Department of Energy
Los Alamos Area Office
Albuquerque Operations Office
Los Alamos, New Mexico 87544

APR 08 1994

APR 13 1994

Mr. Joel Dougherty
Hazardous Waste Management Division
RCRA Enforcement Branch (ALONM)
Environmental Protection Agency, Region 6
1445 Ross Ave., Suite 1200
Dallas, TX 75202-2733

Dear Mr. Dougherty:

This letter notifies you of the completion of the Preliminary Design Summary Report (Title I design) for the Hazardous Waste Treatment Facility (HWTF) at Los Alamos National Laboratory (LANL)(see enclosed). The Department of Energy's (DOE) submittal of this notice letter is required to ensure compliance with milestone number HW-100 contained in the Federal Facilities Compliance Agreement (FFCA). This FFCA has just been signed addressing hazardous and radioactive mixed wastes pursuant to the Resource Conservation and Recovery Act (RCRA). The FFCA specified a due date for this milestone of 30 days after the effective date of the agreement (April 14, 1994); the notice letter is required to be transmitted to EPA within five business days of the milestone date.

LANL signed the Preliminary Design Summary Report (Title I design) for the HWTF on November 30, 1992, certifying completion of the Title I design effort. Since that time, work for the definitive design (Title II) for the HWTF has proceeded. Design information was completed to support submission of the RCRA Part B permit application for the HWTF to the New Mexico Environment Department on October 12, 1993, in fulfillment of FFCA milestone HW-300 (see notification letter for HW-300, submitted concurrently with this notice). The definitive design is scheduled to be completed by January 30, 1995. A notice of completion will be submitted to you at that time to fulfill FFCA milestone HW-200. Information regarding other HWTF milestones is contained in the FFCA Annual Report (milestone AR 100, submitted concurrently with this notice).

Supporting documentation will be retained in DOE and LANL files to support the FFCA, and will be made available to EPA and the State of New Mexico upon request. If you have any questions

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regarding this activity, please contact Jon Mack of my staff at (505) 665-5026.

Sincerely,

Joseph C. Vozella, Chief
Environment, Safety, and Health
Branch

LESH:7JM-113

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HW 100
NOTICE OF COMPLETION OF PRELIMINARY DESIGN SUMMARY REPORT FOR THE HAZARDOUS WASTE TREATMENT FACILITY

December 20, 1993

Submitted in partial fulfillment of the
requirements of the Federal Facility
Compliance Agreement addressing hazardous
and mixed waste under Resource
Conservation and Recovery Act

Los Alamos Area Office
U. S. Department of Energy
528 35th Street
Los Alamos, New Mexico 87544

Los Alamos National Laboratory
P.O. Box 1663
Los Alamos, New Mexico 87545

PREFACE

This notice of the completion of the Preliminary Design Summary Report for the Hazardous Waste Treatment Facility is being submitted to the United States Environmental Protection Agency (EPA) by the Department of Energy (DOE) and Los Alamos National Laboratory (LANL) in fulfillment of their commitment to EPA under the Federal Facility Compliance Agreement (FFCA) developed pursuant to the Land Disposal Restrictions (LDR) requirements of the Resource Conservation and Recovery Act (RCRA), as promulgated in 40 CFR Part 268. This notice is provided in compliance with Milestone HW 100 in Appendix B of the FFCA.

The following table discuss the LDR FFCA milestones that relate to HW 100 and the nature of that inter-relationship.

PRIMARY MILESTONE	RELATED MILESTONE	NATURE OF INTER-RELATIONSHIP
HW 100	HLL 200	Applicable information developed from the waste characterization plan will be incorporated into the definitive design (Title II) for the HWTF.
	ATS 100	The program management plan for the LLMW treatment skids will address the development of additional information from the waste characterization plan that likely will be applicable to the development of future treatment skids.
	HW 200	The definitive design (Title II) will incorporate the Preliminary Design Summary Report (Title I).
	HW 300	Information from the Title I report will be incorporated into the RCRA mixed waste permit application or subsequent modifications of the application.
	HW 400	Information from the Title I report will contribute to the development of the schedule for completion of subsequent milestones.
	HW 500	Information developed for the Title I report will be incorporated in the construction of the HWTF.
	HW 700	Information developed for the Title I report will be incorporated in the construction of the HWTF.

LIST OF ACRONYMS

ACIS	Automated Chemical Inventory Systems
AET	Applied Environmental Technologies
ALARA	As Low As Reasonably Achievable
ATLAS	Advanced Testing for Actinide Separations
BAT	Best Available Technology
BDAT	Best Demonstrated Available Technology
CAI	Controlled-Air Incinerator
CFC	Chlorinated Solvents
CFR	Code of Federal Regulations
CWDR	Chemical Waste Disposal Request
DOE	U.S. Department of Energy
DOE/AL	DOE Albuquerque Operations Office
DOT	Department of Transportation
DSSI	Diversified Scientific Services, Inc.
EPA	U.S. Environmental Protection Agency
ES&H	Environment, Safety, and Health
FERC	Federal Energy Regulatory Commission
FFCA	Federal Facility Compliance Agreement
FY	Fiscal Year
GSA	General Services Administration
HEPA	High Efficiency Particulate Air Filter
HSWA	Hazardous and Solid Waste Amendments
HWTF	Hazardous Waste Treatment Facility
IPC	Industrial Partnership Center
JCI	Johnson Control Incorporated
KOP	Knowledge of Process
LANL	Los Alamos National Laboratory
LAMPF	Los Alamos Meson Physics Facility
LAO	LANL Assessment Office
LDR	Land Disposal Restriction
LLMW	Low-Level Mixed Waste
LP	LANL Procedures
MSDS	Material Safety Data Sheet
NEPA	National Environmental Policy Act
NESHAPS	National Emissions Standards for Hazardous Air Pollutants
NFPA	National Fire Protection Association
NMED	New Mexico Environmental Department
NRC	Nuclear Regulatory Commission
OSHA	Occupational Safety and Health Administration
PPAC	Pollution Prevention Awareness Campaign
PRD	Program Required Document
PTS	Project Tracking System
PWA	Process Waste Assessments
QAP	Quality Assurance Plan
RCRA	Resource Conservation and Recovery Act
R&M	Redistribution and Marketing Center
R&D	Research and Development
RMMA	Radioactive Material Management Area
SOP	Standard Operating Procedure
SSP	Site Specific Plans
TA	Technical Area

LIST OF ACRONYMS
(Continued)

TCLP	Toxicity Characteristic Leaching Procedure
TRU	Transuranic
TSCA	Toxic Substance Control Act
TSDF	Treatment, Storage, or Disposal Facility
UBC	Uniform Building Code
UL	Underwriters Laboratories
ULISSES	Uranium Line for Special Separation Sciences
WAC	Waste Acceptance Criteria
WBS	Work Breakdown Structure
WIPP	Waste Isolation Pilot Plant
WMC	Waste Management Coordinator
WMPO	Waste Minimization Program Office
WPF	Waste Profile Form

HLL 200
LOW-LEVEL MIXED WASTE TREATMENT PRIORITIZATION PLAN

Final

Submitted in partial fulfillment of the requirements of the Federal Facility Compliance Agreement addressing hazardous and mixed waste under the Resource Conservation and Recovery Act

Los Alamos Area Office
U. S. Department of Energy (DOE)
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PREFACE

This Low-Level Mixed Waste (LLMW) Treatment Prioritization Plan (HLL 200) is being submitted to the United States Environmental Protection Agency (EPA) by the Department of Energy (DOE) and Los Alamos National Laboratory (LANL) in fulfillment of DOE's commitment to EPA under the Federal Facility Compliance Agreement (FFCA) developed pursuant to the Land Disposal Restrictions (LDR) requirements of the Resource Conservation and Recovery Act (RCRA), as promulgated in 40 CFR Part 268. This LLMW Treatment Prioritization Plan is provided as a deliverable in compliance with Milestone HLL 200 in Appendix B of the FFCA.

The FFCA Appendix B, Section II.D outlines the actions necessary to bring LANL into compliance with the LDR requirements. The information developed as part of the LLMW characterization project will be used in the LLMW treatment prioritization plan to schedule waste streams for treatment on site and to prioritize the development of treatment skids. The ongoing progress of the LLMW characterization and the prioritization of LLMW treatment will be reported in the Annual Reports (AR 100). Potential treatment options identified for the LLMW include the use of off-site treatment capacity, incineration in LANL's Controlled-Air Incinerator, and use of the treatment skids at the Hazardous Waste Treatment Facility (HWTF).

The purpose of the prioritization plan is to provide a formalized methodology that ranks waste streams based on the characteristics and volume of the waste. Risk will be determined based on the hazards associated with the long-term storage and the health and environmental impacts associated with loss of storage control. Treatment options will be selected or developed for the high risk wastes first.

The following table discusses the LDR FFCA milestones that relate to HLL 200 and the nature of each inter-relationship:

PRIMARY MILESTONE	SECONDARY MILESTONE	NATURE OF INTERRELATIONSHIP
HLL 200	OSS 200	The formal plan for prioritizing LLMW treatment will incorporate applicable off-site treatment/disposal facilities and will be used to develop action plans for off-site shipment of wastes.
	CAI 200	The formal plan for prioritizing LLMW treatment will be reviewed to support selection of wastes to be used for the RCRA trial burn.
	CAI 300	The formal plan for prioritizing LLMW treatment will be used to develop the schedule for incinerating wastes in the CAI work-off plan.
	ATS 100	The formal plan for prioritizing LLMW treatment will be used to further develop and refine LLMW treatment skids and to support the selection of new skids for development (reported in the Annual Report, AR 100).
	HW 200	Applicable information from the treatment prioritization plan will be incorporated into the definitive design (Title II) for the HWTF and treatment skids.
	HW 300	The LLMW treatment prioritization plan will be reviewed to obtain information applicable to the RCRA mixed waste permit application for the HWTF submitted to the New Mexico Environment Department (NMED).

PRIMARY MILESTONE	SECONDARY MILESTONE	NATURE OF INTERRELATIONSHIP
	HW 400	Applicable information and priorities developed from the treatment prioritization plan will be used to develop the schedule for operation of the HWTF.
	HW 500	Applicable information developed from the treatment prioritization plan, such as waste segregation information, will affect construction components of the HWTF.
	HW 600	Applicable information developed from the treatment prioritization plan will affect the LLMW work-off plan for the HWTF.
	HW 800	Applicable information and priorities developed from the treatment prioritization plan will affect the initiation of treatment operations at the HWTF.
	HW 900	Applicable information and priorities developed from the treatment prioritization plan will affect the type of treatment and schedule for the LLMW work-off plan for the HWTF.
	GAS 100	Gas cylinders which cannot be shipped to off-site treatment facilities will be evaluated for on-site treatment using the prioritization plan.
	HLL 100	Information developed from the waste characterization plan will be the basis for the development of the formal plan for prioritizing LLMW treatment.

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LIST OF ACRONYMS

ACIS	Automated Chemical Inventory Systems
AET	Applied Environmental Technologies
ALARA	As Low As Reasonably Achievable
ATLAS	Advanced Testing for Actinide Separations
BAT	Best Available Technology
BDAT	Best Demonstrated Available Technology
BEJ	Best Engineering Judgment
BIF	Boiler and Industrial Furnace
CAI	Controlled-Air Incinerator
CAMs	Continuous Air Monitors
CFC	Chlorinated Solvents
CFR	Code of Federal Regulations
CLS	Analytical Chemistry Group
CWM	Chemical Waste Management, Inc.
CWDR	Chemical Waste Disposal Request
DOE	U.S. Department of Energy
DOE/AL	DOE Albuquerque Operations Office
DOT	Department of Transportation
DSSI	Diversified Scientific Services, Inc.
EPA	U.S. Environmental Protection Agency
ERC	Earth Resources Corporation
ES&H	Environment, Safety, and Health
FERC	Federal Energy Regulatory Commission
FFCA	Federal Facility Compliance Agreement
FY	Fiscal Year
GCP	Gas Cylinder Project
GSA	General Services Administration
HEPA	High Efficiency Particulate Air Filter
HSWA	Hazardous and Solid Waste Amendments
HWFP	Hazardous Waste Facility Permit
HWTF	Hazardous Waste Treatment Facility
ICP	Inductively Coupled Plasma
IPC	Industrial Partnership Center
JCI	Johnson Control Incorporated
KOP	Knowledge of Process
LAMPF	Los Alamos Meson Physics Facility
LANL	Los Alamos National Laboratory
LAO	LANL Assessment Office
LDR	Land Disposal Restriction
LLMW	Low-Level Mixed Waste
LLW	Low-Level Radioactive Waste
LP	LANL Procedures
MSDS	Material Safety Data Sheet
MWRSF	Mixed Waste Receiving and Storage Facility
NEPA	National Environmental Policy Act
NESHAPS	National Emissions Standards for Hazardous Air Pollutants
NFPA	National Fire Protection Association
NMED	New Mexico Environmental Department
NPDES	National Pollutant Discharge Elimination System

LIST OF ACRONYMS
(Continued)

NRC	Nuclear Regulatory Commission
PPAC	Pollution Prevention Awareness Campaign
PRD	Program Required Document
PTS	Project Tracking System
PWA	Process Waste Assessments
QA	Quality Assurance
QAP	Quality Assurance Plan
RCRA	Resource Conservation and Recovery Act
R&D	Research and Development
R&M	Redistribution and Marketing Center
RES	Rollins Environmental Services
RMMA	Radioactive Material Management Area
RSWD	Radioactive Solid Waste Disposal Record
SOP	Standard Operating Procedure
SSP	Site Specific Plans
SWDA	Solid Waste Disposal Act
TA	Technical Area
TCLP	Toxicity Characteristic Leaching Procedure
TRU	Transuranic
TSCA	Toxic Substance Control Act
TSDF	Treatment, Storage, or Disposal Facility
UBC	Uniform Building Code
UL	Underwriters Laboratories
ULISSES	Uranium Line for Special Separation Sciences
WAC	Waste Acceptance Criteria
WBS	Work Breakdown Structure
WIPP	Waste Isolation Pilot Plant
WMC	Waste Management Coordinator
WMPO	Waste Minimization Program Office
WPF	Waste Profile Form

HLL 200
LOW-LEVEL MIXED WASTE TREATMENT PRIORITIZATION PLAN

1.0 INTRODUCTION

The Los Alamos National Laboratory (LANL) has produced many low-level mixed wastes (LLMWs) as a result of its research and development activities. Generally, the volume of individual waste streams is small but the number of wastes with different characteristics is large. Legacy LLMW (generated before May 1991) was not fully characterized for treatment before being placed in storage, and therefore has required additional characterization to meet Resource Conservation and Recovery Act (RCRA) requirements and to allow off-site treatment or the development of on-site treatment options. These ongoing characterization activities are being conducted in accordance with the *Low-Level Mixed Waste Characterization Plan* (FFCA milestone HLL 100).

During negotiation of the Federal Facility Compliance Agreement (FFCA), the U.S. Environmental Protection Agency (EPA) expressed concerns that some waste streams would have to be stored for extended periods of time as a result of the absence of appropriate on-site and off-site treatment facilities for the waste in question. For this reason, the EPA asked that a prioritization plan be developed under the FFCA to rank the long term storage risk of certain waste streams.

The ranking methodology will prioritize waste streams for treatment on site in the Controlled Air Incinerator (CAI), and for the development of skid mounted treatment units. The FFCA includes a commitment to start the design of two new skid mounted treatment units each year. A generic program plan for the treatment skid development was delivered to EPA in fulfillment of FFCA milestone ATS 100. The treatment skids will ultimately be operated in the Hazardous Waste Treatment Facility (HWTF) (FFCA milestones HW 100 - HW 900). It is not intended for the ranking methodology to be applied to wastes being shipped off site for treatment. Wastes for which off-site treatment is available will be shipped to the appropriate treatment facility as soon as possible in accordance with a prioritization established in OSS 200 (*Annual Action Plan for Off-Site Shipment of Wastes*).

The ranking methodology discussed during negotiations with EPA was intended to be an approach using LANL's specific knowledge of the waste streams. Such knowledge included factors such as the physical, chemical and radiological characteristics, and volume of the waste. Such a methodology was based on partiality and not intended to compare waste streams to existing universal standards.

The purpose of the Treatment Prioritization Plan (TPP) is to provide a formalized methodology for assessing the risk of long term storage of LLMW so that the high risk waste streams will be treated first, and be given priority in treatment skid development. The ranking methodology reflects the relative risk for each LLMW stream if released to the environment. The methodology will be applied to all LLMW streams currently stored at LANL. Additional FFCA milestones that will either contribute to or use information developed from this TPP are the *Gas Cylinder Work-Off Plan* (GAS 100), *Work-Off Plan for Applicable LLMW for Controlled Air Incinerator* to be treated in the CAI (CAI 300), *Annual Action Plan for Off-Site Shipment of Waste* (OSS 200), and *Treatment Skid Annual Report* (AR 100).

2.0 DEVELOPMENT AND BACKGROUND

The TPP has been developed to provide LANL personnel with a uniform ranking methodology. The rankings will be used to prioritize the various LLMW streams at LANL for treatment in existing on-site facilities, and for development of skid mounted treatment units (at LANL) for which treatment technology or capacity does not currently exist.

The waste streams to be evaluated initially, using the methodology, are those legacy LLMW streams presently stored on site. These waste streams are identified in the FFCA, Appendix B, Attachment A, Tables 1 and 2. It is LANL's expectation that the initial uses of the treatment skids will be to work-off the existing inventories of Legacy wastes in order to comply with milestone HW 900 (*Complete Waste Work-Off*) as described in the FFCA. The TPP methodology and program are flexible enough to allow for the ranking, or prioritization of other types of waste. Therefore, it is expected that once the legacy wastes are worked-off, the methodology will be used to prioritize waste streams recently generated at LANL, as well as those generated on an ongoing basis.

2.1 Development of the Methodology

The methodology selected for the prioritization plan is based on the assignment of weighting factors to selected categories of concern for the waste streams at LANL. The weighting factors are used to calculate a ranking score for each waste stream, which will then be used to prioritize the wastes streams.

The score is calculated using the LLMW scoring matrix presented in Table 1. In selecting the weighting factors which appear in Table 1, variables that affect the feasibility of storage as a long-term waste management option were evaluated. These included physical, chemical, and radiological characteristics of the waste, the volume of the waste, and the type and condition of primary and secondary containerization. Evaluation of the effect of these variables resulted in the elimination of those variables concerned with the type and condition of primary and secondary containment. This decision was based on the fact that, in accordance with 40 CFR Part 265, and LANL policies and procedures, LANL must inspect containers and ensure that each container is in good condition and is compatible with the waste stored in it. In addition, in accordance with IFLL 100 and IFLL 200, storage facility upgrades (either in progress or planned) will provide secondary containment and protection for the containers to meet the requirements of 40 CFR Part 264. Therefore, any factors associated with type and condition of containers and containment systems will be equivalent between waste streams and would not affect the ranking. The weighting factors finally selected focus on the chemical, radiological and physical characteristics, and volume of the waste stream.

The sets of numbers assigned to the weighting factors were developed pursuant to 40 CFR Part 261 and were based on specific knowledge of the waste stream by the engineers and scientists involved in waste management at LANL. Their experience with and knowledge of the wastes, and the potential hazards posed by the wastes were crucial elements in assigning the factor values. The values assigned to the weighting factors were developed as a consensus among the engineers and scientists involved as to the importance of each different waste type, volume and hazards relative to each other.

The weighting factors determined to be most valuable for prioritizing waste streams at LANL for treatment, based on the criteria specified in the FFCA, were selected and placed in the matrix (Table 1). The categories and factors presented in Table 1 represent the types of waste characterization information which are presently available from the LANL waste stream database or will be provided by the waste characterization activities under the *LLMW Waste Characterization Plan* (HLL 100). The factor categories are as follows:

- Toxicity of the waste stream
- Concentration of the most hazardous constituent
- Physical form of the waste (i.e., gas, liquid, solid, etc.)
- Radiological components (Potential Effective Dose Equivalent)
- Volume of the waste stream
- Number of containers

TABLE 1

WASTE STREAM SCORING MATRIX

Toxicity [10][a]	**Concentration** (%) [8]	**Physical Form** [8]	**Radionuclide Risk (PEDE)** [6][b]	**Volume** (liters) [3]	**Numbers of Containers** [1]
P-Codes [16]	10-100 [10]	Gas [10]	Highest PEDE [10]	>20,000 [10]	>100 [10]
D003 [12]	1<10 [5]	Liquid [8]	↑	1000 to <20,000 [8]	25<100 [8]
F007 [8]	<1 [1]	Powder [8]	|	100<1000 [5]	5<25 [3]
U Codes [7]		Sludge [4]	|	1<100 [3]	1<5 [1]
D001 [6]		Hetero. Solid [2]	↓	<1 [1]	
D002 [5]		Homo. Solid [1]	Lowest PEDE [1]		
F001-F005 [4]					
D012-D043 [3]					
D004-D011 [3]					
K Codes [1]					

Notes: a - *Numbers in brackets are the values assigned to the multipliers and weighting factors.*
b - *The PEDE will be determined for all waste streams at the same time. Numbers in Appendix B are for illustrative purposes only using surrogate waste stream information.*

2.2 Flexibility of the Methodology

With respect to the flexibility of the methodology in selecting new or additional weighting factor or values, the factors and values presented in Table 1 are the result of evaluation of the available information at the time of selection. Changes to the weighting factors or values can be made where new information becomes available. When changes to the weighting factors or values are made, the methodology should be evaluated to determine how the new factor(s) or values will affect the results. In addition, the ranking scores for all the waste streams should be recalculated to determine how previous priorities may have been changed.

3.0 EXPLANATION OF THE MATRIX AND FACTOR VALUES

The matrix presented in Table 1 was prepared to illustrate the weighting factors and thought processes to be used in prioritizing the waste streams for treatment. The matrix also presents the values assigned to the weighting factors used in the prioritizing determination. As the matrix illustrates, the individual factors and factor categories have been assigned values and multipliers (respectively) which appear in brackets. These values were arrived at by the waste management staff at LANL and are used to weight the factors against one another for comparative purposes. The values reflect an evaluation of available waste stream information, experience of the waste management staff, and their opinions as to the relative importance of the factors compared to each other.

Toxicity - The toxicity of the waste stream is reflected in how the wastes at LANL compare to each other as illustrated in the "Toxicity" column of the matrix presented in Table 1. The toxicity rank presented in the matrix is based on the actual type of waste at LANL, and on the immediate hazard of the waste on human health and the environment, if released. The weighting for toxicity is irrespective of volume or radioactivity factors which were evaluated separately and given their own weighting values.

Concentration - The concentration of the most hazardous constituent of the waste reflects the direct relationship between the amount of the hazardous constituent and the hazard posed by the waste stream if there was a release to the environment. The more concentrated the hazardous constituent, the more hazardous the waste will be to the public or the natural environment.

Physical Form - The physical form of the waste corresponds to its mobility if released to the environment. For this factor, containerization is not considered since the value of the factor assumed the waste was released. Therefore, a gas is considered the most mobile and from a storage standpoint presents a higher risk of release from storage as a result of it being under pressure. Liquid is also very mobile and is considered second along with powder. Powder was ranked with the same value as liquid due to the subsequent potential for dispersion of the waste if the waste becomes airborne, and the potential for exposure through inhalation. In general, sludges were rated much lower since they tend to be much less mobile than gases, liquids or powders. Heterogeneous solids are rated higher than homogeneous solids based on the fact that the layering and variance of materials and textures in heterogeneous materials could make them less stable and less predictable than a homogeneous solid with known physical properties.

Radionuclide Risk - The weighting factor selected to represent the radiological components of waste streams is the potential-effective dose equivalent (PEDE). The PEDE is intended to simplify the evaluation of the relative radiological hazard associated with any waste container by converting the dose potential for different radionuclides into comparable dose values. The assumption underlying this concept is that the waste container is breached and the contents of the container become airborne, thus presenting an internal exposure hazard to workers and the public via inhalation.

To establish the PEDE of the radioactive contents of a container, the 50-year committed effective dose equivalent, also known as the dose conversion factor (DCF), is determined for each radionuclide to establish the dose potential of a unit of intake of that radionuclide through inhalation (in rem/Ci). These DCFs have been determined by the method described in International Commission on Radiological Protection (ICRP) Publications 26 and 30 (ICRP

1977; ICRP 1979). The DCF is obtained from the tables contained in the *Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion and Ingestion* (EPA 1988). The DCF is multiplied by a conversion factor to yield the DCF in rem/Ci units.

To calculate the PEDE, the activity (in Ci units) for each radionuclide in the container, is multiplied by the DCF (rem/Ci) which yields a PEDE value (in rem units) for each radionuclide. The total PEDE for the container is the sum of the individual PEDEs. The procedures for the PEDE calculation are presented in Appendix A.

Volume - The volume of the waste stream and the weighting values assigned reflect the premise that the greater the volume of waste, the greater the consequences and likelihood of a release if the waste has to be stored for long periods of time. Higher volumes of waste can pose operational problems for waste management staff when storing for extended periods of time.

Number of Containers - This factor was selected as a discrete weighting factor to reflect the hazards associated with handling and storing a large number of containers over a period of years. The greater the number of containers to be handled, the higher the probability of release if the wastes must be managed over several years. This factor was rated lower because of the waste management practices described in section 2.0, and since management of containers in compliance with those requirements will result in a low probability of loss of containment

3.1 Explanation of the Toxicity Values

With respect to the waste streams listed in the first column of Table 1 under "Toxicity", the order and selection are based on the type and hazard of the various waste types found at LANL. The wastes streams within these waste code categories were evaluated from a hazard standpoint to determine which ones posed the greatest hazard based on their known physical and chemical characteristics. In this case, the LANL waste management staff utilized their specific knowledge and experience with the waste streams to determine which wastes posed the greatest risk if released to the environment, and if stored for prolonged periods, would present the highest potential for a release to occur. The toxicity rank presented in the matrix is based on the actual type of waste at LANL and how they compare to one another.

P Listed Wastes - These wastes are considered to be the most hazardous wastes at LANL and pose the greatest immediate hazard to human health and the environment. The basis for this is that these materials are commonly found (at LANL) in a concentrated reagent grade form. These materials are also acutely toxic and therefore management of these materials must be done with extreme caution.

D003 - The wastes which fall into this category are considered to be the next hazardous waste stream at LANL. These are reactive wastes and are generally unstable, pyrophoric, and water reactive, and if reaction occurs, they may release cyanide and sulfide gases. Waste that is capable of causing fire through the absorption of moisture is considered somewhat more hazardous as it becomes more dangerous once released into the environment, where water is plentiful. This also holds true for a reactive waste that reacts violently with water and releases gases or fumes. Since most gases or fumes are dangerous to human health, it is assigned a higher weighing value. Furthermore, reactive waste that is readily capable of detonation, explosive decomposition, or reaction at standard temperature and pressure is very dangerous, as an explosion can impact other nearby containers and lead to additional releases of hazardous materials.

F007 - This waste stream is composed of liquid plating wastes which contain cyanide and metals including chromium, cadmium and lead. The higher relative importance of this waste compared to others is the result of the cyanide concentration in the waste stream, which present a similar reactive threat as do the D003 wastes. The high concentrations of heavy metals provide additional emphasis, although in general nonreactive heavy metals are considered less of a threat to human health and the environment if released.

U Listed Wastes - These wastes are listed wastes because they contain toxic, ignitable, corrosive, and reactive constituents, either solely or in combination. For LANL waste streams, while they do not present the same level of immediate hazard as the P-listed and D003 wastes, the U-listed waste streams are sometimes ignitable, in addition to being toxic, and therefore pose a greater immediate hazard if released than the LANL D001 waste streams.

D001 - The ignitable wastes are considered to be in this midrange because they are not generally considered toxic. The largest concern with ignitable wastes are from the potential for fire and explosion. Such an incident would not only release the contents of the affected drum to the environment, but it could also cause a chain reaction and rupture and ignite adjacent drums containing flammable or toxic wastes.

Ignitable compressed gases that are heavier than air have the potential to travel relatively long distances to an ignition source and flashback. The potential for such a scenario is much higher in a sprung structure or similar secondary containment.

D002 - The corrosive wastes at LANL are not considered to be reactive, nor do they pose as great a potential to release toxic gases through ignition. Therefore, they were judged to present a lesser immediate hazard than the D001 wastes. Further, they are readily neutralized, and therefore can be relatively easily controlled if released into the environment when compared to the more toxic waste codes discussed above.

F001 to F005 - Although these wastes contain some of the same toxic constituents as the U-listed waste streams, the F waste streams at LANL contain far smaller concentrations of those constituents. The LANL F-listed waste streams are primarily composed of sludges contaminated with the F001-F005 constituents, as opposed to wastes containing high (percent-level) concentrations of the hazardous constituents. For this reason, the F001-F005 waste streams were assigned a lower toxicity factor category.

D012 to D043 - Like the F001-F005 wastes, the D012-D043 wastes contain much lower concentrations of the hazardous constituents than found in the U Code waste streams. The lower concentrations create a lower immediate hazard level. In addition, most of the constituents in the D012-D043 wastes are the same as those found in the F-listed wastes. Although the D012-D043 wastes are potentially more toxic than the D004-D011 metals, they occur only rarely in the LANL waste inventory.

D004 to D011 - The toxic metals represented by these waste codes are considered to pose less of an immediate hazard than the other LANL wastes streams because their risks generally are based on chronic exposures. However, the LANL wastes in this category tend to pose a somewhat greater immediate hazard if released than the K wastes.

K Listed Wastes - Some of the K044-K047 wastes in this category were listed for reactivity, while others were listed for reactivity and toxicity of their high explosive constituents. However, the low ranking for LANL wastes within this toxicity category is a reflection of the fact that the high explosive components in these wastes have been deactivated by treatment at the LANL generator sites prior to transportation to the LANL LLMW storage facilities. In storage, the wastes contain primarily barium, lead, and small concentrations of other metals.

4.0 APPLICATION OF THE PRIORITIZATION MATRIX

The seven columns of the matrix represent the waste characteristic weighting "factor categories". Within each of these factor categories are the specific weighting "factors" and their assigned weighting factor values. The values to be used in the prioritization formula are selected based on specific information for the waste streams being evaluated. The information is obtained from the waste characterization database and the specific waste stream folders which contain all the information used to characterize the waste in accordance with Title 40 CFR Part 261.

The formula used to prioritize the waste streams is linear where the applicable weighting factor values for each waste stream are selected (using the information from the waste characterization database and folders) and multiplied by the Category Multiplier for that specific factor category. The resulting product is then added to the products of the other factor categories. The prioritization score is the sum of the products from all the factor categories. The score will then be used to determine which waste streams are to be evaluated for treatment first.

When selecting the values to use in the scoring formula, where there are multiple factors (and therefore values) identified within a factor category for a waste stream, only the most hazardous and highest weighted factor is selected and used in the scoring. This represents a conservative approach to ranking since the highest weighting factor (most hazardous factor) is used, and it creates a more streamlined approach to the methodology. As noted in Section 3.0, this approach is not applied to the radionuclide risk category.

5.0 TRIAL RUN OF THE METHODOLOGY

After the weighting factors were selected and values were assigned, an exercise was conducted to determine how the various factors and values interplayed to rank the waste streams, and if the results would appear to be accurate from a common sense standpoint. The methodology was expected to show that the most toxic or otherwise dangerous wastes, which would create the greatest health and environmental risk if released to the environment, are therefore a greater risk if stored for prolonged periods.

The exercise was conducted on eight surrogate LANL waste streams which were selected based on the information from Tables 1 through 3 in Attachment A of Appendix B of the FFCA. The waste streams were selected to represent a cross section of the waste streams at LANL (i.e., gases, liquids, solids, toxic, ignitable, reactive, large quantities and small quantities, etc.). These wastes, their characteristics, scores and calculated priority resulting from the TPP methodology are presented in Appendix B. An example score calculation is also presented for the phosphene surrogate waste stream.

Additional testing of the methodology will be necessary once sufficient information from the LLMW characterization project (HLL 100) is available. This testing could result in modifications to the matrix or the weighting factors, as discussed in Section 2.2.

6.0 IMPLEMENTATION PLAN

The following describes how the methodology will be applied to the waste streams at LANL. A flow chart of the process is presented in Figure 1.

1. Waste streams will be evaluated to determine if off-site treatment technology and capacity (OSS) is available (within two years). If so, waste streams will be scheduled for OSS. It should be noted that this evaluation will be performed annually and the results reflected in the *Annual Action Plan for Off-Site Shipment of Waste* (OSS 200).

2. For waste streams where OSS is not available, feasibility for treatment in the CAI will be evaluated. Those wastes determined to be treatable in the CAI will be scheduled for treatment using the treatment prioritization plan

3. Waste streams which cannot be treated in the CAI will be evaluated and prioritized for treatment skid development (ATS). The TPP ranking scores will be collated by treatability group to determine the order in which treatment skids should be developed. The development of each new treatment skid will commence in accordance with the treatment skid *Project Management Plan* (ATS 100).

4. For each of the on-site treatment assignments (i.e., CAI and ATS), the wastes will be prioritized for work-off within their appropriate treatability groups using their TPP ranking scores.

The prioritization plan will be implemented according to the following schedule:

	Activity	Projected Completion
1.	Complete Testing of the Methodology	September, 1994
2.	Begin Application of HLL 200 to Waste Streams	September, 1994
3.	Completion of the Characterization Plan Activity	February, 1995
4.	Complete Prioritization of Wastes	March, 1995

It should be noted that assignment of scores to the waste streams (activity 2) will begin before waste characterization is completed for all waste streams. Therefore, from September 1994 to February 1995, activities 2 and 4 will occur simultaneously. After all the waste streams are characterized and have been assigned scores, then the waste streams can be prioritized (ranked) with respect to one another.

Off-site treatment facilities may become available for some wastes after they are assigned to on-site treatment development, but before the on-site treatment comes on-line. Should this occur, the wastes will be re-evaluated for possible shipment to the available off-site treatment facilities.

Waste streams may not be scheduled or directed for treatment solely on the basis of the ranking score derived from use of this methodology. The TPP methodology is intended to be a tool to assist in formalizing the waste prioritization decision-making process. Treatment scheduling may be modified to compensate for technological, safety, administrative, or other concerns.

7.0 REFERENCES

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FIGURE 1: WASTE STREAM PRIORITIZATION FLOW DIAGRAM

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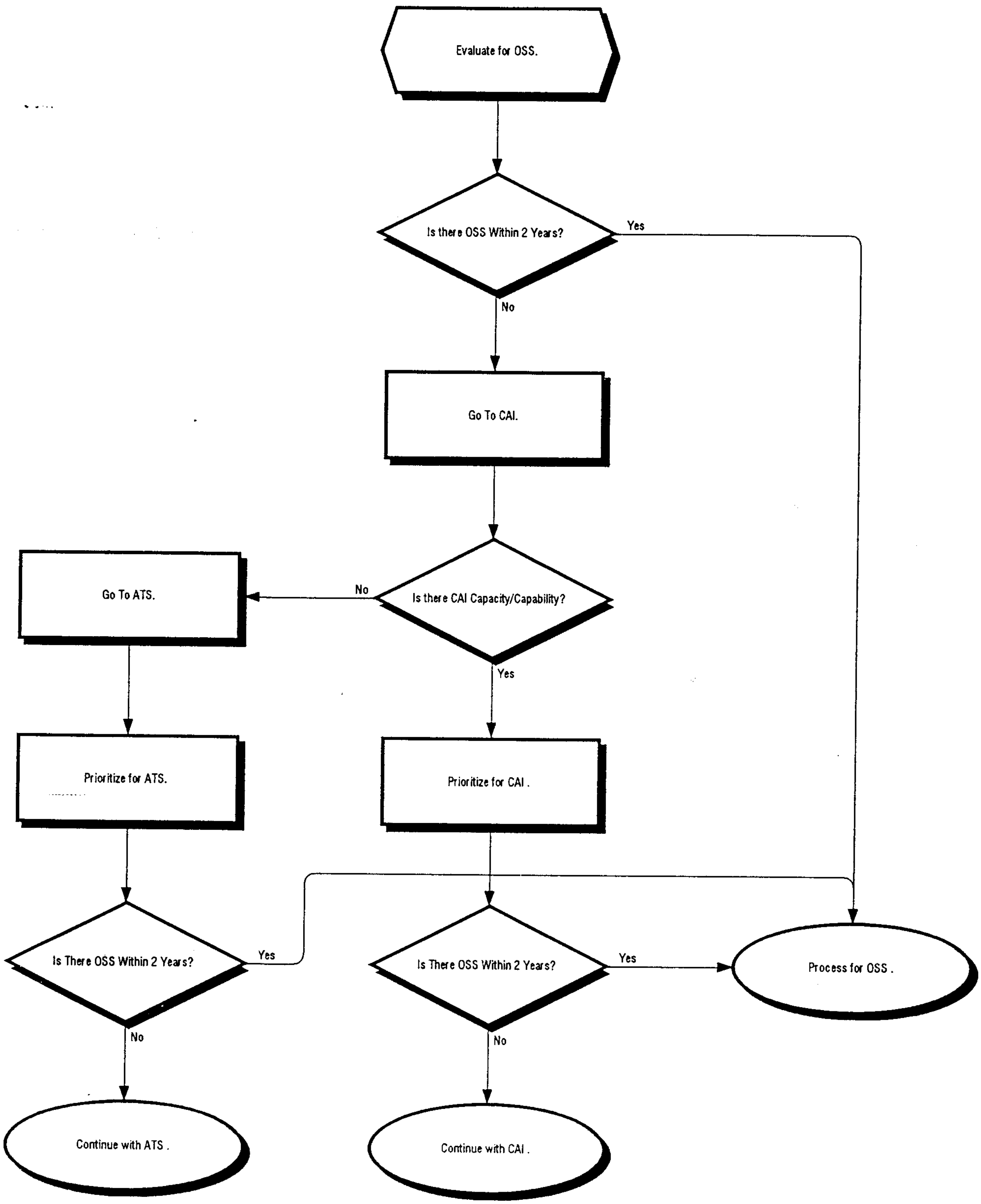

Appendix A
Derivation of Potential Effective Dose Equivalent

Appendix A

Derivation of Potential Effective Dose Equivalent

The relative radiological hazard, or PEDE, associated with the radioactive contents of any drum can be assessed by multiplying the total curie activity of each radionuclide by its DCF, and then summing the results for all the radionuclides in the container. The following equation is used to determine PEDE (rem):

$$\mathbf{PEDE} = \Sigma\ (\mathbf{A_i}\ \mathbf{x}\ \mathbf{DCF_i})$$

where

A_i is the activity of the radionuclide i (Ci), and

DCF_i is the 50 year effective whole body dose commitment per unit of intake (rem/Ci) caused by the inhalation of radionuclide i particulates with 1.0 μm AMAD (activity median aerodynamic diameter) and the pulmonary clearance class resulting in the highest 50 year effective dose equivalent.

Procedures for Calculating PEDE:

1. Identify the DCF for each radionuclide from Table 2.1 in USEPA, 1988.
2. Convert the DCF from Sv/Bq to rem/Ci using the conversion value (3.7×10^{12}).
3. For each radionuclide in the waste stream, multiply the DCF (rem/Ci) times the activity of the waste (Ci) to yield the individual PEDE for each radionuclide.
4. The total PEDE is the sum of the individual PEDEs.
5. For purposes of the matrix and assigning weighting values, the PEDEs for each waste stream will be normalized on a scale of 1 to 10. The waste with the highest PEDE will be assigned a radionuclide risk value of 10. The waste with the lowest PEDE will be assigned a radionuclide risk value of 1. Wastes with PEDE values which fall in between the highest and lowest PEDE will be assigned radionuclide risk values proportional to their PEDE value compared to the highest and lowest PEDE values. For example, if the highest PEDE is 812,990 Ci, and the PEDE for waste "X" is 300,000 Ci, the radionuclide risk value for waste X will be:

   (300,000 / 812,990) x 10 = 3.69 (rounded off to 4)

Appendix B
TPP Methodology Sample Calculations
on Surrogate LANL Wastes

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TPP Methodology Sample Calculations
on Surrogate LANL Wastes

- Phosgene Gas
  P code waste; concentration is in the 10-100% range; radionuclide value is 1, volume is in the 1-100 liters range; there are 5-25 containers in storage.

  Score = 338 Priority = 1

- Oxidizers/Nitrated Compounds
  D001; 10-100% concentration; Powder; radionuclide value is 9, volume is 1,000-20,000 liters; 25-100 containers in storage.

  Score = 290 Priority = 2

- Sodium Metal
  D003; 100% concentration; homogeneous solid; radionuclide value is 4, volume in the 100-1,000 liter range; 5-25 containers in storage.

  Score = 250 Priority = 3

- Scintillation Vials
  D001; liquid; 10-100% concentration; radionuclide value is 3, volume is 1,000-20,000 liters; 5-25 containers in storage.

  Score = 249 Priority = 4

- Mercury (elemental)
  U code waste; liquid; radionuclide value is 2, volume in the 100-1,000 liters range; 5-25 containers in storage.

  Score = 244 Priority = 5

- Paint Stripper Sludge
  Methylene Chloride with <50% concentration; sludge; radionuclide value is 6, volume is in the 1,000 to 20,000 liter's range; and there are approximately 60 containers in storage.

  Score = 220 Priority = 6

- TA-50 Waste Water Treatment Sludge
  F001-F005 Solvents at < 1% concentration; sludge; radionuclide value is 10, volume is greater than 20,000 liters; and there are greater than 100 containers in storage.

  Score = 180 Priority = 7

- Lead Bricks
  D008; 10-100% concentration; homogeneous solid; radionuclide value is 6, volume in the 100-1,000 liters range; 25-100 containers in storage.

  Score = 179 Priority = 8

EXAMPLE SCORE CALCULATION FOR PHOSGENE

Factor Category	Value	Multiplier	Factor Category Score
Toxicity = P-Listed	16	10	160
Concentration = 10-100%	10	8	80
Physical Form = gas	10	8	80
PEDE Normalized Value	1	6	6
Volume = 1-100 liters	3	3	9
Number of Containers = 5-25	3	1	3
		Total Score	338