TA54

Draft Site Treatment Plan for Los Alamos National Laboratory Background Volume

LIBRARY COPY

August 1994

11330

Draft Site Treatment Plan for Los Alamos National Laboratory Background Volume

Contents

1.0 Introduction 1
- 1.1 Purpose and Scope 1
- 1.2 Site History and Mission 2
- 1.3 Framework for Developing DOE's Site Treatment Plans 3
- 1.4 Organization of the Draft Site Treatment Plan 4
- 1.5 Related Documents 5

2.0 Methodology 7
- 2.1 Assumptions 9
- 2.2 Selection Process for Preferred Options 10
- 2.3 Coordination with Regulatory Agencies and Other Stakeholders 11
- 2.4 Characterization of Mixed Waste 12
- 2.5 Waste Minimization 12

3.0 Low-Level Mixed Waste Streams 13
- 3.1 Mixed Waste Streams for Which Technology Exists 14
- 3.2 Mixed Waste Streams for Which Technology Exists but Needs Adaptation or for Which No Technology Exists 25
- 3.3 Mixed Waste Streams Requiring Further Characterization or for Which Technology Assessment Has Not Been Done 27

4.0 TRU Mixed Waste Streams 28
- 4.1 TRU Waste Expected to Go to the WIPP 28
- 4.2 TRU Waste Not Destined for the WIPP 29

5.0 High-Level Mixed Waste Streams 29

6.0 Future Generation of Mixed Waste Streams 29
- 6.1 Environmental Restoration Waste 30
- 6.2 D&D Waste 30

7.0 Storage Report 31

8.0 Process for Evaluating Disposal Issues in Support of STP Decisions 31
- 8.1 Introduction 31
- 8.2 Evaluation Process for Disposal Sites to Date 32
- 8.3 Next Steps in the Evaluation Process for Disposal Sites 34

Tables

I. Sites Eliminated in Initial Screening 37
II. 26 Sites Remaining After Initial Screening 39

Appendix. Methodology Used to Select Preferred and Alternate Options to Treat Low-Level Mixed Waste at Los Alamos National Laboratory

DRAFT SITE TREATMENT PLAN FOR LOS ALAMOS NATIONAL LABORATORY

BACKGROUND VOLUME

1.0 INTRODUCTION

1.1 Purpose and Scope

The Department of Energy (DOE) is required by section 3021(b) of the Resource Conservation and Recovery Act (RCRA), as amended by the Federal Facilities Compliance Act (the Act), to prepare site treatment plans (STPs or plans) describing the development of treatment capacities and technologies to treat mixed waste, which contains both radioactive and hazardous components. The plans will be submitted to the State of New Mexico for approval, approval with modification, or disapproval. The Draft Site Treatment Plan (DSTP or draft plan) of Los Alamos National Laboratory (LANL) is the intermediate version of the STP and is provided to the State of New Mexico, the US Environmental Protection Agency (EPA), and others for review.

STPs are required for facilities at which DOE generates or stores mixed waste, defined by the FFCAct as waste containing both a hazardous waste subject to the Resource Conservation and Recovery Act, and a source, special nuclear material, or by-product material subject to the Atomic Energy Act of 1954 (42 USC 2011 *et seq.*). On April 6, 1993, DOE published a *Federal Register* notice (58 FR 17875) describing its proposed process for developing the STP in three phases, including a Conceptual STP, a Draft STP, and a Final Proposed STP. This Draft Plan identifies the currently preferred options for treating the mixed waste at Los Alamos or for developing treatment technologies when technologies do not exist or need modification. The Draft Plan reflects the site-specific preferred options, developed with the state's input and based on existing available information. The options reflect the "bottom-up" approach and have not been completely evaluated for impacts on other DOE sites and impacts to the overall DOE program. Therefore, changes in the preferred option and associated schedules are possible between the Draft Plan, the Final Proposed Plan, and final approval and issuance of the order as evaluation of DOE-wide impacts and state-to-state discussions progress.

To the extent possible, the Draft Plan identifies specific treatment facilities for treating the mixed waste and proposes schedules as set forth in the FFCAct. When not possible, schedules for alternative activities such as waste characterization and technology assessment are provided as appropriate. All schedule information presented is preliminary and subject to change. For new facilities, the schedule depends heavily on decisions made during the design phase and is contingent on funding availability. Assumptions and professional judgments about the type of treatment technology, location of the treatment facility, contracting mechanism, project approval process, cost, etc., were used to develop the estimated schedule. Any variation from these assumptions will affect the estimated

schedule. Further, cost data used in developing options and schedules and provided in the Draft Plan are planning estimates only and do not reflect a commitment of budgetary resources.

Emerging or new technologies not yet considered may be identified that provide opportunities to manage waste more safely, effectively, and at lower cost than the current technologies identified in the Draft Plan. Working closely with regulators and other interested parties during the implementation of the Draft Plan, DOE will continue to evaluate and develop technologies that offer potential advantages in public acceptance, risk abatement, and performance and life cycle cost. If more promising technologies are identified, DOE may request a modification of its treatment plan in accordance with provisions of the final Site Treatment Plan and/or the order.

The draft plan reflects the results of discussion between New Mexico and other states, EPA, and others based on the Conceptual Site Treatment Plan submitted to the State of New Mexico in October 1993. The conceptual plan presented known treatment needs, capabilities, and preliminary options for treating the mixed waste.

This Background Volume is one of two volumes that constitute the Draft Site Treatment Plan. It provides a detailed discussion of the preferred option or options, identifies the waste streams the option addresses, and provides explanations for the Plan Volume. The Plan Volume identifies the capacities to be developed and associated schedules as required by the Act.

1.2 Site History and Mission

LANL's principal mission is to design and develop weapons for the nation's nuclear arsenal; however, considerable research and development (R&D) is directed toward developing the peaceful uses of nuclear energy, including research on controlled thermonuclear reactions, fission reactors, nuclear safeguards, laser fusion, and medium-energy physics. Extensive basic research programs in physics, chemistry, metallurgy, mathematics and computers, earth sciences, and electronics support these efforts. Biomedical and environmental research includes programs in molecular biology, radiobiology, radioecology, and industrial hygiene. Expansion into nonnuclear areas is represented by applied technology development of solar and geothermal energy and superconducting power transmission lines.

The Waste Management Group, CST-7, operates all waste management facilities at the Laboratory, except those related to high-explosives waste and sanitary waste, and those operated by waste generators in preparing their wastes for disposal. Activities in CST-7 include treating radioactive liquid and solid waste; packaging, transporting, treating, and disposing of hazardous chemical waste; and operating the disposal and storage sites for mixed waste.

The Environmental Restoration Program (ER) remedies environmental problems by assessing, cleaning up, and overseeing the decontamination and decommissioning of LANL facilities.

1.3 Framework For Developing DOE's Site Treatment Plans

LDR requirements. Requirements of the RCRA Land Disposal Restriction (LDR) require the treatment of hazardous waste (including the hazardous component of mixed waste) to certain standards before the waste can be land disposed, and prohibit storage of hazardous waste that does not meet LDR standards, except to accumulate sufficient quantities to facilitate proper recovery, treatment, or disposal of the waste. DOE stores mixed waste inconsistent with the LDR provisions because the treatment capacity for such wastes, either at DOE sites or in the commercial sector, is not adequate or is currently unavailable.

FFCAct. The Federal Facilities Compliance Act (FFCAct), signed on October 6, 1992, waives sovereign immunity for fines and penalties for RCRA violations at federal facilities. However, the Act postpones the waiver for three years for LDR storage prohibition violations for DOE's mixed waste and requires DOE to prepare plans for developing the required treatment capacity for its mixed waste at each site at which it stores or generates mixed waste. Each plan must be approved by the State or EPA, after consultation with other affected states and consideration of public comment, and an order issued by the regulatory agency requiring compliance with the plan. The Act further provides that DOE will not be subject to fines and penalties for LDR storage prohibition violations for mixed waste as long as it is in compliance with an approved plan and order.

The Act requires the plans to contain schedules to develop capacity for mixed waste for which identified treatment technologies exist, and, for mixed waste without an identified existing treatment technology, schedules to identify and develop technologies. The Act also requires the plan to provide certain information when radionuclide separation is proposed. The Act states that the plans may provide for centralized, regional, or on-site treatment of mixed waste, or any combination of these, and requires the states to consider the need for regional treatment facilities in reviewing the plans.

Schedule. The "Schedule for Submitting Plans for the Treatment of Mixed Waste Generated or Stored at Each Site" was published in the *Federal Register* (April 6, 1993; 58 FR 17875). In the notice, DOE committed to providing the site treatment plans in three phases:

- a "conceptual plan" completed in October 1993,
- a "draft plan" no later than August 1994, and
- a "final proposed plan" no later than February 1995.

This process allows early involvement by the states and other stakeholders to discuss technical and equity issues associated with the plans.

The conceptual plan (October 1993) focused on identifying treatment needs, capabilities, and options for treating the site's mixed waste. This draft plan focuses on identifying preferred options for treating the site's mixed waste, wherever possible, and on proposed schedules for constructing capacity. The options presented represent the site's best judgment of the available information and the states' preferences; the options should be viewed as a starting point for discussion leading to the development of the final proposed plan, which will be submitted to the regulatory agency for review and approval, approval with modification, or disapproval, as required by the Act. Each version of the plan will reflect discussions among states and site-specific input from the individual regulatory agency and other stakeholders on the previous submittal. The DOE intends that this iterative process, with ample opportunity for input and discussion, will facilitate approval of the Site Treatment Plan and issuance of the compliance order required by the Act. DOE's goal is to have all plans and orders in place by October 1995.

1.4 Organization of the Draft Site Treatment Plan

To facilitate cross-site comparisons, LANL's draft plan follows the same format as those of other DOE sites. The draft plan is organized in two integrated volumes. The Background Volume provides the detailed discussion of the options:

- information on the waste streams and treatability groups a particular treatment option or options would address,
- descriptions of uncertainties associated with that option, and
- the budget status of the option.

The Compliance Plan Volume is a short, focused document containing the preferred options and schedules for implementing the options and is contains the information required by the Act. The Compliance Plan Volume also contains a mechanism to implement the plan and establish enforceable milestones. It references but does not duplicate details on the options in the Background Volume.

Sections 1.0 and 2.0. Sections 1.0 and 2.0 in both volumes contain introductory material relevant to the purpose of the volume. The Background Volume contains general information on the draft plan and the site in Section 1.0 and provides top-level assumptions and a description of the process used to determine the preferred options in Section 2.0.

Sections 1.0 and 2.0 of the Compliance Plan Volume propose certain administrative provisions appropriate for implementing the finalized plan. These provisions include

- the approach to setting milestones,
- updates to the plan,
- additions to or removals of waste streams covered by the plan, and
- funding considerations.

These sections are intended to initiate discussion; the specific language will be likely developed with the regulatory agency and may eventually be expanded to address other administrative provisions or incorporated into a separate consent order.

Sections 3.0 through 5.0. Sections 3.0 through 5.0 discuss the preferred option or options for low-level mixed waste (LLMW), mixed transuranic (TRU) waste, and mixed high-level waste, and each volume discusses the same waste streams and options in parallel sections. The Background Volume discusses the waste streams, technology needs, and uncertainties and other details about the preferred options. The sections in the Compliance Plan Volume include proposed schedules, to the extent feasible, as required under the Act.

Section 6.0. The Background Volume includes three additional sections that are not included in the Compliance Plan Volume because they are not required by the Act and are not compliance related. Planning and anticipating treatment needs for the generation of future mixed waste streams are discussed in Section 6.0. These waste streams will be incorporated into the Compliance Plan Volume, and treatment approaches and schedules developed when the waste is generated.

Section 7.0. Section 7.0 discusses storage capacity needs and how compliant storage will be provided for LANL's mixed waste pending treatment.

Section 8.0. Section 8.0 describes a process used by DOE and the states to evaluate options to dispose of mixed waste treatment residues. Although the Act does not require disposal to be covered in the plans, DOE includes disposal information because it is an integral part of waste management and compliance with RCRA (that is, properly managing waste from cradle to grave).

The draft plan also discusses the options selection process in an appendix, and describes the results of applying the "Draft Site Treatment Plan Development Framework." For each option, the appendix describes how options from the conceptual plan were evaluated and why the preferred option or options were selected.

1.5 Related Documents

Other DOE efforts are closely linked to STP development, including the Mixed Waste Inventory Report (MWIR); activities conducted pursuant to the National Environmental Policy Act (NEPA); and compliance and cleanup agreements containing commitments relevant to mixed waste.

Mixed waste inventory report

Required by the Act, the MWIR provides an inventory of mixed waste currently stored or generated or expected to be generated over the next five years at each DOE site and an inventory of treatment capacities and technologies. The Interim Mixed Waste Inventory

Report (April 1993) provided information on a waste stream-by-waste stream basis for each DOE site that generates or stores mixed waste. DOE made updated waste stream and technology data available to the states and EPA in May 1994 and is preparing an Updated Mixed Waste Inventory Summary. The report represents the best record of DOE's mixed waste inventory at the beginning of 1994. Because data is constantly being refined, waste stream information in LANL's draft plan may differ somewhat from the most recent inventory report.

NEPA activities

The Programmatic Environmental Impact Statement for Environmental Restoration and Waste Management. DOE is preparing a Programmatic Environmental Impact Statement (PEIS) to support complex-wide integration of environmental management activities. The PEIS presents to the public, states, EPA, and DOE an understanding of effects on human health and the environment and the costs associated with a wide range of alternative strategies for managing the DOE's environmental program. The PEIS examines all waste types and activities, including mixed waste treatment also addressed by the STP process.

Development of the Environmental Management (EM) PEIS is coordinated with the preparation of the plans under the Federal Facilities Compliance Act. Information generated to support the PEIS (for example, hypothetical configurations, preliminary risk analyses, and cost studies) is shared with states to support plan discussions. The draft PEIS will not identify a preferred alternative (that is, configuration) for mixed waste facilities because this will evolve in consultation with the states and EPA through the STP process. However, the PEIS analyses of potential environmental risks and costs associated with a range of possible waste management configurations will provide valuable insight as the public, states, and DOE discuss using existing facilities and constructing new mixed waste facilities to treat mixed waste.

The draft PEIS will be published in the fourth quarter of 1994. The final PEIS will be issued after a public comment period at or near the time when the Final Proposed STPs are submitted to the states or EPA for approval. To remain flexible and accommodate potential changes after submitting the Final STPs to the states and EPA, the PEIS Record of Decision for mixed waste will be issued after the appropriate regulatory agency approves the plans.

Site-Wide Environmental Impact Statement for LANL. An Advance Notice of Intent for the LANL site-wide EIS (SWEIS) was published in the *Federal Register* on August 9, 1994. The effects of the SWEIS on activities outlined in the DSTP have not been determined. Milestones and schedules presented in the Compliance Plan Volume may be affected by the SWEIS.

Compliance agreements

LANL is working to satisfy commitments contained in a Federal Facilities Compliance Agreement (FFCAgreement). The FFCAgreement was negotiated and approved by the DOE and EPA Region VI on March 15, 1994, and applies to LDR waste. The commitments in the FFCAgreement will be replaced with those in the compliance order resulting from the requirements of the FFCAct.

On December 10, 1993, DOE, LANL, and the New Mexico Environmental Department (NMED) signed a final consent agreement (CA) addressing the remediation of TRU waste stored beneath earthen cover on Pads 1,2, and 4 at TA-54, Area G. The CA requires DOE and LANL to implement an action plan to remediate the pads, and place the waste in RCRA-compliant inspectable configuration by 2003. Interim CA milestones require completion of the Pad 1 activity by September 1998 and Pad 4 activities by September 2000.

DOE has also entered into a Federal Facilities Compliance Agreement (CWA-FFCAgreement) with EPA addressing violations of the Clean Water Act (CWA) at LANL. This agreement addresses violations of pollutant discharge limits at several National Pollutant Discharge Elimination System (NPDES) outfalls throughout LANL. The CWA-FFCAgreement requires

- construction of the Sanitary Wastewater Systems Consolidation (completed);
- waste stream characterization surveys (completed);
- addressing deficiencies identified in the surveys (final due date for 100% completion is September 30, 1996);
- construction of the High-Explosive (HE) Wastewater Treatment Project by September, 1997; and
- compliance with NPDES permit limits by October, 1997 is also required under the CWA-FFCAgreement.

DOE-AL Mixed Waste Treatment Plan

DOE-AL has prepared a comprehensive plan (AL Mixed Waste Treatment Plan [MWTP]) to treat LLMW generated and stored at the nine sites managed by DOE-AL. The plan resulted from the activities of the treatment selection team and includes recommendations for treating most waste streams at DOE-AL sites, including LANL. The MWTP, with the FFCAgreement, forms the basis for identifying the preferred options presented in the DSTP. Additional information about the MWTP is in Subsection 2.2.

2.0 METHODOLOGY

The methodology for managing mixed waste parallels that included in the FFCAgreement. The FFCAgreement was negotiated and approved by the DOE and EPA Region VI and addresses compliance with LDRs under RCRA.

Primary components. The primary components of the DSTP and the FFCAgreement are improved waste characterization, prioritization, and treatment. LANL generates and stores many small-volume mixed waste streams from its R&D mission. To effectively evaluate, select, and implement treatment processes, the physical and chemical characteristics of the waste must be clearly defined. The strategy for establishing the capacity to treat mixed waste at LANL requires characterizing these wastes such that treatment processes can be evaluated and implemented. The methodology for improved waste characterization appears in Subsection 2.4.

LANL will first complete the improved waste characterization activity, which includes determining the radioactive components and concentrations, hazardous components and concentrations, physical form, total volume, and condition of storage container. When the characteristics of the waste have been established, the order in which treatment processes are developed will be ranked based on risks to public health and the environment associated with long-term storage. Ranking recognizes the probability and impact of the loss of control of the stored waste. Waste with the highest risk will be treated first.

The plan for treating mixed waste consists of three major components:

- off-site treatment at commercial and other DOE facilities where technically and economically feasible;
- treatment of combustible waste in the Controlled-Air Incinerator (CAI), an existing facility; and
- treatment of noncombustible waste and waste that cannot be treated off-site or in the CAI in the Hazardous Waste Treatment Facility (HWTF).

Hazardous Waste Treatment Facility. The Hazardous Waste Treatment Facility (HWTF) is in the definitive design phase. The HWTF will house treatment processes for LLMW and hazardous wastes that are not amenable to off-site treatment or CAI treatment. The HWTF is being designed to be consistent with the fact that LANL must treat many small-volume hazardous and LLMW streams in this facility. It will comprise four treatment rooms with utilities and containment. Two rooms will be dedicated to hazardous waste, one room for treating characteristic waste and the other for treating listed waste. The third and fourth rooms will be used to treat LLMW, one room for treating characteristic LLMW and one for treating listed LLMW.

Small, skid-mounted treatment equipment will process waste in the HWTF. This equipment will allow multiple use of the treatment facility by processing waste in campaigns. When a campaign has been completed, the skid will be decontaminated and moved into storage. The treatment room will then be available to process a different waste stream using a different treatment skid.

Treatment of waste using skids and precede completion of the HWTF, provided that suitable facility space can be found and permitting completed.

The type and number of treatment skids needed to treat LANL mixed waste cannot be determined until waste has been fully characterized. The methodology for developing treatment processes, however, has been established through a project management plan (PMP) for a generic treatment process. The PMP outlines the tasks, durations, and resources required to develop and implement a treatment process for a given waste stream. It is also used to plan schedules and budgets for the Five-Year Plan, the primary funding mechanism for waste management at LANL.

2.1 Assumptions

All sites used the following assumptions for a degree of consistency in preparing the draft STPs. The assumptions were developed as a part of the "Draft Site Treatment Plan Development Framework" and reflect review and comment from the states and EPA.

1. For defense-related TRU waste, the DSTPs will reflect DOE's current strategy that the Waste Isolation Pilot Project (WIPP) will open and receive a No-Migration Variance. The DSTPs should identify characterization, processing, and treatment of TRU waste to meet the WIPP waste acceptance criteria (WAC). Consistent with this policy, treatment of mixed TRU waste to meet LDR standards will not now be included in the DSTPs.

   However, the STPs will recognize that DOE's policy on the WIPP is under review and may change in the future. As such, the STPs will provide for the flexibility to modify activities and milestones regarding TRU waste to reflect potential future changes in DOE policy.

   Under current DOE policy, nondefense-related TRU waste will not be disposed at the WIPP. As such, the DSTPs should reflect LDR treatment of nondefense mixed TRU waste.

2. DOE recognizes some states' preference for treating all waste on-site. Where appropriate, existing on-site capacity will be used before new facilities are constructed. When on-site treatment or use of commercial or mobile facilities is not practicable, the use of existing off-site capacity and the construction of new facilities will be considered.

3. Sites in the same state will investigate the practicality of consolidated treatment facilities.

4 Mixed waste resulting from ER and decontamination and decommissioning (D&D) activities will be factored into planning activities and equity discussions, particularly where use of facilities identified in the DSTPs is considered for managing ER and D&D waste.

5. The DSTP will address all waste in the updated MWIR. Any changes or corrections to the MWIR waste stream and treatment facility information will be explained in the DSTP.

6. On a volume basis, most of DOE's mixed waste will be treated on-site. Because of transportation concerns and costs, these wastes generally include process wastewater and some explosives and remote-handled waste. Other large volume waste streams will also generally be treated on-site. At a minimum, Richland (RL), Oak Ridge (OR), Idaho (ID) ,and Savannah River (SR) will have on-site facilities to treat most of their waste.

8. The Environmental Management PEIS is being prepared in parallel with the development of the STPs. The DSTP process will provide information for the PEIS. Each site will prepare any necessary specific NEPA documentation before proceeding with a given project or facility ordered by the state or EPA because of the STP process.

9. In support of DOE's cradle-to-grave waste management philosophy, disposal site location and criteria will be factored into state equity discussions, waste treatment facility designs, and the characteristics of the final waste forms.

2.2 Selection Process for Preferred Options

DOE-HQ Support. DOE prepared several guidance documents to assist the sites in working through treatment identification and selection of preferred options. The overall process appears in the Draft Site Treatment Plan Development Framework (DSTP Framework). The DSTP Framework establishes common terminology, objectives and values, planning assumptions, and a recommended methodology for narrowing the alternatives presented in the Conceptual STP. The Treatment Selection Guide provides information on selecting among treatment options by comparing the options on fundamental criteria such as regulatory compliance; environmental, health, and safety issues; treatment effectiveness; ability to implement; stakeholder concerns; life-cycle costs; and technology development. The Draft Site Treatment Plan Cost Information Guidance provides a level of consistency in the cost information by providing common cost assumptions. Drafts of these and other technical assistance documents were provided to the states, and their comments were incorporated into the final revision.

DOE-AL Support. The DOE-AL has prepared an MWTP to address LLMW generated and stored at DOE-AL sites. DOE-AL oversees nine DOE sites that have mixed waste. The size and activities of the DOE-AL sites vary greatly, but volumes of LLMW are generally small. Of the nine sites, five have less than 50 drums of waste, and three of those have less than 10 drums. The MWTP was prepared to address treatment of these wastes. The plan was prepared by a treatment selection team made up of representatives from four of the sites and DOE-AL. The overall approach used to develop the plan was that used in the classical solution of any engineering problem:

- define the problem;
- determine what is given to work with;
- determine a basis for solution; and
- solve the problem.

The team visited each of the nine DOE-AL sites to collect available information on waste and site capabilities. Waste data was recorded and the waste categorized with common treatment approaches. Information was also gathered on off-site treatment capacity, treatment technologies, and regulations affecting treatment. The team rated alternate treatment options for each waste group. Treatment options that rated highly or for which there were no practical alternatives were used to formulate the MWTP.

The MWTP uses the resources of the nine DOE-AL sites to create real treatment capacity for mixed waste that minimizes time and cost. The plan utilizes portable treatment units, off-site treatment capacity, and the ability to survey some waste out of the radioactive designation. Each DOE-AL site is responsible for securing funding, managing, and completing specific activities outlined by the MWTP. An Overall Program Manager ensures that each site meets its obligations. The activities assigned to LANL by the MWTP are consistent with activities included in the FFCAgreement. The preferred options presented in Section 3.0 reflect the recommendations presented in the MWTP.

2.3 Coordination with Regulatory Agencies and Other Stakeholders

The Act allows DOE and the state and EPA regulators who will approve the plans to cooperatively define mixed waste treatment plans. As requested by the states, DOE signed a cooperative agreement in August 1993 with the National Governor's Association (NGA) to facilitate the DOE-to-state interactions. To date, the NGA has sponsored several national meetings between DOE, the states, EPA, and the Indian nations to discuss the development of the STPs. Two working groups have been formed to discuss technical issues related to treatment and disposal of mixed waste. NGA and the states have also reviewed and provided comment on the guidance documents discussed in Section 2.2.

The Act requires the states and EPA to provide for public involvement after the final proposed plans are submitted in February 1995. DOE has provided additional opportunities for public input into the development of draft STP through existing public involvement mechanisms at the site. DOE-AL coordinates public participation associated with the implementation of the MWTP. Activities associated with LANL's involvement are being coordinated with other stakeholder involvement activities associated with LANL-wide programs and operations.

At the national level, DOE has presented information on the development of the STPs to the Environmental Management Advisory Board (EMAB) and will continue to provide information to the EMAB and other national stakeholder groups as the STPs are developed. Other national involvement may be done after the draft STPs are submitted.

2.4 Characterization of Mixed Waste

Mixed waste at LANL has been characterized to the extent necessary to comply with RCRA requirements for storage compatibility and EPA waste code designation. Most of the waste (> 75%) is radiologically contaminated with plutonium or uranium. The radioactive components of the remaining waste are primarily activation products, materials made radioactive by exposure to neutron bombardment or particle beams. Most of the characterization data obtained to date is limited information. This level of detail is sufficient to allow safe storage but insufficient to develop on-site treatment or to take advantage of off-site treatment. A formal plan is being implemented to systematically improve the characterization of the waste. The physical and chemical properties and the radioactive and hazardous components in the waste are required to develop treatment capacity.

To characterize waste, LANL is obtaining as much information as possible on individual containers of waste. The generators of specific waste containers are being interviewed to determine the physical matrix of the waste, the degree of homogeneity, physical properties, hazardous and radioactive components, and packaging methods. Waste will be grouped based on the process from which they were generated. Waste from similar operations will then be combined and defined as waste streams. Development of treatment capacity will focus on the waste streams.

Formal summaries are being prepared from the characterization information from the interviews about each drum of waste. Waste will be sampled and analyzed when interviews do not yield sufficient information to develop a treatment process.

For several major waste streams, additional waste characterization has been done, and the confidence in the drum contents is high. These drums include scintillation vials, lithium hydride, plating waste, and lead bricks. Treatment or recycling processes have been selected for these wastes, and equipment designs are well along. Lead recycling has begun. Treatment process selection for other wastes in this plan is based on less detailed information. Therefore, some of the processes identified as appropriate for a given waste stream may change as more detailed information about the characteristics of the waste are determined.

2.5 Waste Minimization

The overall waste minimization program at LANL systematically identifies the problem, identifies possible solutions, analyzes costs and risks of solutions, implements solutions, and evaluates the results.

The first step in solving waste generation problems by waste minimization is to rank the separate waste streams at the Laboratory. General criteria for ranking streams are

- volume and toxicity of stream,
- cost of existing treatment vs. minimization implementation,
- regulatory drivers, and
- periodic vs. continuous waste generation.

Once problems are identified, existing technical and administrative solutions will be identified.

Technical approaches to minimization include

- abatement or prevention of generation, including substitution and process and program modifications;
- segregation of materials to prevent excess generation; and
- reuse and recycling of waste whose generation could not be prevented by the first two approaches.

Administrative approaches to waste minimization include

- specifying procedures and methodologies to control materials through standard operating procedures;
- Waste Minimization Program Office and generator oversight of generating functions;
- Waste Minimization Program Office review of new projects;
- substantial changes to existing projects. through the Environmental, Safety, and Health Questionnaire Committee, which reviews these projects for all regulatory and procedural concerns; and
- purchasing discipline and housekeeping to prevent mismanagement of materials.

Reasonable technical solutions will be implemented, the resulting waste minimization successes tracked, and an annual report on the program prepared.

3.0 LOW-LEVEL MIXED WASTE STREAMS

LLMW at LANL may include all characteristic hazards, spent solvents, plating waste, and chemical products that include radioactive isotopes. Generally, the radioactive component of waste is plutonium and or uranium. Before 1986, most LLMW was disposed at TA-54, Area G. However, LLMW has been stored since the EPA affirmed its authority over regulating the hazardous component of mixed waste in July 1986. Since 1988, all containers of LLMW have been tracked in accordance with RCRA record keeping requirements.

LLMW exists as solid, liquid, or compressed gas.

Solid LLMW includes the following waste categories: oxidizers, reactive metals, contaminated debris, firing site debris, contaminated scrap metals, process residuals,

contaminated lead shielding, decontamination waste, dewatered treatment sludges from TA-50, and decontamination debris.

Liquid and compressed gas LLMW include the following waste categories: gas cylinders, ignitable liquids, acids, caustics, reactive liquids, analytical laboratory waste, contaminated wastewaters, contaminated nonwastewaters, contaminated metals, contaminated photographic fixer solutions, spent solvents, and contaminated chemical products.

The strategy for treating LLMW at LANL has been modified from that proposed in the CSTP. These modifications reflect and are coordinated with the DOE-AL Mixed Waste Treatment Plan. Based on the evaluation made by the DOE-AL treatment selection team, several of the planned strategies to treat specific LANL waste streams have been changed. Waste treatment technologies and capacity will be developed at LANL or at one of the other DOE-AL sites assigned by DOE-AL. Treatment skids developed at other sites will be transported to LANL for waste processing as needed.

The information about waste stream characteristics is based on data accumulated to date. It does not include information by generator interviews. Revisions from the improved characterization of LLMW will be done when the generator interviews are completed.

The following subsection discusses treatment options for LLMW stored or planned to be generated in the future at LANL. An exception to the format described in Section 1.0 involves the decontamination and recycling of lead shielding, which is surface contaminated with radioactivity. The process to remove the contamination and to permit reuse of the shielding is operating in the mobile Lead Decontamination Trailer (LDT). The operation of the LDT is considered recycle under the guidelines of RCRA and does not require a RCRA permit. Contamination is removed using a high-pressure jet of an inert abrasive material, waste, and air. The jet slurry is recycled through the process until the abrasive material breaks down and is no longer effective in removing contamination. Spent slurry is dewatered and solidified. The solidified product is sampled and subjected to Toxic Constituent Leach Procedure (TCLP) test to ensure that it does not exhibit hazardous characteristics. After passing the TCLP, the solidified product is disposed as LLW. After meeting the free release standards and release criteria specified in DOE Order 5400.5, the decontaminated shielding is then available for reuse at LANL.

Waste Category	Treatability Group	IMWIR ID #	MWIR ID #	RCRA Code	Inventory as of 12/92 (m3)	5-year Generation (m3)	Confidence in Characterization
shielding - lead	Pb-contaminated metal debris	2094	W007	D008	163.3	243.1	high

3.1 Mixed Waste Streams for Which Technology Exists

This section includes mixed waste that can be treated to standards of the LDR best demonstrated available technology (BDAT) using proven technologies; only minor

modifications of the technology, if any, are needed to treat the waste. Options identified for these waste streams include using

- existing on-site or off-site DOE facilities;
- commercial facilities;
- facilities constructed and not currently operating, but being brought into operational status; and
- new on-site or off-site facilities.

Organic Liquids

Waste Category	Treatability Group	IMWIR ID #	MWIR ID #	RCRA Code	Inventory as of 12/92 (m3)	5-year Generation (m3)	Confidence in Characterization
ignitable liquids	organic liquids	2055	W012	D001	79.3	87.7	high
spent solvents	aqueous/ halogenated organic liquids	2145	W024	F001	8.8	13.3	high
spent solvents	aqueous/ halogenated organic liquids	2176	W025	F002	12.7	18.5	high
spent solvents	aqueous/ nonhalo-genated organic liquids	2180	W026	F003	16.2	21.2	high
spent solvents	aqueous/ nonhalo-genated organic liquids	2184	W027	F005	10.8	15.7	high
				Total	**127.8**	**156.3**	

Description of technology and capacity needs. The LDR treatment standards for these waste streams require destroying the hazardous organic component (F-listed waste) or removing the hazardous characteristic (D001). Residuals of F-listed waste must be handled as if they still contain the hazardous organic; therefore, they must meet the LDR restrictions for final disposal. Effluent from liquid residuals must be concentrated, usually by evaporation, and then stabilized. Solid residuals must be stabilized. All stabilized residuals must meet the LDR standards for the particular F-listed waste before land disposal in the RCRA-permitted facility. Treatment of characteristic waste must remove the hazardous characteristic. Once removal has been demonstrated, the residuals are no longer regulated under RCRA. At LANL, the liquid residuals from treatment of characteristic wastes can be sent to the Radioactive Liquid Waste Treatment Plant (RLWTP), and the solid residuals can be sent to the low-level radioactive disposal pit at TA-54, Area G. Residuals from treatment processes must meet the waste acceptance criteria (WAC) for both of these facilities.

Destruction of organic liquids requires oxidation. The most readily available oxidation technology is incineration. Alternative methods to oxidize organics are being developed in the commercial sector and within DOE. These technologies, however, are not available for treatment.

The capacity required for the treatment of these wastes is approximately 90 m^3/y. This estimate is based on the assumption that it will take five years to establish a treatment capacity, five years to treat the backlog (current inventory + waste accumulated during duration required to establish treatment capacity), and an annual generation rate of approximately 30 m^3/y.

Preferred option. LANL has not chosen a preferred option for organic liquids. Several options are being reviewed. The leading candidates are commercial treatment and using the LANL controlled-air incinerator. Alternative technologies are also being considered but will require additional development. Currently, treatment of LANL waste at other DOE sites is unavailable because of the limited number of treatment facilities in operation and the compatibility of LANL waste with the available treatment processes. A treatment option for organic liquids will be selected based on technical and economic feasibility and the time frame to complete treatment.

Commercial treatment. Packaging and transport of organic liquids to a commercial treatment facility is considered an option for these wastes. An opportunity has been identified to treat LLMW organic liquids at a commercial facility, Diversified Scientific Services Inc., (DSSI), in Kingston, Tennessee; the facility is available to treat low-level liquid mixed waste using incineration. The facility does not accept solid or gaseous mixed waste.

DOE will pursue treating these wastes at DSSI if it is technically and economically feasible. The requirements and costs for packaging, transportation, and treatment at DSSI will be reviewed. The feasibility of using the DSSI facility will be documented. A schedule for activities associated with the off-site treatment at DSSI will be included as appropriate.

A contract to ship waste to DSSI is in place. However, current DOE orders require that radioactive waste generated at a DOE site be disposed of on DOE property. Under this order, residuals from off-site treatment of LANL's waste must return to LANL. If the residuals were no longer RCRA hazardous waste, they could be disposed of at LANL's on-site disposal area for low-level radioactive waste. If the residuals were still subject to RCRA, however, they must be stored until a mixed waste disposal facility on DOE property was available. Such a facility is planned as part of ER work at Los Alamos. This facility is scheduled to be available in late 1997. The DOE order governing disposal of radioactive materials allows LANL to seek a variance from this requirement. The variance would allow the residuals generated by off-site treatment to be disposed of at commercial disposal sites permitted and licensed for mixed waste. The DOE order governing

radioactive waste management is being revised, and the revision may allow disposal of residuals from treatment at commercial facilities without requiring a variance.

To effectively use the capabilities and resources available, LANL will annually evaluate the availability and applicability of off-site treatment of LLMW. The evaluation will identify the capabilities of available commercial and DOE facilities and determine the feasibility of treating LANL waste.

Funding required to complete activities associated with shipping and treating organic liquids at a commercial facility has not been specifically included in the Five-Year Plan for waste management at LANL.

Controlled-air incinerator (CAI). The controlled air incinerator (CAI) is an existing unit built in the early 1970s as an R&D project to demonstrate that standard industrial incineration components could be modified and used to safely treat materials contaminated with TRU nuclides. Between 1976 and 1987, 24 tests, including trial burns under RCRA and the Toxic Substances Control Act (TSCA), were conducted. Based on the performance of the system, the CAI was granted a TSCA permit in 1986 and a RCRA Part B Permit to treat hazardous waste in 1989.

Waste handled. The CAI was designed to treat solid, combustible waste but can treat both solid and liquid waste. The unit is equipped to treat liquid waste by injecting these materials directly into the primary chamber of the incinerator. Solid waste must be packaged in a 1-ft x 1-ft x 2-ft cardboard box. Each box will be placed in an airlock, moved through a glovebox, and fed into the primary chamber by a hydraulic ram.

The CAI is nominally rated at 1 million Btu/h and can handle up to 100 lb./h of solid waste or 200 lb./h of liquid waste.

Nuclide Contamination. The CAI has some limitations. It is designed to treat waste contaminated with TRU nuclides but can also treat waste contaminated with other radionuclides, including small quantities of volatile radionuclides (carbon-14 and tritium). The WAC will limit the quantities of volatile radionuclides to minimize impacts on the environment. The RCRA Part B permit for the system prohibits the treatment of Freon-11, Freon-12, and tribromomethane except in trace amounts.

Noncombustible Materials. Treatment of noncombustible materials, including contaminated soil, is restricted because of the fixed-hearth design of the CAI. Solvent-contaminated vermiculite cannot be treated because the vermiculite is an insulator and prevents the ash mass on the hearth floor from reaching temperatures required to complete combustion.

Residuals. Residuals from the CAI include bottom ash, scrubber blowdown, activated carbon, and spent high-efficiency particulate air (HEPA) filters. Disposal of residuals

depends on whether they were generated during the processing of characteristic waste or listed waste.

Radionuclides are concentrated in the bottom ash. If the ash meets the definition of TRU waste, it will be immobilized and managed as other TRU waste. If ash from treatment of RCRA characteristic waste is no longer hazardous under RCRA and does not meet the concentration restrictions for TRU, it will be immobilized to meet WAC requirements and disposed of at TA-54, Area G, as LLW. Ash from the treatment of listed RCRA waste will be immobilized and stored until a mixed waste disposal facility is available on-site or off-site.

Filters and spent activated carbon will be encapsulated and disposed of as mixed waste. Scrubber blowdown from treatment of RCRA characteristic waste will be sampled to ensure that the hazardous characteristic has been removed and sent to LANL's existing Radioactive Liquid Waste Treatment Plant for further treatment. Blowdown from treatment of RCRA listed waste will be evaporated, the clean water recycled, and the salts encapsulated for disposal as a mixed waste.

Schedule. Operations were discontinued in 1987 for an upgrade to improve reliability and allow extended operation of the system. The schedule to restart CAI operations is uncertain and depends on the completion of several activities, including

- hiring and training operating personnel,
- completing system upgrades,
- preparing and obtaining approval of safety documentation,
- doing a RCRA trial burn,
- obtaining NEPA approval for operation,
- obtaining approval of a permit modification for mixed waste, and
- successfully completing an Operational Readiness Review (ORR).

Obtaining NEPA approval for operation is the primary uncertainty associated with the schedule for restart of the CAI. DOE is planning to prepare a Site-Wide Environmental Impact Statement (SWEIS) for LANL. The decision to include the CAI in the SWEIS will be made following the Advanced Notice of Intent (ANOI) meetings. A schedule to restart the CAI cannot be made until a decision on the NEPA requirements has been made. A schedule for CAI activities will be prepared after a decision on NEPA requirements.

Funding required to complete activities associated with startup of the CAI and routine operation of the facility has been included in the Five-Year Plan for waste management operations at LANL.

Other options. The following subsection describes potential alternatives to the commercial treatment or use of the CAI. These technologies are in development and may be used if the other options cannot be used or the technologies and capacity are available in a time frame consistent with a decision to treat the waste.

DETOX process. The DETOX process is a liquid phase, iron-catalyzed oxidation process being developed as a alternative to incineration for some waste and as a treatment process to handle certain waste that cannot be processed in the CAI, including vermiculite contaminated with organics and solvents containing elevated tritium and carbon-14. Candidate waste includes ignitable liquids, metal-contaminated oils, chlorinated solvents, and fluorinated solvents. The process does not oxidize rubber or plastics.

The DETOX process uses iron (III) in an acid solution as the primary oxidant, and the iron (II) formed in the oxidation process is converted back to iron (III) by a second catalyzed reaction with oxygen. The primary benefit of the DETOX process is the ability to oxidize organic constituents in a contained reactor at about 250° C and 40 psig. The process is being bench-tested; testing will determine whether the process is a viable alternative to incineration and applies to LANL wastes. Throughput rates for the system will be established as part of the development program. Activities associated with this technology will be done in accordance with a program management plan for treatment skid development, as appropriate. Funding for these activities has been included in the Five-Year Plan for waste management at LANL.

Hydrothermal processing. Hydrothermal processing is a relatively low-temperature destruction technology that destroys most organic compounds and some inorganics. It could, therefore, be used to destroy toxic organic waste and to treat contaminated waste, soil, and sludges.

In a hydrothermal system, water is mixed with waste in relatively low concentrations (<20%) and with a reactant reagent at temperatures between 400-600° C and at pressures between 250-1000 atm. Because these conditions are above the critical point of pure water (374° C and 218 atm), this process is sometimes referred to as supercritical water oxidation.

Under these conditions, water is a fluid with densities high enough that reasonable process throughput can be achieved, but its transport properties are like those of a gas, allowing rapid chemical reaction. Water near the critical point is a unique solvent in which chemical oxidation or reduction can occur at relatively low temperatures, thereby limiting the production of harmful byproducts, such as NO_x and char.

The reaction occurs entirely in an enclosed pressure vessel containing dilute reactants, so the solvent absorbs the heat of reaction, and the temperature can be maintained readily at the desired level. Rapid chemical reaction occurs on the time scale of seconds to minutes; thus, reactor volumes are relatively small.

Development and demonstration of the hydrothermal process is ongoing at LANL. Results of bench-scale tests will determine whether the process is a viable alternative to incineration and applies to LANL waste. The process will be developed in accordance with a program management plan for treatment skid development, as appropriate. Limited

funding for the project has been identified. Additional support will be required to complete the demonstration of this technology.

Inorganic Heterogeneous Debris

Waste Category	Treatability Group	IMWIR ID #	MWIR ID #	RCRA Code	Inventory as of 12/92 (m3)	5-year Generation (m3)	Confidence in Characterization
debris	inorganic heterogeneous debris	2175	W010	F002	21.8	28.3	medium
debris	inorganic heterogeneous debris	2179	W011	F003	2.0	3.0	medium
				Total	**23.9**	**31.3**	

Description of technology and capacity needs. The LDR treatment standards for these waste streams require destruction of the hazardous organic component. Residuals must be handled as if they still contain the hazardous organic due RCRA regulations (mixture and derived-from rule). Therefore, they must meet the LDR restrictions for final disposal. Effluent from liquid residuals must be concentrated, usually by evaporation, and then stabilized. Solid residuals must be stabilized. All stabilized residuals must meet the LDR standards for the particular F-listed waste before land disposal in the RCRA-permitted facility.

Destruction of the hazardous organic component of these wastes requires oxidation. The most readily available oxidation technology is incineration. Alternative methods for oxidation of organics are being developed in the commercial sector and within DOE. These technologies, however, have not been demonstrated for routine treatment of hazardous, radioactive, or mixed waste.

The capacity required for the treatment of these wastes is approximately 20 m^3/y. This estimate is based on the assumption that it will take five years to establish a treatment capacity, five years to treat the back log (current inventory + waste accumulated during duration required to establish treatment capacity), and an annual generation rate of approximately 5 m^3/y.

Preferred option. The preferred option to treat heterogeneous debris contaminated with organic liquids is the CAI, the only demonstrated and available technology. However, several issues must be resolved before treatment using the CAI (see above).

Other options. Because of the uncertainties associated with the operation of the CAI, alternative technologies have been evaluated. The only alternate technology identified for this waste is thermal desorption, a batch drying process that separates organic and other volatile contaminants from solids, soils, and sludges. In the process, the organic contaminants are vaporized under vacuum in an indirectly heated vessel and passed through an off-gas treatment system. Volatile organics are condensed and treated similar

to organic liquids. If designated as debris, solid residues can be disposed of as LLW. Nondebris solids remaining after treatment must meet LDR standards and must be disposed of in a RCRA-permitted facility.

The primary component of this system is a jacketed batch dryer. Heated electrically or with a fuel to a temperature of about 620° F, hot oil, the heat-transfer medium, is circulated through the dryer jacket. The desorption rates of the contaminants are enhanced by operating under vacuum, down to 29 inches Hg, and stirring the contaminated solids with an internal agitator or by using a rotating double-cone dryer. Nitrogen at low flow rates may be used to inert the dryer and carry the volatiles through the vapor-handling system.

The vapor-handling system is usually a condensation train consisting of a regular filter, a HEPA filter, a multiple-stage chilled water condenser, and an activated-carbon adsorber. Hazardous organics collected in the vapor-handling system require subsequent destruction. Alternatives for destruction of hazardous organic liquids are described above.

A development and demonstration program for this technology has been initiated through the DOE-AL Mixed Waste Treatment Plan. The Grand Junction Project Office is responsible for this program. Results from the program will be used to evaluate the potential for applying the technology to LANL waste streams.

Plating Waste, Acids, and Bases

Waste Category	Treatability Group	IMWIR ID#	MWIR ID#	RCRA code	Inventory as of 12/92 (m^3)	5-year Generation (m^3)	Confidence in Characterization
process residue - Cr	process residues	2087	W006	D007	0.4	0.7	medium
acids	acidic wastewaters	2066	W013	D002	5.1	1.3	high
caustics	basic wastewaters	2067	W014	D002	1.2	2.3	high
reactive - solutions	uncategorized wastewaters	2069	W015	D003	2.0	3.1	medium
analytical lab waste- As	aqueous labpacks	2076	W016	D004	0.7	0.6	medium
analytical lab waste - Ba	aqueous labpacks	2030	W017	D005	2.5	4.0	high
analytical lab waste - Cd	aqueous labpacks	2085	W018	D006	0.3	0.2	medium
analytical lab waste - Cr	aqueous labpacks	2088	W019	D007	4.6	0.8	high
analytical lab waste - Pb	aqueous labpacks	2095	W020	D008	8.0	11.5	high
analytical lab waste - Se	aqueous labpacks	2140	W022	D010	0.5	0.8	medium
photographic fixer	acidic wastewaters	2142	W023	D011	0.5	0.8	medium
chemical products - arsenic oxide	uncategorized labpacks	2186	W028	P012	0.008	0.013	high

Plating Waste, Acids, and Bases (cont)

Waste Category	Treatability Group	IMWIR ID#	MWIR ID#	RCRA code	Inventory as of 12/92 (m^3)	5-year Generation (m^3)	Confidence in Characterization
chemical products - copper cyanide	uncategorized labpacks	2187	W029	P029	0.017	0.029	high
				Total	**25.84**	**26.06**	

Description of technology and capacity needs. The LDR treatment standards for these waste streams require neutralization or removing the corrosive nature of the waste and stabilizing the toxic metal component. Once treated, the D-listed or characteristic waste will no longer be regulated under RCRA and can be disposed of as low-level radioactive waste. The P-listed waste will require disposal in a RCRA-permitted facility after treatment.

The BDAT for these wastes includes neutralization, chemical oxidation or reduction, precipitation, and stabilization. Waste containing heavy metals will require TCLP testing to demonstrate compliance with the LDR standards.

The capacity required for plating waste, acids and bases is approximately 15 m^3/y. This estimate is based on the assumption that it will take five years to establish a treatment capacity, five years to treat the backlog (current inventory + waste accumulated during duration required to establish treatment capacity), and an annual generation rate of approximately 5 m^3/y.

Preferred option. The preferred option for plating waste, acids and bases is the electroplating waste treatment skid being developed at LANL. This treatment skid provides equipment for inorganic oxidation and reduction reactions and for acid and base neutralization. Although designed to treat electroplating waste, the skid can be used for a variety of wet chemical treatment operations, including cyanide and ammonia oxidation and metals precipitation.

The unit consists of a reactor module, a solids module, an off-gas module, and a utility module. The reactor module is a 500-gal. stirred Kynar-lined reactor that can accept solid or liquid reagents. The reactor is jacketed to allow heating or cooling. A diaphragm pump circulates the contents of the reactor. Following precipitation, the reactor contents are pumped to the solids-handling module through a filter press. Solids collected drop into a drum to which grout is added; the drum is tumbled to mix the grout and solid residual. The off-gas module includes a caustic scrubber to control toxic gases that could be generated when treating cyanides, and HEPA filter to control emissions of radioactive particulates. The off-gas is continuously monitored for toxic gases. The utility module includes a water chiller that cools the reactor.

The water left after treatment can be discharged to the RLWTP if it is not an F waste (cyanide) that will require solidification. An electro-oxidation and electrodeposition cell is

being investigated to pretreat electroplating waste. Successful use of the electrolytic cell would reduce reagent requirements and therefore reduce secondary waste generation. The process is a batch operation. Throughput is a function of the batch size and the chemistry.

Final design of the electroplating waste skid has been completed and a RCRA permit application submitted. The skid will be constructed as soon as the permit is granted. Funding for this skid has been included in the Five-Year Plan for waste management at LANL.

Other options. An alternative to the electroplating waste skid is evaporative oxidation. This technology is designed to treat aqueous waste streams with volatile organic and inorganic compounds and such nonvolatile dissolved inorganic contaminants as heavy metals and radionuclides. By combining evaporation and vapor catalytic oxidation, the process concentrates the nonvolatile contaminants into a thick liquor or slurry and destroys the volatile organic compounds. The aqueous waste is concentrated in an evaporator by boiling off most of the water and the volatile compounds. Air or oxygen is added to the vaporized fraction and then forced through a fluidized catalyst bed, where the organic and inorganic compounds are oxidized. The off-gases, composed mainly of water and small amounts of acidic gases from destruction of halogenated compounds, are passed through a scrubber and a condenser. The clean gas is vented.

A proven evaporator design for this application is a single-stage forced-circulation evaporator. The liquid concentrate is heated by forcing it through a low-pressure steam heat exchanger and into the vapor body of the evaporator, where water and volatiles boil off at near-atmospheric pressure. This system can concentrate the nonvolatiles to 20 to 50 times the feed concentration level. The oxidizer is composed of a heater and a fluid bed catalytic reactor that operates at a 900° F to 1200° F. The treated vapors are cooled in a heat exchanger, and the acidic gases are scrubbed off before the clean water vapors are condensed and recycled.

A development and demonstration program for this technology has been initiated through the DOE-AL Mixed Waste Treatment Plan. The Grand Junction Project Office is responsible for this program. Results from the program will be used to evaluate the potential for applying the technology to LANL waste.

Gas Cylinders

Waste Category	Treatability Group	IMWIR ID #	MWIR ID #	RCRA Code	Inventory as of 12/92 (m3)	5-year Generation (m3)	Confidence in Characterization
gas cylinders				D001	0.2	0.5	high
gas cylinders				D001	20.1	10.5	high

Gas Cylinders (cont)

Waste Category	Treatability Group	IMWIR ID #	MWIR ID #	RCRA Code	Inventory as of 12/92 (m3)	5-year Generation (m3)	Confidence in Characterization
gas cylinders				D002	0.2	0.5	high
chemical products							
phosgene	inherently hazardous waste	2188	W030	P095	0.8	1.4	high
gas cylinders				P wastes	1.1	3.0	high
gas cylinders				U wastes	0.1	0.5	high
				Total	**22.55**	**16.40**	

*Gaseous wastes listed in this table were omitted from the IMWIR and MWIR.

Description of technology and capacity needs. The LDR treatment standards for the D-listed gaseous waste require removing the hazardous characteristic associated with the specific waste. Treatment standards for the U- and P-listed waste are specific to that particular waste. Generally, the technologies applying to treating gaseous LLMW at LANL include neutralization, scrubbing, and oxidation. Residuals generated by neutralization and scrubbing may require additional treatment. The liquid residuals can be treated similar to corresponding liquid LLMWs.

The capacity required for gaseous LLMW is approximately 10 m^3/y. This estimate is based on the assumption that it will take five years to establish a treatment capacity, five years to treat the backlog (current inventory + waste accumulated during duration required to establish treatment capacity), and an annual generation rate of less than 5 m^3/y.

Preferred option. The preferred option to treat gaseous LLMW is the gas treatment skid. Design of this skid began in mid FY94. The system can perform caustic scrubbing, acid scrubbing, and water scrubbing, or combinations of these process operations. The skid will treat a wide range of compressed gases and will handle both radioactively contaminated gases and nonradioactive gases for which commercial treatment has not been identified. An oxidation treatment process will later be developed to treat nonscrubbable waste gases. Several oxidation treatment processes will be considered.

A separate component to handle gas cylinders is a recontainerization operation for damaged gas cylinders that cannot be safely opened. A recontainerization process skid is being fabricated for delivery in 1994. Gas cylinders are loaded into a pressure vessel, which is sealed and purged. The cylinder is then pierced and the contents released to the pressure container, where they can be sampled and analyzed, then compressed into new cylinder or drawn off for treatment. The recontainerization process is skid mounted for portability and will include a trailer-mounted mobile laboratory for gas analysis. Gas

analysis includes an ion chamber, Fourier transform infrared spectroscopy (FTIR), and mass spectroscopy.

Funding for design and construction of the gas cylinder recontainerization unit and the gas treatment skid has been included in the Five-Year Plan for waste management at LANL.

Other options. The only alternative identified for gaseous waste involves treating applicable waste in the CAI. The BDAT for many of the LLMW gas cylinders is incineration. The CAI could be used to treat this waste. Modifications to the existing facility would be required to process gases. Funding for modification of the CAI has not been included in the Five-Year Plan for waste management at LANL.

3.2 Mixed Waste Streams for which Technology Exists But Needs Adaptation or for which No Technology Exists

This section includes mixed waste that it is believed can be treated to LDR BDAT standards using existing technologies, but the technologies are expected to require adaptation and technology development because of the radioactive component.

Reactive Metals

Waste Category	Treatability Group	IMWIR ID #	MWIR ID #	RCRA Code	Inventory as of 12/92 (m3)	5-year Generation (m3)	Confidence in Characterization
reactives	uncategorized salt wastes	2068	W002	D003	11.3	5.9	high

Description of technology and capacity needs. LANL will develop technology to treat water-reactive metals and metal hydrides. Lithium, lithium hydride, calcium, sodium, and powdered magnesium are candidates for treatment. The LDR treatment standards for reactive metals requires removing the reactive nature of the waste then neutralizing the treatment solution. The neutralized liquid can then be sent to the RLWTP. Once treated, reactive metals will no longer be regulated under RCRA and can be disposed of as low-level radioactive waste.

The capacity required for reactives is less than 5 m^3/y. This estimate is based on the assumption that it will take five years to establish a treatment capacity, five years to treat the backlog (current inventory + waste accumulated during duration required to establish treatment capacity), and an annual generation rate of approximately 1 m^3/y.

Preferred option. The preferred option to treat this waste stream is the reactive metals skid. This simple technology takes advantage of the water reactivity of the waste. The waste is reacted with water under controlled conditions. The metal or metal hydride reacts to form the metal hydroxide and hydrogen. The hydroxide is then neutralized to make a simple salt solution that is discharged to the RLWTP. The hydrogen gas is diluted below flammability limits and vented. The reaction rate is controlled by adjusting the rate

at which waste is introduced to the reactor The process can handle water-reactive metals alloyed with such nonreactive metals as depleted uranium.

Bench-scale work to define the reaction kinetics for lithium hydride is complete, and conceptual and final design of a skid-mounted treatment unit is scheduled for completion in 1994. Throughput of the skid will not be available until the conceptual design is complete. An attempt will be made to size the unit to treat 60 drums of lithium hydride in six months or less, based on operation of eight hours per day. Additional testing is underway to demonstrate the applicability of this process to other reactive metals.

Other options. No other options are identified.

Miscellaneous Waste

Waste Category	Treatability Group	IMWIR ID #	MWIR ID #	RCRA Code	Inventory as of 12/92 (m3)	5-year Generation (m3)	Confidence in Characterization
oxidizers	inorganic nonmetal debris	2193	W001	D001	16.9	27.9	medium
debris - As	uncategorized metal debris	2075	W003	D004	0.2	0.4	medium
debris - Ba	uncategorized metal debris	2079	W004	D005	5.9	9.8	medium
scrap metal - Cd	Cd-contaminated metal debris	2084	W005	D006	3.3	4.9	medium
decon wastes - Hg	inorganic heterogeneous debris	2135	W008	D009	2.1	2.5	medium
scrap metal - Hg	elemental mercury	2136	W021	D009	10.5	11.1	medium
chemical products				P wastes			
labpacks without metals	uncategorized labpacks	2189	W031		0.003	0.005	high
labpacks with metals	uncategorized labpacks	2192	W032		0.001	0.002	high
chemical products				U wastes			
labpacks	uncategorized labpacks	2194	W033		3.6	3.3	high
				Total	**42.51**	**59.86**	

Description of technology and capacity needs. The technologies proposed for treatment of miscellaneous wastes reflect the recommendations in the DOE-AL Mixed Waste Treatment Plan. Under this plan, other DOE-AL sites will do most of the development and demonstration for the specific technologies required to treat these waste streams. These activities will incorporate the characteristics of the LANL waste streams. Favorable demonstrations of these technologies will likely lead to the construction of a treatment

skid. According to the DOE-AL Mixed Waste Treatment Plan, treatment skids built at other DOE-AL sites will be available for transport to LANL to treat waste. Therefore, another DOE-AL site must develop treatment capacity for these wastes.

Waste Category	Preferred Treatment Option	Responsible DOE-AL Site	Alternate Treatment Option	Responsible DOE-AL Site
oxidizers	stabilization	Pantex, TX	hydrothermal	Los Alamos, NM
debris - As	thermal desorption	Grand Junction, CO	none	N/A
debris - Ba	sulfate precipitation	Pantex, TX	none	N/A
scrap metal - Cd	Envirocare	Kansas City, MO	macroencapsulation	Pantex, TX
decontamination wastes - Hg	thermal desorption	Grand Junction, CO	none	N/A
scrap metal - Hg	amalgamation	Pinellas, FL	triple distillation	Los Alamos, NM
chemical products				
labpacks without metals	sort, survey, decontaminate	Grand Junction, CO	plating waste skid	Los Alamos, NM
labpacks with metals	sort, survey, decontaminate	Grand Junction, CO	plating waste skid	Los Alamos, NM
chemical products				
labpacks	DSSI	Kansas City, MO	plating waste skid	Los Alamos, NM

*LANL is responsible for transporting and disposing of cadmium-contaminated scrap metal at the Envirocare facility in Utah. Kansas City will assist LANL by establishing the methodology for these activities for all the DOE-AL sites.
*Mercury from the treatment of waste streams W005 and W033 will be recycled if possible.

Descriptions of these treatment technologies appear in the DOE-AL Mixed Waste Treatment Plan. The MWTP requires that each site responsible for development, demonstration, and implementation of a treatment technology prepare a detailed project management plan (PMP) for completing the activity. These PMPs include schedules, budgets, and resource requirements.

3.3 Mixed Waste Streams Requiring Further Characterization or for Which Technology Assessment Has Not Been Done

The DOE-AL MWTP addresses all LANL LLMWs that have been identified. Characterization data on these waste streams was sufficient to assess technologies and select treatment technologies. The improved characterization activity described in Subsection 2.4 may identify additional waste streams that have not been included in the MWTP. These "new" wastes will result from the more detailed description of the physical, chemical, and radiological characteristics of the waste. "New" wastes will be subsets of the waste streams presented in the MWIR. Differences in key characteristics may require using a treatment technology different from that recommended in the MWTP.

LANL will assess the results of the improved characterization activity by reviewing the information used to select a treatment technology and comparing the waste characteristics and the limitations of the treatment process. Information presented in the DSTP will be revised to reflect the results of the improved waste characterization during the negotiation of the Final Site Treatment Plan.

An exception is dewatered wastewater treatment sludge. This waste is generated from the treatment of radioactive wastewater. The sludge was labeled as an F-listed waste because of the potential presence of solvents in the wastewater entering the treatment plant. Available analytical data indicate that the solvent concentration of the plant influent does not exceed 25 ppm. Administrative controls and additional sampling and analysis have been implemented to guarantee that hazardous waste solvents are not discharged to the wastewater system. Thus, the current generation of the sludge is not a mixed waste.

Waste Category	Treatability Group	IMWIR ID #	MWIR ID #	RCRA Code	Inventory as of 12/92 (m3)	5-year Generation (m3)	Confidence in Characterization
dewatered treatment sludges	cement forms	2144	W009	F001-5	269.8	0.0	medium

A study will determine the disposition of stored sludge that is labeled as mixed waste. The study will consider the options of

- correlating past sampling of influent and sludge with the current sampling as a means of administratively relabeling the sludge,
- sampling and analyzing the sludge as an option for administratively relabeling the sludge, or
- sampling and analyzing the sludge for delisting or meeting *de minimus* levels should the regulation change.

The study will define a plan of action, including a sampling and analysis plan, if required, and a schedule of activities for the preferred course of action identified by the study. If these options cannot be successfully applied, a plan and schedule will be prepared to treat the waste.

4.0 TRU MIXED WASTE STREAMS

4.1 TRU Waste Expected to Go to the WIPP

Waste Streams

Waste Category	IMWIR ID #	MWIR ID #	RCRA Code	Inventory as of 12/92 (m3)	5-year Generation (m3)	Confidence in Characterization
scrap metal - Na	2089	LA-W034	D003	110.1	3.1	medium
debris - Ba	2086	LA-W035	D005	15.0	0.0	medium
process residues - Cr	2091	LA-W036	D007	115.9	0.3	medium
shielding	2100	LA-W037	D008	2050.7	304.0	medium
cemented process sludges - Pb	2103	LA-W038	D008	15.2	21.2	medium
decontamination waste	2159	LA-W039	F001, F002	276.4	238.9	medium

Waste Streams (cont)

Waste Category	IMWIR ID #	MWIR ID #	RCRA Code	Inventory as of 12/92 (m3)	5-year Generation (m3)	Confidence in Characterization
cemented process sludges	2166	LA-W040	D007, F001, F002, F003	183.9	38.3	medium
dewatered treatment sludges	2160	LA-W041	F001, F002, F005	1088.3	0.0	medium
			Total	**3855.5**	**605.8**	

Preferred option. The DOE-wide strategy for managing defense-related TRU waste is eventual disposal at the Waste Isolation Pilot Plant (WIPP). LANL TRU-related activities reflect current DOE-HQ guidance for characterization, storage, and treatment. A TRU waste characterization program satisfies the requirements of the WIPP, and plans for treating TRU waste are limited to those activities required to meet the WAC for the WIPP.

4.2 TRU Waste Not Destined for WIPP

LANL does not currently generate or plan to generate or store nondefense related TRU waste. Therefore, this section does not apply.

5.0 HIGH-LEVEL MIXED WASTE STREAMS

LANL does not currently generate or plan to generate or store high-level mixed waste streams. Therefore, this section does not apply.

6.0 FUTURE GENERATION OF MIXED WASTE STREAMS

The Environmental Restoration (ER) Program at LANL ensures that the environmental impacts associated with past and present activities at the Laboratory are thoroughly investigated and that appropriate corrective action is taken to protect human health and the environment. In meeting this objective, the ER Program must assess, clean up, decontaminate, and decommission sites and facilities at the Laboratory that have been contaminated by hazardous and radioactive waste.

The generation of mixed hazardous and radioactive waste from corrective actions by the ER Program is addressed in this section. Corrective actions may include retrieving waste from confirmed release sites and subsequent disposal in a permitted facility, and decontamination and decommissioning of facilities. The estimates of waste sources, quantities, and types are for the five-year period from 1994 to 1998.

6.1 Environmental Restoration Waste

The ER Program responds to two primary laws: the Resource Conservation and Recovery Act (RCRA), which is the statutory basis for the ER Program, and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), which provides a framework to remediate certain hazardous materials at the Laboratory that are not covered by RCRA. RCRA was amended by the Hazardous and Solid Waste Amendments (HSWA) in 1984. For radioactive and mixed waste, the regulations of the Atomic Energy Act (AEA) also apply.

The volume of waste that will be generated from ER Program voluntary corrective actions or other site remediation activities is uncertain. Most corrective actions will occur after the Mixed Waste Disposal Facility is constructed and ready for operation, which is expected to be in late 1997 or early 1998. Thus, most of the ER mixed waste will not be generated until after the five-year period being considered for the STP.

In response to requests from local property owners, the ER Program gives priority to field work at former Laboratory locations in the townsite, which are no longer owned by the DOE. The program identifies sites for no further action or cleanup under EPA's provisions for voluntary corrective action as early in the process as possible. Up to 1500 m^3 of mixed waste will likely be generated from these voluntary corrective actions. LANL is preparing characterization plans for ER Program activities. Therefore, waste types and specific characteristics of these wastes are not available.

6.2 D&D Waste

DOE/EM established the Laboratory's current D&D Program in 1989 to manage nonoperational, contaminated facilities in accordance with guidelines. The LANL ER and D&D Programs were combined in March 1993. The primary responsibilities of the D&D Program involve facility assessment and cleanup of inactive and surplus contaminated buildings, structures, and equipment not regulated under CERCLA or RCRA. D&D Program subprojects are done according to federal and state requirements and DOE orders applicable to nuclear and other facilities that generate radioactive and/or hazardous materials and waste. Occasionally, preliminary activities may be required, including removing all stored hazardous and radioactive materials, debris, and waste from process areas; identifying material; and isolating and securing equipment.

Currently in the five-year window covered by the Site Treatment Plan, estimated volumes of D&D waste are based on preliminary assumptions. Buildings 2 and 4 South at TA-21, the Phase Separator Pit at TA-35, several wooden structures at TA-16, and the Tritium Facility at TA-33 are scheduled for D&D by FY 1998. Approximately 75 m^3 of low-level mixed waste will likely be generated from D&D of these buildings. Specific characteristics of these wastes will be determined before initiating D&D activities through sampling and analysis.

7.0 STORAGE REPORT

LANL is committed to storing waste in compliance with RCRA storage requirements in 40 CFR 264 or 40 CFR 265 pending the development of treatment capacity and implementation of the Site Treatment Plan. The requirements of 40 CFR 265 have been evaluated. Results showed that LANL complies with the regulation. A permit modification is being prepared and will require that LANL comply with 40 CFR 264 before approval.

Current and future storage capacity for solid and liquid LLMW has been evaluated. Results of this evaluation showed that LANL will have adequate storage capacity if the generation rate for LLMW remains consistent and treatment technologies are brought on line as planned.

8.0 PROCESS FOR EVALUATING DISPOSAL ISSUES IN SUPPORT OF THE STP DISCUSSIONS

8.1 Introduction

This section discusses the overall process developed by DOE to evaluate issues related to disposing of residues from the treatment of mixed low-level wastes (MLLW) subject to the Act. Los Alamos is among the sites being analyzed further under this process for potential development as a disposal site for residues from the treatment of MLLW subject to the Act.

The ultimate identification of sites that may host mixed waste disposal activities will follow state and federal regulations for siting and permitting and will include public involvement in the decision-making and preparation of the appropriate environmental impact analyses in accordance with the National Environmental Policy Act. Moreover, any recommendations about removing sites from further evaluation under this process do not affect environmental restoration decisions by DOE under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) concerning remediation activities.

Mixed waste subject to the Act includes high level waste (HLW) and mixed-transuranic waste (mixed TRU). However, established processes are already being implemented to study, design, construct, and ultimately operate disposal facilities for these wastes (for example, the HLW repository and the Waste Isolation Pilot Project). Currently, however, no active permitted disposal facilities are operated by DOE for residues from the treatment of MLLW.

Previously, the DOE planning baseline included the development of MLLW disposal facilities at the six DOE sites currently disposing of low-level waste: Hanford Site, Savannah River Site, Oak Ridge, Idaho, Nevada, and Los Alamos. Plans to develop these facilities are currently suspended pending the results of this process and the Environmental

Management Programmatic Environmental Impact Statement (EM PEIS) being prepared by DOE. When the process of acquiring permits for these sites begins, along with associated design and radiological performance assessment efforts, some sites may be found to not be desirable for disposal activities. Further, some sites that have not been before considered for disposal activities may be suitable for the disposal of some MLLW residues.

Pursuant to discussions between DOE and the states, DOE developed a process to evaluate options for disposal of the residues from treatment of mixed waste subject to the Act. The sites subject to this evaluation are the 49 sites reported to Congress by DOE in the Mixed Waste Inventory Report, April 1993, as currently storing or expected to generate mixed waste.

This section outlines the process developed by DOE, in consultation with the states, for evaluating options for disposing of residues from the treatment of MLLW. Because DOE is not now developing MLLW disposal sites, preferred alternatives or final destinations for disposal of treatment residues may not be known when the final proposed Site Treatment Plans are submitted to the states and EPA in February 1995. The results of this process will likely be considered during the discussions about development of the Act Site Treatment Plans between DOE and states and among the states themselves.

8.2 Evaluation Process for Disposal Sites to Date

Although the Act does not specifically address disposal of treated mixed wastes, both DOE and the states have recognized that disposal issues are an integral part of treatment discussions. A process was established to evaluate and discuss the issues related to potential disposal of the residues from the treatment of DOE MLLW at the sites subject to the Act. The focus of this process has been to identify, from among the sites currently storing or expected to generate mixed waste, sites that are suitable for further evaluation of their disposal capability. Sites with marginal or no potential for disposal activities will be removed or postponed from further evaluation under this process. Remaining sites will be evaluated more extensively. Ultimately, several sites are expected to be technically acceptable for disposal activities.

Site grouping. The initial step in this process was to examine each of the 49 sites to determine which sites, while individually listed in the Mixed Waste Inventory Report, were in such geographic proximity that further analysis could address them as a single site. This grouping reduced the number of sites to 44, as follows.

- Idaho National Engineering Laboratory and Argonne National Laboratory (West) are within several miles of each other on a single federally owned reservation in Idaho Falls, Idaho, and are considered a single site for further analysis.

- Sandia National Laboratory, Livermore, and Lawrence Livermore National Laboratory are located on adjoining properties in Livermore, California, and are considered a single site for further analysis.

- The Inhalation Toxicology Research Institute and Sandia National Laboratory, Albuquerque, New Mexico, are located on the same federally owned reservation within several miles of each other and are considered a single site for further analysis.

- Oak Ridge National Laboratory, Oak Ridge K-25 Site, and Oak Ridge Y-12 are all within the federally owned Oak Ridge Reservation, in Oak Ridge, Tennessee, and are considered a single site for further analysis.

Initial site screening. The remaining 44 sites were screened against three exclusionary criteria developed by reviewing federal and state laws about the siting of waste treatment, storage, and disposal facilities to determine whether any criteria could be considered exclusionary minimum requirements for hosting disposal activities and could be applied uniformly across sites. At a joint DOE/States meeting in Tucson, Arizona on March 3-4, 1994, it was agreed that to be further evaluated for potential disposal activities, a site must

- not be located within a 100-year floodplain;
- not be located within 61 meters of an active fault; and
- have sufficient area to accommodate a 100-meter buffer zone.

Two of the criteria—100-year floodplain and active fault—are derived from regulatory requirements under RCRA that restrict the location of waste treatment, storage, and disposal facilities. The third criterion—sufficient area for 100-meter buffer—is derived from guidance from the US Environmental Protection Agency, US Nuclear Regulatory Commission, and US Department of Energy about the area required to properly operate such facilities.

Applying the three exclusionary criteria identified 18 sites that did not meet the criteria (Table I). The results were presented at a joint DOE/States meeting in Dallas, Texas, on March 30-31, 1994. It was agreed to remove the 18 sites from further evaluation and that DOE would collect additional site-specific information on the remaining 26 sites to identify the strengths and weaknesses for disposal activities (Table II). DOE and any affected states may propose additional sites for elimination from further evaluation after reviewing the site-specific information and further discussions.

26-site evaluation. DOE and the states met on July 26-27, 1994, in Denver, Colorado, to discuss the site-specific information on the 26 sites and to consider proposals to eliminate sites from further evaluation. The discussions identified sites suitable for further evaluation of their disposal capability. Sites with marginal or no potential for disposal activities would be removed or postponed from further evaluation under this process. From the meeting, DOE and the states agreed that the following sites would be eliminated from further evaluation because of their limited potential for disposal activities.

Site	State
Energy Technology Engineering Center	California
General Atomics	California
General Electric Vallecitos Nuclear Center	California
Pinellas Plant	Florida
Site A/Plot M	Illinois

DOE and the states further agreed that because of its geographic proximity, the Knolls Atomic Power Laboratory at Niskayuna, New York, would be merged with the Knolls Atomic Power Laboratory at Kesselring, New York, for further analysis. DOE and the states also agreed that the following sites, although not eliminated from further evaluation, would be given a lower priority for further evaluation:

Site	State
Weldon Spring Remedial Action Project	Missouri
Brookhaven National Laboratory	New York
Mound Plant	Ohio
Bettis Atomic Power Laboratory	Pennsylvania

Sites with a lower priority for further evaluation had issues requiring consideration, including whether the technical abilities of the site were adequately known, the volume of mixed waste that could be generated by the site, and whether other arrangements for disposal of the sites' mixed waste were adequate.

DOE and the states agreed to further evaluate these sites for their ability to dispose of their own mixed waste on-site only if no other options for disposal of their wastes could be identified in the evaluation process. In no case would these sites be considered as a disposal option for wastes from other sites, and they can be eliminated from further analysis if sufficient information suggests that their potential for disposal activities is too limited.

8.3 Next Steps in the Evaluation Process for Disposal Sites

For the sites not eliminated from further evaluation or assigned a lower priority for evaluation, a more technically detailed performance evaluation will be done to increase the understanding of the strengths and weaknesses of a site's potential for disposal activities and to better identify what disposal activities could or could not occur at a site. A configuration analysis—risk, cost, transportation—will also be prepared, and a final set of sites will be identified as disposal options that can technically dispose of some waste. In concert with the public and pursuant to the National Environmental Policy Act, DOE officials will then identify those sites that will be further evaluated for potential development as disposal sites. States and regulators will collaborate on permitting and

preparing performance assessments in accordance with regulations for radioactive waste management.

Performance evaluation. The performance evaluation at each remaining sites will entail collecting site-specific data about the natural surroundings, geotechnical setting, groundwater and surface water characteristics, and other factors related to the disposal capabilities of each site. This information will then be used to evaluate the sites and determine what types and quantities of waste could be disposed at a given site. The performance evaluations will begin in August 1994 and will be completed by February 1995. The 16 sites being carried forward for this analysis are:

Site	State
Lawrence Livermore National Laboratory, Site 300	California
Rocky Flats Plan	Colorado
Idaho National Engineering Laboratory	Idaho
Argonne National Laboratory	Illinois
Paducah Gaseous Diffusion Plant	Kentucky
Nevada Test Site	Nevada
Los Alamos National Laboratory	New Mexico
Sandia National Laboratory	New Mexico
Knolls Atomic Power Laboratory - Kesselring	New York
West Valley Demonstration Project	New York
Fernald Environmental Management Project	Ohio
Portsmouth Gaseous Diffusion Plant	Ohio
Savannah River Site	South Carolina
Oak Ridge Reservation	Tennessee
Pantex Plant	Texas
Hanford Site	Washington

Configuration analysis. Through the Draft EM PEIS being prepared by DOE, the potential cost, risks, transportation, and other environmental impacts of using each of the remaining 16 sites for some level of disposal activity will be analyzed. This analysis is currently scheduled to be released for public review and comment in late 1994 or early 1995.

Site limitations analysis. After public comment on the Draft EM PEIS and completion of the performance evaluations on the remaining 16 sites, DOE will work with the states and public to develop estimates of the quantities and types of waste that could be disposed at the 16 sites. The results of these two analyses may indicate that some of these sites are not suitable for further analysis.

Final EM PEIS. Although the final proposed Site Treatment Plans are being prepared and following their submission by DOE to the states and other regulators, the individual states and DOE will likely enter discussions about what wastes will be treated at which

sites. As a part of these discussions, some arrangements may likely be established between DOE sites and states handling any future disposal activities. DOE expects that the information supplied throughout this process will be used in those discussions. Likewise, DOE expects that the Final EM PEIS analyses will encompass the range of discussions and arrangements under consideration.

Post-compliance order activities. By October 1995, when compliance orders are likely to be issued under the Act, discussions among states and DOE sites about disposal of the residues from treating mixed waste may not completed. A Record of Decision under the EM PEIS about disposal activities may be delayed to allow discussions to continue further. When a Record of Decision is issued, it will identify preferred sites to be recommended for further development as disposal facilities.

Post-record of decision activities. After a Record of Decision is issued under the EM PEIS on disposal activities, DOE sites will, as appropriate, initiate site-specific Environmental Impact Statements on the proposed disposal facilities, initiate performance assessment processes in accordance with radioactive waste management regulations, and collaborative with the states and other regulators to begin processes to permit disposal facilities.

Table I. Sites Eliminated in Initial Screening

SITE	Exclusionary Criteria		
	100 meter buffer	100-year floodplain	Active fault
California			
Lawrence Berkeley Laboratory	•		
Laboratory for Energy-Related Health Research	•		
Mare Island Naval Shipyard (a)		•	
Colorado			
Grand Junction Project Office		•	
Connecticut			
Knolls Atomic Power Laboratory, Windsor	•		
Hawaii			
Pearl Harbor Naval Shipyard (a)		•	
Iowa			
Ames Laboratory	•		
Maine			
Portsmouth Naval Shipyard (a)		•	
Missouri			
Kansas City Plant		•	
University of Missouri	•		
New Jersey			
Middlesex Sampling Plant	•		
Princeton Plasma Physics Laboratory	•		
New York			
Colonie Interim Storage Site	•		
Ohio			
Battelle Columbus Laboratory	•		

SITE	Exclusionary Criteria		
	100 meter buffer	**100-year floodplain**	**Active fault**
Ohio (cont)			
RMI Titanium, Inc.	•		
South Carolina			
Charleston Naval Shipyard (a)		•	
Virginia			
Norfolk Naval Shipyard (a)		•	
Washington			
Puget Sound Naval Shipyard (a)		•	
• Site fails criteria (a) Site may be in coastal high-hazard area			

Table II. 26 Sites Remaining after Initial Screening

State	Sites
California	Energy Technology Engineering Center General Atomics General Electric Vallecitos Nuclear Center Lawrence Livermore National Laboratory, Site 300
Colorado	Rocky Flats Plant
Florida	Pinellas Plant
Idaho	Idaho National Engineering Laboratory
Illinois	Argonne National Laboratory Site A/ Plot M
Kentucky	Paducah Gaseous Diffusion Plant
Missouri	Weldon Spring Remedial Action Project
Nevada	Nevada Test Site
New Mexico	Los Alamos National Laboratory Sandia National Laboratory
New York	Brookhaven National Laboratory Knolls Atomic Power Laboratory - Kesselring Knolls Atomic Power Laboratory - Niskayuna West Valley Demonstration Project
Ohio	Fernald Environmental Management Project Mound Plant Portsmouth Gaseous Diffusion Plant
Pennsylvania	Bettis Atomic Power Laboratory
South Carolina	Savannah River Site
Tennessee	Oak Ridge Reservation
Texas	Pantex Plant
Washington	Hanford Site

APPENDIX

Methodology Used to Select Preferred and Alternate Options to Treat Low-level Mixed Waste at Los Alamos National Laboratory

This appendix summarizes the methodology used to select the preferred and alternate options presented in the Draft Site Treatment Plan (DSTP) for treating low-level mixed waste at Los Alamos National Laboratory (LANL). A more detailed explanation of the process used by the DOE-AL Treatment Selection Team (TST) appears in the Mixed Waste Treatment Plan (MWTP).

DOE-AL formed the TST in October 1993. The team was composed of representatives of the Grand Junction Project Office, the Pantex Plant, Sandia National Laboratories, Los Alamos National Laboratory, DOE-AL (two members), and a subcontractor. The TST prepared the methodology used in the LANL DSTP, executed the activities identified in the methodology, and prepared the MWTP.

The methodology employed by the TST was based on the following decision sequence;

- define the problem;
- determine what is given to work with;
- determine a basis for solution; and
- solve the problem.

Step 1. Define the Problem

To define the problem, the TST prepared fact sheets on the waste streams at each of the nine DOE-AL sites. The fact sheets were compiled based on face-to-face discussions with waste management personnel at each site. Information obtained during the discussions was maintained using written descriptions (fact sheets), as opposed to a data base, to establish a visual picture of individual waste streams. This picture was needed to accurately define treatment requirements.

Step 2. Determine What Is Given to Work With

To determine what was given, he TST prepared fact sheets in the following areas:

- site descriptions,
- site capabilities and constraints,
- capabilities and constraints of off-site treatment facilities,
- regulatory requirements, and
- technologies.

Step 3. Determine a Basis for Solution

The basis for solution was the selection of preferred and alternate treatment options for specific waste streams. The selection was made by first establishing treatability groups. A baseline technology was selected for a given waste stream. The characteristics (visual picture) of additional waste streams were compared with the baseline technology. Treatability groups were defined as those waste streams that could be treated by the baseline technology.

The TST recognized that the baseline technology for a given treatability group was not necessarily the best technology available. Alternative technologies were identified and compared with the baseline technology. The comparison used was based on common sense (that is, engineering judgment), and the alternative technologies were graded as being better or worse than the baseline technology. The criteria used in rating the alternative technologies included

- meet the intended function and satisfy regulatory requirements;
- are safe to workers, the public, and the environment;
- minimize risk and have a high potential for success;
- are simple, reliable, and easy to implement;
- are scalable to meet expected volumes; and
- minimize the volume and toxicity of secondary waste.

Technologies selected to solve the problem of LLMW treatment capacity were then selected. The process used to select technologies included identifying the following:

- Unavoidable Technologies - those technologies that were required regardless of other technologies selected (residue stabilization, waste water evaporation, etc.),
- No-Alternative Technologies - those technologies for which no alternative was identified,
- Obvious Choices - those technologies that were clear winners (that is, technologies that were rated in the top two for more than one treatability group or that were well along in development); and
- Selected Technologies - those technologies that were rated high and had a clear need identified.

Step 4. Solve the Problem

The plan for solving the problem of LLMW treatment capacity at LANL and throughout the DOE-AL complex is the MWTP, which

- establishes which technologies must be developed
- establishes the scale at which they should be built, and
- identifies an organization, one of the DOE-AL sites, that is responsible for bringing that capacity on line.

DOE-AL has established the Mixed Waste Treatment Program and has appointed the Grand Junction Project Office (GJPO) as the Overall Manager of the program. The program gives the sites the framework to complete its assigned projects. Several working groups have also been established to address issues associated with the MWTP. The MWTP will use the resources of the nine DOE-AL sites to implement treatment capacity for LLMW while minimizing time and overall cost. The program leverages resources outside those of individual sites and establishes a methodology to satisfy the requirements of the Federal Facilities Compliance Act.