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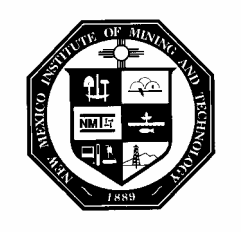

CONTACT HANDLED TRANSURANIC WASTE CHARACTERIZATION REQUIREMENTS AT THE WASTE ISOLATION PILOT PLANT

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New Mexico

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September 2003

FOREWORD

The purpose of the New Mexico Environmental Evaluation Group (EEG) is to conduct an independent technical evaluation of the Waste Isolation Pilot Plant (WIPP) Project to ensure the protection of the public health and safety and the environment of New Mexico. The WIPP Project, located in southeastern New Mexico, became operational in March 1999 for the disposal of transuranic (TRU) radioactive wastes generated by the national defense programs. The EEG was established in 1978 with funds provided by the U.S. Department of Energy (DOE) to the State of New Mexico. Public Law 100-456, the National Defense Authorization Act, Fiscal Year 1989, Section 1433, assigned the EEG to the New Mexico Institute of Mining and Technology and continued the original contract DE-AC04-79AL10752 through DOE contract DE-AC29-89AL58309. The National Defense Authorization Act for Fiscal Year 1994, Public Law 103-160, and the National Defense Authorization Act for Fiscal Year 2000, Public Law 106-65, continued the authorization.

The EEG performs independent technical analyses on a variety of issues. Now that the WIPP is operational, these issues include facility modifications and waste characterization for future receipt and emplacement of remote-handled waste, generator site audits, contact-handled waste characterization issues, the suitability and safety of transportation systems, mining of new panels, and analysis of new information as part of the five year recertification cycles as mandated by the WIPP Land Withdrawal Act. Review and comment is provided on the annual Safety Analysis Report and Proposed Modifications to the Hazardous Waste Facility Permit. The EEG also conducts an independent radiation surveillance program which includes a radiochemical laboratory.

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ACRONYMS

AK	Acceptable Knowledge
ALARA	As Low As Reasonably Achievable
C of C	Certificate of Compliance
CBFO	Carlsbad Field Office
CCA	Compliance Certification Application
CFR	Code of Federal Regulations
CH	Contact Handled
CH WAC	Contact Handled Waste Acceptance Criteria for WIPP, rev 0; rev 0.1
CPR	Cellulose, Plastic and Rubber
DAC	Drum Age Criteria
DOE	Department of Energy
EEG	Environmental Evaluation Group
EPA	Environmental Protection Agency
FGE	Fissile Gram Equivalent
HSG	Headspace Gas
HWFP	Hazardous Waste Facility Permit
IDC	Item Description Code
INEEL (INEL)	Idaho National Engineering and Environmental Laboratory
LANL	Los Alamos National Laboratory
LWA	Land Withdrawal Act
NAS/NRC	National Academy of Sciences. National Research Committee
NDA	Non-Destructive Assay
NETL/CABE	National Energy Technology Laboratory/Center for Acquisitions and Business Excellence
NMAC	New Mexico Administrative Code
NMED	New Mexico environment Department
NRC	Nuclear Regulatory Commission
PCB	Polychlorinated Biphenyls

ACRONYMS (continued)

PE-Ci	Plutonium Equivalent Curies
PMR	Permit Modification Request
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
QAPD	Quality Assurance Program Document
RCRA	Resource Conservation and Recovery Act
RFETS	Rocky Flats Environmental Technology Site
RH	Remote Handled
RIPB	Risk-Informed and performance-based
RTR	Real Time Radiography
SAR	Safety Analysis Report
SARP	Shipping Package Safety Analysis Report
SPM	Site Project Manager
SPQAO	Site Project QA Officer
SRS	Savannah River Site
SVOC	Semivolatile Organic Chemicals
TRAMPAC	TRUPACT-II Authorized Methods for Payload Control
TRU	Transuranic
TSCA	Toxic Substance Control Act
TSR	Technical Safety Requirements
VOC	Volatile Organic Chemicals
VE	Visual Examination
WAC	Waste Acceptance Criteria for WIPP, rev 0 through rev 7
WAP	Waste Analysis Plan
WIPP	Waste Isolation Pilot Plant
WSPF	Waste Stream Profile Forms
WWIS	WIPP Waste Information System

EXECUTIVE SUMMARY

Protection of the safety, health, and the environment at the Department of Energy (DOE) Waste Isolation Pilot Plant (WIPP) relies in part on the quality and completeness of the information about the waste that is shipped to the WIPP. This quality and completeness of the information is created through the waste characterization requirements identified in various regulatory documents. Waste characterization requirements are specified by the three WIPP regulatory agencies and the DOE: (1) the New Mexico Environment Department (NMED) through the Hazardous Waste Facility Permit (HWFP), (2) the U.S. Environmental Protection Agency (EPA) through the transuranic waste disposal Certification, (3) the U.S. Nuclear Regulatory Commission (NRC) through the TRUPACT II Authorized Methods for Payload Control (TRAMPAC), and (4) the Department of Energy through the Waste Acceptance Criteria (WAC). Of the four agencies, the requirements of the NMED for the Hazardous Waste Facility Permit tend to be the most prescriptive.

The Environmental Evaluation Group (EEG) has been evaluating the development of waste acceptance criteria since 1979. This report consolidates the findings and recommendations of the EEG's technical reviews and our current positions with respect to waste characterization requirements.

All waste characterization requirements were, at the time they were proposed and put in place, believed to be important for the protection of the worker safety, public health and the environment. The current waste characterization requirements were not developed ad hoc, but through much technical discussion, reference to accepted standards and codes, and considerable effort by DOE employees, DOE contractors, regulatory agency staff, regulatory agency contractors, the EEG staff, interested organizations, and/or members of the public.

The DOE has submitted several Class 2 and Class 3 Permit Modification Requests to NMED WIPP Hazardous Waste Facility Permit. Some have been accepted, some rejected, some withdrawn, and some are pending as tabulated in this report. EEG has provided a technical review of each. DOE has secured relief from a number of requirements. For example, by using

the permit modification process, the DOE has obtained a reduction of the headspace gas sampling requirement for thermally treated waste from Rocky Flats Environmental Technology Site (RFETS), a reduction in the visual examination requirement for waste from RFETS, and a reduction in headspace gas analysis for waste from the Idaho National Engineering and Environmental Laboratory (INEEL). These reductions in waste characterization requirements saved $30 million, saved $19 million, and allowed DOE to meet a deadline to remove 3100 m^3 from INEEL, respectively. From the time of application through the time of approval, these changes were each achieved in four months or less.

The waste characterization requirements from the various agencies contain many of the same requirements. Despite this overlap, the methods for meeting these requirements are somewhat different. The most complete methods of reaching compliance when requirements overlap, are usually found in the HWFP or the 40 CFR 194 compliance implementation found in Appendix A of the contact handled CH WAC. When considering a requirement change to either of these documents, the effect on all requirements, including those issued by other agencies, should be noted and evaluated for any potential impacts across agencies.

Based on our reviews, EEG offers the following observations and recommendations for waste characterization requirements:

Acceptable Knowledge: Acceptable Knowledge (AK) is the principle waste characterization technique for all of the regulatory agencies. AK is necessary and should be retained. At this time EEG supports the use of the HWFP AK requirements since they are the most explicit.

Headspace Gas Sampling and Analysis: It is desirable to maintain a comprehensive Headspace Gas (HSG) program for WIPP CH TRU waste. However, it should be possible to require less than 100% headspace gas sampling in some cases. Our primary concern is with organic sludges and older waste containers where knowledge of the waste is of lesser quality.

Drum Age Criteria: Drum Age Criteria (DAC) is necessary to ensure that Headspace Gas sampling of waste containers will measure gas concentrations that are at least 90% of

equilibrium. DAC values are required in both the HWFP and the TRAMPAC. The EEG supports this requirement.

Real Time Radiography: All WIPP waste containers are required to undergo either radiography or visual examination by the HWFP. Usually retrieved wastes undergo Real Time Radiography (RTR) and newly generated wastes are examined by visual examination. RTR has been a very effective means of verifying AK and discovering prohibited items in waste containers. It is also used to show compliance with several EPA and TRAMPAC requirements. The overall radiography program is an important part of the WIPP waste characterization program and should be retained. It may be possible to reduce some of the detailed procedural requirements in the HWFP.

Visual Examination for Retrievably Stored Waste: A small percentage (currently less than 2%) of retrievably stored waste is required by the HWFP to undergo visual examination for confirmation of RTR. The Visual Examination (VE) process has the potential for slightly greater radiation exposure than the other waste characterization requirements, although the EEG has seen no data to indicate that exposures are significant enough to justify reducing the requirement. The DOE has been successful in modifying the HWFP on retrievably stored visual examination and this would be the preferred process for seeking further reductions.

Visual Examination for Newly Generated Waste: VE is the method DOE usually prefers for newly generated waste because it can be done at the time the waste container is being filled. The EEG has not objected to any part of this requirement except to state that the requirement for two trained VE operators to perform the visual process "may be overkill" and that a single verification should be adequate.

Coring Sampling and Analysis: Currently the EEG continues to believe that the homogeneous sampling and analysis are unnecessary characterization requirements in the HWFP. Our principal reason for this position is that the data are not used for any additional regulatory control (metals releases from accidents or long-term processes would be controlled by radionuclide control requirements and VOCs and SVOC by HSG or the Confirmatory VOC Monitoring Plan).

Level II Management and Waste Certification HWFP Requirements: The DOE has listed these management and certification requirements as characterization activities in a recent cost analysis. EEG has not previously commented on these requirements. However, our current evaluation indicates that the required procedures are very detailed and somewhat redundant. This may be one of the areas to which the general EEG comment, "We believe waste characterization requirements are excessive," applies.

Characterization Support HWFP Requirements: EEG remains supportive of the WIPP audit and surveillance program. We have also said that we do not believe the relaxation of audit requirements and QA/QC is an appropriate way to reduce the regulatory burden.

EPA Non-Radiological Requirements: EPA's residual liquids, non-ferrous metal and cellulose, plastic and rubber requirements should remain and can continue to be determined as they are now, by the RTR and VE requirements of the HWFP. The ferrous metal requirement can continue to be met by counting waste containers emplaced in the repository.

EPA Radiological Requirements: The EEG agrees with the radioassay requirements for contact-handled transuranic waste specified in Appendix A of the CH WAC and the current procedures for modifying the document.

Current requirements for reporting the 10 required radionuclides should remain. ^{241}Pu should also be reported. The current requirement that all radioassay should be performed by WIPP-certified assay systems should be maintained.

Justification for less than 100% quantification and determination of isotopic ratios may be possible for some, but certainly not all, waste streams.

NRC Container Properties: The TRAMPAC requirements for residual liquids, filter vents and the sealed container prohibition should be retained. These are all verified by requirements in the current HWFP.

NRC Nuclear Properties: All nuclear property requirements should be retained and Appendix A of the CH WAC methodology should be used.

NRC Gas Generation Requirements: Requirements for measuring the chemical, payload classification, and radionuclide concentrations necessary to ensure hydrogen gas concentration criteria are met must be retained. There have been many changes, via the Certificate of Compliance (C of C) revision process, which have allowed additional containers to be shipped without changing the hydrogen gas criteria and additional changes may be justifiable in the future.

The flammable gas concentration limit of ≤ 500 ppm should be retained as described in the current revision of the TRAMPAC. Alternate methods (with appropriate QA) will be necessary if future changes to the HWFP affects the use of HSG sampling as the method for meeting this criteria.

WIPP Waste Acceptance Criteria: The WAC has served a useful historic purpose in developing initial criteria that have been adopted by the other three regulatory agencies. Currently it is a useful document for listing most of the requirements from all four sets of criteria. It would be more useful if the technical justification for each criteria or requirement were restored.

The unique role of the WAC in including any necessary operational safety and health requirements not included elsewhere is very important and must be constantly evaluated via the technical safety requirements (TSR) portion of the CH TRU Safety Analysis Report, and any necessary changes incorporated into the CH WAC.

Summary Observations and Recommendations

EEG's views on waste acceptance criteria and waste characterization continue to evolve. Shortly after the WIPP began receiving waste in 1999, the EEG published calculations comparing the risks from the hazardous constituents and the radioactive constituents in the WIPP inventory. The carcinogenic risks were quite low for both categories, with the expected carcinogenic risk

from the hazardous constituents four orders of magnitude less than the expected risk from the radiological constituents to workers from routine operations and operational accidents. Prudence suggests that mitigating the relatively small risk from the non-radiological constituents should not be the primary cost in waste characterization. Waste characterization efforts should focus on reducing the risk of release of radiological constituents.

Any proposed relaxation of waste characterization requirements needs to be evaluated in sufficient detail to convince the regulatory agencies, the EEG, and others that the modification is justified. Implicit in this approach is the understanding that any changes need to be made in a step-by-step transparent process and through existing regulatory procedures of the NMED, the EPA, and the NRC. This approach requires adequate justification and has worked effectively to obtain approval for a number of changes from all three non-DOE regulatory agencies. Moreover, as noted by the DOE, the regulatory agencies have indicated a preference for this approach.

1.0 PURPOSE AND SCOPE

Protection of the safety, health, and the environment at the Department of Energy (DOE) Waste Isolation Pilot Plant (WIPP) relies in part on the quality and completeness of the information about the waste that is shipped to the WIPP. This quality and completeness is created through the waste characterization requirements established in various regulatory documents.

This report is a compilation of the Environmental Evaluation Group's (EEG) comments since the operational phase of WIPP began and EEG's current positions on the existing waste characterization requirements by three regulatory agencies and the DOE. The report includes discussions about: (1) the process for changing requirements, (2) a comparison of risks due to various constituents in the waste, (3) whether current requirements are necessary, adequate or excessive, and (4) the continued need for the audit/QA process. The rationale for each conclusion and recommendation is also given.

The EEG has been evaluating the development of the WIPP waste characterization criteria since 1979. The WIPP began receiving contact handled (CH) transuranic (TRU) waste in March 1999. Later that same year, the project received its Hazardous Waste Facility Permit (HWFP) from the New Mexico Environment Department (NMED) and began receiving and emplacing mixed CH TRU waste.

The EEG has made several sets of comments since 1999 explaining our evaluations and evolving positions on waste characterization requirements. These were submitted as: (1) comments to the DOE in September 1999 concerning Waste Characterization Task Force recommendations, (2) comments to DOE in January 2002 on the proposed Appendix A changes to the WIPP CH Waste Acceptance Criteria (CH WAC), and (3) statements to the National Academy of Sciences/National Research Council (NAS/NRC) Committee on Optimizing the Characterization and Transportation of Transuranic Waste for the Waste Isolation Pilot Plant in October 2002, January 2003, and May 2003[1]. These comments and statements are included in Appendix A of

[1] EEG understands that the anticipated NAS/NRC committee report is under internal discussion.

this report. The EEG has also provided technical reviews on every Class 2 and Class 3 permit modification request submitted by DOE to the NMED, which is discussed in more detail in Chapter 4. All of these materials are available on EEG's web site (http://www.eeg.org).

This report references waste acceptance criteria, waste characterization requirements, and waste characterization methods cognizant of the DOE statement that, "in some cases the acceptance criteria and regulatory requirements are synonymous." (DOE 1999, p 3-8). The waste characterization methods are also specified in the permit and certificates, and arguably might be viewed as a requirement.

This report concentrates on EEG's position on the various waste characterization requirements, not the details of procedures required to show compliance. We recognize that the procedural requirements are a significant part of the waste characterization issue, but they are outside the scope of this report.

1.1 Overview of Waste Characterization Requirements

The U.S. Department of Energy (DOE), the U.S. Nuclear Regulatory Commission (NRC), the U.S. Environmental Protection Agency (EPA), and the New Mexico Environment Department (NMED) all have requirements for characterization of WIPP waste. A number of the waste characterization requirements are included in more than one set of requirements.

The DOE was self-regulating (except for the U.S. Department of Transportation shipping requirements) for all waste characterization criteria prior to 1989. The DOE, through its Orders and policies as far back as 1979 began to develop criteria protective of worker and public health and safety for anticipated operations. The criteria in the original WAC included limitations on: free liquids; pyrophoric, toxic and corrosive materials; explosive and compressed gas; gas generation and criticality. Container and certification requirements were also included (DOE 1980). Subsequent revisions of the WAC have consolidated into this one document requirements by each regulatory agency as these requirements became applicable. In April 2002, the WAC

was revised to contain only criteria for CH TRU waste. Up to this time, the WAC covered both CH TRU and remote-handled (RH) TRU waste.

The first set of requirements from a regulatory agency came from the NRC issuance of the Certificate of Compliance (C of C) of the TRUPACT-II Type B Package (NRC 71-9218) in 1989. These requirements included physical, nuclear and chemical properties and are included in a document called the TRUPACT-II Authorized Methods for Payload Control (TRAMPAC). Many of the properties were similar to those already in the WAC. In addition, there were extensive requirements dealing with control of the concentration of hydrogen, methane, and flammable volatile organic chemical (VOC) concentrations. Quality assurance (QA) requirements for packaging were also specified in the TRAMPAC.

The 1992 Land Withdrawal Act (LWA) specified that waste coming to WIPP must be transuranic waste (defined in the LWA as, "waste containing more than 100 nanocuries of alpha emitting transuranic isotopes per gram of waste with half-lives greater than 20 years."). Moreover, it was limited to waste generated by atomic energy defense activities of the United States. The LWA also specified a regulatory role for the EPA in ensuring long-term compliance of the WIPP repository. This role for EPA led to several additional waste characterization criteria.

EPA waste characterization requirements provide the most stringent requirements for quantification of radionuclides and also include several other requirements. The official methodology for radionuclide assay is primarily non-destructive assay (NDA) and is contained in Appendix A of the CH WAC (currently DOE 2002b). Modifications to Appendix A require EPA approval. The NDA methodology prescribed in Appendix A is also used in quantifying NRC and DOE radiological requirements.

The HWFP (NMED 1999) became effective in December 1999. The HWFP adds several waste characterization requirements and provides specific details of procedures that must be applied in meeting the requirements. Several NRC and EPA requirements are included in the HWFP and

the methodology specified in the HWFP for meeting the NMED, NRC, and EPA requirements is quite prescriptive.

1.2 Overlap of Waste Characterization Requirements

In our reviews of proposed changes, EEG has found that the waste characterization requirements from the three regulatory agencies and the DOE contain considerable overlap (i.e., contain the same requirements). Despite this overlap, the methods to be used for meeting these requirements are somewhat different. The most complete methods of reaching compliance when requirements coincide are usually those found in the HWFP (NMED) and the 40 CFR 194 (EPA) radioassay compliance implementation found in Appendix A of the CH WAC (DOE).

For example, the maximum of 325 fissile gram equivalent (FGE) requirement in each TRUPACT-II is in the TRAMPAC. Yet, the most complete waste characterization method to ensure compliance with this requirement is specified in Appendix A of the CH WAC, where radionuclide measurement requirements are specified to meet the 40 CFR 194.24 criteria.

Similarly, requirements for limitation of liquids to less than 1% by volume in waste containers are specified by the waste characterization requirements of each agency—as part of the TRAMPAC (free liquids), 40 CFR 194.24 (free water), the HWFP (residual liquid), and the CH WAC (free water, residual liquid, currently total residual liquid). For the purposes of this report, EEG refers to the presence of liquids. The most complete method for determining the presence of liquids, however, is the HWFP requirement that each container must undergo either radiography or visual examination. A further discussion of "overlap" issues is in Chapter 4.0 and Table 4-2.

A change in one set of requirements could have implications for other requirements. For example, if headspace gas (HSG) sampling and analysis was eliminated as a HWFP requirement, it would be necessary to use an alternate methodology to ensure adequate control of flammable gas requirements in the TRAMPAC. Alternate methods exist, but they would need to be

incorporated into the HWFP or some other regulatory document with appropriate QA in order to sustain an adequate level of assurance.

The overlap of requirements of each agency inherently complicates change. When considering a requirement change in either the HWFP or Appendix A of the CH WAC, the effect on all requirements, including those issued by other agencies, should be noted and evaluated for its impact on requirements across agencies.

1.3 EEG Waste Characterization Evaluations and Philosophy

1.3.1 Evaluation History

The EEG has reviewed waste characterization requirements as they were being developed and modified over the years. Our comments are contained primarily in letters or presentations rather than EEG reports. There are EEG reports on specific issues related to waste acceptance criteria (Little 1980), flammability of CH TRU waste drums (Neill and Channell 1983; Silva 1990; 1991), safety documents (primarily the WIPP Safety Analysis Report [SAR]; EEG 1989), and applications to regulatory agencies (the Compliance Certification Application [CCA] from DOE to EPA; Neill and others 1996; 1998) that led to the development or retention of some waste characterization requirements.

Our evaluations concentrated on the specific purpose of each of the criteria or regulatory documents. The initial WAC comments were primarily concerned with operational health and safety at WIPP. Reviews of NRC requirements concentrated on gas generation and adequacy of the TRUPACT-II package itself. These two issues were instrumental in adoption of the legal requirement that all waste shipments to WIPP be in NRC certified Type B packages. The EEG review (Neill and others 1996; 1998) of the DOE application and EPA proposed certification focused on requirements necessary to assure that the WIPP complied with 40 CFR 191 and 40 CFR 194.

EEG's reviews of the HWFP and proposed permit modification requests (PMRs) included detailed technical evaluations of whether the HWFP or a PMR would accomplish the required regulatory objectives. However, with our review of modification requests to the HWFP, we have also evaluated the effect that changes would have on existing requirements of the NRC, the EPA, and DOE (in the CH WAC). This is because the HWFP is usually the most prescriptive in specifying how the requirement will be met. The prescriptiveness of the HWFP increases the assurance that the requirements of the other regulatory agencies will be satisfactorily met.

1.3.2 EEG Philosophy on Waste Characterization Requirements

Much of EEG's overall philosophy on waste characterization requirements can be found in various statements and reports. These are summarized below.

(1) We believe overall waste characterization requirements are excessive. However, any proposed relaxation needs to be evaluated in sufficient detail to convince regulatory agencies, the EEG, and stakeholders that the modification is justified.

(2) Implicit in statement (1) is the belief that any changes need to be made in a transparent, step-by-step approach and through the existing regulatory procedures of NMED, EPA, and NRC. This approach requires adequate justification and has worked effectively to get approval for a number of changes from all three regulators.

(3) Our conclusions on individual waste characterization requirements are based on health and safety, and environmental considerations. The EEG does not speak for the regulatory agencies in offering opinions of legal and regulatory requirements. EEG's current positions on specific waste characterization issues are also subject to change if justified by new evaluations.

(4) Since EEG has concluded that the radiological risk is about 10,000 times that of the hazardous waste risk, we concentrate on those waste characterization requirements that affect the transuranic waste during our health and safety evaluations.

(5) It is important to recognize that a number of the requirements in the Hazardous Waste Facility Permit (HWFP) have a role in ensuring that radiological, transportation, and operational requirements are met.

(6) The relaxation of audit and Quality Assurance and Quality Control (QA/QC) requirements is not an appropriate way to reduce the regulatory burden.

(7) Another factor which EEG has never stated explicitly is our recognition that considerable uncertainty exists in the characteristics of wastes that may come to WIPP in the future. For this reason, our evaluations of waste characterization requirements attempt to also address the potential future characterization needs for presently uncharacterized waste streams.

(8) Claims have been made in the past (see Section 2.1) that removal of unnecessary waste characterization requirements can result in increased shipping rates to WIPP. EEG considers whether a requirement is necessary for health, safety, and environmental reasons and does not factor schedule implications into our conclusions.

Two other issues often discussed by the DOE when proposing reductions in waste characterization requirements are minimizing the risk and exposure to workers performing waste characterization and costs.

EEG has no reason to believe that radiation doses to waste characterization workers are significant and, in the absence of data indicating otherwise, should not be a justification for eliminating or reducing a waste characterization requirement (see Section 3.3).

Costs of waste characterization are significant and it would be desirable to continue to reduce or eliminate those requirements where it is prudent. However, significant non-waste characterization costs were also incorporated into the initial design and operation of the WIPP project; a prudent procedure for a first of a kind deep geologic repository. Few of the waste characterization requirements can be evaluated exclusively by a traditional cost/benefit

comparison. A rigorous evaluation via the regulatory process is the best way to decide on acceptable changes to any waste characterization requirements.

2.0 WASTE CHARACTERIZATION REQUIREMENTS CHANGE PROCESSES

Since the original receipt of waste at the WIPP in March of 1999, the DOE has successfully completed changes to waste characterization requirements specified by each of the different regulatory agencies. The process for creating these changes is significantly different for each of these regulatory agencies, as discussed in the following sections.

2.1 NMED: HWFP Waste Characterization Requirements Change Process

The non-radiological hazardous waste characterization requirements fall under the jurisdiction of the New Mexico Environment Department and are principally (and most completely) specified in Attachment B, including B-1 through B-6 of the HWFP, collectively known as the Waste Analysis Plan (WAP) (currently NMED 2003). Changes to the WAP are therefore subject to the same process as those for the entire HWFP. The New Mexico Administrative Code (20 NMAC 4.1) simply references the EPA-established requirements contained in the Code of Federal Regulations (CFR) for these changes. Either the regulatory agency (under 40 CFR 270.41) or the permittees (under 40 CFR 270.42) can initiate modifications of a permit. The regulatory agency's ability to modify a permit is much more limited than that of the permittee, the implication being that it is incumbent on the regulator to ensure that the initial permit is sufficient.

There are three classes of permit modification requests. The "Classification of Permit Modification" table (Appendix I to 40 CFR 270.42) identifies the process to be used for each class. For those modifications that do not match table entries, the permittees can request that the regulatory agencies make the designation, but the regulation also specifies the criteria under which the regulatory agencies are allowed to do so.

Class 1 modifications are to be used for minor upgrades. Examples include updating the administrative information in the permit (names, titles, etc.), replacement of equipment with functionally equivalent components, or correction of typographical errors. These modifications

keep the permit current with routine changes to the facility or its operation. These changes do not substantially alter the permit conditions (40 CFR 270.42(d)(i)). The Class 1 change process is very simple. The permittee can implement the modification immediately, with notification of the change provided to the regulator within seven days. Other organizations and individuals on the facility mailing list are to be notified within 90 days of the modification. One disadvantage of a Class 1 modification is that there is no requirement that the regulator formally accept the modification. Moreover, the regulator can reject a Class 1 modification at any time for cause. One way to avoid a belated Class 1 modification rejection is to use the Class 2 process.

Class 2 modifications enable a permittee to respond to common variations in the types and quantities of wastes managed, technological advances, and non-trivial changes associated with new regulations. The process to implement these requires a formal submittal of a PMR to the regulator and a subsequent 60-day public comment period. The public comment period must include a permittee-organized public meeting. Within 90 days of the initial submission the regulator must either: (1) approve the modification request (with or without changes), (2) deny the request, or (3) determine that the modification must follow the Class 3 process. Two other options are available. The modification can be temporarily approved for up to 180 days, or the regulator can simply notify the permittee that the decision will be forthcoming in the next 30 days (only one such extension is allowed).

The Class 3 process may be required to accommodate significant public concern or a complex change. Like the Class 2 process, the Class 3 process requires the 60-day public comment period and public meeting. After that the Class 3 can be considerably more complicated and lengthy. The decision making process allows the regulator to request additional information and file formal notices of deficiency on the application. Even after this portion of the process, it may be necessary to create a draft permit including the proposed modification, conduct a more formal public hearing by an independent hearing officer, reopen the public comment period, and produce a hearing officer's report. This would all need to be completed before the regulator makes a decision on the modification.

Class 1 modifications to the HWFP under these processes have usually been successful. However, Class 1 modifications related to waste characterization have suffered a relatively high rate of rejection, usually ascribed to misclassification under 40 CFR 270.42. All changes to the waste sampling and analysis methods should be designated as Class 2 (Appendix I to 40 CFR 270.42). These would be waste characterization changes that are not related to conformation with EPA guidance or regulations, multi-source leachates, or changes associated with underlying hazardous constituents in ignitable or corrosive wastes sampling. Thus, most common waste characterization changes would be Class 2 changes.

The EEG has commented on every Class 2 and Class 3 PMR during the public comment period. For the past two years, any Class 2 comments submitted by the EEG have been submitted to both the NMED and the DOE several days prior to the comment period deadline, so that the DOE could address the concern or respond to the comments in other ways during that same public comment period. EEG comments on PMRs may be viewed at http://www.eeg.org.

The bulk of Class 2 and Class 3 PMRs have been related to waste characterization. The EEG published an analysis of experience with the PMRs that were extant after 18 months experience, noting several areas of concern about the DOE's submissions and suggesting a possible solution (Walker and Silva 2002). Table 2-1 lists all of the HWFP modifications submitted by the DOE so far, and their current status. Despite the complexity of the process for HWFP changes, the DOE has obtained some relief in a timely manner using the modification process. According to the DOE, a Class 2 PMR to allow compositing of headspace gases greatly aided the completion of the Idaho National Engineering and Environmental Laboratory (INEEL) 3100 m^3 Project. Also, a Class 2 PMR allowing reduction in headspace gas measurements for thermally treated wastes saved over $30 million at the Rocky Flats Environmental Technology Site (RFETS). Finally, a Class 2 PMR reducing the number of drums requiring visual examination saved $19 million (DOE 2002c). From the time of application through the time of approval, these changes were each achieved in four months or less.

Table 2-1. WIPP HWFP Class 2 and 3 Modification Proposals

Proposal Date	Mod Class	Item #	Proposed Modification	Disposition	Action Date
03/30/00	2	1	Alter accuracy acceptance criteria for cresols and pyridines	Accepted	08/08/00
		2	Use hgas statistical sampling of homogeneous containers when AK does not indicate hazardous VOCs	Accepted	08/08/00
		3	Use hgas statistical sampling of containers when waste was thermally treated	Accepted	08/08/00
04/20/00	2	1	Add allowance for 3 sub-samples to be taken from solidified container cores	Accepted	08/08/00
		2	Change miscertification rate to SCG from waste stream	Accepted	08/08/00
		3	Use gross alpha/beta measurements for groundwater sampling	Accepted	08/08/00
07/21/00	2	1	Perform waste characterization at the WIPP	Withdrawn	09/29/00
		2	Combine data package reviews; eliminate off-site audits for SQS	Withdrawn	09/29/00
12/07/00	2	1	Change headspace has drum age criteria (DAC-1)	Rejected	03/26/01
01/22/01	2	1	Perform visual examination by tomography (DR/CT)	Withdrawn	03/23/01
03/06/01	2	1	Move inspection forms from the HWFP to the operating record	Accepted w/minor changes	07/06/01
		2	Change the frequency of firefighter I training	Accepted	07/06/01
		3	Eliminate portions of RCT training	Accepted	07/06/01
		4	Add new hazardous waste numbers to HWFP	Accepted all but U-134 (HF)	07/06/01
		5	Extend time for groundwater monitoring reports	Accepted	07/06/01
04/27/01	2	1	Allow additional storage space for TDOPs	Rejected	08/30/01
04/27/01	(2) 3	1	Change headspace gas drum age criteria (Revised; DAC-2)	Accepted w/modifications	12/31/02
06/06/01	3	1	Allow Central Characterization Facility (CCF) at the WIPP	Withdrawn	01/14/03
		2	Add storage capacity for the CCF	Withdrawn	01/14/03
		3	Increase allowed storage time at the WIPP to one year	Withdrawn	01/14/03
		4	Allow prohibited items to be received at the WIPP	Withdrawn	01/14/03
08/28/01	2	1	Allow compositing of headspace gas samples for analysis	Accepted	11/27/01
		2	Alter random sampling for visual examination to allow for site safety considerations	Rejected	11/27/01
		3	Allow hgas samples to be taken through existing filter openings	Accepted, but limited to POCs	11/27/01
06/27/02	2	1	Revised addition of HF hazardous waste number (U-134)	Accepted w/minor changes	11/25/02
		2	Elimination of control charting for repackaged solidified wastes	Accepted w/minor changes	11/25/02
		3	Record keeping and auditing of classified information	Accepted	11/25/02
		4	Add HalfPACT to shipping containers	Accepted	11/25/02
		5	Use of radiography instead of VE for newly generated wastes	Accepted w/minor changes	11/25/02
06/27/02	2	1	Add direct loaded 85-gal and 100-gal drums, and TDOPs	Accepted w/modification	11/25/02
06/27/02	(2)3	1	Data Management Update	Moved to Class 3 (in progress)	
06/28/02	3	1	Add RH-TRU	In process	
10/07/02	3	1	Change panel closures from Option D to WPC design	Proposed as Class 2, accepted as 3 (in progress)	

Table 2-1. WIPP HWFP Class 2 and 3 Modification Proposals (Continued)

Proposal Date	Mod Class	Item #	Proposed Modification	Disposition	Action Date
05/14/03	2	1	DAC for 85-gallon & 100 gallon drums, and TDOPs	Rejected (needs more data)	09/11/03
		2	Removal of booster fans in the underground	Accepted	09/11/03
		3	Eliminate LANL sealed sources waste streams hgas sampling and analysis	Rejected (suggested resubmittal with statistical sampling)	09/11/03
		4	Remove formaldehyde as a required analytical parameter for LANL	Accepted	09/11/03
		5	Add New HWNs (cyanides, DMS, Acetonitrile, 1,4Dioxane, hexaclorobutadiene)	Accepted	09/11/03
05/14/03	3	1	Add new hazardous waste disposal units (panels 4-8)	NMED review period	
05/21/03	2	1	Eliminate PCB prohibition from HWFP	Accepted	09/11/03

"AK" = acceptable knowledge
"DAC" = drum age criteria
"DR/CT" = digital radiography/computerized tomography
"HF" = hydrofluoric acid
"HWN" = hazardous waste number
"hgas" = headspace gas
"homogeneous containers" = containers of solidified or soil/gravel wastes
"POC" = pipe overpack container
"RCT" = radiation control technician
"RH-TRU" = remote-handled transuranic waste
"RTR" = real time radiography
"SCG" = summary category group (debris wastes, solidified wastes, and soil/gravel are the 3 SCGs)
"SQS" = small quantity sites
"TDOP" = ten-drum overpack containers
"U-134" = hazardous waste code, hydrofluoric acid, Chemical Abstract Number 7664-39-3
"VE" = visual examination
"VOC" = volatile organic compound
"WPC" = WIPP panel closure

2.2 EPA: 40 CFR 194 Waste Characterization Requirements Change Process

The most restrictive requirements for radionuclide waste characterization derive from the EPA decision (1998) to certify the WIPP to receive waste as required by the WIPP LWA. 40 CFR 194 contains the criteria the EPA established for the WIPP to be certified. 40 CFR 194.24 requires the DOE to have a system of controls to measure and track the waste components that affect the long-term performance of the repository. These components were identified as ten radionuclides (four plutonium isotopes, three uranium isotopes, americium-241, strontium-90, and cesium-137), cellulosic materials (cellulose, plastic, and rubber), free water, and as two

separate categories, ferrous and non-ferrous metals (DOE 1996; EPA 1998). The amount of the ferrous metal component is easily satisfied by counting waste drums. But the other components required waste characterization methods to measure them. The ten radionuclides are identified and their activity measured principally by NDA techniques. The other components are identified and measured by either radiography (x-ray imaging of container contents) or visual examination (VE) techniques.

Changes to the methods for identifying and measuring these components are relatively informal, except for severe changes to the requirements. The EPA established a rule-making process in 40 CFR 194.65, but has retained a fairly wide latitude in determining whether a change requires a rule-making. For changes that the EPA determines do not require rule-making, the process is informal. The DOE simply negotiates with the EPA on proposed changes, then submits the proposed change to the EPA for evaluation. The EPA sends a letter to the DOE announcing their approval of the elements of the change.

Since late 1999 the 40 CFR 194 radioassay waste characterization requirements have been placed in Appendix A of the CH WAC (currently DOE 2002b). The informal, non-rule system has been used to successfully modify the NDA requirements several times. While there is no formal comment process, the EEG has been notified by either the DOE or the EPA during the latter phase of these negotiations and has submitted technical comments for consideration. Thus far, the EEG has had no objections to the informal process used for modifying waste characterization requirements.

The DOE has initiated several informal changes to the 40 CFR 194 mandated requirements which have been approved by the EPA. These include changes to the NDA Performance Demonstration Program and two non-waste characterization items (a reduction in the requirements for backfill in the repository, and a change to the repository horizon). A more formal change to the implementation of 40 CFR 194, to allow both the EPA and the DOE additional flexibility in several areas, is currently in the final stages.

2.3 NRC: Transportation Waste Characterization Requirements Change Process

Transportation waste characterization requirements are established in the documentation supporting the NRC Certificate of Compliance (C of C) for the transportation package, as required by 10 CFR 71. Changes to any waste characterization requirements in this documentation are initiated by submitting the changed documentation to the NRC; 10 CFR 71.13(c) and 10 CFR 71.31(b) provide criteria by which the NRC evaluates these or any other proposed changes, and revised C of Cs are used to express the NRC's acceptance of these proposals.

The two criteria by which the changes are evaluated are not complex, even though the evaluation itself may be very complex. 10 CFR 71.13(c) states that modifications are not to significantly impact the design, operating characteristics, or fissile material package with respect to criticality, in relation to the stringent testing requirements of the shipping package. 10 CFR 71.31(b) simply requires that modification of the authorized contents of the packaging provide sufficient information to demonstrate that the package will remain in conformance with the package standards in effect at the time the modification is requested.

WIPP CH TRU waste is transported in the Transuranic Package Transporter-II (TRUPACT-II), for which the C of C's principal supporting documentation concerning waste characterization is the *TRUPACT-II Authorized Methods for Payload Control* (TRAMPAC) (DOE 2003a), currently issued as a separate document, but still a part of the *TRUPACT-II Contact Handled Transuranic Waste Shipping Package Safety Analysis Report* (SARP) (DOE 2003b). The SARP specifies the waste characterization methods that will be used to meet the criteria established or referenced in the C of C is in Revision 16 (NRC 2003); while all of these revisions were not necessarily concerned with waste characterization requirements, most of the recent ones (C of C revisions 13 through 16) have adjusted waste characterization criteria.

2.4 DOE: CH WAC Characterization Requirements Change Process

The CH WAC (currently DOE 2002a) contains statements of waste characterization requirements that originate from operational activities at the WIPP. These requirements are

derived from the *Waste Isolation Pilot Plant Contact-Handled (CH) Safety Analysis Report* (CH SAR) (DOE 2003c), and are listed in the Technical Safety Requirements (TSR) attachment 1 (DOE 2003d) to the CH SAR. 10 CFR 830 requires nuclear facilities to establish and maintain a documented safety analysis. The published CH SAR has been updated annually since 1992 and any modifications to waste characterization requirements take place as a part of the ongoing review of this document. EEG is responsible for the review of the CH SAR on behalf of the State of New Mexico. The process for modification is simply to include the changes in the annual CH SAR, a process not necessarily simple in itself. Initiation of the change, review, comment resolution, and signature release are all necessary. These changes are then reflected in the next revision of the CH WAC, except for Appendix A which must be approved by EPA. For example, this process was used in 1999 to change the maximum radiotoxicity limit for 55-gallon drums (from 1000 PE-Ci to 1100 PE-Ci; see Chapter 7 for a discussion of PE-Ci).

The CH WAC also lists the DOE's interpretation of the regulatory criteria for the HWFP, NRC, and EPA. In the past the WAC contained not only the waste acceptance criteria—that is, the data that waste characterization would need to supply, but also a discussion of the source of each criterion from each regulatory organization. In promulgating the immediate predecessor of the current CH WAC, the information presented was changed so that it only reflected the most restrictive criteria in each area. The WAC no longer cites either the source for that most restrictive criterion or the various regulatory sources that place restrictions on that area. Moreover, the CH WAC no longer contains a discussion of the technical justification for each criteria as it once did in the earlier versions. EEG has gone on record urging DOE to restore that discussion into the document (EEG 2002a).

3.0 RISK PERSPECTIVES

When designing and operating a nuclear waste repository, it is necessary to evaluate the risks associated with the wastes being disposed and to use this information to minimize operational and long-term risks to workers, the public, and the environment. Waste characterization should be sufficient to provide the information necessary to ensure that the "mixed" (radiological and hazardous wastes) wastes being shipped and emplaced, meet these operational and long-term safety requirements.

3.1 EEG Evaluations and Statements

The EEG published EEG-72, *A Comparison of the Risks from the Hazardous Waste and Radioactive Waste Portions of the WIPP Inventory*, (Channell and Neill 1999). The six major conclusions from this study were:

1. Risks are low in all cases. Lifetime carcinogenic risks are expected to be about 1×10^{-3} for workers and about 1×10^{-8} for members of the public.

2. The expected radiological carcinogenic risks to workers from routine operations and from operational accidents were at least four orders of magnitude greater than the carcinogenic risk from the hazardous waste constituents. Under maximum conditions, the radiological risks are more than two orders of magnitude greater than the hazardous waste risks.

3. During routine operations, a member of the public residing at the WIPP Site Boundary would receive a very low carcinogenic risk (less than 10^{-8} lifetime) from Volatile Organic Compounds (VOCs) and no radiological risk. The radiological risk to a member of the public from average operational accidents is over five orders of magnitude greater than the hazardous waste risk.

4. Radionuclide annual risks to a resident farmer from average releases to the surface following human intrusion 1000 years after WIPP closure are one order of magnitude greater than total risks from VOCs. These long-term risks are two orders of magnitude lower than risks during the operational period and are less likely to occur.

5. Non-carcinogenic risks from VOCs during operation are less than 2% of the Hazard Index and are not important relative to the carcinogenic risks.

6. The evaluations confirmed the intuitive assumption that radiological risk from WIPP wastes are much greater than the risks from hazardous wastes.

In May 2000 EEG published EEG-75, *Evaluation of Risks and Waste Characterization Requirements for the Transuranic Waste Emplaced in WIPP during 1999*, (Channell and Walker 2000). The waste emplaced during the first year of WIPP operation was non-mixed (did not meet the regulatory definition of hazardous wastes although low concentrations of VOC's were present in headspace gas samples) and with low radionuclide concentrations. The EEG found that risks from VOCs were extremely low (lifetime cancer fatality risks of 10^{-11} to 10^{-14}).

The EEG-72 and EEG-75 conclusions have several implications for waste characterization requirements and priorities. These conclusions have been pointed out by EEG subsequent to July 1999. While many of these comments are quoted elsewhere in this report, the more relevant EEG statements have been:

1. We see no scientific reason why it is necessary to analyze for hazardous metals in waste solids (see discussion in Section 4.7).

2. VOC releases will occur routinely and have a quantifiable, albeit low, risk. Thus, there is a logical reason to quantify VOC releases.

3. In EEG-75, EEG concluded that the Confirmatory VOC Monitoring Plan in the WIPP underground would detect concentrations that are three orders of magnitude below allowable Permit limits.

4. EEG stated in an April 2001 paper at the 9th International High-Level Radioactive Waste Management Conference (Neill and Silva 2001):

> The cost of complying with non-radioactive hazards (Resource Conservation and Recovery Act [RCRA] regulations) may be much more than complying with the radiological hazards, which are about 10,000 times greater. Predicting releases over 100 years for the non-radiological constituents should not be the primary cost in comparison to limiting radiological releases over 10,000 years.

5. In an October 4, 2001 statement to the National Academy of Science/National Research Council Committee on the Characterization of Remote-Handled Transuranic Wastes we said, "… The fact that radiological risks are much greater than hazardous risks needs to be kept in mind by DOE, regulatory agencies, peer review groups, this Committee and oversight agencies when addressing possible changes to waste characterization requirements." (EEG 2001).

3.2 Risk-Based Approach to Characterization

The DOE has proposed at various times since 2000 that a "risk-based" or "performance based" system should be used to determine waste characterization requirements (Moody 2002). These two terms have not been precisely defined by DOE, but presumably refer to only those waste characterization requirements believed to serve a useful purpose in controlling risks.

The NRC has attempted to include the use of probabilistic risk assessment in a Risk-Informed and Performance-Based (RIPB) system since 1995. RIPB analyses are to be used along with traditional deterministic approaches in setting priorities for regulations. The NRC and others

believe this process will encourage more transparent regulatory approaches and focus on requirements that lead to actual reduction in risk. This is apparently the general intent of the DOE thrust in reduction of CH TRU waste characterization requirements.

EEG believes that an RIPB assessment should be included in developing CH TRU waste characterization requirements. A requirement that does not have a health or safety basis should be reevaluated. These considerations have been the general philosophy in EEG's recommendations to date, which have usually been limited to health and safety issues. However, this concept is more easily stated than implemented because the risk being addressed is often not quantifiable. The evaluation of individual CH TRU waste characterization requirements should consider two questions: (1) are the data collected used for any purpose (for example, elimination of waste containers for shipment to WIPP; or controlling quantitative limits for transportation, operations, or long-term performance), and (2) is the particular test being used or it's frequency (for example, 100%) the most cost-effective approach.

3.3 Hazards to Waste Characterization Workers

References have been made to the extra radiation doses incurred by workers performing "unnecessary" waste characterization activities (NAS/NRC 2001, p 33). The DOE was asked to address questions relating personnel radiation exposure (dose) to various characterization activities at the generator sites. The DOE acknowledged that it does not have, "information relative to dose from TRU waste characterization activities… Dosimetry groups at the various DOE sites differentiate dose by individual rather than by tasks." At best, the DOE was only able to address the questions with a qualitative answer and the promise to provide the information if and when it became available (DOE 2002d, p 23).

The EEG has not received any data that the DOE may have on actual doses received by workers characterizing CH TRU wastes. The EEG's present belief is that these doses are very low and cannot be used as a justification for reducing waste characterization requirements. Another reason for this preliminary conclusion is that (even though it is not waste characterization) the external collective radiation doses received by waste handlers and radiation control technicians

handling and emplacing drums at WIPP are so low (0.06 mrem per container from 3/99 through 12/31/02).

This conclusion is consistent with the DOE response in which the DOE noted that the risk for radiological exposure is very low for NDA, RTR, and HSG sampling and analysis during normal operations. VE is considered to be a moderate risk. As noted by DOE, the impact of VE/repackaging is controlled by ALARA (as low as reasonably achievable) principles, which normally result in very low exposures to workers. Personal protective equipment and procedures are used to prevent inhalation of airborne contamination. DOE does caution that repackaging campaigns for special cases such as ^{238}Pu and high-wattage ^{239}Pu require extra measures to avoid significant doses (DOE 2002d, p 4-7).

4.0 HWFP WASTE CHARACTERIZATION REQUIREMENTS AND EEG COMMENTS

The DOE/CBFO requested that the DOE National Energy Technology Laboratory's Center for Acquisition and Business Excellence (NETL-CABE) prepare an analysis on the cost of waste characterization (NETL/CABE 2003) that estimates the CH TRU waste characterization costs per container. Table 4-3 from this study, *Average Cost of Characterization Activities*, is reproduced here as Table 4-1. Table 4-1 is being used in the report for two reasons: (1) it gives a relative idea of the costs for each "characterization activity" (which are significant), and (2) the "characterization activity" breakdown is a convenient one to use in addressing our waste characterization conclusions and recommendations. A review of the cost study is outside the scope of this report and EEG uses the cost figures as provided, without offering an opinion of their accuracy.

Table 4-2 is an EEG-developed table that shows how the overlap of the waste characterization requirements analyzed in Table 4-1 is used to meet the requirements. The table shows which of these methods are required or used by each agency. A "required" characterization method ***must*** be used either 100% of the time or part of the time to meet the indicated requirement. The term "used" is for a waste characterization method that, in some cases, ***may*** be used to meet a requirement, but the method is not specifically mandated. For example, the HWFP requires HSG sampling and analysis, whereas, to satisfy the TRAMPAC limits on flammability, HSG sampling and analysis is not specifically required but may be, and has been used. The associated average cost of characterization per container from the DOE cost study is also included. The EEG notes that some of the categories are not regulatory requirements. For example, the "Segregation/Rework" must be performed in some cases even though it is not required by any regulatory agency. These categories have been included to retain consistency with the DOE cost study.

It is clear from these tables that nearly all of these requirements and a major part of waste characterization costs can be attributed to meeting the requirements of the HWFP. The following sections describe these requirements.

Table 4-1 Average Cost of Characterization Activities.

Characterization Activity	Percentage of Containers Requiring Activity	Average Unit Cost to Characterize	Average Cost of Characterization per Container
Non-Destructive Assay	100%	$840	$840
Headspace Gas Sampling	100%	$620	$620
Real-Time Radiography	32.8%	$730	$240
Visual Examination/ Retrievably Stored	1.2%	$22,500	$270
Visual Examination/ Newly Generated	67.2%	$540	$360
Solids Coring and Sampling	0.5%	$24,000	$120
Solids Analysis	0.5%	$63,000	$310
Acceptable Knowledge	100%	$87	$87
Drum Venting	1.8%	$120	$2
Level II Management	100%	$160	$160
Gas Generation	9%	$670	$60
Drum Age Criterion	68.7%	$46	$32
Segregation/Rework	30%	$1,400	$420
Waste Certification	100%	$330	$330
Characterization Support Activities	8%	$648	$52
Average Cost of Characterization per Container			**$3,900**

Source: NETL/CABE 2003

Table 4.2. Overlap of Regulatory Agencies and DOE Waste Characterization Requirements and Associated Cost Per Container.

	NMED		EPA		NRC		DOE		
Characterization Requirement	Used by HWFP	Req. by HWFP	Used by §194.24	Req. by §194.24	Used by TRU-PACT-II	Req. by TRU-PACT-II	Used by WIPP CH WAC	Req. by WIPP CH WAC	Average Cost of Characterization per Container [b]
Non-Destructive Assay	No	No	Yes[a]	Yes	Yes	Yes	Yes	No	$840
Headspace Gas Sampling	Yes	Yes	Yes	No	Yes	No	No	No	$620
Real-Time Radiography	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	$240
Visual Examination/ Retrievably Stored	Yes	Yes	Yes	No	Yes	No	No	No	$270
Visual Examination/ Newly Generated	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	$360
Solids Coring and Sampling	Yes	Yes	No	No	No	No	No	No	$120
Solids Analysis	Yes	Yes	No	No	No	No	No	No	$310
Acceptable Knowledge	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	$87
Drum Venting	Yes	Yes	No	No	Yes	Yes	Yes	Yes	$2
Level II Management	Yes	Yes	No	No	No	No	No	No	$160
Gas Generation	No	No	No	No	Yes	Yes	No	No	$60
Drum Age Criteria	Yes	Yes	No	No	Yes	Yes	No	No	$32
Segregation/ Rework	No	No	No	No	No	No	No	No	$420
Waste Certification	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	$330
Characterization Support Activities	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	$52
							TOTAL		**$3,900**

[a] In the required (req) column, "yes" means the method ***must*** be performed 100% of the time or part of the time. In the used column, "yes" means the method ***may*** be performed to meet a requirement, but the specific method is not mandated by that requirement.

[b] The cost of activity spread over all the containers shipped to WIPP.

4.1 HWFP: Acceptable Knowledge (AK) Requirements

AK is the principal waste characterization requirement for all of the regulatory agencies. As shown in Table 4-1, the DOE cost study indicates AK to be one of the least costly of the waste characterization techniques at $87/container. However, the AK package is developed on a waste stream basis rather than on individual containers.

Several slightly differing definitions of the term are in use on the WIPP project; the HWFP states:

> Acceptable knowledge includes a number of techniques used to characterize transuranic (TRU) mixed waste, such as process knowledge, records of analysis acquired prior to RCRA, and other supplemental sampling and analysis data (EPA 1994). (NMED 2003, Attachment B4-1).

Process knowledge" is the knowledge of the waste based on the materials and processes used to generate the waste, and "EPA 1994" is an EPA guidance document on waste characterization for facilities that treat, store, or dispose of hazardous wastes (the WIPP is a storage and disposal facility). Thus, acceptable knowledge is effectively the compilation of all useful knowledge about the waste. Container analyses by other waste characterization methods become a part of the AK for the waste stream, as does any other information related to the waste that is discovered. The HWFP requires AK to be organized in a report on each waste stream, from general facility information (areas and facilities) to specific information for the waste stream (description of the generating process to include buildings, process flow diagrams, material inputs, types and quantities generated, and storage locations). An overall AK summary report is generated after records are found, documents are indexed, and applicable waste and facility information has been organized.

The EEG has not commented specifically on the need for AK as a waste characterization requirement. There has never, to the EEG's knowledge, been any question of the need for an AK-like data accumulation. The HWFP's AK requirements are the most prescriptive of any of

the regulatory agencies. At this time the EEG supports the continued use of the HWFP AK requirements.

4.2 HWFP: Headspace Gas Sampling and Analysis Requirements

The AK requirements section of the HWFP also states:

> Radiography and/or visual examination, headspace gas sampling and analysis, and homogeneous waste sampling and analysis ...are used to acquire supplemental sampling and analysis data to meet the requirements of the Waste Analysis Plan (WAP) specified in Permit Attachment B. (NMED 2003, Attachment B4-1).

More often, the HWFP addresses these techniques as "confirmation of AK"; the EEG views these techniques more as a process for discovering deviations from the currently known AK.

At $620/container, headspace gas sampling and analysis is one of the more expensive costs-per-container waste characterization techniques listed in Table 4-1. According to DOE:

> Headspace gas is measured both to meet transportation requirements and to meet NMED requirements. Several methods are used to collect a sample of gas from inside the top of the container. One method involves drawing a sample of gas through the existing filter by inserting a needle through the filter core. The punctured filter is then removed and a new filter installed. A second method involves using a self-tapping replacement filter that first taps a hole in the waste container. Next the samples are drawn through the self-tapping filter assembly. A third method uses a self-tapping sampling port through which a sample is drawn, and then the port is sealed.
>
> Headspace gas sampling is done in a structure that prevents radioactive particulate from the waste container from escaping into the atmosphere. Precautions are taken around the puncture area to prevent releases of radioactive particulate to the

> atmosphere and to prevent drawing outside air into the container during sampling (DOE 2002d, p 5).

Analysis is targeted to determine the presence and concentrations of about 30 different hazardous chemicals within each headspace gas sample, and the HWFP also requires analysts to look for, and identify, other chemicals in the sample from each container. If these other chemicals are on the hazardous waste list, and appear in 25% or more of the individual containers analyzed in each waste stream, then they are added to the target list for that waste stream also. The analysis is performed according to procedures modified from the EPA's *Test Methods for Evaluating Solid Wastes* (EPA 1996) and *Determination of Volatile Organic Compounds (VOCs) in Ambient Air Using Specially Prepared Canisters With Subsequent Analysis by Gas Chromatography* (EPA 1999). Included in the HWFP requirements are the many sample control methods for quality assurance and quality control. Those also contribute to the cost of headspace gas sampling and analysis.

The EEG has commented on HWFP headspace gas requirements, stating to the NAS/NRC WIPP CH Waste Characterization Committee in 2002 that though headspace gas sampling and analysis helps meet the 40 CFR 264.13(a)(1) requirement for a detailed chemical analysis of a representative sample of the waste, "...we do not see why 100% headspace gas sampling at the sites should be necessary to ensure compliance with Room Based Concentration Limits" (EEG 2002c). The HWFP establishes concentration limits for VOCs in the underground rooms, primarily as a protection for underground and above ground workers and members of the public. The headspace gas analysis results are one of two checks to ensure that these concentrations are not exceeded; the other check is by sampling of the air from these underground rooms (confirmatory VOC monitoring). The EEG went on to state the following:

> The Code of Federal Regulations requirement for a detailed chemical analysis of a representative sample of waste is addressed only by headspace gas analysis for most of the debris waste. These analyses do provide additional information on the contents of waste containers. Additional waste streams have been defined because of the results of these analyses, and on occasion additional RCRA

> hazardous waste numbers have been added to waste streams. The importance of these functions has occasionally been denigrated, primarily because this additional information is not used to control quantities of VOCs coming to WIPP other than to show compliance with the room based concentration limits (EEG 2002c).

In more recent comments to the same NAS/NRC committee, the EEG again noted that room-based concentration limits can be met by confirmatory VOC monitoring at the WIPP, that "A comprehensive HSG [headspace gas] sampling program is also the most direct means of ensuring compliance with the flammable gas concentration limits for transportation that are included in the TRAMPAC", and that:

> HSG sampling is the primary way DOE has chosen to meet the "detailed chemical analysis...of a representative sample of the waste" that is specified in the New Mexico Administrative Code. This information is used (in conjunction with acceptable knowledge) to assign hazardous waste numbers to each container. However, EEG is not aware that these hazardous waste numbers are used to exclude waste from the WIPP or to otherwise control the hazardous waste. These data probably provide the incidental benefit of confirming AK and ensuring the various Waste Acceptance Criteria (WAC) requirements for stability of waste are met.
>
> EEG believes that it is desirable to maintain a comprehensive HSG program for WIPP CH-TRU wastes. However, it should be possible to require less than 100% sampling in some cases. This determination needs to be made on small batches or waste streams where there is reason to believe that relative uniformity exists. Also, the detailed approach necessary to ensure that representative data is still obtained needs to be justified by a proposed modification request (PMR) to the HWFP in the same manner that existing PMRs are justified (EEG 2003b).

One of EEG's concerns about the complete elimination of HSG sampling is that knowledge of the waste may be much less certain on retrievably stored waste which has not yet been characterized.

As noted above, the quality control and quality assurance (QA/QC) requirements for headspace gas sampling and analysis processes would appear to contribute to the DOE's estimated cost for headspace gas activity. The EEG has stated several times a variant of the following:

> The relaxation of audit requirements and QA/QC is not an appropriate way to reduce the waste characterization burden. These requirements should maintain the current level of stringency. The appropriate way to reduce the waste characterization burden is to eliminate unnecessary requirements, not to reduce the degree of compliance. (EEG 2002c).

Other EEG comments have noted that headspace gas analysis is often used to ensure that flammable gas limits for transportation are met, and the HWFP itself notes that headspace gas is useful for determining potential flammability.

As noted in Section 2.1, the DOE has successfully pursued modifications related to headspace gas requirements in the HWFP that the DOE believes will result in savings of tens of millions of dollars. It should also be noted that the DOE has itself endorsed continuation of some headspace gas analysis (DOE 2002d, p 17-18).

Reduction in the HSG requirement should be possible if the DOE submits detailed PMRs on specific waste streams.

4.3 HWFP: Drum Age Criteria (DAC) Requirements

The DAC is the time after the closing of a container necessary to ensure that VOC and flammable gas concentrations in the headspace of the container have achieved at least 90% of equilibrium concentration. The times vary widely, currently from four days to 283 days,

depending on the waste type, packaging configuration, and the container filters. The DOE cost study (NETL/CABE 2003) considered the DAC as a separate requirement with a cost of $32/container, but the DAC is solely for purposes of establishing the representativeness of the headspace gas in a container, and is really a part of the sampling process for headspace gases. The DAC is also used as a part of the TRUPACT-II requirements when flammable gases are to be actually measured.

The DOE eventually succeeded in obtaining changes to the initial DAC values in the HWFP, but three modifications were submitted before this success was obtained. In a paper (Walker and Silva 2002) presented at the conference Waste Management '02 conference midway through these attempts, the EEG used the DAC modifications as the principal example to point out four observed difficulties in the DOE's approach to the permit change process. Three of these difficulties delayed the DAC permit modification request.

First, the modification was not properly classified. The DOE submitted the revised DAC as a Class 1. This was immediately rejected by the NMED. Second, when submitted as a Class 2 proposal, the DOE did not provide sufficient data and information. Third, the DOE failed to meet the expectations of the regulator. In rejecting the first PMR, the NMED cautioned DOE to submit the request as a Class 3. Nonetheless, DOE submitted the request as a Class 2. NMED was forced into the process for changing the request to Class 3. The action by DOE contributed to further delay.

The DAC modification was an important change to the HWFP and TRAMPAC. It decreased the storage times on many waste containers by several months. The modification process for the eventual Class 3 request to the HWFP also underscored the value of public involvement as specified in the process. The EEG requested that the DOE provide the input and output files for the DAC computer model. These were later provided to the EEG by the DOE at the insistence of the NMED. The public review process identified six discrepancies between the output files and the DAC tables that until then had not been identified.

4.4 HWFP: Real-Time Radiography (RTR) Requirements

All WIPP waste containers are required by the HWFP to undergo either radiography or VE. RTR is a non-destructive examination technique that utilizes x-ray technology to create images of the interior of waste containers. The "real-time" component is important. It allows the radiography technician to increase and decrease the energy of the x-rays so as to create images of different density materials within the container. Thus, lower energy x-rays can produce an image of loose plastic material in the containers, and adjustments can also be made to observe the interior of metal cans or bottles or other denser material that may be in the container.

With some training, an operator can distinguish between different kinds of metals (lead, steel, aluminum, by their different densities), determine the number of layers of plastic packaging around waste, and detect any free liquid in bottles or cans that are in the waste. Thus, radiography can be used to create a record of the physical contents of the container. The HWFP requires that operators of radiography equipment be trained both formally and by on-the-job techniques. The operator must successfully demonstrate an ability to identify a specific list of objects in the waste prior to performing official scans. Operators must then be further trained to the waste streams they are reviewing, an audio-visual recording of the examination of each container must be made. A similarly-trained independent reviewer must confirm the information in the records created by the operator. Once each day, or once each testing batch, (20 or fewer containers) a replicate analysis must be performed by an independent operator. Operators are required to determine the Waste Matrix Code for the waste, estimate material parameter weights, and look for prohibited items in the waste.

It is worth noting that the 40 CFR 194.24 waste characterization requirements to quantify non-ferrous metals and cellulosic materials are met primarily through radiography. These are some of the material parameters that the HWFP requires radiography operators to estimate. In the absence of HWFP requirements, a comparable program would either be needed to address the 40 CFR 194.24 waste characterization criteria or alternate methods (visual examination) would be necessary.

As with AK, few substantive concerns have been raised about radiography requirements and the EEG's comments on radiography have been brief. In 1999, as part of a broader statement, an EEG comment was that:

> EEG agrees with the generic policy that data that is not going to be used should not be collected. This includes data for all requirements, not just VE. However, it is necessary to do thorough evaluations to show that RTR and/or VE are not providing useful data in a waste stream. At the recent SRS audit, 15% of the first batch of drums was rejected by RTR. (EEG 1999).

Radiography was introduced in lieu of visual examination of waste, so that the DOE's HWFP application expected that only visual examination would be used for newly generated waste. The HWFP initially followed this track, but at least one waste characterization program found radiography to be so useful, the DOE submitted a PMR to allow radiography as well as VE to be used for newly generated waste. The PMR was quickly approved, and either method may now be used for newly generated wastes.

The overall radiography program is an important part of the WIPP waste characterization program and should be retained. It may be possible to reduce some of the detailed procedural requirements in the HWFP.

4.5 HWFP: Visual Examination for Retrievably Stored Waste Requirements

VE may be used as an alternative to RTR for retrievably stored wastes, but this alternative may not have been used yet. However, because RTR is merely an imaging technique, a radiography operator cannot, for instance, read the label on a bottle, or estimate a weight by lifting the object. The HWFP also requires that a statistically determined sample of radiographed containers undergo confirmatory VE. The size of the statistical sample is based on the number of mis-certifications found from the previous year at that site, from each of the three summary category groups (debris, solidified wastes, and soil/gravel wastes). Thus far, less than 2% of retrievably

stored containers undergo VE. Nonetheless, the process is an expensive component of the waste characterization program. The DOE estimates the cost to be $22,500 per container examined, or $270 per container over the entire population sent to the WIPP.

The HWFP requirements for VE include those for RTR (determine Waste Matrix Code, measurement, rather than estimation, of material parameter weights), but also requires that "all discernable waste items" are to be identified, as well as residual and packaging materials. A VE expert is required to be present. This individual's discretion determines whether bags or cans inside the container must also be opened (weights of the contents are to be estimated if it is not opened). The packaging configuration, type and number of filters, and other information necessary for determining the DAC are also to be recorded. Audio-visual recordings of the process are to be made, and operators (as well as the much more thoroughly trained VE expert) must undergo formal and on-the-job training.

The EEG has stated that:

> Claims are often made that VE is dangerous because of additional radiation exposures and possibility of contamination. EEG has discussed this issue with persons doing VE at INEEL, RFETS, and LANL and found they don't feel VE is dangerous and do not have data on incremental radiation exposures. More specific data and evaluations are needed if danger is to be used as an argument against VE. Also, plans to use 100% VE for newly generated wastes appear to be inconsistent with expressed safety concerns. (EEG 1999, p 8).

The DOE has been successful in modifying the HWFP on retrievably stored VE, producing great cost savings, as noted in Section 2.1.

4.6 HWFP: Visual Examination/Newly Generated Requirements

For newly generated wastes, the original HWFP (based on the DOE's application) specified only VE as a method for determining the required detailed physical analysis of a representative

sample of the waste. The process actually specified in the HWFP has the advantage of allowing verification at the time the container is being filled and is somewhat different from retrievably stored VE, and has often been referred to as "visual verification" (V-squared) to distinguish it from the retrievably stored process. No audio/video recording is required, but two visual examination operators are required to observe the loading of waste into containers and record the data. The same data is to be recorded as for retrievably stored VE.

The EEG has not commented specifically on the visual verification process, except when commenting on the PMR to allow radiography as well as visual verification. In those comments the EEG noted that visual verification is a much higher quality process than radiography, and that the requirement for two trained visual examination operators to perform the visual process:

> ...may be overkill; the HWFP could be modified to require generator site procedures be developed and implemented that would require, for each waste container, that a data form be used to document the contents of the container, and then require a single verification of the information on the data form (EEG 2002b).

As noted previously, the PMR submitted by the DOE was successfully integrated into the HWFP.

4.7 HWFP: Solids Coring and Sampling, and Solids Analysis (Homogeneous) Requirements

The DOE's waste characterization cost analysis in Table 4-1 shows solids (solidified wastes and soil/gravel) coring and sampling costs separate from the chemical analysis of these solids. For the 0.5% of drums that will be cored, sampled and analyzed, the estimated cost per drum is $24,000 for coring and sampling and $63,000 for analysis. When spread over all containers shipped to WIPP, for sampling, the cost per drum shipped is estimated at $120; for the analysis, the cost is $310. The overall estimate of $430 per container shipped is among the highest waste characterization method costs.

"Coring" is a process wherein a container of solids is opened, and a hollow drill bit is inserted near the bottom of the container. The core is taken from the bit and "sampled" by removing either one or three thin sections from along its length. These sections become the sample.

For retrievably stored wastes, the HWFP states that homogeneous sampling and analysis is used to determine the toxicity "characteristic" in the waste; that is, the hazardous compounds that are considered toxic only if present above the threshold concentrations listed in 40 CFR 261.24, or if the "listed" wastes under Subpart D of 40 CFR 261 are present. Sampling of these waste streams is statistical, rather than each of the containers; five randomly selected containers must be sampled initially, then chemically analyzed. The average concentration and standard deviation of each hazardous compound is then computed and used, along with the threshold concentrations (or program required quantification limit, if it is a "listed" waste in Subpart D) to calculate the total number of containers from the waste stream that must be sampled. For most (perhaps all) of the homogeneous waste streams analyzed so far, the initial five samples suffice.

The HWFP requires analysis of homogeneous samples for total VOCs, semivolatile organic compounds (SVOCs), and analysis for metals. Tables in the HWFP list over 30 chemicals for the VOC analysis, 11 for the SVOC analysis, and 14 metals that are the primary targets, but other hazardous constituents may be added to the list for a waste stream if they are found in more than 25% of the samples from that waste stream. A test for Polychlorinated Biphenyls (PCBs) is also currently required, but a PMR is currently in process to eliminate those requirements now that the DOE has obtained an approval from the EPA under the Toxic Substances Control Act (TSCA) to dispose of PCB-contaminated wastes at the WIPP. A full panoply of QA/QC requirements are also established for homogenous sample analysis, and radiation protection activities associated with opening of containers and processing the samples also contribute to the homogeneous sampling and analysis program.

The EEG has commented several times on homogeneous waste sampling and analysis, eventually concluding that these requirements are not needed. In 1999, comments on two DOE documents, in a section entitled, "Homogeneous Waste Sampling and Analysis", the EEG first

stated that metals analysis was not needed, and deferred an opinion on the homogeneous VOC and SVOC requirements:

> For the following reasons, EEG sees no scientific reason why it is necessary to analyze for metals at all:
>
> $ DOE apparently did not feel that metals concentration data were important enough to include in the RCRA application. The State apparently concurred since they did not request that the data be include[d].
>
> $ The required hazardous metals data are not to be used for any regulatory control under the Draft Permit.
>
> $ Evaluations in EEG-72 concluded that human exposures to hazardous metals at WIPP would only occur from the types of operational and human intrusion accidents that released radioactive materials. The calculated radionuclide risks (Excess Cancer Fatalities) were $2x10^6$ times the hazardous metals release for operational accidents and $5x10^5$ times for long term releases. Furthermore, methods used to clean up radionuclide contamination would also be effective in cleaning up hazardous materials.
>
> $ EEG has no opinion at this time on sampling for VOCs and SVOCs in homogeneous wastes. The decision should be based on whether any useful information will be obtained for VOC control under the RCRA permit... (EEG 1999).

In 2002, in comments for the NAS/NRC CH waste characterization committee, the EEG added the homogeneous VOC and SVOC analyses to metals:

> The HWFP requires a fraction of homogeneous waste containers to be analyzed for toxic metals, other hazardous chemicals, volatile VOCs [sic], and semi-volatile VOCs [sic] (SVOCs). The EEG has stated that we see no technical reason why it is necessary to analyze for metals and chemicals at all. Our reasons are...[Followed by the information in the first three bullets of the previous quote] (EEG 2002c, p 8).

Currently, the EEG continues to believe that the homogeneous sampling and analysis are unnecessary characterization requirements in the HWFP.

The DOE has successfully pursued changes to the HWFP on homogeneous sampling and analysis issues, the major change being to add to the statistical quality control method initially required for newly generated homogenous wastes so that the retrievably stored process could also be used. Quality control requirements for SVOC specific analytes (pyridines and cresols) were changed in another PMR, and one of the first HWFP PMRs successfully altered the requirement for core sampling to allow one sample to be taken from the core rather than the three samples from each core that was previously required.

4.8 HWFP: Level II Management (Project Level) and Waste Certification Requirements

This is the first time EEG has commented on these Level II and Waste Certification Requirements. "Level II Management" requirements are estimated to cost $160 per container by the DOE. "Level II Management" requirements are apparently those activities addressed in the HWFP as "Project Level" requirements. These are solely HWFP requirements, though they appear to be closely intertwined to the "Waste Certification" requirements (at $330 per container) also shown in Table 4-1. Further, the quality assurance provided by these checks supports non-HWFP requirements as well. The two activities, Level II Management and Waste Certification, from Table 4-1 will be covered as a single topic in this section. It should be noted that the 40 CFR 194 waste certification process does not specify these activities, but a

comparable program would likely need to be developed specifically for the 40 CFR 194 required program were it not specified in the HWFP.

Project level activities are principally performed on data packages developed at the "data generation level" (radiography or visual examination test batch data reports, headspace gas and homogeneous waste sampling batch data reports, and headspace gas and homogeneous analytical data reports). These data packages are compilations of the data specified to be collected during the activity (including quality control information such as independent technical review forms, supervisor review forms, quality assurance review forms, reports on non-conforming items or processes during the activity, chain-of-custody forms, evidence of sample preservation, quality control sample results, etc.). Although radioactive materials are not a part of the HWFP function, data packages for the radioactive component waste characterization are also developed and processed based on the requirements specified in the HWFP.

At the project level, the Site Project QA Officer (SPQAO) is then required to review and sign all batch data reports supplied from the data generation level for completeness. This includes verification that quality control checks were properly performed, and that the quality assurance objectives specified in the HWFP were properly met. The Site Project Manager (SPM) also must sign off on the package; the SPM must ensure that the DAC is valid, that the necessary generation level reviews were performed and ensure that the checklists are complete, and that the data meet the required quality assurance objectives. Both the SPQAO and the SPM must prepare summary reports that include validation checklists, discussion of any nonconformances within the data package, signatures of the individuals. When a new waste stream is proposed, the Site Project Office must determine that sufficient information is available in the preliminary data packages to establish the waste stream. Site project offices are responsible for preparing the Waste Stream Profile Forms (WSPF) that officially document the new waste stream, and a characterization information summary from the preliminary data packages that is required along with the WSPF.

Other project level activities include performing the statistical calculations for random sampling. The site project offices also calculate the confidence levels from analyses, and document that

these are within the quality assurance objectives established in the HWFP. The site project office also is responsible for putting waste characterization and transportation information into the WIPP Waste Information System (WWIS), and negotiating with the WIPP site reviewers of this information.

The EEG has not commented on the project level HWFP requirements, but the data package review and approval process may be one of the areas to which the general EEG comment that, "We believe waste characterization requirements are excessive" applies. We suspect that many of these requirements were provided from a legal perspective, rather than a technical one, and therefore may be useful on that level. However, from a technical perspective, the data package review-and-approval process invoked by the HWFP appears excessive.

The DOE submitted a Class 2 PMR which would have virtually eliminated project level waste characterization activities, among other changes. This modification was later withdrawn by the DOE.

4.9 HWFP: Characterization Support Requirements

The HWFP requires the DOE to conduct an audit and surveillance program to ensure that waste characterization sites conduct waste characterization activities in accordance with the HWFP Waste Analysis Plan, and that the information supplied by each site is managed properly (records management). The HWFP also requires specific training for all areas discussed above. The 40 CFR 194 criteria also require these activities, as does the DOE itself.

The EEG has commented several times on the WIPP audit and surveillance program over the years. These comments have generally been supportive of the program and we have observed it to be a very good QA program. The basic EEG comment has been that waste characterization requirements may be changed, but not the auditing/surveillance program. For example, in a comment to the NAS/NRC committee, the EEG stated:

> Quality assurance requirements in the CBFO Quality Assurance Program Document (QAPD) are applied to waste characterization activities; while

> the EPA has mandated those in use for those processes related to 40 CFR 191/194, the HWFP only requires that the quality assurance practices in the CBFO QAPD be followed, and there may be a way of altering the requirements for non-radioactive waste characterization. However, for a variety of reasons, the EEG believes that a change in the QA requirements would not substantially decrease waste characterization requirements and would likely result in less assurance that the program was in compliance. (EEG 2003a).

Requirements for training are included in the CBFO QAPD, so that this EEG comment would appear to cover training, also. The EEG has not commented on TRUPACT-II loading, equipment and facilities, waste storage, or records maintenance in terms of their importance to the WIPP project.

5.0 40 CFR 194 (EPA) REQUIREMENTS

Title 40 CFR 194.24(c) requires the DOE to specify limiting values for waste components that are to be emplaced at WIPP. The primary analyses are quantification of radionuclides. However, there are three non-radiological waste materials that need to be quantified.

(1) free water (other regulatory agencies use the term free liquids or residual liquids)
(2) ferrous and non-ferrous metals
(3) cellulose, plastic, and rubber (CPR)

These materials are currently quantified principally by use of radiography and visual examination methods, except for the ferrous metal requirement. Chapter 4 provides the discussion of radiography and visual examination waste characterization methods. Both the radiological and non-radiological quantification is to include measurement error statistics (EPA 1998).

Under 40 CFR 194 criteria, radionuclide quantification requirements can be met by either destructive (radiochemical analysis) methods or NDA methods. Nearly all (if not all) radionuclide quantities reported to date have been by NDA. The DOE estimated that the average cost per container for NDA measurements was $840, thus making NDA the single most expensive waste characterization method (see Table 4-1).

5.1 EPA's Non-Radiological Waste Criteria

5.1.1 EPA: Free Water Requirements

EPA's Compliance Certification Decision (EPA 1998) limits the total amount of free water in the repository to 1685m^3, which is equivalent to an average of 1% of the volume of a waste container. This limitation is required because of the assumptions DOE used for waste room modeling in the Compliance Certification Application (DOE 1996). This requirement could be satisfied by a repository (or waste panel) average rather than on each waste container. However,

transportation, HWFP, and WIPP Operations and Safety requirements all limit free water to 1% on each container.

EEG believes the free water limit of 1% on each container should not be changed since it is required for the transportation, HWFP, and WIPP criteria, and is probably the most cost-effective way to ensure the EPA's requirement is met.

5.1.2 EPA: Metals Requirements

The EPA has a minimum requirement for the quantity of ferrous metals in the repository, to maintain a reducing chemical environment in the repository in order to minimize radionuclide mobility. Waste drums and other containers provide more than the minimum ferrous metals requirement. The method of compliance is to simply count the containers in the repository and multiply the number of containers by the amount of iron in each container. The DOE has stated that enough containers have already been placed in the repository to meet the ferrous metal requirement.

EEG has stated that this requirement should be tracked at a waste panel (rather than entire repository) level. However, we have also said "there may be an argument for eliminating further tracking of this parameter" (EEG 2002c). This is really a non-problem and will continue to be unless there are future changes that allow non-ferrous waste containers to be emplaced.

Non-ferrous metals are included in the EPA's requirements because it was argued that these materials will reduce or eliminate the possibility that the radioactive components would attach to organic ligands (EPA 1998). The non-ferrous metals will attach to the binding sites on these ligands (EPA 1998). The amount of non-ferrous metals in each waste container is estimated by radiography or measured (weighed) during visual examination; a discussion of these methods can be found in Chapter 4.

5.1.3 EPA: Cellulose, Plastic and Rubber (CPR) Requirements

The presence of cellulose, plastic, and rubber could cause generation of gas in sealed repository rooms which could affect the release of radionuclides from the repository. Because of this

potential, the EPA has set a maximum repository limit on the kilograms of CPR. At present the mass of CPR is estimated or measured in each container during either radiography or visual examination.

This quantification continues to be necessary because the limit is important to assumptions used in the performance assessment for the repository. However, it does not seem to be difficult to stay below the limit. EEG has stated, "…, quantification on a waste stream (rather than individual container) basis should be acceptable if properly estimated." (EEG 2002c).

5.2 EPA's Radiological Waste Characterization Requirements

The principal EPA radiological waste characterization requirements are for the purpose of tracking the quantities of ten radionuclides emplaced in the repository to ensure that the radiological limits established for the repository are met. This continuously updated radionuclide inventory is also important for evaluation of long-term compliance during the performance assessments required at each five-year recertification. Radionuclide quantification is required on each waste container.

There are additional radiological waste characterization requirements for transportation and for the WIPP repository. These requirements will be discussed in Chapters 6 and 7. However, it is important to recognize that these transportation and WIPP requirements also require determination of some individual radionuclides which would have to be obtained even in the absence of EPA requirements.

Appendix A of the CH WAC of the Waste Isolation Pilot Plan (DOE 2002a) specifies the Radioassay Requirements for CH TRU in considerable detail. The EEG commented on the Draft Appendix A during its development (EEG 2002a).

5.2.1 EPA: The Ten Required Radionuclides

The ten required radionuclides are ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu, ^{241}Am, ^{233}U, ^{234}U, ^{238}U, ^{90}Sr and ^{137}Cs. Some of the radionuclides are more important for long-term compliance. The most

significant are ^{238}Pu, ^{239}Pu, ^{240}Pu, and ^{241}Am. Since their half-lives and specific activities vary considerably, each of the four present a different hazard and their activities should be separately determined. The other tracked radionuclides (^{233}U, ^{234}U, ^{238}U, ^{242}Pu, ^{137}Cs, and ^{90}Sr) have less effect on repository performance but could affect certain scenarios either because of the possibility of "early" human intrusions (that is, within hundreds of years of closure) or non-random emplacement of waste in the repository.

There are other reasons for tracking several of these radionuclides. Uranium-233 must be determined because of the NRC FGE requirement. Uranium-235 is not one of the ten EPA tracked radionuclides, but it is required to be tracked by the NRC FGE requirements. Also, if minor radionuclides in an assay are recognized, there is more assurance that the major contributors are correctly identified.

One important radionuclide not included in the 10 required radionuclides is ^{241}Pu. It is the primary contributor to total WIPP activity (60% of the activity emplaced to date) and it decays with a 14.4 year half-life to ^{241}Am, which is an important radionuclide. The sites are reporting ^{241}Pu now, although not required to do so, and this reporting should continue.

The EEG believes that all ten of the radionuclides should be tracked and reported. Also, ^{241}Pu tracking should be required.

5.2.2 EPA: Other Non-Destructive Assay Issues

EEG has provided opinions on two issues concerning NDA requirements. These are: (1) the EPA requirement that determination of isotopic ratios be on each waste container (rather than on a waste stream); and (2) use of non-WIPP certified instruments to perform waste characterization.

EEG believes justification for less than 100% quantification and determination of isotopic ratios may be possible for some, but certainly not all, waste streams (EEG 2002c).

The DOE has proposed to use non-WIPP certified assay systems used for Safeguards measurements for NDA analysis of WIPP waste. EPA has rejected this DOE proposal. EEG currently agrees with the EPA position. We do not believe that quality control of NDA measurements should be relaxed. Also, it has not been shown that radionuclides other than ^{239}Pu and ^{240}Pu can be reliably determined with these instruments. The EEG has stated:

> EEG believes that quantification of radionuclides and confirmation of isotopic ratios should continue to be obtained as they are now, i.e., by using WIPP-certified NDA systems. These determinations, unlike some other required waste characteristics that cannot be directly measured, can be obtained directly by measurement. Any additional efforts to produce more accurate AK in order to reduce the NDA burden will inevitably result in less accurate radionuclide values (EEG 2002a).

6.0 NRC (TRUPACT-II) TRANSPORTATION REQUIREMENTS

The NRC has extensive payload requirements for shipment of wastes in the TRUPACT-II package. These requirements include:

(1) container and physical properties
(2) nuclear properties
(3) chemical properties
(4) gas generation
(5) payload assembly
(6) quality assurance.

These requirements are specified in detail in the TRUPACT-II TRAMPAC (DOE 2003a). Compliance is through generator or storage site programmatic or waste-specific TRAMPACs. The DOE Carlsbad Field Office (CBFO) is responsible for approving these site-specific TRAMPACs and verifying compliance. The NRC does not become directly involved with this characterization process.

Payload requirements 1 through 4 above include waste characterization requirements. These waste characterization requirements are similar to those required in either the HWFP or in EPA's NDA requirements and are incorporated in these two waste characterization programs.

6.1 TRUPACT-II Container Properties

Most container properties involve weights and listing of acceptable containers. However, there are three container properties that are obtained from waste characterization requirements of the HWFP. These are:

(1) Filter vents are required in each waste container.

(2) Residual liquids shall not be more than 1% of the volume in any payload container. This is verified by RTR, VE, or AK.

(3) Sealed containers greater than four liters (nominal) are prohibited unless in waste material Type II.2 packaged in a metal container. Compliance is determined by RTR, VE, or AK.

6.2 TRUPACT-II Nuclear Properties Characterization

6.2.1 Nuclear Criticality

In order to ensure that nuclear criticality will not occur during shipments it is necessary to limit the FGE in individual waste containers. Requirements in Appendix A of the CH WAC are currently used to satisfy all NRC radioassay requirements even though this is not mandated by the TRAMPAC. This requires quantification of all fissile radionuclides. Although a number of transuranic radionuclides can be fissionable, the most important ones at WIPP are ^{239}Pu, ^{235}U, and ^{233}U. Therefore, it is necessary to determine the quantity of these three radionuclides through the NDA process discussed in Chapter 5. As mentioned in Chapter 5, ^{235}U quantification is not required by the EPA. In many cases the FGE value will be well below allowable container and TRUPACT-II limits and this requirement can be satisfied by AK.

6.2.2. Radiation Dose Rates

External radiation dose rates are limited to 200 millirem per hour at the surface of waste containers. This is a mandatory measurement, but is not a waste characterization requirement.

6.2.3 Decay Heat Limits

Ionization caused by radioactive decay can generate hydrogen gas which must be controlled in the TRUPACT-II. The decay heat value, which is a gas generation requirement, is used in determining the payload shipping category. Decay heat values are calculated from the

radioactivity of each radionuclide in the container. Therefore, it is necessary for the NDA to quantify all significant radionuclides in the waste. The EPA requirements for NDA provide adequate information to determine decay heat values.

6.3 TRUPACT-II Chemical Properties Characterization

Pyrophoric materials are limited to small residual amounts (< 1% by weight). Explosives, corrosives, and compressed gases are prohibited. Chemical composition is required to be known in order to determine gas generating properties. Chemical compatibility is also required by complying with, *A Method for Determining the Compatibility of Hazardous Waste*, (Hatayama and others 1980).

Compliance with the requirements is demonstrated via AK, VE, or RTR. These same criteria are also required under the HWFP, which as noted, requires more robust waste characterization methods (see Chapter 4).

6.4 Gas Generation Requirements

6.4.1 Payload Shipping Category

The payload shipping category determines the decay heat limit that is necessary to ensure that hydrogen gas concentrations will be no more than 5% by volume in the innermost bags within the waste container. In addition to the decay heat value determined from NDA, it is necessary to determine the waste type from the chemical properties and tables of allowed materials. Chemical properties are determined from AK, VE, or RTR. The number of layers of bags in a container, as well as the presence of a rigid liner is both necessary to determine the payload shipping category and these are confirmed by RTR or VE.

6.4.2 Flammable (Gases and VOCs) Concentration Limits

The TRAMPAC also limits the presence of methane and flammable VOCs as well as hydrogen, to ensure the absence of flammable mixtures in TRU waste payloads. The limit of flammable VOCs in the headspace of a waste container is ≤ 500 parts per million.

Procedures for showing compliance with the Gas Generation Requirements can become very complex. If the decay heat limit requirement is met and AK is adequate to verify that the ≤ 500 parts per million flammable VOC requirement can be met, the container falls into the Analytical Category and the requirement can be satisfied by analysis. Otherwise, containers fall into the Test Category.

Test Category containers may be able to show compliance either by measurement of the headspace of payload containers or by Full-Drum Testing. Headspace gas analysis, required in the HWFP, can be used to satisfy the flammable VOC limit requirement.

6.5 EEG Positions on NRC Requirements

The three waste characterization requirements in the Container Properties should be retained. Other changes in Container Properties (primarily specifying appropriate waste containers) would be acceptable if approved by the NRC's Revision Process.

There should not be any changes made in Nuclear Property requirements.

The basic gas generation requirements (hydrogen gas concentrations of < 5% by volume in the innermost bag and flammable VOC concentrations ≤ 500 ppm in the headspace of waste containers) should remain as described in the current version of the TRAMPAC (DOE 2003a). The procedures for showing compliance with the gas generation requirements were quite conservative in the original Certificate of Compliance in 1989. This was because of the lack of sufficient data or demonstration of alternative analytical procedures. There have been many changes in these procedures over the years and it is now possible to show compliance for many waste containers that would not have originally been shippable. EEG has considered this revision process and NRC's evaluations to be an acceptable process. We believe it is appropriate for DOE to continue to propose procedure modifications and that NRC should critically evaluate these before approval.

7.0 THE WIPP CH WAC AND WIPP OPERATIONAL WASTE REQUIREMENTS

7.1 History of the WIPP WAC and Waste Characterization

Waste characterization has been an important consideration for the WIPP since its earliest days. As early as 1976 the WIPP scientific advisor, Sandia National Laboratories, began, "...to gather the diverse input required to establish appropriate criteria," for waste characterization. These were later published in the1980 *Report of the Steering Committee on TRU Waste Acceptance Criteria for the Waste Isolation Pilot Plant*, which was the first of a series of documents referred to as the "WIPP WAC" (DOE 1980). This first WAC contained similar or identical criteria to many of the waste acceptance criteria in the most recent version (DOE 2002a), including elements that are now considered to be HWFP, 40 CFR 194, and TRAMPAC requirements. These include requirements for residual liquids, free water, and free liquids respectively (HWFP, 40 CFR 194, and TRAMPAC), pyrophoric, corrosive, and explosive materials (HWFP, TRAMPAC), compressed gases (HWFP, TRAMPAC), toxic materials (HWFP), waste certification requirements (HWFP, TRAMPAC), physical description of the waste (HWFP, TRAMPAC), combustibility (HWFP TRAMPAC), surface dose rates (TRAMPAC), thermal power (TRAMPAC), container requirements (TRAMPAC, HWFP), and hazardous materials (HWFP). These and other criteria were all included based on internal DOE Order and policy requirements current at that time.

Earlier versions of the WAC contained a discussion of the technical rationale for each criteria and justification to the criteria. The CH WAC no longer includes such rationale or justification. EEG has stated:

> EEG objects to the continued practice of deleting the history and technical justification of criteria when the CH-WAC is revised. Our concern is that a contractor or review group might propose to revise or delete a criteria because they were unaware of the technical basis and that CBFO would too quickly adopt those recommendations. Also, we

> have a concern that future revisions to the CH-WAC may not critically evaluate the need for revised or new requirements that would improve safety at WIPP. EEG, in its role of representing the State of New Mexico in review of the Safety Analysis Report (SAR), will keep this concern in mind during future WAC and SAR reviews (EEG 2002a).

In 1984 DOE Order 5820.2 changed the definition of transuranic from >10 nCi/g of long-lived alpha-emitting waste to >100 nCi/g. Revision 2 of the WAC (DOE 1985) included that definition, but it was not until Revision 3 (DOE 1989) that the definition became a WAC criterion. In 1992, the WIPP Land Withdrawal Act (LWA) included and extended this definition, making it federal law as well as a DOE requirement.

In 1989 the TRAMPAC added criteria and requirements (see previous Chapter), and the NRC became a second regulator of the WIPP waste characterization. To this time the WAC had been the single most important WIPP waste characterization document extant. With first the TRAMPAC, then the applications to the NMED and EPA, and finally the resultant 40 CFR 194 Certification by the EPA (1998) and promulgation of the HWFP (1999), the criteria in the WAC also became less authoritative. The WAC became more the DOE's working version of the criteria included in these other documents.

At the waste characterization level, other more specific requirement documents began at least as early as 1991, implementing the methods used to meet the criteria from these upper-tier documents. In 1979 the INEEL (then INEL) had set up a program to, "...confirm that drums shipped from Rocky Flats contained the assigned item description code (IDC), and to determine the possible hazardous constituents in the waste." (Haily1995). The waste characterization methods of visual examination and gas sampling were used. A 1983-1985 program at the INEL pioneered real-time radiography, headspace gas sampling, solids sampling and analysis, and radioassay (gamma only) in the first attempt to examine waste for compliance with the WAC (Clements and others 1985). Extensive visual examination was also performed. In 1985 neutron NDA—the basic component of current NDA systems–was used in still another INEL program (Hailey 1995).

By 1991 intermediate-level requirements documents were developed by the WIPP. These documents translated the WAC criteria into waste characterization methods and requirements for the transuranic waste generating and storage sites in the DOE complex. The 1995 *Transuranic Waste Characterization Quality Assurance Program Plan* (DOE 1995) included the TRAMPAC waste characterization requirements and also established the waste characterization requirements that the EPA accepted as a part of the 40 CFR 194 certification of the WIPP. This document also contained equivalent methods and requirements to those later promulgated in the WIPP HWFP in 1999 (Channell and Walker 2000).

7.2 Current DOE Waste Acceptance Criteria

The current WAC is for CH TRU waste only (a draft WAC for RH is a part of a DOE submittal currently under evaluation by the EPA for approval of RH TRU waste characterization). Most of the waste characterization criteria found in the CH WAC has been addressed in earlier chapters of this document in one form or another; the remaining area are primarily those self-required by the DOE. As is noted in Section 2.4 of this report, these are primarily from the WIPP site Safety Analysis Report (SAR) (currently DOE 2003c), and more specifically are collected in the Technical Safety Requirements (TSRs) (currently DOE 2003d) which is an attachment to the SAR.

Statements in the TSRs clearly indicate that the WIPP Waste Acceptance Criteria, which drive the waste characterization program, is very important for the safety, health, and environment of the WIPP. The quality and completeness of the waste characterization effort is critically important to WIPP operational activities and some of the requirements are only covered in the CH WAC. It is very important that operational health and safety requirements are constantly evaluated via the TSR portion of the CH TRU SAR and any necessary changes be incorporated in the CH WAC.

The SAR and TSR waste characterization criteria are developed by applying DOE Orders and other DOE internal regulatory documents to the WIPP site. The WIPP TSR criteria include many prohibited wastes that are also prohibited by other WIPP waste characterization

regulations, including the less-than-1% liquids prohibition described in Chapters 4, 5, and 6; the prohibition against pyrophoric materials; prohibition of explosive and compressed gases (Chapters 4 and 6); and the prohibition of RCRA characteristic wastes considered ignitable, corrosive , and reactive (Chapter 4). These criteria can be characterized in the waste by AK, chemical tests (headspace gas or homogeneous analysis) and radiography or visual examination.

The WIPP TSRs add one additional radiological requirement, limiting the plutonium-equivalent activity (PE-Ci) in the waste. The PE-Ci represents a normalization of the radiotoxicity of prominent radionuclides expected to be in the waste to equivalency with ^{239}Pu. To characterize this component of the waste the amounts of these prominent individual radionuclides are necessary. While PE-Ci can be calculated from AK information if the AK contains radioassay values for the radionuclides; these values are currently obtained from the EPA-required assay of each container.

The CH WAC still contains the >100 nCi/g of alpha-emitting transuranic isotopes with half-lives of 20 years criterion, which is also met through the NDA program established to meet the 40 CFR 194 radioassay requirements.

The CH WAC combines the TSR criteria for acceptable waste with those from the HWFP, the TRUPACT-II criteria in the TRAMPAC, and the 40 CFR 194 waste characterization criteria. The waste characterization methods discussed in Chapters 4-6 of this report are used to ensure that these criteria are met.

8. CONCLUSIONS

Waste characterization criteria, requirements/methods, and procedures for WIPP are specified in the DOE Waste Acceptance Criteria, the NRC Certificate for transportation, the EPA Certificate for disposal, and the NMED Hazardous Waste Facility Permit for disposal. EEG has provided a technical review of these measures over many years. Our reviews have considered the need for a requirement as well as whether a proposed change is justified.

The summary below presents EEG's current assessment of the key components of the waste characterization requirements for the more significant requirements/methods. Our views continue to evolve to reflect new information and analyses.

8.1 Overlap of Requirements

Between the four entities, there is considerable overlap in waste characterization requirements. The HWFP and Appendix A of the CH WAC are the more prescriptive for specifying compliance. When considering a requirement change to either of these documents, the effect of the change on all requirements, including those issued by other agencies, should be noted and evaluated for its potential impact across agencies.

8.2 The Change Processes

The DOE, NMED, EPA, and NRC each have different processes for changing the requirements and these vary considerably in the degree of formality and participation by outside organizations. All processes have proved to be workable and effective. The proposed modifications are implemented more effectively and expeditiously if they are considering smaller, less comprehensive changes. The EEG believes that in the future, proposed changes to the waste characterization requirements should continue to use the existing processes.

8.3 Risk Considerations

The radiological risk from routine operations, operational accidents, and long-term releases is orders of magnitude greater than the risk from hazardous waste. Therefore, a risk based approach to waste characterization should concentrate on those requirements that affect the radiological risk.

No data have been provided by the DOE to indicate that exposures to workers performing CH TRU waste characterization are large enough to be a significant reason for reducing waste characterization requirements.

8.4 Acceptable Knowledge Requirement

Acceptable Knowledge is a principal waste characterization technique for all the regulatory agencies. AK is necessary and should be retained. At this time the EEG supports the use of the HWFP AK requirements since they are the most prescriptive.

8.5 Headspace Gas Sampling and Analysis

DOE has indicated that HSG sampling and analysis is one of the most expensive waste characterization requirements and the HWFP requires this be conducted in 100% of all non-thermally treated waste containers. HSG sampling is the primary way DOE has chosen to meet the "detailed chemical analysis…" specified in the New Mexico Administrative Code. Data from HSG sampling is used to verify that VOC concentrations in waste storage rooms meet the Room Based Concentration limits in the HWFP. However, these limits can also be verified by data obtained from the Confirmatory VOC Monitoring Plan in the WIPP underground. Since HSG is required by the HWFP, it is a convenient (but not the only) way of assuring that flammable gas concentration limits in the TRAMPAC are met.

EEG believes it is desirable to maintain a comprehensive HSG program for WIPP CH TRU wastes. However, it should be possible to require less than 100% sampling in some cases. Our primary concerns are with organic sludges and older waste containers where information may be less reliable.

8.6 Drum Age Criteria Requirements

Drum Age Criteria is necessary to ensure that HSG sampling of waste containers will measure gas concentrations that are at least 90% of equilibrium. DAC values are required in both the HWFP and the TRAMPAC. The EEG supports this requirement.

8.7 Real Time Radiography

All WIPP waste containers are required to undergo either radiography or visual examination by the HWFP. Usually retrieved wastes undergo RTR and newly generated wastes are examined by visual examination. RTR has been a very effective means of verifying AK and discovering prohibited items in waste containers. It is also used to show compliance with several EPA and TRAMPAC requirements.

The overall radiography program is an important part of the WIPP waste characterization program and should be retained. It may be possible to reduce some of the detailed procedural requirements in the HWFP.

8.8 Visual Examination/Retrievably Stored Waste

A small fraction (currently less than 2%) of retrievably stored waste is required by the HWFP to undergo visual examination for confirmation of RTR. The VE process has the potential for slightly greater radiation exposure than the other waste characterization requirements, although the EEG has not been provided any data from the DOE to indicate that exposures are significant enough to justify reducing the requirement.

The DOE has been successful in modifying the HWFP on retrievably stored visual examination and this would be the preferred process for seeking further reductions.

8.9 Visual Examination/Newly Generated Waste

VE is the method DOE prefers for newly generated waste because it can be done at the time the waste container is being filled. The EEG has not objected to any part of this requirement except to state that the requirement for two trained VE operators to perform the visual process “may be overkill” and that a single verification should be adequate.

8.10 Solids Coring and Sampling and Solids Analysis

The EEG continues to believe that the homogeneous sampling and analysis are unnecessary waste characterization requirements in the HWFP. Our principal reason for this position is that the data are not used for any additional regulatory control (metals releases from accidents or long-term processes would be controlled by radionuclide control requirements and VOCs and SVOCs by HSG or the Confirmatory VOC Monitoring Plan).

8.11 Level II Management and Waste Certification HWFP Requirements

The DOE has listed these management and certification requirements as characterization activities in a recent cost analysis. EEG has not previously commented on these requirements. However, our current evaluation indicates that the required procedures are very detailed and somewhat redundant. This may be one of the areas to which the general EEG comment, "We believe waste characterization requirements are excessive," applies.

8.12 Characterization Support HWFP Requirements

EEG has been supportive of the WIPP audit and surveillance program and has observed it to be a very good QA program. The EEG does not believe the relaxation of audit requirements and QA/QC is an appropriate way to reduce the regulatory burden.

8.13 EPA Non-Radiological Requirements

EPA's free water, non-ferrous metal and cellulose, plastic and rubber requirements should remain and can continue to be determined as they are now, by the RTR/VE requirements of the HWFP. However, the required CPR data could be provided to EPA on a waste stream rather than individual container basis. The ferrous metal requirement can continue to be met by counting waste containers emplaced in the repository.

8.14 EPA Radiological Requirements

The EEG agrees with the radioassay requirements for contact-handled transuranic waste specified in Appendix A of the CH WAC and the current procedures for modifying the document.

Current requirements for reporting the 10 required radionuclides should remain. The EEG recommends that ^{241}Pu be added to the list of EPA tracked radionuclides. The current requirement that all radioassay should be performed by WIPP-certified assay systems should be maintained.

Justification for less than 100% quantification and determination of isotopic ratios may be possible for some, but certainly not all, waste streams.

8.15 NRC Container Properties

The TRAMPAC requirements for residual liquids, filter vents, and the sealed container prohibition should be retained. These are all verified by requirements in the HWFP.

8.16 NRC Nuclear Properties

All nuclear property requirements should be retained and the methodology in Appendix A of the CH WAC should be used.

8.17 NRC Gas Generation Requirements

Requirements for measuring the chemical, payload classification, and radionuclide concentrations necessary to ensure hydrogen gas concentration criteria are met must be retained. There have been many changes, via the revision process, which have allowed additional containers to be shipped without changing the hydrogen gas criteria and additional changes may be justifiable in the future.

The flammable gas concentration limit of ≤ 500 ppm should be retained as described in the current revision of the TRAMPAC. Alternate methods (with appropriate QA) will be necessary if future changes to the HWFP affects the use of HSG sampling as the method for meeting this criteria.

8.18 WIPP Waste Acceptance Criteria

The WAC has served a useful historic purpose in developing initial criteria that have been adopted by the three regulatory agencies. Currently it is a useful document for listing most of the characterization requirements. It would be more useful if the technical justification for each criteria or requirement were restored.

The unique role of the CH WAC in including any necessary operational safety and health requirements not included elsewhere is very important and must be constantly evaluated via the TSR portion of the CH TRU SAR, and any necessary changes incorporated into the CH WAC.

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APPENDIX A

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2. 1/30/02 letter, Silva to Triay (comments on Draft CH WAC, Revision 0)

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4. 1/13/03 EEG response to NAS/NRC WIPP Committee 12/6/02 questions

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APPENDIX B

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LIST OF EEG REPORTS

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