*

A. Name of Operator: U S DEPARTMENT OF ENERGY

Street or P.O. Box: P O BOX 3090

City or Town	State	ZIP Code
CARLSBAD	NM	88221—3090

Phone Number *(Area Code and Number)*	B. Operator Type	C. Change of Operator Indicator	Date Changed (Month / Day / Year)
505—234—7300	F	Yes ☐ No X	

VIII. Facility Owner *(See instructions)*

A. Name of Facility's Legal Owner: U S DEPARTMENT OF ENERGY

Street or P.O. Box: P O BOX 3090

City or Town	State	ZIP Code
CARLSBAD	NM	88221—3090

Phone Number *(Area Code and Number)*	B. Owner Type	C. Change of Owner Indicator	Date Changed (Month / Day / Year)
505—234—7300	F	Yes ☐ No X	

IX. NAICS Codes *(in order of significance; start in left box)*

	Code	(Description)
First	4953	REFUSE SYSTEMS
Second		
Third		
Fourth		

X. Other Environmental Permits *(See instructions)*

A. Permit Type *(Enter code)*	B. Permit Number	C. Description
E		*See Appendix 01, Table 01-1

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EPA ID Number *(Enter from page 1)*: N M 4 8 9 0 1 3 9 0 8 8

Secondary ID Number *(Enter from page 1)*:

XI. Nature of Business *(Provide a brief description)*

The Waste Isolation Pilot Plant (WIPP) is a U.S. Department of Energy facility intended to demonstrate the technical and operational principles involved in the permanent isolation and disposal of defense-generated transuranic waste. For purposes of RCRA, WIPP operations entail receiving, unloading, and transferring radioactive-mixed waste from the surface of the site to the underground hazardous waste management units. Waste will be emplaced in an underground geologic repository horizon located in a deep-bedded salt formation approximately 2,150 feet beneath the surface.

XII. Process Codes and Design Capacities

A. PROCESS CODE - *Enter the code from the list of process codes below that best describes each process to be used at the facility. Thirteen lines are provided for entering codes. If more lines are needed, attach a separate sheet of paper with the additional information. For "other" processes (i.e., D99, S99, T04 and X99), describe the process (including its design capacity) in the space provided in item XIII.*

B. PROCESS DESIGN CAPACITY - *For each code entered in column A, enter the capacity of the process.*
   1. AMOUNT - *Enter the amount. In a case where design capacity is not applicable (such as in a closure/post-closure or enforcement action) enter the total amount of waste for that process.*
   2. UNIT OF MEASURE - *For each amount entered in column B(1), enter the code from the list of unit measure codes below that describes the unit of measure used. Only the units of measure that are listed below should be used.*

C. PROCESS TOTAL NUMBER OF UNITS - *Enter the total number of units used with the corresponding process code.*

PROCESS CODE	PROCESS	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
	Disposal:	
D79	Underground Injection Well Disposal	Gallons; Liters; Gallons Per Day; or Liters Per Day
D80	Landfill	Acre-feet; Hectare-meter; Acres; Cubic Meters; Hectares; Cubic Yards
D81	Land Treatment	Acres or Hectares
D82	Ocean Disposal	Gallons Per Day or Liters Per Day
D83	Surface Impoundment Disposal	Gallons; Liters; Cubic Meters; or Cubic Yards
D99	Other Disposal	Any Unit of Measure Listed Below
	Storage:	
S01	Container	Gallons; Liters; Cubic Meters; or Cubic Yards
S02	Tank Storage	Gallons; Liters; Cubic Meters; or Cubic Yards
S03	Waste Pile	Cubic Yards or Cubic Meters
S04	Surface Impoundment Storage	Gallons; Liters; Cubic Meters; or Cubic Yards
S05	Drip Pad	Gallons; Liters; Acres; Cubic Meters; Hectares; or Cubic Yards
S06	Containment Building Storage	Cubic Yards or Cubic Meters
S99	Other Storage	Any Unit of Measure Listed Below
	Treatment:	
T01	Tank Treatment	Gallons Per Day; Liters Per Day; Short Tons Per Hour; Gallons Per Hour; Liters Per Hour; Pounds Per Hour; Short Tons Per Day; Kilograms Per Hour; Metric Tons Per Day; or Metric Tons Per Hour
T02	Surface Impoundment Treatment	Gallons Per Day; Liters Per Day; Short Tons Per Hour; Gallons Per Hour; Liters Per Hour; Pounds Per Hour; Short Tons Per Day; Kilograms Per Hour; Metric Tons Per Day; or Metric Tons Per Hour
T03	Incinerator	Short Tons Per Hour; Metric Tons Per Hour; Gallons Per Hour; Liters Per Hour; Btu Per Hour; Pounds Per Hour; Short Tons Per Day; Kilograms Per Hour; Gallons Per Day; Liters Per Day; Metric Tons Per Hour; or Million Btu Per Hour
T04	Other Treatment	Gallons Per Day; Liters Per Day; Pounds Per Hour; Short Tons Per Hour; Kilograms Per Hour; Metric Tons Per Day; Metric Tons Per Hour; Short Tons Per Day; Btu Per Hour; Gallons Per Day; Liters Per Hour; or Million Btu Per Hour
T80	Boiler	Gallons; Liters; Gallons Per Hour; Liters Per Hour; Btu Per Hour; or Million Btu Per Hour
T81	Cement Kiln	Gallons Per Day; Liters Per Day; Pounds Per Hour; Short Tons Per Hour; Kilograms Per Hour; Metric Tons Per Day; Metric Tons Per Hour; Short Tons Per Day; Btu Per Hour; Liters Per Hour; Kilograms Per Hour; or Million Btu Per Hour (T81–T86)
T82	Lime Kiln	
T83	Aggregate Kiln	
T84	Phosphate Kiln	
T85	Coke Oven	
T86	Blast Furnace	
T87	Smelting, Melting, Or Refining Furnace	Gallons Per Day; Liters Per Day; Pounds Per Hour; Short Tons Per Hour; Kilograms Per Hour; Metric Tons Per Day; Metric Tons Per Hour; Short Tons Per Day; Btu Per Hour; Gallons Per Hour; Liters Per Hour; or Million Btu Per Hour (T87–T93)
T88	Titanium Dioxide Chloride Oxidation Reactor	
T89	Methane Reforming Furnace	
T90	Pulping Liquor Recovery Furnace	
T91	Combustion Device Used In The Recovery Of Sulfur Values From Spent Sulfuric Acid	
T92	Halogen Acid Furnaces	
T93	Other Industrial Furnaces Listed in 40 CFR §260.10	
T94	Containment Building - Treatment	Cubic Yards; Cubic Meters; Short Tons Per Hour; Gallons Per Hour; Liters Per Hour; Btu Per Hour; Pounds Per Hour; Short Tons Per Day; Kilograms Per Hour; Metric Tons Per Day; Gallons Per Day; Liters Per Day; Metric Tons Per Hour; or Million Btu Per Hour
	Miscellaneous (Subpart X):	
X01	Open Burning/Open Detonation	Any Unit of Measure Listed Below
X02	Mechanical Processing	Short Tons Per Hour; Metric Tons Per Hour; Short Tons Per Day; Metric Tons Per Day; Pounds Per Hour; Kilograms Per Hour; Gallons Per Hour; Liters Per Hour; or Gallons Per Day
X03	Thermal Unit	Gallons Per Day; Liters Per Day; Pounds Per Hour; Short Tons Per Hour; Kilograms Per Hour; Metric Tons Per Day; Metric Tons Per Hour; Short Tons Per Day; Btu Per Hour; or Million Btu Per Hour
X04	Geologic Repository	Cubic Yards; Cubic Meters; Acre-feet; Hectare-meter; Gallons; or Liters
X99	Other Subpart X	Any Unit of Measure Listed Below

UNIT OF MEASURE	UNIT OF MEASURE CODE
Gallons	G
Gallons Per Hour	E
Gallons Per Day	U
Liters	L
Liters Per Hour	H
Liters Per Day	V
Short Tons Per Hour	D
Metric Tons Per Hour	W
Short Tons Per Day	N
Metric Tons Per Day	S
Pounds Per Hour	J
Kilograms Per Hour	R
Million Btu Per Hour	X
Cubic Yards	Y
Cubic Meters	C
Acres	B
Acre-feet	A
Hectares	Q
Hectare-meter	F
Btu Per Hour	I

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Secondary ID Number *(Enter from page 1)*:

XII. Process Codes and Design Capabilities *(Continued)*

EXAMPLE FOR COMPLETING ITEM XII (shown in line number X-1 below): A facility has a storage tank, which can hold 533.788 gallons.

Line Number		A. Process Code (From list above)			B. Process Design Capacity: 1. Amount (Specify)	2. Unit Of Measure (Enter code)	C. Process Total Number Of Units	For Official Use Only
X	1	S	0	2	5 3 3 . 7 8 8	G	0 0 1	
	1	X	0	4	175,600 Total (54,064 in 10 years)	C	0 1 0	
	2				See attached page for additional process information			
	3	S	0	1	91.9	C	0 0 1	
	4				WHB Container Storage Unit See attached page for additional process information			
	5	S	0	1	47.1	C	0 0 1	
	6				Parking Area Container Storage Unit See attached page for additional process information			
	7							
	8							
	9							
1	0							
1	1							
1	2							
1	3							

NOTE: If you need to list more than 13 process codes, attach an additional sheet(s) with the information in the same format as above. Number the lines sequentially, taking into account any lines that will be used for "other" processes (i.e., D99, S99, T04 and X99) in item XIII.

XIII. Other Processes *(Follow instructions from item XII for D99, S99, T04 and X99 process codes)*

Line Number (Enter #s in seq w/XII)		A. Process Code (From list above)			B. Process Design Capacity: 1. Amount (Specify)	2. Unit Of Measure (Enter code)	C. Process Total Number Of Units	D. Description Of Process
X	1	T	0	4	.			In-situ Vitrification
	1				.			
	2				.			
	3				.			
	4				.			

XII. PROCESS—CODES AND DESIGN CAPACITIES (continued)

The Waste Isolation Pilot Plant (WIPP) geologic repository is defined as a "miscellaneous unit" under 40 CFR §260.10. "Miscellaneous unit" means a hazardous waste management unit where hazardous waste is treated, stored, or disposed of and that is not a container, tank, surface impoundment, waste pile, land treatment unit, landfill, incinerator, containment building, boiler, industrial furnace, or underground injection well with appropriate technical standards under 40 CFR Part 146, corrective action management unit, or unit eligible for research, development, and demonstration permit under 40 CFR §270.65. The WIPP is a geologic repository designed for the disposal of defense-generated transuranic (TRU) waste. Some of the TRU wastes disposed of at the WIPP contain hazardous wastes as co-contaminants. More than half the waste to be disposed of at the WIPP also meets the definition of debris waste. The debris categories include manufactured goods, biological materials, and naturally occurring geological materials. Approximately 120,000 cubic meters (m^3) of the 175,600 m^3 of WIPP wastes is categorized as debris waste. The geologic repository has been divided into ten discrete hazardous waste management units (HWMU) which are being permitted under 40 CFR Part 264, Subpart X.

During the Disposal Phase of the facility, which is expected to last 25 years, the total amount of waste received from off-site generators and any derived waste will be limited to 175,600 m^3 of TRU waste of which up to 7,080 m^3 may be remote-handled (RH) TRU mixed waste. For purposes of this application, all TRU waste is managed as though it were mixed.

On March 25, 1996, the DOE reached the conclusion that in order to comply with 40 CFR 191 §13 which regulates the long-term release of radionuclides from a geologic disposal facility, it is necessary to add magnesium oxide to each disposal room. This additive is to be placed as a backfill. The function of the backfill is to chemically alter the composition of brine that may accumulate in the disposal region. The result of the chemical alteration is to significantly reduce the solubility of the prevalent TRU radionuclides.

The process design capacity for the miscellaneous unit (composed of ten underground HWMUs in the geologic repository) shown in Section XII B, is for the maximum amount of waste that may be received from off-site generators plus the maximum expected amount of derived wastes that may be generated at the WIPP facility. In addition, two HWMUs have been designated as container storage units (S01) in Section XII. One is inside the Waste Handling Building (WHB) and consists of the contact-handled (CH) bay, conveyance loading room, waste hoist entry room, RH bay, cask unloading room, hot cell, transfer cell, and facility cask loading room. This HWMU will be used for waste receipt, handling, and storage (including storage of derived waste) prior to emplacement in the underground geologic repository. No treatment or disposal will occur in this S01 HWMU. The capacity of this S01 unit for storage is 87.7 m^3, based on 40 standard waste boxes or seven-packs of drums on pallets and in the TRUDOCKs, one standard waste box of derived waste, seven RH canisters in the transfer cell, and five RH canisters in the hot cell. The second S01 HWMU is the parking area outside the WHB where the Contact Handled Package trailers and the road cask trailers will be parked awaiting waste handling operations. The capacity of this unit is 12 TRUPACT-IIs and three road casks or four rail casks with a combined volume of

47.1 m^3. The railroad side tracks are included in this area to accommodate rail shipments of RH TRU mixed waste. The HWMUs are shown in Appendix O3 as Figures O3-2, O3-3, and O3-4.

During the ten year period of the permit, up to 52,110 m^3 of CH waste and 1,954 m^3 of RH waste could be emplaced in Panels 1 to 3. A fourth HWMU (Panel 4), plus disposal area access drifts (designated as Panels 9 and 10), will be constructed under this permit. These latter areas will not receive waste for disposal under this permit.

EPA ID Number *(Enter from page 1)*

N	M	4	8	9	0	1	3	9	0	8	8

Secondary ID Number *(Enter from page 1)*

XIV. Description of Hazardous Wastes

A. **EPA HAZARDOUS WASTE NUMBER** - *Enter the four-digit number from 40 CFR, Part 261 Subpart D of each listed hazardous waste you will handle. For hazardous wastes which are not listed in 40 CFR, Part 261 Subpart D, enter the four-digit number(s) from 40 CFR, Part 261 Subpart C that describes the characteristics and/or the toxic contaminants of those hazardous wastes.*

B. **ESTIMATED ANNUAL QUANTITY** - *For each listed waste entered in column A estimate the quantity of that waste that will be handled on an annual basis. For each characteristic or toxic contaminant entered in column A estimate the total annual quantity of all the non-listed waste(s) that will be handled which possess that characteristic or contaminant.*

C **UNIT OF MEASURE** - *For each quantity entered in column B enter the unit of measure code. Units of measure which must be used and the appropriate codes are:*

ENGLISH UNIT OF MEASURE	CODE	METRIC UNIT OF MEASURE	CODE
POUNDS	P	KILOGRAMS	K
TONS	T	METRIC TONS	M

If facility records use any other unit of measure for quantity, the units of measure must be converted into one of the required units of measure taking into account the appropriate density or specific gravity of the waste.

D. **PROCESSES**

1. **PROCESS CODES:**

For listed hazardous waste: For each listed hazardous waste entered in column A select the code(s) from the list of process codes contained in item XII A. on page 3 to indicate how the waste will be stored, treated, and/or disposed of at the facility.

For non-listed hazardous waste: For each characteristic or toxic contaminant entered in column A, select the code(s) from the list of process codes contained in item XII A. on page 3 to indicate all the processes that will be used to store, treat, and/ or dispose of all the non-listed hazardous wastes that possess that characteristic or toxic contaminant.

NOTE: THREE SPACES ARE PROVIDED FOR ENTERING PROCESS CODES. IF MORE ARE NEEDED:

1. *Enter the first two as described above.*
2. *Enter "000" in the extreme right box of item XIV-D(1).*
3. *Use additional sheet, enter line number from previous sheet, and enter additional code(s) in item XIV-E.*

2. **PROCESS DESCRIPTION:** *If a code is not listed for a process that will be used, describe the process in the space provided on the form (D.(2)).*

NOTE: HAZARDOUS WASTES DESCRIBED BY MORE THAN ONE EPA HAZARDOUS WASTE NUMBER - Hazardous wastes that can be described by more than one EPA Hazardous Waste Number shall be described on the form as follows:

1. *Select one of the EPA Hazardous Waste Numbers and enter it in column A. On the same line complete columns B, C and D by estimating the total annual quantity of the waste and describing all the processes to be used to treat, store, and/or dispose of the waste.*
2. *In column A of the next line enter the other EPA Hazardous Waste Number that can be used to describe the waste. In column D(2) on that line enter "included with above" and make no other entries on that line.*
3. *Repeat step 2 for each EPA Hazardous Waste Number that can be used to describe the hazardous waste.*

***EXAMPLE FOR COMPLETING ITEM XIV** (shown in line numbers X-1, X-2, X-3, and X-4 below) - A facility will treat and dispose of an estimated 900 pounds per year of chrome shavings from leather tanning and finishing operation. In addition, the facility will treat and dispose of three non-listed wastes. Two wastes are corrosive only and there will be an estimated 200 pounds per year of each waste. The other waste is corrosive and ignitable and there will be an estimated 100 pounds per year of that waste. Treatment will be in an incinerator and disposal will be in a landfill.*

Line Number		A. EPA HAZARD WASTE NO. (Enter code)				B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (Enter code)	D. PROCESS (1) PROCESS CODES (Enter)									D. PROCESS (2) PROCESS DESCRIPTION (If a code is not entered in D(1))
X	1	K	0	5	4	900	p	T	0	3	D	8	0				
X	2	D	0	0	2	400	P	T	0	3	D	8	0				
X	3	D	0	0	1	100	P	T	0	3	D	8	0				
X	4	D	0	0	2												Included With Above

Please print or type with ELITE type (12 characters per inch) in the unshaded areas only

Form Approved, OMB No. 2050-0034 Expires 10/31/02
GSA No. 0248-EPA-OT

EPA ID Number *(Enter from page 1)*: N M 4 8 9 0 1 3 9 0 8 8

Secondary ID Number *(Enter from page 1)*:

XIV. Description of Hazardous Wastes *(Continued; use additional sheets as necessary)*

Line Number	A. EPA Hazardous Waste No. (Enter code)	B. Estimated Annual Quantity of Waste	C. Unit of Measure (Enter code)	D. PROCESSES (1) PROCESS CODES (Enter code)	D. PROCESSES (2) PROCESS DESCRIPTION (If a code is not entered in D(1))
1	F001	1,891	M	X04 S01 S01	
2	F002	1,860	M	X04 S01 S01	
3	F003	1,593	M	X04 S01 S01	
4	F004	26	M	X04 S01 S01	
5	F005	1,829	M	X04 S01 S01	
6	F006	915	M	X04 S01 S01	
7	F007	915	M	X04 S01 S01	
8	F009	915	M	X04 S01 S01	
9	D004	903	M	X04 S01 S01	
10	D005	484	M	X04 S01 S01	
11	D006	1,819	M	X04 S01 S01	
12	D007	1,248	M	X04 S01 S01	
13	D008	3,246	M	X04 S01 S01	
14	D009	1,727	M	X04 S01 S01	
15	D010	186	M	X04 S01 S01	
16	D011	1,090	M	X04 S01 S01	
17	D018	749	M	X04 S01 S01	
18	D019	761	M	X04 S01 S01	
19	D021	26	M	X04 S01 S01	
20	D022	1,098	M	X04 S01 S01	
21	D026	609	M	X04 S01 S01	
22	D027	26	M	X04 S01 S01	
23	D028	449	M	X04 S01 S01	
24	D029	478	M	X04 S01 S01	
25	D030	26	M	X04 S01 S01	
26	D032	26	M	X04 S01 S01	
27	D034	26	M	X04 S01 S01	
28	D035	139	M	X04 S01 S01	
29	D036	26	M	X04 S01 S01	
30	D037	26	M	X04 S01 S01	
31	D038	26	M	X04 S01 S01	
32	D039	26	M	X04 S01 S01	
33	D040	140	M	X04 S01 S01	
34	D043	26	M	X04 S01 S01	
35	P015	945	M	X04 S01 S01	

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EPA ID Number *(Enter from page 1)*: N M 4 8 9 0 1 3 9 0 8 8

Secondary ID Number *(Enter from page 1)*:

XIV. Description of Hazardous Wastes *(Continued; use additional sheets as necessary)*

Line Number	A. EPA Hazardous Waste No. (Enter code)	B. Estimated Annual Quantity of Waste	C. Unit of Measure (Enter code)	D. PROCESSES (1) PROCESS CODES (Enter code)	D. PROCESSES (2) PROCESS DESCRIPTION (If a code is not entered in D(1))
1	U002	344	M	X04 S01 S01	
2	U019	344	M	X04 S01 S01	
3	U037	344	M	X04 S01 S01	
4	U043	344	M	X04 S01 S01	
5	U044	344	M	X04 S01 S01	
6	U052	344	M	X04 S01 S01	
7	U070	344	M	X04 S01 S01	
8	U072	344	M	X04 S01 S01	
9	U078	344	M	X04 S01 S01	
10	U079	344	M	X04 S01 S01	
11	U105	344	M	X04 S01 S01	
12	U122	344	M	X04 S01 S01	
13	U133	344	M	X04 S01 S01	
14	U151	344	M	X04 S01 S01	
15	U154	344	M	X04 S01 S01	
16	U159	344	M	X04 S01 S01	
17	U196	344	M	X04 S01 S01	
18	U209	344	M	X04 S01 S01	
19	U210	344	M	X04 S01 S01	
20	U220	344	M	X04 S01 S01	
21	U226	344	M	X04 S01 S01	
22	U228	344	M	X04 S01 S01	
23	U239	344	M	X04 S01 S01	
24	P120	3.3	M	X04 S01 S01	
25	U134	344	M	X04 S01 S01	
26	D033	344	M	X04 S01 S01	
27	P030	344	M	X04 S01 S01	
28	P098	344	M	X04 S01 S01	
29	P099	344	M	X04 S01 S01	
30	P106	344	M	X04 S01 S01	
31	U003	344	M	X04 S01 S01	
32	U103	344	M	X04 S01 S01	
33	U108	344	M	X04 S01 S01	
34					
35					

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GSA No. 0248-EPA-OT

EPA ID Number (Enter from page 1)	Secondary ID Number (Enter from page 1)
N M 4 8 9 0 1 3 9 0 8 8	

XV. Map

Attach to this application a topographic map, or other equivalent map, of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing and proposed intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all springs, rivers and other surface water bodies in this map area. See instructions for precise requirements.

XVI. Facility Drawing

All existing facilities must include a scale drawing of the facility (See instructions for more detail).

XVII. Photographs

All existing facilities must include photographs (aerial or ground-level) that clearly delineate all existing structures; existing storage, treatment and disposal areas; and sites of future storage, treatment or disposal areas (see instructions for more detail).

XVIII. Certification(s)

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Owner Signature	Date Signed
Name and Official Title (Type or print) Inès R.Triay, Manager, DOE/Carlsbad Field Office	
Owner Signature	Date Signed
Name and Official Title (Type or print)	
Operator Signature	Date Signed
Name and Official Title (Type or print) Inès R.Triay, Manager, DOE/Carlsbad Field Office	
Operator Signature	Date Signed
Name and Official Title (Type or print) S. D. Warren, President – Washington TRU Solutions, LLC	

XIX. Comments

Section XVIII Operator Signature - *See attached "RCRA Part A Application Certification"

- ~~Date of submittal of clarifying information January XX, 2003~~
- ~~Additional data~~Previous revisions were submitted on July 9, 1991; November 12, 1992; January 29, 1993; March 2, 1995; May 26, 1995; April 12, 1996; May 29, 1996; April 21, 1999; May 10, 1999; February 2, 2001; March 7, 2001; June 18, 2001; ~~and~~ December 27, 2002; and January 16, 2003.
- Part A originally signed on January 18, 1991, and submitted on January 22, 1991.

Note: Mail completed form to the appropriate EPA Regional or State Office. (Refer to instructions for more information)

EPA Form 8700-23 (Rev. 10/99)

NM4890139088

RCRA PART A APPLICATION CERTIFICATION

The U.S. Department of Energy (DOE), through its Carlsbad Field Office, has signed as "owner and operator," and Washington TRU Solutions LLC, the Management and Operating Contractor (MOC), has signed this application for the permitted facility as "co-operator."

The DOE has determined that dual signatures best reflect the actual apportionment of Resource Conservation and Recovery Act (RCRA) responsibilities as follows:

> The DOE's RCRA responsibilities are for policy, programmatic directives, funding and scheduling decisions, Waste Isolation Pilot Plant (WIPP) requirements of DOE generator sites, auditing, and oversight of all other parties engaged in work at the WIPP, as well as general oversight.
>
> The MOC's RCRA responsibilities are for certain day-to-day operations (in accordance with general directions given by the DOE and in the Management and Operating Contract as part of its general oversight responsibility), including, but not limited to, the following: certain waste handling, monitoring, record keeping, certain data collection, reporting, technical advice, and contingency planning.
>
> For purposes of the certification required by Title 20 of the New Mexico Administrative Code, Chapter 4, Part 1 (20.4.1 NMAC), Subpart IX, §270.11(d), the DOE's and the MOC's representatives certify, under penalty of law that this document and all attachments were prepared under their direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on their inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of their knowledge and belief, true, accurate, and complete for their respective areas of responsibility. We are aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Owner and Operator Signature: ______________________
Title: Manager, Carlsbad Field Office
for: U.S. Department of Energy
Date: 1/13/03

Co-Operator Signature: ______________________
Title: President
for: Washington TRU Solutions LLC
Date: 1/16/03

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APPENDIX O1
OTHER ENVIRONMENTAL PERMITS

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ACTIVE ENVIRONMENTAL PERMITS AND APPROVALS FOR THE WASTE ISOLATION PILOT PLANT AS OF APRIL 1, 2003

	Granting Agency	Type of Permit	Permit Number	Granted/ Submitted	Expiration	Current Permit Status
1.	Department of the Interior, Bureau of Land Management	Right-of-Way for Water Pipeline	NM53809	08/17/83	In Perpetuity	Active
2.	Department of the Interior, Bureau of Land Management	Right-of-Way for the North Access Road	NM55676	08/24/83	None	Active
3.	Department of the Interior, Bureau of Land Management	Right-of-Way for Railroad	NM55699	09/27/83	None	Active
4.	Department of the Interior, Bureau of Land Management	Right-of-Way for Dosimetry and Aerosol Sampling Sites	NM63136	07/31/86	07/31/11	Active
5.	Department of the Interior, Bureau of Land Management	Right-of-Way for Seven Subsidence Monuments	NM65801	11/07/86	None	Active
6.	Department of the Interior, Bureau of Land Management	Right-of-Way for Aerosol Sampling Site	NM77921	08/18/89	08/18/19	Active
7.	Department of the Interior, Bureau of Land Management	Right-of-Way for 2 Survey Monuments	NM82245	12/13/89	12/13/19	Active
8.	Department of the Interior, Bureau of Land Management	Right-of-Way for telephone cable	NM46029	07/03/90	09/04/11	Active
9.	Department of the Interior, Bureau of Land Management	Right-of-Way for SPS Powerline	NM43203	02/20/96	10/19/11	Active
10.	Department of the Interior, Bureau of Land Management	Right-of-Way for South Access Road	NM46130	09/26/94	08/17/31	Active
11.	Department of the Interior, Bureau of Land Management	Right-of-Way for Duval telephone line	NM60174	11/06/96	03/08/15	Active
12.	Department of the Interior, Bureau of Land Management	Right-of-Way for Wells AEC-7 & AEC-8	NM108365	08/30/02	08/30/32	Active
13.	Department of the Interior, Bureau of Land Management	Right-of-Way for ERDA-6	NM108365	08/30/02	08/30/32	Active
14.	Department of the Interior, Bureau of Land Management	Right-of-Way for Well C-2756 (P-18)	NM108365	08/30/02	08/30/32	Active
15.	Department of the Interior, Bureau of Land Management	Right-of-Way for Monitoring Well C-2664 (Cabin Baby)	NM107944	04/23/02	04/23/32	Active

	Granting Agency	Type of Permit	Permit Number	Granted/ Submitted	Expiration	Current Permit Status
16.	Department of the Interior, Bureau of Land Management	Right-of-Way for Seismic Monitoring Station	NM85426	09/23/91	None	Active
17.	Department of the Interior, Bureau of Land Management	Right-of-Way for Wells C-2725 (H-4A), C-2775 (H-4B), & C-2776 (H-4C)	NM108365	08/30/02	08/30/32	Active
18.	Department of the Interior, Bureau of Land Management	Right-of-Way for Monitoring Wells C-2723 (WIPP-25), C-2724 (WIPP-26), C-2722 (WIPP-27), C-2636 (WIPP-28), C-2743 (WIPP-29), & C-2727 (WIPP-30)	NM108365	08/30/02	08/30/32	Active
19.	Department of the Interior, Bureau of Land Management	Right-of-Way for Aerosol Sampling Sites	NM77921	10/03/89	08/18/19	Active
20.	Department of the Interior, Bureau of Land Management	Right-of-Way easement for accessing state trust lands in Eddy & Lea Counties	NM25430	02/29/00	09/28/04	Active
21.	U.S. Department of the Interior, Fish and Wildlife Service	Concurrence that WIPP construction activities will have no significant impact on federally-listed threatened or endangered species	None	05/29/80	None	Active
22.	U.S. Department of the Interior, Fish and Wildlife Service	Master Personal Banding	#22478	05/19/93	Auto. Renewed every 3 years	Active
23.	New Mexico Commissioner of Public Lands	Right-of-Way for High Volume Air Sampler	RW-22789	10/03/85	10/03/20	Active
24.	New Mexico Environment Department Groundwater Bureau	Discharge Permit	DP-831	07/03/97	07/03/02 (Comments on Draft Renewal submitted April 10, 2003)	Active
25.	New Mexico Environment Department Air Quality Bureau	Operating Permit for two backup diesel generators	310-M-2	12/07/93	None	Active
26.	New Mexico Department of Game and Fish	Concurrence that WIPP construction activities will have no significant impact on state-listed threatened or endangered	None 07/25/83	05/26/89	None	Active

	Granting Agency	Type of Permit	Permit Number	Granted/ Submitted	Expiration	Current Permit Status
		species				
27.	New Mexico Environment Department-UST Bureau	Underground Storage Tanks	NMED11811 (Number changes annually)	07/01/02	06/30/03 (2003 registration submitted 6/18/02)	Active
28.	New Mexico State Engineer Office	Monitoring Well Exhaust Shaft Exploratory Borehole	C-2801,	02/23/01	None	Active
29.	New Mexico State Engineer Office	Monitoring Well Exhaust Shaft Exploratory Borehole	C-2802	02/23/01	None	Active
30.	New Mexico State Engineer Office	Monitoring Well Exhaust Shaft Exploratory Borehole	C-2803	02/23/01	None	Active
31.	New Mexico State Engineer Office	Monitoring Well	C-2811	03/02/02	None	Active
32.	New Mexico State Engineer Office	Appropriation: WQSP-1 Well	C-2413	10/21/96	None	Active
33.	New Mexico State Engineer Office	Appropriation: WQSP-2 Well	C-2414	10/21/96	None	Active
34.	New Mexico State Engineer Office	Appropriation: WQSP-3 Well	C-2415	10/21/96	None	Active
35.	New Mexico State Engineer Office	Appropriation: WQSP-4 Well	C-2416	10/21/96	None	Active
36.	New Mexico State Engineer Office	Appropriation: WQSP-5 Well	C-2417	10/21/96	None	Active
37.	New Mexico State Engineer Office	Appropriation: WQSP-6 Well	C-2418	10/21/96	None	Active
38.	New Mexico State Engineer Office	Appropriation: WQSP-6a Well	C-2419	10/21/96	None	Active
39.	New Mexico State Engineer Office	Monitoring Well AEC-7	C-2742	11/06/00	None	Active
40.	New Mexico State Engineer Office	Monitoring Well AEC-8	C-2744	11/06/00	None	Active
41.	New Mexico State Engineer Office	Monitoring Well Cabin Baby	C-2664	07/30/99	None	Active
42.	New Mexico State Engineer Office	Monitoring Well D-268 Plugged to 220'. Livestock watering	C-2638	01/12/99	None	Active

	Granting Agency	Type of Permit	Permit Number	Granted/ Submitted	Expiration	Current Permit Status
43.	New Mexico State Engineer Office	Monitoring Well DOE-1	C-2757	11/06/00	None	Active
44.	New Mexico State Engineer Office	Monitoring Well DOE-2	C-2682	04/17/00	None	Active
45.	New Mexico State Engineer Office	Monitoring Well ERDA-9	C-2752	11/06/00	None	Active
46.	New Mexico State Engineer Office	Monitoring Well H-1	C-2765	11/06/00	None	P&A
47.	New Mexico State Engineer Office	Monitoring Well H-2A	C-2762	11/06/00	None	Active
48.	New Mexico State Engineer Office	Monitoring Well H-2B1	C-2758	11/06/00	None	Active
49.	New Mexico State Engineer Office	Monitoring Well H-2B2	C-2763	11/06/00	None	Active
50.	New Mexico State Engineer Office	Monitoring Well H-2C	C-2759	11/06/00	None	Active
51.	New Mexico State Engineer Office	Monitoring Well H-3B1	C-2764	11/06/00	None	Active
52.	New Mexico State Engineer Office	Monitoring Well H-3B2	C-2760	11/06/00	None	Active
53.	New Mexico State Engineer Office	Monitoring Well H-3B3	C-2761	11/06/00	None	Active
54.	New Mexico State Engineer Office	Monitoring Well H-3D	pending	11/06/00	None	Active
55.	New Mexico State Engineer Office	Monitoring Well H-4A	C-2725	11/06/00	None	P&A
56.	New Mexico State Engineer Office	Monitoring Well H-4B	C-2775	11/06/00	None	Active
57.	New Mexico State Engineer Office	Monitoring Well H-4C	C-2776	11/06/00	None	Active
58.	New Mexico State Engineer Office	Monitoring Well H-5A	C-2746	11/06/00	None	Active
59.	New Mexico State Engineer Office	Monitoring Well H-5B	C-2745	11/06/00	None	Active
60.	New Mexico State Engineer Office	Monitoring Well H-5C	C-2747	11/06/00	None	Active
61.	New Mexico State Engineer	Monitoring Well	C-2751	11/06/00	None	Active

	Granting Agency	Type of Permit	Permit Number	Granted/ Submitted	Expiration	Current Permit Status
	Office	H-6A				
62.	New Mexico State Engineer Office	Monitoring Well H-6B	C-2749	11/06/00	None	Active
63.	New Mexico State Engineer Office	Monitoring Well H-6C	C-2750	11/06/00	None	Active
64.	New Mexico State Engineer Office	Monitoring Well H-7A	C-2694	04/17/00	None	P&A
65.	New Mexico State Engineer Office	Monitoring Well H-7B1	C-2770	11/06/00	None	Active
66.	New Mexico State Engineer Office	Monitoring Well H-7B2	C-2771	11/06/00	None	Active
67.	New Mexico State Engineer Office	Monitoring Well H-7C	C-2772	11/06/00	None	Active
68.	New Mexico State Engineer Office	Monitoring Well H-8A	C-2780	11/06/00	None	Active
69.	New Mexico State Engineer Office	Monitoring Well H-8B	C-2781	11/06/00	None	Active
70.	New Mexico State Engineer Office	Monitoring Well H-8C	C-2782	11/06/00	None	Active
71.	New Mexico State Engineer Office	Monitoring Well H-9A	C-2785	11/06/00	None	P&A
72.	New Mexico State Engineer Office	Monitoring Well H-9B	C-2783	11/06/00	None	Active
73.	New Mexico State Engineer Office	Monitoring Well H-9C	C-2784	11/06/00	None	Active
74.	New Mexico State Engineer Office	Monitoring Well H-10A	C-2779	11/06/00	None	Active
75.	New Mexico State Engineer Office	Monitoring Well H-10B	C-2778	11/06/00	None	P&A
76.	New Mexico State Engineer Office	Monitoring Well H-10C	C-2695	04/17/00	None	Active
77.	New Mexico State Engineer Office	Monitoring Well H-11B1	C-2767	11/06/00	None	Active
78.	New Mexico State Engineer Office	Monitoring Well H-11B2	C-2687	04/17/00	None	Active
79.	New Mexico State Engineer Office	Monitoring Well H-11B3	C-2768	11/06/00	None	Active

	Granting Agency	Type of Permit	Permit Number	Granted/ Submitted	Expiration	Current Permit Status
80.	New Mexico State Engineer Office	Monitoring Well H-11B4	C-2769	11/06/00	None	Active
81.	New Mexico State Engineer Office	Monitoring Well H-12	C-2777	11/06/00	None	Active
82.	New Mexico State Engineer Office	Monitoring Well H-14	C-2766	11/06/00	None	Active
83.	New Mexico State Engineer Office	Monitoring Well H-15	C-2685	04/17/00	None	Active
84.	New Mexico State Engineer Office	Monitoring Well H-16	C-2753	11/06/00	None	Active
85.	New Mexico State Engineer Office	Monitoring Well H-17	C-2773	11/06/00	None	Active
86.	New Mexico State Engineer Office	Monitoring Well H-18	C-2683	04/17/00	None	Active
87.	New Mexico State Engineer Office	Monitoring Well H-19B0	C-2420	01/25/95	01/31/98	Inactive Renew when necessary
88.	New Mexico State Engineer Office	Monitoring Well H-19B1	C-2420	01/25/95	01/31/98	Inactive Renew when necessary
89.	New Mexico State Engineer Office	Monitoring Well H-19B2	C-2421	01/25/95	01/31/98	Inactive Renew when necessary
90.	New Mexico State Engineer Office	Monitoring Well H-19B3	C-2422	01/25/95	01/31/98	Inactive Renew when necessary
91.	New Mexico State Engineer Office	Monitoring Well H-19B4	C-2423	01/25/95	01/31/98	Inactive Renew when necessary
92.	New Mexico State Engineer Office	Monitoring Well H-19B5	C-2424	01/25/95	01/31/98	Inactive Renew when necessary
93.	New Mexico State Engineer Office	Monitoring Well H-19B6	C-2425	01/25/95	01/31/98	Inactive Renew when necessary
94.	New Mexico State Engineer Office	Monitoring Well H-19B7	C-2426	01/25/95	01/31/98	Inactive Renew when necessary
95.	New Mexico State Engineer Office	Monitoring Well P-14	C-2637	01/02/99	None	P&A

	Granting Agency	Type of Permit	Permit Number	Granted/ Submitted	Expiration	Current Permit Status
96.	New Mexico State Engineer Office	Monitoring Well P-15	C-2686	04/17/00	None	P&A
97.	New Mexico State Engineer Office	Monitoring Well P-17	C-2774	11/06/00	None	Active
98.	New Mexico State Engineer Office	Monitoring Well P-18	C-2756	11/06/00	None	P&A
99.	New Mexico State Engineer Office	Monitoring Well WIPP-12	C-2639	01/12/99	None	Active
100.	New Mexico State Engineer Office	Monitoring Well WIPP-13	C-2748	11/06/00	None	Active
101.	New Mexico State Engineer Office	Monitoring Well WIPP-18	C-2684	04/17/00	None	Active
102.	New Mexico State Engineer Office	Monitoring Well WIPP-19	C-2755	11/06/00	None	Active
103.	New Mexico State Engineer Office	Monitoring Well WIPP-21	C-2754	11/06/00	None	Active
104.	New Mexico State Engineer Office	Monitoring Well WIPP-25	C-2723	07/26/00	None	Active
105.	New Mexico State Engineer Office	Monitoring Well WIPP-26	C-2724	11/06/00	None	Active
106.	New Mexico State Engineer Office	Monitoring Well WIPP-27	C-2722	11/06/00	None	Active
107.	New Mexico State Engineer Office	Monitoring Well WIPP-28	C-2636	01/12/99	None	P&A
108.	New Mexico State Engineer Office	Monitoring Well WIPP-29	C-2743	11/06/00	None	Active
109.	New Mexico State Engineer Office	Monitoring Well WIPP-30	C-2727	08/04/00	None	Active

P&A – Plugged and Abandoned

Attachment C

Revised Inventory Report, 2003

All Waste Streams at RFETS Which Have Been Assigned Hazardous Waste Numbers

AppendixO	Site_Code	WIPP_ID	Handling	MWIR_matrix_code	Final_Waste_Form	EPA_Codes
FALSE	RF	RF-MT0001	CH	S3121	Solidified Inorganics	D004, D005, D009, D010, F001, F002, F005, F006, F007, F009
FALSE	RF	RF-MT0002	CH	S3121	Solidified Inorganics	D004, D005, D009, D010, F001, F002, F005, F006, F007, F010
FALSE	RF	RF-MT0003	CH	S3290	Solidified Organics	F001, F002
FALSE	RF	RF-MT0007	CH	S3190	Solidified Inorganics	F001, F002, F005, F006, F007, F009
FALSE	RF	RF-MT0089	CH	S3229	Solidified Inorganics	D007
FALSE	RF	RF-MT0090	CH	S3119	Solidified Inorganics	D005, D006, D007, D008, D010, D011
FALSE	RF	RF-MT0091	CH	S3119	Solidified Inorganics	D005, D006, D007, D008, D010, D011
FALSE	RF	RF-MT0092	CH	S3119	Solidified Inorganics	D005, D006, D007, D008, D010, D011
FALSE	RF	RF-MT0093	CH	S3119	Solidified Inorganics	D005, D006, D007, D008, D010, D011
FALSE	RF	RF-MT0097	CH	S3119	Solidified Inorganics	D005, D006, D007, D008, D010, D011
FALSE	RF	RF-MT0099	CH	S3229	Solidified Organics	D007
FALSE	RF	RF-MT0290	CH	S3129	Solidified Inorganics	D006, D007, D008, F001, F002, F005
FALSE	RF	RF-MT-0292	CH	S3129	Solidified Inorganics	D004, D005, D006, D007, D008, D009, D010, D011, F001, F002, F003, F005
FALSE	RF	RF-MT-0299	CH	S3129	Solidified Inorganics	D006, D007, D008, D011, F001, F002, F005
FALSE	RF	RF-MT0302	CH	S5313	Combustible Waste	D005, D008
FALSE	RF	RF-MT0320	CH	S5112	Uncategorized Metal	D008
FALSE	RF	RF-MT0321	CH	S5112	Lead/Cadmium Metal Waste	D008
FALSE	RF	RF-MT-0328	CH	S5410	Filter	D004, D005, D006, D007, D008, D009, D010, D011, F001, F002, F005
FALSE	***RF***	***RF-MT0330***	***CH***	***S5390***	***Combustible***	***D004, D005, D006, D007, D008, D009, D010, D011, D018, D019, D022, D028, D029, D035, D038, D040, D043, F001, F002, F005, F006, F007, F009, P030, P098, P099, P106, U003, U103, U108***
FALSE	RF	RF-MT-0331	CH	S5410	Filter	D006, D008, F001, F002
FALSE	RF	RF-MT0332	CH	S3229	Solidified Organics	D007, D008, F001, F002
FALSE	RF	RF-MT-0335	CH	S5410	Filter	D007, D008, D011, F001, F002, F005
FALSE	***RF***	***RF-MT0336***	***CH***	***S5390***	***Combustible***	***D004, D005, D006, D007, D008, D009, D010, D011, D018, D019, D022, D028, D029, D035, D038, D040, D043, F001, F002, F005, F006, F007, F009, P030, P098, P099, P106, U003, U103, U108***
FALSE	***RF***	***RF-MT0337***	***CH***	***S5390***	***Combustible***	***D004, D005, D006, D007, D008, D009, D010, D011, D018, D019, D022, D028, D029, D035, D038, D040, D043, F001, F002, F005, F006, F007, F009, P030, P098, P099, P106, U003, U103, U108***
FALSE	RF	RF-MT0339	CH	S5311	Combustible	D006, D007, D008, F001, F002, F005
FALSE	RF	RF-MT-0342	CH	S5410	Filter	D008
FALSE	RF	RF-MT0371	CH	S5123	Inorganic Non-Metal	D004, D005, D006, D007, D008, D009, D010, D011, F001, F002, F005
FALSE	RF	RF-MT-0372	CH	S5123	Inorganic Non-Metal	D007
FALSE	RF	RF-MT0373	CH	S3119	Solidified Inorganics	D004, D005, D006, D007, D008, D009, D010, D011, F001, F002, F005
FALSE	RF	RF-MT0374	CH	S5420	Heterogeneous	D007, F001, F002, F003, F005, F006, F007, F009, P030, P098, P099, P106, U003, U103, U108
FALSE	RF	RF-MT0377	CH	S5123	Solidified Inorganics	D004, D005, D006, D007, D008, D009, D010, D011, F001, F002, F005
FALSE	RF	RF-MT0378	CH	S5123	Inorganic Non-Metal	D004, D005, D006, D007, D008, D009, D010, D011, F001, F002, F005
FALSE	RF	RF-MT0419	CH	S3111	Solidified Inorganics	D004, D005, D006, D007, D008, D009, D010, D011, F001, F002, F005
FALSE	RF	RF-MT0420	CH	S3111	Solidified Inorganics	D004, D005, D006, D007, D008, D009, D010, D011, F001, F002, F005
FALSE	RF	RF-MT0423	CH	S3111	Solidified Inorganics	D004, D005, D006, D007, D008, D009, D010, D011, F001, F002, F005
FALSE	RF	RF-MT0425	CH	S3111	Solidified Inorganics	D007
FALSE	RF	RF-MT-0438	CH	S5129	Inorganic Non-metal	F001, F002, F005, F006, F007, F009

AppendixO	Site_Code	WIPP_ID	Handling	MWIR_matrix_code	Final_Waste_Form	EPA_Codes
FALSE	RF	RF-MT0440	CH	S5122	Inorganic Non-metal	D005, D008, D009, F001, F002
FALSE	RF	RF-MT0442	CH	S5122	Inorganic Non-Metal	F001, F002
FALSE	RF	RF-MT0443	CH	S5122	Inorganic Non-metal Waste	F001, F002, F005
FALSE	RF	RF-MT0444	CH	S5122	Inorganic Non-Metal	D005, D006, D009
FALSE	RF	RF-MT0480	CH	S5119	Lead/Cadmium Metal Waste	D004, D005, D006, D007, D008, D009, D011, D019, F001, F002, F005, F006, F007, F009
FALSE	RF	RF-MT0488	CH	S5112	Uncategorized Metal	D008
FALSE	RF	RF-MT0490	CH	S5410	Filters	F001, F002, F005, F006, F007, F009
FALSE	RF	RF-MT-0491	CH	S5410	Filter	D008, D010, F001, F002, F005, F006, F007, F009
FALSE	***RF***	***RF-MT0523A***	***CH***	***S3219***	***Solidified Organics***	***D004, D005, D006, D007, D008, D009, D010, D011, D022, D027, D028, D029, D032, D033, D034, D043, F001, F002, F005, F006, F007, F009, P030, P098, P099, P106, U003, U103, U108***
FALSE	***RF***	***RF-MT0523B***	***CH***	***S3900***	***Solidified Organics***	***D004, D005, D006, D007, D008, D009, D010, D011, D022, D027, D028, D029, D032, D033, D034, D043, F001, F002, F005, F006, F007, F009, P030, P098, P099, P106, U003, U103, U108***
FALSE	***RF***	***RF-MT0523C***	***CH***	***S5420***	***Heterogeneous Debris Waste***	***D004, D005, D006, D007, D008, D009, D010, D011, D022, D027, D028, D029, D032, D033, D034, D043, F001, F002, F005, F006, F007, F009, P030, P098, P099, P106, U003, U103, U108***
FALSE	***RF***	***RF-MT0523D***	***CH***	***S5440***	***Heterogeneous Debris Waste***	***D004, D005, D006, D007, D008, D009, D010, D011, D022, D027, D028, D029, D032, D033, D034, D043, F001, F002, F005, F006, F007, F009, P030, P098, P099, P106, U003, U103, U108***
FALSE	***RF***	***RF-MT0523E***	***CH***	***S5490***	***Heterogeneous Debris Waste***	***D004, D005, D006, D007, D008, D009, D010, D011, D022, D027, D028, D029, D032, D033, D034, D043, F001, F002, F005, F006, F007, F009, P030, P098, P099, P106, U003, U103, U108***
FALSE	RF	RF-MT0531	CH	S3229	Solidified Organics	F001, F002, F005
FALSE	RF	RF-MT0532E	CH	S3119	Solidified Inorganics	D004, D005, D006, D007, D008, D009, D010, D011, D018, D019, D035, D040, F001, F002, F005, F006, F007, F009
FALSE	RF	RF-MT0532F	CH	S5129	Inorganic Non-metal Waste	D004, D005, D006, D007, D008, D009, D010, D011, D018, D019, D035, D040, F001, F002, F005, F006, F007, F009
FALSE	RF	RF-MT0541	CH	L1190	Solidified Inorganics	D004, D005, D006, D007, D008, D009, D010, D011
FALSE	RF	RF-MT0800	CH	S3190	Solidified Inorganics	D006, D007, D011, F001, F002
FALSE	RF	RF-MT0801	CH	S3190	Solidified Organics	D005, D006, D007, D010, F001, F002
FALSE	RF	RF-MT0803	CH	S3190	Solidified Inorganics	F001, F002, F005, F006, F007, F009
FALSE	RF	RF-MT0806	CH	S3119	Solidified Inorganics	D004, D008
FALSE	RF	RF-MT0807	CH	S3190	Solidified Inorganics	F001, F002, F005, F006, F007, F009
FALSE	RF	RF-MT0816	CH	S3290	Solidified Organics	D006, D007, D008, D010, D022, D029, F001, F002, F005
FALSE	RF	RF-MT-0823	CH	S3900	Solidified Inorganics	D006, D007, D008, F001, F002, F005
FALSE	RF	RF-MT0827	CH	S3290	Solidified Organics	D004, D005, D006, D007, D008, D009, D010, D011, D022, D027, D028, D029, D034, D041, D043, F001, F002, F005
FALSE	***RF***	***RF-MT0831***	***CH***	***S5390***	***Combustible***	***D004, D005, D006, D007, D008, D009, D010, D011, D018, D019, D022, D028, D029, D035, D038, D040, D043, F001, F002, F005, F006, F007, F009, P030, P098, P099, P106, U003, U103, U108***
FALSE	***RF***	***RF-MT0832***	***CH***	***S5390***	***Combustible***	***D004, D005, D006, D007, D008, D009, D010, D011, D018, D019, D022, D028, D029, D035, D038, D040, D043, F001, F002, F005, F006, F007, F009, P030, P098, P099, P106, U003, U103, U108***

AppendixO	Site_Code	WIPP_ID	Handling	MWIR_matrix_code	Final_Waste_Form	EPA_Codes
FALSE	***RF***	***RF-MT0833***	***CH***	***S5390***	***Combustible***	***D004, D005, D006, D007, D008, D009, D010, D011, D018, D019, D022, D028, D029, D035, D038, D040, D043, F001, F002, F005, F006, F007, F009, P030, P098, P099, P106, U003, U103, U108***
FALSE	RF	RF-MT0855	CH	S5122	Inorganic Non-Metal	D009
FALSE	RF	RF-MT0857	CH	S3119	Solidified Inorganics	D006, D007, D008, F001, F002, F005
FALSE	RF	RF-MT0H61	CH	S3119	Solidified Inorganics	D006, D007, D008, D018, D019
FALSE	RF	RF-MT2116	CH	S5390	Combustible	D007, D008, F001, F002, F005
FALSE	RF	RF-MT3010	CH	S5420	Heterogeneous Debris Waste	D008, D011, F001, F002
FALSE	RF	RF-MT3011	CH	S5490	Heterogeneous Debris Waste	D004, D005, D006, D007, D008, D009, D010, D011, F001, F002, F005
FALSE	RF	RF-MT420P	CH	S3111	Solidified Inorganics	D004, D005, D006, D007, D008, D009, D010, D011, F001, F002, F005
FALSE	RF	RF-MT532A	CH	S3119	Solidified Inorganics	TBD
FALSE	RF	RF-MT532B	CH	S3119	Solidified Inorganics	TBD
FALSE	RF	RF-MT532C	CH	S3119	Solidified Inorganics	TBD
FALSE	RF	RF-MT532D	CH	S3119	Solidified Inorganics	TBD
TRUE	RF	RF-MT0375A	CH	S3113	Solidified Organics	F001, F002, TBD
TRUE	RF	RF-MT0375B	CH	S3114	Solidified Organics	F001, F002, TBD
TRUE	RF	RF-MT0505	CH	TBD	TBD	F001, F002, F005, F006, F007, F009
TRUE	RF	RF-MT0529	CH	TBD	TBD	D004, D005, D006, D007, D008, D009, D010, D011, D018, D019, D022, D027, D028, D029, D034, D039, D040, D043, F001, F002, F003, F005, F006, F007, F009
TRUE	RF	RF-MT0533	CH	TBD	TBD	D007, D010, D022, D028, D029, D043, F001, F002, F005
TRUE	RF	RF-MT0535	CH	TBD	TBD	D004, D005, D006, D007, D008, D009, D010, D011, F001, F002, F003, F005
TRUE	***RF***	***RF-MT0828***	***CH***	***S3190***	***Solidified Inorganics***	***D004, D005, D009, D010, F001, F002, F005, F006, F007, F009, P030, P098, P099, P106, U003, U103, U108***
TRUE	RF	RF-MT0829	CH	S3190	Solidified Inorganics	D004, D005, D009, D010, F001, F002, F005, F006, F007, F009

Attachment D

Hexachlorobutadiene Material Safety Data Sheet

*** CHEMICAL IDENTIFICATION ***

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RTECS NUMBER              : EJ0700000
CHEMICAL NAME             : 1,3-Butadiene, hexachloro-
CAS REGISTRY NUMBER       : 87-68-3
BEILSTEIN REFERENCE NO. : 1766570
REFERENCE                 : 4-01-00-00988 (Beilstein Handbook Reference)
LAST UPDATED              : 200007
DATA ITEMS CITED          : 71
MOLECULAR FORMULA         : C4-Cl6
MOLECULAR WEIGHT          : 260.74
WISWESSER LINE NOTATION : GYGUYGYGUYGG
COMPOUND DESCRIPTOR       : Agricultural Chemical
                            Tumorigen
                            Mutagen
                            Reproductive Effector
                            Primary Irritant
SYNONYMS/TRADE NAMES :
   * Dolen-pur
   * GP-40-66:120
   * HCBD
   * Hexachlor-1,3-butadien
   * Hexachlorbutadiene
   * Hexachlorobutadiene
   * 1,3-Hexachlorobutadiene
   * 1,1,2,3,4,4-Hexachloro-1,3-butadiene
   * Hexachlorobutadiene
   * Perchlorobutadiene
   * RCRA waste number U128
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*** HEALTH HAZARD DATA ***

** SKIN/EYE IRRITATION DATA **

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TYPE OF TEST              : Standard Draize test
ROUTE OF EXPOSURE         : Administration onto the skin
SPECIES OBSERVED          : Rodent - rabbit
DOSE/DURATION             : 810 mg/24H
REACTION SEVERITY         : Moderate
REFERENCE :
   EJTXAZ European Journal of Toxicology and Environmental Hygiene.  (Paris,
   France)  V.7-9, 1974-76. For publisher information, see TOERD9.
   Volume(issue)/page/year: 9,171,1976

TYPE OF TEST              : Standard Draize test
ROUTE OF EXPOSURE         : Administration onto the skin
SPECIES OBSERVED          : Rodent - rabbit
DOSE/DURATION             : 500 mg/24H
REACTION SEVERITY         : Mild
REFERENCE :
   85JCAE "Prehled Prumyslove Toxikologie; Organicke Latky," Marhold, J.,
   Prague, Czechoslovakia, Avicenum, 1986  Volume(issue)/page/year: -,116,1986

TYPE OF TEST              : Standard Draize test
ROUTE OF EXPOSURE         : Administration into the eye
SPECIES OBSERVED          : Rodent - rabbit
DOSE/DURATION             : 162 mg
REACTION SEVERITY         : Mild
REFERENCE :
   EJTXAZ European Journal of Toxicology and Environmental Hygiene.  (Paris,
   France)  V.7-9, 1974-76. For publisher information, see TOERD9.
   Volume(issue)/page/year: 9,171,1976
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TYPE OF TEST            : Standard Draize test
ROUTE OF EXPOSURE       : Administration into the eye
SPECIES OBSERVED        : Rodent - rabbit
DOSE/DURATION           : 500 mg/24H
REACTION SEVERITY       : Mild
REFERENCE :
   85JCAE "Prehled Prumyslove Toxikologie; Organicke Latky," Marhold, J.,
   Prague, Czechoslovakia, Avicenum, 1986  Volume(issue)/page/year: -,116,1986

                        ** ACUTE TOXICITY DATA **

TYPE OF TEST            : LD50 - Lethal dose, 50 percent kill
ROUTE OF EXPOSURE       : Oral
SPECIES OBSERVED        : Rodent - rat
DOSE/DURATION           : 82 mg/kg
TOXIC EFFECTS :
   Details of toxic effects not reported other than lethal dose value
REFERENCE :
   GISAAA Gigiena i Sanitariya.  For English translation, see HYSAAV.  (V/O
   Mezhdunarodnaya Kniga, 113095 Moscow, USSR)  V.1-    1936-
   Volume(issue)/page/year: 37(2),32,1972

TYPE OF TEST            : LD50 - Lethal dose, 50 percent kill
ROUTE OF EXPOSURE       : Intraperitoneal
SPECIES OBSERVED        : Rodent - rat
DOSE/DURATION           : 175 mg/kg
TOXIC EFFECTS :
   Behavioral - somnolence (general depressed activity)
   Behavioral - irritability
REFERENCE :
   EJTXAZ European Journal of Toxicology and Environmental Hygiene.  (Paris,
   France)  V.7-9, 1974-76. For publisher information, see TOERD9.
   Volume(issue)/page/year: 8,180,1975

TYPE OF TEST            : LD50 - Lethal dose, 50 percent kill
ROUTE OF EXPOSURE       : Oral
SPECIES OBSERVED        : Rodent - mouse
DOSE/DURATION           : 87 mg/kg
TOXIC EFFECTS :
   Details of toxic effects not reported other than lethal dose value
REFERENCE :
   GISAAA Gigiena i Sanitariya.  For English translation, see HYSAAV.  (V/O
   Mezhdunarodnaya Kniga, 113095 Moscow, USSR)  V.1-    1936-
   Volume(issue)/page/year: 28(2),9,1963

TYPE OF TEST            : LC50 - Lethal concentration, 50 percent kill
ROUTE OF EXPOSURE       : Inhalation
SPECIES OBSERVED        : Rodent - mouse
DOSE/DURATION           : 370 mg/m3
TOXIC EFFECTS :
   Details of toxic effects not reported other than lethal dose value
REFERENCE :
   GISAAA Gigiena i Sanitariya.  For English translation, see HYSAAV.  (V/O
   Mezhdunarodnaya Kniga, 113095 Moscow, USSR)  V.1-    1936-
   Volume(issue)/page/year: 37(2),32,1972

TYPE OF TEST            : LD50 - Lethal dose, 50 percent kill
ROUTE OF EXPOSURE       : Administration onto the skin
SPECIES OBSERVED        : Rodent - mouse
DOSE/DURATION           : 150 mg/kg
TOXIC EFFECTS :
   Details of toxic effects not reported other than lethal dose value
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REFERENCE :
GISAAA Gigiena i Sanitariya. For English translation, see HYSAAV. (V/O Mezhdunarodnaya Kniga, 113095 Moscow, USSR) V.1- 1936-
Volume(issue)/page/year: 37(2),32,1972

TYPE OF TEST : LD50 - Lethal dose, 50 percent kill
ROUTE OF EXPOSURE : Intraperitoneal
SPECIES OBSERVED : Rodent - mouse
DOSE/DURATION : 76 mg/kg
TOXIC EFFECTS :
Details of toxic effects not reported other than lethal dose value
REFERENCE :
EJTXAZ European Journal of Toxicology and Environmental Hygiene. (Paris, France) V.7-9, 1974-76. For publisher information, see TOERD9.
Volume(issue)/page/year: 7,247,1974

TYPE OF TEST : LD50 - Lethal dose, 50 percent kill
ROUTE OF EXPOSURE : Oral
SPECIES OBSERVED : Mammal - cat
DOSE/DURATION : 187 mg/kg
TOXIC EFFECTS :
Details of toxic effects not reported other than lethal dose value
REFERENCE :
GISAAA Gigiena i Sanitariya. For English translation, see HYSAAV. (V/O Mezhdunarodnaya Kniga, 113095 Moscow, USSR) V.1- 1936-
Volume(issue)/page/year: 37(2),32,1972

TYPE OF TEST : LD50 - Lethal dose, 50 percent kill
ROUTE OF EXPOSURE : Administration onto the skin
SPECIES OBSERVED : Rodent - rabbit
DOSE/DURATION : 100 mg/kg
TOXIC EFFECTS :
Details of toxic effects not reported other than lethal dose value
REFERENCE :
GISAAA Gigiena i Sanitariya. For English translation, see HYSAAV. (V/O Mezhdunarodnaya Kniga, 113095 Moscow, USSR) V.1- 1936-
Volume(issue)/page/year: 37(2),32,1972

TYPE OF TEST : LD50 - Lethal dose, 50 percent kill
ROUTE OF EXPOSURE : Oral
SPECIES OBSERVED : Rodent - guinea pig
DOSE/DURATION : 90 mg/kg
TOXIC EFFECTS :
Details of toxic effects not reported other than lethal dose value
REFERENCE :
GISAAA Gigiena i Sanitariya. For English translation, see HYSAAV. (V/O Mezhdunarodnaya Kniga, 113095 Moscow, USSR) V.1- 1936-
Volume(issue)/page/year: 28(2),9,1963

TYPE OF TEST : LD50 - Lethal dose, 50 percent kill
ROUTE OF EXPOSURE : Oral
SPECIES OBSERVED : Rodent - hamster
DOSE/DURATION : 960 mg/kg
TOXIC EFFECTS :
Details of toxic effects not reported other than lethal dose value
REFERENCE :
TXAPA9 Toxicology and Applied Pharmacology. (Academic Press, Inc., 1 E. First St., Duluth, MN 55802) V.1- 1959- Volume(issue)/page/year: 48,A192,1979

TYPE OF TEST : LC50 - Lethal concentration, 50 percent kill
ROUTE OF EXPOSURE : Inhalation
SPECIES OBSERVED : Mammal - species unspecified

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DOSE/DURATION            : 370 mg/m3
TOXIC EFFECTS :
   Details of toxic effects not reported other than lethal dose value
REFERENCE :
   GISAAA Gigiena i Sanitariya.  For English translation, see HYSAAV.  (V/O
   Mezhdunarodnaya Kniga, 113095 Moscow, USSR)  V.1-    1936-
   Volume(issue)/page/year: 55(5),72,1990

TYPE OF TEST             : LD50 - Lethal dose, 50 percent kill
ROUTE OF EXPOSURE        : Unreported
SPECIES OBSERVED         : Mammal - species unspecified
DOSE/DURATION            : 200 mg/kg
TOXIC EFFECTS :
   Details of toxic effects not reported other than lethal dose value
REFERENCE :
   30ZDA9 "Chemistry of Pesticides," Melnikov, N.N., New York, Springer-Verlag
   New York, Inc., 1971  Volume(issue)/page/year: -,40,1971

                 ** OTHER MULTIPLE DOSE TOXICITY DATA **

TYPE OF TEST             : TDLo - Lowest published toxic dose
ROUTE OF EXPOSURE        : Oral
SPECIES OBSERVED         : Rodent - rat
DOSE/DURATION            : 1274 mg/kg/26W-I
TOXIC EFFECTS :
   Brain and Coverings - other degenerative changes
   Behavioral - alteration of operant conditioning
   Blood - changes in serum composition (e.g. TP, bilirubin, cholesterol)
REFERENCE :
   GTPZAB Gigiena Truda i Professional'nye Zabolevaniya.  Labor Hygiene and
   Occupational Diseases. (V/O Mezhdunarodnaya Kniga, 113095 Moscow, USSR)
   V.1-36, 1957-1992. For publisher information, see MTPEEI
   Volume(issue)/page/year: 11(3),23,1967

TYPE OF TEST             : TDLo - Lowest published toxic dose
ROUTE OF EXPOSURE        : Oral
SPECIES OBSERVED         : Rodent - rat
DOSE/DURATION            : 14600 mg/kg/2Y-C
TOXIC EFFECTS :
   Kidney, Ureter, Bladder - other changes in urine composition
   Kidney, Ureter, Bladder - other changes
   Nutritional and Gross Metabolic - weight loss or decreased weight gain
REFERENCE :
   EVHPAZ EHP, Environmental Health Perspectives.  (U.S. Government Printing
   Office, Supt of Documents, Washington, DC 20402)  No.1-    1972-
   Volume(issue)/page/year: 21,49,1977

TYPE OF TEST             : TDLo - Lowest published toxic dose
ROUTE OF EXPOSURE        : Oral
SPECIES OBSERVED         : Rodent - rat
DOSE/DURATION            : 105 mg/kg/14D-C
TOXIC EFFECTS :
   Kidney, Ureter, Bladder - changes in bladder weight
   Nutritional and Gross Metabolic - weight loss or decreased weight gain
REFERENCE :
   TXAPA9 Toxicology and Applied Pharmacology.  (Academic Press, Inc., 1 E.
   First St., Duluth, MN 55802) V.1-    1959-  Volume(issue)/page/year:
   47,1,1979

TYPE OF TEST             : TDLo - Lowest published toxic dose
ROUTE OF EXPOSURE        : Oral
SPECIES OBSERVED         : Rodent - rat
DOSE/DURATION            : 794 mg/kg/18W-I
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TOXIC EFFECTS :
   Kidney, Ureter, Bladder - changes in tubules (including acute renal failure,
   acute tubular necrosis)
   Kidney, Ureter, Bladder - changes in bladder weight
   Liver - changes in liver weight
REFERENCE :
   TXAPA9 Toxicology and Applied Pharmacology.  (Academic Press, Inc., 1 E.
   First St., Duluth, MN 55802) V.1-    1959-  Volume(issue)/page/year:
   47,1,1979

TYPE OF TEST             : TCLo - Lowest published toxic concentration
ROUTE OF EXPOSURE        : Inhalation
SPECIES OBSERVED         : Rodent - rat
DOSE/DURATION            : 100 ppm/6H/2W-I
TOXIC EFFECTS :
   Kidney, Ureter, Bladder - changes in tubules (including acute renal failure,
   acute tubular necrosis)
   Nutritional and Gross Metabolic - weight loss or decreased weight gain
   Related to Chronic Data - death
REFERENCE :
   BJIMAG British Journal of Industrial Medicine.  (British Medical Journal,
   Box 560B, Kennebunkport, ME 04046)  V.1-    1944-  Volume(issue)/page/year:
   27,1,1970

TYPE OF TEST             : TDLo - Lowest published toxic dose
ROUTE OF EXPOSURE        : Oral
SPECIES OBSERVED         : Rodent - rat
DOSE/DURATION            : 560 mg/kg/4W-C
TOXIC EFFECTS :
   Kidney, Ureter, Bladder - other changes in urine composition
   Endocrine - changes in adrenal weight
   Biochemical - Enzyme inhibition, induction, or change in blood or tissue
   levels - transaminases
REFERENCE :
   FCTOD7 Food and Chemical Toxicology.  (Pergamon Press Inc., Maxwell House,
   Fairview Park, Elmsford, NY 10523)  V.20-    1982- Volume(issue)/page/year:
   31,125,1993

TYPE OF TEST             : TCLo - Lowest published toxic concentration
ROUTE OF EXPOSURE        : Inhalation
SPECIES OBSERVED         : Rodent - rat
DOSE/DURATION            : 26 mg/m3/2H/30D-I
TOXIC EFFECTS :
   Blood - other changes
   Blood - changes in leukocyte (WBC) count
   Nutritional and Gross Metabolic - weight loss or decreased weight gain
REFERENCE :
   GISAAA Gigiena i Sanitariya.  For English translation, see HYSAAV.  (V/O
   Mezhdunarodnaya Kniga, 113095 Moscow, USSR)  V.1-    1936-
   Volume(issue)/page/year: 37(2),32,1972

TYPE OF TEST             : TDLo - Lowest published toxic dose
ROUTE OF EXPOSURE        : Intraperitoneal
SPECIES OBSERVED         : Rodent - rat
DOSE/DURATION            : 313 mg/kg/3D-I
TOXIC EFFECTS :
   Liver - other changes
   Blood - changes in serum composition (e.g. TP, bilirubin, cholesterol)
   Biochemical - Enzyme inhibition, induction, or change in blood or tissue
   levels - phosphatases
REFERENCE :
   TIHEEC Toxicology and Industrial Health.  (Princeton Scientific Pub. Co.,
   POB 2155, Princeton, NJ 08540)  V.1-    1985-  Volume(issue)/page/year:
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8,191,1992

TYPE OF TEST : TDLo - Lowest published toxic dose
ROUTE OF EXPOSURE : Oral
SPECIES OBSERVED : Rodent - mouse
DOSE/DURATION : 540 mg/kg/15D-C
TOXIC EFFECTS :
Cardiac - changes in heart weight
Endocrine - changes in spleen weight
Nutritional and Gross Metabolic - weight loss or decreased weight gain
REFERENCE :
JEPOEC Journal of Environmental Pathology, Toxicology and Oncology. (Chem-Orbital, POB 134, Park Forest, IL 60466) V.5(4)- 1984-
Volume(issue)/page/year: 9,323,1989

TYPE OF TEST : TDLo - Lowest published toxic dose
ROUTE OF EXPOSURE : Oral
SPECIES OBSERVED : Rodent - mouse
DOSE/DURATION : 1092 mg/kg/13W-C
TOXIC EFFECTS :
Cardiac - changes in heart weight
Kidney, Ureter, Bladder - changes in bladder weight
Nutritional and Gross Metabolic - weight loss or decreased weight gain
REFERENCE :
NTIS** National Technical Information Service. (Springfield, VA 22161) Formerly U.S. Clearinghouse for Scientific & Technical Information.
Volume(issue)/page/year: PB91-185884

TYPE OF TEST : TDLo - Lowest published toxic dose
ROUTE OF EXPOSURE : Oral
SPECIES OBSERVED : Rodent - guinea pig
DOSE/DURATION : 420 mg/kg/30W-I
TOXIC EFFECTS :
Liver - other changes
Blood - changes in serum composition (e.g. TP, bilirubin, cholesterol)
Immunological Including Allergic - increase in cellular immune response
REFERENCE :
GTPZAB Gigiena Truda i Professional'nye Zabolevaniya. Labor Hygiene and Occupational Diseases. (V/O Mezhdunarodnaya Kniga, 113095 Moscow, USSR) V.1-36, 1957-1992. For publisher information, see MTPEEI
Volume(issue)/page/year: 9(11),50,1965

** TUMORIGENIC DATA **

TYPE OF TEST : TDLo - Lowest published toxic dose
ROUTE OF EXPOSURE : Oral
SPECIES OBSERVED : Rodent - rat
DOSE/DURATION : 15 gm/kg/2Y-C
TOXIC EFFECTS :
Tumorigenic - Carcinogenic by RTECS criteria
Kidney, Ureter, Bladder - Kidney tumors
REFERENCE :
AIHAAP American Industrial Hygiene Association Journal. (AIHA, 475 Wolf Ledges Pkwy., Akron, OH 44311) V.19- 1958- Volume(issue)/page/year: 38,589,1977

** REPRODUCTIVE DATA **

TYPE OF TEST : TDLo - Lowest published toxic dose
ROUTE OF EXPOSURE : Oral
SPECIES OBSERVED : Rodent - rat
DOSE : 45 mg/kg
SEX/DURATION : male 13 week(s) pre-mating

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                          female 13 week(s) pre-mating  - 3 week(s) post-birth
TOXIC EFFECTS :
   Reproductive - Effects on Newborn - biochemical and metabolic
REFERENCE :
   TXAPA9 Toxicology and Applied Pharmacology.  (Academic Press, Inc., 1 E.
   First St., Duluth, MN 55802) V.1-    1959-  Volume(issue)/page/year:
   42,387,1977

TYPE OF TEST            : TDLo - Lowest published toxic dose
ROUTE OF EXPOSURE       : Oral
SPECIES OBSERVED        : Rodent - rat
DOSE                    : 4 gm/kg
SEX/DURATION            : male 13 week(s) pre-mating
                          female 13 week(s) pre-mating  - 3 week(s) post-birth
TOXIC EFFECTS :
   Reproductive - Effects on Newborn - growth statistics (e.g.%, reduced weight
   gain)
REFERENCE :
   TXAPA9 Toxicology and Applied Pharmacology.  (Academic Press, Inc., 1 E.
   First St., Duluth, MN 55802) V.1-    1959-  Volume(issue)/page/year:
   42,387,1977

TYPE OF TEST            : TDLo - Lowest published toxic dose
ROUTE OF EXPOSURE       : Oral
SPECIES OBSERVED        : Rodent - rat
DOSE                    : 178 mg/kg
SEX/DURATION            : female 1-22 day(s) after conception
TOXIC EFFECTS :
   Reproductive - Specific Developmental Abnormalities - Central Nervous System
   Reproductive - Effects on Newborn - growth statistics (e.g.%, reduced weight
   gain)
REFERENCE :
   AAGEAA Arkhiv Anatomii, Gistologii i Embriologii.  Archives of Anatomy,
   Histology and Embryology. (V/O Mezhdunarodnaya Kniga, 113095 Moscow, USSR)
   V.1-101, 1916-91.  Discontinued  Volume(issue)/page/year: 89(8),44,1985

TYPE OF TEST            : TCLo - Lowest published toxic concentration
ROUTE OF EXPOSURE       : Inhalation
SPECIES OBSERVED        : Rodent - rat
DOSE                    : 15 ppm/6H
SEX/DURATION            : female 6-20 day(s) after conception
TOXIC EFFECTS :
   Reproductive - Effects on Embryo or Fetus - fetotoxicity (except death,
   e.g., stunted fetus)
REFERENCE :
   TOLED5 Toxicology Letters.  (Elsevier Science Pub. B.V., POB 211, 1000 AE
   Amsterdam, Netherlands) V.1-    1977-  Volume(issue)/page/year: 47,235,1989

TYPE OF TEST            : TDLo - Lowest published toxic dose
ROUTE OF EXPOSURE       : Intraperitoneal
SPECIES OBSERVED        : Rodent - rat
DOSE                    : 150 mg/kg
SEX/DURATION            : female 1-15 day(s) after conception
TOXIC EFFECTS :
   Reproductive - Fertility - post-implantation mortality (e.g. dead and/or
   resorbed implants per total number of implants)
   Reproductive - Effects on Embryo or Fetus - fetotoxicity (except death,
   e.g., stunted fetus)
REFERENCE :
   SWEHDO Scandinavian Journal of Work, Environment and Health. (Haartmaninkatu
   1, SF-00290 Helsinki, 29, Finland)  V.1-    1975- Volume(issue)/page/year:
   7(Suppl 4),66,1981
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TYPE OF TEST             : TDLo - Lowest published toxic dose
ROUTE OF EXPOSURE        : Subcutaneous
SPECIES OBSERVED         : Rodent - rat
DOSE                     : 20 mg/kg
SEX/DURATION             : female 1 day(s) pre-mating
TOXIC EFFECTS :
   Reproductive - Effects on Newborn - weaning or lactation index (e.g., #
   alive at weaning per # alive at day 4)
REFERENCE :
   GISAAA Gigiena i Sanitariya.  For English translation, see HYSAAV.  (V/O
   Mezhdunarodnaya Kniga, 113095 Moscow, USSR)  V.1-    1936-
   Volume(issue)/page/year: 31,33,1966

TYPE OF TEST             : TDLo - Lowest published toxic dose
ROUTE OF EXPOSURE        : Oral
SPECIES OBSERVED         : Rodent - mouse
DOSE                     : 10920 ug/kg
SEX/DURATION             : male 13 week(s) pre-mating
TOXIC EFFECTS :
   Reproductive - Paternal Effects - spermatogenesis (incl. genetic material,
   sperm morphology, motility, and count)
REFERENCE :
   NTIS** National Technical Information Service.  (Springfield, VA 22161)
   Formerly U.S. Clearinghouse for Scientific & Technical Information.
   Volume(issue)/page/year: PB91-185884

                            ** MUTATION DATA **

TYPE OF TEST             : Mutation in microorganisms
TEST SYSTEM              : Bacteria - Salmonella typhimurium
DOSE/DURATION            : 1 mg/plate
REFERENCE :
   DHEFDK HEW Publication (FDA. United States).  (Washington, DC)  ?-1979(?).
   For publisher information, see HPFSDS.  Volume(issue)/page/year:
   FDA-78-1046,1978

TYPE OF TEST             : Mutation in microorganisms
TEST SYSTEM              : Bacteria - Salmonella typhimurium
DOSE/DURATION            : 320 ug/plate
REFERENCE :
   CRNGDP Carcinogenesis (London). (Oxford Univ. Press, Pinkhill House,
   Southfield Road, Eynsham, Oxford OX8 1JJ, UK)  V.1-    1980-
   Volume(issue)/page/year: 7,431,1986

TYPE OF TEST             : Cytogenetic analysis
TEST SYSTEM              : Human Lymphocyte
DOSE/DURATION            : 1 mg/L
REFERENCE :
   CYGEDX Cytology and Genetics (English Translation).  Translation of TGANAK.
   (Allerton Press Inc., 150 Fifth Ave., New York, NY 10011)  V.8-    1974-
   Volume(issue)/page/year: 22(4),46,1988

TYPE OF TEST             : Unscheduled DNA synthesis
ROUTE OF EXPOSURE        : Oral
TEST SYSTEM              : Rodent - rat
DOSE/DURATION            : 77 gm/kg/11W
REFERENCE :
   TXAPA9 Toxicology and Applied Pharmacology.  (Academic Press, Inc., 1 E.
   First St., Duluth, MN 55802) V.1-    1959-  Volume(issue)/page/year:
   60,287,1981

TYPE OF TEST             : Cytogenetic analysis
ROUTE OF EXPOSURE        : Oral
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TEST SYSTEM             : Rodent - mouse
DOSE/DURATION           : 2 mg/kg
REFERENCE :
   CYGEDX Cytology and Genetics (English Translation).  Translation of TGANAK.
   (Allerton Press Inc., 150 Fifth Ave., New York, NY 10011)  V.8-    1974-
   Volume(issue)/page/year: 22(4),46,1988

TYPE OF TEST            : Cytogenetic analysis
ROUTE OF EXPOSURE       : Inhalation
TEST SYSTEM             : Rodent - mouse
DOSE/DURATION           : 10 mg/m3
REFERENCE :
   CYGEDX Cytology and Genetics (English Translation).  Translation of TGANAK.
   (Allerton Press Inc., 150 Fifth Ave., New York, NY 10011)  V.8-    1974-
   Volume(issue)/page/year: 22(4),46,1988

TYPE OF TEST            : Unscheduled DNA synthesis
TEST SYSTEM             : Rodent - hamster Embryo
DOSE/DURATION           : 2 mg/L
REFERENCE :
   CALEDQ Cancer Letters (Shannon, Ireland).  (Elsevier Scientific Pub. Ireland
   Ltd., POB 85, Limerick, Ireland)  V.1-    1975- Volume(issue)/page/year:
   23,297,1984

TYPE OF TEST            : Sister chromatid exchange
TEST SYSTEM             : Rodent - hamster Ovary
DOSE/DURATION           : 1400 ug/L
REFERENCE :
   EMMUEG Environmental and Molecular Mutagenesis.  (Alan R. Liss, Inc., 41 E.
   11th St., New York, NY 10003)  V.10-    1987-  Volume(issue)/page/year:
   10(Suppl 10),1,1987

TYPE OF TEST            : Morphological transformation
TEST SYSTEM             : Rodent - hamster Embryo
DOSE/DURATION           : 10 mg/L
REFERENCE :
   CALEDQ Cancer Letters (Shannon, Ireland).  (Elsevier Scientific Pub. Ireland
   Ltd., POB 85, Limerick, Ireland)  V.1-    1975- Volume(issue)/page/year:
   23,297,1984

                              *** REVIEWS ***

   ACGIH TLV-Confirmed animal carcinogen
   DTLVS* The Threshold Limit Values (TLVs) and Biological Exposure Indices
   (BEIs) booklet issues by American Conference of Governmental Industrial
   Hygienists (ACGIH), Cincinnati, OH, 1996  Volume(issue)/page/year:
   TLV/BEI,1999

   ACGIH TLV-TWA 0.02 ppm (skin)
   DTLVS* The Threshold Limit Values (TLVs) and Biological Exposure Indices
   (BEIs) booklet issues by American Conference of Governmental Industrial
   Hygienists (ACGIH), Cincinnati, OH, 1996  Volume(issue)/page/year:
   TLV/BEI,1999

   IARC Cancer Review:Animal Limited Evidence
   IMEMDT IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals
   to Man.  (WHO Publications Centre USA, 49 Sheridan Ave., Albany, NY 12210)
   V.1-    1972-  Volume(issue)/page/year: 20,179,1979

   IARC Cancer Review:Animal Limited Evidence
   IMEMDT IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals
   to Man.  (WHO Publications Centre USA, 49 Sheridan Ave., Albany, NY 12210)
   V.1-    1972-  Volume(issue)/page/year: 73,277,1999
```

IARC Cancer Review:Human No Adequate Data
IMEMDT IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Man. (WHO Publications Centre USA, 49 Sheridan Ave., Albany, NY 12210)
V.1- 1972- Volume(issue)/page/year: 20,179,1979

IARC Cancer Review:Human Inadequate Evidence
IMEMDT IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Man. (WHO Publications Centre USA, 49 Sheridan Ave., Albany, NY 12210)
V.1- 1972- Volume(issue)/page/year: 73,277,1999

IARC Cancer Review:Group 3
IMEMDT IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Man. (WHO Publications Centre USA, 49 Sheridan Ave., Albany, NY 12210)
V.1- 1972- Volume(issue)/page/year: 73,277,1999

*** OCCUPATIONAL EXPOSURE LIMITS ***

OEL-AUSTRALIA: TWA 0.02 ppm (0.24 mg/m3), Skin, Carcinogen, JAN1993

OEL-AUSTRIA: Skin, Suspected Carcinogen, JAN1999

OEL-BELGIUM: TWA 0.02 ppm (0.21 mg/m3), Skin, Carcinogen, JAN1993

OEL-FINLAND: Carcinogen, JAN1999

OEL-GERMANY: Skin, Carcinogen, JAN1999

OEL-THE NETHERLANDS: MAC-TGG 0.02 ppm (0.24 mg/m3), JAN1999

OEL-NORWAY: TWA 0.02 ppm (0.24 mg/m3), JAN1999

OEL-RUSSIA: STEL 0.005 mg/m3, Skin, JAN1993

OEL-SWITZERLAND: MAK-W 0.02 ppm (0.24 mg/m3), Skin, JAN1999

OEL IN ARGENTINA, BULGARIA, COLOMBIA, JORDAN, KOREA check ACGIH TLV;

OEL IN NEW ZEALAND, SINGAPORE, VIETNAM check ACGIH TLV

*** NIOSH STANDARDS DEVELOPMENT AND SURVEILLANCE DATA ***

NIOSH RECOMMENDED EXPOSURE LEVEL (REL) :
NIOSH REL TO HEXACHLOROBUTADIENE-air:10H CA TWA 0.02 ppm (Sk)
REFERENCE :
NIOSH* National Institute for Occupational Safety and Health, U.S. Dept. of Health, Education, and Welfare, Reports and Memoranda.
Volume(issue)/page/year: DHHS #92-100,1992

NIOSH OCCUPATIONAL EXPOSURE SURVEY DATA :
NOES - National Occupational Exposure Survey (1983)
NOES Hazard Code - X6278
No. of Facilities: 3 (estimated)
No. of Industries: 1
No. of Occupations: 11
No. of Employees: 1010 (estimated)
No. of Female Employees: 26 (estimated)

*** STATUS IN U.S. ***

EPA TSCA Section 8(b) CHEMICAL INVENTORY

EPA TSCA 8(a) PRELIMINARY ASSESSMENT INFORMATION, FINAL RULE

FEREAC Federal Register. (U.S. Government Printing Office, Supt. of Documents, Washington, DC 20402) V.1- 1936- Volume(issue)/page/year: 47,26992,82

EPA TSCA Section 8(d) unpublished health/safety studies

On EPA IRIS database

EPA TSCA TEST SUBMISSION (TSCATS) DATA BASE, JULY 2000

NIOSH Analytical Method, 1994: Hexachlorobutadiene, 2543

NTP Toxicity studies, RPT# TOX-01, April 2000

*** END OF RECORD ***

Attachment E

Chemical Compatibility Analysis of Waste Forms and Container Materials

APPENDIX C1
CHEMICAL COMPATIBILITY ANALYSIS
OF WASTE FORMS AND CONTAINER MATERIALS

APPENDIX C1
CHEMICAL COMPATIBILITY ANALYSIS
OF WASTE FORMS AND CONTAINER MATERIALS

The chemical compatibility analysis was carried out with all defense generated, contact-handled (CH) and remote-handled (RH) transuranic (TRU)-mixed waste streams reported in the Waste Isolation Pilot Plant (WIPP) Transuranic Waste Baseline Inventory Report (WTWBIR) (DOE, 1995). A summary of these waste streams is given in Table C-1 (Chapter C). The reported content of CH and RH streams will be verified through the WIPP Generator/Storage Site Waste Screening and Acceptance Audit Program (Appendix C11).

All information for the chemical lists and compatibility study is maintained in databases on a personal computer. The chemicals reported by the generator sites are classified into reaction groups as defined by the U.S. Environmental Protection Agency (EPA) document, A Method for Determining the Compatibility of Hazardous Wastes (Hatayama et al., 1980). The chemical lists are derived from the TRUPACT-II database, EPA hazardous waste codes listed in the WTWBIR, and waste descriptions.

A database program was developed to evaluate the chemical compatibility of the WTWBIR waste streams. Potential incompatibilities are defined on Figure 6 of the EPA document (Hatayama et al., 1980), which identifies combinations of chemical groups that are incompatible and the consequences (e.g., heat generation) of mixing incompatible chemical groups. All incompatible mixtures have been entered into a reference data base to be used in assessing the chemical compatibility of a given list of chemicals. The logic of the program used in evaluating the chemical compatibility by content code is described in detail below.

As an initial step, the program indexes the entire database according to the WTWBIR waste stream codes. The program then locates the first reaction group within the first waste stream code and picks the highest concentration of any chemical in that group. The selected reaction group is then paired with every other reaction group in the waste stream to check for incompatibility. If a potential incompatibility is found, it is printed out along with the corresponding waste stream codes. After finding all potential incompatibilities for a given waste stream code, the program moves on to the next waste stream code until all waste stream codes have been processed.

To ensure accuracy, the reference database was printed and checked against the EPA document for chemical compatibility, and the WTWBIR waste stream database was printed and checked against the original WTWBIR forms from the generator sites. The list of potential chemical incompatibilities reported by the program was hand checked using the EPA document as a reference to assure proper functioning of the program. All potential chemical incompatibilities were then evaluated on a case-by-case basis to identify which, if any, of the reactions could occur, given the nature of the waste, and the its chemical constituents, and final waste form.

Waste streams are classified as "incompatible" if the potential exists for any of the following reactions:

- corrosion
- explosion
- heat generation
- gas generation (flammable gases)
- pressure build-up (nonflammable gases)
- toxic by-product generation

Each generator and storage site has produced a comprehensive list of all possible chemicals present in its waste. The chemical components found in each waste generation process are determined by examination of the process technology, by chemical analysis, or by process flow analysis. Under this system, all chemical inputs into the system are accounted for, even though all of these components may not be a part of the waste. For example, generator sites might include both acids and bases in their lists, even though the two groups have been neutralized prior to placement in a waste container.

In addition to the chemicals listed in Appendix 2 of the EPA document (Hatayama et al., 1980), the following components that exhibit toxicity characteristics defined under 40 CFR §261.24 were added to the chemical list in trace (<1 weight percent) quantities:

Group 3 Acids, Organic
2,4-D
2,4,5-TP (Silvex)

Group 17 Halogenated Organics
Methoxychlor
Toxaphene
2,4-D
Hexachlorobutadiene
Hexachloroethane
Tetrachloroethylene
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol

All hazardous constituents listed in the Part A Permit are present in the chemical lists and accounted for in the compatibility analysis.

The compounds listed on the Material Safety Data Sheet for Radiac™ wash were added to the chemical compatibility assessment. The reactive compounds associated with Radiac™ wash are:

GROUP	COMPOUND	CONCENTRATION
3	citric acid	M
106	water	D

The compounds found in the fire suppressants in use at the WIPP facility were added to evaluate chemical compatibility of these materials with the test wastes. The following reactive compounds were added:

GROUP	COMPOUND	CONCENTRATION
14	diethylene glycol monobutyl ether	D
15	fluorosurfactants	D
106	water	D

Ansulite 6 percent AFFF (AFC-3) contains diethylene glycol monobutyl ether, fluorosurfactants, and water. The FORAY Dry Chemical Extinguishing Agent contains potassium aluminum silicate, magnesium aluminum silicate, monoammonium phosphate, ammonium sulfate, and methyl hydrogen polysiloxane, which are not hazardous reactive constituents.

To account for packaging, container, and backfill materials, the following components were added to the database for each content code in dominant (>10 weight %) quantities:

Group 10 Caustics
Magnesium Oxide

Group 23 Metals, other elemental and alloys as sheets, rods, moldings, drops, etc.
Low Carbon Steel D

Group 101 Combustible Materials
Polyethylene D

The chemical concentration levels are reported as either Trace (T) (<1% by weight), Minor (M) (1-10%), or Dominant (D) (>10%). The chemical list is divided into groups based on chemical properties and structure (e.g., acids, caustics, metals, etc.). If incompatible groups are combined, the possibility exists for the reactions listed above. For example, a reaction between Group 1 (Acids, Mineral, Non-oxidizing) and Group 10 (Caustics) could result in heat generation.

Possible chemical incompatibilities between compounds present in trace quantities (<1 percent by weight) and compounds present in concentrations ≥ 1 percent by weight (i.e., D x T, D x T1, D x T2, D x T3, M x T, M x T1, M x T2, or M x T3) are included in this report. However, interactions between compounds present in trace quantities (<1 percent by weight) and compounds present in concentrations ≤ 1 percent by weight do not pose an incompatibility problem for the following reasons:

- The trace chemicals reported by the sites are in concentrations well below the trace limit of 1 weight percent. Sampling programs show that the concentration levels of these compounds are significantly lower than the upper limit of 1 percent.

- The trace chemicals are usually dispersed in the waste, which further dilutes concentrations of these materials.

- Trace chemicals that might be incompatible with major and dominant materials/chemicals would have reacted during the waste treatment process prior to placement in waste containers.

- Because of restrictions imposed by the EPA on reporting of hazardous wastes, some chemicals are listed in trace quantities even if they have already reacted. Hazardous waste regulations as promulgated by the EPA (EPA, 1988) (known as the mixture rule) require that a mixture of any solid waste and a hazardous waste listed in 40 CFR Part 261, Subpart D, be considered a hazardous waste subject to Resource Conservation and Recovery Act regulations. However, Subpart D does not list minimum concentrations for these listed wastes, with the result that any such mixtures must be considered hazardous waste even if the Subpart D constituent is at or below detection limits.

- The waste is either solidified and immobilized (solidified materials) or present in bulk form as a solid (solid materials). In almost all cases, any possible reactions take place before the waste is generated in its final form.

- Total trace chemicals within a payload container are limited to less than 5 weight percent.

All potential incompatibilities between trace, minor, and dominant compounds have been analyzed on a case-by-case basis for each waste stream reported in Table C-2 (Chapter C). Some chemicals listed as being present in the waste have reacted prior to placement in a waste container. For example, a site listing a caustic (Group 10) and an acid (Group 1) in its waste has only the neutralized product present in an immobilized form. Further reactions of this type do not occur once the waste is neutralized in its final form. An additional constraint on the chemicals and materials that can be present within each waste stream code is their gas generation potential due to radiolysis.

Unresolved incompatibilities between trace and minor, trace and dominant, minor and dominant, minor and minor, or dominant and dominant waste constituents were identified and segregated. These wastes cannot be transported until the incompatibilities are resolved (NuPac, 1989). Table

C1-1 presents the chemical compatibility analysis for the modified chemical lists for the waste streams presented in Table C-2 (Chapter C). A list of explanations describing any noted incompatibilities precedes Table C1-1.

Summary of Potential Incompatibilities for Waste Forms and Container Material

The following is a listing and explanation of compatibility code numbers used to identify potential incompatibilities in Table C1-1. Where incompatibilities are noted, it is important to remember that these potential incompatibilities will be removed prior to shipment of the waste to WIPP. That is, unacceptable waste properties listed in Chapter C, Section C1-b will be removed prior to shipping. Verification of the compatibility of final waste forms will be carried out by the WIPP Generator/Storage Site Waste Screening and Acceptance Audit Program (Appendix C8).

Explanation Code Number Descriptions

00 (1 x 10, 2 x 10, 3 x 10, 5 x 10, 10 x 13, 10 x 17, 10 x 18, 10 x 19, 10 x 21, 10 x 22, 10 x 23, 10 x 24, 10 x 25, 10 x 27, 10 x 32, 10 x 102, 10 x 107) These potential incompatibilities result from the addition of magnesium oxide backfill material. However, the hydration of magnesium oxide results in the formation of brucite ($Mg[OH]_2$), which buffers the pH of the solution at approximately 8.5. Therefore, caustic conditions are not produced by the use of magnesium oxide backfill.

0a. (1 x 4) The potential chemical incompatibility is the possible dehydration or displacement reactions between non-oxidizing mineral acids (Group 1) and alcohols and glycols in waste forms (Group 4) resulting in heat generation. The potential chemical incompatibility results from reporting trace quantities (<1%) of non-oxidizing acid in generator waste streams. However, the non-oxidizing mineral acids are neutralized prior to packaging, and the materials in this waste stream are considered chemically compatible.

0aa. (1 x 10) The potential chemical incompatibility is the possible acid-base reaction between strong mineral acids (Group 1) and strong caustics (Group 10) resulting in heat generation. The potential chemical incompatibility results from reporting trace quantities (<1%) of non-oxidizing acid in generator waste streams. However, the non-oxidizing mineral acids are neutralized prior to packaging, and the materials in this waste stream are considered chemically compatible.

0aaa. (1 x 14) The potential chemical incompatibility is the possible hydrolysis reaction between strong mineral acids (Group 1) and ethers (Group 14), resulting in heat generation. The potential chemical incompatibility results from reporting trace quantities (<1%) of non-oxidizing acid in generator waste streams. However, the non-oxidizing mineral acids are neutralized prior to packaging, and the materials in this waste stream are considered chemically compatible.

0aaaa. (1 x 15) The potential chemical incompatibility is the possible formation of hydrogen fluoride when strong mineral acids (Group 1) mix with inorganic fluorides (Group 15), resulting in toxic gas generation. The potential chemical incompatibility results from reporting trace quantities (<1%) of non-oxidizing acid in generator waste streams. However, the non-oxidizing mineral acids are neutralized prior to packaging, and the materials in this waste stream are considered chemically compatible.

0b. (1 x 17) The potential chemical incompatibility is the possible reaction between strong mineral acids (Group 1) and halogenated organics (Group 17), resulting in generation of heat and toxic hydrogen halide fumes. The potential chemical incompatibility results from reporting trace quantities (<1%) of non-oxidizing acid in generator waste streams. However, the non-oxidizing mineral acids are neutralized prior to packaging, and the materials in this waste stream are considered chemically compatible.

0bb. (1 x 19) The potential chemical incompatibility is the possible condensation reaction between strong mineral acids (Group 1) and ketones (Group 19), resulting in generation of heat. The potential chemical incompatibility results from reporting trace quantities (<1%) of non-oxidizing acid in generator waste streams. However, the non-oxidizing mineral acids are neutralized prior to packaging, and the materials in this waste stream are considered chemically compatible.

1. (1 x 23) The potential chemical incompatibility is the possible reaction between non-oxidizing mineral acids (Group 1) and metals and other elemental alloys as sheets, rods, moldings, drops, etc. (Group 23). The non-oxidizing mineral acids are present only in trace quantities (<1%) and are neutralized and bound in the cemented waste form. Due to the immobilization and prior reaction of the acids, the materials in this waste stream are considered chemically compatible.

2. (1 x 24) The potential chemical incompatibility is the tendency of non-oxidizing mineral acids (Group 1) to solubilize toxic metals and metal compounds (Group 24). The mineral acids are present only in trace quantities (<1%) and are neutralized and bound in the cemented waste form. Due to the immobilization and prior reaction of the non-oxidizing acids, the materials in this waste stream are considered chemically compatible.

3. (1 x 101) The potential chemical incompatibility is the possible reaction between non-oxidizing mineral acids (Group 1) and combustible materials (Group 101). The mineral acids are present only in trace quantities (<1%) and are neutralized and bound in the cemented waste form. An absorbent has been added to immobilize free liquids. Due to the immobilization and prior reaction of the non-oxidizing acids, the materials in this waste stream are considered chemically compatible.

3a. (1 x 102) The potential chemical incompatibility is the possible violent reaction between non-oxidizing mineral acids (Group 1) and explosives (Group 102). However, explosives are not allowed to be shipped to WIPP unless treatment renders them inert. Additionally, mineral acids are present only in trace quantities (<1%) and are neutralized prior to loading in waste containers. Therefore, the materials in this waste stream are considered chemically compatible.

3aa. (1 x 104) The potential chemical incompatibility is the possible reaction between non-oxidizing mineral acids (Group 1) and strong oxidizing agents (Group 104), resulting in heat and generation of toxic and corrosive gases. However, the mineral acids and oxidizing agents are present in trace quantities (<1%) and neutralized prior to loading in waste containers. Therefore, the materials in this waste stream are considered chemically compatible.

3b. (1 x 106) The potential chemical incompatibility is the possible reaction between mineral acids (Group 1) and water (Group 106), resulting in the generation of heat. This potential incompatibility results from the presence of water in Ansulite™ fire extinguishing agents and/or Radiac™ wash solutions and/or absorbed water. However, the mineral acids are present only in trace quantities (<1%) and are neutralized prior to loading in waste containers. In addition, the presence of any absorbed liquids are immobilized in an absorbent and would not be available for reaction.

3c. (2 x 3) The potential chemical incompatibility is the reaction of oxidizing mineral acids (Group 2) with organic acids (Group 3) resulting in heat and gas generation. The potential chemical incompatibility results from the use of citric acid in Radiac™ wash solutions. The solid citric acid is diluted during preparation of the Radiac™ wash and is often further diluted prior to use for decontamination. As a result, the potential for reactions of solid citric acid with oxidizing mineral acids in waste forms is removed.

3d. (2 x 4) The potential chemical incompatibility is the possible dehydration or displacement reactions between oxidizing mineral acids (Group 2) and alcohols and glycols (Group 4), resulting in heat generation. The potential chemical incompatibility results from reporting trace quantities (<1%) of oxidizing acid in generator waste streams. However, the oxidizing mineral acids are neutralized prior to packaging, and the materials in this waste stream are considered chemically compatible.

3e. (2 x 10) The potential chemical incompatibility is the possible acid-base reaction between oxidizing mineral acids (Group 2) and strong caustics (Group 10), resulting in heat generation. The potential chemical incompatibility results from reporting trace quantities (<1%) of oxidizing acid in generator waste streams. However, the oxidizing mineral acids are neutralized prior to packaging, and the materials in this waste stream are considered chemically compatible.

3ee. (2 x 13) The potential chemical incompatibility is the possible reaction between oxidizing mineral acids (Group 2) and esters (Group 13), resulting in heat generation. The potential chemical incompatibility results from reporting trace quantities (<1%) of oxidizing acid in generator waste streams. However, the oxidizing mineral acids are neutralized prior to packaging, and the materials in this waste stream are considered chemically compatible.

3f. (2 x 14) The potential chemical incompatibility is the possible hydrolysis reaction between oxidizing mineral acids (Group 2) and ethers (Group 14), resulting in heat generation. The potential chemical incompatibility results from reporting trace quantities (<1%) of oxidizing acid in generator waste streams. However, the oxidizing mineral acids are neutralized prior to packaging, and the materials in this waste stream are considered chemically compatible.

3g. (2 x 15) The potential chemical incompatibility is the possible formation of hydrogen fluoride when oxidizing mineral acids (Group 2) mix with inorganic fluorides (Group 15), resulting in toxic gas generation. The potential chemical incompatibility results from reporting trace quantities (<1%) of oxidizing acid in generator waste streams. However, the oxidizing mineral acids are neutralized prior to packaging, and the materials in this waste stream are considered chemically compatible.

3gg. (2 x 16) The potential chemical incompatibility is the possible reaction between oxidizing mineral acids (Group 2) and aromatic hydrocarbons (Group 16). Oxidation of the hydrocarbon may produce enough heat to ignite the mixture. The potential chemical incompatibility results from reporting trace quantities (<1%) of oxidizing acid in generator waste streams. However, the oxidizing mineral acids are neutralized prior to packaging, and the materials in this waste stream are considered chemically compatible.

3h. (2 x 17) The potential chemical incompatibility is the possible reaction between oxidizing mineral acids (Group 2) and halogenated organics (Group 17), resulting in generation of heat and toxic hydrogen halide fumes. The potential chemical incompatibility results from reporting trace quantities (<1%) of oxidizing acid in generator waste streams. However, the oxidizing mineral acids are neutralized prior to packaging, and the materials in this waste stream are considered chemically compatible.

3i. (2 x 19) The potential chemical incompatibility is the possible condensation reaction between oxidizing mineral acids (Group 2) and ketones (Group 19), resulting in generation of heat. The potential chemical incompatibility results from reporting trace quantities (<1%) of oxidizing acid in generator waste streams. However, the oxidizing mineral acids are neutralized prior to packaging, and the materials in this waste stream are considered chemically compatible.

3j. (2 x 20) The potential chemical incompatibility is the possible reaction between oxidizing mineral acids (Group 2) and mercaptans (Group 20), resulting in generation of heat and toxic hydrogen sulfide fumes. The potential chemical incompatibility results from reporting trace quantities (<1%) of oxidizing acid in generator waste streams. However, the oxidizing mineral acids are neutralized prior to packaging, and the materials in this waste stream are considered chemically compatible.

4. (2 x 23) The potential chemical incompatibility is the possible reaction between oxidizing mineral acids (Group 2) and metals and other elemental alloys as sheets, rods, moldings, drops, etc. (Group 23). The oxidizing mineral acids are present only in trace quantities (<1%) and are reacted prior to loading in waste containers. In addition, the oxidizing mineral acids are fixed in the solidified product and would not be available to react with the metal.

5. (2 x 23) The potential chemical incompatibility is the possible reaction between oxidizing mineral acids (Group 2) and metals and other elemental alloys as sheets, rods, moldings, drops, etc. (Group 23). The oxidizing mineral acids are present only in trace quantities (<1%) as residues on glass or rubber gloves, and not as free liquids that could react with metals.

6. (2 x 24) The potential chemical incompatibility is the solubilization of toxic metals and metal compounds (Group 24) in oxidizing mineral acids (Group 2). The oxidizing mineral acids are present only in trace quantities (<1%) and are reacted prior to loading in waste containers. In addition, the oxidizing mineral acids are fixed in the solidified product and would not be available to react with the metal.

7. (2 x 24) The potential chemical incompatibility is the possible reaction between oxidizing mineral acids (Group 2) and toxic metals and compounds (Group 24). The oxidizing mineral acids are present only in trace quantities (<1%) as residues on glass or rubber gloves, and not as free liquids that could react with metals.

7a. (2 x 27) The potential chemical incompatibility is the possible reaction between oxidizing mineral acids (Group 2) and nitro compounds (Group 27), resulting in generation of heat and toxic nitrogen oxide fumes. The potential chemical incompatibility results from reporting trace quantities (<1%) of oxidizing acid in generator waste streams. However, the oxidizing mineral acids are neutralized prior to packaging, and the materials in this waste stream are considered chemically compatible.

8. (2 x 101) The potential chemical incompatibility is the possible reaction between oxidizing mineral acids (Group 2) and combustible materials (Group 101). The oxidizing mineral acids are present only in trace quantities (<1%) as residues on glass or rubber gloves, and not as free liquids that could react with metals.

9. (2 x 101) The potential chemical incompatibility is the possible decomposition of combustible materials (Group 101) by the oxidizing mineral acids (Group 2). The oxidizing mineral acids are present only in trace quantities (<1%) and are reacted prior to loading in waste containers. In addition, the oxidizing mineral acids are fixed in the solidified product and would not be available to react with the combustible materials.

9a. (2 x 102) The potential chemical incompatibility is the possible violent reaction between oxidizing mineral acids (Group 2) and explosives (Group 102). However, explosives are not allowed to be shipped to WIPP unless treatment renders them inert. Additionally, mineral acids are present only in trace quantities (<1%) and are neutralized prior to loading in waste containers. Therefore, the materials in this waste stream are considered chemically compatible.

10. (2 x 106) The potential chemical incompatibility is the possible dissolution of oxidizing mineral acids (Group 2) by water (Group 106). The oxidizing mineral acids are present only in trace quantities (<1%) and reacted prior to loading in waste containers. Both the water and the oxidizing mineral acids are fixed in the solidified product and would not be available for reaction.

10a. (2 x 106) The potential chemical incompatibility is the possible reaction between oxidizing mineral acids (Group 2) and water (Group 106), resulting in the generation of heat. This potential incompatibility results from the presence of water in Ansulite™ fire extinguishing agents and/or Radiac™ wash solutions and/or absorbed water. However, the mineral acids are present only in trace quantities (<1%) and are neutralized prior to loading in waste containers. In addition, the presence of any absorbed liquids are immobilized in an absorbent and would not be available for reaction.

11. (3 x 4) The potential chemical incompatibility is the possible reaction between organic acids (Group 3) and alcohols and glycols (Group 4). The organic acids are immobilized in a cement matrix and not available to react with the alcohols and glycols. The alcohols and glycols are also immobilized in the solidified product.

11aa. (3 x 4) The potential chemical incompatibility is the heat generated by polymerization of alcohols and glycols (Group 4) by organic acids (Group 3). Carboxylic acids with a-halogen substituents, or a- or ß-hydroxyl substituents (e.g., citric acid) are the main concern among the organic acids (Group 3). The potential chemical incompatibility results from the use of citric acid in Radiac™ wash solutions. The solid citric acid is diluted during preparation of the Radiac™ wash and is often further diluted prior to use for decontamination. As a result, the potential for reactions of solid citric acid with alcohols and glycols (Group 4) that are dispersed and fixed in waste forms is removed.

11b. (3 x 10) The potential chemical incompatibility is the possibility of acid-base reactions. The organic acids (Group 3) are neutralized in a cement matrix and are not available to react with the Caustics (Group 10). Thus, this potential chemical incompatibility would not occur.

11c. (3 x 10) The potential chemical incompatibility is the heat generated by reactions of organic acids (Group 3) with caustics (Group 10). The potential chemical incompatibility results from the use of citric acid in Radiac™ wash solutions. The solid citric acid is diluted during preparation of the Radiac™ wash and is often further diluted prior to use for decontamination. As a result, the potential for reactions of solid citric acid with caustics in test waste forms is removed. The caustic in the waste forms is calcium oxide. Thus, the more significant incompatibility is potential hydrolysis reaction between water and calcium oxide to release heat. Because the calcium oxide is dispersed in the wastes, reaction is considered unlikely.

11d. (3 x 15) The potential chemical incompatibility is toxic and corrosive fumes generated by reactions of organic acids (Group 3) with metal fluoride salts (Group 15). The potential chemical incompatibility results from the use of citric acid in Radiac™ wash solutions. The solid citric acid is diluted during preparation of the Radiac™ wash and is often further diluted prior to use for decontamination. As a result, the potential for reactions of solid citric acid with fluoride salts in waste forms is removed.

12. (3 x 24) The potential chemical incompatibility is the possible reaction between organic acids (Group 3) and toxic metals and compounds (Group 24). The organic acids are basified prior to cementation and do not exist as free acids in the resulting product. Based on the immobilization of the acids, reactions are considered highly unlikely. In this case, solubilization is not possible.

12aa. (3 x 24) The potential chemical incompatibility is solubilization of toxic metals (Group 24) by complexation with organic acids (Group 3). The potential chemical incompatibility results from the use of citric acid in Radiac™ wash solutions. The solid citric acid is diluted during preparation of the Radiac™ wash and is often further diluted prior to use for decontamination. As a result, the potential for reactions of solid citric acid with toxic metals in waste forms is removed.

12bbb. (3 x 104) The potential chemical incompatibility is decomposition of the hydrocarbon moiety of organic acids (Group 3) by oxidizing agents (Group 104) resulting in heat and gas formation. The potential chemical incompatibility results from the use of citric acid in Radiac™ wash solutions. The solid citric acid is diluted during preparation of the Radiac™ wash and is often further diluted prior to use for decontamination. As a result, the potential for reactions of solid citric acid with oxidizing agents that are dispersed and fixed in waste forms is removed.

12bb. (4 x 104) The potential chemical incompatibility is formation of unstable compounds by reaction of alcohols and glycols (Group 4) with oxidizing agents (Group 104). However the alcohols and glycols are present as trace quantities (<1%) in the waste stream, and they are further isolated by dissemination within the waste stream. Additionally, oxidizing agents must be neutralized prior to shipment to WIPP. Therefore, the final waste form will contain compatible materials.

12b. (7 x 17) The potential chemical incompatibility between amines (Group 7) and halogenated organics (Group 17) would not occur because the halogenated organics are solidified and are not available for reaction.

12c. (7 x 24) The potential chemical incompatibility is the possible increase in the solubility of toxic metal compounds in water due to amines acting as potential surfactants. The amines are present only in trace (<1%) and are immobilized through absorption on sorbent materials. Also, these solid waste forms usually contain very little water and excess sorbents are added to waste containers to sorb any fluids.

12d. (7 x 104) The potential chemical incompatibility is formation of toxic nitrogen oxide fumes by reaction of amines (Group 7) with oxidizing agents (Group 104). However, the alcohols and glycols are present as trace quantities (<1%) in the waste stream, they are further isolated by dissemination within the waste stream. Additionally, oxidizing agents must be neutralized prior to shipment to WIPP. Therefore, the final waste form will contain compatible materials.

12e. (8 x 23) The potential chemical incompatibility is combustion of some azo compounds (Group 8) on contact with surfaces of metal sheets, rods, drops, etc (Group 23). However the azo compounds are present as trace quantities (<1%) in the waste stream and are further isolated by dissemination within the waste stream. Therefore, spontaneous combustion by reaction with metal surfaces is unlikely.

12f. (8 x 106) The potential chemical incompatibility is the generation of nitrogen gas by reaction of some azo compounds (Group 8) with water (Group 106). This potential incompatibility results from the presence of water in Ansulite™ fire extinguishing agents and/or Radiac™ wash solutions and/or absorbed water. However, the azo compounds are present only in trace quantities (T<1%) and are disseminated in the waste containers, which minimizes their potential to form nitrogen gas. In addition, the presence of any absorbed liquids are immobilized in an absorbent and would not be available for reaction.

13. (10 x 17) The potential chemical incompatibility is the possible reaction between caustics (Group 10) and halogenated organics (Group 17). The caustic in this content code is calcium oxide, a solid, which is dispersed in the chloride salts. The halogenated organics are present in only trace quantities (T<1%) and are absorbed, immobilized, or solidified. Due to the immobilization of the calcium oxide in the salt, reactions are considered highly unlikely.

13a. (10 x 19) The potential chemical incompatibility is the possible self-condensation of ketones (Group 19) catalyzed by caustics (Group 10). The caustic in this content code is calcium oxide, a solid, which is dispersed in the chloride salts. Due to the immobilization of the calcium oxide in salt, reactions are considered highly unlikely.

14. (10 x 23) The potential incompatibility is the possible reaction between caustics (Group 10) metals and other elemental alloys as sheets, rods, moldings, drops, etc. (Group 23). The caustic in this waste stream code is calcium oxide, a solid, which is dispersed in the chloride salts. Due to the immobilization of the calcium oxide in salt, dissolution of metals in caustics is not possible.

15. (10 x 23) The potential incompatibility is the possible dissolution of metals and other elemental alloys as sheets, rods, moldings, drops, etc. (Group 23) in caustics (Group 10). The caustics are present only in trace quantities (<1%) and are reacted prior to loading in waste containers. In addition, the caustics are fixed in the cemented sludge and would not be available to react with the metals.

16. (10 x 24) The potential chemical incompatibility is the possible solubilization of toxic metals (Group 24) in caustics (Group 10). The caustic in this content code is calcium oxide, a solid, which is dispersed in the chloride salts. In this case, solubilization is not possible.

16a. (10 x 24) The potential incompatibility is the possible solubility of toxic metals (Group 24) in caustics (Group 10). The caustics are present only in trace (<1% quantities and are reacted prior to loading in waste containers. In addition, the caustics are fixed in the cemented sludge and would not be available to react with the metals.

16b. (10 x 27) The potential chemical incompatibility is the formation of salts from nitro alkanes (Group 27) and caustics (Group 10) in the presence of water. The only caustic in this content code is calcium oxide, a solid, which is dispersed in the chloride salts. In addition, liquids are immobilized through absorption on sorbent materials. Due to the immobilization of the caustic in the fused salt, this reaction would not occur.

16c. (10 x 102) The potential chemical incompatibility is the possible violent reaction between caustics (Group 10) and explosives (Group 102) due to the generation of heat. However, explosives are not allowed to be shipped to WIPP unless treatment renders them inert. Additionally, caustics are present only in minor quantities (<10%) and are neutralized prior to loading in waste containers. Therefore, the materials in this waste stream are considered chemically compatible.

17. (10 x 107) This potential incompatibility is an artifact of the EPA method. Calcium oxide appears in Groups 10 and 107, and is compatible within itself.

17a. (14 x 104) This potential incompatibility is the reaction of ethers (Group 14) with strong oxidizers (Group 104) to produce heat, and possibly ignition or explosions. This incompatibility arises from the presence of diethylene glycol monobutyl ether in Ansulite™ fire extinguishing agents. However, the strong oxidizers are present in trace quantities

(<1%) and disseminated in the waste, making ignition or explosions unlikely in the event the fire extinguishers are used.

17b. (14 x 107) This potential chemical incompatibility is the reaction of ethers (Group 14) with water reactives (Group 107). This incompatibility arises from the presence of diethylene glycol monobutyl ether in Ansulite™ fire extinguishing agents. However, the water reactive substances are present in trace quantities (<1%) and disseminated in the waste, making reactions unlikely in the event the fire extinguishers are used.

18. (15 x 107) This potential chemical incompatibility is the reaction of fluorides (Group 15) and water reactive substances (Group 107). The solid fluorides are present in only trace quantities (T<1%) and form part of the pyrochemical salt matrix. Calcium oxide, the only water reactive substance present, is a solid dispersed in the pyrochemical salt matrix. These salts always occur with each other and are compatible.

18a. (17 x 20) The potential chemical incompatibility is the possible reaction between halogenated organics (Group 17) and mercaptans (Group 20), resulting in generation of heat. The potential chemical incompatibility results from reporting trace quantities (<1%) of halogenated organics and mercaptans in generator waste streams. However, the chemicals are neutralized prior to packaging, and the materials in this waste stream are considered chemically compatible.

19. (17 x 23) The potential chemical incompatibility is the reaction of halogenated organics (Group 17) with metals and other elemental alloys as sheets, rods, moldings, drops, etc. (Group 23). The halogenated organics are present in only trace quantities (T1<1%) and are fixed in cemented sludge and would not be available to react with the metals.

20. (17 x 23) The potential chemical incompatibility is the reaction of halogenated organics (Group 17) with metals and other elemental alloys, as sheets, rods, moldings, drops, etc. (Group 23). The halogenated organics are present in only trace quantities (T<1%) and are absorbed on combustibles. The halogenated organics are not present as free liquids to react with the metals.

21. (17 x 23) The potential chemical incompatibility is the potential reaction between halogenated organics (Group 17) and metals and other elemental alloys as sheets, rods, drops, moldings, etc. (Group 23). Aluminum and magnesium in bulk forms are especially reactive with halogenated hydrocarbons, releasing much heat. Although this is a potential incompatibility, the potential effects are considered minimal for the following reasons. First, the halogenated hydrocarbons are only present in trace quantities (<1 percent by weight) and are immobilized through absorption on sorbent materials or solidification with calcium silicates or gypsum-base processes. Second, although the metals of concern may occur in dominant quantities in the content code, the metals only occur as large pieces and not

in powder form. Due to the trace quantities of immobilized halogenated organics and the non-powder size of the metal pieces, any reaction that may occur will produce minimal heat.

22. (17 x 23) The potential chemical incompatibility is the reaction of halogenated organics (Group 17) with metals and other elemental alloys, as sheets, rods, moldings, drops, etc. (Group 23). The halogenated organics are present in only very small trace quantities (<1 part per million) as residual films on the glass and not as free liquids that could react with metals.

23. (17 x 23) The potential chemical incompatibility is the reaction of halogenated organics (Group 17) with metals and other elemental alloys as sheets, rods, moldings, drops, etc. (Group 23). The halogenated organics are present in only trace quantities (<1%) as coatings on solid organic materials and are not present as free liquids that could react with metals.

24. (17 x 23) The potential chemical incompatibility is the reaction of halogenated organics (Group 17) with metals and other elemental alloys as sheets, rods, moldings, drops, etc. (Group 23). The halogenated organics are present in only trace quantities (<1%) as coating on the inorganic solid materials and are not present as free liquids that could react with metals.

25. (17 x 23) The potential chemical incompatibility is the reaction of halogenated organics (Group 17) with metals and other elemental alloys as sheets, rods, moldings, drops, etc. (Group 23). The halogenated organics are fixed in the cemented product and would not be available for reaction.

26. (17 x 23) The potential chemical incompatibility is the reaction of halogenated organics (Group 17) with metals and other elemental alloys, as sheets, rods, moldings, drops, etc. (Group 23). The halogenated organics are fixed in the solidified product and are not available for reaction with the metals.

27. (17 x 23) The potential chemical incompatibility is the reaction of halogenated organics (Group 17) with metals and other elemental alloys, as sheets, rods, moldings, drops, etc. (Group 23). An absorbent has been added to immobilize any free liquids that may exist. Due to the trace quantities and immobilization of the halogenated organics, reactions are highly unlikely.

28. (17 x 104) The potential chemical incompatibility is the reaction of halogenated organics (Group 17) with oxidizing agents (Group 107), resulting in the liberation of heat and formation of toxic gases. The halogenated organics are present in only trace quantities (<1%) and are not in the form of free liquids. Additionally, the oxidizing agents are

neutralized prior to loading waste containers. Therefore, based on the neutralization of the oxidizing agents, reactions are considered highly unlikely.

28a. (18 x 106) The potential incompatibility is the possible reaction between isocyanates (Group 18) with water (Group 106). The isocyanates are present only in trace quantities (<1%). The water is usually fixed in the solidified product and would not be available for reaction.

28aa. (18 x 106) The potential chemical incompatibility is between isocyanates (Group 18) and water (Group 106) to generate carbon dioxide gas and heat. The potential chemical incompatibility results from the use of water in Ansulite™ fire extinguishing agents and Radiac™ wash solutions. However, isocyanates in the waste forms are present in trace quantities (<1%), are neutralized and fixed prior to loading the waste containers, and are not available for reaction. Therefore, the final waste form contains compatible materials.

28aaa. (19 x 20) The potential chemical incompatibility is the reaction between ketones (Group 19) and mercaptans (Group 20), resulting in heat generation. These chemicals are present only in trace quantities (<1%) as coatings on laboratory glassware. Therefore, contact between the chemicals, if it occurs, will be limited.

28b. (21 x 101) The potential chemical incompatibility is the reaction of alkali and alkaline earth metals (Group 21) with residual water present in the combustible materials (101), resulting in heat generation and ignition of the combustible materials. However, the combustible materials are polyethylene and polyvinyl chloride packaging materials which contain no residual water. Additionally, alkali and alkaline earth metals must be neutralized prior to shipment to WIPP. Therefore, the final waste form will contain compatible materials.

28c. (21 x 104) The potential chemical incompatibility is the violent reaction between alkali and alkaline earth metals (Group 21) and oxidizing agents (Group 104). Oxidizing agents are present in trace quantities (<1%) and are neutralized prior to packaging. Additionally, alkali and alkaline earth metals must be neutralized prior to shipment to WIPP. Therefore, the final waste form will contain compatible materials.

28d. (21 x 106) The potential chemical incompatibility is the violent reaction between alkali and alkaline earth metals (Group 21) and water (Group 106), resulting in the evolution of hydrogen gas and formation of strong caustics. However, alkali and alkaline earth metals must be neutralized prior to shipment to WIPP. Therefore, the final waste form will contain compatible materials.

28e. (22 x 106) The potential chemical incompatibility is the reaction of metal powders (Group 22) with water (Group 106), resulting in the evolution of hydrogen gas and production of heat. Metal powders or shavings are present as trace quantities (<1%) on paper, rags, and rubber. This potential incompatibility results from the presence of water in Ansulite™ fire extinguishing agents and/or Radiac™ wash solutions and/or absorbed water. However, metal powders or shavings are present as trace quantities (<1%) on paper, rags, and rubber, which minimizes their potential to form hydrogen gas. In addition, the presence of any absorbed liquids are immobilized in an absorbent and would not be available for reaction.

29. (23 x 104) The potential incompatibility is the possible reaction between metals and other elemental alloys as sheets, rods, moldings, drops, etc. (Group 23) and oxidizing agents (Group 104). The oxidizing agents are present only in trace quantities (<1%) and reacted prior to loading in waste containers. The waste is mixed with cement to absorb any residual liquid. Due to the immobilization and prior reaction of the oxidizing agents, reactions are highly unlikely.

30. (23 x 104) The potential incompatibility is the possible reaction between metals, other elemental alloys as sheets, rods, moldings, drops, etc. (Group 23) and oxidizing agents (Group 104). The oxidizing agents are present only in trace quantities (<1%) and dissolved in aqueous solutions that were cemented into a solid monolith-type structure. Due to the immobilization and prior reaction of the oxidizing agents, reactions will not occur.

31. (23 x 107) The potential incompatibility is the possible reaction between metals and other elemental alloys, as sheets, rods, moldings, drops, etc. (Group 23) and water reactive substances (Group 107). The outer low carbon steel drum is the only Group 23 metal found in this content code. Calcium oxide, the only water reactive substance present, is a solid dispersed in the chloride salts. Based on the immobilization of the calcium oxide in the salt, reactions are considered highly unlikely.

32. (23 x 107) The potential incompatibility is the possible reaction between metals and other elemental alloys as sheets, rods, moldings, drops, etc. (Group 23) and water reactive substances (Group 107). Calcium oxide, the only water reactive substance present, is a solid dispersed in the chloride salts. Based on the immobilization of the calcium oxide in the salt, reactions are considered highly unlikely.

33. (24 x 106) The potential chemical incompatibility is the possible solubilization of toxic metals (Group 24), which is not a concern since the water (Group 106) from the sludge is fixed in the cemented product and would not be available for reaction.

33a. (24 x 106) The potential chemical incompatibility is the possible solubilization of toxic metals (Group 24) by water (Group 106). This potential chemical incompatibility results from the use of water in Ansulite™ fire extinguishing agents or Radiac™ wash solutions. Metals in the test waste forms are present in trace quantities (T<1%) as large pieces and not in powdered form. As a result, only minimal heat is expected to be formed.

34. (24 x 106) The potential incompatibility is the possible solubilization of toxic metals (Group 24). The water (Group 106) is fixed the in the cemented product and would not be available for reaction.

35. (24 x 107) The potential incompatibility is the possible reaction between toxic metals and metal compounds (Group 24) and water reactive substances (Group 107). The metals are present only in trace quantities (<1% by weight). Calcium oxide, the only water reactive substance present, is a solid dispersed in the chloride salts. Based on the immobilization of the calcium oxide in the salt, reactions are considered highly unlikely.

36. (24 x 107) The potential incompatibility is the possible reaction between toxic metals and metal compounds (Group 24) and water reactive substances (Group 107). Calcium oxide, the only water reactive substance present, is dispersed in chloride salts. Based on the immobilization of the calcium oxide in the salts, reactions are considered highly unlikely.

36a. (25 x 101) The potential chemical incompatibility is the reaction of nitrides (Group 25) with residual water present in the combustible materials (Group 101), resulting in formation of ammonia gas, heat generation, and possible ignition of the combustible materials. However, the combustible materials are polyethylene and polyvinyl chloride packaging materials which contain no residual water. Additionally, any reactive nitrides must be neutralized prior to shipment to WIPP. Therefore, the final waste form will contain compatible materials.

36aa. (25 x 106) The potential chemical incompatibility is the reaction of nitrides (Group 25) with water present in the combustible materials (101), resulting in formation of ammonia gas, heat generation, and possible ignition of the combustible materials. However, any reactive nitrides must be neutralized prior to shipment to WIPP. Therefore, the final waste form will contain compatible materials.

36b. (27 x 104) The potential incompatibility is the possible reaction between nitro compounds (Group 27) and oxidizing agents (Group 107). Calcium oxide, the only water reactive substance present, is dispersed in chloride salts. Reactive oxidizing agents must be neutralized prior to shipment to WIPP. Based on the immobilization of the calcium oxide in the salts and neutralization of oxidizing agents, reactions are considered highly unlikely.

36c. (29 x 104) The potential incompatibility is the possible reaction between saturated aliphatics (Group 29) and oxidizing agents (Group 104). However, reactive oxidizing agents must be neutralized prior to shipment to WIPP. Therefore, the final waste form will contain compatible materials.

36d. (101 x 102) The potential incompatibility is the possible oxidation reaction between combustibles (Group 101) and explosives (102). However, explosives must be reacted prior to shipment to WIPP. Therefore, the final waste form will contain compatible materials.

37. (101 x 104) The potential incompatibility is the possible reaction between combustible materials (Group 101) and oxidizing agents (Group 104). The oxidizing agents are present only in trace quantities (<1%) and are reacted prior to loading in waste containers. In addition, cement is added to absorb any residual liquid. Due to the immobilization and prior reaction of the oxidizing agents, this content code is considered to be chemically compatible.

38. (101 x 104) The potential incompatibility is the possible reaction between combustible materials (Group 101) and oxidizing agents (Group 104). The oxidizing agents are present only in trace quantities (<1%) and are fixed in the solidified product. Due to the immobilization and prior reaction of the oxidizing agents, this content code is considered to be chemically compatible.

39. (101 x 107) The potential incompatibility is the possible reaction between combustible and flammable materials (Group 101) and water reactive substances (Group 107). The dominant combustible material in Group 101 is the polyethylene rigid drum liner. Calcium oxide, the only water reactive substance present, is a solid dispersed in the chloride salts. Based on the immobilization of the calcium oxide in the salt, reactions are considered highly unlikely.

40. (102 x 104) The potential incompatibility is the possible violent reaction between explosives (Group 102) and oxidizing agents (Group 104). However, both of these groups must be neutralized before shipment to WIPP. Therefore, the final waste form will contain compatible materials.

41. (104 x 107) The potential incompatibility is the possible violent reaction between oxidizing agents (Group 104) and water reactives (Group 107). However, both of these groups must be neutralized before shipment to WIPP. Therefore, the final waste form will contain compatible materials.

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