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OAK RIDGE
NATIONAL
LABORATORY

MARTIN MARIETTA

Waste Reduction Program at Oak Ridge National Laboratory During CY 1990

March 1991

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MANAGED BY
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FOR THE UNITED STATES
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ORNL/TM-11780

OAK RIDGE NATIONAL LABORATORY
OFFICE OF WASTE MANAGEMENT AND REMEDIAL ACTIONS
WASTE MANAGEMENT OPERATIONS PROGRAM
WASTE MANAGEMENT COORDINATION OFFICE

WASTE REDUCTION PROGRAM AT OAK RIDGE NATIONAL LABORATORY DURING CY 1990

Date Published: March 1991

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ACRONYM LIST

ALARA	as low as reasonable achievable
AVID	Accelerated Vendor Inventory Delivery (system)
CDS	Chemical Dispensing Station
CH	contact-handled
CSLF II	Centralized Sanitary Land Fill II
CY	calendar year
DOE	Department of Energy
EPA	Environmental Protection Agency
EPO	Environmental Protection Officers
ERDP	Environmental Review and Documentation Program
ESD	Environmental Sciences Division
F&M	Finance and Materials Division
FPDL	Fission Production Development Laboratory
FY	fiscal year
GCO	Generator Certification Official
GET	General Employee Training
GPP	General Plant Project
HFIR	High Flux Isotope Reactor
HQ	Headquarters
HR	high-range
HWOG	Hazardous Waste Operations Group
IDB	Integrated Data Base
LCO	Laboratory Certification Official
LGTTG	Liquid and Gaseous Treatment Technology Group
LLW	low-level waste
LLLW	liquid low-level waste
LLLWC	liquid low-level waste concentrate
LLLWT	liquid low-level waste treatment (system)
LR	low-range
LSA	low specific activity
NEPA	National Environmental Policy Act
NG	newly generated
NPDES	National Pollutant Discharge Elimination System
NRWTP	Nonradiological Wastewater Treatment Plant
ORGDP	Oak Ridge Gaseous Diffusion Plant
ORNL	Oak Ridge National Laboratory
ORO	Oak Ridge Operations
P&E	Plant and Equipment Division
PIP	Performance Improvement Process (Committee)
PPAP	Pollution Prevention Awareness Program
PW	process waste
PWTP	Process Waste Treatment Plant
RCRA	Resource Conservation and Recovery Act
R&D	research and development
REDC	Radiochemical Engineering Development Center
RH	remote-handled
RTR	real-time radiography
SLLW	solid low-level waste
SWIMS	Solid Waste Information Management System
TSA	Technical Safety Appraisal
TRU	transuranic waste
TSCA	Toxic Substances Control Act
WAC	waste acceptance criteria
WHPP	Waste Handling and Packaging Plant
WIPP	Waste Isolation Pilot Plant
WRC	Waste Reduction Coordinator
WRR	Waste Reduction Representative

1.0 INTRODUCTION

Oak Ridge National Laboratory is a multipurpose research and development facility owned and operated by the Department of Energy and managed under subcontract by Martin Marietta Energy Systems, Inc. ORNL's primary role is the support of energy technology through applied research and engineering development and scientific research in basic and physical sciences. ORNL also is a valuable resource in the quest to solve problems of national importance, such as nuclear and chemical waste management. In addition, ORNL produces useful radioactive and stable isotopes for medical and energy research that are unavailable from the private sector.

These activities are conducted predominantly on small scales in over 900 individual R&D laboratories at ORNL. Activities are diverse, variable, and frequently generate some type of waste material. In contrast to the typical production facility's few large-volume waste "streams," ORNL has numerous small ones, including radioactive LLLW, liquid PW, solid radioactive waste (LLW and TRU waste), hazardous waste, industrial waste, and mixed waste (containing both hazardous and radioactive constituents). The wide diversity of waste complicates both management and compliance with reporting requirements that are designed to apply to production facilities.

Since the early-to-mid 1980's, increased effort has been devoted to the minimization of hazardous and radioactive wastes at ORNL. Policy statements supporting such efforts have been issued by both Martin Marietta Energy Systems, Inc., and ORNL management. Motivation for waste reduction is found in federal and state regulations, DOE policies and guidelines, increased costs and liabilities associated with the management of wastes, and limited disposal options and facility capacities.

ORNL's waste minimization efforts have achieved some success. However, because of the diversity and predominantly nonroutine nature of ORNL's wastes, goals for their reduction are difficult to establish. Efforts continue to establish goals that account separately for wastes generated from nonroutine activities, such as laboratory clean outs and spill clean-ups.

The ORNL Waste Reduction Program is managed by the Waste Reduction Coordinator (WRC), who provides leadership, guidance and coordination and facilitates communication. The coordinator prepares and updates ORNL-wide plans and reports and tracks progress toward goals.

Each ORNL division has appointed a waste reduction representative (WRR) to lead activities within the division, including preparing division plans and reports, establishing internal goals, tracking progress, performing waste stream evaluations, and implementing projects. Inter-division communication and projects are facilitated by the WRC.

The basic strategy for waste reduction at ORNL is to (1) identify major generators of major or problem waste streams and implement projects to reduce those streams and (2) train and motivate all ORNL staff to incorporate waste reduction measures into their activities. The latter aspect targets the small, variable, diverse waste streams and is to be accomplished through workshops, posters, incentive programs, and ORNL policies.

In the Fall of 1990, the DOE Tiger Team found ORNL's waste minimization program to be "ineffective." Corrective action plans were developed and overhead fmunding support has been obtained to accelerate and intensify efforts in the second half of FY 1991.

2.0 HAZARDOUS AND MIXED WASTE MINIMIZATION

A formal hazardous waste minimization program for ORNL was launched in mid-1985 in response to the requirements of Section 3002 of the Resource Conservation and Recovery Act. (For the purpose of this report, hazardous wastes are considered to include (1) those wastes regulated under RCRA and (2) wastes not regulated under RCRA, but which could present a hazard if improperly managed. Mixed wastes, which are either RCRA or non-RCRA hazardous waste combined with radioactive waste, are managed as hazardous radioactive wastes.)

The Waste Minimization Program elements described in this section apply to both hazardous and mixed wastes. The major additional waste minimization measure applied to mixed waste streams is segregation of radioactive from hazardous materials. The combination of chemical and radioactive hazards create a waste that is much more difficult and costly to manage. The training program described in Sect. 2.7 teaches waste generators to identify and isolate hazardous from radioactive materials when possible.

The divisional WRRs track monthly waste generation and record "nonroutine" wastes. Nonroutine wastes are generated from activities other than the normal work of the division and consist primarily of wastes from construction and remedial action projects and of chemicals from laboratory cleanouts (further discussed in Sect. 2.6).

Table 2.1 and Figure 2.1 show the total hazardous (RCRA and non-RCRA, both mixed radioactive and nonradioactive) waste generated annually from 1987 through 1990 (estimates of the nonroutine fraction are included). Figure 2.1 also shows the annual generation rates for CYs 1985 and 1986. Data for the nonroutine categories was not available for 1985. Table 2.2 further describes nonroutine waste generated in CY 1990. The break down of the hazardous waste generated during CY 1990 is visually displayed in Figure 2.2. Table 2.3 quantifies the hazardous waste generated by each ORNL division during CY 1990.

Table 2.1. ORNL hazardous waste generation

Calendar year	Waste generation (kg)		
	Routine	Nonroutine	Total
1987	127,470	170,240	297,710
1988	90,930	70,490	161,420
1989	98,550	71,730	170,280
1990	75,397	67,692	143,089

[a]Includes mixed radioactive and nonradioactive, RCRA and non-RCRA waste from ORNL facilities at the Y-12 Plant as well as the main ORNL site in Bethel and Melton Valleys.

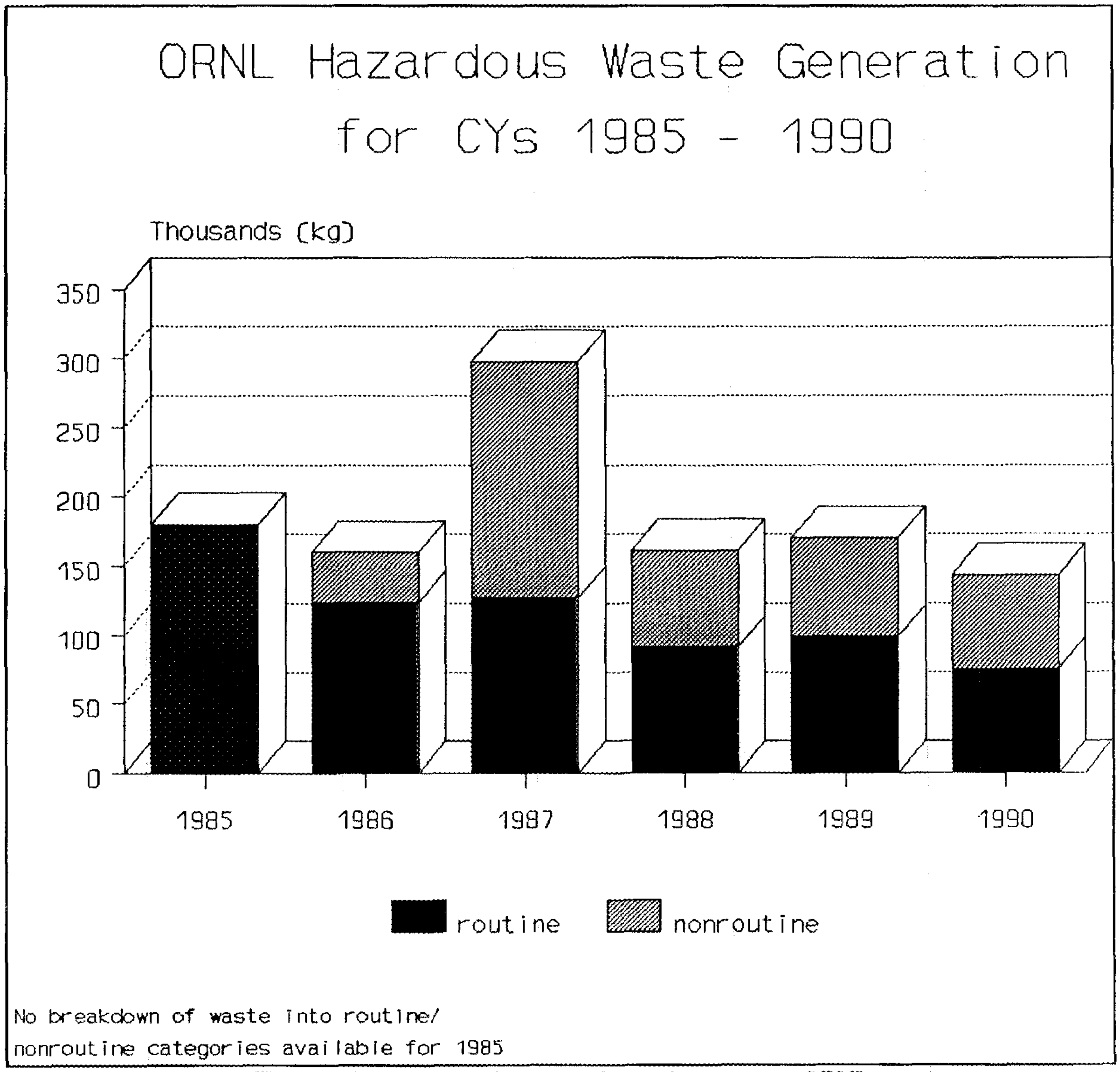

Fig. 2.1. Annual generation rates of hazardous waste at ORNL

Table 2.2. ORNL 1990 hazardous waste[a] generation

Waste category	Waste generated (kg)
Routine	**75,397**
Nonroutine	
Laboratory Cleanout	28,614
Orphaned Waste	3,804
Spills	24,343
Constr/Remed Act	2,979
Other	7,952
Nonroutine Total	**67,692**
TOTAL[b]	**143,089**

[a] Includes mixed radioactive and nonradioactive, RCRA and non-RCRA wastes from ORNL facilities at the Y-12 Plant as well as those in Bethel and Melton Valleys.

[b] December's breakdown of hazardous waste into routine and nonroutine categories was estimated based on historical data.

The 1990 total hazardous waste generation shows a significant decrease from the 1989 total. In the nonroutine category, laboratory cleanout waste generation decreased almost 14 percent, from 33,133 kg in CY 1989 to 28,614 kg in CY 1990. Orphaned waste generation in CY 1990 decreased 86 percent from that of CY 1989, mostly due to improved housekeeping habits during 1989. Orphaned waste is usually waste from past operations that does not have an "owner" due to discontinuation of programs, reorganization, or other extenuating circumstances. In future years, laboratory cleanout activities are expected to decline and stabilize and nonroutine waste from remediation is predicted to increase. A 24 percent decrease from CY 1989 in the generation of routine wastes likely resulted from improved waste segregation, recycling activities, and process modifications.

Hazardous wastes generated at ORNL are temporarily stored in approved areas on-site, until such time as they are either transported to off-site commercial facilities for treatment or disposal or are detonated on-site. Depending on the waste toxicity and classification, different treatment or disposal technologies may be employed. All mixed wastes, except for scintillation fluids, are stored on-site.

Approximately 11,460 kg (25,206 lb) of containerized mixed wastes were generated during CY 1990 (see Table 2.4). Scintillation fluids comprised the majority of these mixed wastes. Mixed waste generation in CY 1990 decreased 57 percent from that of CY 1988 and 36 percent from CY 1989. This downward trend is partly the result of generator training and increased awareness of waste minimization. During CY 1990, the mixed wastes generated were stored on-site awaiting the availability of treatment technologies. ORNL mixed waste storage facilities are essentially full, another factor which has discouraged the generation of such waste.

The majority of ORNL's scintillation fluids are periodically shipped to the Quadrex facility where glass and plastic vials are crushed, liquid is separated and sent to an incinerator, and crushed vials are rinsed and disposed of properly. In the future, the TSCA Incinerator at ORGDP may be used to treat these radioactively-contaminated scintillation fluids, as well as other mixed wastes that are now being stored.

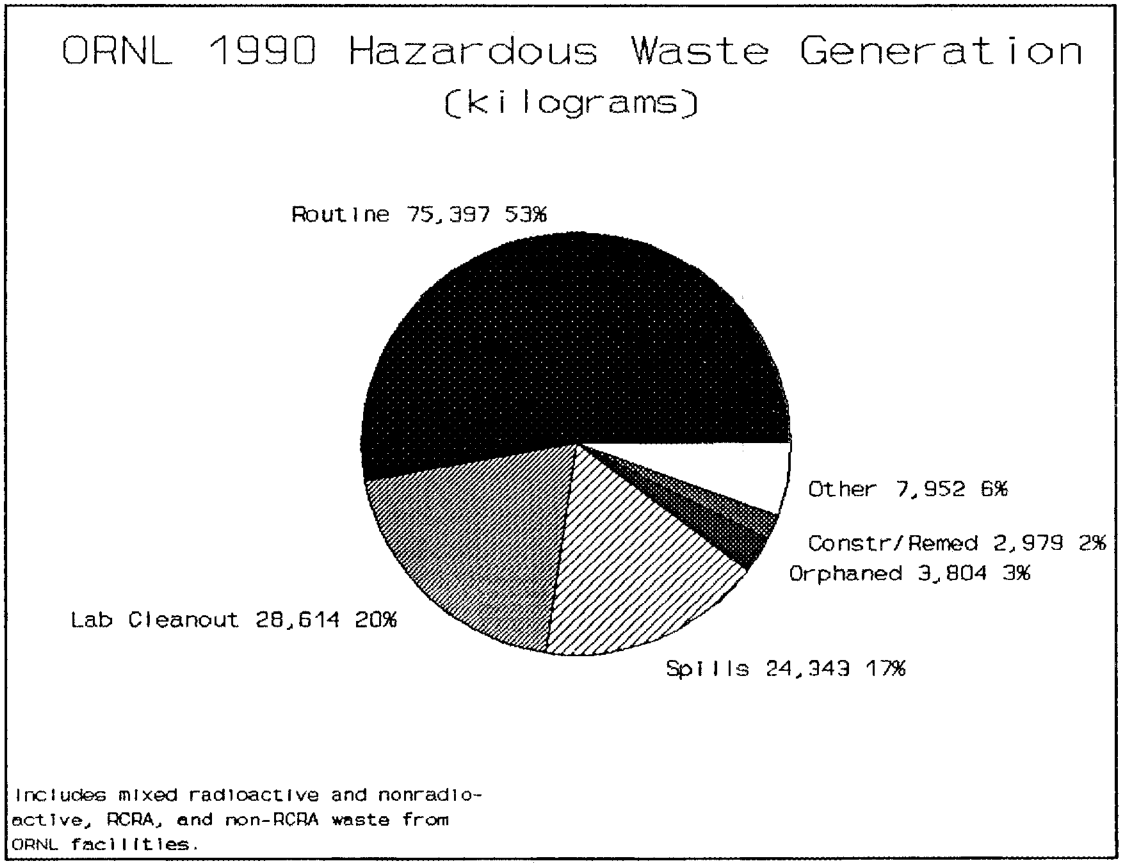

Fig. 2.2. Schematic of ORNL 1990 hazardous waste generation

Table 2.3. ORNL 1990 hazardous waste generation[a] by division

Division	Generation (kg)		
	Routine	Nonroutine	Total[b]
Analytical Chemistry	1,405	874	2,279
Biology	3	5,267	5,270
Central Management Office	18	603	621
Chemical Technology	1,807	4,279	6,086
Chemistry	673	1,924	2,597
Computing and Telecommunications	292	0	292
Energy	4	2	6
Engineering	0	1,293	1,293
Engineering Physics and Mathematics	528	258	786
Environmental and Health Protection	1,037	25,879	26,916
Environmental Restoration	717	576	1,293
Environmental Sciences	1,814	791	2,605
Finance and Materials	105	3,442	3,547
Fuel Recycle	466	416	882
Fusion Energy	1,431	1,641	3,072
Graphics	25,705	0	25,705
Health	253	20	273
Health and Safety Research	724	261	985
Information Service	0	1	1
Instrumentation and Controls	4,560	685	5,245
Laboratory Protection	218	4	222
Metals and Ceramics	12,246	1,520	13,766
Physics	64	5,125	5,189
Plant and Equipment	13,122	6,855	19,977
Publications	1,338	2	1,340
Quality	415	273	688
Research Reactor	1,953	1,869	3,822
Solid State	1,755	555	2,310
Office of Oper. Readiness & Safety	0	0	0
Office of Envir. Comp. and Doc.	0	0	0
Office of Waste Mgmt & Rem. Act.	466	0	466
Office of Envir. and Health Prot.	93	0	93
ORNL Operations at Y-12[c]	2183	3275	5458
TOTAL[d]	75,397	67,692	143,089

[a]Includes mixed radioactive and nonradioactive RCRA and non-RCRA wastes from ORNL facilities at the Y-12 Plant as well as those in Bethel and Melton Valleys.

[b]The total of the routine and nonroutine waste has been rounded off to the nearest kg.

[c]Includes waste generated after October 1, 1990, when Y-12 Waste Management began handling waste from these facilities. Break-out by division not available at the time of this report.

[d]December's breakdown of hazardous waste into division generation was estimated based on historical data.

Table 2.4. Mixed waste generation[a]

Calendar year	Waste generated (kg)
1987	32,730
1988	27,190
1989	17,890
1990	11,460

[a]Includes both RCRA and non-RCRA wastes and waste generated at the ORNL facilities located at the Y-12 Plant.

The substitution of non-RCRA regulated scintillation fluids for those RCRA-regulated ones currently used by ORNL researchers was studied as part of a programmatically funded task during 1988 and 1989 (ORNL/CF-89/31). Some laboratories at ORNL have already converted to the non-RCRA-regulated scintillation fluids. If the new fluids will not degrade the quality of research data, the substitution of a medium that is not regulated under RCRA for one that is regulated as a hazardous waste should enable ORNL to reduce mixed waste generation. Although the EPA has approved a number of these non-RCRA regulated solvents for discharge into municipal sewer systems, prior to discharge ORNL would need to evaluate possible impacts on its wastewater treatment system and the NPDES permit. To date, the non-RCRA solvents are still being containerized and managed in essentially the same manner as the RCRA-regulated solvents. Presently, the prime incentives for the switch are the reduced health and safety liabilities to workers using and handling the material.

2.1 REVIEW OF PROJECTS AND ACTIVITIES

Through coordination with on-going efforts in the ERDS, Pollution Prevention Awareness Program, ALARA Program, and individual divisions, the Waste Reduction Program has benefited from review of projects and activities for waste reduction potential.

For a number of years, the ORNL Environmental Review and Documentation Section has provided NEPA documentation and addressed DOE requirements that environmental and personnel exposure during all activities be kept "as low as reasonably achievable." The ERDS, which employs approximately ten staff, includes several levels of review for projects and activities. The reviews ensure that potential impacts on the environment are evaluated before any action is taken, calling for measures which are considered necessary to protect human health and the environment. Wastes which will be generated are identified and proper disposal procedures are outlined. During the review, opportunities for reduction of waste volume or toxicity by process modification, chemical substitution, or other methods are examined. Environmental documentation includes a paragraph directing project planners to include waste reduction in the planning process.

The ALARA Program at ORNL is expanding its traditional function of setting goals limiting radiation exposure to include nonradioactive functions as requested by DOE. The program is divided into three areas: Reactor ALARA, Non-Reactor ALARA, and Hazardous Chemicals ALARA. An ALARA steering committee meets quarterly to make decisions on ALARA issues and establish a charter. The steering committee consists of ten top members from key ORNL divisions. An ALARA working group, consisting of division members responsible for ALARA functions within their divisions, meets monthly. The ALARA program office has set radiation exposure goals and established an ALARA Suggestion Program.

The Pollution Prevention Awareness Program is setting up quarterly meetings with division EPOs to discuss the reasons for good pollution prevention awareness and provide support for division activities. The PPAP is organizing a PPAP slogan campaign. The division with the winning pollution prevention slogan will receive an "environmental" award, (e.g., a picnic table, tree, or flower box) with a plaque indicating the winner responsible for this environmental improvement. It is also proposed that pollution prevention be part of the GET.

In addition to the activities described above, several divisions including Chemical Technology (Reference 24), Analytical Chemistry, Fuel Recycle, and Environmental Sciences have, on their own initiative, examined their major waste-generating activities for waste reduction potential. As a result, a number of process or administrative changes have been made and waste reductions have been realized.

2.2 TRACKING SYSTEM FOR HAZARDOUS WASTE

A computerized data base is used for tracking ORNL hazardous wastes from the point of generation to ultimate disposal. Data originate from the "Request for Disposal" form completed by the generator (Appendix A) and are logged into the data system by the Documentation Management Center after the wastes have been picked up by the HWOG. The data system has file maintenance capabilities, record query, and report generation functions which facilitate waste management. It is used primarily for record keeping, monthly reports to waste generators, shipping manifest generation, disposal records, and other report generation.

The primary contribution of the waste tracking system to the waste minimization effort is its establishment of generator accountability. The data base provides records of each division's waste and enables charging the generator for associated handling and disposal costs.

2.3 CHARGE-BACK PROGRAM

Cost incentives provide the most effective motivation for waste minimization. Higher waste management and disposal costs have encouraged researchers to examine measures to reduce waste to enhance the economic viability of their research capabilities.

From 1983 to October 1989 generators were charged for the costs of hazardous waste management. The charge-back billing system included cost differentials according to the relative hazards of the wastes. With this costing system, generators were encouraged to generate not only less waste but also less toxic waste. At the direction of DOE-HQ, the Environmental Restoration and Waste Management Five-Year Plan has eliminated the majority of the charge-back system and instead taxes programs at the DOE-HQ level. The amount of tax for programs in the FY 1990 budget was generally based on the estimated levels of waste generated in 1989.

The ORNL charge-back system was the first of its kind in the DOE system. It was used as a model for establishing similar programs at other DOE sites. In addition, papers describing the charge-back system and its role in waste minimization were presented at several major waste management conferences and symposiums (References 8, 12-14).

2.4 PROCUREMENT PRACTICES FOR HAZARDOUS MATERIALS

Control of hazardous materials procurement can prevent excessive inventories, which, if their shelf lives expire, will require disposal. Substitution of less hazardous chemicals, where possible, is also encouraged by a procurement control system.

One of the most important elements of procurement control is limiting the size of units being ordered. Often chemicals are less expensive to buy in bulk quantities. However, the initial cost advantage in purchasing larger sizes is dwarfed by the higher cost incurred in disposing of the unneeded volume. Researchers and purchasers have been advised to purchase only the necessary quantities of chemicals and to procure them in the smallest units practical.

As part of the AVID System, all hazardous chemicals identified in Groups 3 and 4 require management approval before they can be purchased. Group 3 hazardous materials are on the DOE selected chemicals list and include peroxidizables and carcinogens not included in Group 4. Group 4 hazardous materials are identified by installation management as highly controlled/restricted from being brought on-site due to the significant risk and/or cost to remove generated waste. (See Reference 22 for full details on this new procedure.)

ORNL is participating in development of a multi-plant procedure for hazardous material inventory, which includes procurement practices. A Lab-wide inventory of chemicals in research laboratories, process areas, and storage areas is also under way.

Each division has also been advised to consider the substitution, where practical, of less hazardous chemicals in processes and experiments. Often substitution threatens the viability of the research project and cannot be implemented. However, substitution where possible results in less toxic and, therefore, less costly waste generation.

2.5 DISTRIBUTION OF SURPLUS CHEMICALS

One of the most successful endeavors of the Waste Minimization Program at ORNL has been the distribution of surplus chemicals. In past years, unused commercial chemicals were estimated to constitute 90 percent of the waste chemicals collected at ORNL. Approximately 30 percent of these containers had been unopened. Between November 1985 and December 1987, over 31,750 kg (70,000 lb) of chemicals, which were no longer needed by their owners, were transferred to new owners for use. This effort offers the potential of effective waste reduction because those chemicals remaining following the completion of research activities in a given laboratory, which otherwise would become waste, will in effect, be "reused" by other laboratories saving those other laboratories the procurement costs of those chemicals.

Many surplus chemicals have been donated to educational institutions and to the Tennessee Department of General Services. During 1987, Energy Systems Central Staff halted the distribution of chemicals to outside organizations pending the outcome of an evaluation of associated liabilities. A draft corporate policy for off-site shipment of hazardous chemicals was issued. The policy allows continued distribution and calls for expanded communication and cooperation with and between DOE sites to utilize excess chemicals.

During CY 1990, the Finance and Materials Division received kerosene, hydrogen cylinders, used cooking oil, coal tar, driveway sealant and tar, used motor oil, automotive batteries, and other hazardous materials. Instead of disposing of the hazardous materials at a cost of over $300,000, F&M distributed the materials to new owners by means of on-site sales and donations, an idea developed by F&M employees in 1989. The kerosene and motor oil were donated to Jefferson County via the State of Tennessee and Auburn University via the State of Alabama. This practice reduced not only generation of hazardous waste requiring disposal, but also raw materials required by the second-generation owners.

2.6 LABORATORY CLEANOUTS

Laboratory cleanout, the removal of old or unnecessary chemicals from a laboratory, is encouraged for a number of reasons, aside from being a good housekeeping measure. First, clearing the work area of unneeded chemicals reduces health and safety risks. Some chemicals found on laboratory shelves at ORNL are as old as 40 years. Additional hazards are associated with aging of some chemicals, such as picric acid and ethers, which can become explosive.

Secondly, eliminating materials associated with expired research projects helps clear the waste generation record for current and future activities in the laboratory. One of the difficulties encountered in measuring progress in waste minimization is accounting for disposal of wastes from projects terminated in prior years. Also, disposal of unneeded chemicals will be more costly in the future than today. Delaying the cleanout and disposal will only increase the costs.

Of the approximate 137,631 kg (302,789 lb) of waste ORNL managed as hazardous in CY 1990, approximately 25,339 kg (55,747 lb) were generated from the cleanout of laboratories. Hazardous waste generation had increased during the last few years prior to 1990 as awareness of the need escalated and better documentation was implemented. Laboratory cleanout waste generation in CY 1990 decreased by 7,794 kg (17,146 lb) from that of CY 1989. This trend may be due in part to a work backlog that decreased ability of HWOG to provide service. During CY 1990, a Laboratory-wide inventory of chemicals was initiated to identify chemicals whose shelf lives had expired. These were disposed of using established and approved procedures.

One of the difficulties associated with this good housekeeping practice is how to account separately for resulting wastes to avoid an apparent waste minimization "penalty." WRRs were asked to track generation and distinguish routine from nonroutine hazardous wastes within their division. The results of their efforts are reflected in Table 2.3.

2.7 TRAINING AND COMMUNICATION

The Division WRRs and the Waste Reduction Coordinator[a] communicate on a monthly basis concerning the generation of hazardous and mixed wastes. Information is exchanged to keep the routine/nonroutine status of the waste generated current. Semi-annually, a meeting of the WRRs is organized as a forum for exchanging waste reduction ideas, discussing problems, determining future direction of waste reduction at ORNL, and discussing regulatory requirements.

The waste generator training program includes several courses offered to programs and divisions which produce hazardous or radioactive wastes. In general, these training sessions are designed to instruct the waste generator personnel in the proper techniques for waste segregation, certification, minimization, packaging, and the applicable procedures and documentation for waste handling and disposal. This program was expanded during 1989 to include four training courses emphasizing, among other things, waste minimization techniques.

[a]The position of Waste Reduction Coordinator is currently vacant due to lack of funding.

One of these programs is specifically directed toward hazardous and mixed waste generators, describing the procedures and requirements for managing those wastes at ORNL. This training course addresses such topics as identification of hazardous waste, management of accumulation areas, and minimizing the amount of waste being generated. The program was developed in 1988 and was presented to a trial audience of 36 ORNL employees in December 1988. After making corrections and adjustments to the training module, hazardous waste generator training was implemented in 1989 and 180 additional employees were trained through this module. In 1990, the training program was revamped and specialized modules were developed and conducted for satellite collection area operators and 90-day area operators.

A training program specifically for waste minimization techniques was developed in 1988. This course describes some of the problems in waste management, explains the impetus behind implementing the waste minimization program, and includes a classroom exercise in identifying waste streams to which waste reduction techniques could be applied. Fifty-one employees attended this course in 1989. In 1991, the waste minimization module will be converted to a waste reduction workshop. The workshop will be required training as part of the overall waste certification program.

In addition to the formal training programs, an employee awareness program was implemented in 1989 and continued in 1990. The campaign to heighten sensitivity to waste minimization concerns includes promotional posters, announcements in internal publications, and publicity for programs or projects which have been successful in minimizing waste production. During 1989, over 100 waste minimization "incentive" posters were distributed and displayed at ORNL. A part of this campaign will include an incentive program which recognizes individual ORNL employees who provide waste minimization suggestions.

2.8 PROCESS MODIFICATIONS

As a result of cost incentives and the training and communication described in Sect. 2.7, a number of process changes have been effected to reduce waste generation. These include recycling of waste streams into the process, measures to prevent contamination of nonhazardous materials, and process streamlining.

Waste minimization measures vary from small scale modifications in some programs to broad changes in others. Since the ORNL waste generators are primarily numerous small laboratory or research programs, lowering the volume of waste being generated often involves reductions which, taken by themselves, are apparently small changes in the total volume. However, in terms of the quantity of waste produced from that particular program, the savings in waste volumes can be substantial. Conversely, there are programs wherein a large volume reduction can be achieved through a single process modification. The following are some examples:

* The Plant and Equipment Division has added a pre-rinse operation and ion exchange filtering system to the plating operations, eliminating 1,000 gallons/day of contaminated rinse water generation. Implemented in the last quarter of 1989, this process modification has significantly reduced the capacity of the plating operation. GPE funding has been requested for a project which would return the facility to full capacity and provide for the recycling of machine coolants.

* The Paint Department in Plant and Equipment reduced its hazardous waste stream from 990 gallons in 1989 to zero in 1990 by collecting the solvent and paint mixture that results from brush cleaning activities. After the paints precipitate to the bottom of the drum, the solvent (Varsol) is reused. Paint residues remaining in used paint cans is dried on a drying rack, so that the cans can be disposed of as non-hazardous waste. (See Figure 2.3) The amount of unused "waste" paint generated is also reduced by limiting the number of colors used.

- In a continuing 1989 PIP Project, the Plant and Equipment Division is investigating the reuse of motor oil. The spent oil from routine oil maintenance on ORNL vehicles would be burned for the heating value. During the winter months the used oil would be the fuel source for heaters at the ORNL garage. The implementation of this activity is subject to air quality concerns currently under discussion. The used motor oil is presently being donated to Auburn University through F&M's donations program.

- Plant and Equipment Division has requested funds for recycling and water treatment equipment to be installed in stream cleaning operations in B-7002. This project would eliminate an estimated 11,400 kg/yr of oil, dirt, water and grease mixture. Annual disposal savings from this activity are estimated at over $25,000.

2.9 MATERIAL RECOVERY

When deemed practical, ORNL recovers valuable materials from hazardous waste streams for reuse or sale.

The Plant and Equipment Division has implemented a program for reusing oily rags used in machining operations. Oily rags are collected from several sites and are sent either to the Laboratory laundry or to a contractor where they are washed and returned for reuse. This activity has reduced P&E's oily rag waste stream by 80 percent, while saving money in both disposal and replacement costs.

The Plant and Equipment Division has also purchased equipment to be used for recycling antifreeze. Spent antifreeze will be filtered and treated to restore proper pH and other characteristics, and reused in equipment.

The sale of photographic waste to a contractor for silver recovery was discontinued in 1990. The material's low silver content proved to make the recovery process uneconomical for commercial firms. It will be disposed of as hazardous waste until the Laboratory's own silver recovery facility is appropriately permitted and operating. However, at least one division is investigating the feasibility of an evaporator which would reduce waste volume by up to 97 percent.

A program for management of lead has also been instituted at ORNL. P&E's lead shop recasts unwanted, uncontaminated lead into forms demanded by current ORNL activities.

Other metals are also recycled through scrap metal sales. In this program, excess metals are sold to outside organizations for reuse. While not all of the material involved would be considered hazardous waste if it were to be discarded instead of recycled, some of the metals would be regulated by RCRA if they were being handled as waste products. This effort resulted in the recycling of 825 tons of scrap metal in 1988, 1,004 tons in 1989, and 487 tons in 1990.

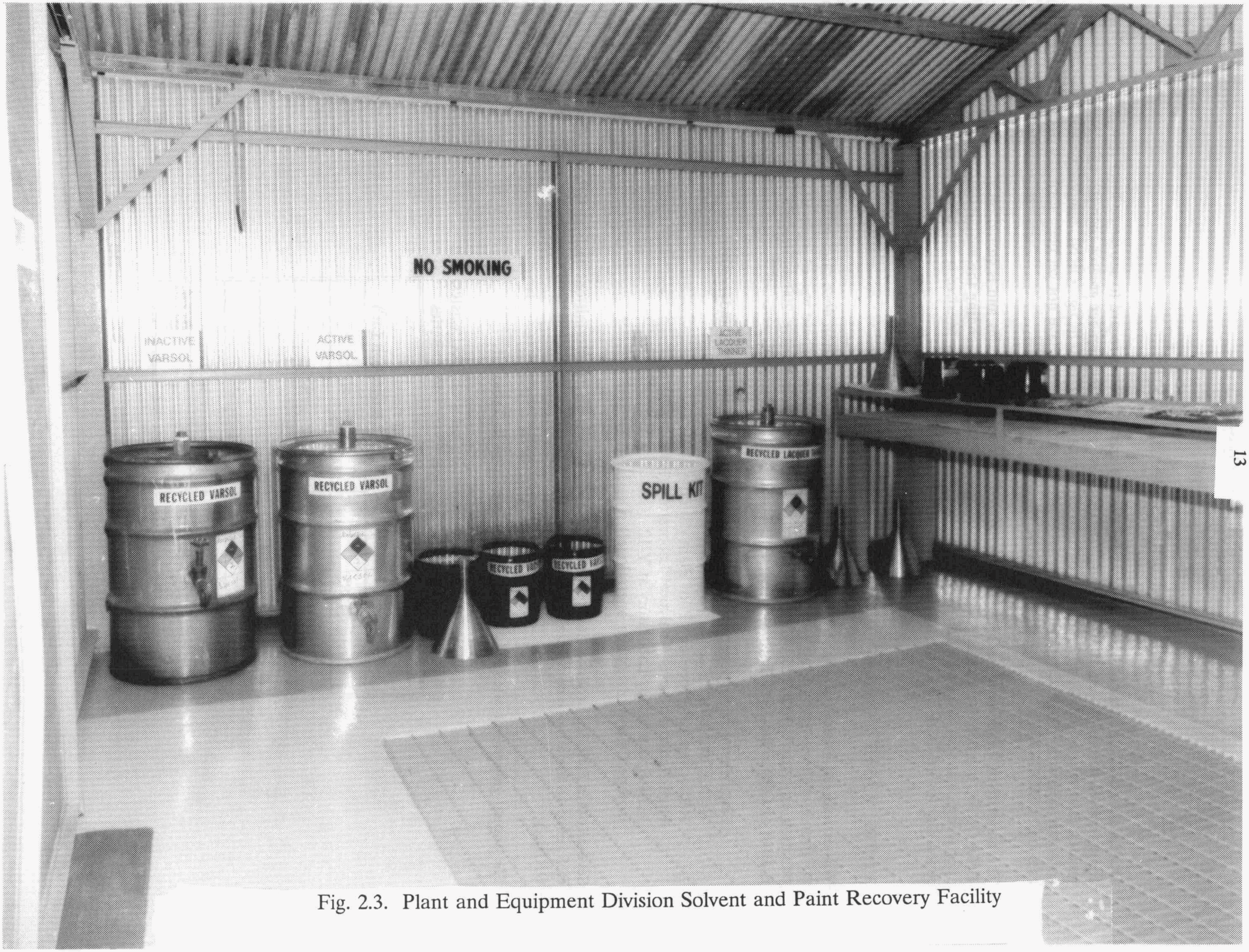

Fig. 2.3. Plant and Equipment Division Solvent and Paint Recovery Facility

3.0 TRANSURANIC WASTES

DOE Order 5820.2A defines TRU waste as radioactive waste without regard to source or form that is contaminated with alpha-emitting radionuclides that have an atomic number greater than 92, half-lives greater than twenty years, and an assay concentration greater than 100 nCi/g. ORNL handles waste contaminated with ^{233}U, ^{244}Cm, and ^{252}Cf as TRU waste, although they have not yet been formally declared as such by DOE-ORO.

The majority of TRU waste at ORNL was generated from past operations and is stored on-site. Since 1970, ORNL has been segregating and retrievably storing TRU waste pending the availability of an approved permanent disposal. The Waste Isolation Pilot Plant, in New Mexico, is the planned central repository for all DOE TRU waste, including that of ORNL.

3.1 TRU WASTE GENERATION

Wastes referred to as remote-handled TRU are wastes that have radiation dose rates greater than 200 millirem/h at the surface of the waste container. Remote handling of these wastes to minimize personnel radiation exposure is required. CH-TRU wastes have surface dose rates $\leq$ 200 millirem/h. The following is a list of ORNL facilities that produce NG CH- and RH-TRU wastes.

Radiochemical Engineering Development Center (Building 7920 and 7930)
High Flux Isotope Reactor (Building 7900)
Radiochemical Processing Pilot Plant (Building 3019)
High-Radiation-Level Analytical Laboratory (Building 2026)
Mass Spectroscopy Laboratory at Y-12
Isotope Operations (when operational)

Several other facilities produce small volumes of TRU wastes on an intermittent basis at ORNL. (See Reference 18 for a more complete explanation of these activities and volumes of stored TRU waste at ORNL.)

The annual generation rates for NG-TRU waste are listed in Table 3.1.

Table 3.1. Annual generation rates of TRU wastes from ORNL operations and activities

TRU waste generation rates CY	Generation (m^3)
1985	70
1986	45
1987	26
1988	35
1989	50
1990	3

The generation rate of TRU waste decreased steadily from 1985 to 1987 followed by a slight increase in 1988 and 1989 due to clean-up efforts in the Radiochemical Processing Pilot Plant. Generation in 1990 fell dramatically to 3 m^3 due to reduced processing activities in the Radiochemical Engineering Development Center (REDC), the shut down of the isotopes programs in Bethel Valley, and the continued shutdown of HFIR for most of CY 1990. This data is shown graphically in Figure 3.1.

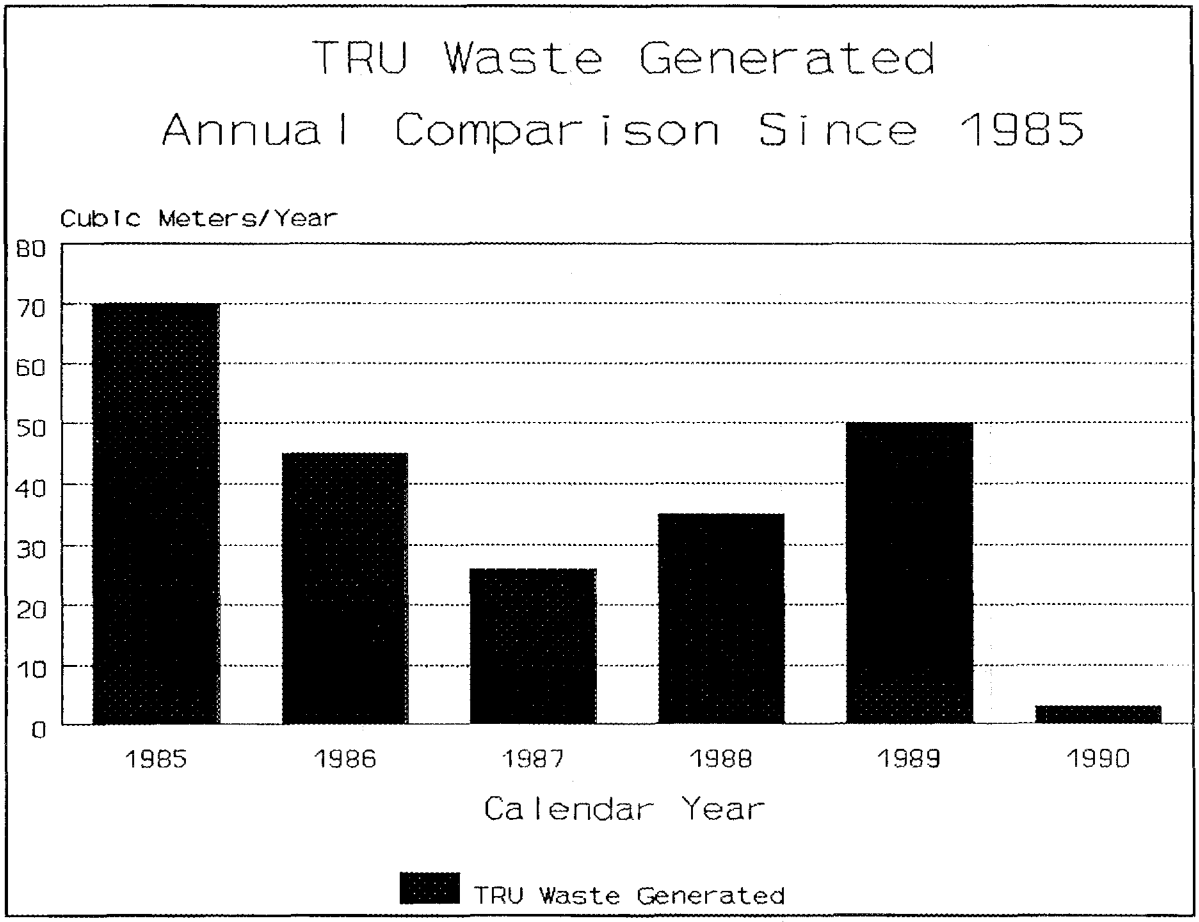

Figure 3.1. Annual generation rates for TRU waste at ORNL

3.2 TRACKING SYSTEM FOR TRU WASTES

The SWIMS is a data base for tracking SLLW and TRU waste. The data processed at ORNL in the SWIMS is included in the DOE-wide IDB. Tracking information for the SWIMS is obtained from the UCN-2822 form, "Request for Storage or Disposal of Radioactive Solid Waste or Special Materials," which generators must fill out before the waste is accepted.

3.3 TRU WASTE GENERATOR TRAINING

Certification training is provided to generators of TRU waste at ORNL. The purpose of this instruction is to familiarize generator personnel who handle and package radioactive waste with the applicable WAC of the receiving facilities which treat, store, or dispose of the waste. The WAC of these facilities specify the physical, chemical, and radiological properties that waste packages must conform to in order to be handled or processed. The specific requirements for each waste type as well as the general requirements for all waste types are presented in the training program. The re-certification period for TRU waste generators is two years. Waste reduction requirements and techniques are part of this certification training.

3.4 REDUCTION OF TRU WASTE

Segregation and isolation of TRU-contaminated waste from other waste are current methods of minimizing the volume of TRU waste which must be stored. Information communicated to generators during the training sessions is a source for waste reduction activities. Two FY 1992 environmental capital projects include waste reduction initiatives. The CH-TRU Waste Repackaging Facility will implement reduction of TRU waste by segregation and the Pretreatment of REDC LLLW project will segregate TRU contaminants from the LLLW system.

The REDC (formerly Transuranium Processing Plant), Building 7920, developed an in-cell melter used to melt primarily polyethylene bottles and tubing. The in-cell melter reduces the volume of plastic waste which is contaminated with TRU constituents by a factor of five.

4.0 SOLID LOW-LEVEL WASTE

As defined by DOE Order 5820.2A, LLW is radioactive waste that cannot be classified as high-level waste, TRU, spent nuclear fuel or a by product material. Radioactive waste containing less than 100 nCi/g of TRU radionuclides is also classified as LLW.

Currently ORNL SLLW is segregated into one of the following categories: CH-LLW, RH-LLW, uranium, biological, asbestos, and suspect.

4.1 SLLW GENERATION

The majority of SLLW at ORNL is generated as CH-LLW. This waste has a radiation dose rate at the surface of the container of $\leq$ 200 millirem/h and is typically slightly contaminated debris or sludges from the PWTP. CH-LLW is divided into three categories: (1) compactible CH-LLW, (2) non-compactible CH-LLW, and (3) sludges. The first two categories of waste are segregated and collected in separate repositories throughout ORNL. Most compactible waste has a surface dose rate less than 10 millirem/hr and consists of slightly contaminated plastic bags, blotter paper, glassware, etc. Non-compactible CH-LLW consists of heavy gauge metals items, wood and other debris that cannot be compacted by conventional methods. (More information on SLLW is available in Reference 19.)

As shown in Table 4.1, the annual generation rate of SLLW decreased from 1984 to 1987. Generation has increased slightly since 1987. These increases are attributed to cleanout operations resulting from discontinued programs and abandoned facilities. The historical generation rates of SLLW are shown graphically in Figure 4.1.

Table 4.1. Annual generation rates of solid low-level wastes from ORNL operations and activities

SLLW waste generation rates CY	Generation (m^3)
1985	2336
1986	2191
1987	1243
1988	1474
1989	1720
1990	1793

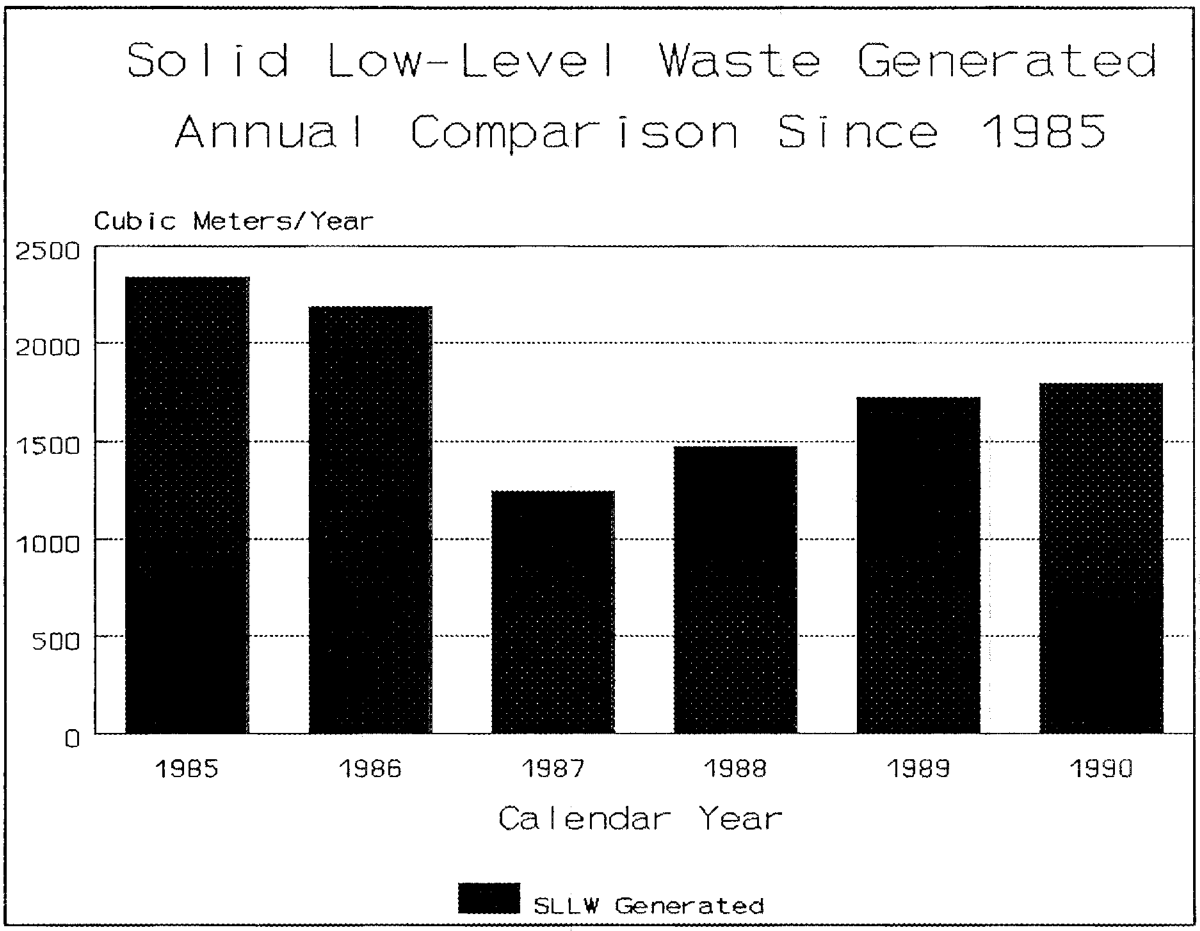

Fig. 4.1. SWWL generation annual comparison since 1985

4.2 TRACKING SYSTEM FOR SLLW

The SWIMS is a data base for tracking SLLW and TRU waste. The data processed at ORNL in the SWIMS is included in the DOE-wide IDB. Tracking information for the SWIMS is obtained from the UCN-2822 form, "Request for Storage or Disposal of Radioactive Solid Waste or Special Materials," which generators must fill out before the waste is accepted.

4.3 SLLW GENERATOR TRAINING

Certification training is provided to generators of SLLW waste at ORNL. The purpose of this instruction is to familiarize generator personnel who handle and package radioactive waste with the applicable WAC of the receiving facilities which treat, store, or dispose of the waste. The WAC of these facilities specify the physical, chemical, and radiological properties that waste packages must conform to in order to be handled or processed. The specific requirements for each waste type as well as the general requirements for all waste types are presented in the training program. The re-certification period for SLLW generators is two years. Waste reduction requirements and techniques are part of this certification training.

4.4 REDUCTION OF SLLW

All DOE low-level generators are required by DOE Orders 5820.2A and 5400.1 to establish waste reduction programs to assure that the amount of LLW generated and/or shipped for disposal is minimized. Following are recent examples of ORNL's effort to reduce the volume of SLLW.

In CY 1990, a total of 380 m^3 of LSA waste material was compacted on-site to reduce the volume of waste by 75 percent and better utilize the expensive and limited tumulus vault space. The compacted SLLW and resulting solidified liquid occupy only 90 m^3 of tumulus storage space. Considering the replacement costs of the vaults, this project saved approximately $294,000 and 290 m^3 of tumulus storage space.

Supercompaction by private firms will also be continued. Approximately 300 drums of LSA waste will be supercompacted by a local vendor in March, saving another $50,000 in vault replacement costs and 50 m^3 of tumulus storage space. This procedure will be performed about once a year. ORNL has a generating rate of approximately 600 LSA waste drums per year.

A FY 1993 planned capital project, "Certification and Segregation of Newly-Generated Solid Waste," is in part a waste reduction activity for SLLW. Segregation of SLLW from other waste is an important step in the minimization process.

The Environmental Sciences Division has implemented a program to reduce SLLW generation through improved segregation from uncontaminated waste. Paper towels, gloves, aluminum foil, and other items used to process contaminated fish taken from reservation stream are scanned with a radiation survey meter. Those items determined to be non-contaminated are disposed of as sanitary waste rather than SLLW.

5.0 LIQUID LOW-LEVEL WASTE

The LLLW system is a collection of 55 active underground tanks, associated transfer pipelines and ancillary equipment designed to collect, neutralize, concentrate, and store wastes prior to disposal. Prior to September 1984, the generated LLLW was disposed of on-site using the hydrofracture process. Today the stored LLLW is being treated using interim measures: solidification and in-tank evaporation. Starting in approximately FY 2002, the LLLW will be processed in the Waste Handling and Packaging Plant.

5.1 LLLW GENERATION

At ORNL, radioactively-contaminated liquid wastes are generated by various activities including R&D functions, decontamination activities, reactor operations, and waste treatment facilities operations. Of these generators of LLLW, waste treatment facility operations' wastes have accounted for approximately 34 percent of dilute LLLW generated, decontamination activities about 45 percent and other activities (including R&D activities and rainwater/groundwater infiltration) account for the remaining 21 percent. During the next 10 years, remedial action activities are expected to be a major LLLW generator. (More detailed explanation of the LLLW system can be found in References 19 and 20.)

Since 1984, generators have significantly reduced their production of LLLW. Increased efficiency of the waste treatment operations in the PWTP have also decreased the amount of LLLW concentrate produced. An explanation of the waste reduction activities for LLLW is given in Section 5.4.

Table 5.1 and Figure 5.1 show numerically and graphically the progress that has been made in the reduction of LLLW.

Table 5.1. Annual generation rates of LLLW from ORNL operations and activities

LLLW waste generation rates	
CY	Generation (m^3)
1985	3985
1986	2180
1987	1450
1988	1300
1989	1270
1990	1534

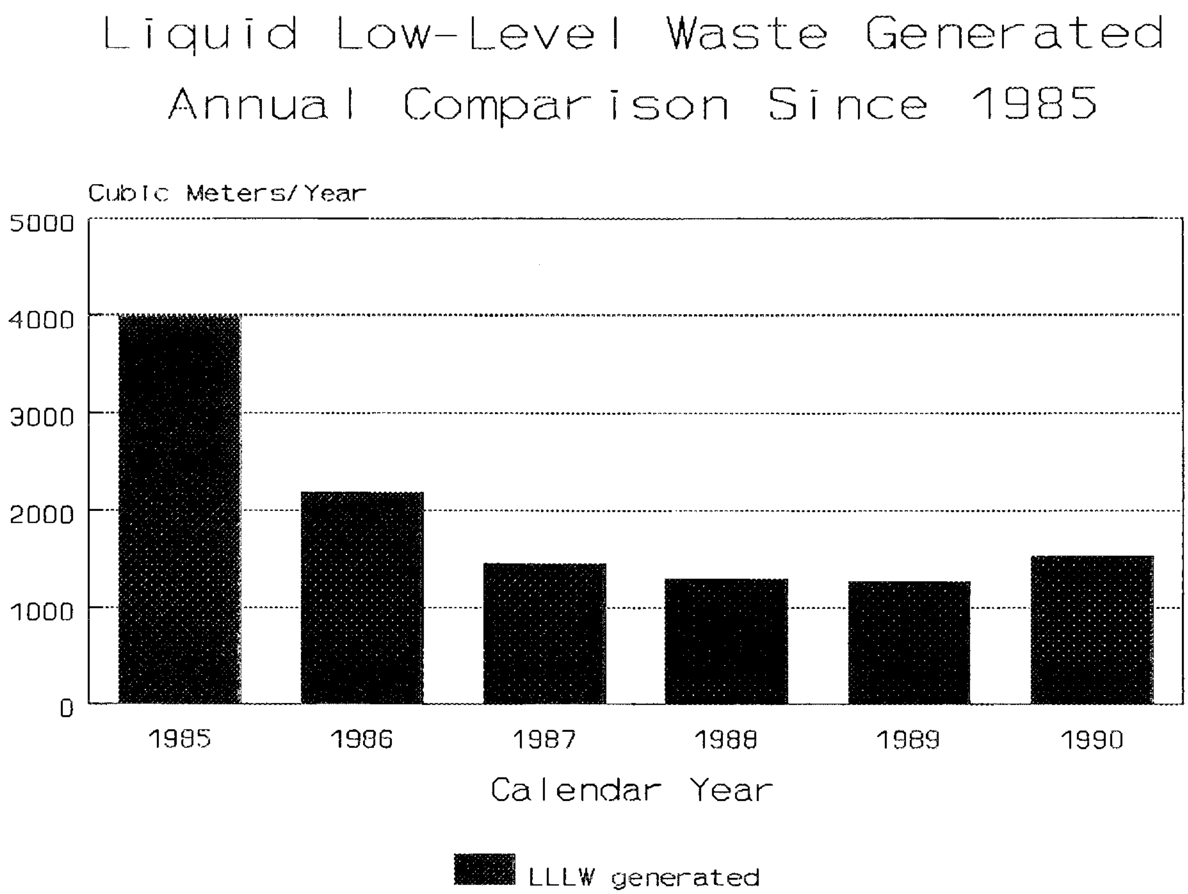

Fig. 5.1. LLLW generation rates for CY 1990

5.2 TRACKING SYSTEM FOR LLLW

A data base has been developed to store, retrieve, and analyze information concerning the LLLW system at ORNL. Although the data base was developed in dBASE III, the end product is a user-friendly and does not require extensive knowledge of DBASE. The information contained in the data base includes: (1) LLLW generator information, (2) LLLW collection tank data, (3) evaporator/evaporation data, and (4) LLLW concentrate data.

The information provided by the Liquid Waste GCOs contained in the data base includes estimated LLLW generation volumes, waste contaminants, future estimated generation rates, if applicable, any waste pretreatment steps, and general descriptions of activities performed in their areas. Weekly summary reports published by the Liquid and Gaseous Waste Operations Group were used to enter daily LLLW collection volumes into the data base. Information concerning the evaporator and the evaporator service tanks was analyzed and entered into the data base. The evaporator campaign data was used to determine the major generators of LLLW concentrate and to calculate volume reduction factors. Volumes of LLLW concentrate generated as well as the liquid levels in the storage tanks are updated in the data base. Analytical results from samples performed on the contents of the Melton Valley Storage Tanks have also been recorded in the data base.

5.3 LLLW GENERATOR TRAINING

The WAC for LLW have been finalized, and a formal training program is being developed for implementation in 1991. Currently, frequent meetings are held with liquid GCOs regarding developments in liquid waste management programs.

5.4 REDUCTION OF LLLW

From 1985 to 1987, a waste minimization program reduced the generation rate of LLLW concentrate to approximately 95 m^3/yr. Further reduction in 1988 and 1989 brought generation to approximately 49 m^3/yr. This was accomplished by a decrease in the generation rate of LLLW at the source and an increase in the evaporation efficiency of the LLLW evaporators from a volume reduction factor of about 9:1 in 1985 to 30:1 in 1987. These waste minimization efforts were accomplished by a series of projects and process changes. At a later date, a clarifier was added to the PWTP thus increasing the treatment efficiency further. The effects on the annual generation rate can be seen graphically in Figure 5.1.

The LGTTG is taking a unique approach to reduction of radioactive liquid wastes by developing the means to analyze the overall ORNL liquid waste system. By developing a model of the overall liquid waste system, the group has created a method to assess the impacts that each portion of the system has on composition and volume of final waste produced for permanent disposal at ORNL. This is a pioneering effort at ORNL to determine what effects each generator and treatment operation (whether at the source or in the centralized treatment facilities) has on the final waste form and to implement waste reduction projects accordingly.

The ORNL liquid radiological waste system actually consists of two interconnected treatment systems, the PWTP and the LLLWT systems. The system presently generates approximately 113 m^3/yr of SLLW and 87 m^3/yr of LLLWC which are being stored for permanent disposal. Since LLLWC is no longer being disposed of by hydrofracture, storage capacity for LLLWC is quickly being depleted. Since new treatment methods (WHPP) will be much more expensive and cannot be implemented for several years (2002 is the presently scheduled start-up date), minimizing the production of LLLWC is imperative. The LGTTG's new approach is effectively reducing the total amount of waste generated by the liquid waste system, with particular emphasis on reduction of LLLWC.

The group performed a comprehensive survey of liquid waste generators to determine the amount and type of waste being generated at ORNL and where these streams are presently being routed for treatment. This information was coupled with a technical analysis of the PWTP and LLLWTs to determine where improvements could be made in the waste system which would result in major reduction in the final waste generation rates. Characterization and treatability studies are being performed to support implementation of such projects to reduce final waste generation rates by (1) treatment at the generation site, (2) modification of the processes generating the waste, and/or (3) improved operations at the centralized facilities.

Results of the systems analysis show that only three current operations at ORNL significantly impact the hazardous nature or the amount of LLLWC. The major contributors to the LLLWC (in descending order) are: (1) the PWTP, (2) Radiochemical Engineering Development Center facility, and (3) the Fission Product Division Laboratory facility. The LGTTG is focusing waste reduction efforts in these areas since they significantly affect LLLWC generation. Since the PWTP is the single largest contributor to the LLLWC, current projects emphasize the upgrade of this facility. Projects are also in progress which will reduce waste generation at the REDC in the next few years.

The systems analysis established that installation of an extra holding tank in the PWTP evaporator loop will reduce the LLLWC by 5.7 m^3/yr. This $30,000 project is a FY 1991 GPP.

The generator survey identified several once-through cooling water streams which are being fed to the PWTP for radionuclide removal. These streams account for 35 percent of the PWTP feed and a corresponding percentage of the secondary waste generated at the plant. Minor piping modifications are being made to segregate these waste streams which will reduce the SLLW production by 39.6 m^3/year (33 percent of the present generation rate) and LLLWC from the PWTP by an additional 4.8 m^3/yr (from 15 m^3/yr to 10.2 m^3/yr). The cost savings for this project are estimated to be $120,000/year.

While many previous "waste reduction" projects have reduced the volume of waste entering a given phase of the liquid waste treatment system, they often have little impact on volumes or compositions of the final waste steams which must be treated for permanent disposal. The LGTTG's systems analysis approach is assuring that waste reduction projects are implemented which will be cost effective and significantly reduce the amount of waste being stored for ultimate disposal.

The final rinse water from regenerating the demineralizers at HFIR, which contains very low concentrations of radionuclides, was previously discharged, after a holding period, to Melton Branch. With the current process wastewater collection system the water would be routed to the PWTP and then to the NRWTP. ^{60}Co in the rinse water would not be removed in the PWTP and would probably concentrate in the activated carbon columns at NRWTP. In order to avoid contamination of the facility, the final rinse water must currently be sent to the LLLW system, at a cost of $6/gal. Installation of equipment to convert all LLLW lines to a dry resin disposal system is currently under way. This system will eliminate all LLLW generation at HFIR. Spent demineralizers will be disposed of as SLLW rather than regenerated with rinse water which requires disposal as LLLW. This system is expected to be operational by 1992.

A FY 1992 GPP at the BSR/ORR should reduce total ORNL LLLW generation by 8 percent and concentrate generation by 4 percent. LLLW will be diverted to PW and solid waste instead of continuing to enter the LLLW system.

The Chemical Technology Division is developing a method for decontaminating the acidic and basic wastes generated in the hot-cells of Building 4501. It utilizes inorganic solid ion-exchangers which are dried and disposed of as contaminated solid waste. Demonstrations have been very successful and there is high hope for use of this technology in other LLLW streams.

Tri-chloroethylene (TCE), a hazardous material used in the manufacture of these ion-exchangers is recycled through distillation. Currently, 200 L/year of TCE are recycled, with virtually no implementation costs as distillation requires only simple laboratory equipment which is already available.

REDC is studying the pretreatment of LLLW by ion exchange, filtration, and precipitation. The possibility of altering the current scrubber solution is also being evaluated. The objectives are reducing the volume of LLLW generated, reducing the amount of non-radioactive salts entering the LLLW system, removing the TRU and high activity constituents of the waste at the source, and reducing dependence on the LLLW collection and transfer system.

6.0 PROCESS WASTE

Process wastes are wastewaters that contain trace levels of radionuclides or hazardous material, generated from numerous laboratories and operations at ORNL. Process waste must be treated to remove the contaminants prior to discharge to the environment. The treatment consists of a series of holding tanks, the PWTP and the NRWTP.

Process waste contaminated with radionuclides is treated by softening, filtration, and ion exchange at the PWTP. The PWTP effluent and the nonradioactive process waste are treated at the NRWTP to remove organic and metal contaminants prior to discharge to the watershed through an NPDES permitted point.

6.1 PROCESS WASTE GENERATION

Table 6.1 and Figure 6.1 show process waste generation trends. The amount of rainfall is the single largest influence on process waste generation, due to inleakage into process waste system piping and storage tanks. The lower generation rates for 1985-1988 reflect the local drought experienced during that period. Normal levels of rainfall returned in 1989 and 1990.

Table 6.1. Annual generation rates of process wastes from ORNL operations and activities

Process waste generation rates CY	Generation (X 1000 m^3)
1985	259
1986	217
1987	198
1988	206
1989	290
1990	270

6.2 TRACKING SYSTEM FOR PROCESS WASTE

Information on process waste generation is obtained from the weekly summary reports distributed by the Liquid and Gaseous Waste Operations Group. This data is a summary of the daily volume data processed through the Waste Operations Central Control facility. Information was also obtained from the Liquid GCO survey as mentioned in Sect. 5.2.

6.3 PROCESS WASTE GENERATOR TRAINING

There is at present no formal training for PW generators, but a draft lesson plan has been developed. Meetings are held with the Liquid GCOs to review developments in the liquid waste management programs.

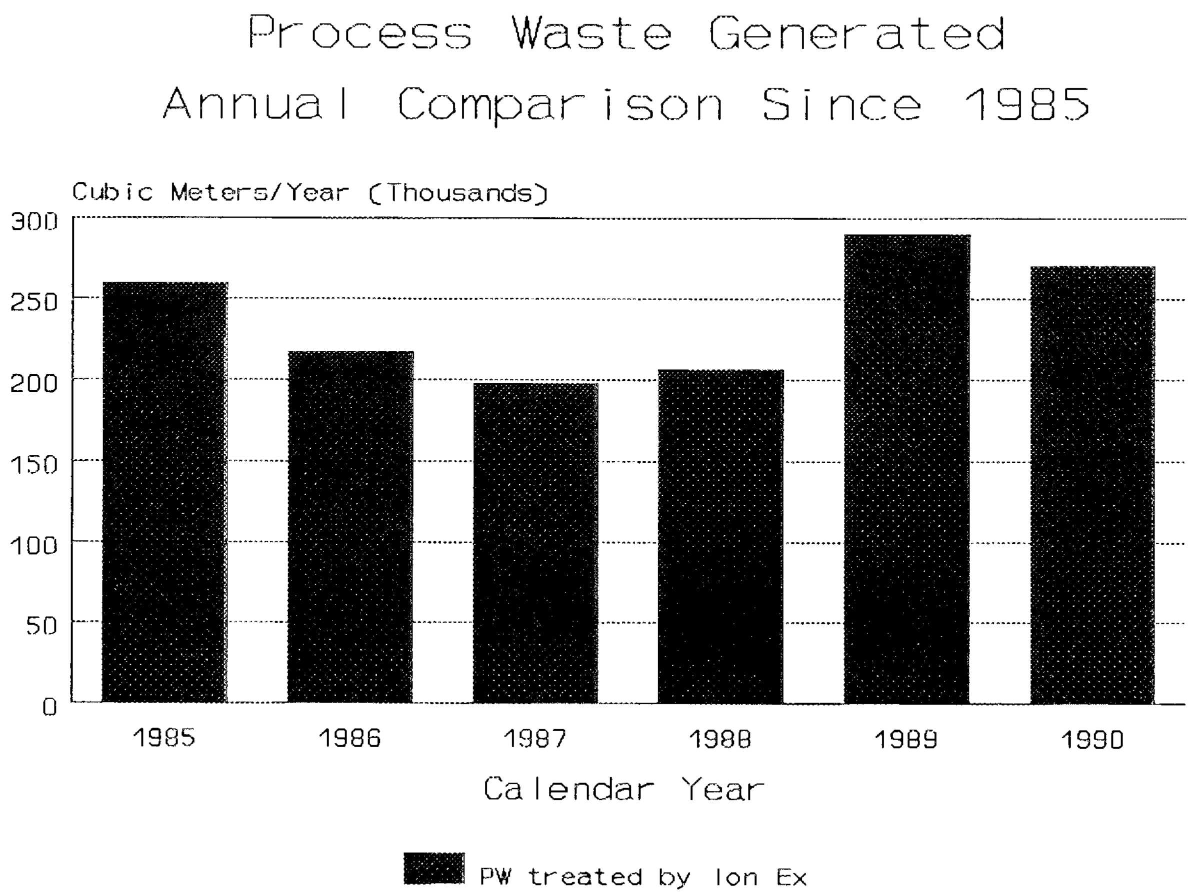

Fig. 6.1. LLLW generation rates since 1985

6.4 REDUCTION OF PROCESS WASTE

The focus of waste reduction activities for the PW system is segregation. By restricting treatment of PW to only those streams requiring contaminant removal, more efficient treatment can be obtained, thus reducing contaminant discharge to the watershed.

Clean water (storm water) can be discharged, according to the NPDES permit, directly to the watershed. Some activities are focused on segregating storm water from the PW system. A FY 1992 GPP is planned to restore the storm sewer piping system feeding Outfall 302 to aid in minimizing the volume of rainwater and groundwater treated at PTWP.

Cooling water often requires only chlorine removal before discharge. Several activities have provided either source treatment or recycle for cooling water. The Energy Division has implemented a project to treat the once-through cooling water from Building 3144 for chlorine removal and discharge it to the storm sewer. Treatment at the source of this stream has removed 110 m^3/day from the PWTP feed, thus increasing its contaminant removal capacity.

The Solid State Division has reduced process waste generation by 70 percent in its photographic darkroom systems by limiting operation to an "only as needed" basis. A closed cycle cooling water system was installed on one accelerator system in Building 3003, reducing process waste generation by 40,000 m^3/year. Similar installations are planned for FY 1991 on two additional accelerator systems, eliminating another 60,000 m^3/year from the PWTP feed.

On-line radiation monitors help segregate radioactive from nonradioactive waste streams. Only radionuclide-contaminated streams must be treated at the PWTP. If a waste stream is found to be free of contaminants or within acceptable limits, it can bypass the PWTP and be treated at the NRWTP, thus reducing the load on the PWTP and enabling more effective contaminant removal.

In another PW segregation project, Chemical Technology Division developed a pH-based system to segregate metals-containing wastewater from "clean" wastewater. Using the pH segregation system could reduce the amount of wastewater treated for heavy metals at the NRWTP to about 57 m^3/week, significantly reducing sludge production of the NRWTP, while increasing metals-removal capacity. Using sludge production data from the pilot plant testing for the NRWTP, the pH segregation system will reduce NRWTP sludge production by a factor of 15.

A FY 1992 GPP is planned to increase Cs-137 removal capacity at the PWTP. Installation of a zeolite system will allow for the removal of ^{137}Cs on a continuous basis, reducing the transfer of ^{137}Cs contamination to the NRWTP and helping to maintain discharge levels below the DCG level of 111 Bq/L established by DOE Order 5400.5.

7.0 SANITARY/INDUSTRIAL WASTE

Waste categorized as sanitary/industrial, sometimes referred to as conventional waste, includes solid wastes generated from sanitary sewage treatment, steam plant operations, coal yard runoff, general refuse, and construction debris. As these wastes are generated, segregation of these wastes streams from radioactivity and hazardous wastes is important.

7.1 SANITARY/INDUSTRIAL WASTE GENERATION

Steam plant ash, sludge from the ORNL Sewage Treatment Plant, filter cake from treatment of coal yard runoff, general office refuse, and wastes from construction and demolition activities are disposed of at the Y-12 Centralized Sanitary Landfill II.

Table 7.1 and Figure 7.1 indicate conventional waste generation for previous years and generation in CY 1990.

Table 7.1. Annual generation rates of sanitary/industrial wastes from ORNL operations and activities

Sanitary/Industrial waste generation rates CY	Generation (m^3)
1985	7760
1986	8400
1987	7810
1988	10,095
1989	12,075
1990	11,920

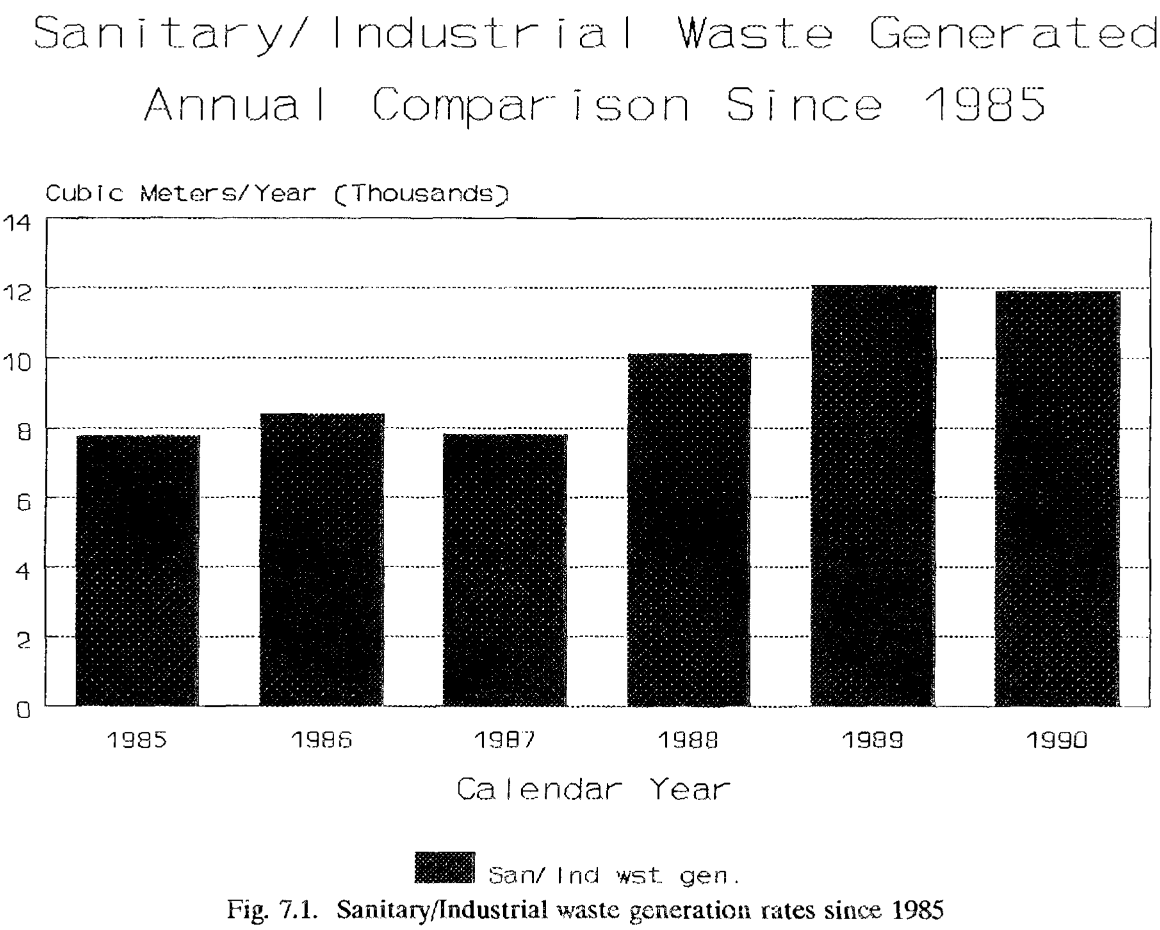

Fig. 7.1. Sanitary/Industrial waste generation rates since 1985

7.2 TRACKING SYSTEM FOR SANITARY/INDUSTRIAL WASTE

The solid conventional waste volumes are estimated and reported in the Waste Management Operations Section monthly report and sent to Y-12 to be compared with Y-12 estimates of ORNL conventional waste volumes.

7.3 SANITARY/INDUSTRIAL WASTE GENERATOR TRAINING

At present, there is no formal training specifically for generators of sanitary/industrial waste. Future development of WAC and certification controls for sanitary/industrial waste will necessitate training requirements.

7.4 REDUCTION OF SANITARY/INDUSTRIAL WASTE

Until recently, waste reduction had not been as important a factor for conventional waste as it had been for radioactive and hazardous waste because the cost for disposal per unit volume is significantly less. However, sanitary waste disposal costs will increase significantly as a result of transportation, emplacement, monitoring, and new site development costs. In addition, CSLF II space is nearly depleted and a replacement facility will not be available in the near term. Therefore, economic incentives to reduce sanitary waste volume will continue to grow rapidly, especially in the area of bulky general refuse.

Some 4,000 tons of potentially recyclable paper and approximately one ton of recyclable aluminum cans are disposed of each year in the sanitary landfill. These materials are filling up rapidly diminishing landfill space. In order to preserve our remaining landfill space and preserve environmental resources, ORNL volunteers implemented an aluminum can recycling program in August 1990. Proceeds from the sale of the cans to ALCOA Recycling are donated to the Tennessee Ronald McDonald House in Knoxville. Also, a Paper Recycling Program began in February 1991. Office paper is collected by and donated to the Knoxville Recycling Coalition (KRC), a non-profit organization. KRC also collects cardboard, paying ORNL 50 percent of its market value. Initially, the program includes one or two buildings with additional buildings added every few weeks. Currently, twenty-five buildings have been approved for inclusion in the recycling programs.

As a PIP Project, the Environmental Sciences Division (ESD) investigated the substitution of 100 percent recycled paper instead of virgin paper for computer output. For three months (November 1989 to February 1990), ESD used recycled paper to ensure that it performs to the same level as the virgin paper. (This PIP Project received the Martin Marietta President's Award for Performance Improvement.) ESD found that the recycled paper performed with minimal difficulties. It continued its experiment with 70 percent recycled computer paper and now uses this exclusively. In its PIP Progress Report, ESD recommended that use of recycled paper products be aggressively pursued within ORNL and Martin Marietta Energy Systems. In fact, the Environmental Protection Agency has required all U.S. Government offices and their contractors to use recycled paper products when possible, in order to create a market for recycled paper, conserve natural resources, and protect the environment.

The Reproduction Department is planning a controlled study of the performance of recycled paper in copying and printing operations. Recycled paper is already used to some extent by many divisions throughout the Lab and is available through AVID.

Another effort to reduce the quantity of waste disposed in the sanitary landfill is the development of another ORNL Recontour Site. Nonbiodegradable natural materials (soil, rocks) from excavation/construction activities will be deposited in the Recontour Site, which is presently on hold pending NEPA approval.

8.0 SUMMARY

The reduction of all ORNL waste generation is an economically logical response to the rising costs and liabilities of waste management and disposal. Human health and the environment are best protected from all types of wastes by prevention of their generation from the start. At ORNL, efforts to minimize many wastes have been mandated by federal regulations and DOE, Energy Systems, and internal policies. Real progress has been achieved. As researchers become increasingly aware of the advantages of improving the efficiency of their procedures and as divisions launch systematic evaluations of activities with reduction potential, further reductions will be achieved.

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APPENDIX A

No. 12602

REQUEST FOR DISPOSAL OF HAZARDOUS WASTE MATERIAL

Date			Page 1 of
Waste Generator		Bldg.	Room No.
Plant	Employee No.	Phone No.	Charge/Work Order No.
Location of Material		Room or Area	

ITEM NO.	DESCRIPTION OF MATERIAL *	QUANTITY	RADIOACTIVE/ NONRADIOACTIVE***	HAZARD INFORMATION	EPA WASTE NO./ CONTAINER NO. **

* IF THE WASTE IS A CHEMICAL MIXTURE OR AN ITEM SUCH AS CONTAMINATED CLOTHING, LIST EACH CHEMICAL AND APPROXIMATE AMOUNTS OF EACH. ALL FORMS NOT PROPERLY FILLED OUT WILL BE RETURNED!

TO BE COMPLETED BY THE HAZARDOUS WASTE OPERATIONS GROUP

STORAGE LOCATION		TOTAL WEIGHT/VOLUME
DATE TO STORAGE	RECYCLE/DISPOSAL DATE	RECYCLE/DISPOSAL SITE

WHITE - HWOG
CANARY - CONTAINER
BLUE - WASTE GENERATOR

**INFORMATION TO BE COMPLETED BY HWOG
***HP TAG REQUIRED PRIOR TO PICKUP

UCN-13698
(3 3-80)

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