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Waste Minimization and Pollution Prevention Awareness Plan

APRIL 1994

Compiled by

Waste Minimization Project

Lawrence Livermore National Laboratory

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MASTER

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1.0 INTRODUCTION/BACKGROUND

1.1 Purpose of Plan

The purpose of this plan is to document Lawrence Livermore National Laboratory (LLNL) projections for present and future waste minimization and pollution prevention. The plan specifies those activities and methods that are or will be used to reduce the quantity and toxicity of wastes generated at the site. It is intended to satisfy Department of Energy (DOE) requirements, as specified by DOE Order 5400.1.

1.2 Overview of LLNL Activities

Pollution prevention and waste minimization activities at LLNL are performed both by the Environmental Protection Department's (EPD's) Waste Minimization Project (WMP) as well as by the Lab's programs. Plans and budgets for the site-wide program administered by WMP are addressed in Section 6.0. The programs' plans and budgets are addressed in Section 7.0 and assume that funding levels shown will be provided to carry out this program. Significant changes in total program funding will result in plan changes. The Nonproliferation, Arms Control, and International Security (NAI) Directorate was included in the 1992 plan update; however, it is not producing significant wastes and is therefore not included in this plan. Budgetary projections through 1999 are now required in the plan. Lab pollution prevention activities reflect plan goals and policies for waste minimization and an ongoing effort to incorporate pollution prevention and waste minimization into the site's operating philosophy.

In accordance with DOE policy, a hierarchical approach to waste minimization has been adopted and is applied to all types of waste. Waste minimization will be accomplished, when possible, through source reduction. Where source reduction cannot be effectively implemented, the waste will be recycled (i.e., reused or reclaimed). A higher priority will be given to on-site versus off-site recycling methods. Whenever possible, "closed loop" recycling of the material within the process that generates it will be used. Any remaining process waste will be treated to reduce its volume, toxicity, or mobility before storage or disposal.

1.3 Scope of Program

A pollution prevention program is an organized, comprehensive, and continual effort to systematically reduce waste generation. The program works to eliminate or minimize pollutants released during the Laboratory's operation. The purpose is to protect public health and the environment as well as to

- Reduce waste management and compliance costs.
- Reduce resource usage.
- Improve product yields.

- Reduce or eliminate inventories and releases of hazardous chemicals reportable under the Emergency Planning and Community Right-to-Know Act (EPCRA).
- Reduce the Laboratory's exposure to civil and criminal liability under existing environmental laws.
- Initiate use of recycled materials, in compliance with Executive Order 12780, "Federal Agency Recycling and the Council on Federal Recycling and Procurement Policy."
- Keep the Lab in compliance with all federal and state statutes and DOE orders and directives.

This plan is a reference tool and guidance document for DOE and LLNL managers, operations personnel, and support staff. It contains the policy, objectives, strategy, and support activities of the WMP. The document will be used to raise employee awareness of waste minimization techniques and train them to reduce waste while meeting program requirements for quality, productivity, safety, and environmental compliance.

This plan will be available to LLNL employees and site contractors, as well as to the outside community. The policy, goals, objectives, and strategy of the plan will be communicated to all employees.

2.0 POLICY

2.1 Policy Statement

The DOE policy regarding waste minimization is summarized in the following mission statement from the 1993 Waste Minimization/Pollution Prevention Crosscut Plan:

"The Department of Energy (DOE) Waste Minimization/Pollution Prevention (WMin/PP) mission is to reduce generation and release of DOE multi-media wastes and pollutants by implementing cost-effective waste minimization and pollution prevention technologies, practices, and policies with partners in government and industry while conducting the Department's operations in a regulatory compliant and environmentally sound manner."

On February 27, 1989, John Nuckolls, the Laboratory Director issued the following policy statement regarding waste minimization at LLNL:

"It is important that the Laboratory make a strong commitment to waste minimization—particularly to hazardous and radioactive waste minimization. Our goal is to reduce the Laboratory's hazardous/radioactive waste streams by a major factor in the next three to five years by reducing generation and increasing recycling. We will implement an incentive system where each laboratory program will pay the costs associated with the handling and disposal of its waste. Each program will establish waste minimization goals and develop plans and assign responsibility for achieving these goals. Waste minimization will be incorporated in the design of new projects."

The LLNL Waste Minimization Project (WMP) has been and will continue to work toward meeting the goals and missions in the above statements.

2.2 Statement of Management Commitment

To ensure that the objectives of the *Waste Minimization and Pollution Prevention Awareness Plan* are met, Laboratory management is totally committed to implementing source reduction and recycling, as well as required employee awareness and training activities.

While many approaches are planned for reducing waste, we will prioritize our activities according to EPA's Environmental Management Hierarchy (see the *Facility Pollution Prevention Guide*, May 1992, EPA/600/R-92/088) in which primary focus is on preventing pollution through source reduction and closed-loop recycling. These approaches eliminate the need for off-site recycling,

treatment, or disposal. Prevention near the source is typically less expensive than collecting, treating, and disposing of wastes. It also minimizes the risk to employees, the surrounding community, and the environment, as well as eliminating the liabilities to the Laboratory associated with transporting waste and disposing of it in landfills that may leak.

The Director of the Laboratory, as well as its Associate Directors and members of its Environmental, Safety and Health (ES&H) Working Group are committed to meeting DOE directives concerning pollution prevention, as well as those contained in federal and state statutes. To meet these requirements, LLNL must seriously commit personnel, budget, training, and equipment. Lab employees from "grass roots" through upper management must be involved, as well as Laboratory contractors and supplementary labor.

3.0 ORGANIZATION AND STAFF RESPONSIBILITIES

Description of LLNL's Pollution Prevention Organization

Responsibilities for ES&H and the programmatic activities of the Laboratory start with the Director and are delegated to Associate Directors and Program Leaders. Pollution prevention and waste minimization are included in these responsibilities.

The Waste Minimization Project (WMP) is part of the Operations and Regulatory Affairs Division of the Environmental Protection Department within the Plant Operations Directorate. The WMP is charged with providing pollution prevention coordination and guidance, as well as cost and waste generation accounting. In addition, the WMP monitors the progress of Lab pollution prevention efforts and offers technology information transfer and engineering support for the LLNL pollution prevention effort. The WMP is also responsible for establishing a pollution prevention awareness program and providing guidance to ensure that LLNL is in compliance with federal and state regulations associated with pollution prevention. The WMP interacts Lab-wide via the Waste Minimization Steering Committee (WMSC), through the ES&H Working Group, and through contacts with the individual program waste minimization committees and coordinators. The WMP also interacts directly with generators to help carry out assessments, assist in technical and economic feasibility studies, and facilitate technology transfer. Figure 3.1 shows this structure.

The LLNL pollution prevention organizational structure is designed to maximize the dissemination and collection of pollution prevention information and to provide waste generating organizations with the necessary data to develop, design, construct, and implement pollution prevention projects.

Waste Minimization Steering Committee (WMSC)

The WMSC, which is chaired by the Head of the Environmental Protection Department, is composed of representatives from each of the directorates and programs. The WMSC serves as a forum for communicating pollution prevention information and data and for discussing regulatory requirements. It also helps to develop and recommend waste minimization policies at LLNL. The Waste Minimization Project Leader serves as the Secretary of the WMSC and leads most of its meetings.

Other functions of the WMSC include, but are not limited to, identifying tasks that implement pollution prevention, reviewing DOE and LLNL policies and federal and state regulations, and exchanging data on Lab-wide and program-specific waste minimization projects.

Figure 3.1. Waste minimization and pollution prevention structure for LLNL

The responsibilities of the WMSC members are to

- Support pollution prevention program (in accordance with DOE Order 5400.1).
- Communicate waste minimization and pollution prevention objectives to Lab programs and personnel.
- Obtain waste generator support and input for the WMP.
- Facilitate integration and coordinated interaction between the activities of waste generators, WMP personnel, and other laboratory employees.
- Sponsor ongoing employee awareness and training.
- Recommend options for management policies and waste reduction implementation.
- Monitor the progress of pollution prevention at LLNL.
- Facilitate technology transfer and pollution prevention awareness.

Waste Minimization Coordinators

Directorates that are large generators of hazardous wastes have waste minimization coordinators and/or waste minimization committees. They are made up of mid-level managers and/or technical staff. The responsibilities of the committees and coordinators include taking part in process waste assessments, identifying targets of opportunity, and facilitating the implementation of pollution prevention measures. In addition, the committee members sometimes take part in supplying data on hazardous materials usage, waste streams, and generating processes.

During 1992, all directorates that conduct operations at Site 300 signed a Memorandum of Understanding that designated the Defense Systems/Nuclear Design Directorate as the lead organization for waste minimization activities at this site.

ES&H Working Group

The ES&H Working Group guides the ES&H program at LLNL. It performs this function by

- Helping to identify, resolve, and as appropriate, elevate to senior management policy and implementation issues concerning environmental protection, safety, health, and related quality assurance.
- Communicating policy, implementation strategy, and guidance on ES&H and related quality assurance.
- Providing a forum for program input and development of recommendations.

This Charter was approved by the Senior Management Council on March 4, 1994.

4.0 GOALS

The University of California Contract Performance Measures require the following activities: Jointly, DOE/OAK and the Laboratory will select three of five process waste streams that were the highest generators of waste (hazardous, radioactive, or mixed) for calendar year 1993. The Laboratory will reduce the waste generation rate of these three streams by 5% in Calendar Year 1994. In addition, the Laboratory will decrease the aggregate weight of all waste generated sitewide (including nonhazardous solid waste) by 10% in Calendar Year 1994, using 1993 as a baseline year.

The California Integrated Waste Management Act of 1989 (AB 939) requires counties to reduce solid waste 25% by 1995 and 50% by 2000 using 1990 as a baseline. Assembly Concurrent Resolution 149 requests the University of California to participate in meeting AB 939 goals. Because of DOE's policy of complying with all local, state, and federal regulations, the reduction goals of AB 939 are considered to apply to LLNL. These goals will be met through a combination of source reduction and recycling.

Procurement of recovered materials in accordance with Executive Order 12873 will be attained to the maximum extent feasible.

All chemicals used at LLNL that meet the reporting threshold established in the Emergency Planning and Community Right-to-Know Act (EPCRA) will be minimized so that their release and off-site transfer will be reduced by at least 50% by the end of 1999, using 1995 as a base year. In the future, usage information will come from LLNL's Chemical Tracking Project.

5.0 SITUATION ANALYSIS

5.1 Current Situation

Most LLNL organizations have implemented some pollution prevention activity and several have accomplished significant reductions. LLNL programs recognize and encourage pollution prevention as an integral component of Laboratory activities. However, diminishing resources and increasing ES&H requirements have made it difficult for programs and support organizations to fully implement pollution prevention programs because the pollution prevention program must compete with other environmental programs that have more stringent legal requirements. LLNL pollution prevention activities have proceeded despite these overall budgetary restrictions and a lack of sufficient funding from DOE to implement waste reduction activities. Further success is dependent on higher levels of funding support from DOE line organizations.

5.2 Program Directives

Regulatory drivers of pollution prevention and waste minimization activities, implementations, and documentation include the following:

Federal

- Resource Conservation and Recovery Act
- Clean Air Act
- Clean Water Act
- Pollution Prevention Act of 1990

State

- Hazardous Waste Source Reduction and Review Act of 1989
- Integrated Waste Management Act of 1989 (see Section 4.0)

DOE Orders

- 5400.1
- 5820.24

Other

- University of California Contract Performance Goals (see Section 4.0)

5.3 Relevant Site Directives or Guidance

LLNL has developed approximately 70 process waste assessments (PWAs) that analyze specific mechanisms of waste generation and alternatives for reducing that generation. In FY 1994, the Waste Minimization Project plans to perform 30 to 40 more PWAs, which will include detailed plans and budgets for waste reduction. These PWAs will be of great benefit in implementing the goals of the *Waste Minimization and Pollution Prevention Awareness Plan*.

5.4 Barrier Analysis

The major system barrier to maximum effectiveness is that DOE has assigned waste minimization responsibility to its line organizations but has only established funding for these efforts through its EM program. However, the waste minimization funding provided by EM can only be spent on planning and reporting activities and not on implementation.

U.S. industry has been successful at waste minimization where it has recognized the economic advantages. In order for the next level of waste minimization accomplishments to be realized, funding mechanisms and economic incentives must be established for the DOE line organizations.

5.5 Planning Assumptions

Plans for FY 1995 activities were formulated assuming a budget of \$1365K, which was the figure that DOE/OAK communicated to the WMP that they hoped to give it, their budget permitting. The target level on the FY 1995 ADS, however, is \$900K. If WMP were to receive less than \$1365K, it could not perform many of the planned activities discussed in Section 6.0. Target funding levels were used for the years FY 1996 through FY 1999.

It is also assumed that the Waste Minimization Project (WMP) will have hired two additional permanent technical staff members by the end of FY 1994; if we cannot do this, certain activities, particularly those related to planning source-reduction and recycling projects, will have to be partially curtailed.

5.6 Strengths and Weakness

LLNL is progressing significantly in reducing waste of all types and to all media, including emissions to the atmosphere. In addition, because of LLNL's excellent laboratory facilities, the WMP and the programs can analyze and evaluate new pollution prevention technologies and develop related measurement equipment.

6.0 SITE-WIDE PROGRAM ELEMENTS

Each of the program elements listed in the accompanying tables are described briefly below.

6.1 Organization and Infrastructure

Besides overseeing its own activities, the Waste Minimization Project (WMP) works with other LLNL ES&H teams and leads a site-wide Waste Minimization (WMin) Steering Committee, which coordinates directorates' WMin activities. In addition, the WMP works with the local DOE Operations Office and DOE Headquarters to ensure that DOE information and policy is conveyed to site generators and other ES&H functional committees.

This program element also includes the day-to-day management of WMP personnel, including hiring and performance appraisal.

6.2 Program Development

The WMP is developing and continuing a waste minimization program that updates the waste minimization and pollution prevention (WMin/PP) site plan, incorporates a site WMin/PP policy statement into program objectives, and establishes quantitative goals to measure waste minimization progress. In addition, program development duties include developing activity schedules for specific tasks and projects, formulating budgets for site programmatic activities, integrating WMin/PP practices into site operating procedures, and assigning trained personnel to develop and implement the site WMin/PP program. Program development activities also include incorporating DOE quality assurance policies, objectives, methods, and metrics into waste minimization plans, actions, and site activities.

6.3 Employee Involvement

The WMP is developing an awareness of and participation in WMin/PP activities among LLNL employees. Efforts to increase employee awareness include publicizing WMin/PP progress and technologies in *Newsline* and other site publications and developing and updating employee general WMin training. Efforts to increase employee participation include recognizing their accomplishments in *Newsline* and other Lab periodicals, rewarding waste minimization activities and ideas with awards and trips to relevant conferences and workshops, involving LLNL employees in waste minimization activities on a day-to-day basis, and providing technical design and planning services to help actualize employees' waste minimization ideas. WMP also helps in planning and executing an annual Earth Day Fair in which LLNL activities are communicated to employees as well as members of the surrounding community.

6.4 Tracking

The WMP tracks generation rates of hazardous, radioactive, mixed, and nonhazardous solid wastes. Tracking hazardous, radioactive, and mixed-waste is done by building, directorate, account number, and state and federal waste codes. These waste generation databases serve as "scorecards" to show how well LLNL's pollution prevention activities are working and are the bases for preparing the *Annual Report on Waste Generation and Waste Minimization Progress* for DOE. Data from any of the fields can be quickly downloaded and has proved helpful to generators who are building waste minimization programs. The databases are also needed to track progress in meeting University of California Performance Measure goals. The LLNL Chem Track group tracks use of chemicals from the time they enter the Lab until they become wastes. The WMP works closely with their effort.

Future plans for improving these tracking systems include: tracking waste handling, disposal, and other waste management costs; establishing quality control for data entry; and improving waste requisition data in order to create better waste minimization data.

In addition to these tracking systems, the WMP is maintaining a database to track progress in substituting environmentally friendly cleaning solvents for CFCs and chlorinated chemicals used in LLNL's shops and laboratories.

6.5 Reporting

All WMin/PP compliance reporting activities and requirements are fulfilled. In addition, all WMin/PP Headquarters and Operations Office reporting requirements, including the *Annual Report Waste Generation and Waste Minimization Progress*, which involves preparing waste generation baselines and current generation rates are completed. The many requests for information from Headquarters and the Operations Office, as well as from local, state, and federal agencies, are all responded to. All of these requests are thoroughly reviewed before leaving LLNL and are among the major activities of the WMP, requiring a significant fraction of its budget.

6.6a. Establish Site-Wide Source Reduction Programs for Hazardous, Mixed-, and Radioactive Wastes

Based on waste generation data, the WMP evaluates source-reduction options and develops procedures to reduce the use of toxic chemicals, identifying, testing, and substituting chemicals and materials that will be less hazardous to LLNL employees and to the surrounding environment (e.g., WMP's alternative solvents program). The WMP will also work to enhance process efficiencies so that lower volumes of toxic feed materials are required and less hazardous waste is generated.

6.6b. Establish Site-Wide Recycling Programs for Hazardous, Mixed-, and Radioactive Wastes

Based on the waste generation data, WMP evaluates both on- and off-site recycling options. Working with other Lab groups such as the Environmental Protection Department's (EPD's) Permits and Regulatory Affairs Group (PRAG) and the Environmental Operations Group (EOG) and with local, state, and federal agencies, the Lab classifies on-site recycling projects as "recycling product chemicals" before they are classified as "waste" or "recycling of hazardous waste." Regulatory requirements for this latter category are more rigorous and more expensive to comply with. We are currently examining solvents used in the plastics shop and oily wastes from vehicles.

Vendors are identified and evaluated for off-site recycling contracts. Waste streams currently being disposed of are evaluated for their recycling potential and recycled wherever possible. Examples of current evaluations include waste waters from photoprocessing, floor stripping, and electronic fabrication.

6.6c. Establish and Maintain Site-Wide Reduction and Recycling Programs for Sanitary Waste Streams

White paper recycling was established several years ago, and we are looking for ways to increase Lab personnel's voluntary participation in this program. Also, colored paper recycling is being evaluated for possible program inclusion. Cardboard recycling, currently very limited in scope, is also being evaluated for expansion. Moving-box reuse, Christmas-tree recycling, and surplus-food reuse programs were established earlier this fiscal year. Other projects being analyzed for possible implementation include cafeteria plastic-waste reduction, plastic recycling, and LLNL telephone book recycling.

6.7. Technical Assistance

The WMP assists LLNL generators in defining and planning waste minimization activities. The WMP staff also help generators to assess waste-producing processes, develop options for WMin improvements, develop cost schedules and returns on investment for those improvements, and establish which improvements are the most beneficial to implement.

6.8. Information and Technology Exchange

The WMP offers presentations and one-on-one consulting to many groups at LLNL regarding pollution prevention technologies and approaches for reducing wastes. Also, pollution prevention information is presented at different directorates' periodic waste minimization meetings (Chemistry and Material Sciences, Lasers, and Plant Operations hold such meetings.) as well as at the monthly Waste Minimization Steering Committee that WMP organizes, and

which includes WMin coordinators from all directorates. WMP also regularly presents pollution prevention data and information to the ES&H Working Group, which reports to the Director of LLNL. Finally, WMP maintains a library of pollution-prevention-related articles and vendor information.

To foster information exchanges with other DOE organizations, WMP regularly attends and presents papers at both Environmental Restoration Waste Management's (ERWM's) and Defense Project's (DP's) biennial pollution prevention conferences, as well as at the Bay Area's DOE WMin Coordinators' meetings. The WMP is planning a series of articles for the DP newsletter, *Pollution Prevention Advisor*, which is circulated throughout the DOE complex.

To foster outreach to the non-DOE community and improve public relations, WMP regularly attends meetings of such groups as the Integrated Waste Management Board (concerned with solid-waste reduction issues) and the Government Organizations Roundtable. Some of WMP's articles for *Newsline* are also released to outside newspapers. In addition, WMP speaks at non-DOE professional conferences such as solvent substitution conferences, Hazmacon, and those of the Chemical Manufacturer's Association.

6.9. Program Evaluation

Working with EPD management and the ES&H Working Group, the WMP has developed pollution prevention performance measures that are benchmarks of the Lab's waste minimization progress and are written into the current University of California contract. The WMP annually assesses its program and the activities of each of its employees and determines quantitative levels of reduction that have been achieved for all types of wastes.

Table 6.1 Required resources for the site-wide WMin/PP program for FY 1994 through FY 1996.

Program Element	\$K FY 1994 (Budgeted)	\$K FY 1995 (Estimated)	\$K FY 1996 (Estimated)
6.1 WMin/PP Organization and Infrastructure	190	201	260
6.2 Program Development	220	233	120
6.3 Employee Involvement	55	58	0 ^c
6.4 Tracking	65	68	120
6.5 Reporting	225	238	530
6.6a Establish Site-Wide Source Reduction Programs for Hazardous, Radioactive, and Mixed Waste Streams	150	159	70
6.6b Establish Site-Wide Recycling Programs for Hazardous, Radioactive, and Mixed Waste Streams	40	42	70
6.6c Establish Site-Wide Source Reduction and Recycling Programs for Sanitary Waste Streams	200	212	70
6.7 Technical Assistance	52	55	0 ^c
6.8 Information and Technology Exchange	75	78	90
6.9 Program Evaluation	20	21	70
Total	1292^a	*1365^b	1400^d

a. The target level for FY 1994 is only \$500K. The difference between that and \$1292K was supplied by carryover from the previous year.

b. Estimates in Table 6.1 are for activities that are direct-funded by DOE-EM30. These are fully burdened and include LLNL overhead expenses. The estimate for FY 1995 is for a planning level of \$1365 K, which is what DOE/OAK indicated that it hoped to provide. The target funding level on the FY 1995 ADS, however, is \$900 K. Many activities listed in Chapter 6.0 would be severely curtailed if the planning level of \$ 1365 K were not provided.

c. This funding is reported in the current ADS at the "planning level," which is not shown in this table.

d. "Target" funding level.

Table 6.2 Estimated resources required for the site-wide WMin/PP program for FY 1997 through FY 1999.

Program Element	\$K FY 1997 (Estimated)	\$K FY 1998 (Estimated)	\$K FY 1999 (Estimated)
6.1 WMin/PP Organization and Infrastructure	266	272	279
6.2 Program Development	123	126	129
6.3 Employee Involvement	†0	†0	†0
6.4 Tracking	123	126	129
6.5 Reporting	542	555	569
6.6a Establish Site-Wide Source Reduction Programs for Hazardous, Radioactive, and Mixed Waste Streams	72	74	76
6.6b Establish Site-Wide Recycling Programs for Hazardous, Radioactive, and Mixed Waste Streams	72	74	76
6.6c Establish Site-Wide Source Reduction and Recycling Programs for Sanitary Waste Streams	72	74	76
6.7 Technical Assistance	0 ^b	0 ^b	0 ^b
6.8 Information and Technology Exchange	92	94	96
6.9 Program Evaluation	72	74	76
Total	1434^a	1469^a	1506^a

a. The estimate^a numbers in Table 6.2 are for costs of WM/PP activities that are direct-funded by DOE-EM30. These are fully burdened costs that include LLNL overhead expenses.

b. This funding is reported in the current ADS at the "planning level," which is not shown in this table.

Biology & Biotechnology Research

7.0 BIOLOGY & BIOTECHNOLOGY RESEARCH PROGRAM ELEMENTS

The Biology & Biotechnology Research Program Directorate occupies 12 buildings and trailers. Buildings used for research, as opposed to storage and office buildings, are:

- Building 361—General research, major facility.
- Building 362—General research, major facility.
- Building 363—Food mutagen research.
- Building 364—General research and animal use.
- Building 365—Carcinogen exposure.
- Building 366—Food mutagen research.

Biology & Biotechnology Program Directorate Missions

The Biology & Biotechnology Research Program (BBRP) Directorate conducts basic and applied research directed toward understanding and measuring the critical biological effects of nuclear and nonnuclear energy agents in the environment. The major emphasis is on understanding the human Genome at the molecular level and on genetic toxicology. Technological emphasis is on analytical cytology—the quantitative study of cells and cellular organelles using optical and other physical/chemical probes.

7.1 Organization and Infrastructure

The Environmental Safety & Health (ES&H) Officer of the Biology & Biotechnology Research Directorate has responsibilities that include acting as Waste Minimization/Pollution Prevention (WM/PP) Coordinator and forming and directing the activities of a Waste Minimization Committee. The committee, with representation from all major projects within the Program, is responsible for forming the BBRP Waste Management/Pollution Prevention Plan (WM/PP). The BBRP WM/Coordinator interfaces with the site-wide WM/PP Coordinator and is an active participant on the sit-wide WM/PP Committee. The ES&H officer institutes corrective actions resulting from Program evaluations.

7.2 Facility Program Development

The update of the WM/PP Plan will be conducted annually. The WM/PP Committee will develop the WM/PP program objectives and quantitative goals, as well as develop activity schedules for specific tasks and projects. The Environmental Safety & Health (ES&H) officer will formulate budgets

for programmatic activities. The ES&H officer and the WM/PP Committee will develop and implement the generator WM/PP program, while integrating the WM/PP practices into all site operating procedures.

7.3 Site-Wide Program Participation

All employees will be involved in job-specific WM/PP practices. The BBRP Directorate will exchange information and technologies with the other LLNL directorates to minimize waste. BBRP will continue to seek professional advice from site wide program. The WM/PP Coordinator will report material usage, waste generation, recycling and progress made in implementing WM/PP practices and participate in the site-wide source reduction and recycling programs.

7.4 Facility Training

Training in the principles of waste minimization will focus on issues specific to the BBRP Directorate and will augment training already provided by the Environmental Protection Department and the Hazards Control Department. This will be accomplished primarily through EP0006—Hazardous Waste Handling Practices. This training is required of all personnel who use hazardous materials or generate hazardous waste. Attendance at these classes is a factor to be considered in performance evaluations.

7.5 Opportunity Assessments

The Waste Minimization Committee will perform annual reviews of waste minimization efforts and identify opportunities for additional waste minimization or elimination. The assessment will determine how well individuals (generators) are following their waste management plans. Items to be assessed include:

- Amount and kinds of waste generated.
- Waste reductions that have been accomplished.
- New chemicals added to the waste stream.
- Substitutions that have been made.
- Inventory management.
- Recycling efforts.
- Material conservation.

The committee will evaluate the results of the assessment and make changes in the Waste Minimization/Pollution Prevention Plan where required.

7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams

The operations of the BBRP Directorate are performed under Facilities Safety Procedures (FSPs) and Operational Safety Procedures (OSPs) developed by the Program with the guidance of the Hazards Control and Environmental Protection Departments. When each of the FSPs comes due for renewal, sections explaining the rationale for minimizing waste production and examples of activities that minimize waste or reduce its toxicity will be incorporated. Approval of new OSPs and revisions of old OSPs require that the amount and types of waste have been reviewed for minimization possibilities and substitutes for processes or materials have been considered and adopted where possible. Other areas that will be addressed as methods of implementing waste minimization practices include: (1) Monitoring of purchase orders to assure that chemicals are not ordered when the requested chemicals are already present and available within the program; (2) Recycling—New users will be sought for surplus chemicals by using the Chemical Exchange Warehouse (CHEW); (3) Reducing the quantity of radioactive materials purchase to eliminate the quantity to be disposed of; (4) Reducing the use radioactive materials with long half-lives.

The BBRP Directorate is continuously looking for alternative materials that can be substituted for hazardous materials.

7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams

Whenever possible, the BBRP Program will recycle the appropriate waste streams such as pump oils, solvents, and radioactive materials.

7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams

The BBRP Directorate takes all opportunities to recycle sanitary waste streams. This is accomplished by recycling white paper, cardboard, glass, and aluminum cans. In terms of source reduction, the program is using recycled paper, using both sides of the paper and increasing the use of electronic mail.

7.7 Design Considerations

The BBRP Directorate will continue to design WM/PP principles and practices into new facilities; incorporate WM/PP into facility upgrades

and process modifications; and evaluate the potential of new technologies on waste-generating activities.

7.8 Program Evaluation

Progress in hazardous waste minimization in the BBRP Directorate will be reviewed annually by the Waste Minimization Committee.

Table 7.1 Required resources for the Biology & Biotechnology Research WMin/PP program for FY 1994 through FY 1996.

Program Element	\$K FY 1994 (Budgeted)	\$K FY 1995 (Estimated)	\$K FY 1996 (Estimated)
7.1 Organization and Infrastructure	.5	.55	.6
7.2 Facility Program Development	.5	.55	.6
7.3 Site-wide Program Participation	1.5	1.55	1.6
7.4 Facility Training	1.5	1.55	1.6
7.5 Opportunity Assessments	.5	.55	.6
7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed Waste Streams	1.5	1.55	1.6
7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed Waste Streams	1.5	1.55	1.6
7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	1.5	1.55	1.6
7.7 Design Considerations	.5	.55	.6
7.8 Program Evaluation	.5	.55	.6
Total	10	10.5	11

Table 7.2 Estimated resources required for Biology & Biotechnology Research WMin/PP program for FY 1997 through FY 1999.

Program Element		\$K FY 1997 (Estimated)	\$K FY 1999 (Estimated)	\$K FY 1999 (Estimated)
7.1	Organization and Infrastructure	.65	.7	.75
7.2	Facility Program Development	.65	.7	.75
7.3	Site-wide Program Participation	1.65	1.7	1.75
7.4	Facility Training	1.65	1.7	1.75
7.5	Opportunity Assessments	.65	.7	.75
7.6a	Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed Waste Streams	1.65	1.7	1.75
7.6b	Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed Waste Streams	1.65	1.7	1.75
7.6c	Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	1.65	1.7	1.75
7.7	Design Considerations	.65	.7	.75
7.8	Program Evaluation	.65	.70	.75
Total		11.5	12	12.5

Business Operations

7.0 BUSINESS OPERATIONS PROGRAM ELEMENTS

Fleet Management

The Fleet Management Group, Materials Distribution Divisions occupies Building 611 at LLNL's main site and Building 879 at Site 300.

Both buildings are used for vehicle and forklift maintenance and repairs and both have administrative offices. The Livermore facility, Building 611, also houses the bicycle shop, where bicycles are repaired and maintained.

7.1 Organization and Infrastructure

Estimated through FY 1999, costs include funding to participate in the site-wide Waste Minimization Steering Committee and expenses for developing and maintaining plans required for waste minimization.

The Business Operations' ES&H Assurance Manager is a member of the site-wide Waste Minimization Steering Committee. The Assurance Manager is responsible for representing Business Operations on the Committee. In addition, the Assurance Manager insures that there are open lines of communication on waste minimizations issues. The Fleet Management Group Leader is directly responsible for developing and maintaining plans required for waste minimization and designating appropriate personnel to perform day-to-day waste minimization functions.

7.2 Facility Program Development

Participation in the site-wide waste minimization program through FY1999 will include informing, educating, and otherwise involving employees in waste minimization practices.

The Fleet Management Group Leader, will develop Waste Minimization/Pollution Prevention (WM/PP) program objectives and quantitative goals.

7.3 Site-Wide Program Participation

Funding will be required for reporting on material usage, waste generation, recycling, and progress in implementing waste minimization practices and participation in the site-wide source reduction and recycling programs.

7.4 Facility Training

Through FY 1999, specific training in the principles of waste minimization will focus on personnel working in the processes that contribute to Fleet Management's waste stream. Funding will be necessary to assess and implement appropriate training.

7.5 Opportunity Assessments

To identify and evaluate current and potential waste-generating activities for Fleet Management's waste stream, funding will be required through FY 1999. The Business Operations' ES&H Assurance Manager and Fleet Management Group leader will jointly evaluate the results and make appropriate changes and recommendations. Items to be assessed may include:

- Amount and kinds of waste generated.
- Waste reductions.
- New chemicals added to the waste stream.
- Substitutions.
- Inventory management of items affecting waste generation.
- Recycling.
- Material conservation.

7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams

Fleet Management Group operations are conducted within the parameters of established Facilities Safety Procedures (FSP). As each safety procedure is renewed, sections explaining the rationale for minimizing waste production and examples of minimization activities will be incorporated.

Approval of new OSPs and revisions of old OSPs require review to ensure that minimization and substitutes for processes or materials have been considered and adopted where possible. Areas that will be addressed will include: (1) recycling of tires, (2) recycling motor oils, (3) using the Chemical Exchange Warehouse.

7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams

The Fleet Management Group sends motor oils, cleaning solvents, and other wastes such as brake fluid and antifreeze to HWM for recycling.

Fleet Management has a program under review, investigating the possibility of recycling antifreeze at the Motor Fleet facility, Building 611.

In addition, the Fleet Management Group is researching a new cleaning solvent, that has the potential for a nonhazardous classification.

7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams

The Fleet Management Group takes every opportunity to recycle sanitary waste streams such as white paper, cardboard, and aluminum cans.

Source reduction is encouraged through the use of recycled paper, double-sided documents, and E-mail.

7.7 Design Considerations

Although no new facilities are scheduled at this time, the Fleet Management Group will design WM/PP principles and practices into any new facilities and evaluate the potential of new technologies on waste-generating activities. Funding will be required to implement these practices for current facility upgrades or enhancements.

7.8 Program Evaluation

Funding can be applied through FY1999 to evaluate program implementation status and the effect of source reduction and recycling on waste generation.

Table 7.1 Required resources for the Fleet Group WMin/PP program for FY 1994 through FY 1996.

Program Element	\$K FY 1994 (Budgeted)	\$K FY 1995 (Estimated)	\$K FY 1996 (Estimated)
7.1 Organization and Infrastructure	1	1.05	1.1
7.2 Facility Program Development	.5	.525	.550
7.3 Site-Wide Program Participation	1	1.05	1.1
7.4 Facility Training	.5	.525	.55
7.5 Opportunity Assessments	.5	.525	.55
7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed Waste Streams	2	2.1	2.2
7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed Waste Streams	1	1.05	1.1
7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	.5	.525	.55
7.7 Design Considerations	.5	.525	.55
7.8 Program Evaluation	.5	.525	.55
Total	8	8.4	8.8

Table 7.2 Estimated resources required for the Fleet Group WMIn/PP program for FY 1997 through FY 1999.

Program Element	\$K FY 1997 (Estimated)	\$K FY 1998 (Estimated)	\$K FY 1999 (Estimated)
7.1 Organization and Infrastructure	1.15	1.2	1.25
7.2 Facility Program Development	.6	.65	.7
7.3 Site-Wide Program Participation	1.15	1.2	1.25
7.4 Facility Training	.6	.65	.7
7.5 Opportunity Assessments	.6	.65	.7
7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed Waste Streams	2.3	2.35	2.4
7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed Waste Streams	1.15	1.2	1.25
7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	.6	.65	.7
7.7 Design Considerations	.6	.65	.7
7.8 Program Evaluation	.6	.65	.7
Total	9.35	9.85	10.35

Chemistry & Material Sciences

7.0 CHEMISTRY AND MATERIAL SCIENCE PROGRAM ELEMENTS

7.1 Organization and Infrastructure

Chemistry & Materials Science Directorate Mission

As a multidisciplinary directorate, Chemistry & Materials Science (C&MS) provides scientific and technical expertise and leadership in the chemical and materials sciences and supports LLNL's many programs. In accomplishing this mission, the Directorate seeks to advance the frontiers of science, develop a qualified and responsive scientific and technical staff, be innovative in advancing technologies with end applications, and increase its interactions with scientists in universities, government laboratories, and industry. The Directorate is organized into four divisions, as described below, which focus their programs on this Directorate mission. An administrative organizational chart is attached as Figure 7.1. An ES&H Responsibility in C&MS organizational chart is attached as Figure 7.2.

The Chemical Sciences Division (CSD) includes scientific staff who support the Weapons, Laser Fusion, Laser Isotope Separation, Energy, and Special Projects programs and conducts research in a variety of areas. The Division provides research on new explosives and explosives compositions for the LLNL's nuclear and nonnuclear programs; focuses on the initiation, performance, and hazards and vulnerability of energetic materials; develops and characterizes advanced polymeric materials; synthesizes and characterizes low-density materials; develops computer models simulating chemical reactions and processes; participates in the oil-shale project; and provides expertise in theoretical and experimental atomic and molecular physics, molecular dynamics, thermodynamics, and modeling of chemical reactions.

The Condensed Matter Sciences Division (CMSD), a multidisciplinary organization of chemists, physicists, and materials scientists, provides expertise and experimental facilities to solve a broad spectrum of programmatic problems. CMSD is responsible for materials characterization for many LLNL programs. The Division develops a fundamental understanding of measurement sciences and solid-state materials properties through discoveries and exploration of new knowledge in these areas. The Division research programs explore fundamental problems in solid-state physics, surface science and technology, interface science, biomaterials, and theory, simulation, and modeling of materials and materials processing.

Figure 7.1. C&MS administrative organizational chart

Figure 7.2. ES&H C&MS responsibility

The Analytical Sciences Division (ASD) provides a broad range of analytical chemistry support services to the scientific and engineering programs at LLNL as its primary mission. Members of the ASD solve numerous analytical problems, ranging from routine standard analyses to unique problems that require significant development of methods and techniques as well as new instruments. The Environmental Analytical Sciences (EAS) laboratory resides within the ASD. EAS is an overhead-funded, California Department of Toxic Substances Control-certified laboratory charged with providing analytical services for LLNL in the areas of waste water and hazardous waste analysis. It is managed and staffed by ASD personnel and is operated for the Environmental Monitoring and Analysis Division within the Environmental Protection Department (EPD).

The Materials Science and Technology Division (MSTD) is responsible for R&D on metals, ceramics, salts, and various metal/ceramic matrix composites needed for program support. It develops and implements processes in the areas of metal forming, bonding, joining, coating, powder processing, and various methods to produce materials with useful properties and configurations. Efforts range from the most basic research on phase transformation to actual fabrication of special components.

The Divisions described above and numerous other programs operate in facilities managed by C&MS. The C&MS Directorate is responsible for waste minimization activities of its programs in the following buildings: 231, 191, 222 Complex, 232, 235, 241, and 281. The C&MS programs in its facilities at Site 300 fall within the waste minimization program managed by the Defense Systems/Nuclear Design Directorate (DS/ND) via a Memorandum of Understanding between C&MS and DS/ND.

The C&MS Facilities/Operations Manager has been directed by the Associate Director for C&MS to implement and manage the waste minimization program. A Waste Minimization Committee (WMC) has been established consisting of members representing the Divisions within the Directorate. The Chair of the WMC is the Facility/Operations Manager or his representative. The WMC meets monthly as part of the ES&H/Operations meeting to discuss waste minimization issues. The Chair of the WMC attends the monthly LLNL Waste Minimization Steering Committee (LLNL WMSC) meetings as the representative of C&MS.

The WMC is responsible for

- Collecting process and facility data.
- Developing a set of assessment parameters that will permit targeting of waste streams for waste minimization consideration.
- Identifying and prioritizing high-volume/highly toxic streams.
- Reviewing data and inspecting sites of identified targets.
- Generating waste minimization options.
- Addressing waste minimization concerns.
- Establishing a program for educating the Directorate staff.
- Assisting in the preparation of Waste Minimization/Pollution Prevention (WMin/PP) Plans and Reports for the DOE, U.S. Environmental Protection Agency (USEPA), and the California Environmental Protection Agency (CalEPA).

C&MS programs may generate nonhazardous, hazardous, radioactive, and mixed (combination of hazardous and radioactive) wastes. The types of hazardous and mixed wastes generated include organic, inorganic, corrosive, ignitable, reactive, and toxic. These and other regulated wastes are managed for disposal by the Hazardous Waste Management Division (HWM) of EPD. Wastes that are nonhazardous and nonregulated are disposed of through the municipal trash (solids) or sanitary sewer (liquids). The hazardous, radioactive, and mixed wastes generated in C&MS programs are associated with small, bench-scale R&D. As such, they are represented by small quantities of a large variety of waste types that are not typically conducive to traditional waste minimization techniques.

The importance of minimizing all waste generation through source reduction, process modification, or recycling has been acknowledged by Directorate management. This recognized need for waste minimization is being translated into an ongoing assessment of C&MS waste streams and identification of individual projects that may offer opportunities for waste minimization. As these projects and waste streams are identified, they will be investigated for alternative approaches to carrying out the same work that will generate less-toxic wastes or reduced quantities of wastes. This approach is gradually achieving the waste reduction necessary for a successful WMin/PP Plan.

7.2 Facility Program Development

The C&MS WMin/PP Plan is reviewed annually and updated triennially by the WMC. Criteria include changes that affect the goals, implementation or scope of the plan. The most recent update was in the Spring of 1994.

C&MS objectives and goals have been met with one exception as described below. C&MS has evaluated all major waste streams in its facilities and programs. When proposed actions, as described in 7.1, are identified, they are evaluated for waste minimization opportunities. When feasible and economical, the alternatives are implemented, preventing the generation of waste at the front end of the project. Cost to implement waste minimization is borne by the program and is generally low enough to be relatively insignificant. Changes in environmental regulations and policies that restrict the use of chemicals (such as CFCs) will also initiate waste minimization implementation when it may not be otherwise economical.

One recently identified new objective is to evaluate the potential for microscale chemistry experimentation in C&MS programs. Conducting research and development experiments on a microscale will theoretically reduce the small amount of a wide variety of waste streams currently generated in C&MS programs. The goal is to evaluate microscale experimentation from 1994 through 1995 for possible phase implementation by 1996. Up to \$2,000 will be spent in 1994 for the evaluation. If the program is implemented, adequate funds, estimated at \$5,000 per year, will be budgeted in 1995/96. Funds will come from the Facilities/Operations budget and from participating C&MS programs.

The C&MS WMin/PPA Plan is managed by and implemented through the C&MS Facilities/Operations Manager. The Facilities/Operations Manager or his representative acts as the Chair of the C&MS WMC. The WMC consists of representatives of C&MS divisions. The WMC maintains and oversees the implementation of the plan by C&MS personnel.

As noted in the introduction in 7.1, waste minimization is addressed in each Facility Safety Procedure, Operational Safety Procedure, and Project Work Plan.

7.3 Site-Wide Program Participation

All personnel in C&MS facilities who propose a new project or major modification to an existing project must evaluate the project for waste minimization and pollution prevention opportunities via the PWP. Additionally, the FSPs and OSPs require waste minimization when practical and economical.

The Chair of the C&MS WMC attends the monthly LLNL Waste Minimization Subcommittee meetings. These meetings facilitate the sharing of information, which is then shared at the C&MS WMC meetings, and later shared by the Division representatives with personnel. Information is also distributed via lab mail between meetings.

Technical assistance is available from the EPD WMPO, the Environmental Operations Group Environmental Analyst, and from individuals who have developed waste minimization expertise.

Hazardous waste generation rates are tracked by the HWM Division of EPD. Nonhazardous municipal wastes are tracked by the WMPO of EPD. The use of hazardous materials regulated by the Bay Area Air Quality Management District are documented by individual users. General chemicals and materials in the Chemical Tracking database are tracked by EPD. Hazardous waste recycling operations maintain a log of recycling rates. Annual reports are prepared by EPD.

7.4 Facility Training

All ES&H required training is provided by the Hazards Control and Environmental Protection Departments. Waste minimization training is incorporated into the course, EP0006, "Hazardous Waste Handling Practices." This course is required annually for generators of hazardous or radioactive waste. Additionally, C&MS offers on-the-job training and information is distributed via newsletters and memorandums.

7.5 Opportunity Assessments

The WMC and personnel have previously evaluated all significant waste streams for waste minimization opportunities. Where economical and feasible, these have been implemented. Personnel working in C&MS facilities currently use a Project Work Plan (PWP) to describe proposed projects or significant changes in ongoing work. A section of the PWP requires the proponent to evaluate the proposed action for waste minimization opportunities. This evaluation often includes specialists from the Environmental Protection Department (EPD), Hazards Control Department, WMC members, and other scientists.

One new potential waste minimization opportunity has recently been identified at this time: microscale chemistry experimentation. It will be evaluated during the next two years.

7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed Waste Streams

Processes have been modified and substitute materials are used. When it is economical and practical, equipment is purchased and research and development conducted.

7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed Waste Streams

Major waste streams have been evaluated and are being recycled where practical and economical.

7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams

Recycled paper is purchased for use in copiers and laser printers. White paper waste is collected and recycled as part of the LLNL-wide program. Sanitary wastes are managed by EPD and LLNL as a whole.

7.7 Design Considerations

Waste minimization is considered when new projects are proposed and when C&MS facilities are designed and modified.

New technologies that may afford C&MS additional waste minimization opportunities are evaluated as they are identified. For example, the potential for microscale chemistry experimentation will be evaluated

7.8 Program Evaluation

C&MS, through the self assessment process and by C&MS Assurance Office oversight, evaluates waste minimization implementation in C&MS programs.

Table 7.1 Required resources for the Chemistry WMin/PP program for FY 1994 through FY 1996.

Program Element	\$K FY 1994 (Budgeted)	\$K FY 1995 (Estimated)	\$K FY 1996 (Estimated)
7.1 Organization and Infrastructure	*	*	*
7.2 Facility Program Development	1	5	5
7.3 Site-Wide Program Participation	*	*	*
7.4 Facility Training	*	*	*
7.5 Opportunity Assessments	*	*	*
7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	*	*	*
7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	*	*	*
7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	*	*	*
7.7 Design Considerations	*	*	*
7.8 Program Evaluation	*	*	*
Total	1	5	5

*The WMin/PPA Plan has been implemented and there are no significant additional costs. Cost of waste minimization for new projects is generally internalized and can not be estimated until the project is proposed.

Table 7.2 Estimated resources required for the Chemistry WM/PP program for FY 1997 through FY 1999.

Program Element	\$K FY 1997 (Estimated)	\$K FY 1998 (Estimated)	\$K FY 1999 (Estimated)
7.1 Organization and Infrastructure	*	*	*
7.2 Facility Program Development	*	*	*
7.3 Site-Wide Program Participation	*	*	*
7.4 Facility Training	*	*	*
7.5 Opportunity Assessments	*	*	*
7.6a Implement Source Reduction opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	*	*	*
7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	*	*	*
7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	*	*	*
7.7 Design Considerations	*	*	*
7.8 Program Evaluation	*	*	*
Total	*	*	*

*The WM/PPA Plan has been implemented and there are no significant additional costs. Cost of waste minimization for new projects is generally internalized and can not be estimated until the project is proposed.

Computation Organization

7.0 COMPUTATION ORGANIZATION PROGRAM ELEMENTS

The Computation Organization (CO) manages a small photographic processing laboratory to provide film media services to several dozen customers. Continuing advances in on-line data visualization is gradually obviating the need for such services. The CO intends to phase out its film media services at the earliest possible opportunity. This plan will provide general guidance to that effort. There are no other sources of waste materials production within the CO.

7.1 Organization and Infrastructure

Responsibilities for managing Waste Minimization and Pollution Prevention within the Computation Organization rests ultimately with the Associate Director (AD). The AD has delegated responsibility through the following management chain: the Principal Deputy Associate Director, the Deputy Associate Director for Assurance and Operations (A &O), Department Heads, Division Leaders, Group Leaders, and first-line supervisors. Within the CO, the Livermore Computing (LC) Department is headed by the Deputy AD for LC, and he has delegated responsibility for managing the key waste generating activity, the Photolab, to the Deputy Department Head for Operations and Administration. The Deputy Department Head for A&O has in turn delegated responsibility for operations of the Photolab to the first-line supervisor, and the supervisor monitors and directs the activities of the photo-technicians who staff the process.

7.2 Facility Program Development

The Computation Organization supports the intent of the Laboratory Waste Minimization and Pollution Prevention policies. Wherever and to the extent that the operations of the CO are not negatively affected, the CO will reduce the generation of waste products from its operations, including paper, chemicals, and other materials. In addition, the CO will cease waste-generating operations wherever economically possible to do so. Quantitative goals are not realistically possible to set for several reasons: First, the services provided by the CO are technology driven, so it is not possible to make long-term commitments to the reduction of its operations that may generate waste; Second, the quantities are relatively trivial and represent a minimal impact on the ability of treatment processes to entirely eliminate the hazardous portions of the waste.

Given these factors, it is not a cost-effective effort to develop a formal plan for waste reduction for the Computation Organization. All waste is handled in accordance with applicable laws, regulations, orders, and policies.

7.3 Site-Wide Program Participation

Computation Organization waste is automatically piped into a dual retention tank system and periodically picked up by Hazardous Waste technicians from the Environmental Protection Department. The wastes are stored in the Hazardous Waste Management yard and disposed of/treated in accordance with all applicable federal and state laws, municipal ordinances, DOE Orders and directives, University of California policies, and LLNL policies and procedures.

7.4 Facility Training

All CO phototechnicians and other personnel who generate or handle the wastes from the photo lab operations are fully and completely trained to the standards set by federal and state laws, municipal ordinances, DOE Orders and directives, University of California policies, and LLNL policies and procedures.

7.5 Opportunity Assessments

The Computation Organization generates approximately 1200 gallons of low-level hazardous chemical wastes per year. The quantity of waste is determined by the level of services requested from the customers and cannot be unilaterally reduced by the Organization. However, as computer data visualization technology changes, the movement away from photographic media hardcopy is correspondingly increasing.

There are no known barriers to the accomplishment of the goal of eliminating the photolaboratory activities from the services provided by the Livermore Computing Department of the Computation Organization; the only issues are when and how. Both of these issues are being actively discussed and a resolution will be determined within fiscal 1994.

7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams

Since the photolab services are a very small portion of the overall activities of the LC, and since the waste generated is a very small fraction of the overall Laboratory waste production, this issue does not warrant a high priority. However, it is being actively considered as a mid-range implementation target.

7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams

There are no radioactive or mixed-waste streams generated by the Computation Organization. Its wastes are strictly low-level diluted aqueous photochemical solutions. These diluted aqueous solutions are amenable to industry standard treatment processes that render them completely benign. If the opportunity to process these aqueous solutions onsite presents itself and if the CO still produces an aqueous waste stream, the CO will avail itself of the processes.

7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams

Conditions controlling the possibilities for managing the generation portion of the waste stream have been described in sections 7.2 and 7.5 above.

7.7 Design Considerations

Since it is a goal of the CO to eliminate the waste stream entirely, it is not planning to redesign any portion of the existing waste stream management system. The CO envisions nor anticipates the development of technology relevant to its activities that would create a waste stream.

7.8 Program Evaluation

The Computation Organization waste management activities are entirely adequate and suited to its function. The volume of the waste stream is determined by the service users demand and the demand is steadily decreasing. The CO fully anticipates that it will have shut down its waste stream generator in the near future, possibly before the end of fiscal 1994, but more likely by the end of fiscal 1995.

**Table 7.1 Required resources for the Computations Organization
WMin/PP program for FY 1994 through FY 1996.**

Program Element	\$K FY 1994 (Budgeted)	\$K FY 1995 (Estimated)	\$K FY 1996 (Estimated)
7.1 Organization and Infrastructure	0	0	0
7.2 Facility Program Development	0	0	0
7.3 Site-Wide Program Participation	0	0	0
7.4 Facility Training	11	11	0
7.5 Opportunity Assessments	0	0	0
7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	0	0	0
7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	0	0	0
7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	0	0	0
7.7 Design Considerations	0	0	0
7.8 Program Evaluation	0	0	0
Total	11	11	*

*Upon further evolution of technology, the need for hardcopy output on film media is anticipated to decline to the point that it is not cost-effective to maintain the capability and the photolab will be retired. For all of these reasons, the Computation Organization, while it scrupulously complies with all applicable waste management requirements, it is not investing significant resources in the development and implementation of a waste reduction plan.

Table 7.2 Estimated resources required for the Computer Organization WMin/PP program for FY 1997 through FY 1999.

Program Element	\$K FY 1997 (Estimated)	\$K FY 1998 (Estimated)	\$K FY 1999 (Estimated)
7.1 Organization and Infrastructure	0	0	0
7.2 Facility Program Development	0	0	0
7.3 Site-Wide Program Participation	0	0	0
7.4 Facility Training	0	0	0
7.5 Opportunity Assessments	0	0	0
7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	0	0	0
7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	0	0	0
7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	0	0	0
7.7 Design Considerations	0	0	0
7.8 Program Evaluation	0	0	0
Total	*	*	*

*Upon further evolution of technology, the need for hardcopy output on film media is anticipated to decline to the point that it is not cost-effective to maintain the capability and the photolab will be retired. For all of these reasons, the Computation Organization, while it scrupulously complies with all applicable waste management requirements, it is not investing significant resources in the development and implementation of a waste reduction plan.

Defense Systems/Nuclear Design

7.0 DEFENSE SYSTEMS/NUCLEAR DESIGN PROGRAM ELEMENTS

The Defense Systems/Nuclear Design (DS/ND) Waste Minimization/Pollution Prevention (WMin/PP) Program is designed to meet DOE's WMin/PP Policy Statement, which promotes a hierarchical approach considering source reduction; recycle/reuse; treatment to reduce volume, toxicity, or mobility before storage or disposal; and environmentally safe residual waste disposal. The DS/ND Waste Minimization and Pollution Prevention Plan serves as the foundation for carrying out generator WMin/PP activities associated with the directorate. It assigns responsibility for implementing the WMin/PP program to line management. Each Site 300 organization and DS/ND facility at Livermore is served by a WMin/PP representative who interacts with the DS/ND WMin/PP Manager.

7.1 Organization and Infrastructure

The directorate's WMin/PP Program is coordinated by the directorate's WMin/PP Manager, who on the DS/ND Assurance Office staff. The WMin/PP Manager represents DS/ND on the site-wide WMin/PP Steering Committee, and serves as the communication link between that committee and DS/ND and Site 300 field representatives. This is an ongoing activity that is included in the ADS for the DS/ND Assurance Office support.

7.2 Facility Program Development

WMin/PP goals and objective were established and included in the WMin/PP Program Plan, which is reviewed annually and revised as necessary; however, at a minimum this plan is to be updated every three years. Each year, WMin/PP field representatives, who were assigned wmin/pp responsibilities by their line management, identify projects, develop schedules, and coordinate budget requests with their program organization. The field representatives also integrate wmin/pp requirements into operating procedures when applicable. These are ongoing activities included in the ADS for DS/ND Facility Manager ES&H Support and the ADS for the DS/ND Assurance Office Support. The ADS for DS/ND Assurance Office Support

7.3 Site-Wide Program Participation

The WMin/PP field representatives develop and implement the source reduction and recycling programs in their respective facilities. They lead their employees in implementation of WMin/PP projects and share their ideas and lessons learned with other WMin/PP field representatives at quarterly DS/ND WMin/PP Meetings and other technical symposia. They also provide information on their successes and lessons learned to the DS/ND WMin/PP Manager for inclusion in mandated reports and information exchange sessions. The DS/ND WMin/PP Manager also develops opportunities for defense-related external wmin/pp assessment and technology exchanges and projects. These are ongoing activities and are included in the ADS for DS/ND Facility Manager ES&H Support and the ADS for DS/ND Assurance Office Support.

Tracking of waste generation rates is performed by LLNL's Hazardous Waste Management Division, who periodically provides waste generation data to the WMin/PP Manager. This activity is not included in Tables 7.1 and 7.2. since the activity is not performed by DS/ND.

7.4 Facility Training

DS/ND employees who handle hazardous and/or radioactive materials are required to attend waste management training courses. One of the courses, EP-0006 must be attended annually and includes information to heighten waste minimization and pollution prevention awareness. This activity is not included in Tables 7.1 and 7.2 because training is managed institutionally by LLNL's Environmental Protection Department.

7.5 Opportunity Assessments

Opportunity assessments are conducted in accordance with the DS/ND Waste Minimization and Pollution Prevention Plan. These activities are ongoing and are included in the ADS for DS/ND Facility Manager ES&H Support and the ADS for the DS/ND Assurance Office Support.

7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams

In following the WMin/PP hierarchy, source reduction is the first consideration for minimizing waste and preventing pollution. Approaches include modifying processes to reduce waste and air pollution and substitution of materials to reduce hazardous, radioactive and/or mixed-waste generation and to avoid toxic air releases. Source reduction measures that can be easily implemented at low costs are carried out within existing operating budgets.

For FY 1997 through FY 1999, implementation costs for a new Site 300 Contained Firing Facility which would incorporate WMin/PP principles into the facility and its processes, are shown. These costs are included in the ADS for the Site 300 Contained Firing Facility.

7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams

Recycling and reuse are being employed as wmin strategies. Preference is given to onsite recycling, but offsite recycling is deemed acceptable if onsite recycling is not feasible.

In FY1994, gravel contaminated during explosives testing will be recycled at Site 300. This project will be completed before the end of FY 1994.

7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams

None

7.7 Design Considerations

The feasibility of applying new technologies on waste generating activities is evaluated during the design phase of projects. DS/ND designs and incorporates Wmin/PP principles and practices into new facilities, facility upgrades, and process modifications. A new contained firing facility has been proposed for Site 300. This facility would significantly minimize the generation of wastes and the emission of pollutants during explosives testing. Funding amounting to \$6.6 M has been identified for FY 1996 and is included in the ADS for the LLNL Contained Firing Facility.

7.8 Program Evaluation

Progress on Wmin/PP implementation is reviewed at least annually by line management and/or the DS/ND WM/PP Manager. Reductions in volume and toxicity of wastes and waste management costs, as well as improvements in safety, operational efficiency, compliance status and community relations are considered in evaluations. This is an ongoing activity included in the ADS for the DS/ND Assurance Office Support and the ADS for Facility Manager ES&H Support.

Table 7.1 Required resources for the Defense Systems/Nuclear Designs WMin/PP program for FY 1994 through FY 1996.

Program Element	\$K FY 1994 (Budgeted)	\$K FY 1995 (Estimated)	\$K FY 1996 (Estimated)
7.1 Organization and Infrastructure	50	50	50
7.2 Facility Program Development	65	65	65
7.3 Site-Wide Program Participation	260	260	140
7.4 Facility Training	0	0	0
7.5 Opportunity Assessments	30	30	30
7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-waste Streams	0	0	0
7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	100	0	0
7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	0	0	0
7.7 Design Considerations	0	0	6600
7.8 Program Evaluation	5	5	5
Total	510	410	6890

Table 7.2 Estimated resources required for the Defense Systems/Nuclear Designs WMin/PP program for FY 1997 through FY 1999.

Program Element	\$K FY 1997 (Estimated)	\$K FY 1998 (Estimated)	\$K FY 1999 (Estimated)
7.1 Organization and Infrastructure	50	50	50
7.2 Facility Program Development	65	65	65
7.3 Site-Wide Program Participation	140	140	140
7.4 Facility Training	0	0	0
7.5 Opportunity Assessments	30	30	30
7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-waste Streams	27,900	8,200	6,100
7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	0	0	0
7.7 Design Considerations	0	0	0
7.8 Program Evaluation	5	5	5
Total	28,190	8,490	6,390

Energy

7.0 ENERGY PROGRAM ELEMENTS

Because waste generated by Energy Program activities is relatively small compared to LLNL as a whole, the program resources devoted to Waste Minimization/Pollution Prevention (WMin/PP) are correspondingly small. The WMin/PP Coordinator is a member of the Program's Environmental Safety & Health (ES&H) Committee and takes guidance from that committee's activities. The coordinator reports to the Program Facility Manager and, therefore, to the Program Principal Deputy Associate Director (DAD). Supporting personnel directly involved in Program WMin/PP include the Waste Accumulation Area (WAA) Facility Manager, Environmental Protection Department (EPD) technician specialists in waste handling, ES&H, and environmental protection. Various line managers and personnel from the program support organizations are directly involved in personnel training and on the job department.

7.1 Organization and Infrastructure

The close interaction between project planning and facility management ensures adequate support to the WMin/PP Coordinator and ready cooperation for corrective actions. It should be noted that considerable attention is given to early planning and eliminating pollution producers from the work site before new project work begins. While it is difficult to isolate discrete charges for coordination and planning, it seems about 0.5 of an FTE should be assigned to these general activities.

7.2 Facility Program Development

The Program has a current WMin/PP Plan with its latest revision dated November 1993. The plan is reviewed annually and historically has been revised on a two-year cycle to reflect Program changes. While WMin/PP objectives and goals are included in the plan, interim tasks are inserted, modifying those objectives and goals as opportunities develop, or as Laboratory guidance directs. In addition, Program Facility Safety Procedures (FSP) and Operational Safety Procedures (OSP) include instructions and requirements for WMin/PP planning and implementation.

7.3 Site-Wide Program Participation

Program representation is maintained on both the ES&H Working Group and on the Waste Minimization Steering Committee. This provides WMin/PP continuity and awareness of Laboratory-wide developments and directions for WMin/PP. Program support is required periodically for

progress and status reports, for participation in audits and surveys, and for evaluation of potential alternate solvent and cleansing materials and procedures.

7.4 Facility Training

All personnel who are potential waste generators are assigned classwork on hazardous waste handling practices. In addition, there are courses on spill prevention and control, waste certification, and operation of the WAA itself. These training requirements are current and require annual renewal.

Participation on the ES&H Working Group and the Waste Management Steering Committee is continuous, which ensures information exchange, and involvement in site-wide source-reduction and recycling programs when available to our environmental remediation facilities.

7.5 Opportunity Assessments

The principal sources of hazardous wastes are the machine shops located throughout the Energy facilities, the experimental laboratories and assembly areas involved in developing alternate energy and related energy technologies, and the support work for large offsite experiments at Stanford, Princeton, and General Atomics. The following areas are targeted for waste minimization activities:

- The first priority will be to implement recycling and recovery of cooling and cutting oils in the machine shops: recycled wipedcloths will be substituted for paper swipes and the use of biodegradable solvents and wash materials will be continued and expanded so we can replace those chemicals covered by the EPA 33/50 program.
- There is a continuing need to identify and characterize discrete hazardous wastes generated by new laboratory activities. Early design reviews and management overviews of project goals, objectives, processes, and process materials can anticipate and avert most problems; but constant monitoring of experimental wastes will be required to avoid surprises, unwanted impact releases to the environment, or increases in toxicity or complexity in newly generated hazardous wastes.
- An accelerated effort is planned for FY 1995 and 1996 to remove all hazardous materials from the deactivated magnetic fusion energy experimental facilities and to renovate them for use in new energy-related research and development activities. While this renovation will generate large quantities of ordinary and hazardous wastes, the result will be the cost-effective recovery of high-cost-per-square-foot experimental facilities.

7.6a Implement Source Reduction Opportunities for Hazardous Waste Streams

As noted earlier, the Energy Program's waste streams consist of continuing operational waste and one-time general and hazardous waste associated with the cleanup of outdated and essentially abandoned laboratory facilities. The WMin/PP activities addressing program operational wastes will concentrate initially on source reduction by using acceptable alternate materials, by developing and implementing alternate processes, or apparatus to contain and recover certain chemicals for reuse in lieu of routine disposal. In like manner, as new technologies develop, each new process must be examined for other opportunities for source material substitutions.

7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams

While wipe cloths have been substituted for paper wipes in the larger machine shops, their use has not been fully incorporated in the smaller shops and assembly areas. Use and recycling procedures and required apparatus needs to be developed and implemented. The costs are minimal; but the educational and supervisory implications are complex. The benefits can appear slight to the individual, and ingrained work habits have proven very difficult to change. Cooling, vacuum, and/or cutting oils provide other candidates for recycling and reuse in the same or other applications. Some effort is required to determine the opportunities and apparatus required to implement this savings.

7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Stream

Not applicable.

7.7 Design Considerations

Peer group review is basic to early design approval of new experiments, processes, and apparatus. Incorporating WMin/PP principles and practices into these reviews, and into the continuing overview of ongoing experimental activities, calls for a different perspective and set of disciplines for maximum effect. Adding costs to develop and implement changes to affected projects while seeking to minimize scheduling impacts can be serious, particularly for small projects. Supplemental funding to cover this so-called overhead function must be provided, again particularly to protect the small, marginally funded, innovative project. Exploring new technologies to develop alternate sources of energy to fossil fuels can lead to new uses of common elements and chemical

compounds. New processes in development can generate wastes of unexpected character and toxicity. There is a continuing need for constant overview of these new efforts, as well as current ongoing project work, to assess the opportunities for source reduction and minimization of hazardous wastes. Realization of such opportunities can require process changes, equipment procurement, and special personnel training.

7.8 Program Evaluation

Evaluation of the status and progress made in each project's and each facility's WMin/PP efforts will be incorporated in the Energy Program's self-assessment audit program. This program involves both line management and Associate Director staff personnel and is funded either by direct program or the ES&H budgets.

Table 7.1 Required resources for the Energy Program WMin/PP program for FY 1994 through FY 1996.

Program Element	\$K FY 1994 (Budgeted)	\$K FY 1995 (Estimated)	\$K FY 1996 (Estimated)
7.1 Organization and Infrastructure	35	37	40
7.2 Facility Program Development	10	11	12
7.3 Site-Wide Program Participation	5	5	6
7.4 Facility Training	20	22	24
7.5 Opportunity Assessments	87	518	668
7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	10	20	25
7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	5	6	7
7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	NA	NA	NA
7.7 Design Considerations	28	30	33
7.8 Program Evaluation			
Total	200	649	815

Table 7.2 Estimated resources required for the Energy Program WMin/PP program for FY 1997 through FY 1999.

Program Element	\$K FY 1997 (Estimated)	\$K FY 1998 (Estimated)	\$K FY 1999 (Estimated)
7.1 Organization and Infrastructure	43	45	48
7.2 Facility Program Development	14	15	15
7.3 Site-Wide Program Participation	7	7	7
7.4 Facility Training	26	26	26
7.5 Opportunity Assessments	80	25	29
7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	25	25	25
7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	10	10	10
7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	NA	NA	NA
7.7 Design Considerations	35	37	40
7.8 Program Evaluation			
Total	240	190	200

Engineering and Technological Transfer

ENGINEERING AND TECHNOLOGY TRANSFER PROGRAM

The Engineering and Technology Transfer Directorate has reported a Section 7.0 for each of nine waste streams plus a table of cumulative estimated costs for each fiscal year.

7.0 ENGINEERING AND TECHNOLOGY TRANSFER PROGRAM ELEMENTS

Liquid Waste with pH<2, with Metals—For Building 141

7.1 Organization and Infrastructure

Costs in this category through 1998 include providing personnel to work with site-wide Waste Minimization/Pollution Prevention (WMin/PP) coordinator(s) and participate in the site-wide WMin/PP Committee. The primary anticipated expense is instituting corrective actions in response to program evaluation.

7.2 Facility Program Development

Facility program development funds through 1999 will be needed to develop WMin/PP program objectives, establish quantitative goals, and develop and periodically update the generator WMin/PP Plan. A corollary activity will be formulating budgets for generator programmatic activities. Finally, funds must be allocated to integrating WMin/PP practices into all site operating procedures.

7.3 Site-Wide Program Participation

Participation in the Lab-wide waste minimization program through 1999 will include informing, educating, and otherwise involving employees in job-specific WMin/PP practices. Such participation will also call for the exchange of information and technologies with other waste generators to ensure the application of the most appropriate available waste reduction methods. It is further expected that such an information/technology exchange will involve seeking some technical assistance from the site-wide program. Finally, funding will be required for participating in site-wide source reduction and recycling programs.

7.4 Facility Training

Through 1997, waste minimization will require job-specific training for personnel working in the processes that contribute to this waste stream. To help ensure the identification of proper training needs, it will be necessary to fund participation in opportunity assessments, and it will then be necessary to implement the training.

7.5 Opportunity Assessments

With respect to opportunity assessments, funding will be required through 1997 to identify and evaluate current and potential waste-generating activities and identify and prioritize WMin/PP opportunities

for the waste stream in question. In addition, funding will be used to identify research and development opportunities for application to the waste stream.

7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams

It is estimated that funding will be required through 1999 for the implementation of source-reduction opportunities for the waste stream in question. Efforts will include modifying processes to reduce hazardous, radioactive, and mixed-waste generation, substituting materials to reduce toxic chemical use and release, and substituting materials to reduce hazardous, radioactive, and mixed-waste generation. The bulk of the estimated funding is for 1996-1997, and is planned for conducting research, development, and demonstration activities on this difficult-to-manage waste stream.

7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams

Implementing the reuse or recycling of hazardous, radioactive, and mixed wastes onsite and the recycling of hazardous wastes offsite is estimated to require minimal funding through 1999.

7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams

Efforts to implement source-reduction and recycling opportunities will include using affirmative procurement practices to encourage the purchase and use of recovered materials and reusing or recycling sanitary wastes. These efforts should extend over 1994-1996.

7.7 Design Considerations

It is estimated that funding can be applied during 1995-1997 to incorporate WMin/PP into facility upgrades and process modifications and also to evaluate the potential use of new technologies for waste-generating activities.

7.8 Program Evaluation

As a corollary effort to 7.7, funding can also be applied during 1995-1997 to evaluate generator program implementation status and the effect of source reduction and recycling on waste-generation and disposal rates.

**Table 7.1 Required resources for Engineering & Technology Transfer
WMin/PP program for FY 1994 through FY 1996. (Liquid Waste
with pH<2, with Metals—Building 141.)**

Program Element	\$K FY 1994 (Budgeted)	\$K FY 1995 (Estimated)	\$K FY 1996 (Estimated)
7.1 Organization and Infrastructure	2	12	5
7.2 Facility Program Development	1	2	2
7.3 Site-Wide Program Participation	1	5	2
7.4 Facility Training	1	2	1
7.5 Opportunity Assessments	1	2.5	
7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	2	2	10
7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	1	1	1
7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	1	1	1
7.7 Design Considerations	N/A	2	1
7.8 Program Evaluation	N/A	2	1
Total	10	31.5	24

Table 7.2 Estimated resources required for Engineering & Technology Transfer WMin/PP program for FY 1997 through FY 1999. (Liquid Waste with pH<2, with Metals—Building 141.)

Program Element	\$K FY 1997 (Estimated)	\$K FY 1998 (Estimated)	\$K FY 1999 (Estimated)
7.1 Organization and Infrastructure	2	1	N/A
7.2 Facility Program Development	1	1	1
7.3 Site-Wide Program Participation	1	1	1
7.4 Facility Training	1	N/A	N/A
7.5 Opportunity Assessments	1	N/A	N/A
7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	10	2	1
7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	1	1	1
7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	N/A	N/A	N/A
7.7 Design Considerations	1	N/A	N/A
7.8 Program Evaluation	1	N/A	N/A
Total	19	6	4

7.0 ENGINEERING AND TECHNOLOGY TRANSFER PROGRAM ELEMENTS

Replace Photoresist with Less Toxic Solvent or Aqueous Solution— Building 153

7.1 Organization and Infrastructure

Costs in this category estimated through 1997 include funding to participate in the site-wide WMin/PP Committee. The primary anticipated expense is instituting corrective actions in response to program evaluation.

7.2 Facility Program Development

Facility program development funds through 1998 will be needed to develop activity schedules for specific tasks and projects and assign personnel to develop and implement the generator WMin/PP program.

7.3 Site-Wide Program Participation

Participation in the Lab-wide waste minimization program through 1999 will include informing, educating, and otherwise involving employees in job-specific WMin/PP practices. Such participation will also include exchanging information and technologies with other waste generators to ensure the application of the most appropriate available waste-reduction methods. Finally, funding will be required for reporting on material usage, waste generation, recycling, and progress in implementing WMin/PP practices.

7.4 Facility Training

Through 1999, waste minimization will require job-specific training for personnel working in the processes that contribute to this waste stream. To help ensure the proper identification of training needs, it will be necessary to fund participation in opportunity assessments, and it will then be necessary to implement the training.

7.5 Opportunity Assessments

With respect to opportunity assessments, funding will be required through 1999 to identify and evaluate current and potential waste-generating activities for the waste stream in question and for identify research and development opportunities for application to the waste stream.

7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams

It is estimated that funding will be required through 1999 for the implementation of source reduction opportunities for the waste stream in question. Efforts will include modifying processes to reduce hazardous, radioactive, and mixed-waste generation, and substituting materials to reduce toxic chemical use and release. The bulk of the estimated funding is for 1995-1997, and is planned to be applied to conducting research, development, and demonstration activities on this difficult-to-manage waste stream.

7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams

Implementing the reuse or recycling of hazardous, radioactive, and mixed wastes onsite and the recycling of hazardous wastes offsite is estimated to require funding through 1997.

7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams

Efforts to implement source reduction and recycling opportunities will include using affirmative procurement practices to encourage the purchase and use of recovered materials and reusing or recycling sanitary wastes. These efforts should extend through 1999.

7.7 Design Considerations

It is estimated that funding can be applied through 1999 to design WMin/PP principles and practices into new facilities, to incorporate WMin/PP into facility upgrades and process modifications, and to evaluate the potential of new technologies on waste-generating activities.

7.8 Program Evaluation

As a corollary effort to 7.7, funding can also be applied through 1999 to evaluate generator program implementation status and to evaluate the effect of source reduction and recycling on waste-generation and disposal rates.

**Table 7.1 Required resources for Engineering & Technology Transfer
WMin/PP Program for FY 1994 through FY 1996. (Replace
photoresist with less toxic solvent or aqueous solution—Building 153.)**

Program Element		\$K FY 1994 (Budgeted)	\$K FY 1995 (Estimated)	\$K FY 1996 (Estimated)
7.1	Organization and Infrastructure	2	8	2
7.2	Facility Program Development	2	8	4
7.3	Site-Wide Program Participation	2	8	9
7.4	Facility Training	2	6	6
7.5	Opportunity Assessments	2	5	5
7.6a	Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	2	12	10
7.6b	Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	2	4	3
7.6c	Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	2	2	2
7.7	Design Considerations	2	12	10
7.8	Program Evaluation	2	2	2
Total		20	67	53

Table 7.2 Estimated resources required for Engineering & Technology Transfer WMin/PP program for FY 1997 through FY 1999. (Replace photoresist with less toxic solvent or aqueous solution—Building 153.)

Program Element	\$K FY 1997 (Estimated)	\$K FY 1998 (Estimated)	\$K FY 1999 (Estimated)
7.1 Organization and Infrastructure	2	N/A	N/A
7.2 Facility Program Development	1	1	N/A
7.3 Site-Wide Program Participation	1	2	1
7.4 Facility Training	2	2	2
7.5 Opportunity Assessments	2	2	2
7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	8	2	2
7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	2	N/A	N/A
7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	2	2	2
7.7 Design Considerations	8	6	2
7.8 Program Evaluation	2	2	2
Total	30	19	13

7.0 ENGINEERING AND TECHNOLOGY TRANSFER PROGRAM ELEMENTS

Solvent Reclamation and Cleaning from Chemical Etching— Building 153

7.1 Organization and Infrastructure

Costs in this category estimated through 1996 include funding to participate in the site-wide WMin/PP Committee. The primary anticipated expense is instituting corrective actions in response to program evaluation.

7.2 Facility Program Development

Facility program development funds through 1997 will be needed to formulate budgets for generator programmatic activities and integrate WMin/PP practices into all site operating procedures.

7.3 Site-Wide Program Participation

Participation in the Lab-wide waste minimization program through 1998 will include informing, educating, and otherwise involving employees in job-specific WMin/PP practices. Such participation will also call for the exchange of information and technologies with other waste generators to ensure the application of the most appropriate available waste reduction methods. It is further expected that such an information/technology exchange will involve seeking some technical assistance from the site-wide program. Finally, funding will be required for participation in site-wide source reduction and recycling programs.

7.4 Facility Training

For the period of 1995 through 1997, waste minimization will require job-specific training for personnel working in the processes that contribute to this waste stream. To help ensure the proper identification of training needs, it will be necessary to fund participation in opportunity assessments and implement the training.

7.5 Opportunity Assessments

Funding will be required through 1996 to identify and prioritize WMin/PP opportunities for the waste stream in question and to identify research and development opportunities.

7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams

It is estimated that funding will be required through 1999 to implement source-reduction opportunities for the waste stream in question. Efforts will include modifying processes to reduce hazardous, radioactive, and mixed-waste generation, substituting materials to reduce toxic chemical use and release and hazardous, radioactive, and mixed-waste generation. The bulk of the estimated funding is for 1996–1997 and is planned for conducting research, development, and demonstration activities on this difficult-to-manage waste stream.

7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams

Implementing the reuse or recycling of hazardous, radioactive, and mixed wastes onsite and the recycling of hazardous wastes offsite is estimated to require funding through 1997. Primary attention will be placed on onsite reuse and recycling.

7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams

Efforts to implement source-reduction and recycling opportunities will include using affirmative procurement practices to encourage the purchase and use of recovered materials and reusing or recycling sanitary wastes. These efforts should extend from 1995 through 1996.

7.7 Design Considerations

It is estimated that funding can be applied during 1995–1997 to incorporate WMin/PP into facility upgrades and process modifications and also to evaluate the potential of new technologies on waste-generating activities.

7.8 Program Evaluation

As a corollary effort to 7.7, funding can also be applied during 1995–1997 to evaluate generator program implementation status and evaluate the effect of source reduction and recycling on waste-generation and disposal rates.

**Table 7.1 Required resources for Engineering & Technology Transfer
WMin/PP program for FY 1994 through FY 1996. (Solvent
reclamation and cleaning from chemical etching—Building 153.)**

Program Element	\$K FY 1994 (Budgeted)	\$K FY 1995 (Estimated)	\$K FY 1996 (Estimated)
7.1 Organization and Infrastructure	2	10	5
7.2 Facility Program Development	1	4	2
7.3 Site-Wide Program Participation	1	5	3
7.4 Facility Training	N/A	2	2
7.5 Opportunity Assessments	1	2	1
7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	2	2	10
7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	1	2	2
7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	N/A	2	1
7.7 Design Considerations	N/A	4	1
7.8 Program Evaluation	N/A	2	1
Total	8	35	28

Table 7.2 Estimated resources required for Engineering & Technology Transfer WMin/PP program for FY 1997 through FY 1999. (Solvent reclamation and cleaning from chemical etching—Building 153.)

Program Element		\$K FY 1997 (Estimated)	\$K FY 1998 (Estimated)	\$K FY 1999 (Estimated)
7.1	Organization and Infrastructure	N/A	N/A	N/A
7.2	Facility Program Development	2	N/A	N/A
7.3	Site-Wide Program Participation	1	1	N/A
7.4	Facility Training	1	N/A	N/A
7.5	Opportunity Assessments	N/A	N/A	N/A
7.6a	Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	10	2	1
7.6b	Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	1	N/A	N/A
7.6c	Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	N/A	N/A	N/A
7.7	Design Considerations	1	N/A	N/A
7.8	Program Evaluation	1	N/A	N/A
Total		17	3	1

**7.0 ENGINEERING AND TECHNOLOGY TRANSFER PROGRAM
ELEMENTS
Hazardous Aqueous Solution with Organics <10%—Building 321)**

7.1 Organization and Infrastructure

Participating in the WMin organization and infrastructure will include costs for personnel support of the WMin/PP Coordinator, for interface with the site-wide WMin/PP Coordinator(s), and for institution if corrective actions in response to program evaluation.

7.2 Facility Program Development

Facility program development funding will be allocated to integrating WMin/PP practices into all site-operating procedures.

7.3 Site-Wide Program Participation

Participating in the overall waste minimization program will include informing, educating, and otherwise involving employees in job-specific WMin/PP practices. Such participation will also call for exchanging information and technologies with other waste generators to ensure application of the most appropriate available waste-reduction methods. It is further expected that such an information/technology exchange will involve seeking technical assistance from the site-wide program. Finally, funding will need to be allocated for tracking material use, waste-generation rates, and recycling rates and reporting on material usage, waste generation, recycling, and progress in implementing WMin/PP practices.

7.4 Facility Training

Facility training funding will be required to allow participation in opportunity assessments and to implement training.

7.5 Opportunity Assessments

Funding in this category will go to identifying research and development opportunities for application to the waste stream.

7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams

It is estimated that funding will be required through 1997 for procuring capital equipment to implement WMin/PP source-reduction opportunities.

7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams

It is estimated that funding will be required through 1995 for implementing the reuse or recycling of hazardous, radioactive, and mixed wastes onsite.

7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams

N/A

7.7 Design Considerations

Costs for design considerations will come from evaluating the potential of new technologies on waste-generating activities.

7.8 Program Evaluation

As part of the ongoing program evaluation, funding needs to be allocated to evaluating the effect of source reduction and recycling on waste-generation and disposal rates.

Table 7.1 Required resources for Engineering & Technology Transfer WMin/PP program for FY 1994 through FY 1996. (Hazardous aqueous solution with organics <10%—Building 321.)

Program Element	\$K FY 1994 (Budgeted)	\$K FY 1995 (Estimated)	\$K FY 1996 (Estimated)
7.1 Organization and Infrastructure	5.0	5.3	5.5
7.2 Facility Program Development	2.5	2.6	2.7
7.3 Site-Wide Program Participation	11.2	11.7	6.0
7.4 Facility Training	1.2	1.4	1.6
7.5 Opportunity Assessments	2.5	2.6	2.7
7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	100.0	5.0	3.0
7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	30.0	2.0	N/A
7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	N/A	N/A	N/A
7.7 Design Considerations	10.0	5.0	N/A
7.8 Program Evaluation	2.5	2.6	2.7
Total	164.9	38.2	24.2

**Table 7.2 Estimated resources required for Engineering & Technology Transfer WMin/PP program for FY 1997 through FY 1999.
(Hazardous aqueous solution with organics <10%—Building 321.)**

Program Element	\$K FY 1997 (Estimated)	\$K FY 1998 (Estimated)	\$K FY 1999 (Estimated)
7.1 Organization and Infrastructure	5.8	6.0	6.2
7.2 Facility Program Development	2.0	1.0	N/A
7.3 Site-Wide Program Participation	5.0	4.0	3.0
7.4 Facility Training	1.8	2.0	2.2
7.5 Opportunity Assessments	2.8	2.9	3.0
7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	1.0	N/A	N/A
7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	N/A	N/A	N/A
7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	N/A	N/A	N/A
7.7 Design Considerations	N/A	N/A	N/A
7.8 Program Evaluation	2.8	2.9	3.0
Total	21.2	18.8	17.4

7.0 ENGINEERING AND TECHNOLOGY TRANSFER PROGRAM ELEMENTS

Hazardous Aqueous Solution with Metals—Building 321

7.1 Organization and Infrastructure

Participating in the WMin organization and infrastructure will include costs for support personnel for the WMin/PP Coordinator, for interface with the site-wide WMin/PP coordinator(s), and for instituting corrective actions in response to program evaluation.

7.2 Facility Program Development

Facility program development funding will be allocated to integrating WMin/PP practices into all site operating procedures.

7.3 Site-Wide Program Participation

Participation in the Lab-wide waste minimization program through 1999 will include exchanging information and technologies with other waste generators to ensure the application of the most appropriate available waste-reduction methods. It is further expected that such an information/technology exchange will involve seeking some technical assistance from the site-wide program. Finally, funding will be required for tracking material use, waste generation rates, and recycling rates.

7.4 Facility Training

Facility training funding will be required to allow participation in opportunity assessments and to implement training.

7.5 Opportunity Assessments

Funding in this category will go to identifying research and development opportunities to apply to the waste stream.

7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams

In implementing WMin/PP source-reduction opportunities, it is estimated that funding will be required through 1997 for substituting materials to reduce toxic chemical use and release and hazardous, radioactive, and mixed-waste generation.

7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams

It is estimated that funding will be required through 1996 to implement the reuse or recycling of hazardous, radioactive, and mixed wastes onsite.

7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams

N/A

7.7 Design Considerations

Costs associated with design considerations will derive from the need to evaluate the potential of new technologies on waste-generating activities.

7.8 Program Evaluation

As part of the ongoing program evaluation, funding needs to be allocated to evaluating the effect of source reduction and recycling on waste-generation and disposal rates.

Table 7.1 Required resources for Engineering & Technology Transfer WMin/PP program for FY 1994 through FY 1996. (Hazardous aqueous solution with metals—Building 321.)

Program Element	\$K FY 1994 (Budgeted)	\$K FY 1995 (Estimated)	\$K FY 1996 (Estimated)
7.1 Organization and Infrastructure	4.8	5.0	5.2
7.2 Facility Program Development	2.5	2.6	2.7
7.3 Site-Wide Program Participation	8.2	8.6	9.0
7.4 Facility Training	1.2	1.3	1.4
7.5 Opportunity Assessments	2.5	2.6	2.7
7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	10.0	5.0	3.0
7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	2.5	2.0	1.0
7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	N/A	N/A	N/A
7.7 Design Considerations	2.5	3.0	2.0
7.8 Program Evaluation	2.5	2.6	2.7
Total	36.7	32.7	29.7

Table 7.2 Estimated resources required for Engineering & Technology Transfer WMin/PP program for FY 1997 through FY 1999 (Hazardous aqueous solution with metals—Building 321.)

Program Element	FY 1997 (Estimated)	FY 1998 (Estimated)	FY 1999 (Estimated)
7.1 Organization and Infrastructure	5.4	5.6	5.8
7.2 Facility Program Development	2.0	1.0	N/A
7.3 Site-Wide Program Participation	7.0	5.0	3.0
7.4 Facility Training	1.5	1.6	1.7
7.5 Opportunity Assessments	2.8	2.9	3.0
7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	1.0	N/A	N/A
7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	N/A	N/A	N/A
7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	N/A	N/A	N/A
7.7 Design Considerations	1.0	N/A	N/A
7.8 Program Evaluation	2.8	2.9	3.0
Total	23.5	19.0	16.5

7.0 ENGINEERING AND TECHNOLOGY TRANSFER PROGRAM ELEMENTS

Hazardous Unspecified Aqueous Waste—Building 321

7.1 Organization and Infrastructure

Participation in the WMin organization and infrastructure will include costs for personnel to support the generator WMin/PP coordinator, interface with the site-wide WMin/PP coordinator(s), and institute corrective actions resulting from program evaluation.

7.2 Facility Program Development

Facility program development funding will be allocated for integrating WMin/PP practices into all site operating procedures.

7.3 Site-Wide Program Participation

Participation in the Lab-wide waste minimization program through 1999 will include informing, educating, and otherwise involving employees in job-specific WMin/PP practices. Such participation will also call for exchanging information and technologies with other waste generators to ensure the application of the most appropriate available waste reduction methods. It is further expected that such an information/technology exchange will involve seeking some technical assistance from the site-wide program. Finally, funding will be required for tracking material use, waste generation rates, and recycling rates.

7.4 Facility Training

Facility training funding will be required to allow participation in opportunity assessments and to implement training.

7.5 Opportunity Assessments

Funding in this category will provide for the identifying of research and development opportunities for application to the waste stream.

7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams

In implementing WMin/PP source reduction opportunities, it is estimated that funding will be required through 1997 for substituting materials to reduce toxic chemical use and release and for substituting materials to reduce hazardous, radioactive, and mixed-waste generation.

7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams

It is estimated that funding will be required through 1996 for implementing the reuse or recycling of hazardous, radioactive, and mixed wastes onsite.

7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams

N/A

7.7 Design Considerations

Costs associated with design considerations will derive from the necessity for evaluating the potential of new technologies on waste-generating activities.

7.8 Program Evaluation

As part of the ongoing program evaluation, funding needs to be allocated to evaluating the effect of source reduction and recycling on waste-generation and disposal rates.

Table 7.1 Required resources for Engineering & Technology Transfer WMin/PP program for FY 1994 through FY 1996. (Hazardous unspecified aqueous waste—Building 321.)

Program Element	\$K FY 1994 (Budgeted)	\$K FY 1995 (Estimated)	\$K FY 1996 (Estimated)
7.1 Organization and Infrastructure	4.8	5.0	5.2
7.2 Facility Program Development	2.5	2.6	2.7
7.3 Site-Wide Program Participation	11.2	11.7	6.0
7.4 Facility Training	1.2	1.3	1.4
7.5 Opportunity Assessments	2.5	2.6	2.7
7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	10.0	5.0	3.0
7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	2.5	2.0	1.0
7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	N/A	N/A	N/A
7.7 Design Considerations	2.5	3.0	2.0
7.8 Program Evaluation	2.5	2.6	2.7
Total	39.7	35.8	26.7

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**Table 7.2 Estimated resources required for Engineering & Technology Transfer WMin/PP program for FY 1997 through FY 1999.
(Hazardous unspecified aqueous waste—Building 321.)**

Program Element		\$K FY 1997 (Estimated)	\$K FY 1998 (Estimated)	\$K FY 1999 (Estimated)
7.1	Organization and Infrastructure	5.4	5.6	5.8
7.2	Facility Program Development	2.0	1.0	N/A
7.3	Site-Wide Program Participation	5.0	4.0	3.0
7.4	Facility Training	1.5	1.6	1.7
7.5	Opportunity Assessments	2.8	2.9	3.0
7.6a	Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	1.0	N/A	N/A
7.6b	Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	N/A	N/A	N/A
7.6c	Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	N/A	N/A	N/A
7.7	Design Considerations	1.0	N/A	N/A
7.8	Program Evaluation	2.8	2.9	3.0
Total		21.5	18.0	16.5

7.0 ENGINEERING AND TECHNOLOGY TRANSFER PROGRAM ELEMENTS

Mixed Aqueous Wastes—Building 321

7.1 Organization and Infrastructure

Participation in the WMin organization and infrastructure will include costs for personnel to support the generator WMin/PP coordinator, interface with the site-wide WMin/PP coordinator(s), and institute corrective actions resulting from program evaluation.

7.2 Facility Program Development

Facility program development funding will be allocated to integrating WMin/PP practices into all site operating procedures.

7.3 Site-Wide Program Participation

Participation in the overall waste minimization program will include informing, educating, and otherwise involving employees in job-specific WMin/PP practices and tracking material use, waste generation rates, and recycling rates.

7.4 Facility Training

Facility training funding will be required to allow participation in opportunity assessments and to implement training.

7.5 Opportunity Assessments

Funding in this category will go to identifying of research and development opportunities to apply to the waste stream.

7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams

In implementing WMin/PP source reduction opportunities, it is estimated that funding will be required through 1997 for the procurement of capital equipment and for substituting materials to reduce hazardous, radioactive, and mixed-waste generation.

7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams

It is estimated that funding will be required through 1995 for implementing the reuse or recycling of hazardous, radioactive, and mixed wastes onsite.

7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams

N/A

7.7 Design Considerations

Costs associated with design considerations will derive from the necessity for evaluating the potential of new technologies on waste-generating activities.

7.8 Program Evaluation

As part of the ongoing program evaluation, funding needs to be allocated to evaluating the effect of source reduction and recycling on waste-generation and disposal rates.

**Table 7.1 Required resources for Engineering & Technology Transfer
WMin/PP program for FY 1994 through FY 1996. (Mixed aqueous
wastes—Building 321.)**

Program Element		\$K FY 1994 (Budgeted)	\$K FY 1995 (Estimated)	\$K FY 1996 (Estimated)
7.1	Organization and Infrastructure	2.4	5.0	5.2
7.2	Facility Program Development	2.5	2.6	2.7
7.3	Site-Wide Program Participation	7.5	7.8	4.0
7.4	Facility Training	1.2	1.3	1.4
7.5	Opportunity Assessments	2.5	2.6	2.7
7.6a	Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	20.0	5.0	3.0
7.6b	Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	10.0	2.0	N/A
7.6c	Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	N/A	N/A	N/A
7.7	Design Considerations	5.0	3.0	1.0
7.8	Program Evaluation	2.5	2.6	2.7
Total		53.6	31.9	22.7

Table 7.2 Estimated resources required for Engineering & Technology Transfer WMin/PP program for FY 1997 through FY 1999. (Mixed aqueous wastes—Building 321.)

Program Element	\$K FY 1997 (Estimated)	\$K FY 1998 (Estimated)	\$K FY 1999 (Estimated)
7.1 Organization and Infrastructure	5.4	5.6	5.8
7.2 Facility Program Development	2.0	1.0	N/A
7.3 Site-Wide Program Participation	3.0	2.0	1.0
7.4 Facility Training	1.5	1.6	1.7
7.5 Opportunity Assessments	2.8	2.9	3.0
7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	1.0	N/A	N/A
7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	N/A	N/A	N/A
7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	N/A	N/A	N/A
7.7 Design Considerations	N/A	N/A	N/A
7.8 Program Evaluation	2.8	2.9	3.0
Total	18.5	16.0	14.5

**7.0 ENGINEERING AND TECHNOLOGY TRANSFER PROGRAM
ELEMENTS
Unspecified Sludge Waste—Building 321**

7.1 Organization and Infrastructure

Participation in the WasteMin organization and infrastructure will include costs for personnel to support the generator WMin/PP coordinator, participate in the site-wide WMin/PP committee, and institute corrective actions resulting from program evaluation.

7.2 Facility Program Development

Facility program development funding will be allocated to integrating WMin/PP practices into all site operating procedures.

7.3 Site-Wide Program Participation

Participation in the overall waste minimization program will include seeking technical assistance from the site-wide program and tracking material use, waste generation rates, and recycling rates.

7.4 Facility Training

Funding in this category will provide for participation in opportunity assessments and implementation of training.

7.5 Opportunity Assessments

With respect to opportunity assessments, funding will be required for identifying and evaluating current and potential waste-generating activities and identifying and prioritizing WMin/PP opportunities for the waste stream in question. In addition, funding will go to identifying research and development opportunities to apply to the waste stream.

7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams

N/A

7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams

It is estimated that funding will be required through 1995 to implement the reuse or recycling of wastes onsite from the waste stream in question.

7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams

N/A

7.7 Design Considerations

It is estimated that funding can be applied through 1995 to evaluate the potential of new technologies on waste-generating activities.

7.8 Program Evaluation

As part of the ongoing program evaluation, funding needs to be allocated to evaluating the effect of source reduction and recycling on waste-generation and disposal rates.

**Table 7.1 Required resources for Engineering & Technology Transfer
WMin/PP program for FY 1994 through FY 1996. (Unspecified
Sludge Waste—Building 321.)**

Program Element		\$K FY 1994 (Budgeted)	\$K FY 1995 (Estimated)	\$K FY 1996 (Estimated)
7.1	Organization and Infrastructure	4.8	5.0	5.2
7.2	Facility Program Development	2.5	2.6	2.7
7.3	Site-Wide Program Participation	7.5	7.8	4.0
7.4	Facility Training	1.2	1.3	1.4
7.5	Opportunity Assessments	20.0	5.0	3.0
7.6a	Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	N/A	N/A	N/A
7.6b	Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	10.0	2.0	N/A
7.6c	Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	N/A	N/A	N/A
7.7	Design Considerations	10.0	5.0	N/A
7.8	Program Evaluation	2.5	2.6	2.7
Total		58.5	31.3	19.0

Table 7.2 Estimated resources required for Engineering & Technology Transfer WMin/PP program for FY 1997 through FY 1999. (Unspecified Sludge Waste—Building 321.)

Program Element	\$K FY 1997 (Estimated)	\$K FY 1998 (Estimated)	\$K FY 1999 (Estimated)
7.1 Organization and Infrastructure	5.4	5.6	5.8
7.2 Facility Program Development	2.0	1.0	N/A
7.3 Site-Wide Program Participation	3.0	2.0	1.0
7.4 Facility Training	1.5	1.6	1.7
7.5 Opportunity Assessments	1.0	N/A	N/A
7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	N/A	N/A	N/A
7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	N/A	N/A	N/A
7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	N/A	N/A	N/A
7.7 Design Considerations	N/A	N/A	N/A
7.8 Program Evaluation	2.8	2.9	3.0
Total	15.7	13.1	11.5

7.0 ENGINEERING AND TECHNOLOGY TRANSFER PROGRAM ELEMENTS

Mixed-waste Solvents—Building 321

7.1 Organization and Infrastructure

Participation in the WMin organization and infrastructure will include costs for personnel to support the generator WMin/PP coordinator, interface with the site-wide WMin/PP coordinator(s), and institute corrective actions resulting from program evaluation.

7.2 Facility Program Development

Facility program development funding go to integrating WMin/PP practices into all site operating procedures.

7.3 Site-Wide Program Participation

Participation in the Lab-wide waste minimization program through 1999 will include informing, educating, and otherwise involving employees in job-specific WMin/PP practices. Such participation will also call for exchanging information and technologies with other waste generators to ensure the application of the most appropriate available waste reduction methods. It is further expected that such an information/technology exchange will involve seeking some technical assistance from the site-wide program. Finally, funding will be required for tracking material use, waste generation rates, and recycling rates and reporting on material usage, waste generation, recycling, and progress made because implementing WMin/PP practices.

7.4 Facility Training

Facility training funding will be required to allow participation in opportunity assessments and implement training.

7.5 Opportunity Assessments

Funding in this category will provide for the identification of research and development opportunities to apply to the waste stream.

7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-waste Streams

In implementing WMin/PP source reduction opportunities, it is estimated that funding will be required through 1995 for the procurement of capital equipment and for substituting materials to reduce hazardous, radioactive, and mixed-waste generation.

7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams

It is estimated that funding will be required through 1995 for implementing the reuse or recycling of hazardous, radioactive, and mixed wastes onsite.

7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams

N/A

7.7 Design Considerations

Costs associated with design considerations will derive from the need to evaluate the potential of new technologies on waste-generating activities.

7.8 Program Evaluation

As part of the ongoing program evaluation, funding needs to be allocated to evaluating the effect of source reduction and recycling on waste-generation and disposal rates.

**Table 7.1 Required resources for Engineering & Technology Transfer
WMin/PP program for FY 1994 through FY 1996. (Mixed-waste
solvents—Building 321.)**

Program Element		\$K FY 1994 (Budgeted)	\$K FY 1995 (Estimated)	\$K FY 1996 (Estimated)
7.1	Organization and Infrastructure	5.0	5.3	5.5
7.2	Facility Program Development	2.5	2.6	2.7
7.3	Site-Wide Program Participation	10.5	11.0	6.0
7.4	Facility Training	1.2	1.4	1.6
7.5	Opportunity Assessments	2.5	2.6	2.7
7.6a	Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	10.0	3.0	N/A
7.6b	Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	2.5	3.0	N/A
7.6c	Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	N/A	N/A	N/A
7.7	Design Considerations	2.5	3.0	2.0
7.8	Program Evaluation	2.5	2.6	2.7
Total		39.2	34.5	23.2

Table 7.2 Estimated resources required for Engineering & Technology Transfer WMin/PP program for FY 1997 through FY 1999. (Mixed-waste solvents—Building 321.)

Program Element	FY 1997 (Estimated)	FY 1998 (Estimated)	FY 1999 (Estimated)
7.1 Organization and Infrastructure	5.8	6.0	6.2
7.2 Facility Program Development	2.0	1.0	N/A
7.3 Site-Wide Program Participation	5.0	4.0	3.0
7.4 Facility Training	1.8	2.0	2.2
7.5 Opportunity Assessments	2.8	2.9	3.0
7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	N/A	N/A	N/A
7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	N/A	N/A	N/A
7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	N/A	N/A	N/A
7.7 Design Considerations	N/A	N/A	N/A
7.8 Program Evaluation	2.8	2.9	3.0
Total	20.2	18.8	17.4

Engineering and Technology Transfer Cumulative Totals

Totals by fiscal year for nine Engineering and Technology Transfer waste streams.

Table 7.1 Required resources for Energy & Technology Transfer WMin/PP program for FY 1994 through FY 1996—Cumulative.

Cumulative Program Budget	\$K FY 1994 (Budgeted)	\$K FY 1995 (Estimated)	\$K FY 1996 (Estimated)
Total	430.6	337.9	250.5

Table 7.2 Estimated resources required for Energy & Technology Transfer WMin/PP program for FY 1997 through FY 1999—Cumulative.

Cumulative Program Budget	\$K FY 1997 (Estimated)	\$K FY 1998 (Estimated)	\$K FY 1999 (Estimated)
Total	186.6	131.7	111.8

Lasers

7.0 LASERS PROGRAM ELEMENTS

Inertial Confinement Fusion

The Inertial Confinement Fusion (ICF) Program has established an assurance function at the Deputy Program Leader level with responsibility for developing and overseeing of the ICF Waste Minimization program. This office is responsible for issuing and updating the waste minimization planning as well as developing waste minimization policy.

Measuring waste-minimization program performance in a laboratory is more complicated than measuring performance in a production facility. Since Laser Programs programmatic activity is essentially experimental and developmental, waste generation fluctuates from year to year. Hazardous waste quantities may actually increase despite expected progress in minimizing waste from specific projects. Normalizing generation rates by reporting quantities per unit of production, cost, full-time equivalents (FTEs), or other measures, does not accurately reflect waste minimization progress. Since the ICF laboratories are not in the business of production, and cost and number of FTEs is dependent on numerous factors such as process complexity, funding limitations, and programmatic decisions; normalizing of waste quantities will result in some inconsistencies that can lead to erroneous conclusions without more in-depth analysis.

The Laser Programs' policy on waste minimization was issued by the Associate Director for Lasers in February 1990:

"Laser Programs is strongly committed to minimizing the generation of hazardous and radioactive wastes in Laser Programs activities. Its goal is to minimize hazardous and radioactive waste streams through careful planning, reduced generation, increased recycling, process changes, employee awareness and administrative controls.

Each major program or project should establish waste minimization goals, develop plans and assign responsibilities for achieving these goals. A waste minimization committee, with members from each Laser Programs element, will provide guidance and monitor progress. The success of waste minimization will depend on active participation and contribution from every member of Laser Programs. New projects will incorporate waste minimization considerations in their design and operations."

The Laser Programs effort supports the Director's statement on waste minimization.

7.1 Organization and Infrastructure

- We have a Waste Minimization and Pollution Prevention (WMin/PP) Coordinator to evaluate ICF Program waste streams and processes that might provide innovative waste reduction opportunities to reduce the volume and/or toxicity of laboratory-generated waste.
- We have the WMin/PP coordinator with the support staff necessary to be effective.
- WMin/PP coordinator participates in the LLNL site-wide WMin/PP committee and coordinator network.
- WMin/PP coordinator institutes corrective actions in response to program evaluation.

7.2 Facility Program Development

Under the direction of the Deputy Program Leader, the WMin/PP Coordinator will (1) participate in developing and periodically updating the Laser and Environmental Programs Directorate WMin/PP Plan, (2) develop WMin/PP program objectives, and (3) develop activity schedules for specific tasks.

7.3 Site-Wide Program Participation

The WMin/PP Coordinator exchanges information and technologies with other waste generators through informal meetings and the site-wide WMin/PP Steering Committee.

7.4 Facility Training

The WMin/PP Coordinator will foster education on waste reduction opportunities through departmental meetings, memos, electronic media, and seminars.

7.5 Opportunity Assessments

Currently an aqueous cleaning system is being designed to replace the VOC system currently in use in Building 391. Building 298 waste tank declassification from hazardous to nonhazardous through changes made to existing waste stream.

7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams

See Section 7.5

7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams

Must be done at LLNL site-wide level.

7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams

White paper recycling implemented in all offices and laboratories at LLNL site-wide level.

7.7 Design Considerations

Currently an aqueous cleaning system is being designed to replace the VOC system currently in use in Building 391.

7.8 Program Evaluation

Waste minimization has historically been the goal of the ICF Program. As part of Continuing Quality Improvement, line personnel are becoming more involved with the WMin/PP objectives.

Table 7.1 Required resources for the Lasers' ICF WMin/PP program for FY 1994 through FY 1996.

Program Element	\$K FY 1994 (Budgeted)	\$K FY 1995 (Estimated)	\$K FY 1996 (Estimated)
7.1 Organization and Infrastructure	35	35	35
7.2 Facility Program Development	*	*	*
7.3 Site-Wide Program Participation	*	*	*
7.4 Facility Training	*	*	*
7.5 Opportunity Assessments	*	*	*
7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	*	*	*
7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	*	*	*
7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	*	*	*
7.7 Design Considerations	*	*	*
7.8 Program Evaluation	*	*	*
Total	*370	*385	*385

*Due to size of the ICF program, this effort is funded by Laser Directorate funds as part of their core environmental program. Although we can estimate the total funding, we do not know how the funds will be allocated to the different categories in this table, except for 7.1. Organization and Infrastructure.

Table 7.2 Estimated resources required for Lasers' ICF WMin/PP program for FY 1997 through FY 1999.

Program Element	\$K FY 1997 (Estimated)	\$K FY 1998 (Estimated)	\$K FY 1999 (Estimated)
7.1 Organization and Infrastructure	36	37	37
7.2 Facility Program Development	*	*	*
7.3 Site-Wide Program Participation	*	*	*
7.4 Facility Training	*	*	*
7.5 Opportunity Assessments	*	*	*
7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	*	*	*
7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	*	*	*
7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	*	*	*
7.7 Design Considerations	*	*	*
7.8 Program Evaluation	*	*	*
Total	*390	*390	*390

*Due to size of the ICF program, this effort is funded by Laser Directorate funds as part of their core environmental program. Although we can estimate the total funding, we do not know how the funds will be allocated to the different categories in this table, except for 7.1. Organization and Infrastructure.

7.0 LASER PROGRAM ELEMENTS

Isotope Separation and Advanced Manufacturing

As a result of a Memorandum of Agreement (MOA) with the United States Enrichment Corporation (USEC) in October 1993, the Isotope Separation and Advanced Manufacturing (ISAM) Technology Program has been placing all the Atomic Vapor Laser Isotope Separation (AVLIS) facilities into a "planned shutdown" mode. Only regular inspection and facility maintenance and surveillance are occurring. A decision on future activities is expected in April 1994.

At the time a decision is made regarding the future of the AVLIS facilities, ISAM will prepare within 90 days a Waste Minimization and Pollution Prevention Awareness Plan consistent with the work scope and level of funding. Until that decision is made ISAM will continue to follow all applicable LLNL and DOE waste minimization and pollution prevention directives.

Nuclear Test-Experimental Science

7.0 NUCLEAR TEST-EXPERIMENTAL SCIENCE PROGRAM ELEMENTS

7.1 Organization and Infrastructure

Nuclear Test-Experimental Science (NTES) has a Waste Minimization Coordinator at the Directorate level and a waste minimization contact in each division. The NTES program has experienced budget cuts and downsizing, and it is expected that remaining NTES' activities will be folded into an existing directorate or directorates before the close of this fiscal year. Therefore, we do not believe it is appropriate to provide a five-year directorate waste minimization plan/budget. However, we have provided budget numbers for FY 1994.

7.2 Facility Program Development

Not applicable. Explained in Section 7.1.

7.3 Site-Wide Program Participation

The Directorate participates in white paper recycling. Operational Safety Procedure reviews are used to identify new waste minimization opportunities. We are sending our surplus chemicals to the Chemical Exchange Warehouse whenever possible.

7.4 Facility Training

All waste generators receive hazardous waste handling practices training annually. Transuranic (TRU) waste generators receive additional training. Training costs are part of the Program budget.

7.5 Opportunity Assessments

Not applicable. Explained in Section 7.1.

7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams

Chemical inventories are reviewed by management and surplus chemicals are sent to the Chemical Exchange Warehouse for use by other programs whenever possible. Radioactive waste streams in the Heavy Element Facility are being characterized to allow disposal in Nevada.

7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams

Not applicable. Explained in Section 7.1.

7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams

Not applicable. Explained in Section 7.1.

7.7 Design Considerations

Not applicable. Explained in Section 7.1.

7.8 Program Evaluation

Although the Directorate has a limited waste minimization program, NTES is committed to decrease hazardous, radioactive, and mixed waste. Our principal investigators, who are in charge of research carried out in our facilities, evaluate waste minimization options as they develop new experiments. Environmental analysts assigned to the Directorate review new activities for waste minimization opportunities.

Waste generated by experimental processes has decreased. However, the total amount of radioactive and mixed waste has increased because of the ongoing cleanup of our facilities and, in particular, the preparation of our Heavy Element Facility for standby status.

Table 7.1 Required resources for the NTES WMin/PP program for FY 1994 through FY 1996.

Program Element	\$K FY 1994 (Budgeted)	\$K FY 1995 (Estimated)	\$K FY 1996 (Estimated)
7.1 Organization and Infrastructure	15	*	*
7.2 Facility Program Development	*	*	*
7.3 Site-Wide Program Participation	5	*	*
7.4 Facility Training	*	*	*
7.5 Opportunity Assessments	10	*	*
7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	*	*	*
7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	*	*	*
7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	*	*	*
7.7 Design Considerations	*	*	*
7.8 Program Evaluation	*	*	*
Total	30	*	*

* See Section 7.1.

Table 7.2 Estimated resources required for NTES WMin/PP program for FY 1997 through FY 1999.

Program Element	\$K FY 1997 (Estimated)	\$K FY 1998 (Estimated)	\$K FY 1999 (Estimated)
7.1 Organization and Infrastructure	*	*	*
7.2 Facility Program Development	*	*	*
7.3 Site-Wide Program Participation	*	*	*
7.4 Facility Training	*	*	*
7.5 Opportunity Assessments	*	*	*
7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	*	*	*
7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	*	*	*
7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	*	*	*
7.7 Design Considerations	*	*	*
7.8 Program Evaluation	*	*	*
Total	*	*	*

* See Section 7.1.

Physical Sciences

7.0 PHYSICAL SCIENCES PROGRAM ELEMENTS

The Physical Sciences budget is integrated into the Environmental Health & Safety (ES&H) ADS.

7.1 Organization and Infrastructure

The Physical Sciences Directorate consists of several major research organizations: Advanced Technology, Geoscience and Environmental Research, Physics Research, and University of California Institutes. These organizations have multiple divisions and/or programs within each.

The Physical Sciences Deputy Associate Director (AD) for Operations appoints a committee member to the Waste Minimization/Pollution Prevention Steering Committee. That committee member reports back to the Deputy AD and to the Physical Sciences Safety Committee on the activities of the steering committee. The members of the safety committee include the Deputy AD for Operations, the AD Assurance Officer, the AD Environmental Health & Safety (EH&S) Operations Manager, and Facility Managers and EH&S Officers from throughout the Directorate.

7.2 Facility Program Development

The Directorate receives guidance from the laboratory and evaluates the cost effectiveness for implementation within the Directorate. The Directorate participates in waste minimization/pollution prevention (WMin/PP) awareness training and WMin/PP practices in all of its operating procedures. The Directorate does continuing evaluation of institutional and Directorate WMin/PP goals to find opportunities for waste reduction and pollution prevention.

7.3 Site-Wide Program Participation

The Directorate participates through the following six actions:

- Provides a working member to the WMin/PP Steering Committee.
- Receives and evaluates the waste records from Hazardous Waste Management and evaluates output stream.
- Receives and evaluates the input stream from data from Chem Track.
- Participates in the white waste paper recycling program.
- Continuously monitors waste streams coming into its Waste Accumulation Areas (WAA). This WAA monitoring provides immediate feedback to the waste generators of changes in quantities.
- Requires and monitors the attendance of waste generators at the necessary Waste Generator training.

7.4 Facility Training

The Directorate insures, through the AD Assurance Officer and each organizational element's self assessment, that the proper training is conducted for each person's job responsibilities. Particular attention is given to the non-FTE personnel, (i.e., consultants, participating guests, summer students, and CRADA contacts), to be certain that the need for WMin/PP awareness and/or training is completed.

7.5 Opportunity Assessments

The Directorate continually evaluates all of its waste generation processes to take advantage of new technologies and improvements of in house capabilities.

For FY 1994, the Directorate will be investigating the application of administrative controls before new chemical orders are placed. These controls will check to see if the needed chemicals are on hand either through the new Chem Track Inventory or through the new Chemical Exchange Warehouse. We will also be accessing possible reduction of sewerable solvent wastes at the Building 197 microcircuit research facility.

We are analyzing the inventory from Chem Track and evaluating possible chemical substitutions to reduce the output wastes.

7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams

During FY 1993, Building 3703 hydrochloric acid wastes were reduced to zero. Nitric acid use was reduced from 100mL to 5mL per sample in the research on Hiroshima samples.

The administrative controls on new orders, as described in Section 7.5, may be implemented during FY 1994 depending on the outcome of assessment of this process.

7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed Waste Streams

In Buildings 194, 212, and the 412 machine shops, the use of cooling oil for milling and lathes was changed to aqueous fluids that can be filtered and reused. In the Advanced Technology Program, a type of vacuum pump oil is in use that can be recycled by the manufacturer to obtain a 95% recovery of the usable oil.

7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams

Dependent upon the assessment described in Section 7.5.

7.7 Design Considerations

The Directorate has no new facility design needing WMin/PP input.

7.8 Program Evaluation

The Directorate is awaiting institutional evaluation.

Table 7.1 Required resources for Physical Sciences WMin/PP program for FY 1994 through FY 1996.

Program Element	\$K FY 1994 (Budgeted)	\$K FY 1995 (Estimated)	\$K FY 1996 (Estimated)
7.1 Organization and Infrastructure	*	*	*
7.2 Facility Program Development	*	*	*
7.3 Site-Wide Program Participation	*	*	*
7.4 Facility Training	*	*	*
7.5 Opportunity Assessments	*	*	*
7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	*	*	*
7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	*	*	*
7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	*	*	*
7.7 Design Considerations	*	*	*
7.8 Program Evaluation	*	*	*
Total	*10	*10	*11

*The budget numbers are subject to DOE funding and the outcome of the proposed assessments. For this reason, we cannot break down this budget beyond the total amount at this time.

Table 7.2 Estimated resources required for the Physical Sciences WMin/PP program for FY 1997 through FY 1999.

Program Element	\$K FY 1997 (Estimated)	\$K FY 1998 (Estimated)	\$K FY 1999 (Estimated)
7.1 Organization and Infrastructure	*	*	*
7.2 Facility Program Development	*	*	*
7.3 Site-Wide Program Participation	*	*	*
7.4 Facility Training	*	*	*
7.5 Opportunity Assessments	*	*	*
7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed Waste Streams	*	*	*
7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed Waste Streams	*	*	*
7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	*	*	*
7.7 Design Considerations	*	*	*
7.8 Program Evaluation	*	*	*
Total	*12	*12	*13

*The budget numbers are subject to DOE funding and the outcome of the proposed assessments. For this reason, we cannot break down the budget beyond this amount at this time.

Plant Operations

Hazardous Waste Management Division

7.0 PLANT OPERATIONS PROGRAM ELEMENTS

Hazardous Waste Management Division

7.1 Organization and Infrastructure

Hazardous Waste Management Division is responsible for the treatment, storage, and disposal of all hazardous, mixed, low-level and transuranic waste created at Lawrence Livermore National Laboratory. The Division is broken into three sections: Technology and Information Systems, Facilities and Assessments, and Waste Operations. Waste Operations is the only section in the Division that creates waste, other than sanitary waste. In addition, this section works with all of the program waste generators. Thus, the section leader of Waste Operations, or the leader's designee, is in charge of waste minimization efforts within the Division.

7.2 Facility Program Development

The Division has no formal waste minimization plan because the Division has only two major waste streams (other than sanitary waste): plastic booties worn in the 514 treatment area and filter cake created in the treatment of aqueous radioactive (mixed- and low-level) waste. The Supervisor of the 514 treatment facility is in charge of developing a program to reduce or eliminate the bootie waste stream. The Environmental Process Engineering Group Leader is in charge of developing aqueous radioactive waste treatment methods that create less mixed-waste product. We have several very small waste streams (trash from maintenance, carboys from Process Engineering lab). The workers creating these waste streams are trained in waste minimization techniques and already limit this waste to the extent possible.

7.3 Site-Wide Program Participation

The Waste Operations Section Leader or designee is a member of the site-wide Waste Minimization Steering Committee. The leader will ensure that all employees of the Division are aware of opportunities to reduce or recycle waste.

7.4 Facility Training

The primary formal training in waste minimization is provided by EP-0006, Hazardous Waste Handling Practices. All Division employees who work with hazardous waste attend this class annually.

7.5 Opportunity Assessments

The Division has only two waste streams (other than sanitary waste); plastic booties worn in the 514 treatment area and filter cake created in the treatment of aqueous radioactive (mixed- and low-level) waste. The Supervisor of the 514 treatment facility is in charge of developing a program to reduce or eliminate the bootie waste stream. He is working with the health physicist in the Hazards Control Department to eliminate the need for booties in the area. The Group Leader of the Environmental Process Engineering group is in charge of developing aqueous radioactive waste treatment methods that create less mixed-waste product. A vacuum evaporator system has been ordered and will be installed in FY 1994 and should be in full operation in FY 1995. This system should eliminate a large portion of the filter cake waste.

7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams

See Section 7.5

7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams

The plastic booties could be replaced by washable booties, but since they are worn only by visitors (facility personnel wear Lab-provided boots), it would not save money. There is no way of recycling the filter cake waste.

7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams

All employees of the Division are encouraged to participate in the white paper recycling program. In addition, the use of colored paper for mailings/newsletters is discouraged. Double-sided copying is used whenever practical. Electronic mail and a network computer server, available to all Division employees, is used for transmitting most Divisional information.

7.7 Design Considerations

See Section 7.5

7.8 Program Evaluation

Division personnel are encouraged to continuously look for opportunities for waste minimization, both within the Division as well as the programs we serve.

Table 7.1 Required resources for Hazardous Waste Management WMin/PP program for FY 1994 through FY 1996.

Program Element	\$K FY 1994 (Budgeted)	\$K FY 1994 (Estimated)	\$K FY 1996 (Estimated)
7.1 Organization and Infrastructure			
7.2 Facility Program Development			
7.3 Site-Wide Program Participation			
7.4 Facility Training			
7.5 Opportunity Assessments			
7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	240 Oper. 250 Cap.	200 Oper.	50 Oper.
7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams			
7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams			
7.7 Design Considerations			
7.8 Program Evaluation			
Total	490	200	50

Table 7.2 Estimated resources required for Hazardous Waste Management WMin/PP program for FY 1997 through FY 1999.

Program Element	\$K FY 1997 (Estimated)	\$K FY 1998 (Estimated)	\$K FY 1999 (Estimated)
7.1 Organization and Infrastructure			
7.2 Facility Program Development			
7.3 Site-Wide Program Participation			
7.4 Facility Training			
7.5 Opportunity Assessments			
7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	50 Oper.	60 Oper.	55 Oper.
7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams			
7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams			
7.7 Design Considerations			
7.8 Program Evaluation			
Total	50	60	55

Chemical Exchange Warehouse

7.0 PLANT OPERATIONS PROGRAM ELEMENTS

Hazardous Waste Management Division

Chemical Exchange Warehouse

The Chemical Exchange Warehouse (CHEW) project is designed to identify and temporarily store excess, usable chemicals until an internal or external group is found who will take the chemicals and use them productively instead of buying new ones from a manufacturer.

CHEW was established to safely and cost-effectively improve Lawrence Livermore National Laboratory's (LLNL's) waste minimization efforts. The Laboratory is organized into many research programs and support functions that independently buy, store, and dispose of a wide range of chemicals. When programs shut down, employees retire, or inventories are reduced, many usable chemicals are sent to Hazardous Waste Management (HWM) for disposal as waste. Unused chemicals represent a substantial portion of wastes entering the HWM facility destined for disposal. Managing these usable materials as hazardous waste is expensive and in many cases unnecessary because many of the materials are commonly used and desired by another LLNL program or by external groups.

A lab-wide computerized database for linking the original chemical purchaser with potential users existed at LLNL—the Chemical Exchange Database. This system allowed the original purchaser to list the excess chemicals on a database; however, the owner was required to retain the material until a suitable match was made with a new user. The Chemical Exchange Warehouse is a quality improvement to that database. The warehouse enables HWM to accept unused chemicals and products, store them in one facility, and redistribute them to users onsite or offsite when a potential user is found.

The budget items for CHEW, FY 1994 have been submitted under Hazardous Waste Management ADS 3941.5.6.8

7.1 Organization and Infrastructure

The Chemical Exchange Warehouse is operated by the Hazardous Waste Management Division at a hazardous waste storage unit in Building 693. This building is operated under an Interim Status Agreement with the Department of Toxic Substances Control, the state agency controlling hazardous waste storage.

HWM has an organization that handles chemicals on a Lab-wide basis and strong management team capable of directing this effort. The HWM field

technicians manage most of the waste packing campaigns that are required when chemical inventories are reduced. The field technicians can evaluate the excess chemical products and channel appropriate ones to CHEW.

7.2 Facility Program Development

The Department of Energy funded \$45,000 to help meet startup costs. Those costs included but were not limited to:

- Cabinets equipped with earthquake bars were installed for storage of chemicals.
- Retrofit cabinets to wall for earthquake proofing.
- Portable fork truck barriers to separate CHEW area from waste area in Building 693.
- Upgrade for computer software.
- Computer installation at Building 693.
- Office setup at Building 693.
- Manpower to organize, facilitate, and develop initial opening.

We expect to accept 1000 containers per quarter into CHEW. We foresee distributing only 25% of the CHEW inventory to onsite users. A routine inventory will be taken of CHEW at monthly intervals. One purpose of the inventory is to establish a list of chemicals in sealed, unused containers that are not moving onsite. As required by DOE regulations, the list of excess chemicals will be offered to the DOE community on a agency-wide database. The excess chemicals will also be offered to selected colleges and universities that have access to government databases. If an interested user is not located, certain chemicals will be offered for public bid, depending on their estimated value.

The typical movement of chemical/product into and out of CHEW is as follows:

INTO CHEW:

- Custodian of chemical contacts HWM field technician for inventory reduction.
- Field technician reviews excess inventory against CHEW suitability criteria.
- Current custodian and field technician fill out CHEW Acceptance Form.
- Request for CHEW sent to HWM review chemist and CHEW technician for approval.
- CHEW technician moves chemicals into CHEW stock at B693.
- Chew technician enters item into database and downloads daily to files accessible to LLNL potential users via a on-line server.

OUT OF CHEW TO LLNL USER:

- Potential user identifies a need to procure a chemical.
- Potential user interfaces with CHEW data base via one of two avenues:
 - 1) Reviews the CHEW file on HWM operations server.
 - 2) Potential user sends chemical requisition to Purchasing. Purchasing checks the CHEW data file, identifies a potential match and phones potential user and suggests CHEW.
- Potential user decides to use CHEW inventory and calls CHEW technician
- CHEW technician completes and files CHEW Delivery form (Attachment B), delivers item with appropriate MSDS, and removes from database.

OUT OF CHEW TO AN OFF SITE DESTINATION:

- Chew database indicates a chemical has reached a storage time review point.
- CHEW technician places appropriate items on a list for movement offsite.
- Material is listed by Property Management on a nation-wide DOE database (REAPS) for exchange with other DOE facilities and various colleges and universities.
- Desired items will be removed from CHEW database, delivery form completed and material packaged and transported to interested organizations.
- Items not exchanged via the DOE community may be offered for public bid.
- Items not sold will be declared hazardous waste and managed appropriately.

7.3 Site-Wide Program Participation

Experimenters and scientists Labwide have access to the CHEW database via a Macintosh computer Open Labnet. The CHEW technician maintains one master database using Filemaker Pro. The master database is not available to the general Lab population and is accessible only by the CHEW technician and certain designated key personnel. A Word and Excel file is exported daily from the master database and made available to the general Lab population in the CHEW file on a designated server.

The inventory of CHEW chemicals is marketed to LLNL employees in various ways: first, through various media at LLNL, including articles and advertisements in *Newsline*, the semi-weekly lab-wide newspaper and in articles in *Waste Matters* the HWM quarterly news bulletin; second, through HWM technicians who assist program people to identify potential users of CHEW materials; and third, through the Environmental

Protection Department, which has incorporated information about CHEW in the waste minimization section of the LLNL Hazardous Waste Generation and Certification training course.

The CHEW technicians strongly encourage all the chemical buyers in Procurement to use the CHEW database regularly before purchasing chemicals that might be in the CHEW inventory. Buyers are encouraged to contact the Lab requester to ask if they are interested in using the chemicals available in CHEW at no charge, including delivery within 24-hours, rather than making an outside purchase. In addition the LLNL Plating Shop and HWM Tank Farm are large users of acids and bases. The CHEW technician contacts both of these users when CHEW has slow moving inventory items that they might be able to use. Most of the acids and bases can be used in this manner, rather than managed as waste.

7.4 Facility Training

As discussed in Section 7.1, the Environmental Protection Department has incorporated information about CHEW in the waste minimization section of the LLNL Hazardous Waste Generation and Certification training course.

7.5 Opportunity Assessments

Not applicable

7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed Waste Streams

Not applicable. See Section 7.1.

7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed Waste Streams

Not applicable. See Section 7.1.

7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams

Not applicable

7.7 Design Considerations

Not applicable

7.8 Program Evaluation

The Chemical Exchange Warehouse received approval for operation from DOE/OAK on October 14, 1993, and shortly thereafter began accepting material into the warehouse. We estimate that after operating less than five months, the program has saved LLNL \$32,102 (by eliminating the new purchase price of material and expenses for handling, storing, and disposing of the material as hazardous waste). The following is approximate statistical information that can be applied to the program.

**LLNL Chemical Exchange Warehouse
11/1/93-3/17/94**

Item	Fiscal Year Total
Opened containers received	662
Unopened containers received	902
Opened containers delivered	151
Unopened containers delivered	187
Total containers delivered	338
Estimated cost savings of items delivered	\$42,616

**Table 7.1 Required resources for CHEW WMin/PP program for
FY 1994 through FY 1996.**

Program Element	\$K FY 1994 (Budgeted)	\$K FY 1995 (Estimated)	\$K FY 1996 (Estimated)
7.1 Organization and Infrastructure	*	*	*
7.2 Facility Program Development	*	*	*
7.3 Site-Wide Program Participation	75	90	92
7.4 Facility Training	*	*	*
7.5 Opportunity Assessments	*	*	*
7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	*	*	*
7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	*	*	*
7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	*	*	*
7.7 Design Considerations	*	*	*
7.8 Program Evaluation	*	*	*
Total	75	90	92

*The Chemical Exchange Warehouse Program has been implemented. The ongoing expense is for manpower to operate the facility on a daily basis coupled with occasional administrative expenses. The cost of a program upgrade generally cannot be estimated until the project is proposed

Table 7.2 Estimated resources required for CHEW WMin/PP program for FY 1997 through FY 1999.

Program Element	\$K FY 1997 (Estimated)	\$K FY 1995 (Estimated)	\$K FY 1999 (Estimated)
7.1 Organization and Infrastructure	*	*	*
7.2 Facility Program Development	*	*	*
7.3 Site-Wide Program Participation	93.5	97	103
7.4 Facility Training	*	*	*
7.5 Opportunity Assessments	*	*	*
7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	*	*	*
7.6b Implement Recyclin Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	*	*	*
7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	*	*	*
7.7 Design Considerations	*	*	*
7.8 Program Evaluation	*	*	*
Total	93.5	97	103

*The Chemical Exchange Warehouse Program has been implemented. The ongoing expense is for manpower to operate the facility on a daily basis coupled with occasional administrative expenses. The cost of a program upgrade generally cannot be estimated until the project is proposed

Plant Engineering and Maintenance & Operations

7.0 PLANT OPERATIONS PROGRAM ELEMENTS
Plant Operations and Maintenance and Operations

- Waste Minimization Committee.
- Hazardous waste technicians.
- Monitor hazardous waste streams.
- Identify waste-minimization targets.

7.1 Organization and Infrastructure

- Hazardous Waste Program Manager.
- Trained hazardous waste technicians.
- Plant Engineering Assurance Manager.

7.2 Facility Program Development

None.

7.3 Site-Wide Program Participation

Waste Minimization Steering Committee.

7.4 Facility Training.

None.

7.5 Opportunity Assessments

On-going.

**7.6a Implement Source Reduction Opportunities for Hazardous,
Radioactive, and Mixed-Waste Streams**

Implemented source reduction in the following areas:

- Freon (cleaning purposes).
- General solvent use.
- Aqueous waste.

**7.6b Implement Recycling Opportunities for Hazardous,
Radioactive, and Mixed-Waste Streams**

- Batteries.
- Oil.
- Freon.

**7.6c Implement Source Reduction and Recycling Opportunities for
Sanitary Waste Streams**

None.

7.7 Design Considerations

None.

7.8 Program Evaluation

None

Table 7.1 Required resources for the Plant Operations and Operations and Maintenance WMin/PP program for FY 1994 through FY 1996.

Program Element	\$K FY 1994 (Budgeted)	\$K FY 1995 (Estimated)	\$K FY 1996 (Estimated)
7.1 Organization and Infrastructure	70	70	70
7.2 Facility Program Development	0	0	0
7.3 Site-Wide Program Participation	0	0	0
7.4 Facility Training	25	25	25
7.5 Opportunity Assessments	0	0	0
7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	0	0	0
7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	0	0	0
7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	0	0	0
7.7 Design Considerations	0	0	0
7.8 Program Evaluation	0	0	0
Total	95	95	95

Table 7.2 Estimated resources required for the Plant Operations and Operations and Maintenance WMin/PP program for FY 1997 through FY 1999.

Program Element	\$K FY 1997 (Estimated)	\$K FY 1998 (Estimated)	\$K FY 1999 (Estimated)
7.1 Organization and Infrastructure	70	70	70
7.2 Facility Program Development	0	0	0
7.3 Site-Wide Program Participation	0	0	0
7.4 Facility Training	25	25	25
7.5 Opportunity Assessments	0	0	0
7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	0	0	0
7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	0	0	0
7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	0	0	0
7.7 Design Considerations	0	0	0
7.8 Program Evaluation	0	0	0
Total	95	95	95

Hazards Control Department

7.0 PLANT OPERATIONS PROGRAM ELEMENTS

Hazards Control Department

Hazards Control Department operates several Safety Laboratories to analyze samples taken from throughout LLNL. In the process, a waste stream is generated consisting of hazardous, mixed, and low-level waste. The Department maintains two approved Waste Accumulation Areas where materials are collected prior to pick up by the Hazardous Waste Management Division of the Environmental Protection Department.

7.1 Organization and Infrastructure

- Trained hazardous waste generators.
- Waste Accumulation Area Coordinators and Operators.
- Waste Minimization Coordinator.
- Hazards Control Assurance Representative.

7.2 Facility Program Development

None.

7.3 Site-Wide Program Participation

Participation on the Waste Minimization Steering Committee.

7.4 Facility Training

Waste minimization coordinator is available to answer questions, and keep knowledgeable about ongoing and one-time waste minimization efforts and encourage additional efforts. Training provided to personnel includes EP0006, EP0052, and EP0053.

7.5 Opportunity Assessments

Waste minimization coordination is an ongoing effort to evaluate areas of waste minimization in the laboratories.

7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams

New procedures, if successful, will eliminate the mixed waste from the Bioassay Laboratory, leaving just some liquid hazardous waste.

7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed Waste Streams

Hazards Control Safety Labs have implemented recycling by participating in the chemical exchange program. Thus they take other peoples waste for programmatic use.

7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams

None

7.7 Design Considerations

None

7.8 Program Evaluation

The Bioassay Laboratory is conducting a study and investigating new procedures for preparing bioassay samples for counting.

Table 7.1 Required resources for the Hazards Control WMin/PP program for FY 1994 through FY 1996.

Program Element	\$K FY 1994 (Budgeted)	\$K FY 1995 (Estimated)	\$K FY 1996 (Estimated)
7.1 Organization and Infrastructure			
7.2 Facility Program Development			
7.3 Site-Wide Program Participation			
7.4 Facility Training	3	3	3
7.5 Opportunity Assessments	3	3	3
7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams		10	10
7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	1	1	1
7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams			
7.7 Design Considerations			
7.8 Program Evaluation	38		
Total	45	17	17

Table 7.2 Estimated resources required for the Hazards Control WMin/PP program for FY 1997 through FY 1999.

Program Element	\$K FY 1997 (Estimated)	\$K FY 1998 (Estimated)	\$K FY 1999 (Estimated)
7.1 Organization and Infrastructure			
7.2 Facility Program Development			
7.3 Site-Wide Program Participation			
7.4 Facility Training	3	3	3
7.5 Opportunity Assessments	3	3	3
7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	10	10	10
7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	1	1	1
7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams			
7.7 Design Considerations			
7.8 Program Evaluation			
Total	17	17	17

Health Services Department

7.0 PLANT OPERATIONS PROGRAM ELEMENTS

Health Services Department

Health Services Department (HSD) provides comprehensive preventative medical services as well as treatment of injury and illness that occur during work hours at LLNL. One waste stream generated by HSD is biohazardous waste. This is rendered sterile for sanitary disposal by Biology and Biotechnology in an approved procedure. Our average is 400 pounds of nonhazardous (biohazardous) waste per year. A small amount (100 gal per year) of hazardous waste is generated from the developing chemicals used for x-ray film. Building 663's retention tanks have never been used for disposal of hazardous or biohazardous waste. Building 663's FSP dictates that radiological waste will be collected in a carboy and returned to the program generating the waste.

7.1 Organization and Infrastructure

HSD's building coordinator manager spends a about 15% of his/her time providing waste management duties. The facilities manager oversees the waste management duties. He/she and the assistant spend a total of 15% of their time on waste management issues. Both the facility manager and the building coordinator participate in the Plant Operations Assurance Representatives Committee.

7.2 Facility Program Development

This area is not applicable.

7.3 Site-Wide Program Participation

The Building Coordinator tracks material usage and waste generation.

7.4 Facility Training

This area is not applicable.

7.5 Opportunity Assessments

This area is not applicable.

7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams

This area is not applicable.

7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams

This area is not applicable.

7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams

This area is not applicable.

7.7 Design Considerations

As new technology becomes cost-effective for nonhazardous chemical development of x-ray films this area might be explored.

7.8 Program Evaluation

Our waste generation is low and program evaluation concentrates on maintaining our low level of generation

Table 7.1 Required resources for the Health Services Department WMin/PP program for FY 1994 through FY 1996.

Program Element	\$K FY 1994 (Budgeted)	\$K FY 1995 (Estimated)	\$K FY 1996 (Estimated)
7.1 Organization and Infrastructure	.30 FTE/25	26	26
7.2 Facility Program Development	NA	NA	NA
7.3 Site-Wide Program Participation	NA	NA	NA
7.4 Facility Training	NA	NA	NA
7.5 Opportunity Assessments	NA	NA	NA
7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	NA	NA	NA
7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	NA	NA	NA
7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	NA	NA	NA
7.7 Design Considerations	NA	NA	NA
7.8 Program Evaluation	NA	NA	NA
Total	25	26	26

Table 7.2 Estimated resources required for the Health Services Department WMin/PP program for FY 1997 through FY 1999.

Program Element		\$K FY 1997 (Estimated)	\$K FY 1998 (Estimated)	\$K FY 1999 (Estimated)
7.1	Organization and Infrastructure	27	27	28
7.2	Facility Program Development	NA	NA	NA
7.3	Site-Wide Program Participation	NA	NA	NA
7.4	Facility Training	NA	NA	NA
7.5	Opportunity Assessments	NA	NA	NA
7.6a	Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	NA	NA	NA
7.6b	Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	NA	NA	NA
7.6c	Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	NA	NA	NA
7.7	Design Considerations	NA	NA	NA
7.8	Program Evaluation	NA	NA	NA
Total		27	27	28

Technical Information Department

7.0 PLANT OPERATIONS PROGRAM ELEMENTS

Technical Information Department

7.1 Organization and Infrastructure

The Technical Information Department (TID) has a fully implemented waste minimization/pollution prevention program, technically approved by the Environmental Protection and Hazards Control Departments. TID's hazardous waste is generated in the Print Plant and Photo Lab. It is temporarily stored by TID in an approved Waste Accumulation Area, picked up regularly by Hazardous Waste Management, and reduced to sludge and disposed of by Hazardous Waste Management.

Reducing or eliminating the hazardous waste streams in TID's Print Plant and Photo Lab would not require any organizational expenses other than those to retrain employees in using new equipment. Removing current equipment and installing new equipment in the Photo Lab would probably mean significant noncapital alterations. The cost of these noncapital alterations is unknown, but some of them could be financed by inclusion in the appropriate TID recharge rates.

Removing some existing equipment and installing new equipment would free up space in the Photo Lab for the Print Plant's bindery expansion. One of the Print Plant's most serious problems is the lack of sufficient space. This lack causes serious environmental safety and health problems through crowding, inadequate storage space for materials, and fume buildup.

7.2 Facility Program Development

TID will begin immediately to plan an implementation schedule to modify our present waste minimization/pollution prevention program based on the possible acquisition of new equipment. With this new equipment, TID could eliminate most of its hazardous waste streams. See Paragraph 7.6a for particulars.

7.3 Site-Wide Program Participation

N/A

7.4 Facility Training

N/A

7.5 Opportunity Assessments

N/A

7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams

TID Printing Plant

Color digital printing is affecting the industry, and TID plans to meet future Laboratory printing needs through environmentally clean, high-speed, high-quality digital color printing. We plan to request funding for a new, Indigo Digital Offset Color Press in FY 1995. The cost would be approximately \$300K and would permit us to dispose of our Heidelberg offset color press, the operation of which generates hazardous waste. We believe that aside from ES&H considerations, we can fully cost-justify the acquisition of this press because of the technological advancements it provides.

Digital offset color printing transfers the ink image from the plate on which the image is electronically digitized to a blanket, and from the blanket to the paper. Unlike conventional offset printing, there is no residual ink left on the blanket. A 100% transfer of the ink to the paper occurs, with no waste by the liquid ink used. Inks on these digital presses are made in a light mineral oil base which is environmentally clean.

The acquisition of this digital offset color press would enable the Print Plant to eliminate 764 gallons of hazardous waste per year, plus eliminate approximately 250 pounds of regular ink. The Print Plant is gradually changing over to soy-based inks wherever possible. Acquisition of this new press would permit use of only soy based inks, which are about as environmentally clean as ink can be.

Aside from environmental considerations, acquiring this new press can be justified purely by cost. It would simplify the printing process sufficiently to permit a significant reduction in TID's recharge rates to its customers.

TID Photo Lab

The conversion of TID's Photo Lab to a digital darkroom would cost approximately \$810K at FY 1994 prices. However, technology is advancing so rapidly that in two years, the price could easily drop to \$500-600K. TID plans to implement this conversion over two fiscal years, FY 1996 and FY 1997. At FY 1994 prices, this would require approximately \$380K the first year and \$430K the second year.

In the second year, approximately \$150K of the funding could be handled out of the operating budget, as it consists of equipment that could be expensed. In addition, it may be possible and desirable to lease some of this equipment because technology is advancing rapidly and prices are dropping at the same time.

Not all photo chemical processors would be eliminated in this conversion. Some film processors for color and black and white negatives and transparencies would be retained since technology is not moving as rapidly in areas of photographic developing and printing.

Acquisition of this digital darkroom equipment would allow us to reduce our hazardous waste stream in the Photo Lab from 12,500 pounds per year to 2500 pounds initially.

7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams

N/A

7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams

N/A

7.7 Design Considerations

N/A

7.8 Program Evaluation

N/A

**Table 7.1 Required resources for the Technical Information Department
WMin/PP program for FY 1994 through FY 1996.**

Program Element	\$K FY 1994 (Budgeted)	\$K FY 1995 (Estimated)	\$K FY1996 (Estimated)
7.1 Organization and Infrastructure			
7.2 Facility Program Development			
7.3 Site-wide Program Participation			
7.4 Facility Training			
7.5 Opportunity Assessments			
7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	0	300	380
7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams			
7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams			
7.7 Design Considerations			
7.8 Program Evaluation			
Total	0	300	380

**Table 7.2 Estimated resources required for Technical Information
Department WMin/PP program for FY 1997 through FY 1999.**

Program Element	\$K FY 1997 (Estimated)	\$K FY 1998 (Estimated)	\$K FY 1999 (Estimated)
7.1 Organization and Infrastructure			
7.2 Facility Program Development			
7.3 Site-Wide Program Participation			
7.4 Facility Training			
7.5 Opportunity Assessments			
7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	430	0	0
7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams			
7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams			
7.7 Design Considerations			
7.8 Program Evaluation			
Total	430	0	0

Environmental Restoration Division

7.0 PLANT OPERATIONS PROGRAM ELEMENTS

Environmental Restoration Division

The primary function of the Environmental Restoration Division (ERD) is to investigate and remediate contamination of soil and groundwater from past operations conducted at LLNL's Livermore Site and Site 300. Remediation includes evaluating, selecting, and implementing pertinent environmental restoration technologies. ERD is implementing health-protective, cost-effective, state-of-the-art environmental investigations and remediation of soil and groundwater.

7.1 Organization and Infrastructure

A designated Waste Minimization Coordinator (WMC) represents the Environmental Restoration Division at the monthly Plant Operations (PO) Waste Minimization Committee meetings for the Livermore Site and quarterly meetings for Site 300. The PO Waste Minimization Committee consists of representatives from each department housed within the Plant Operations Directorate. The Site 300 Waste Minimization Committee is composed of site-wide line management personnel. The WMC acts as a liaison between the PO Waste Minimization Committee and ERD by attending the committee meetings and providing an informational link to ERD.

7.2 Facility Program Development

The Waste Minimization/Pollution Prevention (WMin/PP) Program Plan is reviewed annually and at a minimum revised every three years. WMin/PP is an on-going ERD effort that maintains and/or improves existing technologies and results in the most effective use of waste minimization applications.

7.3 Site-Wide Program Participation

Remediation processes, routine groundwater sampling, and drilling activities are performed seeking innovative technologies to optimize waste reduction. Waste minimization ideas are exchanged at scheduled meetings. The WMC attends seminars and workshops to stay abreast of waste minimization technologies used outside LLNL. Upper-level management also represents ERD on the site-wide Waste Minimization Steering Committee. ERD actively participates in the site-wide white paper recycling program. The Chemical Exchange Warehouse is used when feasible in lieu of purchasing new chemicals and having large unused portions remaining.

7.4 Facility Training

ERD personnel who handle various wastes such as investigation-derived drill cuttings, unused core samples, and purge fluids must annually attend the EP-0006 Lab course, which encourages waste minimization and enhances pollution prevention awareness. The training is managed institutionally; therefore costs are not reflected in Table 7.1

7.5 Opportunity Assessments

Waste minimization is designed into remediation processes at the beginning. Processes are constantly being evaluated to incorporate newer and more effective technologies as they become available. For example, the most effective destruction technology is used to break down volatile organic compounds (VOCs), resulting in a lower accumulation of VOCs onto the granulated carbon at the end of the process, thereby reducing the amount of waste.

7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams

Implementing source reduction does not generally apply to ERD's remediation processes with the exception of strategically locating extraction wells to optimize the influent of contaminants and minimizing the amount of groundwater extracted. Source reduction is applicable to the groundwater sampling portion of ERD's activities. Micropurging is currently being pursued and if successful will result in a 2/3 reduction in the volume of groundwater purged during routine quarterly sampling events. Consultation with other waste generators is conducted to actively discourage the use of hazardous materials in processes that will lead to soil and/or groundwater contamination.

7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams

Recycling and reuse are implemented whenever feasible to create as much of a closed loop system as possible.

7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams

None

7.7 Design Considerations

ERD is actively implementating waste minimization applications during the design phase of its projects. Waste minimization is optimized during this stage using the best available technology.

7.8 Program Evaluation

Waste minimization applications are continuously reviewed by the ERD staff. Ideas regarding waste minimization and cost-effective methods of conducting business are frequently recruited from ERD employees. ERD will continue to develop and implement optimized remediation plans using the latest feasible waste minimization applications.

**Table 7.1 Required resources for the ERD WMin/PP program for
FY 1994 through FY 1996.**

Program Element	\$K FY 1994 (Budgeted)	\$K FY 1994 (Estimated)	\$K FY 1996 (Estimated)
7.1 Organization and Infrastructure	12	13	14
7.2 Facility Program Development	15	15	15
7.3 Site-Wide Program Participation	5	6	7
7.4 Facility Training	0	0	0
7.5 Opportunity Assessments	50	50	50
7.6a Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	35	10	5
7.6b Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	5	5	5
7.6c Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	0	0	0
7.7 Design Considerations	145	145	145
7.8 Program Evaluation	2	2	2
Total	269	246	243

Table 7.2 Estimated resources required for the ERD WMin/PP program for FY 1997 through FY 1999.

Program Element		\$K FY 1997 (Estimated)	\$K FY 1998 (Estimated)	\$K FY 1999 (Estimated)
7.1	Organization and Infrastructure	15	15	15
7.2	Facility Program Development	15	15	15
7.3	Site-wide Program Participation	7	7	7
7.4	Facility Training	0	0	0
7.5	Opportunity Assessments	35	23	23
7.6a	Implement Source Reduction Opportunities for Hazardous, Radioactive, and Mixed- Waste Streams	2	2	2
7.6b	Implement Recycling Opportunities for Hazardous, Radioactive, and Mixed-Waste Streams	5	5	5
7.6c	Implement Source Reduction and Recycling Opportunities for Sanitary Waste Streams	0	0	0
7.7	Design Considerations	105	70	70
7.8	Program Evaluation	2	2	2
Total		186	139	139

Plant Operations Cumulative Totals

Table 7.1 Required resources for Plant Operations WMin/PP program for FY 1994 through FY 1996—Cumulative.

Cumulative Program Budget	\$K FY 1994 (Budgeted)	\$K FY 1995 (Estimated)	\$K FY 1996 (Estimated)
Total	999	979	903

Table 7.2 Estimated resources required for Plant Operations WMin/PP program for FY 1997 through FY 1999—Cumulative.

Cumulative Program Budget	\$K FY 1997 (Estimated)	\$K FY 1998 (Estimated)	\$K FY 1999 (Estimated)
Total	898.5	435	437

8.0 SUMMARY

This *Waste Minimization and Pollution Prevention Awareness Plan* provides an overview of projected activities from FY 1994 through FY 1999. The plans are broken into site-wide and problem-specific activities. All directorates at LLNL have had an opportunity to contribute input, to estimate budget, and to review the plan.

In addition to the above, this plan records LLNL's goals for pollution prevention, regulatory drivers for those activities, assumptions on which the cost estimates are based, analyses of the strengths of the projects, and the barriers to increasing pollution prevention activities.

DATE

FILMED

7/29/94

END

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