Appendix I

Response to Section 311 NOD Comments 3.2.t and 3.2.u

RESPONSE TO NOD COMMENTS 3.2.t AND 3.2.u

As referred to in this comment, the National Research Council (NRC) Waste Isolation Pilot Plant (WIPP) Review Panel, in its 2004 report on transuranic (TRU) waste characterization, recommended that the DOE perform a systematic analysis to support arguments that waste characterization requirements can be reduced. The NRC envisioned a formal, broad-based study that goes beyond the regulations that implement the Resource Conservation and Recovery Act (RCRA) and the scope of the changes proposed in this permit modification. Likewise, the Environmental Evaluation Group (EEG) proposed that some reduction in waste characterization was justifiable. The New Mexico Environment Department (NMED) put the NRC and EEG recommendation into perspective by narrowing the scope to:

> The Permittees must identify the source of authority for these proposed changes to generator/storage site waste characterization requirements, the exclusive reliance on AK and the proposed changes to compliance with 40 CFR §264.13(a) by generator/storage sites and disposal facilities. The Permittees must also provide a technical justification as to why the proposed changes (which appear to decrease the accuracy of the waste analysis process) will not negatively impact the accuracy of that process and will, instead, be sufficient to accurately characterize wastes destined for WIPP.

SOURCE OF AUTHORITY

The revised Permit Modification Request (PMR), a Class 3 modification, is submitted pursuant to 20.4.1.900 New Mexico Administrative Code (NMAC) incorporating 40 CFR §270.42 and is consistent with the requirements of Sections 311/310. The proposed changes are:
a) Consistent with the overall waste analysis requirements of the WAP in the current permit because the revised PMR continues to require the collection of needed chemical and physical information for each waste stream and that the Permittees verify each shipment of waste;
b) Consistent with administrative requirements because the revised PMR uses methods established in the Hazardous Waste Facility Permit (HWFP) through the administrative process;
c) Consistent with the applicable RCRA regulatory requirements because all of the elements of a Class 3 permit modification request as stipulated in 20.4.1.900 NMAC incorporating 40 CFR 270.42(c) are included in the revised PMR;
d) Protective of human health and the environment because they call for every shipment of TRU mixed waste to be examined by the Permittees prior to disposal and because the performance standards for the WIPP facility are unchanged and the method of demonstrating compliance through monitoring is enhanced; and are
e) Consistent with the requirements of Sections 311/310 which directs the Permittees to confirm that waste contains no ignitable, corrosive, or reactive waste using radiography or visual examination (VE) and that the Permittees use monitoring of closed disposal rooms to determine compliance with environmental performance standards.

TECHNICAL JUSTIFICATION

This discussion focuses on the technical justification for the proposed changes to the following waste analysis activities:

- Acceptable Knowledge
- Headspace Gas Sampling and Analysis (HSGSA)
- Solid Sampling and Analysis (SSA)
- Radiography (including Visual Examination as a Quality Control (QC) check on Radiography)
- Visual Examination
- Estimation of Material Parameter Weights

For each of these waste analysis activities the following topics are discussed:

- Changes to the waste analysis activity proposed in the revised PMR
- Success in performing the waste analysis activity
- Justification for the change

In the following discussions, the Permittees will address both sufficiency and accuracy. In this discussion, "accuracy" refers to the very specific meanings in the HWFP in terms of Quality Assurance Objectives (QAOs) for each waste analysis method. Generally, QAOs are quantitative measures of method quality. The definitions of these accuracy measures are not changed in the revised PMR, although the method for determining accuracy for the acceptable knowledge process is being modified. Likewise, in this discussion, "sufficiency" refers to the ability of the overall waste analysis process to provide the information needed to satisfy the regulatory standards, thereby assuring the protection of human health and the environment and assuring compliance to the RCRA standards in the HWFP.

Topic: Acceptable Knowledge

Changes to the waste analysis activity proposed in the PMR: The HWFP currently requires that acceptable knowledge (AK) be assembled into an auditable record that documents the following:

- Delineation of the waste into a waste stream
- Assess if TRU mixed heterogeneous debris waste exhibits a toxicity characteristic
- Assess if the TRU mixed wastes are listed waste
- Identify the physical form of the waste
- Document the absence of prohibited items
- Estimate waste stream volumes
- Assign hazardous waste numbers

The HWFP is very explicit in terms of the information that must be collected to assure the sufficiency of the determinations listed above. In addition, the Quality Assurance (QA) of the program that the generator/storage site must implement in order to provide AK information to the Permittees is specified in the permit and controlled through audits.

The revised PMR would not decrease the amount and type of AK information that must be collected to satisfy the waste analysis needs of WIPP. In response to NMED's comments, two paths are proposed for assuring sufficiency of the AK information. The sampling and analysis pathway requires the generator/storage sites to compile the AK information into an auditable record for the waste stream and to perform sampling and analysis on a representative portion of the waste stream. The AK sufficiency determination pathway applies to those waste streams that, in the opinion of the Permittees, have sufficient AK information to assign U. S. Environmental Protection Agency (EPA) hazardous waste numbers (HWNs). For those waste streams the Permittees may request an AK sufficiency determination from NMED. If NMED determines that the AK is sufficient, the waste may be shipped to WIPP without further sampling and analysis. If NMED determines that AK is not sufficient, or when the Permittees do not submit an AK sufficiency determination request, additional waste analysis will be performed on a representative portion of the waste stream.

The AK process used at the generator/storage site is subject to the Permittees' Audit and Surveillance Program. This program assures that the generator/storage site's AK program is conducted pursuant to written procedures by trained individuals and that program implementation is occurring as expected. The audit process assures sufficient characterization of TRU mixed waste.

The sufficiency of AK can be viewed in the context of the definition of the term "accuracy" appearing in the HWFP as follows:

> **Accuracy** - Accuracy is the degree of agreement between an observed sample result and the true value. The percentage of waste containers which require reassignment to a new waste matrix code and/or designation of different hazardous waste ~~codes~~ numbers based on the reevaluation of acceptable knowledge or on obtaining sampling and analysis data will be reported as a measure of acceptable knowledge accuracy. (HWFP Section B4-3e)

This accuracy requirement is implemented at each generator site through a (Department of Energy, Carlsbad Field Office (CBFO)-approved TRU waste characterization program. The determination of AK accuracy in the HWFP involves the confirmation of AK information using several methods: waste examination through radiography or visual examination (VE), headspace gas sampling and analysis (HSGSA), and, for some waste streams, solids sampling and analysis (SSA).

Success in performing the waste analysis activity: Requirements in the HWFP for confirming AK information can be expressed in terms of AK accuracy metrics. Two of these metrics are related to radiography and VE and are defined below. Two others are associated with HSGSA and SSA and are discussed subsequently.

Metric 1: Waste Matrix Code (WMC) and waste stream assignment are confirmed using radiography or VE. Each time a container is assigned a new WMC or moved to another waste stream, the reassignment is recorded against AK accuracy.

Metric 2: Toxicity Characteristic Assignment is confirmed by determining a base material that may contain a toxicity characteristic hazardous waste (such as lead) in a waste container through radiography or VE. The presence of the material in a container where it is not expected is counted against AK accuracy.

Verification of information collected through the AK process has resulted in generally high AK accuracies as shown in Table I. These results are based on generator/storage site AK Accuracy reports available through August 2004.

Table I Overall Results of Acceptable Knowledge Accuracy Assessed Through Radiography or Visual Examination (Through August 2004)

Metric	Number Of Containers	AK Accuracy
1. Waste Matrix Code or Waste Stream Reassignment	70,021	98.3%
2. Base Material Toxicity Characteristic Assignment	70,021	99.8%

Metric 1 resulted from a total of 1,216 reassignments of containers to new Waste Matrix Codes as the result of radiography or VE. These are as follows:

- The Advanced Mixed Waste Treatment Project (AMWTP) reassigned 44 of 9,037 containers through radiography. These were generally distributed across all waste forms managed at the AMWTP.
- The Central Characterization Project (CCP) at Argonne East (ANL-E) reassigned 61 of 396 containers. After processing 61 containers in the waste stream, the Site Project Manager decided to reclassify the entire waste stream to a broader debris waste matrix code (From S5420, Predominantly Inorganic Debris to S5400, Uncategorized Metals based on the estimated volumes observed for the waste)
- CCP at the Savannah River Site (SRS) reassigned 252 of 5,452 containers. After examining 257 containers in one waste stream, the Site Project Manager determined that only 6 containers met the definition for the WMC (S5420, Predominantly Inorganic Debris) and subsequently reassigned the waste stream to S5440, Predominantly Organic Debris); one container from another SRS waste stream was reassigned to a S3000 Summary Category Group after radiography
- The Los Alamos National Laboratory (LANL) reassigned 9 of 1,399 debris containers to existing waste streams after determining the organic or inorganic content of the containers
- The Rocky Flats Environmental Technology Site (RFETS) reclassified a total of 691 of 26,958 containers based on either radiography or VE. The majority moved from Metal Debris (S5119) to Predominantly Inorganic Debris (S5420). None of the reassignments resulted in unshippable containers.
- The 3,100m^3 Project reassigned 159 of 25,531 containers distributed across numerous waste streams.
- CCP/LANL (8 containers), CCP/ Nevada Test Site (NTS) (275 containers)/ CCP/Lawrence Livermore National Laboratory (LLNL) (5 containers), and Hanford (960 containers) had no reassignments.

Metric 2 resulted from 100 assignments of hazardous waste numbers as the results of radiography or VE. These are as follows:

- CCP/ANL-E assigned hazardous waste codes to a waste stream after 11of 396 containers were discovered to contain lead (leaded rubber) and mercury (light bulbs). Both codes are acceptable at WIPP.
- CCP/SRS assigned hazardous waste codes to a waste stream after 17 of 5,452 containers were discovered to contain either lead (leaded rubber) or mercury (light bulbs). Both codes are acceptable at WIPP.
- RFETS changed the HWN assignments on 72 of 26,958 containers as the result of radiography. A total of 6 of these containers were found to have free liquids that were assumed to be prohibited characteristic waste and had to be remediated.
- The rest of the sites (AMWTP, 9,037 containers), CCP/LANL (8 containers), CCP/LLNL (5 containers), CCP/NTS (275 containers), Hanford (960 containers), and the 3,100m^3 Project (25,531 containers) had no reassignment of hazardous waste codes as the result of radiography or VE.

Justification for the change: Operating experience indicates that the process for assembling and interpreting AK information is robust and results in an accurate assessment of the characteristics of the waste stream. Accuracy is directly attributable to the comprehensiveness of the AK requirements in the HWFP. This standard for completeness has not been changed by the proposal. Therefore, confidence in the sufficiency of the data to meet permit conditions will continue to be high, even as older waste is retrieved and prepared for shipment to WIPP. Even though the degree of confidence is high, the Permittees have additionally assured the sufficiency by retaining the audit activity for the AK process and by having NMED independently approve the sufficiency of the AK record for those waste streams where the Permittees have determined that additional sampling and analysis are not necessary in order to meet the requirements of the WAP.

Topic: Headspace Gas Sampling and Analysis

Changes to the waste analysis activity proposed in the PMR: The current HWFP requires that every container of waste that is disposed at WIPP have a reported headspace gas concentration for 29 target analytes specified in the WAP. These analytes are the compounds that are associated with listed chemicals (mostly solvents) that generator/storage sites have indicated could be present in their waste. Concentration values of analytes are obtained through HSGSA in accordance with specific methods in the WAP. These HSGSA data have two uses. First, the results of HSGSA are examined to evaluate the accuracy of AK information regarding the assignment of ~~hazardous waste numbers (~~HWNs~~)~~ to the waste stream. Second, they are used in calculations to assure that the repository remains in compliance with the Room based VOC limits in the HWFP. For these calculations, the reported values are averaged for the adjacent closed room in the repository to assure that the concentration of VOCs plus projected increases due to the average container emission rate does not exceed the limits in the HWFP.

The revised PMR does not make any changes to the methods for HSGSA. However, the sampling frequency has changed. Instead of reporting VOC concentrations for each container that is disposed, the revised PMR requires that a generator/storage site obtain additional chemical testing if AK information is not sufficient to resolve the assignment of HWNs. In such cases, the generator/storage site will obtain and analyze an initial ten samples chosen randomly from the entire waste stream. If there are less than ten containers in the waste stream, all containers will be sampled once. If these samples are sufficient to resolve the assignment of HWNs, then no additional samples are required. If the prescribed number of samples cannot be collected because chosen containers are not available, then ten random samples are to be taken from the available population and additional samples are to be taken as unavailable containers become available for sampling.

The proposed sampling approach is consistent with the approach in the HWFP. It is based on Chapter 9 of the EPA's SW-846 Sampling Guidance Manual. In Chapter 9, the EPA recommends that sufficient samples be taken to form a preliminary estimate of the mean and variance of each hazardous constituent in a waste stream. Using these preliminary estimates, the generator/storage site can determine the number of required samples that are needed to resolve the assignment of HWNs. Required samples must be taken in accordance with the HWFP. Generator/storage sites are allowed to use preliminary samples as required samples if they were taken in accordance with the HWFP. After the minimum of ten required samples (or preliminary samples if taken in accordance with the HWFP) are taken and analyzed, no further sampling is needed if the generator/storage site can assign HWNs based on the sample results. For example, assume a generator/storage site takes ten preliminary samples in accordance with the HWFP and the analysis indicates the presence of a F001 listed solvent not assigned to the waste stream by AK. In addition, assume the calculation of the number of required samples indicates that the generator/storage site needs twenty samples to determine with a 95 percent confidence that the concentration of F001 is less than the threshold for adding the HWN. In this case, if the generator wanted to avoid adding the HWN, then all required samples would have to be taken. If the generator/storage site decides to add the HWN, no additional samples are needed since the ten preliminary samples can be used to satisfy the minimum of ten required samples.

If a waste stream is approved by the NMED as having sufficient AK information, no HSGSA will be performed.

The majority of the data currently collected for VOC concentrations is used by the Permittees to demonstrate compliance with the environmental performance standards established for closed rooms in the repository, rather than for the assignment of HWNs. In the revised PMR, the collection and reporting of these data are replaced by the closed and active room monitoring in the repository.

Success in performing the waste analysis activity: There are two measures of the success of the HSGSA process in the HWFP. First, HSGSA data are used to evaluate the AK information used to determine the HWNs that are assigned to the waste. Second, HSGSA is used to show that room-based limits are not exceeded in the repository.

Regarding the first use, confirmation of the AK information, the HWFP defines the following metric for evaluating AK information with regard to HWN assignment:

> Metric 3: F-listed solvent assignment is confirmed using headspace gas sampling and analysis. If the ninety percent upper confidence limit (UCL_{90}) concentration of an F-listed solvent exceeds the regulatory threshold established by the HWFP and the solvent has <u>not</u> been identified in the AK record, the HWN is added. The addition is counted against AK accuracy unless the presence of the solvent can be explained as a result of packaging or radiolysis.

Verification of HWN information collected through the AK process has resulted in generally high AK accuracies as shown in Table 2. Results indicate that AK accuracy is high because very few (2.8%) changes in the assignment of HWNs from AK have resulted from subsequent chemical testing. These results are based on generator/storage site AK Accuracy reports available through August 2004. In the case of the 3,100m^3 Project results, assignment of additional HWNs was made at the time the waste stream profile form (WSPF) was completed, based on the limited sample taken to develop the waste stream profile. In the case of the RFETS, the HWN assignment for individual containers was changed if the HSGSA results from ongoing waste analysis indicated additional HWNs should be applied to these containers. Using this approach, RFETS reported that the highest number of reassignments in any single waste stream was 17 percent (58 of 333 containers of Leaded Gloves). These hazardous constituents were not present in the majority of the containers in the waste stream. In no case did the Rocky Flats Environmental Technology Site (RFETS) identify a HWN that was not allowed by the WIPP HWFP.

Table 2 Overall Results of Headspace Gas Sampling and Analysis Compared to the Assignment of Hazardous Waste Numbers through Acceptable Knowledge (Through August 2004)

Metric	Number Of Containers	AK Accuracy
3. F-listed Solvent Assignment (headspace gas sampling and analysis)	51,441	97.2%

Metric 3 resulted in 1,496 assignments of HWNs out of a total of 51,411 containers tested as the result of HSGSA. These were split almost evenly between RFETS and the 3,100m³ Project. No other sites had HWN assignments as the result of HSGSA.

In most cases, the assignment based on AK information was sufficient. In the cases where HWNs were assigned, limited sampling (as proposed in the revised PMR) would have been sufficient to resolve any assignment of HWNs.

With regard to the second use of HSGSA in the HWFP, generator/storage sites have reported concentrations for target analytes for every container that has been disposed at WIPP. These are shown as average, maximum and minimum concentrations for the containers in each disposal room in Tables 3a to 3m. Currently, the average value is compared to the room based limit to demonstrate compliance with the room-based environmental performance standards. Room 2 of Panel 2 contains the greatest quantity of waste high in organic solvents since it contains primarily the RFETS inventory of Oil and Solvent Immobilization System (OASIS) sludge waste (500 containers). It can be noted that even this high VOC concentration waste exhibits an average concentration that is two orders of magnitude below the room based limit. As can be seen from Tables 3a to 3m, VOCs that are not included in the list of 9 target analytes do not generally exist in the headspace of containers in significant concentrations.

These HSGSA data show that the actual average concentrations of VOCs in the rooms are well below levels that pose a threat to workers in an adjacent open room that is being filled with TRU mixed waste.

Data from a test conducted by the Permittees to measure VOCs in closed rooms in the repository indicate that there is a rank correlation between the VOCs in the containers disposed and the VOCs measured in the repository. This means that the highest VOC concentrations recorded in the test correlate with the highest average concentration in the containers. However, there are no numerical representations that relate the container VOCs to the concentrations in the room. This is because it is difficult, if not impossible, to model all of the mechanisms in the repository that may affect the VOC equilibrium concentration within a room (e.g., plastic sorption by shrink wrap and slip sheets, plating on repository walls, emission characteristics of containers inside of overpack containers, dilution, filter blockage due to stacking, barometric pumping). Because of this difficulty, measuring VOC concentrations in the containers have been of little practical use to the Permittees in making decisions regarding the protection of workers. Instead, the Permittees believe closed-room monitoring is a significantly better approach to protecting workers from the possibility of high concentrations of VOCs because the actual concentrations can be readily determined and suitable action taken if needed when actual risks exist.

Table 3a – Average, Minimum, and Maximum VOC Concentrations in Containers in Room 7 of Panel 1

HSG target analyte from Table B-3 (excludes formaldehyde and hydrazine)	CAS Number	Actual Concentration (ppmv)			Room-Based Limit (ppmv)
		Minimum	Average	Maximum	
Acetone	67-64-1	< 1	6	340	
Benzene	71-43-2	< 1	< 1	52	
Bromoform	75-25-2	< 1	< 1	11	
Butanol	71-36-3	< 1	4	55	
Carbon tetrachloride	56-23-5	< 1	1	300	9,625
Chlorobenzene	108-90-7	< 1	< 1	9	13,000
Chloroform	67-66-3	< 1	< 1	170	9,930
1,1-Dichloroethylene	75-35-4	< 1	< 1	96	5,490
1,2-Dichloroethane	107-06-2	< 1	< 1	14	2,400
1,1-Dichloroethane	75-34-3	< 1	< 1	26	
(cis)-1,2-Dichloroethylene	156-59-2	< 1	< 1	10	
(trans)-1,2-Dichloroethylene	156-60-5	n/a	n/a	n/a	
Ethyl benzene	100-41-4	< 1	< 1	29	
Ethyl Ether	60-29-7	< 1	< 1	28	
Methanol	67-56-1	< 1	14	190	
Methylene chloride	75-09-2	< 1	< 1	120	100,000
Methyl ethyl ketone	78-93-3	< 1	2	187	
Methyl isobutyl ketone	108-10-1	< 1	2	108	
1,1,2,2-Tetrachloroethane	79-34-5	< 1	< 1	17	2,960
Tetrachloroethane	127-18-4	< 1	< 1	130	
Toluene	108-88-3	< 1	3	130	11,000
1,1,1-Trichloroethane	71-55-6	< 1	20	2000	33,700
Trichloroethylene	79-01-6	< 1	4	470	
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	< 1	< 1	340	
Xylene-p,m	108383/106423	< 1	< 1	63	

Table 3b – Average, Minimum, and Maximum VOC Concentrations in Containers in Room 6 of Panel 1

HSG target analyte from Table B-3 (excludes formaldehyde and hydrazine)	CAS Number	Actual Concentration (ppmv)			Room-Based Limit (ppmv)
		Minimum	Average	Maximum	
Acetone	67-64-1	< 1	5	290	
Benzene	71-43-2	< 1	1	13	
Bromoform	75-25-2	< 1	< 1	3	
Butanol	71-36-3	< 1	6	23	
Carbon tetrachloride	56-23-5	< 1	1	370	9,625
Chlorobenzene	108-90-7	< 1	< 1	4	13,000
Chloroform	67-66-3	< 1	1	610	9,930
1,1-Dichloroethylene	75-35-4	< 1	1	55	5,490
1,2-Dichloroethane	107-06-2	< 1	< 1	2	2,400
1,1-Dichloroethane	75-34-3	< 1	1	180	
(cis)-1,2-Dichloroethylene	156-59-2	< 1	< 1	3	
(trans)-1,2-Dichloroethylene	156-60-5	n/a	n/a	n/a	
Ethyl benzene	100-41-4	< 1	< 1	52	
Ethyl Ether	60-29-7	< 1	1	5	
Methanol	67-56-1	1	13	200	
Methylene chloride	75-09-2	< 1	3	1700	100,000
Methyl ethyl ketone	78-93-3	< 1	3	80	
Methyl isobutyl ketone	108-10-1	< 1	2	17	
1,1,2,2-Tetrachloroethane	79-34-5	< 1	< 1	3	2,960
Tetrachloroethane	127-18-4	< 1	< 1	58	
Toluene	108-88-3	< 1	3	120	11,000
1,1,1-Trichloroethane	71-55-6	< 1	27	1800	33,700
Trichloroethylene	79-01-6	< 1	3	520	
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	< 1	2	73	
Xylene-p,m	108383/106423	< 1	1	110	

Table 3c – Average, Minimum, and Maximum VOC Concentrations in Containers in Room 5 of Panel 1

HSG target analyte from Table B-3 (excludes formaldehyde and hydrazine)	CAS Number	Actual Concentration (ppmv)			Room-Based Limit (ppmv)
		Minimum	Average	Maximum	
Acetone	67-64-1	< 1	4	120	
Benzene	71-43-2	< 1	1	130	
Bromoform	75-25-2	< 1	< 1	4	
Butanol	71-36-3	< 1	6	36	
Carbon tetrachloride	56-23-5	< 1	2	600	9,625
Chlorobenzene	108-90-7	< 1	< 1	8	13,000
Chloroform	67-66-3	< 1	1	170	9,930
1,1-Dichloroethylene	75-35-4	< 1	1	51	5,490
1,2-Dichloroethane	107-06-2	< 1	< 1	9	2,400
1,1-Dichloroethane	75-34-3	< 1	1	29	
(cis)-1,2-Dichloroethylene	156-59-2	< 1	< 1	33	
(trans)-1,2-Dichloroethylene	156-60-5	n/a	n/a	n/a	
Ethyl benzene	100-41-4	< 1	< 1	92	
Ethyl Ether	60-29-7	< 1	1	30	
Methanol	67-56-1	2	11	140	
Methylene chloride	75-09-2	< 1	5	1800	100,000
Methyl ethyl ketone	78-93-3	< 1	2	31	
Methyl isobutyl ketone	108-10-1	< 1	2	8	
1,1,2,2-Tetrachloroethane	79-34-5	< 1	< 1	5	2,960
Tetrachloroethane	127-18-4	< 1	1	620	
Toluene	108-88-3	< 1	4	47	11,000
1,1,1-Trichloroethane	71-55-6	< 1	14	1200	33,700
Trichloroethylene	79-01-6	< 1	2	710	
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	< 1	2	340	
Xylene-p,m	108383/106423	< 1	1	300	

Table 3d – Average, Minimum, and Maximum VOC Concentrations in Containers in Room 4 of Panel 1

HSG target analyte from Table B-3 (excludes formaldehyde and hydrazine)	CAS Number	Actual Concentration (ppmv)			Room-Based Limit (ppmv)
		Minimum	Average	Maximum	
Acetone	67-64-1	< 1	4	240	
Benzene	71-43-2	< 1	1	31	
Bromoform	75-25-2	< 1	< 1	7	
Butanol	71-36-3	< 1	7	73	
Carbon tetrachloride	56-23-5	< 1	3	1900	9,625
Chlorobenzene	108-90-7	< 1	< 1	15	13,000
Chloroform	67-66-3	< 1	< 1	56	9,930
1,1-Dichloroethylene	75-35-4	< 1	1	100	5,490
1,2-Dichloroethane	107-06-2	< 1	< 1	16	2,400
1,1-Dichloroethane	75-34-3	< 1	1	89	
(cis)-1,2-Dichloroethylene	156-59-2	< 1	< 1	17	
(trans)-1,2-Dichloroethylene	156-60-5	n/a	n/a	n/a	
Ethyl benzene	100-41-4	< 1	< 1	61	
Ethyl Ether	60-29-7	< 1	1	46	
Methanol	67-56-1	3	13	80	
Methylene chloride	75-09-2	< 1	1	210	100,000
Methyl ethyl ketone	78-93-3	< 1	2	26	
Methyl isobutyl ketone	108-10-1	< 1	2	19	
1,1,2,2-Tetrachloroethane	79-34-5	< 1	< 1	11	2,960
Tetrachloroethane	127-18-4	< 1	< 1	16	
Toluene	108-88-3	< 1	4	76	11,000
1,1,1-Trichloroethane	71-55-6	< 1	11	3500	33,700
Trichloroethylene	79-01-6	< 1	1	290	
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	< 1	5	4300	
Xylene-p,m	108383/106423	< 1	1	200	

Table 3e – Average, Minimum, and Maximum VOC Concentrations in Containers in Room 3 of Panel 1

HSG target analyte from Table B-3 (excludes formaldehyde and hydrazine)	CAS Number	Actual Concentration (ppmv)			Room-Based Limit (ppmv)
		Minimum	Average	Maximum	
Acetone	67-64-1	< 1	4	100	
Benzene	71-43-2	< 1	1	35	
Bromoform	75-25-2	< 1	< 1	9	
Butanol	71-36-3	< 1	7	52	
Carbon tetrachloride	56-23-5	< 1	2	1900	9,625
Chlorobenzene	108-90-7	< 1	< 1	24	13,000
Chloroform	67-66-3	< 1	< 1	150	9,930
1,1-Dichloroethylene	75-35-4	< 1	1	61	5,490
1,2-Dichloroethane	107-06-2	< 1	< 1	20	2,400
1,1-Dichloroethane	75-34-3	< 1	1	260	
(cis)-1,2-Dichloroethylene	156-59-2	< 1	< 1	27	
(trans)-1,2-Dichloroethylene	156-60-5	< 1	< 1	11	
Ethyl benzene	100-41-4	< 1	< 1	140	
Ethyl Ether	60-29-7	< 1	1	48	
Methanol	67-56-1	< 1	13	210	
Methylene chloride	75-09-2	< 1	1	130	100,000
Methyl ethyl ketone	78-93-3	< 1	2	49	
Methyl isobutyl ketone	108-10-1	< 1	2	99	
1,1,2,2-Tetrachloroethane	79-34-5	< 1	< 1	16	2,960
Tetrachloroethane	127-18-4	< 1	1	1200	
Toluene	108-88-3	< 1	3	260	11,000
1,1,1-Trichloroethane	71-55-6	< 1	14	3300	33,700
Trichloroethylene	79-01-6	< 1	2	660	
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	< 1	3	1200	
Xylene-p,m	108383/106423	< 1	1	210	

Table 3f – Average, Minimum, and Maximum VOC Concentrations in Containers in Room 2 of Panel 1

HSG target analyte from Table B-3 (excludes formaldehyde and hydrazine)	CAS Number	Actual Concentration (ppmv)			Room-Based Limit (ppmv)
		Minimum	Average	Maximum	
Acetone	67-64-1	< 1	11	960	
Benzene	71-43-2	< 1	1	92	
Bromoform	75-25-2	< 1	1	81	
Butanol	71-36-3	< 1	6	250	
Carbon tetrachloride	56-23-5	< 1	2	2400	9,625
Chlorobenzene	108-90-7	< 1	1	66	13,000
Chloroform	67-66-3	< 1	2	840	9,930
1,1-Dichloroethylene	75-35-4	< 1	1	150	5,490
1,2-Dichloroethane	107-06-2	< 1	1	65	2,400
1,1-Dichloroethane	75-34-3	< 1	1	140	
(cis)-1,2-Dichloroethylene	156-59-2	< 1	1	80	
(trans)-1,2-Dichloroethylene	156-60-5	< 1	1	52	
Ethyl benzene	100-41-4	< 1	1	230	
Ethyl Ether	60-29-7	< 1	1	150	
Methanol	67-56-1	1	18	1000	
Methylene chloride	75-09-2	< 1	3	3600	100,000
Methyl ethyl ketone	78-93-3	< 1	6	1600	
Methyl isobutyl ketone	108-10-1	< 1	5	250	
1,1,2,2-Tetrachloroethane	79-34-5	< 1	1	62	2,960
Tetrachloroethane	127-18-4	< 1	1	320	
Toluene	108-88-3	< 1	6	760	11,000
1,1,1-Trichloroethane	71-55-6	< 1	22	4700	33,700
Trichloroethylene	79-01-6	< 1	5	1900	
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	< 1	7	12000	
Xylene-p,m	108383/106423	< 1	2	660	

Table 3g – Average, Minimum, and Maximum VOC Concentrations in Containers in Room 1 of Panel 1

HSG target analyte from Table B-3 (excludes formaldehyde and hydrazine)	CAS Number	Actual Concentration (ppmv)			Room-Based Limit (ppmv)
		Minimum	Average	Maximum	
Acetone	67-64-1	1	18	460	
Benzene	71-43-2	< 1	2	45	
Bromoform	75-25-2	< 1	2	7	
Butanol	71-36-3	1	13	221	
Carbon tetrachloride	56-23-5	< 1	7	14000	9,625
Chlorobenzene	108-90-7	< 1	2	8	13,000
Chloroform	67-66-3	< 1	2	73	9,930
1,1-Dichloroethylene	75-35-4	< 1	2	100	5,490
1,2-Dichloroethane	107-06-2	< 1	2	6	2,400
1,1-Dichloroethane	75-34-3	< 1	2	27	
(cis)-1,2-Dichloroethylene	156-59-2	< 1	2	6	
(trans)-1,2-Dichloroethylene	156-60-5	< 1	2	7	
Ethyl benzene	100-41-4	< 1	2	8	
Ethyl Ether	60-29-7	< 1	2	9	
Methanol	67-56-1	< 1	16	870	
Methylene chloride	75-09-2	< 1	2	22	100,000
Methyl ethyl ketone	78-93-3	< 1	12	430	
Methyl isobutyl ketone	108-10-1	< 1	12	160	
1,1,2,2-Tetrachloroethane	79-34-5	< 1	2	6	2,960
Tetrachloroethane	127-18-4	< 1	2	31	
Toluene	108-88-3	< 1	5	160	11,000
1,1,1-Trichloroethane	71-55-6	< 1	9	8200	33,700
Trichloroethylene	79-01-6	< 1	2	430	
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	< 1	2	170	
Xylene-p,m	108383/106423	< 1	3	39	

Table 3h – Average, Minimum, and Maximum VOC Concentrations in Containers in Room 7 of Panel 2

HSG target analyte from Table B-3 (excludes formaldehyde and hydrazine)	CAS Number	Actual Concentration (ppmv)			Room-Based Limit (ppmv)
		Minimum	Average	Maximum	
Acetone	67-64-1	< 1	24	4200	
Benzene	71-43-2	< 1	2	190	
Bromoform	75-25-2	< 1	1	40	
Butanol	71-36-3	< 1	13	292	
Carbon tetrachloride	56-23-5	< 1	42	34000	9,625
Chlorobenzene	108-90-7	< 1	1	42	13,000
Chloroform	67-66-3	< 1	3	600	9,930
1,1-Dichloroethylene	75-35-4	< 1	2	600	5,490
1,2-Dichloroethane	107-06-2	< 1	2	600	2,400
1,1-Dichloroethane	75-34-3	< 1	2	730	
(cis)-1,2-Dichloroethylene	156-59-2	< 1	1	59	
(trans)-1,2-Dichloroethylene	156-60-5	< 1	2	64	
Ethyl benzene	100-41-4	< 1	2	77	
Ethyl Ether	60-29-7	< 1	2	110	
Methanol	67-56-1	2	40	37560	
Methylene chloride	75-09-2	< 1	6	5000	100,000
Methyl ethyl ketone	78-93-3	< 1	15	1700	
Methyl isobutyl ketone	108-10-1	< 1	13	550	
1,1,2,2-Tetrachloroethane	79-34-5	< 1	1	80	2,960
Tetrachloroethane	127-18-4	< 1	1	96	
Toluene	108-88-3	< 1	8	1700	11,000
1,1,1-Trichloroethane	71-55-6	< 1	27	8800	33,700
Trichloroethylene	79-01-6	< 1	2	440	
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	< 1	11	5600	
Xylene-p,m	108383/106423	< 1	3	280	

Table 3i – Average, Minimum, and Maximum VOC Concentrations in Containers in Room 6 of Panel 2

HSG target analyte from Table B-3 (excludes formaldehyde and hydrazine)	CAS Number	Actual Concentration (ppmv)			Room-Based Limit (ppmv)
		Minimum	Average	Maximum	
Acetone	67-64-1	< 1	29	670	
Benzene	71-43-2	< 1	2	99	
Bromoform	75-25-2	< 1	1	10	
Butanol	71-36-3	< 1	17	140	
Carbon tetrachloride	56-23-5	< 1	5	2600	9,625
Chlorobenzene	108-90-7	< 1	1	9	13,000
Chloroform	67-66-3	< 1	2	360	9,930
1,1-Dichloroethylene	75-35-4	< 1	2	16	5,490
1,2-Dichloroethane	107-06-2	< 1	2	7	2,400
1,1-Dichloroethane	75-34-3	< 1	2	30	
(cis)-1,2-Dichloroethylene	156-59-2	< 1	2	8	
(trans)-1,2-Dichloroethylene	156-60-5	< 1	2	10	
Ethyl benzene	100-41-4	< 1	2	150	
Ethyl Ether	60-29-7	< 1	2	130	
Methanol	67-56-1	2	30	25000	
Methylene chloride	75-09-2	< 1	5	7800	100,000
Methyl ethyl ketone	78-93-3	< 1	18	480	
Methyl isobutyl ketone	108-10-1	< 1	17	650	
1,1,2,2-Tetrachloroethane	79-34-5	< 1	2	10	2,960
Tetrachloroethane	127-18-4	< 1	2	210	
Toluene	108-88-3	< 1	8	540	11,000
1,1,1-Trichloroethane	71-55-6	< 1	5	4600	33,700
Trichloroethylene	79-01-6	< 1	2	430	
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	< 1	2	310	
Xylene-p,m	108383/106423	< 1	4	610	

Table 3j – Average, Minimum, and Maximum VOC Concentrations in Containers in Room 5 of Panel 2

HSG target analyte from Table B-3 (excludes formaldehyde and hydrazine)	CAS Number	Actual Concentration (ppmv)			Room-Based Limit (ppmv)
		Minimum	Average	Maximum	
Acetone	67-64-1	< 1	24	450	
Benzene	71-43-2	< 1	3	150	
Bromoform	75-25-2	< 1	2	10	
Butanol	71-36-3	< 1	17	117	
Carbon tetrachloride	56-23-5	< 1	16	5400	9,625
Chlorobenzene	108-90-7	< 1	2	11	13,000
Chloroform	67-66-3	< 1	6	1700	9,930
1,1-Dichloroethylene	75-35-4	< 1	2	550	5,490
1,2-Dichloroethane	107-06-2	< 1	2	33	2,400
1,1-Dichloroethane	75-34-3	< 1	2	89	
(cis)-1,2-Dichloroethylene	156-59-2	< 1	2	15	
(trans)-1,2-Dichloroethylene	156-60-5	< 1	2	10	
Ethyl benzene	100-41-4	< 1	2	150	
Ethyl Ether	60-29-7	< 1	2	11	
Methanol	67-56-1	2	24	2300	
Methylene chloride	75-09-2	< 1	3	730	100,000
Methyl ethyl ketone	78-93-3	< 1	17	216	
Methyl isobutyl ketone	108-10-1	1	18	337	
1,1,2,2-Tetrachloroethane	79-34-5	< 1	2	10	2,960
Tetrachloroethane	127-18-4	< 1	2	65	
Toluene	108-88-3	< 1	9	990	11,000
1,1,1-Trichloroethane	71-55-6	< 1	19	12000	33,700
Trichloroethylene	79-01-6	< 1	4	4000	
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	< 1	8	8200	
Xylene-p,m	108383/106423	< 1	4	340	

Table 3k – Average, Minimum, and Maximum VOC Concentrations in Containers in Room 4 of Panel 2

HSG target analyte from Table B-3 (excludes formaldehyde and hydrazine)	CAS Number	Actual Concentration (ppmv)			Room-Based Limit (ppmv)
		Minimum	Average	Maximum	
Acetone	67-64-1	2	27	1200	
Benzene	71-43-2	< 1	3	2103	
Bromoform	75-25-2	< 1	2	10	
Butanol	71-36-3	4	21	210	
Carbon tetrachloride	56-23-5	< 1	30	45000	9,625
Chlorobenzene	108-90-7	< 1	2	10	13,000
Chloroform	67-66-3	< 1	5	1600	9,930
1,1-Dichloroethylene	75-35-4	< 1	3	190	5,490
1,2-Dichloroethane	107-06-2	< 1	2	17	2,400
1,1-Dichloroethane	75-34-3	< 1	2	110	
(cis)-1,2-Dichloroethylene	156-59-2	< 1	2	29	
(trans)-1,2-Dichloroethylene	156-60-5	< 1	2	16	
Ethyl benzene	100-41-4	< 1	2	200	
Ethyl Ether	60-29-7	< 1	2	10	
Methanol	67-56-1	4	25	5600	
Methylene chloride	75-09-2	< 1	6	5300	100,000
Methyl ethyl ketone	78-93-3	2	23	290	
Methyl isobutyl ketone	108-10-1	2	22	730	
1,1,2,2-Tetrachloroethane	79-34-5	< 1	2	10	2,960
Tetrachloroethane	127-18-4	< 1	2	76	
Toluene	108-88-3	< 1	5	420	11,000
1,1,1-Trichloroethane	71-55-6	< 1	27	23000	33,700
Trichloroethylene	79-01-6	< 1	2	200	
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	< 1	8	6600	
Xylene-p,m	108383/106423	< 1	5	520	

Table 3l – Average, Minimum, and Maximum VOC Concentrations in Containers in Room 3 of Panel 2

HSG target analyte from Table B-3 (excludes formaldehyde and hydrazine)	CAS Number	Actual Concentration (ppmv)			Room-Based Limit (ppmv)
		Minimum	Average	Maximum	
Acetone	67-64-1	1	28	1400	
Benzene	71-43-2	< 1	3	540	
Bromoform	75-25-2	0	2	5	
Butanol	71-36-3	2	22	400	
Carbon tetrachloride	56-23-5	< 1	32	26000	9,625
Chlorobenzene	108-90-7	< 1	2	10	13,000
Chloroform	67-66-3	< 1	5	1200	9,930
1,1-Dichloroethylene	75-35-4	< 1	3	200	5,490
1,2-Dichloroethane	107-06-2	< 1	2	23	2,400
1,1-Dichloroethane	75-34-3	< 1	2	400	
(cis)-1,2-Dichloroethylene	156-59-2	< 1	3	25	
(trans)-1,2-Dichloroethylene	156-60-5	< 1	2	15	
Ethyl benzene	100-41-4	< 1	2	140	
Ethyl Ether	60-29-7	< 1	3	11	
Methanol	67-56-1	3	24	3900	
Methylene chloride	75-09-2	< 1	15	55000	100,000
Methyl ethyl ketone	78-93-3	1	23	94	
Methyl isobutyl ketone	108-10-1	1	23	820	
1,1,2,2-Tetrachloroethane	79-34-5	< 1	3	12	2,960
Tetrachloroethane	127-18-4	< 1	2	88	
Toluene	108-88-3	< 1	7	1900	11,000
1,1,1-Trichloroethane	71-55-6	< 1	29	13000	33,700
Trichloroethylene	79-01-6	< 1	3	213	
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	< 1	31	112000	
Xylene-p,m	108383/106423	< 1	5	460	

Table 3m – Average, Minimum, and Maximum VOC Concentrations in Containers in Room 2 of Panel 2

HSG target analyte from Table B-3 (excludes formaldehyde and hydrazine)	CAS Number	Actual Concentration (ppmv)			Room-Based Limit (ppmv)
		Minimum	Average	Maximum	
Acetone	67-64-1	< 1	37	2400	
Benzene	71-43-2	< 1	3	180	
Bromoform	75-25-2	< 1	2	47	
Butanol	71-36-3	< 1	23	2500	
Carbon tetrachloride	56-23-5	< 1	3896	230000	9,625
Chlorobenzene	108-90-7	< 1	2	57	13,000
Chloroform	67-66-3	< 1	27	3600	9,930
1,1-Dichloroethylene	75-35-4	< 1	14	1900	5,490
1,2-Dichloroethane	107-06-2	< 1	4	150	2,400
1,1-Dichloroethane	75-34-3	< 1	5	950	
(cis)-1,2-Dichloroethylene	156-59-2	< 1	3	200	
(trans)-1,2-Dichloroethylene	156-60-5	< 1	3	240	
Ethyl benzene	100-41-4	< 1	3	1200	
Ethyl Ether	60-29-7	< 1	3	180	
Methanol	67-56-1	< 1	126	30000	
Methylene chloride	75-09-2	< 1	9	8100	100,000
Methyl ethyl ketone	78-93-3	< 1	24	1800	
Methyl isobutyl ketone	108-10-1	< 1	24	1700	
1,1,2,2-Tetrachloroethane	79-34-5	< 1	3	41	2,960
Tetrachloroethane	127-18-4	< 1	3	98	
Toluene	108-88-3	< 1	7	1300	11,000
1,1,1-Trichloroethane	71-55-6	< 1	2259	110000	33,700
Trichloroethylene	79-01-6	< 1	5	5700	
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	< 1	740	60000	
Xylene-p,m	108383/106423	< 1	6	3700	

Justification for the change: Eliminating the requirement for HSGSA of every container does not reduce the reliability of the HWN assignment made by the generator/storage site. This is due to the fact that generator/storage site host states require that a hazardous waste determination be made and that this determination be based on reliable information or testing. Generator/storage sites have been diligent in making this determination. Generally, AK information is sufficient to assign HWNs. There may be situations, however, when the AK information is not sufficient to resolve the HWN assignment for debris waste. In these cases, the generator/storage site will use HSGSA in accordance with the sampling approach in the revised PMR to sample and test a representative portion of the waste stream.

Operational experience indicates that the use of HSGSA data for demonstrating compliance with room-based concentrations has not been useful to the Permittees. This is because the concentrations have generally been small and the mechanisms for release in underground rooms are too complex to model accurately. Experience indicates that room-based monitoring is more reliable than individual container measurements for decision-making purposes since actual concentrations will be observed, resulting in the implementation of appropriate actions prior to the exposure limits being exceeded.

The Permittees also believe that limiting HSGSA to the minimum number of representative samples needed to resolve HWN assignment will accelerate the process of reducing the risk posed by undisposed waste in the DOE Complex and reduce the overall cost of waste analysis. Also, the potential for dose to operators will be reduced by requiring fewer containers to be sampled.

Topic: Solids Sampling and Analysis

Changes to the waste analysis activity proposed in the PMR: Solids sampling and analysis (SSA) is used in the HWFP to verify the assignment of toxicity characteristic hazardous waste numbers by AK. The Permittees propose to retain SSA as a waste analysis method for resolving the assignment of HWNs. SSA would be used for homogeneous solids and soil/gravel waste streams when AK information cannot resolve the assignment of toxicity characteristic HWNs. The generator/storage site will take an initial five samples chosen randomly from the entire waste stream and deliver these samples for analysis at one of the Permittee approved laboratories. If there are fewer than five containers in the waste stream, then each container will be sampled once. If these samples are sufficient to resolve the assignment of ~~hazardous waste numbers~~ HWNs, then no additional samples are required. If all five samples cannot be collected because chosen containers are not available, then five random samples are to be taken from the available population and the remaining samples taken as unavailable containers become available for sampling. Generator/storage sites can sample the containers themselves, or send the container to the Permittees Approved Laboratory at the INL for sampling and analysis.

The proposed sampling approach is consistent with the approach in the HWFP. It is based on Chapter 9 of the EPA's SW-846 Sampling Guidance Manual. In Chapter 9, the EPA recommends that sufficient samples be taken to form a preliminary estimate of the mean and variance of hazardous constituents in a waste stream. Using these preliminary estimates, the generator/storage site can determine the number of required samples that are needed to resolve the assignment of HWNs. Required samples must be taken in accordance with the HWFP. A minimum of five required samples must be taken for SSA. Generator/storage sites are allowed to use the preliminary samples as required samples if they were taken in accordance with the HWFP. After the minimum of five required samples (or preliminary samples if taken in accordance with the HWFP) are taken and analyzed, no further sampling is needed if the generator/storage site chooses to assign HWNs indicated by the sample results. For example, assume a generator/storage site takes five preliminary samples in accordance with the HWFP and the analysis indicates the presence of D008 toxicity characteristic metal that was not assigned to the waste stream by AK. In addition, assume the calculation of the number of required samples indicates that the generator/storage site needs seven samples to determine with a 95 percent confidence whether the concentration of D008 is less than the regulatory threshold for adding the HWN. If the generator wanted to avoid adding the HWN, then all required samples would have to be taken. If the generator/storage site decides to add the HWN, no additional samples are needed since the five preliminary samples can be used to satisfy the minimum of five required samples.

Success in performing the waste analysis activity: There is one measure of the success of the SSA process in the HWFP. SSA data are used to evaluate the AK information used to determine the HWNs that are assigned to the waste.

Regarding the confirmation of the AK information, the HWFP defines the following metric for evaluating AK information with regard to HWN assignment:

> Metric 4: If a toxicity characteristic metal, volatile organic compound (VOC) or semi volatile organic compound (SVOC) is detected in the solids portion and the toxicity characteristic HWN was not previously assigned, the HWN will be assigned and counted against AK accuracy.

Verification of information collected through the AK process has resulted in generally high AK accuracies as shown in Table 4. These results are based on generator/storage site AK Accuracy reports available through August 2004.

Verification of HWN information collected through the AK process has resulted in generally high AK accuracies as shown in Table 4. In both cases, the assignment of additional ~~codes~~ numbers was made at the time the waste stream profile form was completed, based on the limited sample taken to develop the waste stream profile. On going sampling or the sampling of subsequent waste stream lots did not change the initial assignments. In both cases, the new HWNs were allowed by the WIPP HWFP.

In most cases, the assignment based on AK information was sufficient. In the cases where HWNs were assigned, limited sampling (as proposed in the revised PMR) was sufficient to resolve any assignment of HWNs.

Table 4 Overall Results of Solids Sampling and Analysis Compared to the Assignment of Hazardous Waste Numbers through Acceptable Knowledge (Through August 2004)

Metric	Number Of Containers	AK Accuracy
4. Toxicity Characteristic Assignment (solids sampling and analysis)	31,607	96%

Metric 4 resulted in 1,240 assignments of Toxicity Characteristic HWNs out of 31,607 containers covered by SSA. These were as follows:

- Hanford assigned the hazardous waste number for silver (D011) to an entire waste stream (291 of 291 containers) as the result of detecting that metal in the samples. Note that this discrepancy was reported in the WSPF for the RLMHASH.001 waste stream.
- RFETS reported sampling results covering 18,959 containers that resulted in the assignment of D008 (lead) and D011 (silver) to the TRM Plutonium Fluoride waste stream (949 containers).
- No other site shipping homogeneous solids reported HWN additions.

Justification for the change: Eliminating SSA for every container does not reduce the reliability of the HWN assignment made by the generator/storage site because, generally, AK information is sufficient to assign HWNs. There may be situations, however, when the AK information is not sufficient to resolve the HWN assignment for homogeneous solids waste. In this case, the generator/storage site will use SSA in accordance with the sampling approach in the revised PMR to sample a representative portion of the waste stream.

The Permittees also believe that reducing SSA to the minimum number of representative samples needed to resolve HWN assignment will reduce the overall cost of waste analysis and accelerate the process of reducing the risk posed by undisposed waste in the DOE Complex. Related to this, dose to operators will be reduced by requiring fewer containers to be handled and sampled.

Topic: Radiography

Changes to the waste analysis activity proposed in the PMR: Radiography is a nondestructive qualitative and quantitative technique that involves X-ray scanning of waste containers to identify and verify waste container contents. In the HWFP, radiography is used to examine every waste container to verify its physical form. This technique can detect liquid wastes and containerized gases, which are prohibited for WIPP disposal. The prohibition of liquids and containerized gases prevents the shipment of corrosive, ignitable, or reactive wastes. Radiography can also confirm that the physical form of the waste matches its waste stream description.

A radiography system (e.g., real time radiography, digital radiography/ computed tomography) normally consists of an X-ray-producing device, an imaging system, an enclosure for radiation protection, a waste container handling system, an audio/video recording system, and an operator control and data acquisition station. To perform radiography, the waste container is scanned while the operator views the television screen. An audio/videotape or equivalently non-alterable media is made of the waste container scan and is maintained as a non-permanent record. A radiography data form is also used to document the WMC and estimated waste material parameter weights of the waste. The radiography system involves qualitative and semi-quantitative evaluations of visual displays. Operator training and experience are the most important considerations for assuring quality controls in regard to the operation of the radiography system and for interpretation and disposition of radiography results. Only trained personnel are allowed to operate radiography equipment for WIPP waste analysis.

In the revised PMR, radiography may be used to determine the absence of liquids and compressed gases in order to demonstrate that there is no ignitable, corrosive or reactive waste in the container. The Permittees may use radiography to verify that each shipment of TRU mixed waste is in accordance with the requirements of 40 CFR §264.13. Containers will be selected randomly from the shipment to assure that the selection is statistically representative. The method for using radiography is detailed in the revised PMR in HWFP Attachment B7. Where the Permittees perform radiography to verify each shipment, such activity is subject to direct inspection by the NMED as opposed to annual audits.

In lieu of radiography, the Permittees may use the VE method, as more fully discussed in the topic, Visual Examination, below. Regardless of the method used by the Permittees, seven percent of the containers (55-,85-,or 100-gallon drum, direct loaded standard waste box (SWB), direct loaded ten drum overpack (TDOP) from each waste stream in each shipment will be randomly selected and reviewed. A minimum of at least one container in each waste stream will be examined.

The proposed waste examination rate has the advantage that it satisfies the requirement to examine each movement of waste in each waste stream (similar to other permits issued in New Mexico) and it offers simplicity because there would not be multiple rates for different waste streams. Having it performed by the Permittees also simplifies the verification process because containers to be examined are not pre-selected from the entire waste stream population. Instead, they are selected once a shipment is configured, assuring the availability of every selected container.

The Permittees waste analysis activities may occur either off-site at the generator/storage site or on-site at the WIPP facility. For on-site verification, arriving waste would be segregated into staging areas, pending verification. Staging areas would be specifically designated and would be separate from permitted storage areas. Shipments arrive at the WIPP site as seven-pack assemblies from which specific drums are removed for waste examination. Until waste examination of the specified drum is complete, the entire assembly would be "tagged" to indicate that waste examination has not occurred.

Off-site radiography may also be used by the Permittees. Off-site radiography may be used when the generator/storage site is shipping containers that cannot be radiographed at WIPP. For example, if the generator/storage site is placing 55-gallon drums into TDOPs, radiography for the Permittees' verification will have to occur prior to packaging into the TDOP because of the container size limitation for typical radiography units (drums or standard waste boxes). Waste that is examined by the Permittees off-site will arrive at the WIPP and can be placed into permitted storage areas once the container integrity and identification numbers are verified.

Currently, several overpacked containers cannot be effectively radiographed at WIPP, including TDOPs or SWBs used to overpack drums. These overpacked containers would be radiographed at the generator/storage site by the Permittees prior to overpacking. Containers selected for examination that contain classified materials that can be viewed using radiography would be radiographed by the Permittees or under the supervision of the Permittees at a location where the proper security measures are in place (e.g., the generator/storage site).

In some cases, the AK information developed by a generator/storage site will indicate that prohibited items could be present in the waste stream or there is insufficient documentation to assure that prohibited items have been excluded. In this case, the generator/storage site may use methods like radiography to examine each container to locate any prohibited items. These radiography methods would have to meet the general performance standards listed in the revised PMR (Attachment B, Section B-2) and would be subject to the Permittees Audit and Surveillance Program. The general performance standards in Attachment B, Section B-2 of the revised PMR specify that any method used by the generator/storage site shall be performed to written procedures by trained individuals. The field application of the methods and associated procedures are subject to examination by the Permittees during initial and subsequent audits. NMED is an observer on these audits.

Success in performing the waste analysis activity: The HWFP currently requires that all containers undergo radiography (or VE in lieu of radiography). As of April 1, 2005, generator/storage sites have radiographed 54,843 containers using 16 different approved radiography procedures. These are documented in Table 5. Each container was checked for physical form and the presence of prohibited items. The comparison between the results of radiography and AK information was discussed above. There is insufficient information in the AK Accuracy reports produced by the generator sites to separate radiography results from the results of VE.

As a measure of radiography accuracy, generator sites are required to calculate the miscertification rate associated with the use of radiography. An initial rate of 11 percent is used until sufficient containers have been processed to determine a site-specific rate. The minimum number of containers is 50. Most sites have established site-specific miscertification rates. Some have established rates for both Summary Category Group S5000 debris and Summary Category Group S3000 Homogeneous Solids. Table 6 provides a summary of historical and current miscertification rates for various sites that are shipping waste to WIPP.

Generally, miscertification rates are low and reveal the fact that radiography operations are of sufficient quality to assure consistent identification of important waste parameters. The high quality of radiography is in major part because the radiography process includes numerous methods in the HWFP for controlling the quality of radiography. These include training, the use of a second operator to serve as an Independent Technical Reviewer, and independent observations and independent replicate scans by trained operators. These methods are retained except for VE as a QC check on radiography. As the result of the historically low miscertification rates and the fact that radiography itself (or VE) will be used by the Permittees as a verification check on the generator/storage sites, the use of VE as a QC check on radiography is proposed to be deleted in the revised PMR.

Table 5 Approved Radiography Processes and Usage as of April 1, 2005

WWIS DESIGNATION	DESCRIPTION	NUMBER OF CONTAINERS
13RR1	MCS-RTR-2	682
1RR1	RTR-1 MCS RTR DRUM	14616
2RR1	104-ND-06-104A (NDE-A)	1582
2RR2	104-ND-06-104B (NDE-B)	701
3RR1	RTR-RTR-1001 - RTR DRUM	1768
3RR2	RTR-RTR-0000 - RTR DRUM	3235
4RR1	MOBILE RTR	1356
5MR1	MOBILE RTR	1521
5RR1	569 RTR - RTR DRUMS & SWBS	2975
5RR2	664 RTR - RTR DRUMS & SWBS	5394
6RR1	SWHS-MON-21094206 - RTR DRUM	275
7RR1	MCS - RTR-5	1114
8RR1	MCS RTR-5	381
9RR1	RTR SYSTEM RTR1	802
9RR2	RTR SYSTEM RTR2	678
RTR	REAL-TIME RADIOGRAPHY	17510
RTRM	MOBILE RTR	253
	TOTAL	54843

Table 6 Annual Miscertification Rates for Each Generator Site Shipping Waste to WIPP (As reported through summer 2004)

SITE	SUMMARY CATEGORY GROUP	MISCERTIFICATION RATE FOR EACH CALENDAR YEAR (Notes 1, 2, and 3)				
		2000	2001	2002	2003	2004
AMWTP	S3000				11 (0)	1
	S5000				11 (0)	1
CCP/ANL-E	S5000			11 (0)	1 (0)	
CCP/LANL	S5000					11
CCP/LLNL	S5000					11
CCP/NTS	S5000				11 (0)	1
CCP/SRS	S5000		11 (2)	4 (0)	1 (0)	1
HANFORD	S5000	11 (0)	1 (0)	1 (0)	1 (0)	1
LANL	S5000	11 (3)	6 (2)	3 (0)	1 (0)	
RFETS	S3000	11 (0)	1 (0)	1 (0)	1 (0)	1
	S5000	11 (0)	1 (0)	1 (0)	1 (0)	1
3,100m³ PROJECT	S3000	1 (1)	5 (1)	3 (0)		
	S5000	11(2)	3(0)	1 (0)		
TOTAL MISCERTIFICATIONS	S3000	1	1	0	0	0
	S5000	5	4	0	0	0

Note 1: The miscertification rate in the first year is 11% until a site-specific rate is established.
Note 2: The minimum rate allowed by the HWFP is 1%; therefore, actual rates of 0% are implemented at the minimum.
Note 3: Number of miscertified containers found during VE as a quality control (QC) check on radiography is shown in parentheses. Results for 2004 have not been reported by the generator/storage sites.

Justification for the change: The changes proposed in the revised PMR are justified for the following reasons. First, the change satisfies Section 311/310 requirements to confirm that waste is not ignitable, corrosive, or reactive using radiography or VE. Second, the process is defined in the revised PMR as a Permittee activity, subject to inspection by the NMED. Third, every shipment is confirmed prior to disposal, making the operation of the WIPP facility closer to the standard commercial operation of a treatment, storage, and disposal facility under RCRA. This also provides the Permittees with an almost daily opportunity to evaluate the generator/storage site waste analyses program by checking their shipments as opposed to the annual audits or the review of data in the WIPP Waste Information System (WWIS). If generator/storage sites cannot provide documentation that there are no prohibited items in the waste, all containers will be subject to radiography (or VE) by the generator/storage site in addition to the Permittees verification of seven percent of the containers in each waste stream in each shipment.

Topic: Visual Examination

Changes to the waste analysis activity proposed in the PMR: VE is performed by opening a container and physically examining its contents and may be used to examine a waste container to verify its physical form in lieu of radiography. VE can detect liquid wastes and containerized gases, which are prohibited for WIPP disposal. The prohibition of liquids and containerized gases prevents the shipment of corrosive, ignitable, or reactive wastes. VE may also be used to verify that the physical form of the waste matches its waste stream description. VE is conducted to describe all contents of a waste container, and includes estimated or measured weights of the contents. The description shall clearly identify all discernible waste items, residual materials, packaging materials, or waste material parameters. VE activities may be documented on video/audio tape and on visual examination data forms. Instead of videotaping the VE activity, generator/storage sites can use two trained operators who will sign the data record describing the contents of the waste container.

In the revised PMR, VE will continue to be used to determine the absence of liquids and compressed gases which is proof that there are no ignitable, corrosive or reactive waste in the container. However, the frequency of VE performed by the generator/storage sites is proposed for reduction of those waste streams that have AK documentation that no prohibited items were included in the waste. Like radiography, VE is a method that the Permittees may use to verify that each shipment of TRU mixed waste is in accordance with the requirements of 40 CFR §264.13. The Permittees will either observe VE activities at the generator/storage site or will review the VE videotape or VE records. Containers will be selected randomly from every shipment to assure that the selection is statistically representative. The method for using VE in this fashion is detailed in the revised PMR in HWFP Attachment B7.

For waste streams where no VE videotape is or has been created, the Permittees may use a packaging record that is signed by two trained VE operators who witnessed the waste packaging. In this case, the Permittees will ascertain through audit or review of the generator/storage site program records that the packaging record was created consistent with the VE method described in the revised PMR. Because the Permittees are performing an examination of VE records directly to verify each shipment, these activities are subject to direct inspection by the NMED.

In lieu of VE, the Permittees may use the radiography, as more fully discussed in the topic, Radiography, above. Regardless of the method used by the Permittees, seven percent of the containers (55-, 85-, or 100-gallon drum, direct loaded SWB, direct loaded TDOP) from each waste stream in each shipment will be randomly selected and reviewed. A minimum of at least one container in each waste stream will be examined.

The proposed waste examination rate has the advantage that it satisfies the requirement to examine each movement of waste in each waste stream (similar to other permits issued in New Mexico) and it offers simplicity because there would not be multiple rates for different waste streams. Having it performed by the Permittees also simplifies the verification process because containers to be examined are not pre-selected from the entire waste stream population. Instead, they are selected once a shipment is configured, assuring the availability of every selected container.

The Permittees' waste analysis activities may occur either off-site at the generator/storage site or on-site at the WIPP facility. For on-site waste analysis activities, arriving waste would be segregated into staging areas, pending verification. Staging areas would be specifically designated and would be separate from permitted storage areas. Shipments arrive at the WIPP site as seven-pack assemblies from which specific drums are removed for waste examination. Until waste examination of the specified drum is complete, the entire assembly would be "tagged" to indicate that waste examination has not occurred.

In some cases, the AK information developed by a generator/storage site will indicate that prohibited items could be present in the waste stream or there is insufficient documentation to assure that prohibited items have been excluded. In this case, the generator/storage site may use methods like VE to examine each container to locate prohibited items. These VE methods would have to meet the general performance standards listed in the revised PMR (HWFP Attachment B, Section B-2) and would be subject to the Permittees Audit and Surveillance Program. The general performance standards in HWFP Attachment B, Section B-2 of the revised PMR specify that any method used by the generator/storage site shall be performed to written procedures by trained individuals with properly maintained equipment. The field application of the methods and associated procedures are subject to examination by the Permittees during initial and subsequent audits. NMED is an observer on these audits.

Success in performing the waste analysis activity: Requirements in the HWFP require that all containers undergo radiography (or VE in lieu of radiography). As of April 1, 2005, generator/storage sites have used VE on 26,441 containers using nine different approved VE procedures. These are documented in Table 7. Each container was checked for physical form and the presence of prohibited items. The comparison between the results of VE and AK information was discussed above. There is insufficient information in the AK Accuracy reports produced by the generator sites to separate radiography results from the results of VE.

As indicated in Table 7, VE is used principally to collect needed waste information during waste packaging. This can include newly generated waste, repackaged waste, or treated waste. It is the Permittees' belief that the majority of the Remote-Handled (**RH**) TRU mixed waste will use VE methods to assure that no prohibited items are packaged with the waste. This is because most RH TRU mixed waste has not been packaged into its final payload container (either an RH TRU mixed canister or a 55-gallon drum). When generator/storage sites produce records such as videotapes that will be used by the Permittees to perform waste verification, those records must be produced in accordance with the requirements in the revised PMR and will be subject to audit and approval by the Permittees.

Table 7 Approved Visual Examination Processes and Usage as of April 1, 2005

WWIS DESIGNATION	DESCRIPTION	NUMBER OF CONTAINERS
13VE1	CCP MOBILE VE AND REPACKAGING	65
13VE2	VISUAL EXAMINATION IN LIEU OF RTR	14
2VE1	VE TECHNIQUE	1834
4VE2	VE TECHNIQUE FOR OSR WASTE	2
7VE2	VISUAL EXAMINATION IN LIEU OF RTR	249
8VE1	VISUAL EXAMINATION TO CONFIRM RTR	58
8VE2	VISUAL EXAMINATION IN LIEU OF RTR	109
NEWLY GENERATED	VE OF NEWLY GENERATED WASTE	23480
VISUAL	VISUAL CHARACTERIZATION METHOD	630
	TOTAL	26441

Justification for the change: The changes proposed in the revised PMR are justified for the following reasons. First, the change satisfies Section 311/310 requirements to confirm that waste is not ignitable, corrosive, or reactive using radiography or VE. Second, the process is defined in the revised PMR as a Permittee activity, subject to inspection by the NMED. Third, every shipment is confirmed prior to disposal, making the operation of the WIPP facility closer to the standard commercial operation of a treatment, storage, and disposal facility under RCRA. This also provides the Permittees with an almost daily opportunity to evaluate the generator/storage site waste analyses program by checking their shipments as opposed to the annual audits or the review of data in the WWIS. If generator/storage sites cannot provide documentation that there are no prohibited items in the waste, all containers will be subject to radiography or VE in addition to the Permittees verification of seven percent of the containers in each waste stream in each shipment.

Topic: Material Parameter Weight Estimation

Changes to the waste analysis activity proposed in the PMR: In the HWFP, the objective of radiography for the program is to verify the WMC and identify prohibited items for each waste container and to estimate each waste material parameter weight. A table of waste material parameters is given in the HWFP and includes the following items:

- Iron-based Metals/Alloys
- Aluminum-based Metals/Alloys
- Other Metals
- Other Inorganic Materials
- Cellulosics
- Rubber

- Plastics (waste materials)
- Organic Matrix
- Inorganic Matrix
- Soils/gravel
- Steel (packaging materials)
- Plastics (packaging materials)

These parameters were identified for evaluation as important parameters in the numerical modeling that was performed to evaluate the repository as a miscellaneous unit. Of these parameters, only those related to gas generation were determined to be important. These material parameters are routinely evaluated by the generator/storage site when conducting radiography. Results are reported to the ~~WIPP Waste Information System (~~WWIS~~)~~ and are compared against repository limits annually for the EPA.

The HWFP derives values for material parameter weights from radiography or VE when it is conducted in lieu of radiography. Because the revised PMR is proposing reduced rates for radiography or VE, an alternative method is proposed. The revised PMR will require the generator/storage site to estimate material parameter weights using AK information.

Generator/storage sites will be required to include steps in their procedures to assign material parameter weights based on either unit weight or unit volume. For example, a generator/storage site may estimate the total weight of a material parameter for a waste stream and the total weight of the waste in the waste stream. These would be expressed in kilograms of material parameter per kilogram of waste. Parameter weights can then be assigned to individual containers of waste based on the net weight of the waste in each container. For example, if AK indicates that there are 0.2 kilograms of cellulose, rubber and plastic per kilogram of waste, then a container with a net waste weight of 100 kilograms would be assigned 20 kilograms of cellulose, rubber, and plastic.

Success in performing the waste analysis activity: A comparison of reported material parameter weights to what would be estimated based on the AK record was performed. To perform this comparison, a query of the WWIS was made for all containers disposed of as of April 1, 2005 and their associated material parameter weights. A total of 109 waste streams have been disposed of, either in part or in whole. This information is summarized in Table 8 (which is included at the end of this section due to its size). Next, the AK for the waste stream was identified in the Compliance Recertification Application (CRA). Those waste streams for which AK information was not compiled in the CRA were eliminated from the comparison. These are shaded gray in Table 8. Since the WWIS data needed to be converted to kg/m^3, those waste streams that were shipped in overpacks were also eliminated leaving only waste streams shipped in 55-gallon drums. Retained waste streams are shown in bold. This resulted in 19 waste streams containing about 13,000 containers.

Using this representative sampling of containers, the ratio of material parameter weights determined by AK to the information from radiography as reported in the WWIS was determined for the material parameter weights. The result is shown in Table 9. Non-corrodible metals were combined into one group as were cellulose, plastic and rubber since these combined material parameters are of interest. A value greater than one in Table 9 indicates that the AK information over predicts the material parameter weights. All the values in Table 9 are greater than 1 but are very close to 1 meaning that AK is as good an indicator of material parameter weights as is the estimate from radiography.

Table 9 Comparison of Material Parameter Weights Determined through AK and Those Reported in the WWIS

MATERIAL PARAMETER	CONTAINERS	AK	WWIS	RATIO
IRON BASE METAL ALLOYS	12,803	1.48E+05	1.39E+05	1.07
OTHER METAL/ALLOYS	12,746	2.58E+04	1.74E+04	1.48
OTHER INORGANIC MATERIALS	12,878	7.94E+05	7.84E+05	1.01
CELLULOSICS, RUBBER, PLASTIC	12,880	1.68E+06	1.59E+06	1.06
SOLIDIFIED INORGANIC MATERIAL	7799	2.07E+05	1.81E+05	1.15
STEEL CONTAINER MATERIALS	12,880	5.24E+06	5.20E+06	1.01
PLASTIC/LINERS CONTAINER MATERIALS	12,880	3.84E+05	3.65E+05	1.05

Justification for the change: The Permittees believe that estimating material parameter weights using AK information is adequate and will provide reasonable values to check against repository limits established by the EPA. The use of AK information has several distinct advantages. First, the waste processing time is shortened because generator/storage sites do not have to dwell on radiography images to estimate material sizes and associated weights. Second, radiography training is significantly easier, since operators will be able to focus on recognizing prohibited items and not estimating weights. Shorter radiography cycle times will reduce overall costs. The results of this method may produce an overestimate of those parameters that have maximum values associated with them. This is conservative since it may result in less gas generation in the closed repository. The use of AK also produces overestimates of those parameters that have minimum values associated with them. This could be non-conservative except that one of the parameters with a minimum value is Other Metal/Alloys and the minimum repository limit has already been satisfied so that future estimates are inconsequential and the other parameter, Corrodible Metals, will be satisfied by the volume of iron in containers that are disposed and the corrodible metal content of the waste is also inconsequential.

Table 8 Average Material Parameter Weights per Container for Each Waste Stream Disposed by April 1, 2005

WASTE STREAM	AVERAGE MATERIAL PARAMETER WEIGHT PER CONTAINER IN KILOGRAMS											
	1	2	3	4	6	7	8	9	10	12	13	14	15
AECHDM	24.56	2	4.99	4.07	3.28	3.92	11.24	8.57	10.24	1.64	29.94	4.37	
AECHHM								89.6			28.04	6.68	
BLCHDN.001	12.78			2.85	1.8	1.5	8.53	4.63			24.75	4.3	
BNINW216	0.33		7.2	15.08	1.81	2.07	1.79	180.76	173.92		26.76	8.41	
BNINW218				24.99	1.81	0.11	2.14	181.14			26.76	7.85	
INW161.001	0.91		2.04	51.5	5.41	0.05	1.27				26.76	8.07	
INW169.001	2.27	0.91	2.04	1.83	27.1	2.34	1.72				26.76	8.09	
INW198.001	1.63	0.23	3.06	2.93	1.95	1.98	18.06	0.09			26.76	8.72	
INW211.001	1.36	2.75	1.49	6.49	29.54	2.08	2.02				26.76	8.12	
INW216.001	1.59	0.41	3.73	5.95	26.63	1.23	1.7	174.64	112.27		27.13	9.3	
INW218.001	1.08		1.05	12.03	178.72	1.75	2.14	201.61	107.96		39.68	10.16	
INW222.001	0.11		0.6	2.14	1.25		3.45	117.86			26.76	8.16	
INW243.001	0.98	0.27	3.1	34.03	1.88	2.49	6.04	0.01			26.76	9.64	
INW247.001R1	1.35		0.38	48.58	5.35		2.17				26.76	9.2	
INW252.001			43.12	1.86	3.18	43.3	1.69				26.76	7.99	
INW276.001	0			68.49	0.98	0	0.78				27	8.02	
INW276.002				66.69	1.94						27	8.78	
INW276.003	0.24	0.11	0.29	68.48	1.82		0.63				26.76	8.91	
INW276.004	1.32		0.98	68.22	2.78		1.6				26.76	9.71	
INW296.001	3.61	6.28	46.51	2.7	1.25	2.59	2.3				26.76	9.48	
LA-OS-00-01	27.2		0.2		28.6						82.7	37.2	
LA-TA-55-19.01	67.14	1.23	0.99	0.86	8.28	4.79	31.72				179.34	4.5	
LA-TA-55-19.02	2.95	1.23	2.24	2.84	12.14	3.46	14.93		6.8	3.69	28.82	4.5	
LA-TA-55-30	47.82	4.89	4.5	23.87	6.56	1.75	3.18			8.91	26.79	4.5	
LA-TA-55-43.01	86.33	0.79	0.8	1.14	2.3	3.98	16.75				290		
LL-M001-S5400	19.7	3.83	6.49	3.18	2.61	2.65	12.38	14.07	9		28.47	7.02	
MU-W002	4.57	5.2	0.1	2.62	0.5		1.82				29.07	2.07	
NTS54332R0	9.79	1.52	2.55	1.95	2.95	3.27	9.8	13.75	2.78	0.62	27.32	4.91	
NTS54COMR0	11.12	1.18	1.12	2.24	4	3.87	12.64	6.76	1.3		26.38	3.7	
NTS54MIX1R0	7.05			1	8	8.65	8				27.5	1.7	
RF001.01	0.62	0.44	4.9	4.95	17.67	3.43	18.95	0.2	7.23	2.43	32.41	5.68	

Table 8 Average Material Parameter Weights per Container for Each Waste Stream Disposed by April 1, 2005 (Continued)

WASTE STREAM	AVERAGE MATERIAL PARAMETER WEIGHT PER CONTAINER IN KILOGRAMS												
	1	2	3	4	6	7	8	9	10	12	13	14	15
RF002.01	139.49	18.05	35.93	3.77	4.79	2.56	2.98	2	3.45		82.25	6.26	
RF003.01	3.27		1.79	15.02	30.3	0.32	0.8	20.97	0.24		94.29	5.22	
RF004.01	3.47	4.8	32.32	99.94	2.88	0.79	2.24	1.72			29.86	7.56	
RF005.01	3.96		1.42	4.01	35		0.36				110	5	
RF005.02	2.9		1.18	5.71	35						110	5	
RF006.01	1.75		7.55	6.71	34.91	0.24	0.39				109.22	5.01	
RF008.01	1.17	5	5.38	11.92	34.1		1.45				106.27	5.07	
RF009.01	2.18		1.33	3.64	34.98		0.3	0.24			109.57	5	35
RF010.01	9.9	8.73	15.83	4.4	23.18	4.28	4.56	3.26	2.12	27.98	52.6	6.43	
RF011.01	3.94	0.1	0.32	5.4	1.1		0.8				29.03	7.24	
RF015.01	3.99			1.05	2.7		0.54				29.03	6.8	
RF029.01	314.84	19.76	12.94	45.07	32.26	8.56	56.99	2.85	3.08	78.4	281.33	10.69	35
RF031.01	0.99		2.4	2.08	2.56		9.83		20.83		30.7	6.47	
RF032.01	3.24		1.7	6.68	34.97		0.39				108.9	5.03	
RF033.01	6.58	0	3.47	23.28	2.6		9.92				66.15	6.18	35
RF036.01	3.34	5		101.29	2.69		4.75			64.67	29.03	6.57	
RF101.01	0.57	0.44	1.91	8.68	20.03	3.87	8.85		49		34.15	6.52	
RF101.29	0.77	0.4	0.02	17.24	17.23	8.25	11.8				30.97	6.57	
RF101.30	0.78	0.5	1.34	4.26	16.24	4.69	11.82	5	1.87	0.37	30.26	6.51	
RF101.31	0.71		1.88	4.29	18.01	3.04	12.86	1.4	0.51		34.65	6.51	35
RF101.35	0.61			7.27	22	1.86	14.71				30.61	5.65	
RF102.01	170.89	7.46	36.6	5.41	4.68	1.89	3.4		0.04		107.45	6.56	
RF102.31	228.01	10.81	111.3	20	4.91	33.52	3.17				111.89	10.33	35
RF104.01	5.21	0.4	4.86	52.54	2.86	1.76	1.7				46.15	6.32	35
RF107.01	2.75		23.1	123.34			3.52	166.43	181.63		29.03	8.51	
RF107.03	5.2						3.11	173.99			29.03	8.38	
RF107.04	1				2.7		3.09		213.44		29.03	7.98	
RF107.05					2.7		3.22	82.63			29.03	6.8	
RF107.06	1.55						1.88	182.94			29.03	6.79	
RF107.07							3.39	251.84			29.02	7.18	

Table 8 Average Material Parameter Weights per Container for Each Waste Stream Disposed by April 1, 2005 (Continued)

WASTE STREAM	AVERAGE MATERIAL PARAMETER WEIGHT PER CONTAINER IN KILOGRAMS												
	1	2	3	4	6	7	8	9	10	12	13	14	15
RF110.01	3.16	2.57	0.7	2.79	16.51	2.45	6.61	0.6			29.02	6.81	
RF110.05	10.92			4.02	3.58	0.46	5.9		2.35		29.03	7.13	
RF113.01				9.8	0.2		1.8				29	6.8	
RF115.01	4.46	0.7	3.5	12.03	29.75	0.48	0.78		0.72		95.49	5.3	35
RF116.01	4		3.35	6.82			0.67				110.03	5	35
RF117.01	1.8		2.4	21.75	2.7		2.1				29.02	6.58	
RF118.01	2.34	0.14	1.69	3.37	34.99	0.11	0.27	0.9		2.53	109.99	5	35
RF119.01	18.47	0.28	20.4	21.63	1.46		3.32	51.68	2.06		32.85	6.54	35
RF121.01	1.16		1.39	2.32	35		0.28				110.03	5	35
RF122.01	2.1		2.59	4.28	0.24		0.52				108.56	4.97	35
RF122.03				115.84			1.38	118.71			29.03	6.8	
RF122.04				138.27	1.44		1.76				29.03	6.8	
RF122.05			2.5	105.78			11.19				29.03	6.92	
RF122.06	1.98		2.72	10.74			0.58				104.97	5.17	35
RF123.02	6.07			26.71	2.7		0.52				29.03	6.8	
RF123.03	1.09			4.71	2.7		0.54				29.03	6.64	
RF123.04	0.36	0.1	0.07	3.75	1.88	0.03	0.06	3.75	0.03		29.03	6.8	
RF124.01	0.6	0.63	47.6	11.06	6.42	27.69	2.23				29.61	6.47	
RF124.02	1.75		43.84	37	2.6	25.69	2.14				29.01	6.97	
RF125.01	2.44		1.32	1.38			0.44		3.03		84.35	5.53	35
RF126.01	1.8		2.4				0.48		2.9		110.03	5	35
RF126.04	1.26		1.68				0.34		2.32		110.03	5	35
RF128.01	0.98	0.9	1.23	1.9	35		0.25				110.03	5	35
RF129.01	251.93	21.17	97.2	51.33	24.96	14.95	46.1	6.79	7.5	0	247.19	10.5	35
RF129.05	340.09	12.71	134.41	43.05	15.31	16.68	43.52	0	23.67	0	281.84	13.78	
RF130.01	4.45	1.95	10.13	3.74	1.34	0.72	2.26	3.12	3.04	0.25	29.03	6.67	
RF134.02	37.97	25.31		7.19	20.16		23.96			1258.94	290.3	4.1	
RF135.02	18.9				1.83		1		92.72		29.03	6.88	
RF139.01				173.03			2.03	164.15	86.65		29.02	6.67	
RF140.01	292.88	102.63	200.14	241.05	9.03	9.3	12.82		1.61		245.94	10.13	
RF141.01	1.52		1.84	2.99	35		0.37		0.24		110.03	5	35
RF141.02	1.09	1.2	1.32	2.28	34.33	0.24	0.26		0.24		110.03	5	35
RLHMOX.001				4.25	35						115.16	5.03	34.93

Table 8 Average Material Parameter Weights per Container for Each Waste Stream Disposed by April 1, 2005 (Continued)

WASTE STREAM	AVERAGE MATERIAL PARAMETER WEIGHT PER CONTAINER IN KILOGRAMS												
	1	2	3	4	6	7	8	9	10	12	13	14	15
RLMHASH.001				3.48	35						114.3	4.99	35.01
RLMPDT.001	10.91	4.81	2.52	5.8	4.69	7.42	10.28	4.45	0.5	17.73	29.58	0.5	
RLMPURX.001	14.93	2	0.64	4.22	1.66	19.37	8.44				29.48	0.37	
RLMSSC.001				10.31	35						112.81	5	
RLNPDT.002	12.66	5.43	1.04	7.06	5.48	2.36	10.58			4.04	29.87	0.49	
RLNPURX.001	12.59	7.94	0.5	4.32	1.56	2.41	5.74				29.69	0.39	0.1
RLRFETS.001				3.72	35						113.62	4.99	35
SR-W026-221F-HET	16.05	0.82	2.55	3.43	1.24	5.67	10.73				28.1	8.2	
SR-W026-772F-HET	1.8	0.41	6.17	4.03	0.76	2.19	10.08				29.59	8.2	
SR-W027-221F-HETA	5.27	4.75	3.94	3.86	2.44	2.02	14.76	10.07	5.15	0.6	29.08	8.06	
SR-W027-221H-HET	6.27	1.5	5.88	3.14	1.27	3.52	11.88	6.7	0.1		28.8	8.19	
SR-W027-235F-HET	6.32	0.93	8.7	2.19	1.49	2.88	12.09	0.8			30.02	8.2	
SR-W027-FB-PRE86-C	5.12	2.08	1.2	3.17	1.94	1.67	13.52		1.7		30.06	8.15	
SR2001.001.00	3.13		0.53	5.27	2.63	0.96	17.89				28.71	6.65	
SR2002.002.00	2.3	4.01	0.52	5.35	2.08	1.46	16.93				28.9	7.55	

KEY TO MATERIAL PARAMETERS

NUMBER	MATERIAL PARAMETER
1	IRON BASE METAL ALLOYS
2	ALUMINUM BASE METAL/ALLOYS
3	OTHER METAL/ALLOYS
4	OTHER INORGANIC MATERIALS
5	CEMENT (NONE REPORTED)
6	CELLULOSICS
7	RUBBER
8	PLASTICS
9	SOLIDIFIED INORGANIC MATERIAL
10	SOLIDIFIED ORGANIC MATERIAL
11	VITRIFIED (NONE REPORTED)
12	SOILS
13	STEEL CONTAINER MATERIALS
14	PLASTIC/LINERS CONTAINER MATERIALS
15	CELLULOSICS PACKAGING MATERIAL