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Waste Management and Remedial Action Division

OAK RIDGE NATIONAL LABORATORY WASTE MANAGEMENT PLAN

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OAK RIDGE NATIONAL LABORATORY
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MARTIN MARIETTA ENERGY SYSTEMS, INC.
for the
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ACRONYMS AND INITIALISMS

AcDM	Activities Description Memorandum
ADM	Action Description Memorandum
ADS	Activity Data Sheets
AEA	Atomic Energy Act
AMERD	Assistant Manager for Energy Research and Development
AMERWM	Assistant Manager for Environmental Restoration and Waste Management
ANSI	American National Standards Institute
ARARS	Applicable or Relevant and Appropriate Requirements
ASME	American Society of Mechanical Engineers
BMP	Best Management Practices
BSR	Bulk Shielding Reactor
CAA	Clean Air Act
CAT	collection and transfer
CDR	Conceptual Design Report
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CH	contact-handled
COM	commercially held, DOE-owned radioactive material
COR	Contractor Officer's Representative
CV	cell ventilation
CWA	Clean Water Act
CWCH	central waste collection header
CWMD	Central Waste Management Division
CYRTF	Coal Yard Runoff Treatment Facility
CYRTS	Coal Yard Runoff Treatment System
CYWP	Current Year Work Plan
D&D	decontamination and decommissioning
DDDP	Defense Decontamination and Decommissioning Program
DF	disposal facility
DMC	Documentation Management Center
DMS	Documentation Management System
DOE	U.S. Department of Energy
DOE-HQ	U.S. Department of Energy, Headquarters
DOE-OR	U.S. Department of Energy, Oak Ridge Field Office
DOT	U.S. Department of Transportation
EA	environmental assessment
EASC	Emergency Avoidance Solidification Campaign
EIS	Environmental Impact Statement
EMP	Environmental Monitoring Plan
EPA	U.S. Environmental Protection Agency
EPO	Environmental Protection Officer
ER	Energy Research
ERP	Environmental Restoration Program
ES&H	environmental, safety, and health

FFCA	Federal Facility Compliance Agreement
FPDL	Fission Products Development Laboratory
FR	Federal Register
FY	fiscal year
GCD	greater confinement disposal
GPP	general plant project
GTCC	greater than Class C
G-M	Geiger-Mueller
HAZWDDD	Hazardous Waste Development, Demonstration, and Disposal (Program)
HAZWRAP	Hazardous Waste Remedial Action Program
HEPA	high-efficiency particulate air (filter)
HFIR	High Flux Isotope Reactor
HLI	high-level incidental waste
HLW	high-level waste
HPGe	Hyper-pure germanium
HQ	Headquarters
HRE	Homogeneous Reactor Experiment
HSWA	Hazardous and Solid Waste Amendments
HWOG	Hazardous Waste Operations Group
HWSF	Hazardous Waste Storage Facilities
HWTS	Hazardous Waste Tracking System
ITE	in-tank evaporation
IWMF	Interim Waste Management Facility
LDR	land disposal restrictions
LGWOD	Liquid and Gaseous Waste Operations Department
LI	Line Item
LITR	Low-Intensity Test Reactor
LLLW	liquid low-level waste
LLW-CAT	Low-Level Waste—Collection And Transfer (Liquid)
LLW	low-level waste
LLWDDD	Low-Level Waste Disposal Development and Demonstration (Program)
LWSP	Liquid Waste Solidification Project
MSRE	Molten Salt Reactor Experiment
MVST	Melton Valley storage tank
NARM	naturally occurring and accelerator-produced radioactive material
NCP	National Contingency Plan
NDA	nondestructive assay
NDE	nondestructive examination
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NFS	Nuclear Fuels Services
NG	newly generated
NHF	New Hydrofracture Facility
NPDES	National Pollutant Discharge Elimination System
NPL	National Priories List
NQA	nuclear quality assurance
NRC	Nuclear Regulatory Commission
NRWTP	Nonradiological Wastewater Treatment Plant
OD	outer diameter
OGR	Oak Ridge Graphite Reactor

OHF	Old Hydrofracture Facility
ORNL	Oak Ridge National Laboratory
ORR	Oak Ridge Reservation
ORR/BSR	Oak Ridge Research Reactor/Bulk Shielding Reactor
OSHA	Occupational Safety and Health Administration
P&E	Plant and Equipment (Division)
PA	performance assessment
PAL	performance assessment limiting
PCB	polychlorinated biphenyl
PCBTS	PCB Tracking System
PVC	polyvinylchloride
PWA	Process Waste Assessment
PWS	Process Waste System
PWTDF	Process Waste Treatment Disposal Facility
PWTP	Process Waste Treatment Plant
QA	quality assurance
R&D	research and development
RAPIC	Remedial Action Program Information Center
RCRA	Resource Conservation and Recovery Act
REDC	Radiochemical Engineering Development Center
RH	remote-handled
RI/FS	Remedial Investigation/Feasibility Study
RTR	real-time radiography
RWMD	Reservation Waste Management Division
S&M	surveillance and maintenance
SARA	Superfund Amendments and Reauthorization Act
SC	special case
SCFP	Surplus Contaminated Facilities Program
SCMP	Site Corrective Measures Program
SDWA	Safe Drinking Water Act
SFMP	Surplus Facilities Management Program
SLF II	Sanitary Landfill II
SLLW	solid low-level waste
SNM	special nuclear material
SSP	Site Specific Plan
SWIMS	Solid Waste Information Management System
SWMU	solid waste management unit
SWSA	Solid Waste Storage Area
SWSF	Sanitary Waste Storage Facilities
SWOD	Solid Waste Operations Department
TDDP	Tumulus Disposal Demonstration Project
TDEC	Tennessee Department of Environment and Conservation
TEC	total estimated cost
TRANSCOM	System to be used for tracking TRU waste shipments from ORNL to WIPP
TRU	transuranic
TRUPACT II	NRC-approved shipping package for CH-TRU waste
TSCA	Toxic Substances Control Act
TSD	treatment, storage, and disposal
TVA	Tennessee Valley Authority

UC	uncertified or uncharacterized
WAC	waste acceptance criteria
WACCC	Waste Acceptance Criteria Certification Committee
WCCF	Waste Certification and Characterization Facility
WEAF	Waste Examination and Assay Facility
WHPP	Waste Handling and Packaging Plant
WIPP	Waste Isolation Pilot Plant
WMCO	Waste Management Coordination
WMRAD	Waste Management and Remedial Actions Division
WOC	White Oak Creek
WOCC	Waste Operations Control Center

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EXECUTIVE SUMMARY

U.S. Department of Energy (DOE) Order 5820.2A was promulgated in final form on September 26, 1988. The order requires heads of field organizations to prepare and to submit updates on the waste management plans for all operations under their purview according to the format in Chap. VI, "Waste Management Plan Outline." These plans are to be submitted by the DOE Oak Ridge Field Office (DOE-OR) in December of each year and distributed to the DP-12, EH-1, and other appropriate DOE Headquarters organizations for review and comment. The *Oak Ridge National Laboratory Waste Management Plan* (ORNL) was prepared in response to this requirement.

The goal of the ORNL Waste Management Program is the protection of workers, the public, and the environment. A vital aspect of this goal is to comply with all applicable state, federal, and DOE requirements. Waste management requirements for DOE radioactive wastes are detailed in DOE Order 5820.2A, and the ORNL Waste Management Program encompasses all elements of this order. The requirements of this DOE order and other appropriate DOE orders, along with applicable Tennessee Department of Environment and Conservation (TDEC) and U.S. Environmental Protection Agency (EPA) rules and regulations, provide the principal source of regulatory guidance for waste management operations at ORNL.

The objective of the *Oak Ridge National Laboratory Waste Management Plan* is to compile and to consolidate information annually on how the ORNL Waste Management Program is conducted, which waste management facilities are being used to manage wastes, what forces are acting to change current waste management systems, what activities are planned for the forthcoming fiscal year (FY), and how all of the activities are documented.

ORNL WASTE MANAGEMENT ACTIVITIES

Waste management operations are activities that minimize, treat, store, recycle, or dispose of all radioactive, hazardous, mixed and sanitary wastes generated as a result of operations at active and inactive facilities. Routine waste management operations at ORNL are the direct responsibility of the Waste Management and Remedial Action Division (WMRAD). The following table shows the quantities of solid waste generated and handled at ORNL during FY 1991 and FY 1992. In addition to newly generated wastes, significant quantities of transuranic (TRU) waste and some solid low-level waste (SLLW) and mixed waste from past operations have been placed in long-term storage.

Waste stream	Quantity	
	FY 1991	FY 1992
Radioactive:		
• Transuranic waste	8 m^3 (297 ft^3)	23 m^3 (814 ft^3)
• Low-level waste	1,952 m^3 (69,711 ft^3)	2,783 m^3 (99,394 ft^3)
Hazardous	106,343 kg (234,447 lb)	81,902 kg (180,563 lb)
Mixed	22,633 kg (49,898 lb)	19,538 kg (43,074 lb)
Sanitary	13,300 m^3 (474,984 ft^3)	10,310 m^3 (368,199 ft^3)

Radioactive Waste Management

ORNL radioactive waste management activities primarily involve TRU waste and low-level waste (LLW). Small quantities of naturally occurring and accelerator-produced radioactive material are generated and managed as LLW. ORNL does not generate high-level waste but does store a small quantity as a special-case (SC) waste such as irradiated and spent fuel. Stored TRU waste consists of sludge primarily from previous operations and lesser volumes of hot-cell-derived waste. Only small amounts of solid TRU waste are currently being generated. Radioactive waste management operations include solid, liquid, and gaseous waste activities.

Transuranic waste

Under DOE guidance ORNL has been segregating and retrievably storing the majority of its solid alpha-contaminated waste since 1970, pending the availability of permanent disposal. Some of these wastes, such as glove boxes and other large, bulky items, have been irretrievably buried as SC waste. The Waste Isolation Pilot Plant (WIPP), located in New Mexico, is the planned DOE disposal facility for TRU waste. Over the past several years ORNL has been developing the procedures for certifying TRU waste for disposal at WIPP and has employed the Waste Examination and Assay Facility (WEAF) for nondestructive assaying and nondestructive examination of stored contact-handled (CH) TRU waste. Significant quantities of sludges contaminated with TRU radionuclides from liquid waste operations are stored at ORNL. These sludges are to be processed as remote-handled (RH) TRU waste in the planned Waste Handling and Packaging Plant (WHPP) at ORNL. A number of issues, however, have recently been identified that may impact the WHPP Project.

Solid TRU and TRU mixed wastes at ORNL are stored in various facilities in the north area of Solid Waste Storage Area (SWSA) 5. Sludges are stored in the Melton Valley storage tanks (MVSTs) and other active and inactive tanks in the Liquid Low-Level Waste (LLLW) System at ORNL.

Solid low-level waste

Until 1986 all SLLW including some mixed waste (primarily lead) generated at ORNL was disposed of on-site by shallow land burial generally in unlined trenches and auger holes. SWSA 6, which is the active LLW disposal area at ORNL, has been used for LLW disposal since 1969. Starting in 1984, the practice of shallow land disposal on the Oak Ridge Reservation (ORR) came under close scrutiny by federal and state regulators and DOE officials. Major changes in the operation of SWSA 6 were initiated in 1986 including (1) the exclusion of all mixed waste from disposal, (2) the increased use of greater confinement disposal techniques such as concrete silos and lined auger holes for disposal of CH and RH LLW, and (3) the storage of some CH LLW at the Oak Ridge K-25 Site. Because of the disposal practices in SWSA 6 prior to 1986, some areas in SWSA 6 are being remediated under the ORR Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Federal Facility Agreement (FFA).

Current plans are to phase out below-grade disposal in SWSA 6 by December 1993 and to begin closure of the site. Beginning in January 1994, ORNL LLW will be disposed only in the above-grade tumulus Interim Waste Management Facility (IWMF). The IWMF began operation in FY 1992. In the early 2000s, new LLW disposal facilities being developed by the Central Waste Management Division (CWMD) are to begin operation, and the IWMF will be closed.

DOE Order 5820.2A, Chap. III, requires that each operating LLW disposal facility meet radiological performance objectives. SWSA 6 and the IWMF will demonstrate compliance with these performance objectives by preparing a site-specific radiological performance assessment (PA). The current strategy for managing ORNL LLW is to develop radionuclide concentration limits for each disposal technique at SWSA 6 and the IWMF based on the final results of the PA. This strategy is used in lieu of the Low-Level Waste Disposal Development and Demonstration (LLWDDD) Program strategy developed by Martin Marietta Energy Systems, Inc., in 1987. The LLWDDD strategy established classes of waste disposal technologies (i.e., Classes L-I, L-II, L-III, and L-IV) depending on the isotopic composition and concentrations in the waste. The LLWDDD waste classes continue to be used to refer to types of LLW storage or disposal facilities but are only a carryover from the former LLWDDD Program. In general, Class L-I refers to wastes suitable for below-grade trench disposal, Class L-II refers to wastes requiring disposal in engineered facilities designed to isolate the waste from the environment for long time periods, and Classes L-III and L-IV refer to higher activity wastes not suitable for disposal on the ORR. The "classes of waste" system may be adopted by ORNL in the future if the CWMD disposal facilities require this type of waste classification.

Solid special-case waste

SC wastes do not fit into typical management strategies developed for the other major LLW waste types, nor do they fit into a TRU waste category; therefore they require special management and disposal strategies. Five categories of SC waste and one category of special interest DOE-owned materials have been identified for management as SC waste: (1) DOE comparable greater than Class C; (2) performance assessment limiting; (3) uncertified or uncharacterized; (4) noncertifiable, nontransportable TRU; and (5) high-level incidental waste. The special interest category is commercially held, DOE-owned radioactive material. This category, although not a waste category, has been included in the SC identification and characterization task in order to meet the needs of DOE's management plan development. ORNL has been asked by DOE to identify SC wastes or potential waste materials that may fall within these six categories and, if possible, to provide a detailed characterization of waste in each category.

Under the former LLWDDD Program, PA limitations for on-site disposal were the principle consideration for SC waste, which included Class L-III and Class L-IV waste. The exact segregation, storage, and disposal requirements for various categories of SC waste at ORNL have yet to be determined.

Liquid low-level waste

ORNL employs two systems for handling and processing liquids that contain radioactive constituents: the LLLW System and the Process Waste System (PWS). The LLLW System handles waste solutions with significant amounts of radioactivity including waste streams originating from hot sinks and drains in research and development (R&D) facilities and from other sources such as TRU-processing facilities, the High Flux Isotope Reactor, and the Process Waste Treatment Plant (PWTP). The LLLW System, which uses an evaporation system for volume reduction, processed approximately 2 million L (540,000 gal) of waste and produced 83,279 L (22,000 gal) of concentrate in FY 1992. The evaporator overhead was discharged to the PWS, and the concentrates were placed in storage in the MVSTs.

Process waste

The PWS handles all liquid aqueous waste that contains trace amounts of radioactivity, heavy metals, and organics or has the potential to be contaminated with these constituents. The process waste solutions generated by various program activities throughout ORNL are collected into central holding tanks and processed through the PWPT, which employs softening and ion exchange units to remove radionuclides. The PWTP throughput is approximately 260 million L/year (70 million gal). In April 1990 the Nonradiological Wastewater Treatment Plant (NRWTP) began polishing the PWTP effluent and other ORNL process waste streams prior to release to White Oak Creek (WOC). The NRWTP throughput was approximately 550 million L (146 million gal) in 1991. The NRWTP effluent is released to WOC through a National Pollutant Discharge Elimination System (NPDES) monitoring station. Operations for both the LLLW System and the PWS are monitored, controlled, and recorded at the Waste Operations Control Center.

Gaseous waste

The three general types of radioactive air streams at ORNL include (1) process off-gas streams characterized as low-volume, potentially high-activity gaseous streams from process vessels and from systems or other sensitive areas where the concentration of radioactivity may be routine and highly concentrated; (2) cell ventilation (CV) air streams characterized as high-volume, low-activity gas streams from enclosed areas such as containment or confinement areas, limited-access areas, and hot cells; and (3) laboratory hoods and individual vents that provide controlled ventilation for laboratory-type operations or exhaust from vessels that are vented through appropriate pollution control devices at the source location.

Seven CV Systems with stacks are currently used for discharging CV air and process off-gas containing gaseous radioactive effluents. The basic equipment used in most of the CV Systems that discharge to major stacks includes filters, fans, and the ducts used to transport air. Radiation-monitoring instruments are connected to either the stacks or ducts entering the stacks. Where conditions dictate, charcoal absorbers or chemical scrubbers are used in the process off-gas streams to remove reactive gases such as halogens and acidic vapors prior to discharge to the Cell Ventilation System. For short half-life radionuclides, such as radon, holdup is used to allow decay before discharge. Noble gases are diluted with CV air and discharged to the stacks.

In addition to the major stacks, a number of individual vents through which small quantities of radioactive material may be discharged are used at ORNL. Located throughout the ORNL facilities, these sources are mainly vents from storage tanks and exhausts from hoods and glove boxes used for individual small-scale experiments and analytical chemistry work.

Many of the facilities for handling radioactive gas emissions have been in operation for over 20 years. Generally, the equipment that is accessible has been maintained in good working condition. Some systems have undergone significant upgrading through a line item capital project initiated in 1981. The program strategy is to identify and to implement system upgrades needed to ensure regulatory compliance and to meet DOE "as low as reasonably achievable" objectives. In addition, potential regulatory changes or new regulations are evaluated to determine if additional upgrades or new equipment will be required for future compliance.

Hazardous Waste Management

The Resource Conservation and Recovery Act (RCRA) is the primary regulatory driver for ORNL hazardous waste management operations. The state of Tennessee has been authorized by the EPA to develop and to implement laws and regulations essentially equivalent to those of RCRA. The state regulations are addressed in the Tennessee Hazardous Waste Management Rules. The Toxic Substances Control Act (TSCA) is the secondary driver for ORNL waste management operations. Under the TSCA, the EPA regulates the handling, management, and disposal of polychlorinated biphenyls (PCBs). At ORNL, hazardous wastes include those regulated by RCRA or the TSCA, special sanitary wastes, and other wastes identified by ORNL as representing an unacceptable hazard to personnel or to the environment if improperly managed.

Solid and liquid hazardous wastes

ORNL's diverse R&D activities produce a large number of different waste streams. All the characteristically hazardous and many of the listed hazardous wastes defined by the EPA and/or the TDEC appear on ORNL's RCRA Part A permit application. Because liquid and containerized gaseous wastes are considered "solid" wastes by the EPA and the TDEC and are subject to solid waste rules, liquid, gaseous (containerized), and solid hazardous wastes are managed similarly at ORNL.

The focus of hazardous waste management is segregation, repackaging, and storage in preparation for shipment to commercial facilities for treatment and/or disposal. Waste tracking and documentation is a critical aspect of the ORNL management strategy. Waste treatment is provided on-site at the Acid Neutralization Facility for bulk non-nitrate acid and at the Chemical Detonation Facility for explosive wastes.

Several facilities are currently used for the short-term storage of hazardous waste at ORNL. The majority of waste is stored in 208-L (55-gal) drums in Building 7652, which has a capacity of 57,254 L (15,125 gal). Inventories of waste in the various storage facilities vary monthly, since these areas are used for staging the waste for final disposition. Additional hazardous waste storage facilities are located in the Hazardous Waste Management Area off the Health Physics Research Reactor access road at ORNL.

Two major policy developments occurred in 1991 that continue to have major impact on hazardous and mixed waste operations: the so-called "Off-Site Shipment Moratorium" and the "No Rad Added" policies. The Off-Site Shipment Moratorium was implemented by DOE on May 17, 1991, and it halted all off-site shipments of hazardous or mixed waste from ORR sites. This was followed in November 1991 with the companion policy referred to as the Performance Assessment for the Certification of Non-Radioactive Waste. This policy stipulated that no waste shall be shipped to a private sector treatment, storage, and disposal facility unless it has been certified as not containing DOE-added radioactive contamination (i.e., no rad added). Compliance with these policies has placed an additional administrative and certification burden on the various waste management organizations effected by these policies. To help alleviate the storage problems created by accumulating wastes on ORR sites, the CWMD has been evaluating the potential for off-site shipment of radioactive wastes to other DOE sites for disposal.

Gaseous hazardous waste

Approximately 12 leaking cylinders are handled per year at ORNL. The current management strategy involves the venting of compressed gases to the atmosphere at a remote site (i.e., away from inhabited areas) off Ramsey Drive and the Melton Valley access road at ORNL.

Mixed Waste Management

Mixed waste contains both hazardous and radioactive components. Currently, the hazardous components of mixed wastes are defined and regulated under RCRA; the radioactive components, under the Atomic Energy Act. Regulation under both of these acts has evolved because the handling and disposing of mixed wastes involve both toxic and radioactive hazards and because no regulatory program focused exclusively on mixed wastes. DOE Order 5400.3 states that "whenever any hazardous waste identified or listed in 40 CFR Pt. 261 is mixed with any source material, special nuclear material, or byproduct material, the hazardous component is subject to regulation under Subtitle C of the RCRA." A parallel strategy has been implemented for radioactively contaminated PCB wastes. These are also classified as mixed wastes.

Examples of mixed waste at ORNL are cleaning fluids and oils removed from systems operated in contaminated environments and from scintillation fluids that contain radioactive tracer elements used for chemical and biological analyses. In addition, small quantities of a wide variety of mixed wastes are generated by ORNL R&D and operational activities. These wastes fall into hazard categories such as PCBs, corrosives, oxidizers, poisons, and flammables. Because liquid and containerized gaseous wastes are considered "solid" wastes by the EPA and are subject to respective solid waste regulations, solid, liquid, and gaseous mixed wastes are managed similarly at ORNL.

ORNL generates about 100 208-L (55-gal) drums of mixed waste annually. Currently, commercial treatment is available only for some scintillation wastes. No on-site treatment of mixed waste is available at this time, although decontamination of surface-contaminated lead is planned. Until treatment methods become available, these wastes must be stored on-site. Additional characterization and evaluation is needed to determine whether some of these wastes may be accepted for treatment at the TSCA incinerator at the Oak Ridge K-25 Site.

Mixed waste storage capacity at ORNL is severely limited at present. Drum storage for solid and liquid mixed waste is currently provided in Buildings 7654, 7507W, and 7823. Bulk storage of mixed waste oils is provided by two tanks: 7075 and 7830a. Building 7507W has been filled to capacity, and Building 7654 is nearing capacity. Tank 7860a was used until early 1991 for mixed oil storage but has been closed under RCRA. To relieve this congested condition, new mixed waste storage facilities are planned.

An effort to better characterize 850 mixed waste drums was initiated in early 1991. The objective of this work includes (1) identification of drums that would meet the PWTP waste acceptance criteria (WAC) to facilitate treatment, (2) improvement of characterization data to help identification and selection of off-site waste treatment facilities including the K-25 TSCA Incinerator, and (3) characterization of those drums that have little or no process data traceable to them in accordance with RCRA. This work is expected to be complete by the end of CY 1993. These drums were received by WMRAD prior to 1984 and did not undergo the level of tracking and documentation currently applied to newly generated waste.

On May 8, 1992, the RCRA land disposal restriction (LDR) rule prohibiting the land disposal of all untreated mixed wastes became fully effective. This development prompted the signing of a Federal Facilities Compliance Agreement (FFCA) to provide a system of schedules and milestones intended to bring ORNL into compliance with RCRA LDR. The primary deliverables for the FFCA are a Waste Treatment Plan, a Waste Treatment Strategy Plan, a Waste Minimization Plan, a Waste Storage Plan, and an Implementation Plan. Successful completion of the FFCA has become one of the highest priority activities for WMRAD for FY 1993 and beyond. Significant levels of resources are being devoted to implementation of the FFCA.

Sanitary Waste Management

Sanitary wastes at ORNL include both solid and liquid wastes. The state of Tennessee regulates these waste streams at ORNL via the Tennessee Solid Waste Disposal Act and ORNL's NPDES permit.

Solid sanitary waste

Solid sanitary wastes that contain no radioactive or hazardous materials or free liquids include filter cake from the Coal Yard Runoff Treatment Facility (CYRTF), fly ash from the ORNL steam plant, general refuse collected in trash cans and dumpsters, and construction debris. The volume of general refuse is estimated to be about 45.9 m^3/day (60 yd^3); fly ash and sludge from coal pile runoff accounts for approximately 9.2 m^3/day (12 yd^3).

Other than the equipment used for the compaction of general refuse, no treatment or storage facilities currently exist at ORNL for handling solid sanitary waste. The majority of ORNL sanitary waste is now disposed of in Sanitary Landfill Facility II (SLF II), which is located on Chestnut Ridge south of the Oak Ridge Y-12 Plant and about 9.66 km (6 miles) east of ORNL. Approximately 300 to 400 m^3 (400 to 500 yd^3) of soil, rock, and concrete mixtures are deposited at the Y-12 SLF II dirt fill area annually. The SLF II is scheduled to be closed when the new Industrial Landfill V is opened (around the July 1993 time frame).

ORNL has established recycling programs for white paper cardboard and aluminum beverage containers to reduce the amount of solid sanitary waste disposed in the Y-12 SLF II.

Liquid sanitary waste

Liquid sanitary waste includes nonradioactive waste streams that are discharged, either directly or following treatment, to WOC. ORNL sources include (1) sewage treatment plant effluent from Bethel and Melton Valleys, (2) area runoff of rainwater, and (3) CYRTF effluent.

Approximately 2.0×10^5 gal/day of ORNL sanitary sewage is treated by an aerobic digestion process. The ORNL Sewage Treatment Plant, operated under ORNL's NPDES permit, produces a sludge that is dewatered on sludge-drying beds. Most of the Storm Sewer System is constructed of reinforced concrete piping and contains catch basins that drain areas in Bethel and Melton Valleys and drain to WOC.

Acidic rainwater runoff from the ORNL Coal Storage Yard is collected in a clay-lined basin. Neutralization of the acid with magnesium hydroxide in the CYRTF causes precipitation of contaminants that have been leached from the coal pile. The precipitated solids are disposed of in the SLF II as a special waste.

Decommissioning of Radioactively Contaminated Facilities

ORNL has many radioactively contaminated facilities that are awaiting decontamination and decommissioning (D&D) and must be managed in a manner that protects the public health and safety and the environment. Also, new and existing facilities will eventually require D&D some time in the future. In general, D&D activities are concerned with facilities such as reactors, hot cells, processing plants, some LLLW storage tanks, and other structures whose demolition is likely to result in health and safety and environmental impacts if sufficient controls are not exercised.

The ORNL waste management activities associated with decommissioning of radioactively contaminated facilities can be divided into four areas: operational facilities, inactive or surplus facilities, future facilities planning, and D&D activities. Radioactively contaminated facilities that are currently operational are the responsibility of the line management organization operating the facility. Funding for the operation and maintenance of these facilities is provided by various program organizations within DOE.

ORNL, which has been an operational site since the 1940s, has approximately 70 surplus facilities. The overall strategy for the management of these inactive facilities is (1) to maintain and to monitor these facilities to ensure that the radioactivity is contained in a manner that limits exposure to personnel and the general public and protects the environment from potential hazards and (2) to plan for D&D of these facilities.

The goals of D&D are (1) to decontaminate facilities to the extent necessary for compliance with approved health and safety standards and (2) to decommission facilities in accordance with the requirements set forth in an approved environmental compliance plan. Several ORNL facilities have undergone D&D over the past 5 to 10 years, and several D&D projects are currently in progress. Planning for D&D will be an integral part of the design of all future facilities at ORNL.

MAJOR ACCOMPLISHMENTS AND SIGNIFICANT REGULATORY AND ENVIRONMENTAL ISSUES FOR FISCAL YEAR 1992

In FY 1992 WMRAD participated in, conducted, or supervised a wide diversity of environmental and waste management activities. The major operational activities included the treatment, storage, and handling of approximately 830 million L (220 million gal) of liquid waste regulated under the Clean Water Act and 14,000 m^3 (500,000 ft^3) of solid waste covered under RCRA and/or DOE Order 5820.2A. Of the solid radioactive waste, 1484 m^3 (53,000 ft^3) was nonretrievably disposed in accordance with DOE Order 5820.2A. Projected annual generation rates for the major ORNL waste streams are listed in the tables at the end of this summary. The remaining activities can generally be characterized as operational support, program and project management, waste reduction and minimization, and other environmental activities.

Several reporting mechanisms are used by WMRAD to communicate accomplishments, status, and concerns to DOE, the CWMD, and ORNL management. The information contained in these reports is usually in bulletized, discrete form. The most relevant and significant of the items reported by WMRAD in FY 1992 follow:

Waste Certification

- Information from profile sheets was reviewed by generator organizations and used to complete UCN 2109 forms for all Energy Systems industrial waste containers. These forms were sent to the Hazardous Waste Operations Group for signature prior to forwarding to the Y-12 SLF-II to fulfill documentation requirements for ORNL wastes.
- The document *Guidelines for Establishing Waste Certification Plans and Procedures at Waste Generator Facilities* was published. Using this document, generator organizations will establish programs and procedures for compliance with WAC for the IWMF. This activity is a key step in proceeding with the implementation of DOE Order 5820.2A compliant waste certification program.

Waste Reduction and Minimization

- An Energy Systems assessment (a.k.a. audit) of the Waste Reduction Program has been initiated. Documentation by ORNL Waste Management, CWMD, and Quality Assurance staffs is being used to make a baseline assessment, the results of which will be used to upgrade the current Waste Reduction Program.
- An audit of the ORNL Waste Reduction Program was completed. This activity focuses on the largest waste-generating divisions at ORNL; the results will be used to evaluate the effectiveness of Waste Reduction Program initiatives. This action also closes a Tiger Team finding.
- Parts cleaners at ORNL typically use a hazardous solvent as a degreaser. In the summer of 1992, one operation switched to an aqueous parts washer. This machine is similar in design to a large industrial dishwasher and uses a citric acid–based detergent. The aqueous solution is recycled, and oily residue from the parts is skimmed off the top of the solution. This not only eliminates a hazardous waste stream but greatly reduces employee exposure to toxic chemicals.
- The Radiochemical Engineering Development Center (REDC) changed the operation of the hot cell off-gas scrubber from the hydroxide mode to the carbonate/bicarbonate mode. By implementing this change in operations, the total ORNL LLLW concentrate was significantly reduced. The REDC operations contribute approximately 40% to the total LLLW generation. By reducing their contribution, the total LLLW concentrate generation has been reduced by 20 to 25%.
- The Paint Department determined that by limiting the number of colors available, the disposal of partially used containers of paint would be avoided. If paint is left over at the end of a project, it is used on the next job requiring the same color. This administrative decision eliminated the disposal of unused paint.
- Wooden pallets that have never been circulated within the plant are returned to the vendor. Pallets are held in a designated location in the 7000 Area. When the vendor returns, the pallets are placed back on the vendor's truck. Pallets that have been circulated in the plant are handled as waste.
- An award fee milestone, "Completion of Photographic Waste Process Waste Assessment," was completed. This activity satisfies a requirement of the Tennessee Oversight Agreement for completion of an initial process waste assessment. Additionally, this effort is a pilot process waste assessment for ORNL; lessons learned are to be factored into future such assessments.
- A prerinse and an ion-exchange filtering system were added to the plating operation to eliminate the need for discharging rinse wastes, which contain a low concentration of plating chemicals (metals). The closed-loop system cleans spent rinse water for

indefinite reuse and zero discharge. This activity reduced rinse water discharged by 980,000 L/year (260,000 gal), which translates into a cost avoidance of approximately $1 million annually.

- The Pressure Washer Water Recycling Unit degreases water generated from steam cleaning automobile engines in garage operations. The clean water is then reused. Formerly, water was used once and collected for treatment in the Wastewater Treatment Plant. It is estimated that it saves $60,000/year in waste disposal costs.
- Antifreeze (ethylene glycol) is recycled from emergency generators and automobiles. The equipment filters the antifreeze, which is then pH adjusted and reused. Total cost for purchase and installation of the equipment was $6184. The annual savings is calculated to be $12,578/year through disposal cost avoidance and by not purchasing new antifreeze.
- Oil filters are removed from vehicles in the garage area as part of normal vehicle maintenance. Previously, these filters were disposed of as hazardous waste. A commercial oil filter crusher mechanically crushes the filters and forces 88% of the residual oil out of the filter material. More oil is reclaimed and available for recycling, and crushing the filters reduces waste management costs.
- In late 1990 ORNL started an employee-volunteer aluminum beverage collection program. In 1991, 3175 kg (7000 lb) of cans were collected and donated to the Ronald McDonald house. This generates a charitable donation and avoids the landfill disposal costs (approximately at $1200/year).
- ORNL began collecting white office paper, computer paper, and corrugated cardboard for recycle in 1991: 86,500 kg (190,700 lb) of white paper and 76,657 kg (169,000 lb) of cardboard were recycled. The market value of the white office paper covers the cost of collection and transportation. The cardboard is sold for 50% of the official board market price, which has averaged $12.50/ton. The primary value of the paper, cardboard, and aluminum recycling program is not the income from the sale of recyclable material but the unused landfill space.
- Sample analysis requires that 180 mL of methylene chloride, an ozone-depleting chemical, be used in each sample preparation. The laboratories cut their use of methylene chloride by recycling most of what is used in each sample preparation. Over 94% of the solvent used in this preparation is purified and recycled to then be used on another sample preparation.

Liquid Low-Level Waste Management

- Research is ongoing to support the design of facilities to treat newly generated LLLW. Microspheres containing sodium cobalt hexacyanoferrate embedded in hydrous titanium oxide are being tested for removal of cesium from newly generated LLLW at pH 8. The use of these particles is envisioned as a polishing step to remove traces of cesium from the newly generated LLLW after the bulk of the cesium is removed with potassium cobalt hexacyanoferrate slurry. Decontamination factors of about 600 were measured for 750-μm-diam beads. A white aluminum flocculent formed in the feed and plugged the system during tests with the beads in an ion exchange column. A new procedure for preparing microspheres to improve the kinetics of cesium removal is under way.
- A study is under way to determine economical, efficient methods of mixing and mobilizing materials in the ORNL LLLW tanks. Initial efforts are focused on addressing the MVSTs and the LLLW evaporator service tanks. Single point sluicing and a submersible jet pump are being evaluated. Tests have begun in the slurry test loop located in Building 2528 to obtain rheology data on simulated MVST waste. This

information is needed to design a submersible jet sluicer system for the MVST tanks using a computer code being written by Pacific Northwest Laboratories.

- Treatability studies have been completed to support the design of the evaporator system for out-of-tank evaporation for the MVSTs. A batch of simulated waste solutions have been prepared and will be shipped to Licon, Inc., who will conduct fouling studies in a bench-scale evaporator system. The R&D support for this project is on schedule, and testing should begin July 15, 1992.
- A preconceptual study for out-of-tank evaporation of MVST liquids was completed. The study indicated that a skid-mounted evaporator could be used to reduce the volume of MVST supernate. Some testing of vendor equipment with surrogate waste will be required. Preliminary estimates indicate that a system would cost approximately $3 million to install and could be operational in approximately 2 years. This concept was subsequently dropped for safety reasons.
- A leak-test plan was submitted to the Energy Systems FFA coordinator for submittal to the FFA regulators. This plan outlines methods for performing leak tests on the 42 ORNL active LLW tank systems.
- The water purity experiment at the Oak Ridge Research Reactor and the Bulk Shielding Reactor has demonstrated that the purity of the water in the reactor pools can be maintained by adding a small amount of deionized water and overflowing the pools to the PWTP. This mode of operation will eliminate the production of LLLW at the reactors. A letter report was issued describing the results of the 22-week experiment.
- Leak-testing of three waste management LLLW tanks was initiated using a newly developed methodology of liquid volume measurement that includes diurnal temperature compensation.
- The design demonstration documentation showing FFA compliance of 11 ORNL secondarily contained tank systems was submitted to DOE.
- A feasibility study to use acoustic emission for leak-testing the ORNL LLLW System was completed. The study shows that acoustic emission is feasible to detect leaks in doubly contained pipelines. The advantage of acoustic leak-testing compared with the current proposed method of volume balancing is that acoustic emission testing can locate the leak in long pipes.
- A report was drafted summarizing the results of R&D efforts to support treatment of newly generated LLW radioactive waste. Research efforts are focusing on removal of TRU and organic contaminants at the source and removal of cesium, strontium, and ruthenium in centralized facilities.

Process Waste Management

- Flow diagrams, instrumentation requirements, and valving schemes were prepared for the zeolite development test systems being installed in the new Wastewater Treatability Test Facility, Building 3455A. The development data will be used in the design of full-scale zeolite systems to be used in upcoming upgrades at the PWTP.
- Construction activities were completed for the FY 1989 GPP Manhold Monitors—Process Waste (WBS 3.50), which also closed Tiger Team finding SW/BMPF-4.

Mixed Waste Management

- Assistance was given in preparation of the proposed FFCA regarding LDR RCRA hazardous and mixed waste.
- Information from the Hazardous Waste Tracking System was provided to the CWMD to support development of the LDR FFCA mandated Treatment Plan. WMRAD staff supported CWMD's preparation of a prioritization scheme for development of this plan.
- A letter report, "Characterization of Stored Mixed Waste," was transmitted to the CWMD for submission to DOE-OR. The report categorizes waste by treatability groupings and represents the documentation process knowledge evaluations for mixed waste generated during the past 9 years.
- The LLLW database was updated to reflect new information received from LLLW generators for calendar year 1992. A new survey was distributed to determine the source of LDR components in the ORNL waste treatment systems. The data indicates that the generation rates will be reduced in several areas because of waste minimization activities. Several generators are beginning to minimize waste generation; however, waste generation will increase in areas where remediation and decontamination activities are under way.
- Data packages for all prethirds radioactive mixed waste, thirds radioactive mixed waste, and CY 1990 hazardous waste was compiled and submitted to the CWMD as requested.
- A Conceptual Design Report for the MVST capacity increase line item project was submitted to DOE-OR. The report was completed 2 weeks earlier than was projected. This enabled DOE-OR to include definitive funding profiles in the Activity Data Sheets (ADSs), which were being finalized.
- The volume of dry air being bubbled through six MVSTs was increased to 2.8 m^3 (100 ft^3) per tank, which initiated routine operation of the in-tank evaporation process. Surveillance of this process is ongoing.
- Benchscale evaporation tests were completed to support out-of-tank evaporation at the MVSTs. Test results indicated that foaming and scaling would not be a problem and that a single-stage, low-pressure evaporator would be adequate for the full-scale operation.
- The Action Plan for the ORNL Mixed Waste Facilities was submitted, and all the findings are now closed.
- A letter report on radioactive mixed waste treatment technology demonstrations was issued. This activity evaluates the technologies demonstrated during the fiscal year for the treatment of mixed waste and provides information to support the current reservation-wide effort to address LDR-FFCA requirements for waste treatment.
- An ORNL procedure for implementation of a No-Rad Added Policy with respect to off-site disposal of hazardous waste was completed and transmitted to the CWMD.

Transuranic Waste Management

- An interim CH TRU characterization report was received from S. M. Stoller Corporation. This completed the first phase of an effort to characterize the existing CH TRU inventory effectively at ORNL.
- A WIPP Waste Analysis Plan for TRU Waste prepared by Benchmark Environmental Corporation will be submitted to the state of New Mexico as Chap. C of the WIPP RCRA Part B permit application.
- Support was provided to the WIPP audit of the Rocky Flats Plant Transuranic Program. This activity is in support of the preparation of the Rocky Flats Plant to ship test-phase

waste to the Carlsbad, New Mexico, facility. As part of the program audit team, ORNL staff evaluated characterization methods.

- Several readiness review criteria items were completed for the receipt and storage of waste from Nuclear Fuels Services, Inc. (NFS) in Erwin, Tennessee. All items associated with Waste Examination and Assay Facility equipment are now complete.
- The ORNL response to the WIPP audit of the Transuranic Waste Program was finalized and forwarded to DOE-OR for transmission to the WIPP Project Integration Office. Corrective actions have been proposed or already undertaken to close out all findings and observations identified in the audit report.
- A revised Environmental Assessment for the NFS Storage Project that incorporated comments from DOE-HQ was submitted to DOE. The approved WAC for receipt and storage of NFS TRU wastes at ORNL was issued. Support was provided to DOE in discussions with NFS concerning use of the TRUPACT II for shipment of wastes to ORNL.
- The final WAC for the NFS wastes was completed, resolving all items related to mixed oxide waste. This document has been incorporated into the DOE Nuclear Fuel Services, Inc., contract as Attachment B.
- A report was issued identifying the R&D activities necessary to characterize solid RH TRU waste. This report was prepared in response to the Tiger Team finding WM/CF-13.
- DOE approval was received for categorical exclusion of PWTP process improvements and wastewater feed capacity increase modifications covered in Phase I of the line item project.

Solid Low-Level Waste Management

- A subcontract with Science Applications International Corporation to verify the radionuclide inventory disposed in SWSA 6 from September 26, 1988, to the present was approved. The subcontractor began work April 13, 1992, on the SWSA 6 Inventory Verification Study by providing a list of 55 SLLW document numbers as being highest in priority for initial review. Specific activities included reviewing Solid Waste Information Management System and original disposal records, investigating anomalous or suspicious radionuclide concentrations, documenting corrections previously made to the database records or recommending corrections that appear warranted, and estimating the uncertainty in reported radionuclide concentrations. The revised inventory was used in the final SWSA 6 performance assessment (PA).
- A cost summary of PA activities through September 1992 was prepared by the Energy Division. Approximately $300,000 was spent during that period on PA development work. Approximately $300,000 additional funds are needed for PA work for the remainder of FY 1993.
- Construction of a newly designed rectangular shaped silo in SWSA 6 was completed. The purpose of the new design is to better accommodate waste boxes and thus eliminate the excessive void spaces created when the boxes are placed into conventional cylindrical silos.
- IWMF pad No. 2 was successfully poured on February 1, 1992.
- Fourteen vaults of SLLW were placed onto the Tumulus II pad, completing operation of this facility.

Gaseous Waste Management

- Construction of the Stack Monitoring Improvements GPP was completed; this provided improved sampling capabilities on the 2026 and 3020 stacks.

Sanitary Waste Management

- The ORNL Industrial Waste Control Plan was implemented. This activity is a result of a collaborative effort between ORNL, the K-25 Site, and the Y-12 Plant to improve the level of assurance that only permitted items are placed into containers on-site for disposal in the Centralized Sanitary Landfill.
- The ORNL Value Engineering Team identified cost avoidances on the FY 1992 Sanitary Sewer Upgrade Project estimated to be between $3 million to $4 million. This Value Engineering study evaluated the Conceptual Design Report and identified numerous areas where pipe sizes, types, and hydraulic designs could be modified and relocation(s) of sanitary sewer lift stations could be effected that would reduce the overall cost of the project.

Compliance

- The First Quarter CY 1992 Waste Management Compliance Report was issued to provide assistance to the DOE program manager in regulatory duties.
- Activities to begin the RCRA closure of Buildings 7826, 7834, 7555, 7075, and the Bottle Smasher Facility in Building 7659 were initiated.
- The TDEC conducted an inspection of the Solid Waste Operations Department. Operations at hazardous and solid TRU waste storage facilities as well as the WEAF were inspected. No findings or violations were identified by the team.
- Generators were notified that mixed waste storage space is limited and that the generation of mixed waste should be minimized. This closes Tiger Team Finding WM/CF-1-003.
- RCRA closure activities are ongoing in the following facilities: TRU Drum Storage Facilities (Buildings 7826 and 7834), the 3001 canal, the 7075 waste oil tank, the Chemical Detonation Facility (Building 7822A), and the former Reactive Waste Disposal Facility (Building 7659B).

Remedial Action

- An evaluation of historical ORNL waste characterization data was initiated by request of Pacific Northwest Laboratory for the Buried Waste Integration Demonstration Project located at Idaho National Engineering Laboratory. This project is intended by DOE-HQ to be the major technology development and demonstration activity for remediation of buried waste.
- Major support and input were provided to three major ER regulatory deliverables: site characterization summary reports, a preliminary risk assessments report, and an operable unit strategy document for Waste Area Grouping 1 (main plant area) at ORNL.

Capital Projects

- Twelve preliminary proposals for waste management facilities for FY 1993 GPPs were completed.
- As a result of DOE-OR reviews of capital projects for financial compliance, some GPPs have been reprogrammed into line items. This has produced delay in the projects, increased costs, and increased environmental, safety, and health (ES&H) risks.
- Requirements for National Environmental Policy Act (NEPA) documentation preparation, review, and approval continue to be a problem for capital and expense projects. Regulatory noncompliance as well as ES&H impacts could result if specific NEPA documents are further delayed.
- A facility planning overview was presented to TDEC, including Tennessee Oversight Agreement staffs on SWSA 7. The presentation provided an overview of the plans for SWSA 7 and described proposed facilities.

Decontamination and Decommissioning Programs

- Completed and submitted to DOE-OR the DOE-HQ milestone under ADSs OR-313-AA and 314 to update the Surveillance and Maintenance (S&M) Plan for the ORNL D&D Program. This plan includes revised S&M estimates for ORNL facilities in the D&D Program including the Oak Ridge Research Reactor, which is expected to transfer into the program in FY 1993.

Nonradioactive hazardous waste summary for FY 1992

Waste category	Units	Current month	Fiscal year to date	Projected annual generation rate
RCRA[a]	kg	5,868	42,892	47,181
	lb	12,934	94,533	103,986
Non-RCRA hazardous	kg	196	10,398	11,438
	lb	432	22,917	25,209
Asbestos	m^2	9	338	354
	ft^2	97	3,638	3,804
Polychlorinated biphenyl (PCB)[b]	kg	172	28,636	31,500
	lb	379	63,113	69,424
Y-12 Plant[c]	kg	0	0	0
	lb	0	0	0
Oak Ridge Associated Universities	kg	0	0	0
PCB	lb	0	0	0

[a]RCRA—Resource Conservation and Recovery Act. Includes Y-12 Plant waste in fifth entry.
[b]Includes Oak Ridge Associated Universities PCB waste in sixth entry.
[c]Primarily photographic wastes.

Radioactive liquid waste summary for FY 1992

Waste category	Units	Current month	Fiscal year
Liquid low-level waste (LLLW) generated	m^3 (× 10^2)	1.09	15.58
	gal (× 10^3)	28.72	411.52
LLLW evaporated	m^3 (× 10^2)	0.88	15.54
	gal (× 10^3)	23.15	410.52
LLLW evaporator concentrate to storage	m^3 (× 10^1)	0.00	3.68
	gal (× 10^3)	0.00	9.71
Process waste treated by the PWTP[a] (no volume change)	m^3 (× 10^4)	1.75	26.40
	gal (× 10^6)	4.62	69.76
PWTP clarifer sludge generated	drums	52.00	582.00
	m^3 (× 10^1)	1.08	12.11
	ft^3 (× 10^2)	3.82	42.78
PWTP concentrate to LLLW storage	m^3 (× 10^{-1})	1.89	31.07
	gal (× 10^3)	0.50	8.21
Discharge to White Oak Creek (from the NRWTP)[b]	m^3 (× 10^4)	4.78	57.78
	gal (× 10^6)	12.62	152.65
Total LLLW concentrate to storage	m^3 (× 10^1)	0.19	6.78
	gal (× 10^3)	0.50	17.92

[a]PWTP—Process Waste Treatment Plant.
[b]NRWTP—Nonradiological Wastewater Treatment Plant.

Sanitary/industrial solid waste summary for FY 1992

Waste category[a]	Units	Current month	Fiscal year
Sanitary/industrial (Y-12 Sanitary Landfill)	m^3	434	10,861
	yd^3	568	14,205
Industrial waste (X-10 Contractors' Landfill)	m^3	0	0
	yd^3	0	0
Recontour site	m^3	0	0
	yd^3	0	0
Miscellaneous scrap metal	ton	0	0
Metal shavings	ton	0	0

[a]No treatment of these wastes; quantity disposed of equals quantity received.

Solid waste summary for FY 1992

Waste category	Units	Current month	Fiscal year
Solid low-level waste[a]	m^3	191	2,915
	ft^3	6,743	103,007
Compactible[b]	m^3	20	568
	ft^3	720	20,077
Compacted[c]	m^3	5	127
	ft^3	163	4,489
Received from:			
• ORAU	m^3	0	0
	ft^3	0	0
• Y-12	m^3	0	0
	ft^3	0	0
Shipped to K-25	m^3	0	0
	ft^3	0	0
	drums	0	0
	m^3	0	0
	ft^3	0	0
	boxes	0	0
Transuranic	m^3	2	16
	ft^3	88	551
Suspect	m^3	70	558
	ft^3	2,475	19,706
Asbestos	m^3	5	108
(rad contaminated)	ft^3	166	3,804

[a]Total low-level waste received.
[b]Volume of total low-level waste that is compactible prior to compaction.
[c]Volume of compactible waste after compaction.

Mixed waste summary for FY 1992

Waste category	Units	Current month	Fiscal year
Mixed (RCRA)[a]	kg	500	5,644
	lb	1,103	12,439
Mixed (non-RCRA hazardous)	kg	1,481	6,911
	lb	3,264	15,232
Polychlorinated biphenyl (rad contaminated)	kg	0	8,970
	lb	0	19,770
Oak Ridge Associated Universities[b]	kg	0	0
	lb	0	0

[a]RCRA—Resource Conservation and Recovery Act. Includes Oak Ridge Associated Universities waste in fourth entry.
[b]Primarily scintillation fluids.

PLANNED ACTIVITIES

Activities in this category include long-range and strategic planning, operational continuity planning and support, and newly generated waste evaluation and pilot plant testing. The more significant activities identified in the FY 1993 Current Year Work Plan follow:

Liquid Low-Level Waste

- Develop a flow sheet for centralized treatment of waste streams resulting from segregated/pretreated LLLW to minimize the production of CWMD >Class I and Class II and TRU solid waste.
- Support the design of the FY 1995 line item for the new ORNL PWTP with capabilities to dilute/pretreat LLLW.

Solid Low-Level Waste

- Complete the final SWSA 6 PA in FY 1993, the purpose of which is to determine if the active disposal units in SWSA 6 meet the performance objectives in DOE Order 5820.2A.

Planning

- Develop the Waste Management Long-Range Plan and support the FFCA Waste Storage Plan, the Waste Treatment Plan, and the Waste Treatment Strategic Plan.

Waste Certification

- Conduct an internal assessment of the ORNL TRU Waste Program (including an audit and surveillance of generator TRU Waste Certification Programs) and support external audits and reviews.
- Continue coordination with divisional SLLW generator certification officials and revise, update, and develop the SLLW certification documents.

Waste Minimization

- Survey ORNL's waste streams with an emphasis on hazardous content, volume, cost, and technical capability to reduce waste volume.
- Identify systems for Process Waste Assessments (PWAs).
- Complete PWA demonstrations.
- Continue to support and to expand recycling programs and activities.

General Plant Projects

- Continue to identify and to develop environmental projects (Environmental Projects Section). This activity will be performed in cooperation with long-range strategies for waste management within ORNL.

Line Item Support

- Finalize all documentation to support the WCCF as an FY 1994 line item.
- Conduct project planning, engineering, and development work to support the FY 1996 line item and the RH TRU Waste Bunker Project.
- Support the PWTP FY 1996 line item by the following activities: completion of the systems requirement document, preparation of a feasibility study, initiation of the conceptual design report, and preparation and review of NEPA documentation.
- Finalize project documentation to support the MVST capacity increase line item.
- Support the Out-of-Tank Evaporation Project by the following activities: completion of design criteria, equipment procurement, completion of detailed design, a criticality review, a shielding analysis, and preparation of NEPA documentation.
- Finalize project documentation to support the Bethel Valley FFA Project.

Clean Water Act

- Evaluate the effect that more stringent NPDES requirements will have on ORNL Wastewater Treatment Facility operations.

Federal Facility Agreement

- Evaluate the pretreatment options for LLLW streams from Building 3025 to facilitate the removal of cobalt.
- Support ER remediation schedules, waste characterization, and risk assessment on inactive (Category D, Group 6) tanks.
- Determine the compliance status of LLLW tank, drain, and piping systems, and track these findings on a personal-computer-hosted program.
- Continue the design of secondary containment for FFA Category B tanks and associated lines.
- Develop acoustic emission leak detection for suspect pipelines.

Waste Management Operations

- Provide compliant operations in all activities associated with LLLW, SLLW, hazardous waste, mixed waste, process waste, and industrial waste management.
- Initiate RCRA closure of the following units: the former Reactive Waste Disposal Facility (Building 7659B), the former Chemical Waste Disposal Facility (Building 7822A), Retrievable Waste Storage Facilities 1 and 2 (Buildings 7826 and 7834), and the 7075 waste oil tank.
- Support transfer of SWSA 5N from RCRA status to CERCLA control.

1. INTRODUCTION

Waste management requirements at Oak Ridge National Laboratory (ORNL) are imposed by federal and state regulations as well as Executive and U.S. Department of Energy (DOE) orders. The Atomic Energy Act of 1976 as amended (AEA) and the Resource Conservation and Recovery Act of 1976 as amended (RCRA) are the primary driving forces behind their implementation. The AEA regulates research and development activities related to atomic energy and provides for the safe processing and management of source, special nuclear, and by-product materials. Through the RCRA, the U.S. Environmental Protection Agency (EPA) is given the responsibility for a nationwide program that regulates most aspects of hazardous waste management. The state of Tennessee has been authorized to administer the hazardous waste management program. The EPA also regulates the handling of polychlorinated biphenyls (PCBs) under the Toxic Substances Control Act (TSCA).

DOE Order 5820.2A, the principal regulation that governs management of radioactive waste at ORNL, establishes requirements to ensure that all DOE operations involving management of radioactive waste, waste by-products, and surplus facilities are conducted in a manner that will ensure protection of public health and safety in accordance with DOE Orders 5480.1B and 5400.5. DOE Order 5820.2A has four major subsections that address specific procedures and requirements related to decontamination and decommissioning of surplus facilities. Several other DOE orders referred to in DOE Order 5820.2A have supplemental and related requirements. This plan complies with DOE Order 5820.2A, Chap. VI, and provides a comprehensive description of current ORNL waste management activities and strategies.

1.1 OBJECTIVES

Waste management operations are activities that minimize, treat, store, and dispose of all radioactive, hazardous, mixed, and conventional wastes generated as a result of (1) operations at active facilities and (2) decontamination and decommissioning and environmental restoration activities at inactive facilities. These operations are based on a series of waste management objectives. The objectives of the ORNL Waste Management Program are:

- to manage the treatment, storage, and disposal (TSD) of solid, liquid, and gaseous wastes in a timely and cost-effective manner that ensures the health and safety of the on-site personnel and the protection of the public and the environment;
- to ensure that the generation of all wastes is minimized to the extent reasonably achievable; and
- to ensure that the treatment, storage, transportation, and/or disposal of all wastes meet or exceed all applicable federal, state, and local environmental, safety, and health regulatory requirements.

This plan describes how the ORNL Waste Management Program is conducted, identifies which waste management facilities are being used to manage wastes, indicates what forces are acting to change current waste management systems, discusses what activities are planned for the forthcoming fiscal year, and relates how all these activities are documented.

1.2 PURPOSE

DOE Order 5820.2A requires that ORNL submit to the DOE Oak Ridge Field Office (DOE-OR) an annual report outlining its waste management activities for the minimization, treatment, storage, and disposal of waste. In fulfillment of this requirement, this plan also provides a ready reference of the ORNL Waste Management Program for internal and external use.

1.3 SCOPE

Addressed in this plan are all applicable requirements of DOE Order 5820.2A and other applicable DOE orders pertaining to waste management activities for low-level radioactive, transuranic (TRU), hazardous, and mixed wastes. Although not specifically required by DOE Order 5820.2A, this plan also addresses special case (SC) and sanitary wastes. ORNL does not generate high-level waste but does store a small quantity as SC wastes. ORNL generates small volumes of waste containing naturally occurring and accelerator-produced radioactive material (NARM). NARM wastes at ORNL are managed as low-level waste (LLW) in accordance with DOE Order 5820.2A.

This plan is organized in eight primary sections and has two supporting appendixes. The first two sections provide basic information about the ORNL site and the principal organizations at ORNL and DOE-OR involved in waste management activities. The remaining sections address the management of the various types of wastes (i.e., radioactive, hazardous, mixed, and sanitary), provide an overview of the decommissioning of radioactively contaminated facilities, and discuss waste management support activities at ORNL. Each section provides an overall summary of the waste categorization, a generic description of the characteristics of the wastes, the status of current and future plans for TSD of the wastes, and the compliance status and information regarding the support functions employed for each waste category. Appendix A provides an update to the original implementation summary since issuing the *Oak Ridge National Laboratory Implementation Plan for DOE Order 5820.2A* on April 28, 1989. Appendix B provides an updated listing of principal ORNL waste management documents generated since issuing the implementation plan.

1.4 REGULATORY REQUIREMENTS

1.4.1 Federal and State Regulations

Operations programs must comply with the federal and state statutes and regulations, the AEA, and DOE orders. The major federal and state statutes applicable to waste management operations are summarized in the following paragraphs.

RCRA, as amended by the Hazardous and Solid Waste Amendments of 1984 (HSWA), regulates the activities associated with hazardous waste management. Its primary objective is to protect human health and the environment; its secondary objective, to conserve valuable material and energy resources. RCRA requires cradle-to-grave tracking of hazardous waste. Those hazardous waste disposal sites that were closed or abandoned before November 19, 1980 (effective date of RCRA regulations) are regulated under the

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA).

Persons (including a federal facility) who generate, transport, treat, store, or dispose of RCRA hazardous waste, as well as persons who produce, burn, distribute, or market any hazardous waste-derived fuels or store regulated substances in underground tanks, must comply with RCRA by notifying the EPA or authorized states of their activities. As amended by HSWA, RCRA Sect. 3004(u) requires corrective actions for releases of hazardous constituents. RCRA Sect. 3004(v) mandates off-site corrective actions. The RCRA provisions for corrective actions overlap to some degree with CERCLA provisions—creating the need for coordination of RCRA and CERCLA activities.

The state of Tennessee is authorized (1) to administer its own RCRA program in lieu of the federal program (new RCRA regulations that become effective after the authorization date must be adhered to pending issuance of corresponding state regulations) and (2) to regulate mixtures of hazardous and radioactive wastes. The Tennessee Hazardous Waste Management Act and its implementing regulations are administered by the Tennessee Department of Environment and Conservation (TDEC), Division of Solid Waste Management. EPA Region IV administers the federal RCRA program including certain HWSA provisions that have been enacted by the TDEC.

TSCA regulates, among other things, the use and disposal of materials containing more than 50 ppm of PCBs. These regulations apply to Waste Management Operations projects involving PCBs. Martin Marietta Energy Systems, Inc., policy is to regulate the storage and disposal of materials containing greater than 2 ppm of PCBs.

CERCLA, as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), provides a federal mechanism to respond to the hazards posed by abandoned disposal sites and federal authority to respond to current uncontrolled releases of hazardous and radioactive (since May 1989) substances from a vessel (including transportation vehicles) or from any onshore or offshore facilities. The act imposes strict liability on a broad class of potentially responsible parties and establishes the funding (the "Superfund") that enables the government either to order the responsible parties to clean up the spill or to seek reimbursement from the responsible parties after the government has completed cleanup.

CERCLA also imposes reporting requirements on owners and operators of currently operating vessels and facilities. In general, any releases of a reportable quantity of "hazardous substances" must be reported, and the responsible party must clean it up. A "hazardous substance" is anything included on a "list of lists" compiled by referring to the four major environmental statutes including the Clean Air Act (CAA), the Clean Water Act (CWA), RCRA, and TSCA. As a result of the incorporation of the CAA into CERCLA, CERCLA regulates releases of radioactive source, special nuclear, or by-product material. The EPA is authorized to expand the CERCLA list by adding compounds or mixtures that, when released into the environment, may present substantial danger to public health or welfare or the environment.

Section 105 of CERCLA states that the government's cleanup activity must be conducted in accordance with the National Contingency Plan (NCP). The NCP establishes a blueprint for cleaning up releases to the water, land, or air and assigns response authority to federal and state governments and private parties. The NCP details response procedures including both immediate removal and long-term remedial actions. Section 105 also authorizes the EPA to designate sites for inclusion of sites requiring remedial action on the National Priorities List (NPL).

SARA amended CERCLA by *inter alia* (adding provisions specifically aimed at federal facilities) and by increasing EPA enforcement authority. As amended by SARA, CERCLA provides the framework for determining cleanup standards, schedules, and evaluation of remedies.

ORR was placed on the NPL December 21, 1989. The Federal Facility Agreement (FFA) between EPA Region IV, the TDEC, and DOE requires Oak Ridge Reservation (ORR) cleanups to be conducted in compliance with both RCRA and CERCLA/SARA. The FFA, which became effective on January 1, 1992, is intended to satisfy the requirements for an interagency agreement under Sect. 120 of CERCLA. The agreement establishes a procedural framework and schedule for developing, implementing, and monitoring appropriate response actions at the site in accordance with CERCLA, the NCP, the National Environmental Policy Act of 1970 (NEPA), and Tennessee law. The agreement contains provisions for coordinating response actions under CERCLA, RCRA, and applicable state laws. Specifically, the agreement establishes requirements for performing Remedial Investigation/Feasibility Studies and identifies the nature, objective, and schedule of response actions to be taken at the site. The agreement provides the basis for the creation of operable units and the implementation of final remediation actions. The agreement also establishes requirements for underground LLLW tank systems to ensure structural integrity, containment and detection of releases, and source control for LLLW tank systems pending final remedial action at the site.

Effective May 13, 1991, DOE entered into an agreement with the state of Tennessee regarding DOE's provision of financial and technical support for state oversight activities. The Tennessee Oversight Agreement applies to TDEC participation in the FFA for environmental restoration of the ORR, oversight, monitoring, access, and emergency response initiatives to ensure compliance with applicable environmental laws and regulations. ORNL is obligated to a number of action items including a source reduction/zero discharge study, an air emissions inventory, waste and residue characterization, and others.

Effective June 12, 1992, DOE entered into a Federal Facility Compliance Agreement (FFCA) with the EPA to ensure compliance by DOE with land disposal restrictions under RCRA. The FFCA became necessary because of the fact that many of the radioactive mixed wastes (mixed wastes) generated by DOE sites (including ORNL) had no available treatment capacity, resulting in a noncompliance situation. The FFCA dictates the steps required to bring ORR facilities into compliance with respect to the management of mixed wastes.

NEPA requires every federal agency to publicly address (prior to initiation) the environmental impact of major federal actions that may significantly affect the environment. These concerns are addressed in documents such as Environmental Assessments or Environmental Impact Statements, which are made available to the public and are circulated to other interested agencies. Secretary of Energy Notice 15-90 provides guidance for developing NEPA documentation. DOE Notice 5400.4 establishes DOE policy on integrating NEPA and CERCLA processes for Environmental Restoration Program projects. NEPA implementation procedures to be used by DOE were promulgated in the *Federal Register* on April 24, 1992.

The CAA is a comprehensive and complex federal statute designed to prevent and to control air pollution from stationary and mobile sources. The CAA authorizes the EPA to establish national standards for air quality that must be met by the states through compliance with EPA-approved state implementation plans. These plans are also required to contain standards for preventing significant deterioration of air quality in areas where the ambient standards are already being met. Permits are required for specific air emissions. CAA requirements may also become Applicable or Relevant and Appropriate Requirements (ARARS) for CERCLA cleanups. Radionuclides are also regulated under the CAA and 40 CFR Pt. 61, Subpart H.

Air emissions from ORR facilities are managed in accordance with DOE Orders 5400.1, 5400.5, 5480.1A, 5480.1B, 5480.4, and 5820.2A and guidelines of the CAA as regulated by the TDEC Division of Air Pollution Control. The TDEC has the primary responsibility for ensuring compliance with the CAA within the state of Tennessee and for protecting and maintaining Tennessee ambient air quality standards pursuant to the Tennessee Air Quality Control Act. The TDEC's Division of Air Quality administers the air permits program.

In May 1992 DOE and the EPA entered into an FFCA to achieve compliance in all CAA issues at the Oak Ridge Reservation. This agreement committed ORNL to a number of actions including monthly reporting, air emission inventories, quality assurance plans, and system upgrades.

The CWA sets standards for, and regulates discharges into, surface waters and sets pretreatment standards for discharges into publicly owned treatment works. Facilities, like ORNL, that directly discharge wastewaters must obtain a National Pollutant Discharge Elimination System (NPDES) permit. CWA regulations address technology-based effluent limitations, water quality-based effluent limitations, new source performance standards, control strategies for toxic pollutants, and thermal discharges. Water quality criteria established under the CWA may become ARARS for CERCLA cleanups. At the state level, water pollution is controlled through the Tennessee Water Quality Control Act and implementing regulations. The NPDES permit program is administered by the Division of Water Pollution Control within the TDEC.

The Safe Drinking Water Act (SDWA) sets regulatory standards for organic chemicals and other pollutants in drinking water through two regulatory programs: National Drinking Water Standards for Public Water Systems and Underground Well Injection. SDWA Primary Drinking Water Standards are frequently used to establish groundwater protection standards pursuant to RCRA and CERCLA.

There are other numerous state regulations applicable to ORNL waste management activities for which compliance must be ensured. The bulk of these fall under a series of rules identified as Tenn. 1200 rules.

1.4.2 DOE Orders

DOE and DOE contractors are subject to the requirements of DOE orders in addition to the requirements of federal and state regulatory agencies. Therefore DOE orders will impact waste management processes as well. DOE orders of significance to waste management are summarized in the following paragraphs.

DOE Order 5820.2A establishes policies, guidelines, and minimum requirements for managing radioactive and mixed wastes. This order requires that DOE LLW be managed to protect public health and safety and to preserve the environment. The order also requires that a performance assessment of all aspects of waste management be conducted.

Chapter V of DOE Order 5820.2A sets forth requirements for decommissioning radioactively contaminated facilities. Planning for facility decommissioning must be initiated during the design phase for new facilities and before termination of operations for existing operational facilities, and must consider the 2-year budget cycle to ensure adequate funding availability. Decommissioning project activities include facility characterization, the environmental review process (i.e., NEPA, RCRA, CERCLA, and

SARA), and technical engineering planning, which includes a Decommissioning Project Plan. Status reports on project activities must be prepared in accordance with DOE Order 1332.1A or 4700.1.

In December 1991 several rules appeared in the Code of Federal Regulations codifying existing DOE orders. Following is a summary of those rules:

- "Procedural Rules for DOE Nuclear Activities" (10 CFR Pt. 820) sets forth the procedures to govern the conduct of persons involved in DOE nuclear activities and, in particular, to achieve compliance with the DOE Nuclear Safety Requirements by all persons subject to those requirements. The subparts of 10 CFR Pt. 820 are "Enforcement Process," "Compliance Orders," "Interpretations," "Exemption Relief," "Criminal Penalties," and "Enforcement of Technical Specifications Operational Safety Requirements." An appendix to 10 CFR Pt. 820 is a general statement of enforcement policy that includes tables of civil penalties and severity levels.
- "Nuclear Safety Management" (10 CFR Pt. 830) provides rules to govern the conduct of DOE contractors and other persons at DOE nuclear facilities. In addition to providing a definition of a nonreactor nuclear facility that significantly broadens the nature of facilities in that category, and a definition of graded approach, the subparts of 10 CFR Pt. 830 include "Design," "Operations," and "Material Management." Within these subparts are 28 separate sections. Eleven of those sections are complete and include subjects such as "Safety Analysis Reports," "Quality Assurance Requirements," "Training and Certification," "Maintenance Management," and "Conduct of Operations." Sections that are assigned but have no content yet include subjects such as "Configuration Management," "Fitness for Duty," "Fire Protection," "Design Criteria," "Criticality Safety," and "Packaging and Transportation."
- "Radiation Protection for Occupational Workers" (10 CFR Pt. 835) establishes radiation protection standards, limits, and program requirements for protecting workers and other persons from ionizing radiation at DOE facilities. This rule is the most detailed of the three published so far, and includes subparts that describe "Radiation Protection Programs," "Standards for Internal and External Exposure," 'Monitoring in the Workplace," "Entry Control Programs," "Posting and Labeling," "Records," "Reports to Employees," "Radiation Safety Training," "Design Control," "Release of Material and Equipment from Radiological Areas," and "Accidents and Emergencies."

Postdecommissioning activities involve final chemical and radiological surveys and preparation of a project final report. The responsible field organization will compile a Project Data Package. Long-term maintenance, surveillance, and other safety controls will be provided by the responsible program organization. The decommissioned property may be released from DOE ownership according to the requirements of DOE Order 4300.1B. DOE Order 5700.6B requires that quality assurance be maintained by using the applicable requirements of American National Standards Institute/American Society of Mechanical Engineers, NQA-1, 1983, "Quality Assurance Program Requirements for Nuclear Facilities."

DOE Order 5400.2A establishes the DOE requirements for coordinating significant environmental compliance issues by creating a process within DOE for resolving conflicting compliance issues. DOE Order 5400.3 establishes DOE hazardous and radioactive mixed waste policies and requirements. The order clarifies DOE's interpretation of the definition of "byproduct material" (10 CFR Pt. 962) as it relates to RCRA regulation of mixed wastes and establishes the lines of authority at DOE Headquarters for RCRA implementation. CERCLA requirements are now addressed in

DOE Order 5480.4. The order provides DOE policy resolving RCRA/CERCLA overlap issues, integrating NEPA with RCRA/CERCLA processes, and resolving organizational conflict of interest issues for RCRA/CERCLA contractors.

DOE Order 5440.1C provides DOE guidelines for developing and routing NEPA documentation. DOE Order 5480.3 establishes requirements for the packaging and transportation of hazardous materials, hazardous substances, and hazardous wastes. DOE Order 1540.1 establishes DOE policies for management of materials transportation activities. DOE Order 1540.2 establishes administrative procedures for the certification and use of radioactive and other hazardous materials packaging by DOE.

Other relevant DOE orders include DOE Order 5400.1 which establishes the environmental monitoring, waste minimization, and pollution prevention requirements for DOE operation, and DOE Order 5480.1B, along with DOE Order 5400.5, both of which outline environmental protection safety and health protection policies and responsibilities.

1.5 OVERALL GOALS

The goal of the ORNL Waste Management Program is protection of the workers, the public, and the environment. A vital aspect of this goal is to comply with all applicable state, federal, and DOE requirements. Waste management requirements for DOE wastes are detailed in DOE Order 5820.2A, and the ORNL Waste Management Program encompasses all elements of this order. Compliance with the requirements of this DOE order and other appropriate DOE orders, along with applicable TDEC and EPA rules and regulations, provide the principal source of regulatory guidance for waste management operations at ORNL.

As a goal, ORNL continues to place increased emphasis on minimizing the amount of generated waste that will eventually require TSD. Steps taken to avoid generating waste help decrease risks to on-site personnel, the general public, and the environment and reduce operational costs. Another ORNL goal is to provide adequate TSD capacity for the waste that is expected to be generated.

The goals for managing TRU waste include the preparation of the waste for safe storage in an interim retrievable facility until facilities are available for permanent disposal. The Waste Isolation Pilot Plant, near Carlsbad, New Mexico, is the designated disposal site for TRU waste.

The goals for managing LLW are to treat the waste to reduce its volume and dispersability and to dispose of it in facilities that allow for increased environmental protection. More efficient TSD of LLW will reduce potential future liabilities.

The goals for managing hazardous waste and mixed wastes are very similar. By avoiding its generation and by destroying the hazardous nonradioactive constituents, the problems and costs associated with waste management may be minimized.

Sanitary waste facilities are managed with the goal of landfilling solid sanitary wastes in compliance with all applicable regulations. Operational goals are to reduce waste generation and to develop cost-effective improvements to ensure regulatory compliance and to reduce expenditures.

2. GENERAL SITE INFORMATION

This section provides the general characteristics of Oak Ridge National Laboratory (ORNL) operations: organization and administration, documentation, support activities, and site description.

2.1 ORGANIZATION AND ADMINISTRATION

2.1.1 ORNL Mission

ORNL is a multiprogram laboratory operated for the U.S. Department of Energy (DOE) by Martin Marietta Energy Systems, Inc. ORNL's mission is to conduct research and development (R&D) activities for DOE and other U.S. government agencies as well as for private industry and institutions. Currently, these research efforts are focused in the areas of (1) magnetic fusion, (2) nuclear fission, (3) biological and environmental basic and applied research, (4) conservation and renewable energy, (5) fossil energy, and (6) basic research in physical sciences. The diversity of these programs and the complement of unique research facilities that support these activities present equally diverse and unique environmental and waste management challenges.

2.1.2 Historical Development of Waste Management at ORNL

Since the beginning of operations at the site in 1943, significant changes have occurred in the scope of R&D activities and in the supporting waste management requirements. While early site development focused on direct support of defense programs during and following World War II, the unique facilities that were established at that time formed the nucleus of the multidisciplinary research laboratory that now exists. Similarly, waste management requirements have changed over the years. Early waste management practices, which left significant environmental concerns unsatisfied, were a product of the limited scientific knowledge of the day and the urgency of the early mission. Compliant management of waste streams from ORNL facilities is now the continuing responsibility of DOE and its managing site contractors.

Over the past decade, awareness of environmental issues has increased, and major environmental legislation has been enacted at both the federal and state levels to control existing and potential sources of pollution. As a result of this changing regulatory environment, the number of inspections, audits, and reviews that have been conducted, including an evaluation by the DOE Tiger Team, have increased markedly. These have revealed the need to accelerate activities that protect ORNL employees, the general public, and the environment on a more comprehensive basis, particularly through standards, practices, and procedures that reduce hazards to the environment, the public, and the employee to as low as reasonably achievable. Facilities for treatment of discharges are being constructed or upgraded, and results of earlier disposal practices are being corrected. Action in this area will continue to bring ORNL into greater compliance with current and future regulations and guidelines. Effluent monitoring has been used to aid waste management operations and to ensure the safety of on-site personnel, the general public, and the environment.

2.1.3 Waste Management Organizational Structures

2.1.3.1 Martin Marietta Energy Systems, Inc.

The three sites on the Oak Ridge Reservation (ORR) are operated for DOE by Energy Systems. As the operating contractor, Energy Systems manages the environmental, safety, and health (ES&H) programs at the sites and supports the DOE Oak Ridge Field Office (DOE-OR) in management of the overall ES&H program. Energy Systems has a strong environmental management organization that is organized to parallel the DOE-OR Environmental Restoration and Waste Management Organization.

Within Energy Systems, environmental restoration and decontamination and decommissioning (D&D) are the responsibility of the Environmental Restoration and Waste Management Programs. This organization has direct interface with the DOE-OR Assistant Manager for Environmental Restoration and Waste Management (AMERWM).

At ORNL, the Waste Management and Remedial Action Division (WMRAD) is responsible for operating the waste management systems in full compliance with all current regulations. Although WMRAD reports through the ORNL line organization to the ORNL director, it also reports to the Central Waste Management Division (CWMD). An organizational overview of the Energy Systems Environmental Restoration, Decontamination and Decommissioning, and Waste Management Programs is shown in Fig. 2.1.

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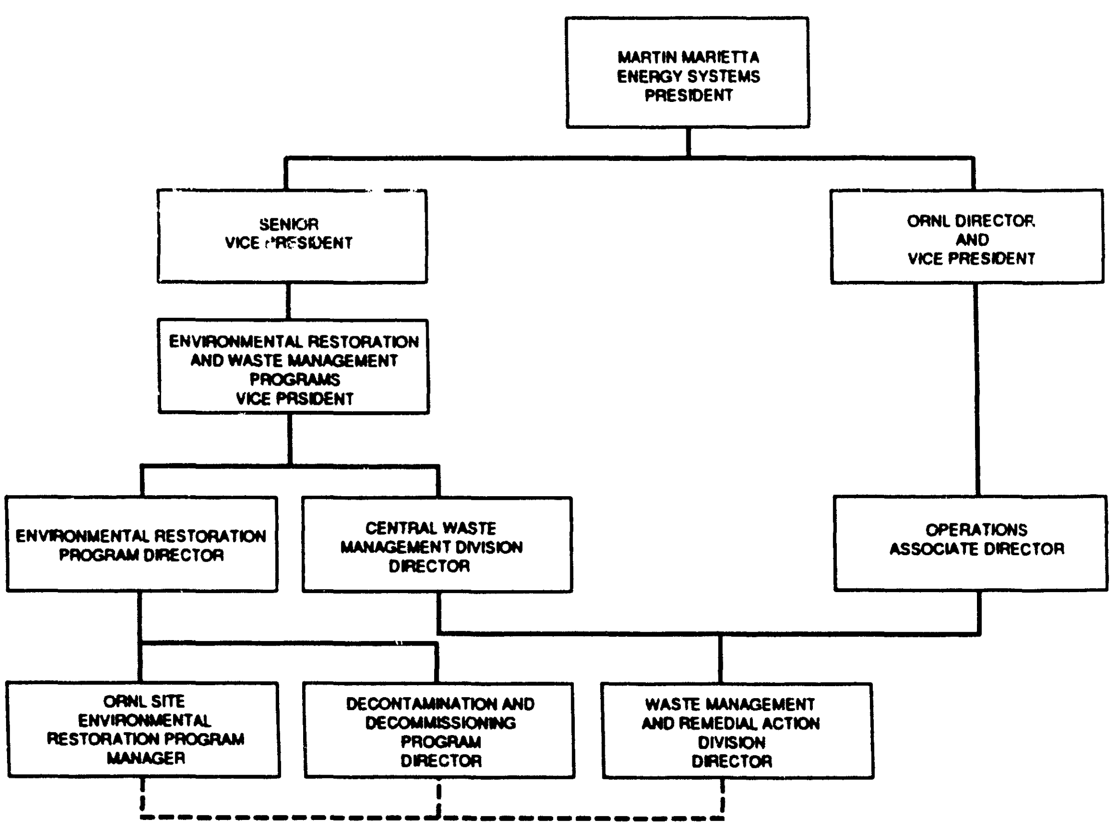

Fig. 2.1. Organizational overview for the Energy Systems Environmental Restoration, Decontamination and Decommissioning, and Waste Management Programs.

2.1.3.2 DOE-OR Field Office

DOE-OR has placed the overall responsibility for all environmental restoration and waste management activities under AMERWM. Within AMERWM are three divisions and two site offices: Environmental Restoration, Waste Management, Former Sites Restoration, Weldon Springs Site Office, and the K-25 Site Office (Fig. 2.2).

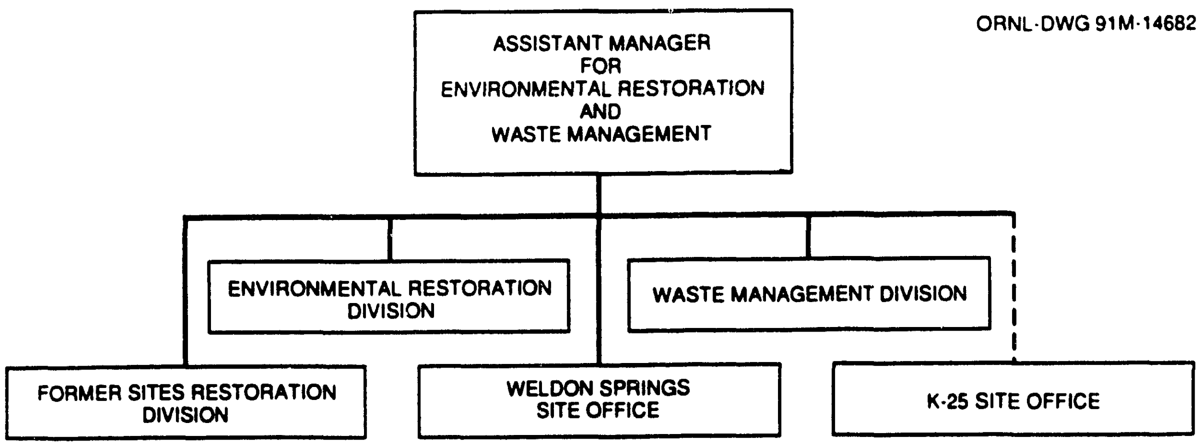

Fig. 2.2. AMERWM organization for the U.S. Department of Energy's Oak Ridge Field Office.

Responsibility for overall planning, budget development, and program management of corrective activities and waste management operations for radioactive, hazardous, and mixed waste rests with the Waste Management Division under AMERWM. The Assistant Manager for Energy Research and Development (AMERD) organization is the Contractor Officer's Representative (COR) for ORNL. The AMERD is responsible for the direct daily management and implementation of corrective activities and waste management activities at ORNL. These activities are implemented by the Energy Systems site manager who is responsible to the DOE-OR COR for reporting on status and supporting the COR on meeting the planning, status, and monitoring requirements of the DOE-OR Waste Management Division director. Implementation of corrective activities and waste management operations at each of the sites is the responsibility of the respective Energy Systems site manager.

2.1.3.3 ORNL waste management

Waste management operations at ORNL are the direct responsibility of WMRA (Fig. 2.3). This division is responsible for the continued operation of the radioactive, hazardous, mixed, and solid sanitary waste management systems at ORNL in a manner that protects the health and safety of workers and the general public, minimizes impacts to the environment, and complies with all applicable regulations, rules, and policies. The division is also responsible for remedial action functions that cover surveillance and maintenance (S&M) of inactive waste sites and surplus radioactively contaminated facilities and D&D of the contaminated facilities. WMRAD is comprised of four line management sections and two matrixed programs. The four sections are Waste Management Operations, Environmental Projects, Environmental Programs Coordination,

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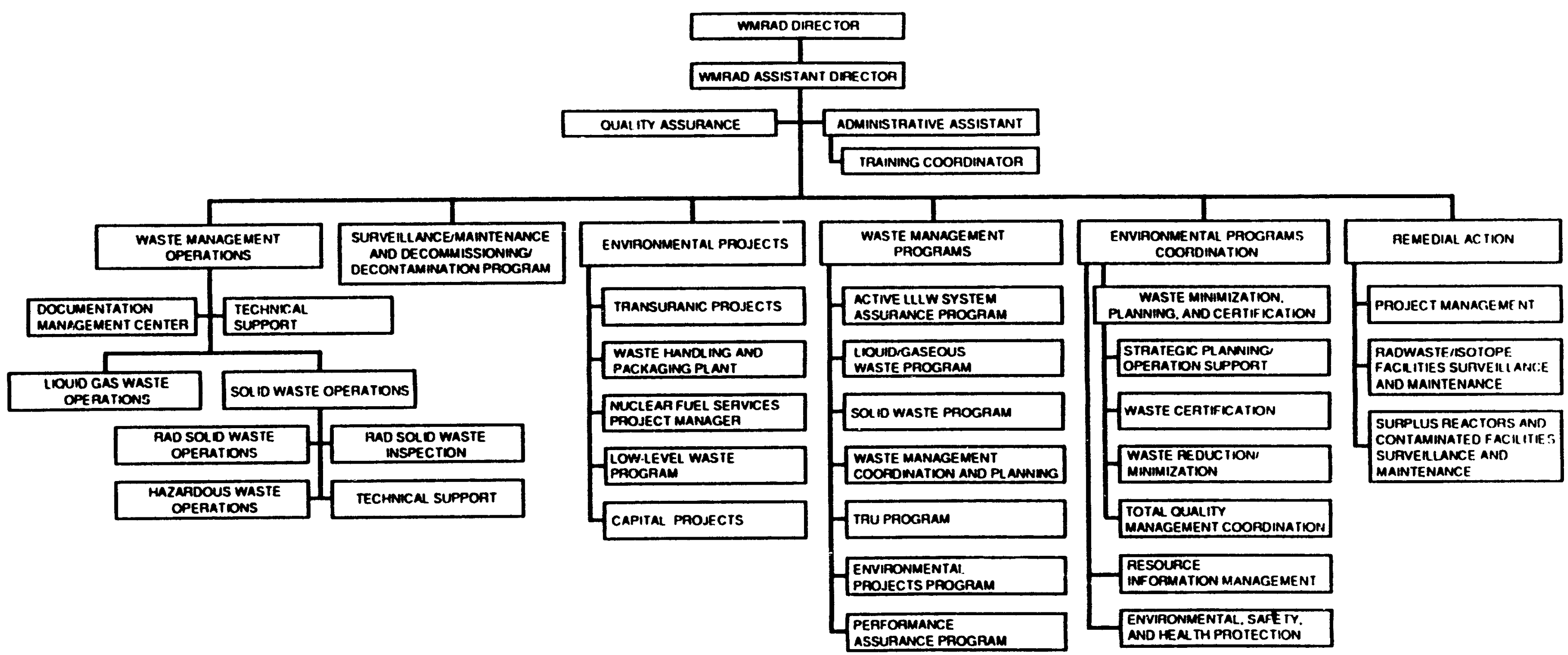

Fig. 2.3. Organization of the Waste Management and Remedial Action Division at Oak Ridge National Laboratory.

and Remedial Action. The two programs are Waste Management and Decontamination and Decommissioning.

The Waste Management Program has programmatic responsibility for seven areas: solid waste activities; liquid and gaseous waste activities; coordination, certification, and strategy development; environmental project management; transuranic (TRU) waste management; fiscal analysis and reporting; and active Liquid Low-Level Waste (LLLW) System compliance management. This section reports to the director of WMRAD but is programmatically responsible to the director of the CWMD. The D&D Program is responsible for management of the ORNL D&D Program.

The Waste Management Operations Section is responsible for the management and operation of the hazardous, radioactive, mixed, and sanitary solid waste systems. It is made up of two major departments: the Liquid and Gaseous Waste Operations Department (LGWOD) and the Solid Waste Operations Department (SWOD).

The LGWOD is responsible for the safe operations necessary for management of a number of ORNL liquid and gaseous waste streams. The liquid waste streams include radioactive process waste, radioactive LLLW, and various wastewater streams. The LGWOD is not responsible for sanitary liquid waste streams including coal yard runoff, sewage, or any liquid waste streams released to the watershed without treatment. The sanitary liquid waste streams are the responsibility of the Plant and Equipment Division (P&E) at ORNL. The gaseous waste streams include those flows in the main ORNL plant area terminating at the 3039 stack. The LGWOD is not responsible for gaseous wastes going to other stacks at ORNL.

The SWOD is responsible for ensuring the proper characterization, storage, treatment, recycle, and/or disposal of radioactive, hazardous, mixed, and sanitary solid wastes. ORNL waste management facilities include the solid waste storage area (SWSA) 5N for TRU and special case wastes, the SWSA 6 disposal site for solid low-level waste, the Hazardous/Mixed Waste Management Area, and other hazardous/mixed waste tanks or facilities.

The Environmental Projects Section provides engineering support to manage line items (LIs) and general plant projects (GPPs) during functional/systems requirements definition, feasibility studies, conceptual design, detailed design, procurement, and construction. The LI and GPP are required for upgrading, replacing, or constructing new facilities or systems required to conduct waste management operations in an efficient, safe, and compliant manner.

The Environmental Programs Coordination Section provides integration for strategic and long-range planning activities, project tracking, fiscal analysis, and periodic progress reporting. Planning documents include the *DOE Environmental Restoration and Waste Management Five-Year Plan, Fiscal Years 1993-1997*, the supporting *Environmental Restoration and Waste Management Site-Specific Plan for the Oak Ridge Operations Reservation*, and the Current Year Work Plan.

The Waste Minimization, Planning, and Certification Department provides detailed strategy development and planning for continuity of waste management system operations.The major function of this office is to develop viable strategies for the compliant management of ORNL waste operations and to identify the need for the upgrade, replacement, and construction of new facilities. This department also develops and maintains central programs for waste certification, generator training, and waste reduction.

The Remedial Action Section is responsible for management, project planning, and execution of S&M and D&D for surplus facilities. This responsibility includes the following program management functions: securing funds to achieve DOE and ORNL D&D program objectives, monitoring progress of D&D activities against program budgets and milestone commitments, and ensuring that these activities are conducted in accordance with all applicable ES&H regulations and DOE orders.

The regulatory oversight of waste management systems operations is maintained by the ES&H compliance organization shown in Fig. 2.4. Within this organization is the Office of Environmental Compliance and Documentation's Environmental Compliance Section. The Environmental Compliance Section provides guidance concerning environmental protection standards and regulatory requirements to ORNL staff and management to facilitate compliance with those standards and requirements. This group also prepares, or coordinates the preparation of, all regulatory permit applications and oversees the negotiation of these into operating permits.

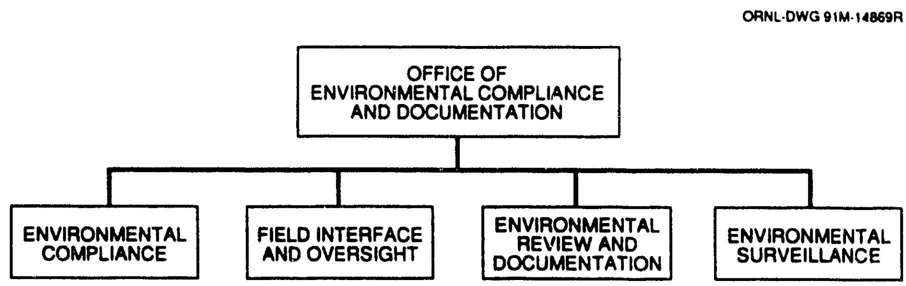

Fig. 2.4. Organization of the Office of Environmental Compliance and Documentation at ORNL.

2.1.3.4 Former LLWDDD and HAZWDDD Programs

Energy Systems, in cooperation with DOE-OR, developed strategies and program plans for the management of LLW and hazardous and mixed wastes. The first effort was the establishment of the Low-Level Waste Disposal Development and Demonstration (LLWDDD) Program in 1986. This program was responsible for the development of a strategy and an implementation plan for managing LLW on the ORR. A draft of the proposed LLWDDD strategy was submitted to DOE-OR in July 1987. A summary of both the strategy and the implementation plans for the Energy Systems installations was prepared and submitted to DOE-OR in December 1988. Shortly after the draft LLWDDD strategy was prepared in 1987, efforts began later that year to establish the Hazardous Waste Development Demonstration and Disposal (HAZWDDD) Program. A *Hazardous Waste Development, Demonstration, and Disposal Program Plan* was developed in 1988, the objective of which was to ensure that Energy Systems needs for treatment, storage, and disposal (TSD) of hazardous and mixed wastes had been identified and that efforts were under way to meet those needs.

In April 1989 DOE-OR requested that Energy Systems evaluate the feasibility of establishing a new organization responsible for the design, construction, and operation of the new LLW disposal facilities being developed as part of the LLWDDD Program. Also, this new waste management organization was to be separate from the generator organizations. In May 1989 the Reservation Waste Management Division (RWMD) was established and reported to the K-25 Site manager. In establishing the RWMD, the roles and waste management responsibilities of the RWMD and DOE-OR installations were identified. A decision was made by Energy Systems to phase out the LLWDDD and HAZWDDD Programs in 1989. Issues and tasks identified by the two programs have been assigned to appropriate Energy Systems organizations for implementation.

2.1.3.5 Central Waste Management Division

The CWMD reports to the Environmental Restoration and Waste Management Programs Vice President. CWMD responsibilities include the siting, design, construction, operation, and monitoring of new solid waste disposal facilities (Fig. 2.5).

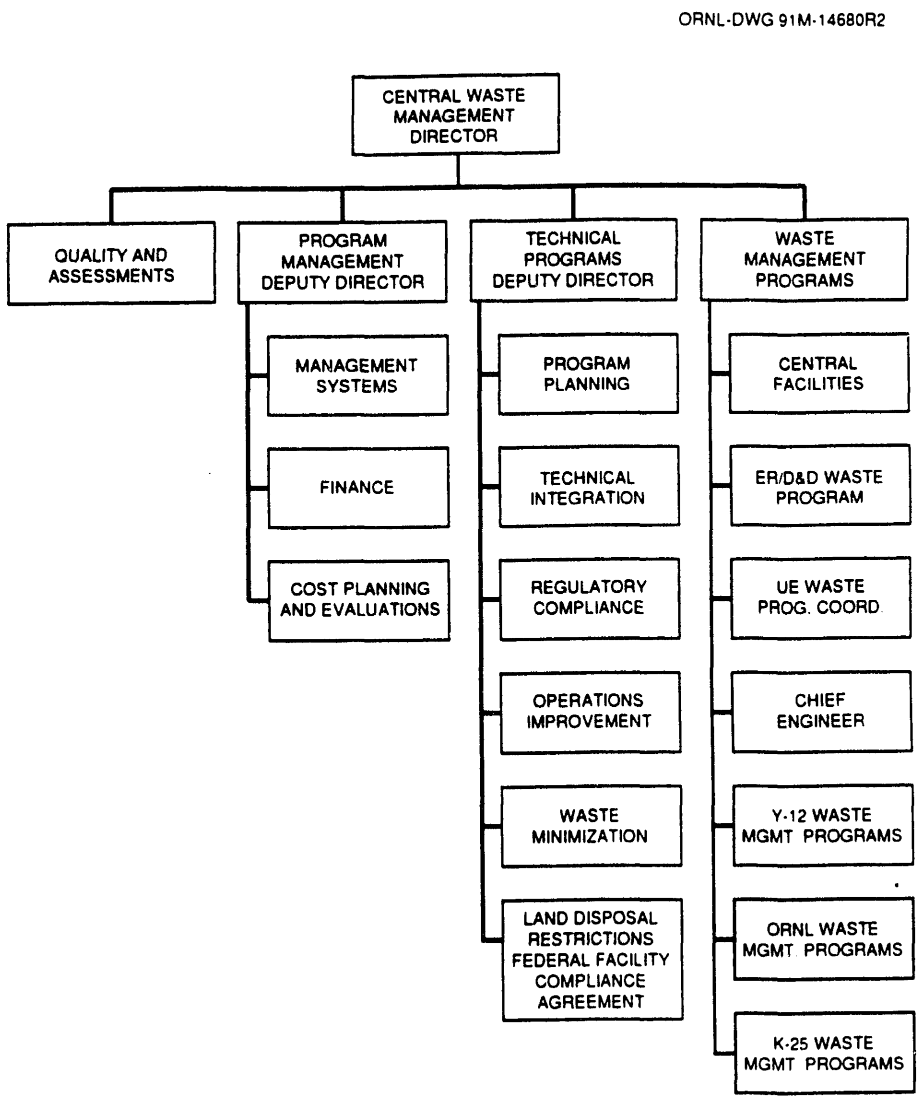

Fig. 2.5. Central Waste Management Division for Martin Marietta Energy Systems, Inc.

The CWMD provides support to the DOE-OR Reservation Waste Management environmental impact statement (EIS). This EIS will assess the potential environmental impacts from waste management activities related to all three installations on the ORR:

the Y-12 Site, the K-25 Site, and ORNL. The acceptability of continued disposal of LLW on the ORR will be assessed. ORNL's WMRAD provided the CWMD with technical input and review during development of the EIS.

The CWMD has also been assigned the responsibility for the preparation and issuance of radiological performance assessments (PAs), as required under the DOE Order 5820.2A, for ORR LLW disposal sites. The CWMD assigned the responsibility for developing SWSA 6 and the Interim Waste Management Facility PA to WMRAD.

2.2 DOCUMENTATION

Various documents are developed to guide and to support the waste management program at ORNL; the Documentation Management Center (DMC) at ORNL is responsible for maintaining current revisions of all waste management documents. Information regarding both the applicable documents and the DMC is provided in the following subsections.

2.2.1 ORNL Waste Management Guidance and Support Documents

In addition to the *Oak Ridge National Laboratory Waste Management Plan for Department of Energy Order 5820.2A*, the following documents are used to guide and to support the ORNL Waste Management Program:

- the *DOE Environmental Restoration and Waste Management Five-Year Plan, Fiscal Years 1993–1997*,
- the *Environmental Restoration and Waste Management Site-Specific Plan for the Oak Ridge Operations Reservation* (SSP),
- Activity Data Sheets (ADSs),
- the Current Year Work Plan (CYWP),
- strategy documents, and
- the *Active Sites Environmental Monitoring Program: Program Plan*.

2.2.1.1 The DOE Five-Year Plan

The *DOE Environmental Restoration and Waste Management Five-Year Plan, Fiscal Years 1993–1997*, is the cornerstone of DOE's long-term strategy in environmental restoration and waste management. The plan consolidates DOE's three major areas of nuclear operations: those under the Assistant Secretary of Defense Programs, the Assistant Secretary of Nuclear Energy, and the Director of the Office of Energy Research. The plan is revised annually to incorporate departmental progress and to reflect changes in planning as more definitive cost estimates are developed for those actions required to meet compliance obligations. This plan encompasses all radioactive, hazardous, mixed, and solid sanitary waste activities including applied R&D activities to accelerate the deployment of new technologies in achieving better results at lower costs.

This plan encompasses three discrete activity areas: corrective activities, environmental restoration, and waste management operations. "Corrective activities" denotes activities necessary to bring active and standby facilities into compliance with federal, state, and local regulations. "Environmental restoration" includes the assessment and cleanup of surplus facilities and inactive sites. Waste Management Operations is concerned with the TSD of wastes generated as a result of current operations at active facilities.

2.2.1.2 DOE-OR's Environmental Restoration and Waste Management Site-Specific Plan

The *DOE Environmental Restoration and Waste Management Five-Year Plan, Fiscal Years 1993–1997*, serves as a source document for a detailed site-specific implementation plan prepared by DOE-OR. This plan encompasses environmental restoration and waste management activities at OR facilities including ORNL. The OR SSP describes FY 1992 activities and provides funding summaries as well as descriptions of organizational structures, regulatory issues, reporting requirements, and quality assurance (QA) programs. The SSP is the vehicle for participation by affected parties at the regional/local level. It is also used by the DOE-OR and DOE Headquarters to measure progress in meeting DOE's goal for environmental cleanup, waste operations, and technology development activities. In support of the OR SSP, ORNL prepares the ORNL portion, which is then combined with portions from the K-25 and Y-12 Sites.

2.2.1.3 Activity Data Sheets

ADSs are used by ORNL to identify all environmental restoration, waste management, and corrective actions projects; appropriate information on priority and funding levels, budget reporting codes, and a short narrative description are provided. ADSs are the basic unit of description necessary to develop the comprehensive *DOE Environmental Restoration and Waste Management Five-Year Plan, Fiscal Years 1993–1997*, and will be updated annually. The 1994 ADSs were scheduled to be completed by March 1992 to support the 1994 budget submission. A list of the regulatory drivers is shown in Table 2.1.

Table 2.1. ORNL waste management Activity Data Sheets for FY 1994 and related regulatory drivers

Regulatory driver	FY 1994 ADS
Federal Facility Agreement, Sect. IX and Appendix F	3101, 3102, 3201, 3203, 3204, 3206, 3251, 3252, 3253, and 3254
National Pollutant Discharge Elimination System; Tenn. Rule 1200-4-5, Water Pollution Control Regulations	3201, 3204, 3205, 3207, 3252, 3253, and 3255
Federal Facility Compliance Agreement (FFCA) for National Emission Standards for Hazardous Air Pollutants—Radionuclides; Resource Conservation and Recovery Act (RCRA) land disposal restrictions FFCA; RCRA Part A and Part B permits; Tenn. Rule 1200 [1-11-.02; 1-11-.02(3)(e); 1-11-.03(1)(b); 1-11-.05; 1-11-.06; 1-11-.07; 1-11-.10; 1-15; 3-1 through 3-26, Air Pollution Control Regulations; and 4-1 through 4-5, Water Pollution Control Regulations]	3201, 3202, 3203, 3204, 3205, 3207, 3251, 3252, and 3253

2.2.1.4 Current Year Work Plan

CYWPs, prepared for programmatic waste management tasks each fiscal year, include the following information:

- the task description,
- the task budget and spending schedule,
- the task schedule, and
- milestones.

The budget information provided in the CYWP is developed to be consistent with guidance received from the Energy Systems CWMD and DOE-OR.

2.2.2 Documentation Management Center

The DMC maintains quality records for the Waste Management Operations Section at ORNL by use of the Documentation Management System (DMS), which was conceived, designed, and configured by the DMC to meet requirements for NQA-1 document control and quality records. The scope and requirements of this QA-based system operation are contained in the Waste Management Operations Section Procedure, WM-DMC-101. For additional information on the DMS, see Subsect. 8.3 of this plan.

2.3 SITE DESCRIPTION

This subsection briefly describes the physical characteristics of the ORNL site that are relevant to waste management activities.

2.3.1 Location and Size

ORNL, one of three industrial complexes located on the DOE ORR, is located in an area of hills and valleys approximately 12.87 km (8 miles) southwest of the city of Oak Ridge in eastern Tennessee (Fig. 2.6). The ORR 15,322 ha (38,306 acres) is in a rural setting and is bounded by the Clinch River and Tennessee Valley Authority (TVA) land on its eastern, southern, and western borders. ORNL is located on the southern border of the federal reservation.

ORNL and its accompanying buffer zone, encompassing 3508 ha (8771 acres), is situated almost entirely within the 16.8 km^2 (6.5-mi^2) White Oak Creek (WOC) drainage basin. The central ORNL complex area is located in Bethel Valley (Fig. 2.7), which runs approximately in a northeast-southwest direction. Although the valley floor is highly developed within the central site area, the surrounding terrain is wooded. WOC passes to the south of the developed area and leaves the valley through a gap in Haw Ridge into Melton Valley. All the satellite facilities are located in Melton Valley except the Tower Shielding Facility, which is on Copper Ridge, south of Melton Valley. A number of ORNL facilities including the Biology Division are located at the Y-12 Site.

The central ORNL complex, the SWSAs, and the outlying facilities (Fig. 2.7) occupy about 701 ha (1754 acres), or approximately 20% of the entire ORNL site. The remaining 2806 ha (7017 acres), or 80% of the entire ORNL site, is predominantly forested buffer zone.

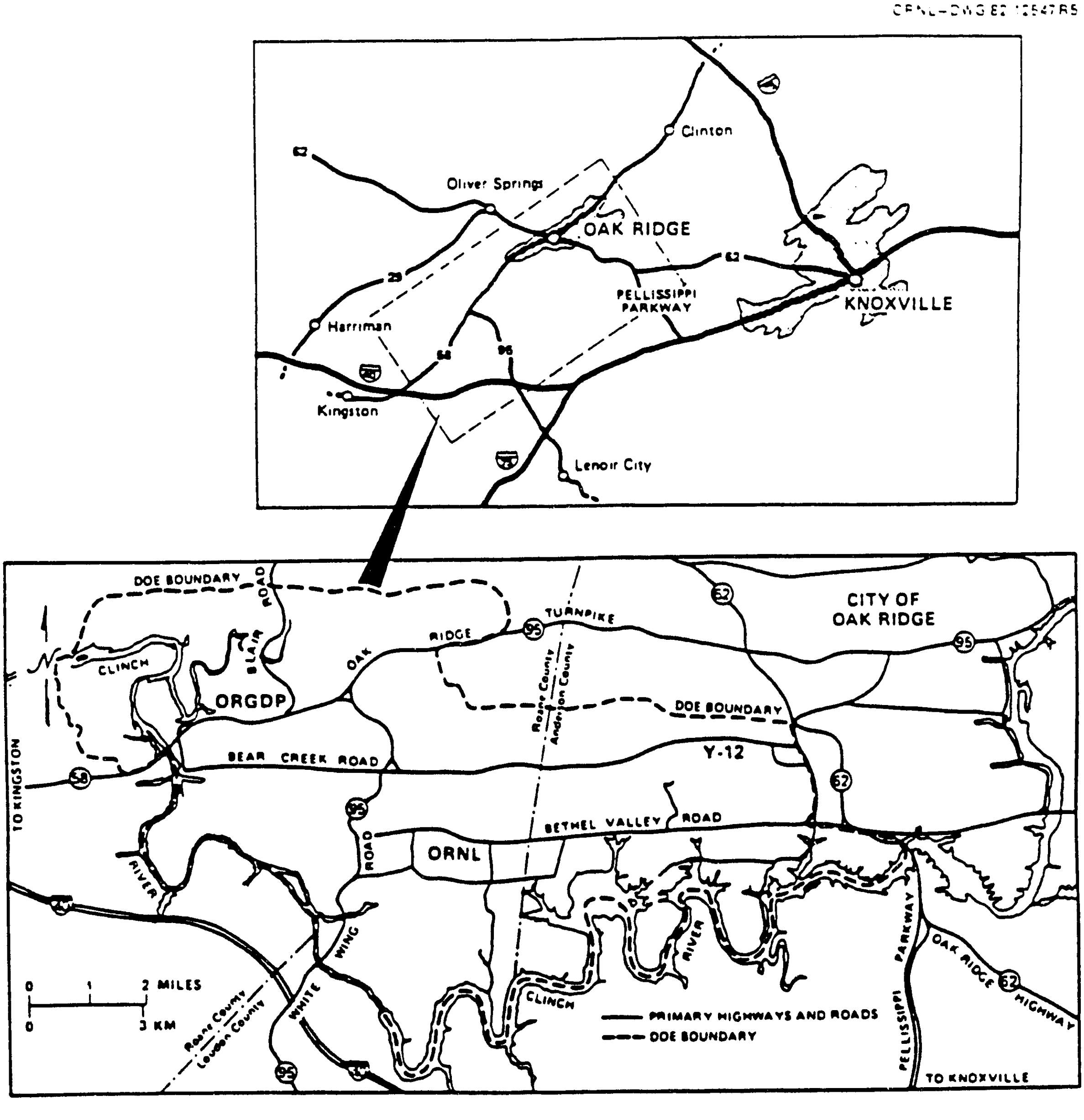

Fig. 2.6. Area map indicating location of Oak Ridge National Laboratory.

Most of the land on the ORR is subject to forest management administered through the P&E Division at ORNL. Forest management on the ORR has involved such practices as the planting of pines on abandoned agricultural lands after acquisition of the land by the federal government in the 1940s and 1950s, clearing of immature second-growth hardwood-pine forests for planting of pine, and thinning and cutting of both hardwood and pine forests for pulpwood and sawtimber. Forest management objectives are coordinated with those of other land uses on the ORR, such as waste management activities.

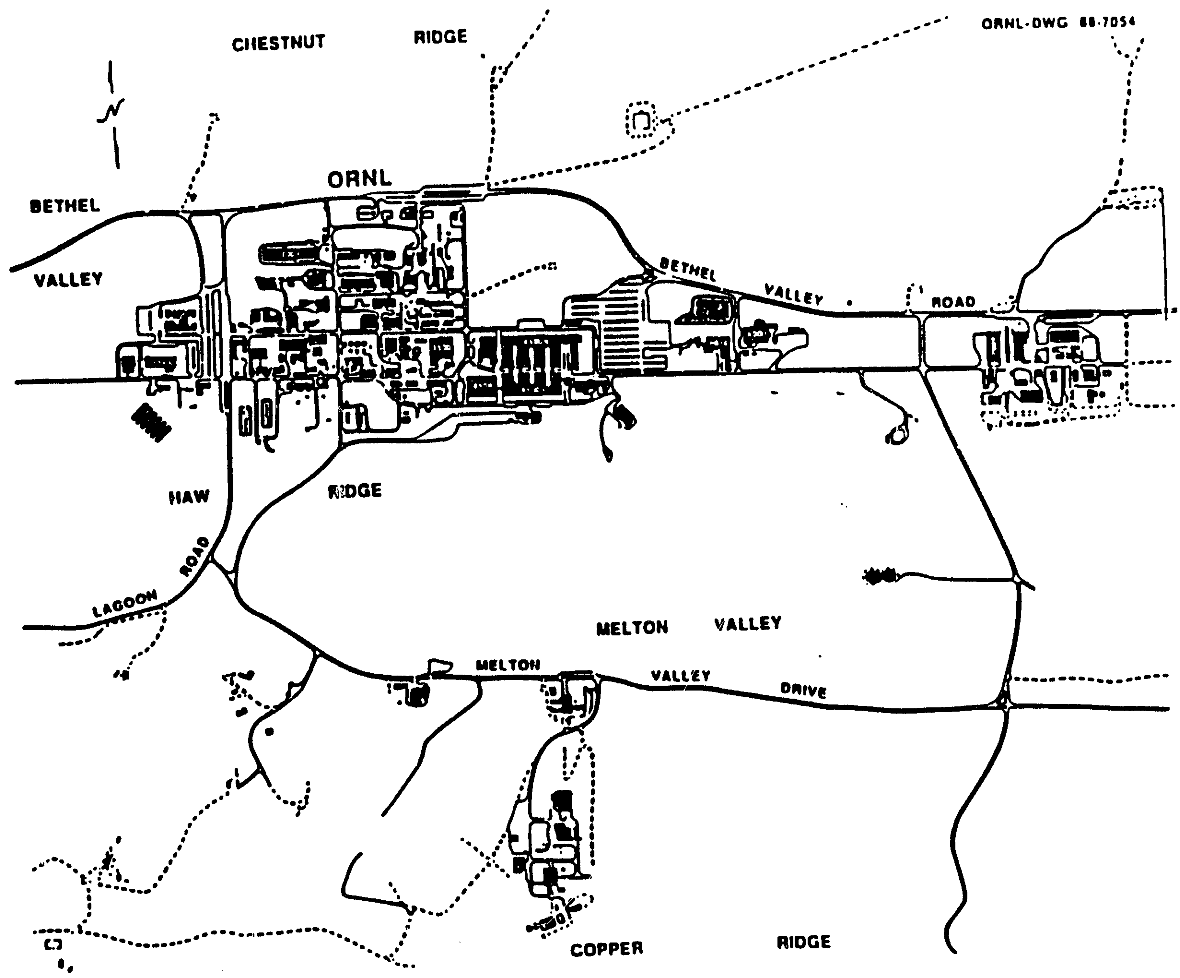

Fig. 2.7. Layout of the central Oak Ridge National Laboratory complex in Bethel Valley.

2.3.2 Demography

Except for the city of Oak Ridge, the land within 8.05 km (5 miles) of the ORR is predominantly rural and is used largely for residences, small farms, and pasture land. Fishing, boating, water skiing, and swimming are favorite recreational activities in the area. The approximate location and population (1980 census data) of the towns nearest the ORR are Oak Ridge (pop. 28,000); Oliver Springs (pop. 3600), 10.94 km (6.8 miles) to the northwest; Clinton (pop. 5300), 16 km (10 miles) to the northeast; Lenoir City (pop. 5400), 10.94 km (6.8 miles) to the southeast; Kingston (pop. 4400), 10.94 km (6.8 miles) to the southwest; and Harriman (pop. 8300), 12.88 km (8 miles) to the west. Knoxville, the major metropolitan area nearest Oak Ridge, is located about 40.25 km (25 miles) to the east and has a population of about 183,000. Fewer than 5000 people live within 9.66 km (6 miles) of the ORR center. The TVA Melton Hill and Watts Bar reservoirs on the Clinch River form the southern, eastern, and western boundaries of the ORR, and the residential sector of the city of Oak Ridge forms the northeastern boundary.

2.3.3 Site Topography

Site topography is characterized by a series of alternating, elongated, and parallel valley troughs and ridges trending northeast to southwest in general accord with the strike of the underlying rock strata. The valleys have been eroded in areas underlain by the less resistant limestone and shale strata, while the ridges are underlain by more resistant sandstone, shale, and cherty dolomite formations.

Surface elevations range from about 225 m (740 ft) at the Clinch River to about 413 m (1356 ft) at the crest of Melton Hill. The succession of alternating ridges and valleys in the ORNL site area (in order from the Clinch River in the southeast to the northwest) is as follows: Copper Ridge, Melton Valley, Haw Ridge, Bethel Valley, and Chestnut Ridge.

2.3.4 Climate

The Oak Ridge climate is typical of the humid southern Appalachian region. The local climate is noticeably influenced by topography. The prevailing winds, as measured by an on-site meteorological tower, are from the southwest and northeast under both stable and unstable conditions. Average monthly wind speeds range from 1.6 m/s (5.2 ft/s) in October to 2.5 m/s (8.2 ft/s) in April. Differences in elevation have a measurable influence on the changes in climate along a northwest-southeast axis. The average annual precipitation measured in the Oak Ridge vicinity is 138 cm (54.4 in.), ranging from 94.9 cm (37.4 in.) to 186.9 cm (76.3 in.). A trace or more of snow has been reported each winter on record; the annual average snowfall is 26.4 cm (10.4 in.).

2.3.5 Geologic and Hydrogeologic Conditions

Nine geologic formations (Fig. 2.8) or groups ranging in age from Early Cambrian to Early Mississippian have been mapped within the ORR. All the formations are of sedimentary origin, either chemical (limestone and dolomite) or clastic (sandstone and shale). From oldest to youngest, they include the Rome Formation, the Conasauga Group, the Knox Group, the Chickamauga Group, the Sequatchie Formation, the Rockwood Formation, the Chattanooga Shale, the Maury Formation, and the Fort Payne Chert.

Of the nine units mapped within the reservation, the four that underlie ORNL and the WOC drainage basin from northwest to southeast are (1) the Knox Group, a predominantly dolomite strata of Cambrian and Ordovician ages underlying Chestnut Ridge to the north and Melton Hill and Copper Ridge to the south; (2) the Chickamauga Group of Ordovician age, which underlies the main ORNL complex in Bethel Valley; (3) the Rome Formation, shale, siltstone and sandstone unit of Cambrian age that underlies Haw Ridge, separating the main ORNL complex from the satellite facilities located in Melton Valley; and (4) the Conasauga Group, Cambrian-age shales interbedded with limestones and siltstone that underlie the waste management TSD facilities in Melton Valley.

The rock is generally covered by a mantle of residual alluvial and colluvial material in places more than 30 m (100 ft) thick. Soils developed on the Rome, Conasauga, and Chickamauga are generally thin [i.e., less than 4.8 m (16 ft) but somewhat thicker where shale is deeply weathered]. Knox residuum is generally thick but irregular.

In the Oak Ridge area the Knox dolomite and the Rome Formation are the principal aquifers. The Conasauga Group is a potential low-yield groundwater source. The

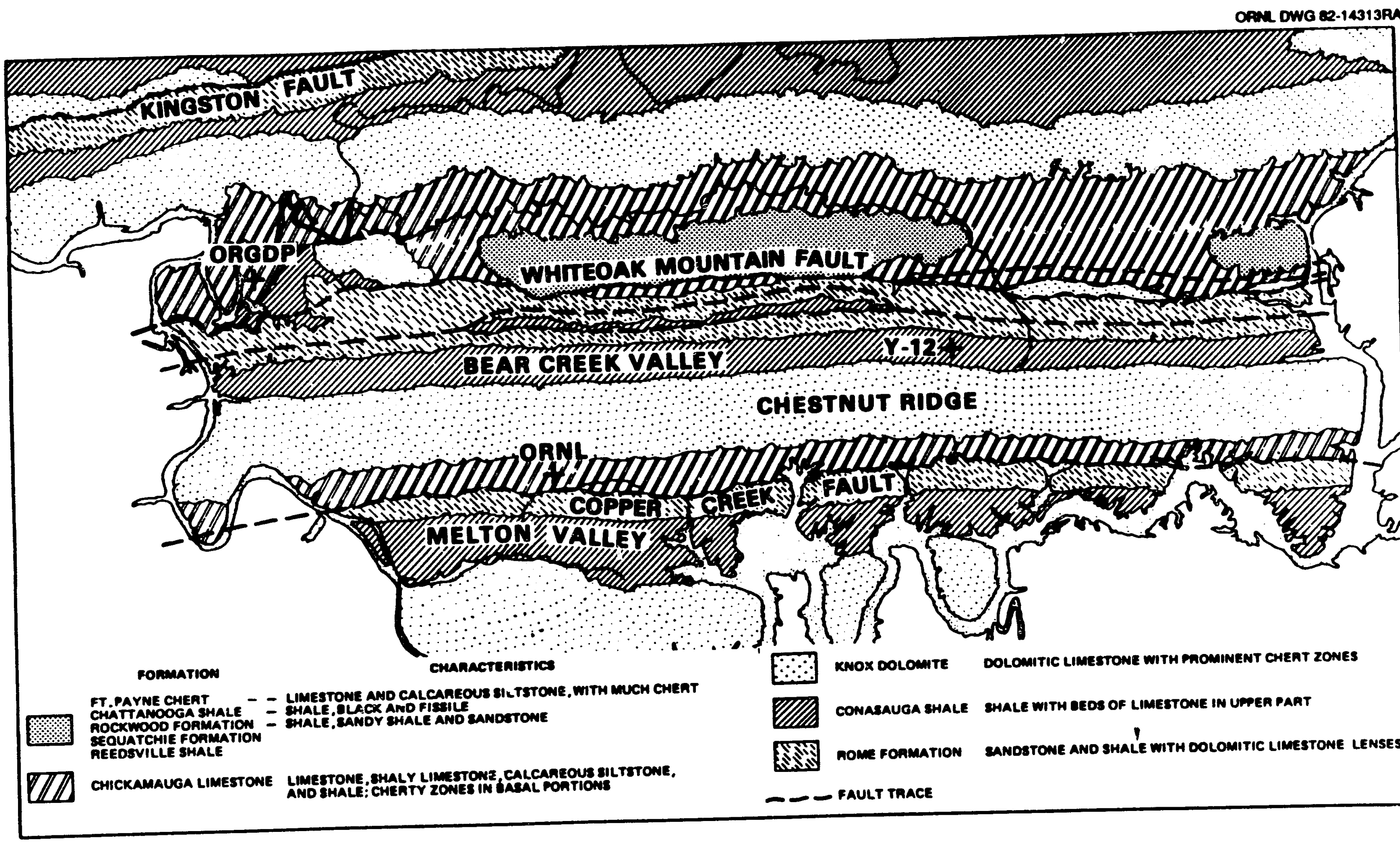

Fig. 2.8. Geologic formations within the Oak Ridge Reservation.

Knox, located beneath Chestnut Ridge, is the major aquifer in the WOC basin. The thick, weathered mantle seems to have a high-infiltration capacity and serves as a reservoir feeding large solution cavities in bedrock. Springs at the base of Chestnut Ridge are a primary natural source of base flow for WOC. Groundwater discharge from the Knox beneath Copper Ridge is probably not into WOC basin but, instead, to the southeast along the Clinch River.

The mean yield of springs and wells in the Knox Group used for public and industrial water supplies is 1014 L/min (268 gal/min). No estimate is available for mean well yield of domestic water wells in the Knox Group.

Depth to the water table varies both spatially and temporally. At a given location, depth to water is generally greatest during the October-December quarter and least during the January-March quarter. In Bethel Valley, depth to water table ranges from 0.30 to 10.66 m (1 to 35 ft), while in Melton Valley the range is from 0.30 to 20.42 (1 to 67 ft). Seasonal fluctuations tend to be greatest beneath hillsides. A seasonal variation of as much as 4.57 m (15 ft) has been reported for Melton Valley. The major portion of the industrial and drinking water supplies in the Oak Ridge area is taken from surface water sources. However, single-family wells are common in adjacent rural areas not served by public water supply systems. For more detailed information concerning the hydrologic and geologic conditions affecting the ORR, *Status Report—A Hydrologic Framework for the Oak Ridge Reservation* (Solomon, et al., 1992) should be consulted.

3. RADIOACTIVE WASTE MANAGEMENT

Oak Ridge National Laboratory (ORNL) radioactive waste management activities are primarily concerned with transuranic (TRU) waste and low-level wastes (LLW). Small quantities of naturally occurring and accelerator-produced radioactive material (NARM) are generated and managed as LLW. ORNL does not generate high-level waste (HLW) but stores a small quantity as special case (SC) waste. Radioactive waste management operations include solid, liquid, and gaseous waste management activities.

3.1 SOLID WASTE

At ORNL, solid radioactive waste is segregated for on-site storage or disposal. The decision tree for segregation and disposition of the various types of radioactive waste generated at ORNL is presented in Fig. 3.1. The following subsections describe the

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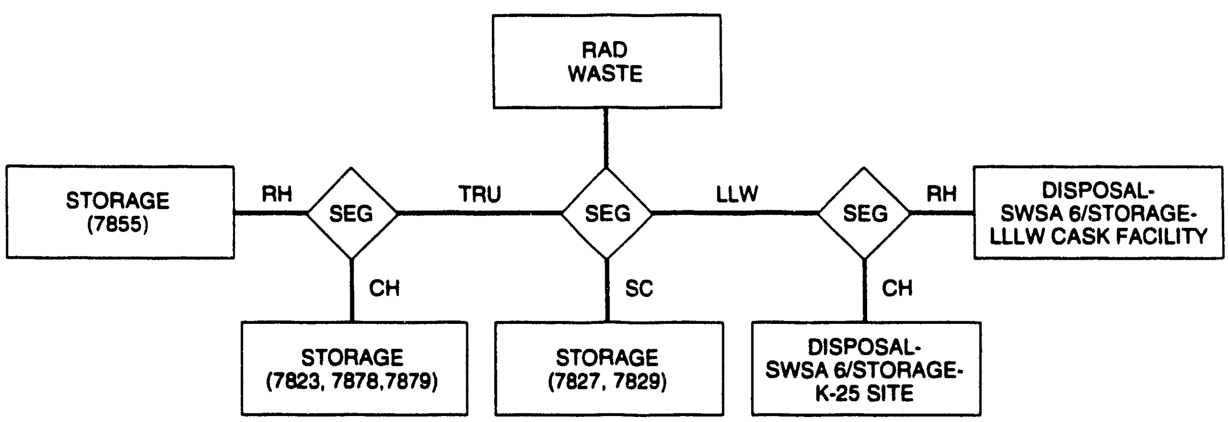

Fig. 3.1. Decision tree for the segregation and disposition of solid radioactive waste at ORNL.

strategy, generic description, and characteristics of the waste and the status of treatment, storage, and disposal (TSD) facilities for TRU, LLW, and SC waste at ORNL.

3.1.1 Transuranic Waste

TRU waste is defined in DOE Order 5820.2A as radioactive waste that, without regard to source or form at the end of the institution control period, is contaminated with alpha-emitting TRU radionuclides that have (1) an atomic number greater than 92, (2) half-lives greater than 20 years, and (3) an assay concentration greater than 100 nCi/g. Heads of field elements can also determine that other alpha-contaminated waste, peculiar to a specific site, must be managed as TRU waste. Waste contaminated with ^{252}Cf, ^{244}Cm, and ^{233}U in concentrations greater than 100 nCi/g are also handled as TRU waste at ORNL, although they have not been formally declared as such by the U.S. Department of Energy Oak Ridge Field Office (DOE-OR).

The majority of TRU waste stored at ORNL is from past operations. Currently, ORNL produces only small quantities (e.g., ~20 m^3/year) of newly generated (NG) TRU waste. Most of the existing TRU waste storage facilities at ORNL are located in the north area of solid waste storage area (SWSA) 5 (Fig. 3.2).

3.1.1.1 Strategy

Since 1970 ORNL has been segregating and storing solid alpha-contaminated waste that meets the TRU definition, pending the development of an approved strategy for permanent disposal. The Waste Isolation Pilot Plant (WIPP), located in Carlsbad, New Mexico, is the DOE geologic disposal facility for all TRU waste including ORNL's. TRU waste to be shipped to WIPP must be certified to the waste acceptance criteria (WAC) of WIPP. Over the past several years ORNL has been developing the procedures for certifying TRU waste for disposal at WIPP.

Disposal at the Waste Isolation Pilot Plant

According to DOE Order 5820.2A, TRU waste will be disposed of at the DOE WIPP, a research and development (R&D) facility for the safe disposal of TRU wastes resulting from defense activities. It is the planned destination for all certified contact-handled (CH) and remote-handled (RH) TRU waste including mixed TRU waste.

Prior to shipment of waste, WIPP personnel will validate the data package for each waste shipment. On receipt of waste, WIPP personnel will (1) verify the package or assembly identification numbers against the data package, (2) measure the external radiation dose rate of the package and shipping container, (3) verify that contamination levels on the package and shipping container surfaces are within acceptable limits, and (4) review and process all shipping papers and manifests.

The initial 5-year period of operation at WIPP is designated as the Test Phase, during which time the waste will be retrievably stored. A 20-year operating period is planned to follow the Test Phase.

CH TRU waste

Solid TRU waste is segregated and handled based on the radiological dose rate at the surface of the waste package. CH TRU waste is defined in the WIPP WAC as TRU waste that has a surface dose rate of $\leq$200 mrem/h and can be handled by direct means without extensive shielding.

Stored CH TRU waste. ORNL has a significant backlog of stored CH TRU waste, the majority of which is contained in 208-L (55-gal) stainless steel drums; other CH TRU waste packages include stainless steel drums, overpacks, and some large (4 $\times$ 4 $\times$ 5 ft) boxes. The CH TRU waste is stored in below-grade concrete block facilities in SWSA 5N (Buildings 7826, 7834, and 7879). Approximately 616 m^3 (22,000 ft^3) of CH TRU waste is currently stored at ORNL, which includes about 2800 drums and over 50 boxes. The strategy for stored CH TRU waste is to certify the waste to the WIPP WAC and to store the certified waste at ORNL awaiting shipment to WIPP. Because of recent changes in transportation requirements, most of the CH TRU waste stored at ORNL will require repackaging.

Newly generated CH TRU waste. Currently, ORNL has only a few sources of NG CH TRU waste. The five ORNL facilities that generate this waste are

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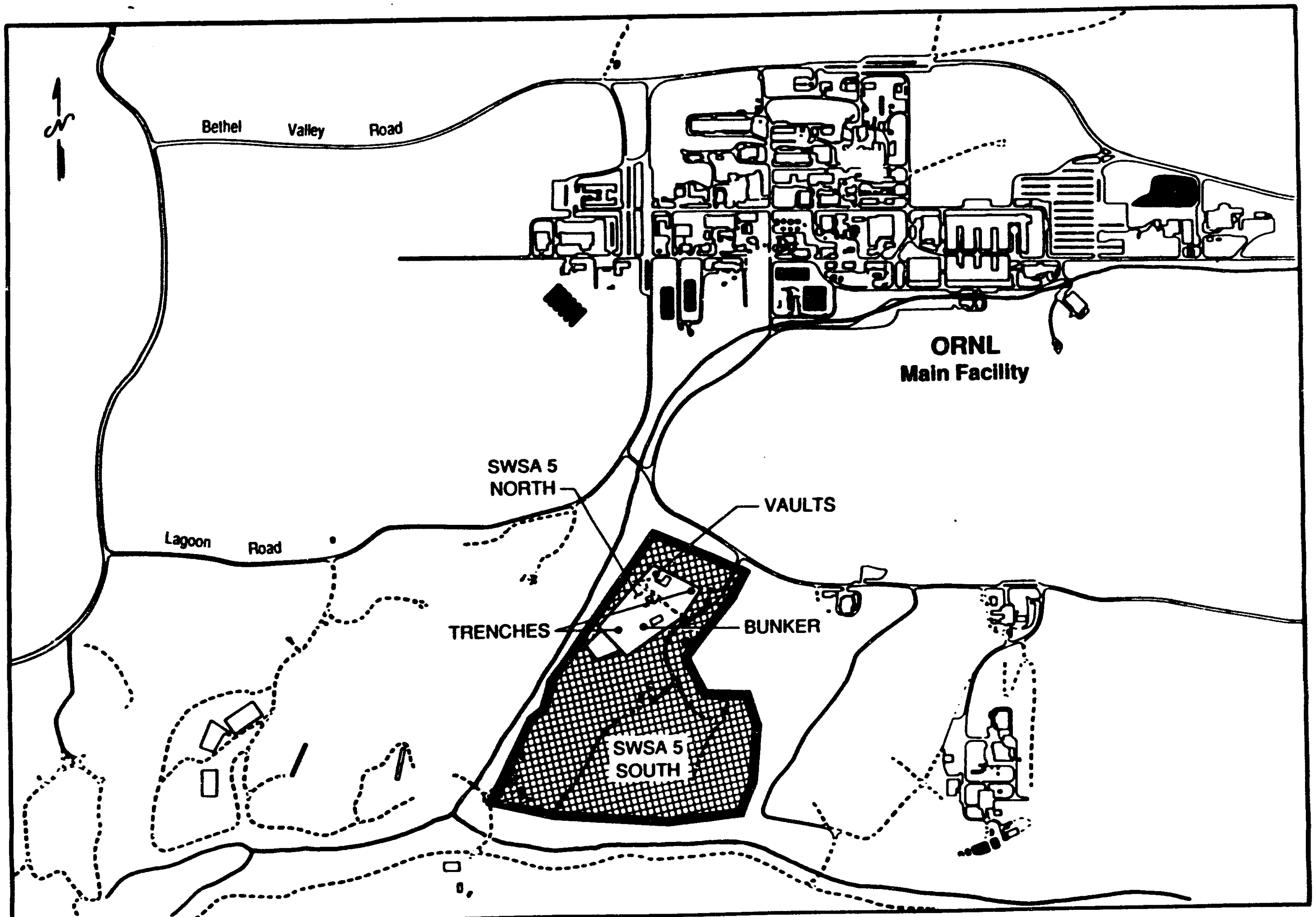

Fig. 3.2. Transuranic waste storage facilities in the north area of Solid Waste Storage Area 5.

(1) Building 7920, the Radiochemical Engineering Development Center (REDC); (2) Building 3019, the Radiochemical Development Facility; (3) Building 2026, the High-Radiation-Level Analytical Laboratory; (4) Building 5505, the Transuranium Research Laboratory; and (5) the Isotopes Area of ORNL. Building 7920 is the largest generator, and Buildings 2026 and 5505 generate much less, each producing (in some cases) less than one 208-L (55-gal) drum per year. The estimated annual CH TRU waste generation rate is expected to be 12 to 15 m^3 (400 to 500 ft^3/year) from normal facility operations. The strategy for NG CH TRU waste is to certify the waste for WIPP disposal. For NG CH TRU waste, the generator is responsible for providing a WIPP-certified waste.

RH-TRU waste

RH TRU waste is TRU waste that has a surface dose rate of >200 mrem/h and must be handled by remote means.

Stored RH TRU waste. The currently identified inventory of RH TRU solid waste stored at ORNL facilities totals 381 waste containers [168 m^3 (6000 ft^3)] consisting mainly of concrete casks.

Disposed RH TRU waste. The strategy of stored RH TRU waste is to certify the waste to the WIPP WAC by retrieving and processing in the proposed Waste Handling and Packaging Plant (WHPP). The mission of the WHPP is to retrieve, receive, characterize, repackage, certify, and prepare for shipping TRU waste. Concrete casks that are buried in trenches in SWSA 5N and SWSA 5S and are considered nonretrievable total 108.

NG RH TRU waste. The majority of NG RH TRU waste is generated during the normal process operations of Buildings 7920 and 7930. The current generation rate is about six to ten casks per year. Decontamination and decommissioning (D&D) and remedial action activities will also likely produce RH TRU waste. The strategy for RH TRU waste is to repackage at the proposed WHPP and to certify for WIPP disposal.

TRU sludges

Sludges are contaminated with TRU radionuclides primarily because of past liquid waste operations at ORNL. These sludges are either residual heels in tanks from past operations or the end product of waste evaporation. TRU-contaminated sludges will be processed and certified as RH TRU waste.

NG-LLLW System sludges. TRU-contaminated sludges currently being generated at ORNL are primarily the result of operations at the REDC (Buildings 7920 and 7930). The existing Liquid Low-Level Waste (LLLW) System does not currently have provisions for handling TRU-contaminated liquids separate from non-TRU LLLW waste streams. Modification of the LLLW System to isolate TRU-contaminated liquid waste is currently being studied.

Past LLLW System sludges. About 1.25×10^5 gal of sludge currently stored in the gunite tanks and the Melton Valley storage tanks (MVSTs) is classified as RH TRU waste. The result of waste accumulation from the past 48 years of ORNL waste operations, these sludges are residuals from sluicing operations conducted several years ago when the majority of the gunite tank contents were removed for hydrofracture disposal. Hydrofracture disposal ended in 1984 because of changing regulatory requirements. The sludges in MVSTs also resulted partly from this process.

Also, various active and inactive tanks in the LLLW System contain residual heels contaminated with TRU radionuclides. Characterization of these sludges has been completed for inactive tanks by the Environmental Restoration Program and for the active tanks by the Waste Operations Program. The ORNL strategy for stored TRU sludges involves removal, solidification, and certification to the WIPP WAC in the proposed WHPP.

Buried TRU waste

Buried TRU waste is defined as TRU waste disposal prior to 1970. Records from that time period indicate several sites where buried TRU is known or suspected: (1) approximately 6200 m^3 of solid TRU waste commingled with solid low-level waste (SLLW) and disposed in shallow-land burial trenches prior to 1970 (i.e., SWSAs 3, 4, and 5); (2) wastes in pits and trenches from past liquid waste disposal operations (i.e., four pits and three trenches); (3) contaminated soil sites from leaks in the liquid processing systems (also, some contaminated soils from deteriorated waste packages in the solid waste burial sites); and (4) some grout sheets below the New Hydrofracture Facility (NHF) [and possibly below the Old Hydrofracture Facility (OHF)] that contain TRU radionuclides. The final disposition of buried TRU waste is a part of the Remedial Investigation/Feasibility Study (RI/FS) currently in progress under the Energy Systems ER Program and is not specifically addressed in this plan. Buried TRU waste is not a part of the WIPP mission as currently defined.

3.1.1.2 Generic description and characteristics of waste

CH TRU Waste

CH TRU waste consists of miscellaneous waste from glove box operations (e.g., paper, glassware, plastic, shoe covers, and wipes), discarded high- efficiency particulate air (HEPA) filters, and discarded equipment (e.g., glove boxes, processing equipment, etc.). The majority of the CH TRU waste has a surface dose rate much less than 200 mrem/h.

CH TRU waste is generally contained within polyethylene bags inside 208-L (55-gal) stainless steel drums. Metal paint cans, plastic buckets, and other similar containers are also used to package waste inside the 208-L (55-gal) drums. The flow sheet for handling newly generated CH TRU waste is shown in Fig. 3.3.

The current inventory of CH TRU waste at ORNL is approximately 2400 208-L (55-gal) drums placed in storage facilities or awaiting examination in the Waste Examination and Assay Facility (WEAF). Also, a small quantity of CH TRU waste is stored in 50 large (typically 4 × 4 × 6 ft) boxes but is not restricted to this type package.

Of the approximately 2400 drums in storage, approximately 200 are known to contain lead and/or mercury and are handled as a mixed waste. Also in storage are 217 drums containing free liquids and 81 drums with unpunctured aerosol cans or compressed gas cylinders. Insufficient data are available on the remaining 484 drums. Further work on characterizing the drums with liquids, gases, or unknowns is ongoing.

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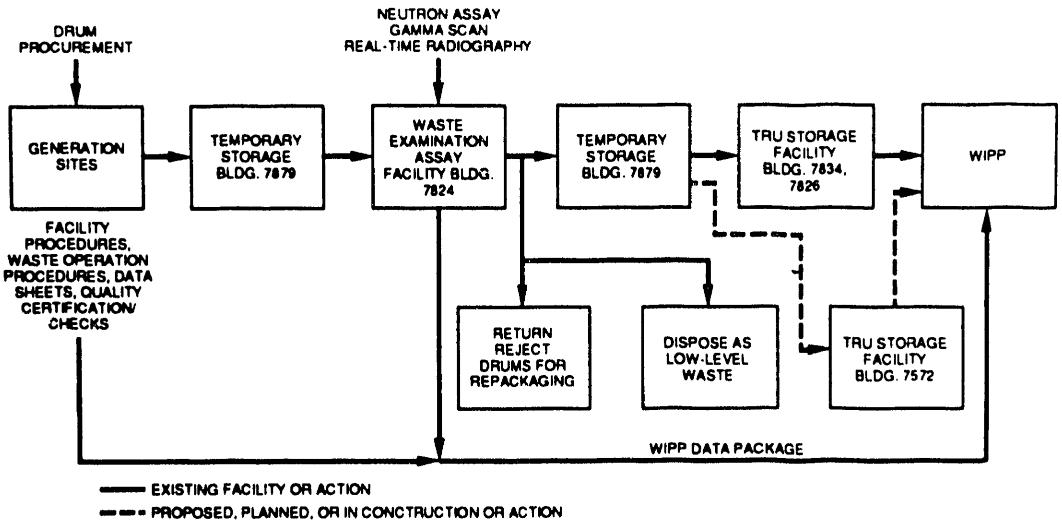

Fig. 3.3. Flow sheet for handling newly generated contact-handled transuranic waste.

RH TRU waste

Solid RH TRU waste consists primarily of miscellaneous cell waste (e.g., paper, glass, plastic tubing, shoe covers, wiper, etc.), HEPA filters from off-gas cleanup systems, and discarded equipment (e.g., processing racks, vacuum pumps, furnaces). The unshielded individual waste packages within the casks typically have radiation levels that measure between 10 and 2000 rem/h; the majority are below 100 rem/h. Resource Conservation and Recovery Act (RCRA) materials in RH TRU waste primarily consists of lead that was used as shielding and limited amounts of mercury from discarded mercury vapor lamps.

RH TRU waste is typically contained in cylindrical concrete casks 1.37 m (4.5 ft) in diameter by 2.28 m (7.5 ft) high. Wall thickness of the casks are currently either 15.24 or 30.48 cm (6 or 12 in.) thick, depending on the radiation level of the contents. The majority of the RH TRU wastes inside the concrete casks are also contained inside polyethylene bags. Smaller waste packages such as 11-L (3-gal) plastic buckets, 3.7-L (1-gal) paint cans, and 18.9-L (5-gal) metal cans are packaged within the polyethylene bags. Also 37.8-L (10-gal) fiber drums and 114- and 208-L (30- and 55-gal) carbon and steel drums have been used to package waste material before placing the waste in concrete casks. The RH TRU waste currently stored within SWSA 5N at ORNL consists of about 100 concrete casks stored in Building 7855 and another 200 casks stored in trenches (7802N).

Sludges

TRU sludges in storage in the gunite tanks are residual heels from sluicing operations between 1980 and 1984 when the majority of the gunite tank contents were removed for hydrofracture disposal at the NHF. The sludges in the MVSTs are a result of past hydrofracture disposal and N6 LLLW concentrate. These sludges have a relatively high water content and a density of about 1.2 to 1.5 g/cm^3. The surface dose rates of these sludges are generally near 10 rem/h (unshielded). After solidification the majority of these sludges will be certified as RH TRU waste. The quantity of RH TRU sludges in the gunite and other inactive tanks and the MVSTs is estimated to be 1.25×10^5 gal. When the sludges are mobilized and transported to the proposed WHPP for solidification, a much greater volume of TRU liquids and solids will result.

3.1.1.3 Treatment facilities

Treatment facilities for solid TRU waste do not currently exist at ORNL. However, WEAF currently serves as the inspection facility for the examination of TRU waste and SLLW. Although WEAF is utilized as a verification facility for data provided by the waste generators, it is listed in this section as a "treatment" facility since it may be considered as a pretreatment step for WIPP.

CH TRU waste

The proposed treatment facility for CH TRU waste is the WHPP. The WHPP is discussed under the RH TRU subsection that follows. WEAF and the proposed Waste Certification and Characterization Facility are described in the following paragraphs.

Waste Examination and Assay Facility. WEAF (Building 7824), located in SWSA 5N, houses equipment for nondestructive examination (NDE) and nondestructive assay (NDA) of CH TRU and SLLW as well as personnel offices and a control room. NDE and NDA equipment located in WEAF includes the real-time radiography (RTR) unit, the Passive/Active Neutron Assay System, and the Segmented Gamma Scanner.

Environmental monitoring. Constant air monitors operate to detect alpha and beta/gamma emissions. An alarm sounds when a preset level of emissions is detected.

Permitting status. Although WEAF is not a treatment, storage, or disposal facility, it was included in ORNL's RCRA permit application at the request of the State.

Facility status. WEAF is currently operational.

Waste Characterization and Certification Facility. This facility is planned to replace WEAF for NDA and NDE of waste, as required to verify that the WAC for storage and disposal of TRU waste and LLW have been met. The facility will house the existing nondestructive inspection equipment for RTR and assay of drummed and boxed waste that is currently located in WEAF. Automated handling equipment will be provided to move waste containers within the building in order to reduce personnel exposure. The building will also be equipped with a HEPA-filtered ventilation system and other utilities.

Environmental monitoring. The facility will be equipped to meet current and anticipated environmental monitoring requirements.

Permitting status. The need for a RCRA permit has not yet been established. An environmental assessment (EA) will be prepared to meet National Environmental Policy Act (NEPA) documentation requirements.

Facility status. This facility is currently planned as a 1994 line item (LI) project; total estimated cost (TEC) is expected to be $18.0M. The functional design requirements for the facility have been established, and it is to be located in SWSA 7 near the site of the proposed CH TRU waste storage facilities.

RH TRU waste

No facilities exist at ORNL for the treatment of RH TRU waste. The WHPP is the proposed facility for processing the stored solid RH TRU waste and sludges.

Waste Handling and Packaging Plant. The WHPP is a proposed major system acquisition project designed to process stored RH TRU waste and TRU-containing sludges. The WHPP will be designed to mobilize, transfer, and solidify sludges stored in MVSTs, to process solid RH TRU waste, and to certify and package RH and CH TRU waste for shipment to WIPP. The WHPP will be capable of receiving casks of different sizes, off-site wastes, and liquid and sludge from ORNL's liquid waste storage tanks. The main processing cell will be remotely operated and remotely maintained and will have the capacity for unpackaging, characterizing, volume reducing, assaying, repackaging, and certifying the waste to meet the WIPP WAC.

A conceptual cutaway of the WHPP showing equipment layout and process flow is shown in Fig. 3.4. The proposed site of the WHPP, showing its relationship with the main ORNL complex and other TRU waste facilities, is depicted in Fig. 3.5.

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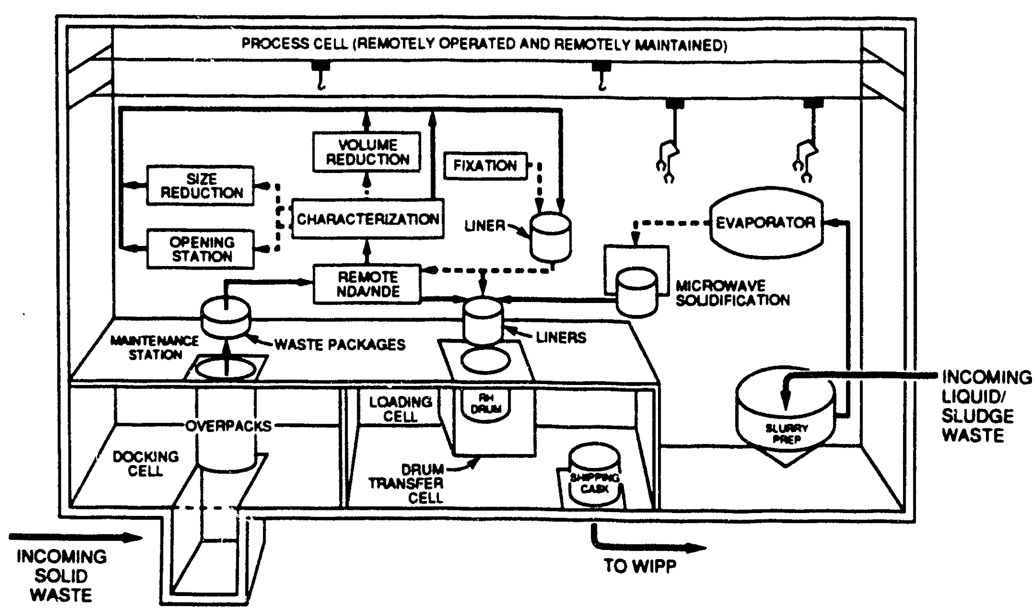

Fig. 3.4. Conceptual Waste Handling and Packaging Plant cutaway.

Environmental monitoring. The facility will be equipped to meet current and anticipated environmental monitoring requirements.

Permitting status. An environmental impact statement will be submitted to meet NEPA requirements, and the WHPP will be a RCRA-permitted facility.

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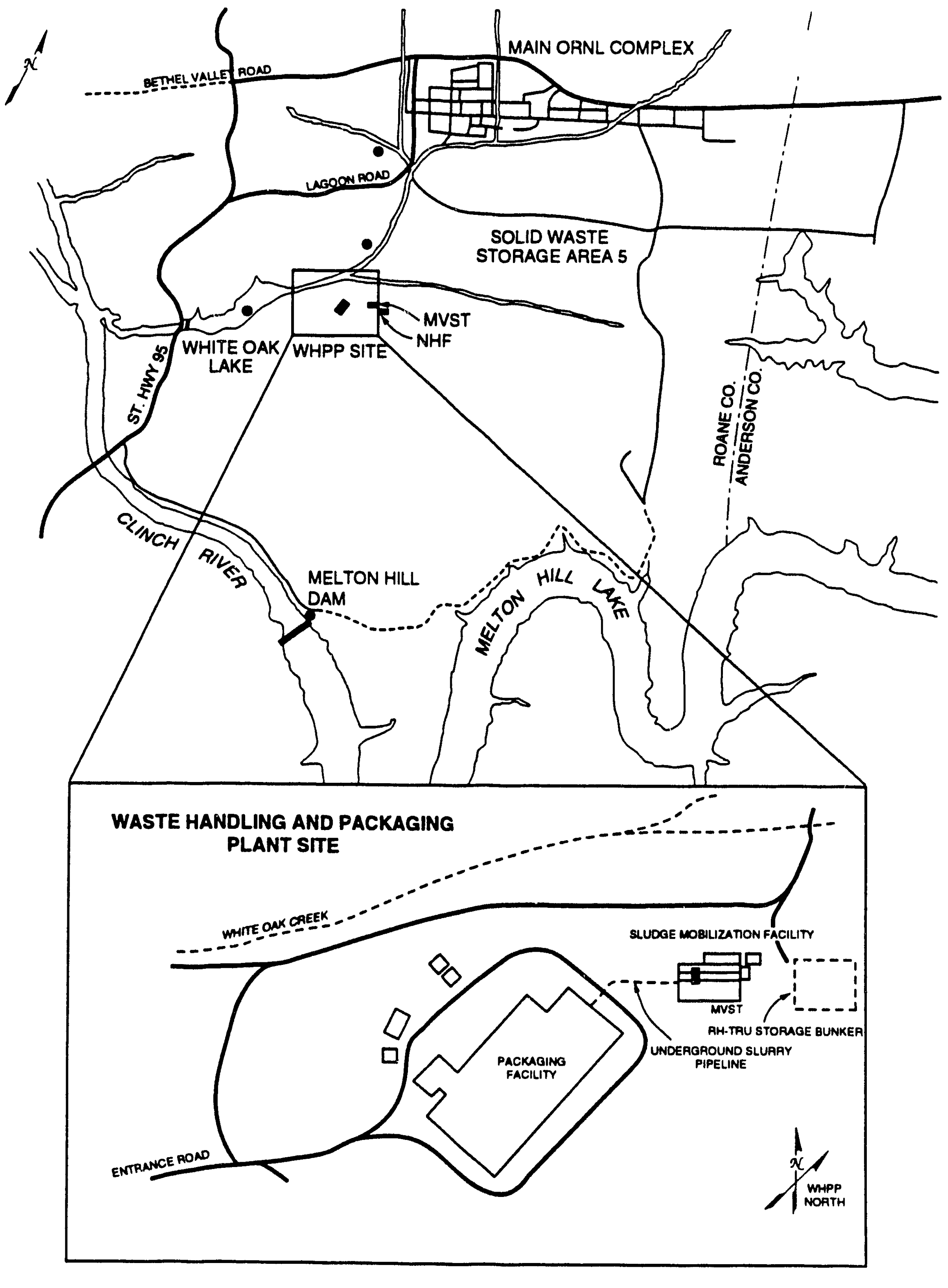

Fig. 3.5. Waste Handling and Packaging Plant site and its relationship to main Oak Ridge National Laboratory Complex and other transuranic waste facilities.

Facility status. ORNL will seek funding for the WHPP as an FY 1996 LI project. Preliminary cost estimates for the WHPP indicate a TEC of $300M as a 1996 LI. If the WHPP is funded as planned, it will be operational in FY 2003.

3.1.1.4 Storage facilities

The locations of solid TRU waste storage facilities and trenches in the north area of SWSA 5 are shown in Fig. 3.6. Sludges are stored in MVSTs and in eleven or more of the inactive tanks. The inactive tanks containing TRU sludges are located in the main ORNL complex and at the OHF. In addition, unknown quantities of sludge may be stored in various active tanks in the LLLW System. Most of these active tanks are located primarily in the main ORNL complex.

CH TRU waste

CH TRU waste is currently stored in Buildings 7826 and 7834. Buildings 7823 and 7879 are staging facilities for drummed waste and for the temporary storage of boxed waste. Two new CH TRU storage facilities are planned.

Building 7823. Building 7823, a single-level, semiunderground building approximately 391 m^2 (4200 ft^2), has a concrete floor, steel supports, wire fabric ceiling, and metal roof and walls. Located in SWSA 5N, the building was used for the temporary storage of TRU glove boxes and 208-L (55-gal) drums of SLLW. It is currently used for storage of mixed wastes (Subsect. 5.1.4.3).

Environmental monitoring. The staging facility is monitored periodically by health physics surveys and visual inspections.

Permitting status. The facility is currently operating under RCRA interim status. Current plans are to upgrade and to permit this facility as a RCRA Part B facility.

Facility status. Building 7823 was phased out as a TRU staging facility in early 1991 on completion of Building 7879. The facility is currently used as a mixed waste storage facility. When permitted, this facility could be used to store TRU or mixed TRU waste.

Buildings 7826 and 7834. Current facilities for storage of drummed 208-L (55-gal) CH TRU waste consist of two nearly identical facilities (Buildings 7826 and 7834). Building 7826, the oldest of the CH TRU storage facilities, is a concrete block structure built approximately 85% below-grade. The facility has 24 storage compartments or cells, each of which will hold 64 208-L (55-gal) drums for a total capacity of 1536 drums. The drums are stacked four layers high in each storage compartment.

Building 7834 is very similar except the 24 storage cells will each hold 80 drums (when stacked five layers high) for a total capacity of 1920 drums. Also, this newer facility has removable concrete roof plugs instead of the sheet metal roof covers used in the 7826 facility.

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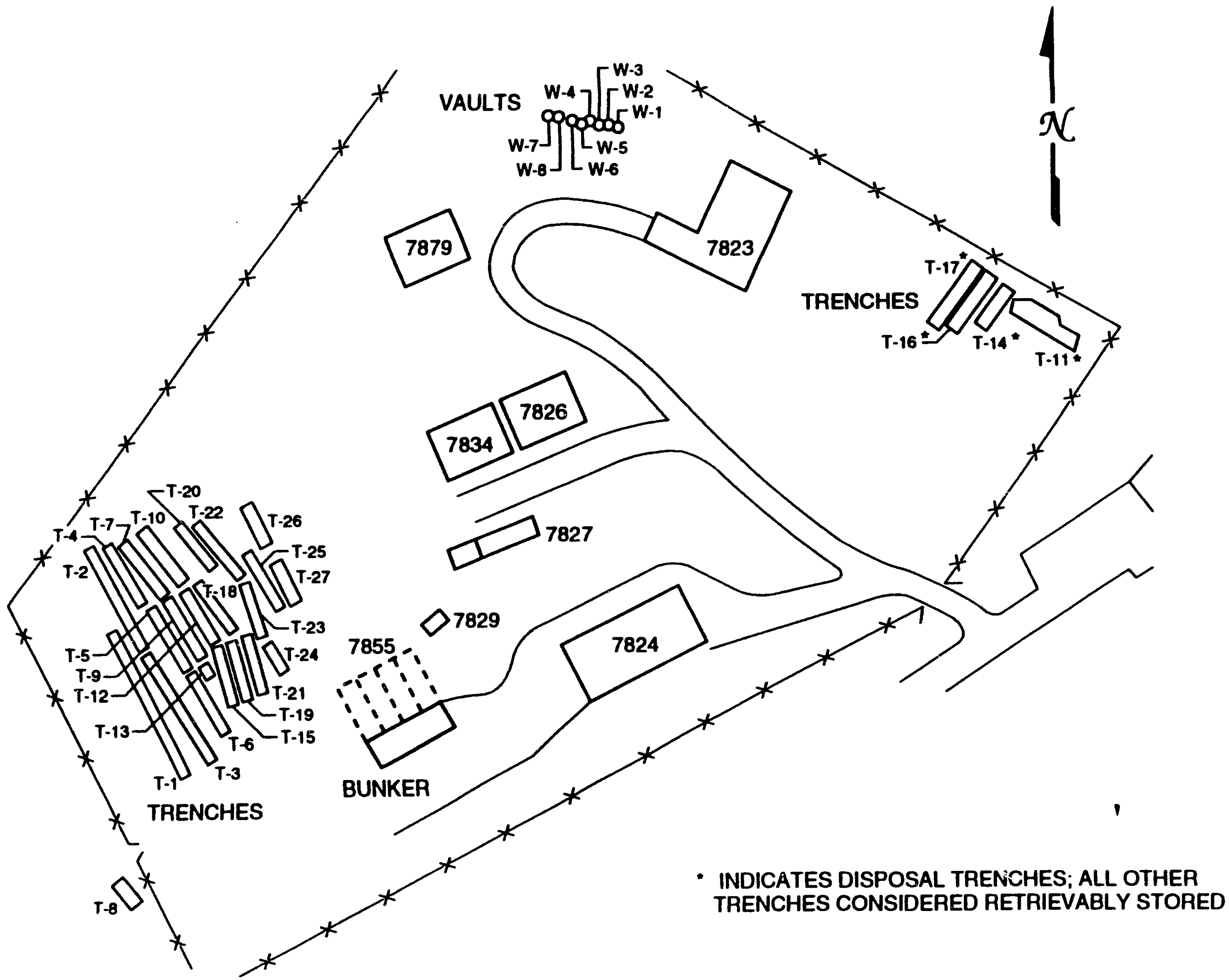

Fig. 3.6. Locations of transuranic waste storage and disposal facilities in the north area of Solid Waste Storage Area 5.

Environmental monitoring. Monitoring of Building 7834 and 7826 is primarily conducted through the sampling of sumps located in each storage compartment. Each compartment contains a floor drain and a sump that empties to an external catch basin. The catch basin is sampled monthly.

Permitting status. The facilities are currently operating on a RCRA interim status permit. The interim status ends on November 8, 1992, and closure of these facilities must be initiated at that time; however, a revised closure plan will extend that date.

Facility status. These facilities will begin the closure process in accordance with RCRA beginning in November 1992.

Building 7879. Building 7879 is a metal Butler-type building of 15 × 25 m (50 × 83 ft) used for temporary storage of TRU SLLW. The facility has a sealed concrete floor with curbing to meet RCRA requirements. The facility is able to store more than 1000 drums in a configuration that allows RCRA inspection.

Environmental monitoring. The facility was designed and equipped to meet all applicable environmental and personnel monitoring requirements as specified in RCRA, DOE orders, and other applicable regulations.

Permitting status. Currently operating under a RCRA interim status permit, the facility is listed on ORNL's RCRA Part B permit application.

Facility status. The facility began operation in early 1991.

Buildings 7572 and 7577. Two new CH TRU waste storage facilities are planned to replace existing CH TRU storage facilities, Buildings 7826 and 7834. The new facilities will be aboveground metal Butler-type buildings having sealed concrete floors and curbing to meet RCRA and DOE requirements. The facilities will have storage capacities of about 3000 208-L (55-gal) drums and will be located in the SWSA 7 area.

Environmental monitoring. The facilities will be designed to meet all applicable environmental and personnel monitoring requirements as specified in RCRA, DOE orders, and all other applicable regulations.

Permitting status. The facilities will be RCRA Part B permitted. An EA has been submitted to DOE to meet NEPA requirements.

Facility status. Building 7572 is planned as a 1990 general plant project (GPP) with a TEC of $1.1M. Functional design requirements and a conceptual design for the facility have been prepared. Construction will begin upon completion of the NEPA process.

Building 7574. A new waste storage facility is planned for long-term storage of 154 m^3 (5500 ft^3) (about 750 drums) of CH TRU waste from Nuclear Fuel Services, Inc. The waste will be temporarily stored in the new TRU SLLW Staging Facility, Building 7879. Building 7574 will be nearly identical to Building 7879 and will be located in the SWSA 7 area.

Environmental monitoring. The facility will be designed to meet all applicable environmental and personnel monitoring requirements as specified in RCRA, DOE orders, and all other applicable regulations.

Permitting status. The facility is included in the ORNL RCRA Part B application. A revised EA was submitted to DOE to meet NEPA requirements.

Facility status. This facility is planned as a 1992 GPP, but construction will await completion of the NEPA process (a Finding of No Significant Impact is expected in FY 1992). Construction is expected to be complete in FY 1994.

RH TRU waste

RH TRU waste at ORNL is currently stored in an earth-sheltered building (7855) and in trenches in SWSA 5N. The locations of the RH TRU waste storage facility and the trenches containing stored RH TRU wastes are shown in Figs. 3.2 and 3.6. A new RH TRU waste storage facility is planned to be located near the New Hydrofracture Facility. The facilities used for the storage of the RH TRU sludges are discussed under LLLW (Subsect. 3.2.2).

Building 7855. The storage bunker currently used at ORNL for storing RH TRU waste in concrete casks is Building 7855, a one-story, largely underground concrete block structure on a reinforced concrete slab with a reinforced concrete roof. The structure is a minimum of 0.60 m (2 ft) below-grade except for the open south-facing side.

The structure is divided into four bays by concrete block walls that extend from the floor to the roof. Each bay of the facility is approximately 4.6 × 13.7 × 3.04 m (15 × 45 × 10 ft). Each bay of the facility has adequate area to hold 27 concrete casks, giving a total capacity for the facility of 108 casks. When a bay is filled, a concrete block wall is constructed across the bay to provide shielding and to close off the bay. When retrieval becomes necessary, the walls will be removed, and the concrete casks will be retrieved.

Environmental monitoring. Each bay contains a sump and a drain system for collection of groundwater or any leakage from the stored casks. The collection system is sampled monthly. Pipe sleeves penetrate various locations in the roof to allow for air sampling.

Permitting status. The facility is currently operating under a RCRA Part B permit.

Facility status. The facility has been in operation since 1979 and will continue to be used until the WHPP becomes operational and the inventory of the RH TRU waste stored in the facility is retrieved for repackaging at the WHPP.

RH TRU Waste Storage Bunker. The RH TRU Waste Storage Bunker Project is a 1989 GPP to provide additional storage capacity of RH TRU waste in concrete casks. The facility will be an earth-sheltered structure similar to the configuration of Building 7855. A front elevation view of a typical RH TRU storage bunker is shown in Fig. 3.7. The bunker will have four bays and a storage capacity of 108 casks; each bay will hold 27 casks. The bunker will be located near the MVST Capacity Increase.

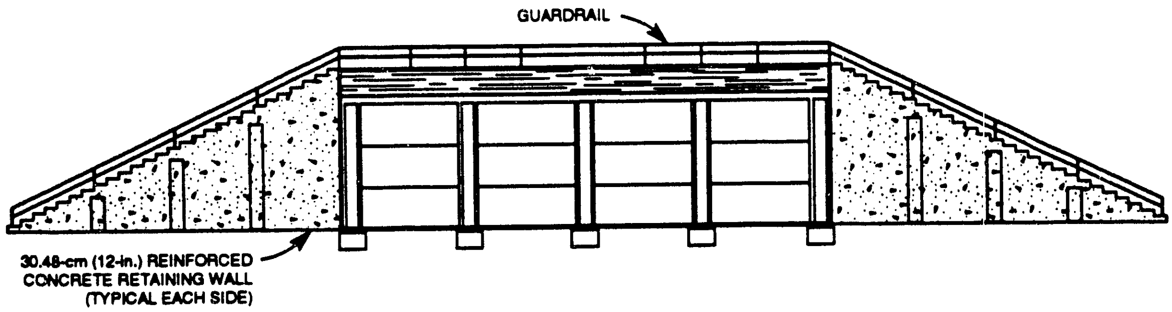

Fig. 3.7. Front elevation view of a typical remote-handled transuranic storage bunker (Building 7883).

Environmental monitoring. The facility will be designed to meet RCRA permitting requirements and all other environmental and personnel monitoring requirements as specified in DOE orders and all other applicable regulations.

Permitting status. The facility is listed on the RCRA Part B permit application. An EA was submitted to meet NEPA requirements.

Facility status. Design was completed and certified for construction in February 1990. Bidding for the project is on hold pending NEPA approval. Construction will begin after the NEPA process is completed.

RH TRU in burial trenches. The location for RH-TRU waste stored in trenches in SWSA 5N is shown in Fig. 3.6. Twenty-seven trenches, used between 1970 and 1979, contain 274 waste containers. The estimated quantity of RH TRU waste buried in this manner is 200 concrete casks. An FY 1996 LI project, Retrieved Cask Storage Bunker, has been proposed to provide storage for these casks.

Environmental monitoring. Monitoring of TRU waste stored in burial trenches is conducted by the routine environmental surveillance program for SWSA 5. Groundwater evaluations are being conducted as a part of ORNL RI/FS activities.

Permitting status. The buried RH TRU waste in the trenches in SWSA 5N was considered to be stored under RCRA interim status. ORNL/DOE have requested that the SWSA 5N trenches be removed from the RCRA interim status permit and have proposed that the trenches be closed under the Comprehensive Environmental Response, Compensation, and Liability Act.

Facility status. RH TRU storage trenches were used between 1970 and 1979. Trenches have not been used for interim storage since the RH TRU bunker (Building 7855) became available in 1979. Planning for the FY 1996 LI project, Retrievable Cask Storage Bunker, will begin in FY 1993.

3.1.1.5 Status of support systems

Training

TRU waste generator training is required for all personnel involved in loading, handling, and examining TRU waste packages prior to being authorized to perform their duties. Specific guidance is given to certifying TRU waste and preparation for CH TRU waste destined for WIPP. The training is conducted on a monthly basis for all generators. The new generator training program presents TRU requirements in tandem with SLLW requirements. Generators of TRU waste are required to attend both SLLW and TRU waste generator training. All personnel who package TRU waste at ORNL are required to complete this course satisfactorily every 2 years, which includes attending the training program and passing a written examination. RCRA training is required annually for personnel involved in handling TRU mixed wastes at ORNL (Subsect. 4.1.6.1).

Certification

The first TRU waste certification plan at ORNL was developed in May 1984. In May 1985 the WIPP Waste Acceptance Criteria Certification Committee (WACCC) audited the ORNL TRU Waste Certification Program. Several items found to be inadequate or deficient resulted in a significant effort at ORNL to correct the problems. In September 1985 a revised certification plan was submitted to the WIPP WACCC.

An internal QA audit of ORNL TRU waste generators and the Waste Certification Program was conducted during December 1990; no major program deficiencies were identified. Subsequently, the WIPP WACCC audited the ORNL TRU Waste Certification Program in February 1991. That audit resulted in the identification of three findings: (1) the need to submit the Quality Assurance (QA) Plan formally to the WACCC, (2) the need to document the RTR verification activity as a "special process," and (3) the need to establish the maintenance of duplicate file points as prescribed by the QA Plan.

Database management

A computer database is currently being used at ORNL to monitor the generation rates of radioactive wastes. The Solid Waste Information Management System (SWIMS) is the repository of information on the generation of both LLW and TRU solid radioactive waste.

3.1.1.6 Update of implementation summary table

Appendix A provides an update to the original implementation summary for management of transuranic waste that was provided in the *Oak Ridge National Laboratory Implementation Plan for DOE Order 5820.2A* issued April 28, 1989. The format in Appendix A duplicates the format of the requirements for the management of TRU waste contained in DOE Order 5820.2A. Many activities planned for achieving compliance with the order are applicable to more than one requirement. To avoid duplication of costs for achieving compliance, cross-referencing between requirements is used extensively. Revisions to the original table are underscored.

The most significant revision to the table occurs under requirement b(1). The TEC for the WHPP has been increased from $200M to $300M, and the project date has been moved from FY 1995 to FY 1996. The increase in TEC is the escalation contributable to the time delay of the project. Other revisions to the table are very minor and reflect, primarily, points of edification.

3.1.1.7 Line item and general plant projects

A listing of proposed LI and GPPs for TRU facilities at ORNL is provided in Table 3.1. This table indicates the project title, TEC, funding type (i.e., DOE program budget code), and the respective fiscal year for funding.

Table 3.1. Line item and general plant projects for transuranic waste facilities at Oak Ridge National Laboratory

Title	TEC[a] ($ × 1,000)	Funding type	Fiscal year
Line item projects			
Waste Handling and Packaging Plant	$300,000	EW	1996
Waste Characterization and Certification Facility	18,000	EX	1994
General plant projects			
Remote-Handled Transuranic Waste Storage Bunker I (Building 7883)		EW	1989
Contact-Handled Transuranic Storage Facility (Building 7572)	1,100	EW	1990
Waste Examination and Assay Facility upgrade (Building 7824)	1,070	EW	1990
Nuclear Fuel Services, Inc., Waste Storage Facility (Building 7574)	1,100	EW	1991
Transuranic Waste Storage Facility (Building 7577)	1,100	EW	1995

[a]Total estimated cost.

3.1.2 Low-Level Waste

LLW is radioactive waste that cannot be classified as HLW, TRU waste, spent nuclear fuel, or a by-product material as defined by DOE Order 5820.2A. In general, LLW contains radionuclides that are beta-gamma emitters with relatively short half-lives. LLW is also characterized as radioactive waste containing less than 100 nCi/g of TRU radionuclides.

3.1.2.1 Strategy

On an annual basis ORNL generates LLW and extremely small volumes of waste containing NARM. Past management practices did not differentiate NARM waste from LLW. According to DOE Order 5820.2A, small volumes of NARM waste can continue to be managed as LLW. However, NARM wastes are regulated by the U.S. Environmental

Protection Agency (EPA). An action plan is under development to address reportable quantities of NARM, and the new WAC will require waste generators to identify and to quantify NARM waste.

Current practice

Currently, LLW is separated primarily for handling purposes to minimize the radiation exposure to operating personnel during treatment, storage, and disposal operations. The LLW segregation categories are presented in Table 3.2.

Table 3.2. Current solid low-level waste segregation categories

Waste type	Description
Contact-handled low-level waste (LLW)	≤200 mrem/h • compactible (plastic, rags, etc.) • noncompactible (metal, wood, etc.) • dewatered sludges
Remote-handled LLW	>200 mrem/h • reactor/hot cell debris • solidified sludges
^{235}U	LLW that contains >1 g ^{235}U per container
Biological	LLW of a biological nature
Asbestos	LLW containing friable asbestos
Suspect	Waste that has no measurable contamination by radiation survey but must be handled as a category of LLW and disposed of in a controlled trench because of its history and the potential for internal, undetectable contamination

Until 1986 all LLW including LLW mixed with hazardous waste (i.e., mixed waste) generated at ORNL was disposed of on-site by shallow land burial generally in unlined trenches and auger holes. SWSA 6, which is the active disposal area at ORNL, has been used for LLW disposal since 1969. Starting in 1984 the practice of shallow land disposal on the Oak Ridge Reservation (ORR) became subject to RCRA regulations. As a result of federal and state regulatory pressure, major changes in the operation of SWSA 6 were initiated in 1986 including (1) the exclusion of all mixed waste from disposal in SWSA 6, (2) the use of greater confinement disposal (GCD) techniques such as concrete silos and lined auger holes for disposal of CH and RH LLW, and (3) the storage of some CH LLW at the K-25 Site and of all mixed waste at ORNL. The current LLW operating strategy at ORNL was initiated in 1986. Because of the disposal practices in SWSA 6 prior to 1986, most of the areas in SWSA 6 are being remediated under the ORR CERCLA Federal Facility Agreement. These remediation activities are coordinated with current waste disposal operations. Because of revised closure plan schedule agreements, plans are now to phase out the GCD below-grade disposal operations in SWSA 6 and to begin closure by December 1993.

LLWDDD Program

In 1986 Energy Systems established the Low-Level Waste Disposal Development and Demonstration (LLWDDD) Program to develop a comprehensive strategy for managing LLW on the ORR. The strategy developed by LLWDDD established "classes" (i.e., Class L-I through L-IV) of disposal technologies for managing on-site generated LLW depending on the specific isotopic composition and concentration in the waste. A draft of the proposed LLWDDD strategy was submitted to the DOE-OR in July 1987. A summary of both the strategy and the implementation plans prepared by Energy Systems installations was prepared and submitted to DOE-OR on December 16, 1988. ORNL was assigned the responsibility for the design and construction of the Class L-II Interim Waste Management Facility (IWMF) and the overall management responsibility for the Tumulus Disposal Demonstration Project (TDDP).

In the implementation of the LLWDDD strategy, a site-specific pathways analysis was going to establish the specific waste concentration limits for the various waste disposal technologies. Class L-III disposal was dropped because of the unproven nature of the disposal technology and uncertainties associated with performance and intruder protection. Storage for Class L-III and Class L-IV was proposed. As previously described in Subsect. 2.1.3.4, the formal LLWDDD Program was phased out in 1989, and the issues and tasks identified by the program were reassigned to various Energy Systems organizations. However, Classes L-I through L-IV continue to be used to designate planned storage or disposal facility types, although formal waste concentration limits will now be based on site-specific radiological performance assessments as required by DOE Order 5820.2A. Figure 3.8 provides the anticipated schedule and the expected duration of the availability of treatment, storage, and disposal facilities for managing ORNL's SLLW.

Performance assessments

DOE Order 5820.2A, Chap. III, requires that each operating LLW disposal facility meet radiological performance objectives:

- to protect public health and safety in accordance with standards specified in environmental health orders and other DOE orders;
- to ensure that external exposure to the wastes and concentrations of radioactive material that may be released into surface water, groundwater, soil, plants, and animals results in an effective dose equivalent that does not exceed 25 mrem/year to a member of the public (releases to the atmosphere should maintain releases of radioactivity in effluents to the general environment as low as reasonably achievable);
- to ensure that the committed effective dose equivalents received by individuals who inadvertently intrude into the facility after loss of active institutional control (i.e., 100 years) will not exceed 100 mrem/year for continuous exposure or 500 mrem for a single acute exposure; and
- to protect groundwater resources consistent with federal, state, and local requirements.

DOE Order 5820.2A requires a site-specific performance assessment (PA) on all new disposal facilities and for any disposal facility that was in operation as of September 26, 1988. The Waste Management and Remedial Action Division (WMRAD) has been

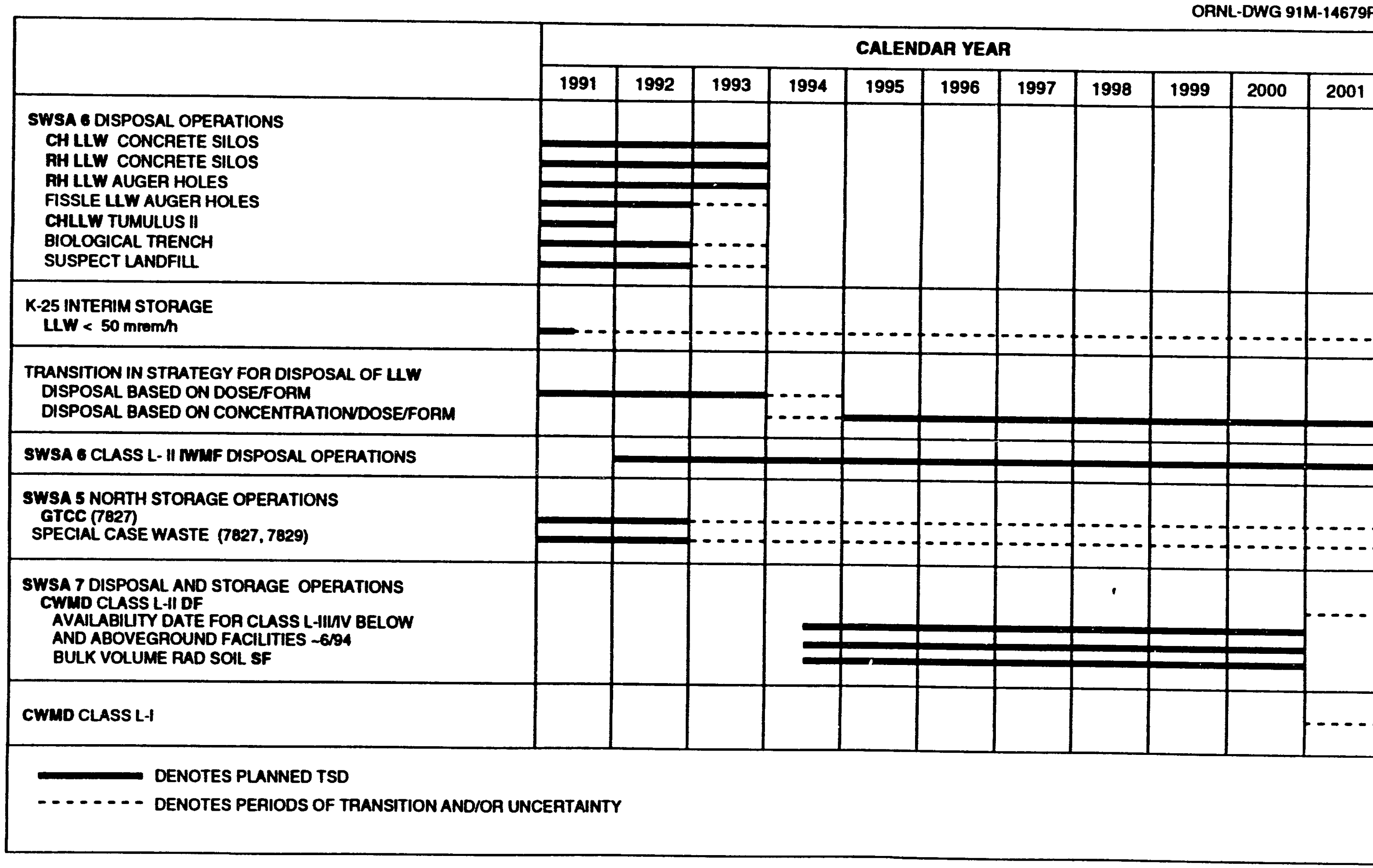

Fig. 3.8. Projected availability of low-level waste storage and disposal facilities.

assigned by the Central Waste Management Division (CWMD) the responsibility for the preparation and the issuance of the radiological PA for SWSA 6.

A preliminary PA was prepared for disposal technologies and active disposal units (as of September 26, 1988) in SWSA 6 and for the Class L-II IWMF located in the southwestern portion of SWSA 6. The draft report was submitted to DOE in September 1990 for review by the DOE Peer Review Panel. The preliminary PA indicated that many of the disposal units in SWSA 6 do not presently meet the performance objectives of DOE Order 5820.2A. Work is ongoing to evaluate the uncertainties and improve the analysis in the PA. A final report will be issued that reflects the resolution of the comments received by the DOE Peer Review Panel. The final PA for SWSA 6 and IWMF is scheduled to be delivered to DOE-OR for submittal to DOE-HQ at the end of FY 1993. The current strategy for managing ORNL LLW is to develop radionuclide concentration limits for the IWMF based on the final results of the PA.

3.1.2.2 Generic description and characteristics of waste

Approximately 812 m^3/year (29,000 ft^3/year) of SLLW is routinely handled at ORNL. The majority of SLLW is CH waste having a radiation level less than 50 mrem/h. As presented in Table 3.2, the various categories of SLLW at ORNL are discussed in the following subsections.

CH LLW

CH LLW is waste that has a radiation dose rate of $\leq$200 mrem/h at the surface of the package and consists of various discarded slightly contaminated debris (i.e., blotter paper, plastic, shoe covers, swipes, glass, wire, metal equipment items) and sludges from the Process Waste Treatment Plant (PWTP).

Compactible CH LLW. Compactible CH LLW usually consists of plastic bags, blotter paper, light gauge metal, and glassware that can be compacted by conventional compaction equipment. Because of the concern with personnel exposure, compactible CH LLW is limited to packages with a surface dose rate less than 200 mrem/h. Most compactible waste has a surface dose rate less than 10 mrem/h. CH LLW that is to be shipped to the K-25 Site for storage is limited to a dose rate no greater than 50 mrem/h. For handling purposes, compactible CH LLW is segregated and collected in separate containers throughout ORNL.

Noncompactible CH LLW. Noncompactible CH LLW generally consists of heavy gauge metal items, wood, and other debris that cannot be compacted by conventional means. Noncompactible CH LLW is segregated and collected in yellow dumpster-type containers.

Dewatered sludges. The principle source of CH LLW sludges is the clarifier at the PWTP. The clarifier is used to soften the incoming feed stream prior to ion exchange and produces a ferrous hydroxide sludge. CH LLW sludges are also generated at the Nonradiological Wastewater Treatment Plant (NRWTP) from metals removal (i.e., clarification) processes.

Biological CH LLW. Biological CH LLW mainly consists of animal excrements and animal bodies or parts that were generated when radionuclides were used in biological research. Also included are large animals (e.g., deer), contaminated trees, vegetation, animal bedding, and sewage sludge from the Sanitary Treatment Plant. The activity of this type of waste is usually very low (i.e., much less than 10 mrem/h).

Asbestos CH LLW. Until the late 1970s, asbestos was used extensively at ORNL for the insulation of pipes. Asbestos waste usually consists of debris generated during maintenance or demolition of contaminated facilities. The radiation levels in asbestos CH LLW is usually very low (i.e., much less than 10 mrem/h).

Suspect CH LLW. Suspect CH LLW usually consists of debris that is generated during the demolition or construction of facilities. Because of the history and location of these facilities, the debris has the potential to be contaminated even though radiation surveys do not reveal contamination.

RH LLW

RH LLW is waste that has a surface dose rate of >200 mrem/h and consists of debris from reactors and hot cell-type operations and solidified sludges from the LLLW System.

Reactors and hot cell debris. This waste consists of various equipment components contaminated with radioactive materials or activation products. Because of its very high radiation level, this waste must be transported in special shielded containers and handled remotely. Activated components from reactors and contaminated equipment items from isotope production hot cells can have very high surface dose rates. RH LLW that has a very high surface dose rate is handled on a case-by-case basis to minimize operator exposure. This type of waste can have surface dose rates up to thousands of rems per hour.

Solidified sludges. Special campaigns for solidification of sludges from the LLLW System will produce an RH LLW.

^{235}U LLW. This type of LLW usually consists of debris from operations where enriched uranium is processed. For criticality and security reasons, RH LLW containing greater than 1 g of ^{235}U is handled and disposed of separately.

3.1.2.3 Treatment facilities

Extensive facilities for the treatment of SLLW do not currently exist and are not planned at ORNL. One LLW treatment facility at ORNL is the waste compaction facility (Building 7831) in SWSA 5N.

Waste Compaction Facility (Building 7831)

Building 7831, located in SWSA 5N, is a metal Butler-type building approximately 12 × 13 m (40 × 43 ft) with a personnel area and a 4.6-m-high (15-ft) compactor area. The compactor area occupies half of the building and houses a box compactor. The box compactor is used to reduce compactible CH LLW waste into 1.2 × 1.2 × 1.8 m (4 × 4 × 6 ft) metal boxes with a compression force of 1750 psi.

Environmental monitoring. Two continuous air monitors are provided to monitor and to alarm airborne activity detected above preset limits. Monitoring of the area for radiation levels (i.e., background, point source, and transferrable) is provided using portable survey instruments during operation.

Permitting status. A RCRA permit is not required for this facility.

Facility status. ORNL intends to continue operating this facility for the foreseeable future.

3.1.2.4 Storage facilities

Interim storage of LLW waste was initiated during 1987 because of the regulatory concern with disposal practices on the ORR and the limited capacity of SWSA 6. Currently, ORNL is utilizing the K-25 Site storage vaults and the LLLW Solidification Cask Storage Area as interim storage facilities. Building 7842 in SWSA 6 has been used as a temporary storage facility for LLW prior to placement on the tumulus pad or for more permanent storage at SWSA 6. The intention is to utilize interim storage only until suitable permanent disposal can be developed. New storage facilities for contaminated soil and other LLW streams are also planned.

Building 7842—SWSA 6 equipment building

This building is used as a staging and a temporary storage area for CH LLW waste awaiting containment in concrete casks for placement on the tumulus pads or storage at the K-25 Site storage vaults. Building 7842, which was originally constructed to store SWSA 6 heavy equipment, is a prefabricated metal structure on a reinforced concrete pad. The building, which is approximately 12 × 24 m (40 × 80 ft), is equipped with electricity and telephone lines.

Environmental monitoring. Portable survey instrumentation is used to monitor radiation levels at this facility.

Permitting status. A RCRA permit is not required.

Facility status. ORNL intends to continue operating this facility for the foreseeable future.

K-25 Site Storage Facility

Some CH LLW is currently stored at the K-25 Site in Buildings K-310-2 and K-310-3, and Vault 31X. The K-25 Site Storage Facility, which can only accommodate CH LLW with a surface dose rate of <50 mrem/h, utilizes the surplus K-25 Site buildings for storage. The first waste stream shipped to the K-25 Site for interim storage was dewatered sludge from the PWTP (Building 3544) in 1986. This waste stream is fairly homogeneous and contains very low radioactivity. The PWTP waste and compactible waste in metal boxes were shipped to the K-25 Site for interim storage until 1991. A shortage of available permitted storage space forced the K-25 Site to stop accepting LLW from ORNL. New vault areas are being prepared and will be placed in service in FY 1992 for hazardous wastes. Additional storage areas for LLW may not be available at the K-25 Site in FY 1992. To date, approximately 2500 drums of LLW and 125 1.2 × 1.2 × 1.8 m (4 × 4 × 6 ft) boxes from ORNL are being stored at the K-25 Site.

Environmental monitoring. Monitoring of the facility is the responsibility of the K-25 Site.

Permitting status. Permitting of the storage facility is the responsibility of the K-25 Site.

Facility status. The facility is expected to be utilized in the future as additional permitted storage capacity is prepared and placed in service.

LLLW Solidification Cask Storage Facility

An interim storage facility for storing solidified waste from the Emergency Avoidance Solidification Campaign (EASC) of 1987 and the current Liquid Waste Solidification Project (LWSP) is located near the NHF. This storage facility was designed specifically for storing the cement-solidified LLW generated during the processing of LLLW.

The solidified waste is contained in interim storage casks that were designed to provide (1) multiple containment barriers for the solidified waste form, (2) adequate shielding for the high-activity waste, and (3) sampling capabilities to monitor for the possible presence of entrained liquids and gases. The casks were fabricated of 0.3-m-thick (1-ft) steel-reinforced concrete with an inner liner of corrosion-resistant synthetic, vinyl ester, fiber-reinforced plastic laminate. Each cask is about 2.7 m (9 ft) in diameter and about 2.7 m (9 ft) high and has a precast waterproof reinforced concrete cask lid 0.3 m (1 ft) thick. A total of 60 casks were used during the EASC campaign.

The storage facility consists of a graveled-pad interim-storage yard. The storage area is approximately 91 × 122 m (300 × 400 ft). A layer of geotextile fabric was placed on top of a cleared and graded soil base. Six inches of crushed limestone was placed directly over the geotextile fabric and capped with an additional layer of compacted crushed limestone. The entire graveled area was sized to accommodate a maximum of about 160 casks. The storage area was enclosed with a chain-link security fence to control personnel entry.

The LWSP began in October 1991 and concluded in February 1992.

Environmental monitoring. The facility is routinely monitored by the Operations TSD Monitoring Program. The casks are monitored for releases of gases or entrained liquids on a routine basis.

Permitting status. The facility is being operated per an agreement with the TDEC that originally limited storage at the site to a maximum of 5 years, (i.e., 1992). A formal request to extend the interim storage period will be made to the TDEC. A RCRA permit is not required for this facility.

Facility status. The facility will be closed as required by agreement with the TDEC.

Bulk Contaminated Soil Storage Facility

A building will be constructed in SWSA 7 to store radioactively contaminated soil generated during construction and maintenance activities at ORNL. This building will be used to store CH soil in metal containers.

The project shall consist of a pre-engineered, single-story metal building approximately 15 × 30 m (50 × 100 ft). It is to be erected on a reinforced concrete floor with curbing and a sump for spill containment and cleanup operations. The storage area will be able to contain 300 1.2 × 1.2 × 1.8 m (4 × 4 × 6 ft) steel boxes stacked two high. The total storage capacity of this area is approximately 8409 m^3 (1100 yd^3) of soil.

Environmental monitoring. The facility will contain radiation alarm systems including alpha and beta/gamma air monitors and personnel monitors.

Permitting status. A RCRA permit is not required.

Facility status. This project is a 1991 GPP with a TEC of $1M. The Functional Requirements Document was issued in February 1991, and the Preliminary Proposal was approved and sent to DOE in August 1991. The project has been on hold pending NEPA determination.

SLLW Staging Facility

A building will be constructed in SWSA 7 for staging and storing SLLW and mixed waste.

Environmental monitoring. The facility will be equipped to meet current and anticipated environmental monitoring requirements.

Permitting status. This will be a RCRA-permitted facility.

Facility status. This project is a proposed 1994 GPP with a TEC of $1.1M.

3.1.2.5 Disposal facilities

ORNL is currently operating SWSA 6 as a disposal site for LLW. This site has been used by ORNL since 1969 for the disposal of on-site generated LLW. ORNL has also been developing SWSA 7 since 1979 as an additional disposal site for LLW. The CWMD is responsible for developing Class L-I and L-II disposal facilities for the ORR.

Future operations at SWSA 6 will gradually phase out below-grade disposal and use only above-grade tumulus disposal. SWSA 7 is the site for several planned storage facilities and possibly Class L-II waste disposal.

SWSA 6

SWSA 6 is located south of Lagoon Road and immediately east of White Wing Road. Development of this 27.2-ha (68-acre) site was started in 1959. An 2.4-m-high (8-ft) chain-link fence with barbed wire outriggers encloses the area. The operational life of SWSA 6, under the current rate of waste generation and improved disposal criteria, is estimated to be through the mid-2000s (see the following subsection). Less than 12 ha (30 acres) of usable land is available in this 27.2-ha (68-acre) tract.

Since 1986, SWSA 6 has utilized a variety of GCD techniques for the disposal of ORNL LLW including the use of below-grade concrete silos and wells and an above-grade tumulus demonstration project. The method of disposal currently used for each waste type disposed of in SWSA 6 is presented in Table 3.3.

Table 3.3. Disposal method for waste currently disposed in Solid Waste Disposal Area 6

Waste type	Disposal method
Contact-handled low-level waste (LLW)	Concrete silos/tumulus
Remote-handled LLW	
• ≤1 rem/h	Concrete silos
• ≤1 rem/h	Double-walled pipe wells, wells in silor
^{235}U (fissile waste)	Lined auger holes
Biological waste	Unlined trenches
Asbestos	Concrete silos
Suspect construction debris	Landfill (<0.25 acre)

The majority of CH and RH LLW being disposed of in SWSA 6 would likely be classified as Class L-II LLW under the former LLWDDD strategy. Waste disposal operations in SWSA 6 can be divided into below-grade and above-grade disposal activities. Plans to phase out the below-grade disposal operations in SWSA 6 over the next several years is currently under way. Details on the specific disposal methods employed in SWSA 6 are discussed in the following sections.

Below-grade disposal. Below-grade disposal methods used in SWSA 6 include concrete silos, wells in silos, double-walled pipe wells, lined auger hole wells, and unlined trenches. All RH LLW waste >1 rem/h is shipped to SWSA 6 in shielded, bottom-unloading casks and disposed of in the various types of wells. The type of well facility utilized largely depends upon the configuration of the waste package. Fissile waste is handled in lined auger holes.

Concrete silos. Concrete silos are used for most CH LLW and some RH LLW (<1 rem/h). These concrete silos are located in separate areas of SWSA 6. A concrete silo is constructed of two 16-gauge, corrugated steel pipes—one 2.4 m (8 ft) in diameter and the other 2.7 m (9 ft) in diameter. The smaller pipe is concentrically placed inside the larger pipe, and both are placed vertically in a trench. The annular space between the two pipes is filled with concrete. The pipes range from 4.3 to 6 m (14 to 20 ft) in length, depending on the depth of the water table at a given location. A wire reinforced, 30.48-cm-thick (12-in.) concrete pad is poured in the bottom of the silo.

The silos are aligned in clusters within the trench. The depth of the trench is always located and dug with its lowest point a minimum of 0.60 m (2 ft) above the maximum water table elevation. A 3-in.-diam polyvinylchloride (PVC) pipe with a bottom cap is used as a monitoring well and placed to the low point of the trench between each silo. A 3-in. PVC monitoring well without a bottom cap is installed inside each silo with the bottom resting on the concrete pad. The bottom 0.60 to 0.91 m (2 to 3 ft) of each monitoring well is slotted to allow collection of liquids for sampling and quarterly monitoring of the hydrological isolation of the silos.

Fill dirt is placed around the silos, leaving the tops of the silos at finish grade. As the fill settles, more fill is added as required to provide water runoff away from the silo. Each silo is identified by a unique number such as TL-XXX (trench/low range). The silo is capped with a 30.48-cm-thick (12-in.) steel-reinforced concrete cap. A sectional view of a typical silo used for CH and RH LLW is shown in Fig. 3.9.

Concrete silos with containment wells. A modified version of the concrete silo described previously is used for the disposal of some RH LLW (>1 rem/h). A concrete silo is constructed in the same manner as for CH LLW. Then 7 to 11 27.94-cm-diam by 6-m-long (20-in. by 20-ft) cast iron pipes are placed vertically in a geometric array within the 2.4-m (8-ft) inside diameter of the concrete silo. The annular space between the outside surface of the cast iron pipes and the inside surface of the concrete silos is filled with concrete. A 30.48 to 45.72-cm (12- to 18-in.) concrete base is poured into each pipe. When the pipes are filled with wastes within 0.91 m (3 ft) of the surface, the remaining volume is capped with poured concrete to seal the well. Each pipe is filled and capped sequentially until the capacity of each pipe within the silo is depleted. A typical section view of the modified concrete silo used for some RH LLW is shown in Fig. 3.10. No limits exist on the amount of radioactive material placed in the well provided the radiation reading over the top of the open well does not exceed 200 mrem/h.

Double-walled pipe wells. Some RH LLW (1 rem/h) contained in 208-L (55-gal) drums is disposed in double-walled pipe wells. These disposal units are constructed of two 11-gauge, corrugated steel drainage pipes 6-m-long (20 ft)—one 91.44 cm (36 in.) in diameter and one 76.20 cm (30 in.) in diameter placed in a drilled auger hole. The 76.20-cm-diam (30-in.) pipe is concentrically placed inside the 91.44-cm-diam (36-in.) pipe with the tops of the pipes at ground level. The bottom of the well is a minimum of 0.60 m (2 ft) above the maximum water table elevation. The space between the two pipes is filled with a concrete grout. A wire-reinforced, 30.48-cm-thick (12-in.) concrete plug is poured in the bottom of the well.

A monitoring well, made from a 7.62-cm-diam (3-in.) PVC pipe and having a bottom cap slotted 1.5 m (5 ft) from the bottom, is placed outside the well to allow collection of liquids for sampling and quarterly monitoring of the hydrological isolation of the wells. Each well is identified by a unique number such as WH-XXX (well/high range).

Only radioactive waste packaged in 208-L (55-gal) drums is placed in the grouted double-pipe well. The maximum radiation reading over the top of an open well shall not exceed 200 mrem/h. No limits exist on the amount of radioactive material placed in the well provided the radiation reading at the top is not exceeded. When the well is filled, it is capped with a 30.48-cm-thick by 121.92-cm-OD (12-in. by 48-in.) concrete collar. After

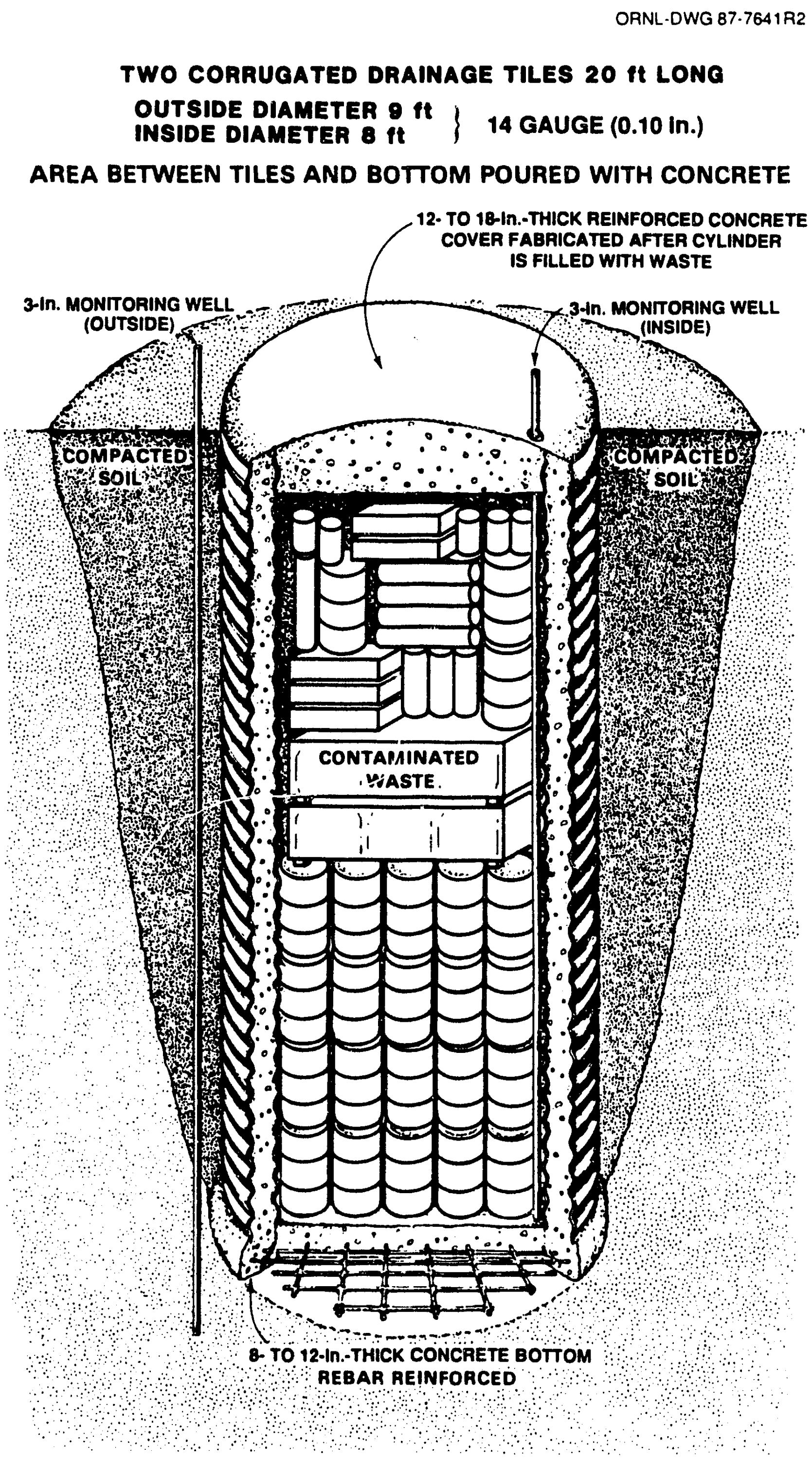

Fig. 3.9. Schematic of concrete silo in Solid Waste Storage Area 6.

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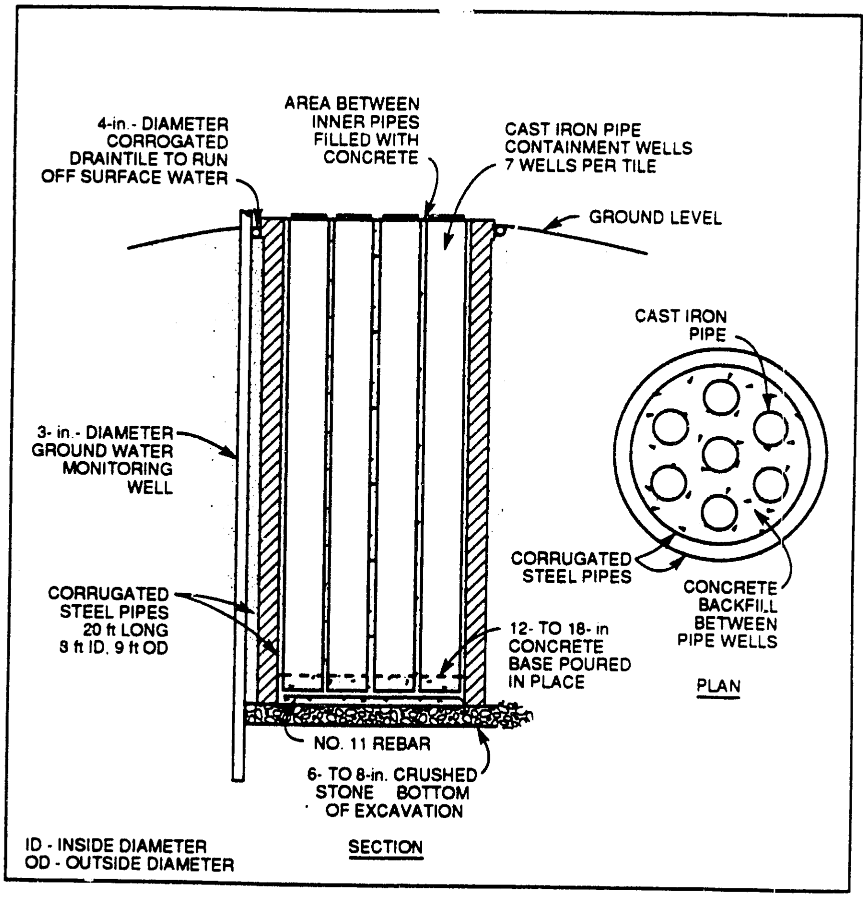

Fig. 3.10. Cross section of concrete silos with containment wells.

closure and capping of the well, the radiation reading over the top of the well must be less than 2.5 mrem/h.

Pipe-lined auger hole wells. Heavy-wall cast iron pipe wells are also used to dispose of some very high activity (>1 rem/h) RH LLW. These wells are constructed of a 3/4-in.-thick cast-iron pipe vertically centered in a drilled auger hole; the surrounding space is backfilled with dirt. The pipes are 6 m (20 ft) long and have an inside diameter of 50.80 cm (20 in.). A 30.48-cm-thick (12-in.) concrete plug is poured in the bottom of the auger hole.

A monitoring well, made from a 7.62-cm (3-in.) PVC pipe having a bottom cap and slotted 0.30 m (1 ft) up from the bottom, is placed outside the well to allow collection of liquids for sampling and quarterly monitoring of the hydrological isolation of the auger hole. Each well is identified by a unique number such as WH-XXX (well/high range). Very high activity (>1 rem/h) RH LLW in waste containers 50.80 cm (20 in.) in diameter are placed in these wells. After an auger hole is filled, the hole is then capped with a 30.48-cm-thick by 121.92-cm-OD (12-in. by 48-in.) concrete collar. After closure and capping of the hole, the radiation reading over the top of the hole must be less than 2.5 mrem/h.

^{235}U fissile waste disposal. Fissile waste is disposed of in lined auger holes. These fissile disposal wells are made from auger holes lined with steel pipe. The wells are located in SWSA 6, grouped together in a location just south of the main SWSA 6 road as it approaches Building 7842. Fissile wells are identified by a number such as WF-XXX (well/fissile). The fissile disposal wells are spaced so that a minimum of 0.91 m (3 ft) of earth exists between sides of adjacent wells. Each fissile disposal well consists of a heavy-wall (3/4-in.-thick) steel pipe centered vertically in an auger hole and with the top at ground level. The pipe is normally 6 m (20 ft) long with a 76.20-cm (30-in.) ID; dirt backfilling is around the outside of the pipe. A bottom cap of at least 30.48 cm (12 in.) of concrete is poured in the bottom. All below-grade fissile disposal wells are constructed with their lowest point a minimum of 0.6 m (2 ft) above the maximum known water table elevation. When the fissile disposal well is filled, it is capped with a 30.48-cm-thick by 121.92-cm-OD (12-in. by 48-in.) concrete collar.

Trench disposal. Biological waste (i.e., deer carcasses, mouse bedding, etc.) is disposed of in trenches that are nominally 3 × 15 m (10 × 50 ft); the depth varies depending on the water table elevation. The lowest point in the trench is at least 0.60 m (2 ft) above the known maximum water table elevation. Spacing between adjacent trenches is at least 1.5 m (5 ft). The trench is graded to slope to one end at a rate of approximately 0.5 in./ft. Trenches are separately located from other waste disposal sites. Each trench is identified by a unique number such as TB-XXX (trench/biological). Surface water drainage is controlled by separate ditching around the trench that conforms to existing topographic conditions. The ditching is compatible with the overall drainage network of the waste area regardless of whether the trench is on standby, in use, or closed.

The trenches are located and oriented to utilize the most efficient and practical land usage. The trenches are sized and sectioned by removable steel plates to improve efficiency of land usage and to prevent trench sidewall collapse. In the event that, because of unplanned variance in the water table, the excavation falls below the water table, the trench is backfilled with Conasauga shale to a depth of at least 0.60 m (2 ft) above the maximum water table.

Only biological waste is placed in the trenches. After the waste is placed in the trench, it is covered with at least 0.91 m (3 ft) of earth cover. When the trench is filled, the surface of the closed trench is planted with grass, mowed, and kept free of trees.

Asbestos waste disposal. Contaminated asbestos wastes are disposed of in dedicated concrete silos. The concrete silos are constructed as described in this subsection.

Suspect waste disposal. Suspect waste material, which registers no external radiation but cannot be certified as free of contamination, is shredded and/or disposed of in the northeast area of SWSA 6. The waste is covered with soil. The disposal area covers approximately 0.10 ha (0.25 acre) and is an open landfill-type site. Only waste classified as suspect waste is disposed of in this area.

Above-grade tumulus disposal. Above-grade tumulus disposal is the preferred method for disposal of LLW in SWSA 6. Tumuli I and II were used for the disposal of LLW in SWSA 6 from April 1988 through December 1991. Use of the Class L-II IWMF for LLW disposal in SWSA 6 began in late 1991 and will continue until new CWMD disposal facilities are operational. The site layout of SWSA 6 showing the location of tumulus disposal is shown in Fig. 3.11.

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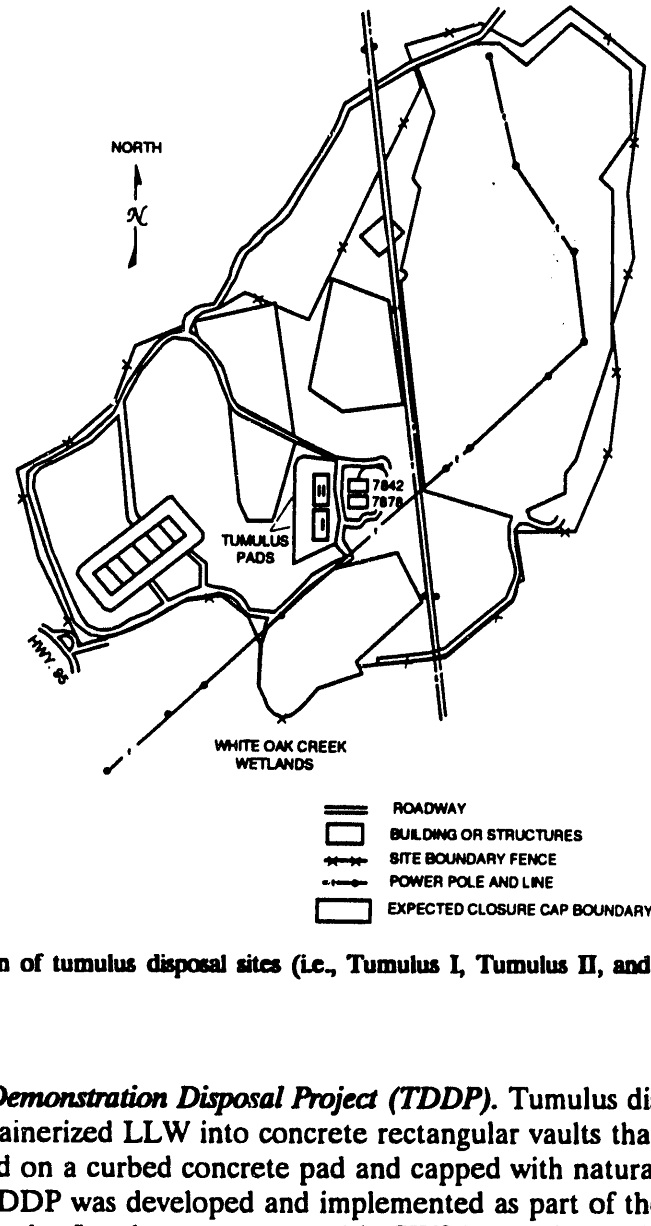


Fig. 3.11. Location of tumulus disposal sites (i.e., Tumulus I, Tumulus II, and Class L-II Interim Waste

Tumulus Demonstration Disposal Project (TDDP). Tumulus disposal involves the placement of containerized LLW into concrete rectangular vaults that are subsequently loaded and stacked on a curbed concrete pad and capped with natural materials (Fig. 3.12). The TDDP was developed and implemented as part of the former LLWDDD Program. The Tumulus I pad was constructed in SWSA 6 during early 1987. Actual loading of concrete vaults onto the pad began in April 1988. The Tumulus I pad was filled to capacity in June 1990, and a plastic cover was installed over the entire assembly. A total of 290 vaults [approximately 784 m^3 (28,000 ft^3)] were placed on the Tumulus I pad.

The Tumulus I pad is approximately 19.8 × 32 m (65 × 105 ft). The pad was constructed using high-strength (6000 psi) concrete and reinforced using epoxy-coated rebar. The concrete pad varies in thickness from 20.32 cm (8 in.) at the center to 40.64 cm (16 in.) along the perimeter of the pad. The pad has a concrete curb 15.24 cm (6 in.) high

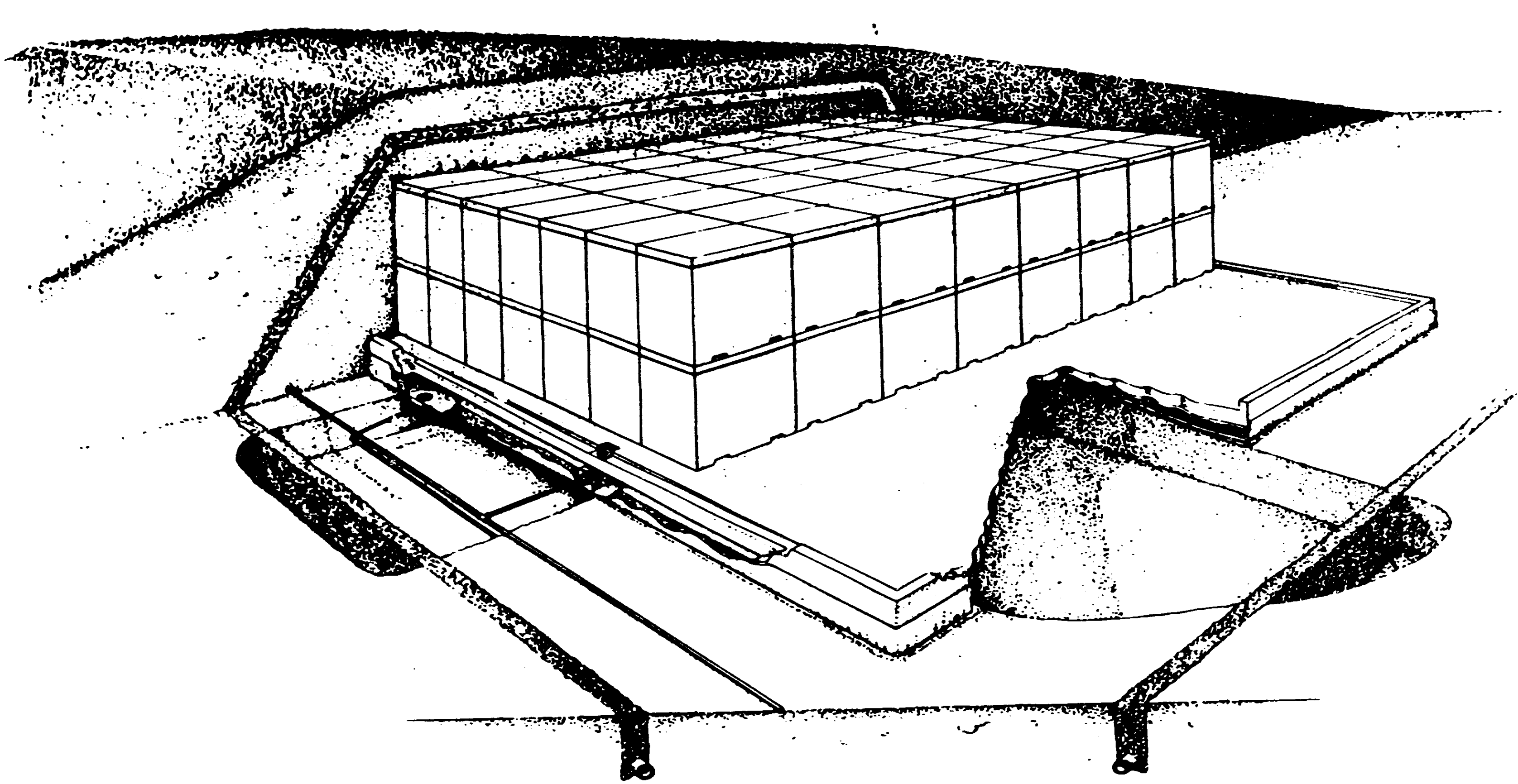


Fig. 3.12. Tumulus Disposal Demonstration Project showing casks of low-level waste, drain lines, and final cover.

along the entire perimeter. Surface drainage channels were constructed north, east, and south of the pad to divert surface runoff away from the pad.

The concrete vaults that are loaded and stacked on the concrete pad are designed to be used as structurally stable overpacks for containerized LLW. The concrete vaults' outer dimensions are 2.39 m (7 ft 10 in.) long; an inner cavity is sized to receive a standard box 1.2 × 1.8 × 1.2 m (4 × 6 × 4 ft) and to leave a 10.16-cm (4-in.) annular space. After the containerized solid LLW is placed in the vault, the annular space is filled with concrete, and a precast concrete lid is placed on the vault and sealed with bitumen. The loaded and sealed concrete casks are subsequently placed and stacked on the tumulus pad in rows abutting each other.

Tumulus II disposal. The Tumulus II pad began operation in October 1990 and was filled to capacity in late 1991. Prior to the operation of the Class L-II IWMF in the southwestern portion of SWSA 6, a total of 220 vaults were placed on the Tumulus II pad.

The Tumulus II pad is located on an approximately 0.40-ha (1-acre) site just north of the Tumulus I pad (Fig. 3.11). The tumulus pad is approximately 18.2 × 27.4 m (60 × 90 ft) and is 30.48 cm (12 in.) thick. The pad was constructed of high-density concrete and reinforced with epoxy-coated steel. The pad has concrete curbs 0.30 m (1 ft) high on the south, east, and west sides. The north side does not have a curb and was used for vehicle access during cask unloading operations. The loading area was adjacent to the north side of the pad and was constructed of crushed stone. Surface drainage channels are constructed north and east of the pad. These channels are connected to the existing surface drainage channels for Tumulus I.

Class L-II IWMF. The first phase of Class L-II IWMF was completed in FY 1992. The disposal capacity of the IWMF is anticipated to be extended with additional pads to be constructed depending on the waste generation rate and development of new Class L-II disposal facilities.

The Class L-II IWMF occupies an area of approximately 3.8 ha (9.5 acres) in the southwest portion of SWSA 6. Construction will continue over a period of 5 to 6 years, at which time the project is expected to be complete. The first phase will include the construction of two tumulus pads, a loading area, surface drainage channels, under- and surface-pad drainage systems, a monitoring/transfer station, and the required utilities. When the disposal capacity of the first pad is depleted, construction of the third pad will be initiated. This process will continue until six pads have been constructed—utilizing the maximum capacity of the site. Each tumulus pad will be approximately 18.2 × 27.4 m (60 × 90 ft) and 30.48 cm (12 in.) thick. The pads will be constructed using high-density concrete and reinforced with epoxy-coated steel.

Environmental Monitoring. Currently, various environmental programs at ORNL monitor the performance of operational LLW disposal facilities to conform with DOE Order 5484.1 and to meet the requirements of DOE Order 5820.2A. All LLW facilities becoming operational after September 1988 shall have monitoring programs meeting the requirement of DOE Order 5820.2A.

The entire environmental monitoring program at ORNL is undergoing review and will culminate in an Environmental Monitoring Plan (EMP) meeting the requirements of DOE Order 5400.1. The EMP will cover all activities at ORNL, not just those related to LLW. The EMP and its associated program will coordinate all environmental monitoring and surveillance activities at ORNL (1) to ensure compliance with all federal, state, and DOE requirements for the prevention, control, and abatement of environmental pollution; (2) to assess facility performance; (3) to monitor the adequacy of containment and effluent controls; and (4) to assess impacts of releases from ORNL facilities on the environment. As a result, ORNL's plan for compliance with DOE Order 5400.1 implicitly ensures compliance with the environmental monitoring requirement for DOE Order 5820.2A.

The specific features of the environmental monitoring program for active disposal facilities in SWSA 6 can be divided into below- and above-grade disposal. In both types of disposal, ground and surface water is the principal pathway of concern.

Below-grade disposal. The main element of the EMP for below-grade disposal facilities is the quarterly sampling of groundwater monitoring wells. Currently, all the GCD units (e.g., concrete silos) have monitoring wells directly adjacent to the individual disposal units. In the concrete silos, monitoring wells were also placed directly in the waste cells as well as adjacent to the units. The detection of any contamination in the wells directly adjacent to a disposal unit will provide an early warning of the potential for groundwater contamination and allow time to apply remedial measures.

Above-grade tumulus disposal. One of the principal features of tumulus disposal is the inherent capability for monitoring ground and surface water for contamination. These features are illustrated in the design of the Tumulus I pad in which the sealed concrete pad is the primary barrier from the groundwater. The pad is sloped 1% to one side where a curb and gutter collects all surface pad runoff and drains the water to a monitoring station. A liner below the pad provides a secondary barrier from the groundwater and collects any water that may have penetrated the pad. Any water collected in the secondary barrier is also diverted to the monitoring station. The monitoring station is equipped for receiving, monitoring, and collecting samples from flows received from both the surface pad drain and under-pad liner drain systems.

Permitting status. SWSA 6, which has both active and inactive disposal units, is currently operating under the ORR CERCLA FFA. Closure activities in SWSA 6 under RCRA are expected to occur during 1994 through 1997 depending on the number and complexity of corrective measures implemented. Closure activities are not expected to affect the operation of the IWMF in the southwestern portion of SWSA 6. Closure of the IWMF will occur under a separate closure plan.

An ORR EIS for all waste activities is currently being prepared. This EIS will specifically address the Class L-I and L-II disposal facilities being planned by the CWMD. Potential sites in the ORR are being evaluated for the Class L-I disposal facility. The one site within the ORR being evaluated for the Class L-II disposal facility is SWSA 7.

SWSA 7

SWSA 7 is an ORNL site that has been under development since 1979 for the disposal of LLW. The site is located to the east of SWSA 6 in an area east of the High Flux Isotope Reactor (HFIR) (Fig. 3.13). The site is relatively hilly and has only about 6.8 ha (17 acres) of usable space. SWSA 7 is also the proposed site of several planned TRU waste and LLW storage facilities as well as the planned site for the CWMD Class L-II tumulus disposal facility.

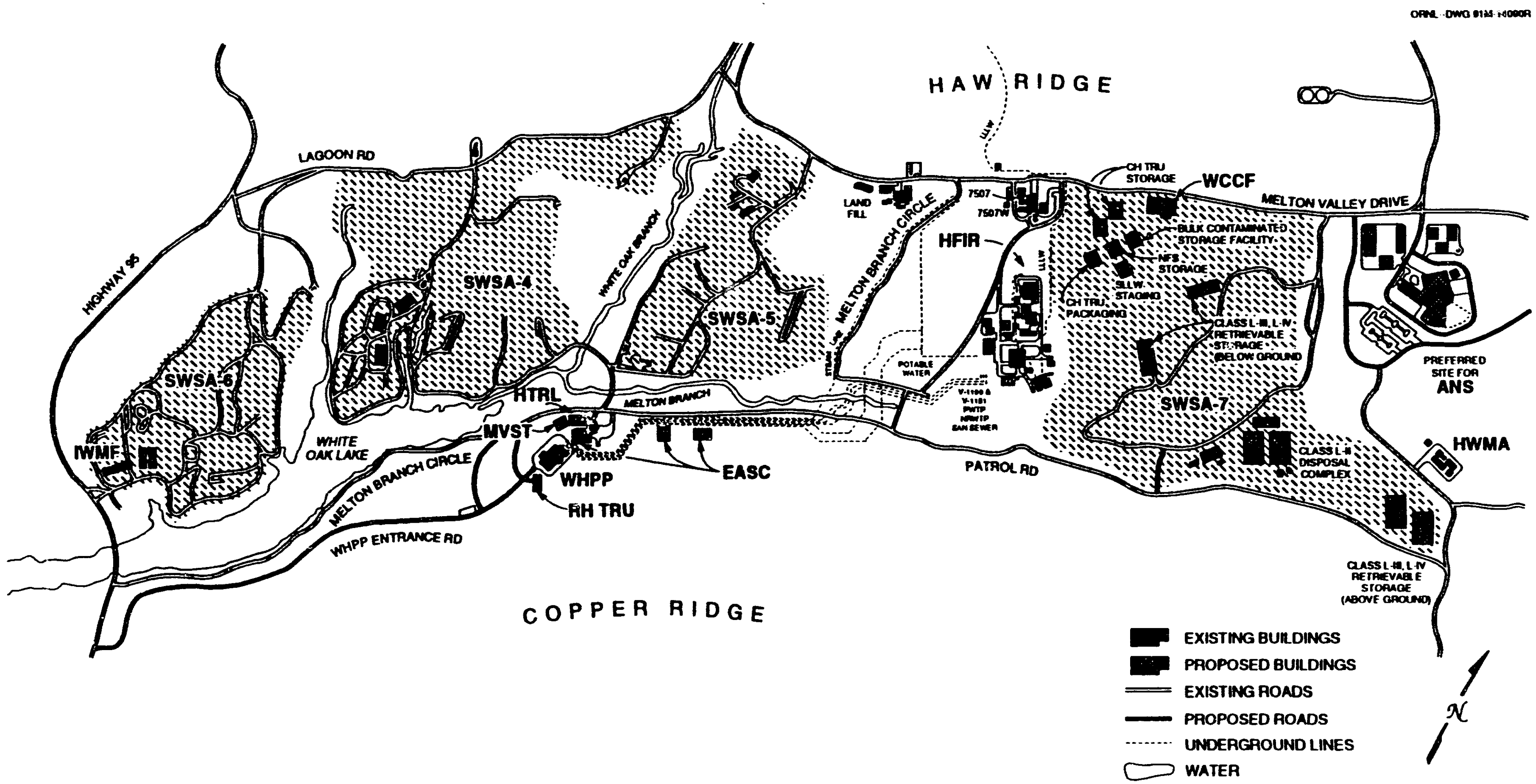


Fig. 3.13. Location of waste disposal sites at Oak Ridge National Laboratory.

CWMD Class L-II Disposal Facility

Candidate sites for the new Class L-II DF originally included West Bear Creek Valley and SWSA 7. The preferred site was West Bear Creek Valley; however, that site now seems unavailable. Conceptually, the Class L-II DF will consist of groups of tumulus pads abutted *en echelon*. The tumulus pads and performance monitoring systems will be designed and constructed in a nearly identical manner as those for the IWMF. The IWMF, while creating disposal capacity for ORNL during 1992–1996, will also serve as a prototype for the Class L-II DF. The Class L-II DF will have ancillary facilities similar to those for the Class L-I DF. These facilities will include an administration building, a heavy equipment storage building, a waste-staging and stabilization facility, and a guard portal.

The CWMD Class L-II DF was anticipated to be operational by the end of 1996. Delays in the preparation of NEPA documentation have deferred the LI project to FY 1994. In FY 1991 the preferred site for the facility was taken away by the Nuclear Weapons Reconfiguration Site (Complex 21) project planning. Now the Class L-II DF is planned for the alternate site in SWSA 7. The current plan is to build a 20-year facility in SWSA 7 that would be operational in 2000. However, the SWSA 7 site is small and has a complex topography. If a suitable area cannot be found in SWSA 7, a new site will be needed. No other suitable sites appear to be available on the ORR, and off-site disposal at a DOE or commercial disposal facility may ultimately be required.

3.1.2.6 Status of support systems

Training

The "Radioactive Solid Waste Generator Certification Training" is required for waste generators at ORNL to allow for disposal of that waste material through the Radioactive Waste Operations Group. The course covers ORNL's classifications of waste, identification of materials that should not be included in solid LLW, and the proper completion and use of appropriate forms (e.g., Log-in Data Sheet, Request for Storage, or Disposal of Radioactive Solid Waste or Special Materials).

Certification

A draft SLLW certification program was developed in September 1990 to meet the requirements of DOE Order 5820.2A. Implementation of the program is currently under way. Certification demonstration projects currently under way at ORNL are discussed in Subsect. 8.7 of this plan.

Database management

SWIMS is the database for both LLW and TRU solid radioactive waste. ORNL manages and administers this database and provides input to the national SWIMS.

3.1.2.7 Update of implementation summary table

Appendix A provides an update to the original implementation summary for management of LLW that was provided in the *Oak Ridge National Laboratory*

Implementation Plan for DOE Order 5820.2A issued April 28, 1989. The format in Appendix A duplicates the format of the requirements for the management of LLW contained in DOE Order 5820.2A. Many activities planned for achieving compliance with the order are applicable to more than one requirement. To avoid duplication of costs for achieving compliance, cross-referencing between requirements is used extensively. Revisions to the original table are underscored.

The most significant revision to the table results from the deletion of LLWDDD Program activities. As explained in Subsect. 2.1.3.5 of this plan, tasks originally assigned to the LLWDDD Program (for achieving compliance with the DOE Order 5820.2A) have been reassigned to the appropriate Energy Systems installations. The change in total cost in this table, as a result of this shift in strategy, does not reflect a reduction in cost but rather a redistribution of costs between all Energy Systems installations. Other revisions to the table are minor and reflect points of edification and/or slight changes in strategic planning.

3.1.2.8 General plant projects

A listing of proposed GPPs for SLLW facilities at ORNL is provided in Table 3.4. This table indicates the project title, TEC, funding type (i.e., DOE program budget code), and the respective fiscal year for funding.

Table 3.4. General plant projects for solid low-level waste facilities at Oak Ridge National Laboratory

Title	TEC[a] ($ × 1000)	Funding type	Fiscal year
IWMF[b]	1100	EW	1989
SWSA 6 improvements[c]	309	EW	1990
Bulk Contaminated Soil Facility	1000	EW	1991
Solid Low-Level Waste Staging Facility	1100	EW	1994
IWMF upgrade	500	EW	1995
Verification Facility	1000	EX	1995

[a]Total estimated cost.
[b]Interim Waste Management Facility.
[c]Solid Waste Storage Area.

3.1.3 Special-Case Wastes

With the issuance of DOE Order 5820.2A, DOE enacted a comprehensive plan for managing radioactive wastes at all DOE facilities. Three major categories of radioactive waste (i.e., HLW, LLW, and TRU waste) were key features around which the DOE order was developed. However, not all wastes fit the criteria of the three major radioactive waste types. These wastes may have some characteristics of one or more of the major waste types; however, they may also have additional characteristics that prevent them from being managed as typical HLW, LLW, or TRU waste. Because of these characteristics, such wastes are potential problems to generators, handlers, and disposal facility operators. DOE has termed these SC wastes. SC wastes do not fit into typical management plans for the three major waste types and may therefore require special management and disposal schemes.

Six categories of special case waste and one category of special interest DOE-owned materials have been identified for management as SC waste: (1) performance assessment limiting (PAL); (2) greater than Class C (GTCC); (3) uncertified or uncharacterized (UC); (4) high-level incidental waste (HLI); (5) noncertifiable, nontransportable TRU waste; and (6) commercially held, DOE-owned radioactive material (COM). ORNL has been asked to identify SC wastes or potential waste materials that may fall within these six categories and, if possible, to provide detailed characterizations of each category of waste.

3.1.3.1 Strategy

Under the former LLWDDD Program at ORNL, the development of waste management strategies for waste not suitable for on-site disposal because of PA limitations had been the principal consideration for SC waste. The LLWDDD Class L-III and L-IV wastes are SC PAL wastes and would include SC GTCC and SC HLI as subsets of Class L-IV waste.

The exact segregation, storage, and disposal requirements for various categories of SC waste at ORNL have not been determined. Information on SC waste is intended as a guide to determine the magnitude of any particular problem wastes and to assist in long-term management planning. Buried wastes are also of interest. If candidate SC wastes have already been disposed of, then funds may need to be identified for PAs, and management strategies may need to be developed to assess the potential need for removing these wastes to more suitable locations.

Facilities suitable for the disposal of waste meeting the SC waste definitions will not be available until well beyond the year 2000. Storage facilities must be developed to store this waste in an environmentally acceptable manner until suitable disposal facilities are available.

3.1.3.2 Generic description and characteristics of waste

SC waste is a waste category recently identified by DOE and includes waste not suitable for on-site disposal. Plans for managing SC waste are currently being formulated.

SC PAL

Most SC PAL waste at ORNL would fall into the LLWDDD Class L-III and L-IV waste classes. The Class L-III designation is primarily for those isotopes having long half-lives or those isotopes with intermediate half-lives that are environmentally mobile. The isotopes of uranium account for most of the volume of waste falling within the Class L-III limits. Other isotopes comprising the Class L-III designation include those of Th, Np, Am, Be, C, Zr, Pu, and Tc. ORNL currently generates less than 93 m^3/year (1000 ft^3) of Class L-III waste.

The Class L-IV waste designation applies to isotopes having both short and long half-lives. Isotopic concentrations in waste exceeding either the Class L-II limits (or depending on the isotope, the Class L-III limits) will prohibit the disposal of that waste on the ORR. Currently, ORNL generates about 300 m^3/year (10,000 ft^3) of waste that would be classified as L-IV waste.

SC GTCC

ORNL SC GTCC waste is a subset of Class L-IV waste and would largely consist of small quantities of highly radioactive waste such as discarded isotope sources and activated parts from reactors. SC GTCC waste containing high-curie loadings require special packaging, transport, and handling capabilities as well as unique storage facilities. The characteristics and quantities of the ORNL waste in the SC GTCC category have not been determined.

SC UC

ORNL has waste of this type, and most of this waste will fall into the Class L-III/IV PAL category. The characteristics and quantities of ORNL waste in the SC UC category have not been determined.

SC HLI

ORNL has a small quantity of SC HLI waste in SWSA 5 storage wells that will fall into this category. This waste mainly consists of reactor fuel samples from reactors and irradiation tests, is highly radioactive, and must be handled and transported in shielded containers.

SC TRU

SC TRU waste largely consists of large equipment items that existing or planned facilities cannot process for certification to the WIPP WAC. Currently, ORNL has a very small quantity of waste in this category; however, future D&D operations may produce significant quantities of this SC TRU.

SC COM

ORNL submitted a draft action plan to DOE-HQ for managing limited volumes of COM for DOE in December 1989. The plan addressed storage of 31 PuBe sealed sources currently held by universities. DOE Headquarters (DOE-HQ) has not pursued storage of the sources at ORNL; thus ORNL does not anticipate storing any SC COM at this time.

3.1.3.3 Treatment facilities

No specific treatment facilities exist or are currently being planned for ORNL's SC waste. Various existing and planned facilities can probably be used for treating some SC waste; however, these have yet to be identified. Additional treatment facilities may be required in the future.

3.1.3.4 Storage facilities

A portion of SC waste is stored in Buildings 7827 and 7829 in SWSA 5N. Planned SC waste storage projects include two Class L-III/IV Below-Ground Storage Facilities, two Class L-III/IV Aboveground Storage Facilities, and the Dry Cask Storage Facility.

Building 7827 shielded dry well

This facility is located in SWSA 5N and provides retrievable storage of SC waste. Building 7827, a two-section structure built in the ground, consists of 30 stainless steel-lined wells in one section and 24 stainless steel-lined wells in the other section. The bottom of each well cavity is sealed with a welded plug.

Section 1 wells are either 20.32, 40.64, or 76.20 cm (8, 16, or 30 in.) in diameter: 15 wells are 3 m (10 ft) deep; the other 15 wells are 4.6 m (15 ft) deep. Section 2 wells are all 20.32 cm (8 in.) in diameter and 4.6 m (15 ft) deep. A 0.91-m-thick (3-ft) stepped concrete plug is provided as a cover for each well.

The waste is contained within sealed metal capsules inside a well cavity. Environmental monitoring consists of routine radiation monitoring of the area. The waste is isolated from the groundwater by the closed-bottom well and its waste container.

One 20.32-cm (8-in.) well and one 76.20-cm (30-in.) well remain in this facility. The latter well has been designated for storage of SC HLI waste from the ORNL HFIR.

Building 7829 shielded dry well

This facility is located adjacent to Building 7827 and provides retrievable storage of SC waste. Currently, only nuclear fuel materials from the Peach Bottom Reactor are stored in this facility. Building 7829 is similar in design to Building 7827 with the following exceptions: (1) the facility consists of only one section containing 10 wells, and (2) all 10 wells are 30.48 cm (12 in.) in diameter by 4.6 m (15 ft) deep. One empty well remains in this facility.

Class L-III and L-IV Below-Ground Storage Facility

A new facility is planned for interim storage of Class L-III/IV RH waste. The facility will consist of several below-grade, concrete vaults having multiple 4.6-m-deep (15-ft) storage wells in each vault. Each storage well will have a removable carbon-steel, double-wall liner. Shielding will be designed to reduce the dose rate at exposed surfaces to <2.5 mrem/h. Each storage unit will be constructed so that the waste can be retrieved for future treatment or disposal. The facility will be designed so that additional vaults can be constructed as needed.

Environmental monitoring. Each liner will be designed so that the annular space in the double-wall liner can be monitored to detect leakage of the insert.

Permitting status. The facility will be permitted under RCRA to store mixed waste. An EA is being prepared.

Facility status. The Class L-III amd L-IV Retrievable Storage Facility is a 1991 GPP having a TEC of $1.1M. The facility will be located in SWSA 7 and will initially consist of four storage units (32 wells). The design criteria was approved in June 1991. Design is on hold waiting approval of NEPA documentation. Additional storage units will be added as necessary. An expansion to the facility is planned as a 1993 GPP.

Class L-III and L-IV Aboveground Storage Facility

A new waste storage facility is planned for storing Class L-III and L-IV CH waste. Conceptually, this facility will consist of several graveled benches cut in a hillside on the southern slopes of SWSA 7. Each bench will accommodate 96 casks or 30 above-grade concrete vaults. Each concrete storage module will provide sufficient shielding to reduce the dose rate at exposed surfaces to <10 mrem/h. Each module will be constructed for long-term storage and future retrievability of the waste.

Environmental monitoring. Each concrete module will contain an internal cavity for collecting and analyzing any liquids that might be present in the module.

Permitting status. The facility will be designed and constructed to meet RCRA requirements but is not expected to receive mixed wastes. An EA is being prepared.

Facility status. The Class L-III and L-IV Aboveground Facility is a 1992 GPP having a TEC of $500K. The Functional Requirements Document was approved in October 1990. The preliminary proposal was issued, approved, and sent to DOE-OR in August 1991. A second aboveground facility is planned as a 1994 GPP.

Dry Cask Storage Facility

This facility will be designed to handle very high activity waste, such as HLI waste and reactor components. The configuration or planned location have yet to be identified. Conceptual planning of the facility will begin in late FY 1992. The facility is projected as an out-year LI project having a cost estimate of $25M.

3.1.3.5 Disposal facilities

No disposal facilities are planned for SC case wastes.

3.1.3.6 Status of support systems

See Subsect. 3.1.2.6 for training and certification requirements.

Line item and general plant projects

A listing of proposed LI and GPPs for SC waste facilities at ORNL is provided in Table 3.5. This table indicates the project title, TEC, funding type (i.e., DOE program budget code), and the respective fiscal year for funding.

Table 3.5. Line items and general plant projects for special case waste and SLLW facilities at Oak Ridge National Laboratory

Title	TEC[a] ($ × 1,000)	Funding type	Fiscal year
Line item projects			
Dry Cask Storage Facility	$25,000	EW	*b*
General plant projects			
Class L-III and IV Retrievable Storage Facilities	1,100	EW	1991
Class L-III and IV Aboveground Storage Facility	500	EW	1992
Class L-III and IV Retrievable Storage Facilities	1,050	EW	1993
SWSA 7 Aboveground Storage Facility	1100	EW	1994

[a]Total estimated cost.
[b]Out year; actual fiscal year not yet determined but will be beyond FY 1996.

3.2 LIQUID WASTE

ORNL employs two systems for handling and processing liquids that contain radioactive constituents: the LLLW System and the Process Waste System (PWS). The LLLW System handles waste solutions with a significant amount of radioactivity including waste streams originating from hot sinks and drains in R&D facilities and from other facilities such as nuclear reactors and the concentrate from the PWTP (Building 3544). The Process Waste System (PWS) handles all liquid waste that contains trace amounts of radioactivity, heavy metals, and organics or that has the potential to be contaminated with these constituents.

3.2.1 Strategy

An overview of the program strategy for LLLW, process waste, and area sources is depicted in Fig. 3.14. Figure 3.15 summarizes both the existing and proposed facilities and actions, the details of which are described separately later. The functional areas used for strategy development are outlined in the left column: generation, waste transfer/operational monitoring control, waste collection, waste treatment, waste disposal/discharge, and environmental monitoring/permitting.

The LLLW System and the PWS treat contributions from generators, surface water, and groundwater. Strategy is being developed to meet the objectives of improved control of contaminated surface water and groundwater as well as to improve control of processes that generate waste. Linkages between the liquid waste systems are being modified to improve system operations and to better meet regulatory requirements.

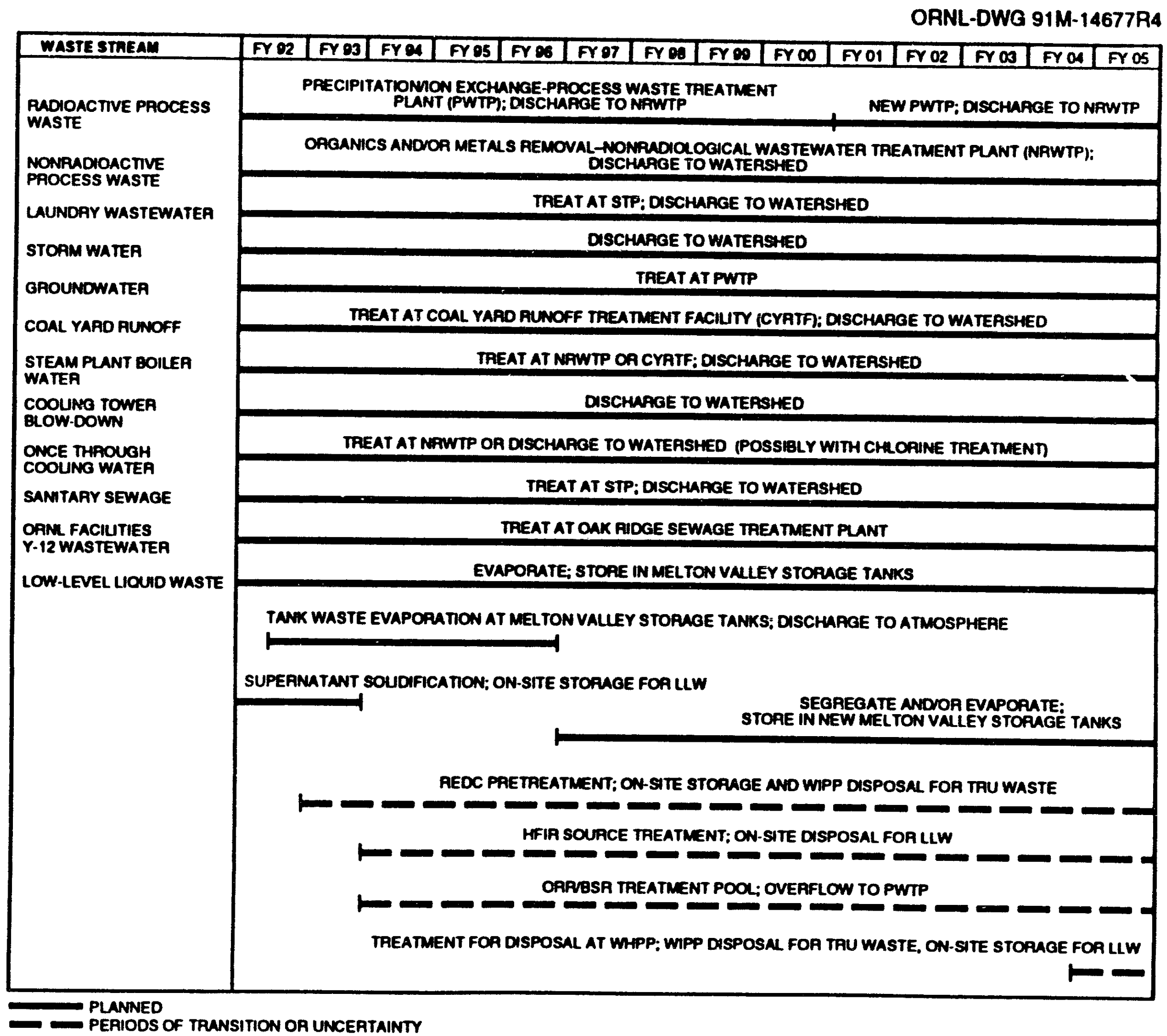


Fig. 3.14. Liquid waste management strategy.

ORNL-DWG 91M-14041R

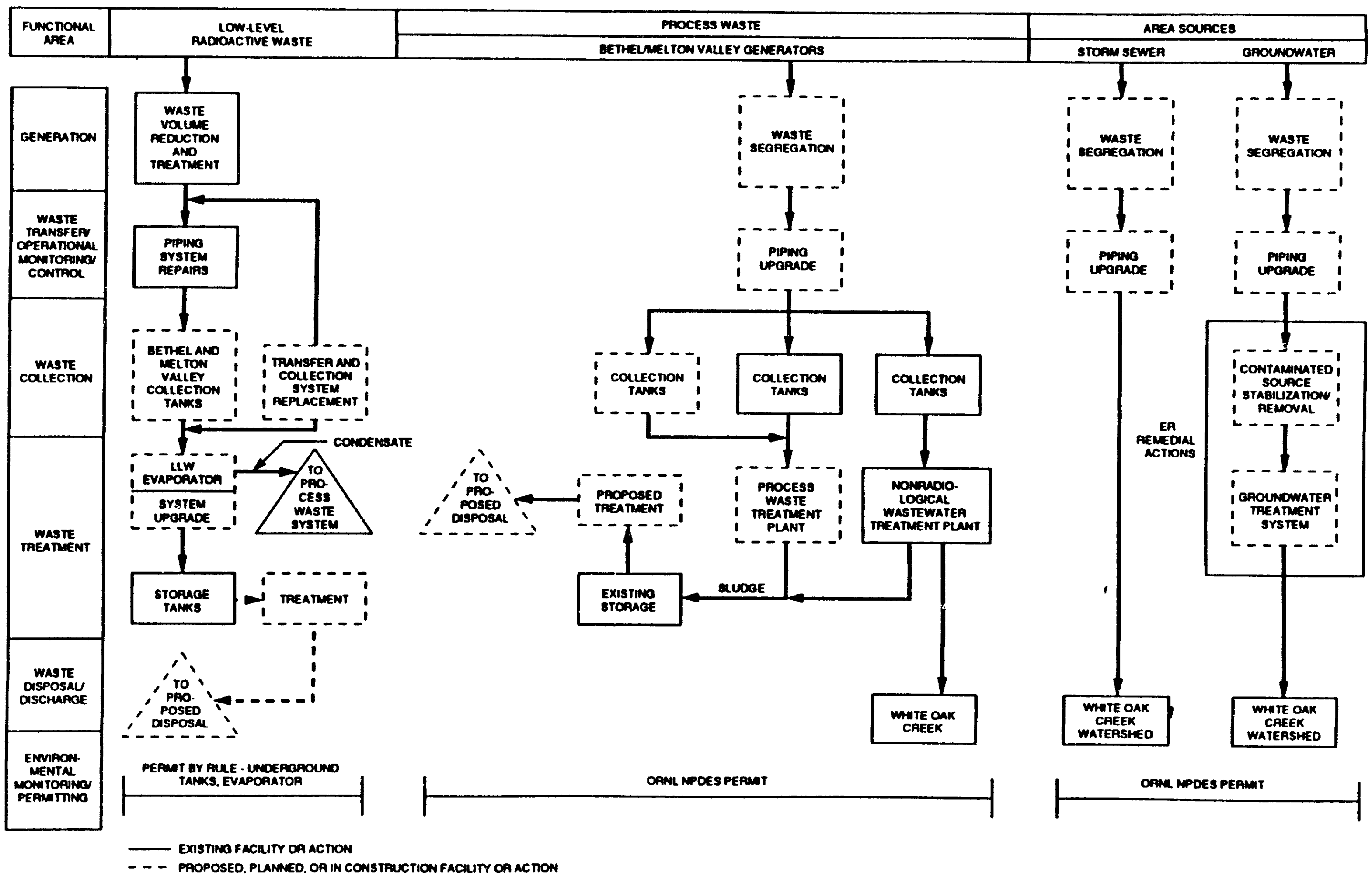


Fig. 3.15. Existing and proposed facilities for LLLW, process waste, and area sources.

3.2.2 Liquid Low-Level Waste System

The LLLW System is an assemblage of tanks, associated transfer pipelines, and ancillary equipment (e.g., pumps and evaporators) designed for collecting, neutralizing, concentrating, and storing wastes prior to disposal. The bulk of the LLLW tanks and transfer lines are buried underground for purposes of radiation shielding.

The LLLW System was designed to handle waste solutions with maximum activity of 20 Ci/gal. However, current WAC limits influents to 2 Ci/gal ^{90}Sr equivalent and <100 nCi/g of alpha-emitting transuranic elements. Surveys of newly generated (NG) materials sent to the system seem to indicate that these solutions do not contain significant quantities of hazardous chemicals. However, both past and current waste treatment and storage practices (e.g., waste neutralization and evaporation) have produced LLLW concentrates and sludges containing concentrations of hazardous chemicals high enough to be subject to new regulatory controls (i.e., RCRA LDRs for mixed radioactive and hazardous chemical wastes).

The active LLLW System may be viewed as containing eight major subsystems:

- small tanks and lines, located in/near individual source building, used for initial accumulation or transfer of LLLW;
- waste-collection vehicles that serve a few facilities (i.e., containerized waste and ta[illegible] truck capabilities);
- intermediate collection tanks and lines in the main ORNL complex in Bethel Valley for collection and transfer (CAT) of wastes received from the accumulation subsystem to a central waste collection header (CWCH);
- four intermediate collection tanks and transfer lines in the Melton Valley Area that discharge to a central pumping station;
- a Melton Valley pumping station and a transfer line that move LLLW received from the four intermediate collection tanks to the CWCH in the main ORNL complex;
- a CWCH that receives LLW from the intermediate collection tanks in the main ORNL complex and from the Melton Valley pumping station and, in turn, transfers the wastes to the evaporator facility (Building 2531);
- waste evaporators and their associated service and storage tanks (five tanks, in all); and
- eight tanks located near the NHF that represent the principal storage site for evaporator concentrates.

Disposal of waste concentrates on-site is not currently possible because concerns about potential releases and changing regulatory requirements forced shutdown of the ORNL hydrofracturing process in 1984. The stored concentrates are to be processed in a new WHPP and disposed of off-site. Interim measures (including waste minimization, treatment of newly generated waste, and building new storage tanks as necessary) are being implemented to ensure that adequate storage volume is maintained until the WHPP becomes available.

The system receives LLLW from 32 source buildings (including 4 in the Melton Valley Area) via local accumulation tanks and/or bottling or trucking transfers. Transfer piping (typically unvalved) connects these components with one or more of the stainless steel collection tanks [1892- to 56,781-L-capacity (500- to 15,000-gal), median <7570 L (2000 gal)] that are still in service. Each collection tank currently in service is equipped with liquid-level instrumentation and a filtered vent to the atmosphere or to the off-gas system of the facility that it serves. Wastes are neutralized in the collection tanks and periodically transferred (by pump or steam jet) to the doubly contained, stainless steel CWCH. The LLLW is directed through this header to one of the 189,270-L (50,000-gal), stainless steel evaporator service tanks (located in an underground, stainless steel-lined concrete vault).

The LLLW evaporators are centrally located in the main ORNL complex in Bethel Valley. Waste from Melton Valley collection tanks is first transferred to a local pumping station. A singly contained transfer line conducts the LLLW from that point, over Haw Ridge, and into the main ORNL complex. Waste concentrates from the evaporators are transferred through doubly contained, stainless steel piping either to storage tanks located near the evaporator [189,270-L (50,000-gal) stainless steel, underground in concrete vault] or to one of the MVSTs [eight 189,270-L (50,000-gal) stainless steel, underground in stainless steel-lined concrete vault].

3.2.2.1 Generic description and characteristics of waste

Liquid low-level waste

Several facilities at ORNL contribute to the generation of LLLW. The radioactive liquid waste generated at ORNL can be categorized into several types of waste: (1) liquid wastes that are a result of air and water treatment facility operations, (2) wastes that result from decontamination of hot cells and various areas, and (3) R&D process-generated wastes. Of these types of LLLW, air and water treatment facility operations wastes have accounted for approximately 20% of the dilute LLLW generated in 1989 and 1990. Decontamination and R&D activities have generated about 40% of the waste, and rainwater/groundwater infiltration account for the remaining 40% of the dilute LLLW generation in the past 2 years.

Major generators of dilute LLLW include the 3039 off-gas scrubber, High Flux Isotope Reactor (HFIR) (Building 7900), the Oak Ridge Reactor/Bulk Shielding Reactor (ORR/BSR), and the REDC (Building 7920). In addition, leakage of rainwater and groundwater into the LLLW System accounts for approximately 40% of the waste volume collected. Annual LLLW generation is on the order of 5.4×10^5 gal.

The major generators of concentrated LLLW are the PWTP, the REDC, HFIR, and the High-Radiation-Level Examination Laboratory (Building 3525) (see Table 3.6). Over 99% of the radionuclides entering the LLLW System are generated at the REDC. The only other generators who produce significant quantities of radionuclides are the High-Radiation-Level Analytical Laboratory (Building 2026) and the Isotopes Area (most operations stopped in early 1990). The majority of the transuranic isotopes were generated at the REDC. The majority of the ^{90}Sr and ^{137}Cs was generated at the Fission Product Development Laboratory (Building 3517) and Building 3525. HFIR generated the majority of the ^{60}Co. The primary contributors of dissolved solids to the LLLW were the REDC, the PWTP, and HFIR. These results are particularly important because the dissolved solids content and amount of dilute LLLW fed to the evaporator during a given run are the primary factors that determine the efficiency of the LLLW evaporator. Approximately 49,210 to 83,279 L (13,000 to 22,000 gal) of concentrate are being stored each year for future treatment and disposal.

In the past, the isotope facilities at ORNL were used primarily for producing and distributing various radionuclides. A wide range of radionuclides were handled. Major activities at the facilities included tritium processing, ^{85}Kr enrichment, short-lived fission

Table 3.6. Average monthly dilute liquid low-level waste generation

Generator	Monthly generation [L (gal)] 1990	1991	Percent of total 1990	1991
Isotopes[a,e]	12,389 (3,273)	7,900 (2,083)	12	6
3039 stack area	13,332 (3,522)	13,252 (3,501)	13	10
Fission Products Development Laboratory[e]	3,705 (979)	7,498 (1,981)	4	6
High Flux Isotope Reactor	23,352 (6,169)	39,553 (10,449)	23	31
High-Radiation-Level Examination Laboratory	6,529 (1,725)	4,833 (1,277)	6	4
Radiochemical Engineering Development Center	4,035 (1,066)	5,409 (1,429)	4	4
4500 Complex[e]	2,861 (756)	7,283 (1,924)	3	6
Reactors[b,e]	9,209 (2,433)	6,230 (1,646)	9	5
Tank W1-A[c,e]	14,702 (3,884)	12,245 (3,235)	14	10
Building 3019	359 (95)	318 (84)	1	0.2
Process Waste Treatment Plant spent acid[d]	1,177 (311)	2,336 (617)	1	2
Tank WC-8 pump pit[e]	4,485 (1,185)	1,355 (358)	4	1
All others[e]	5,625 (1,486)	20,471 (5,408)	6	16
Total	101,615 (26,884)	128,673 (33,992)	100	100

[a]Isotopes includes all collections from Isotopes Area collection tank, Building 3026-C collection tank, and Building 3026-D collection tank.

[b]Reactors included are the Oak Ridge Research Reactor and the Bulk Shielding Reactor.

[c]Tank W1-A is abandoned.

[d]The PWTP is actually the largest single contributor to LLLW concentrate storage because it provides another highly concentrated waste stream directly to storage.

[e]Tanks collect waste from nongenerator sources such as rainwater from vault sumps, filter pit sumps, building floor drains, etc.

products processing, ^{137}Cs and ^{90}Sr source fabrication, ^{60}Co storage, ^{99}Tc processing, and some TRU isotope processing. Most processing operations stopped in 1990. In the Isotopes Area, very little LLLW is now generated as a direct result of processing activities. Most of the waste production is a result of routine and nonroutine hot-cell decontamination. The primary radionuclides expected to be in the waste streams generated from these facilities are ^{137}Cs, ^{90}Sr, ^{140}La, ^{152}Eu, and ^{154}Eu. Waste generation decreased with the Isotopes Area shutdown in 1990 but is now increasing owing to decontamination efforts.

The scrubbing operation for the Central Off-gas Collection System (Building 3039) produces a spent caustic solution that is slightly radioactively contaminated. The 3039

Stack Area produces approximately 13,248 L/month (3500 gal) of dilute LLLW and accounts for approximately 13% of the total LLLW collected since 1986.

LLLW collected from HFIR is generated primarily from the following sources: (1) regeneration and backwashing of primary and pool demineralization systems, (2) waste from sampling, (3) head tank overflow, (4) gaseous waste filter pit, (5) 7911 stack drainage, and (6) the off-gas condensate collection pit. When HFIR was shut down, the LLLW generation rate was approximately 10,220 L/month (2700 gal). When in operation, the system is the largest generator of dilute LLLW at ORNL. During HFIR operations the most significant LLLW generation source is the regeneration and backwashing of the primary and pool demineralization systems. In 1990 these regeneration solutions accounted for approximately 264,978 L (70,000 gal) of LLLW generated during the year and also represented the primary source of ^{60}Co in the LLLW System at ORNL. In 1991, processing problems occurred that caused an increase in the number of regenerations, and the LLLW generated increased to 4,731,764 L (1,250,000 gal).

The Oak Ridge Research Reactor and the BSR were shut down permanently in 1987 and will not be restarted. Current and future waste generated from the Oak Ridge Research Reactor are the result of D&D activities and ion-exchange column regenerant solutions.

The High-Level Radiation Examination Laboratory (Building 3525) primarily serves as an area where irradiated metallurgical specimens can be examined. Currently, the facility is expected to handle a variety of radionuclides including cesium, uranium, plutonium, and thorium isotopes. The area possesses both hot cells and storage wells for containment of radioactive materials. The average monthly LLLW generation rate of the High-Level Radiation Examination Laboratory has been approximately 6813 L (1800 gal) since 1986. This decreased to 4921 L (1300 gal) in 1991.

The 4500 Complex (Buildings 4500N, 4500S, 4501, and 4508) is a multipurpose research facility. A wide variety of radioactive materials are handled in the complex, and trace quantities of any radionuclide used at ORNL may originate in several laboratories where R&D work may involve radioactivity. The 4500 Complex has historically accounted for 3 to 8% of all LLLW collected at ORNL. Since 1986, the average LLLW generation rate has dropped from 9085 L/month (2400 gal) to 6057 L/month (1600 gal) (including rainwater/groundwater collection) in 1991.

The leakage of rainfall into the LLLW CAT System has been qualitatively recognized for some time as a major contributor to the quantity of waste requiring processing by the LLLW evaporator. However, a quantitative estimate of the effects of rainfall on the volume of LLLW collected at ORNL was not determined until 1989. A time series analysis identified LLLW collected in the following tanks to be significantly influenced by rainfall: WC-19, W-1A, WC-11, WC-12, Building 3517 tanks, WC-8, WC-5, and W-17 and W-18. Estimates are that approximately 5678 L (1500 gal) of LLLW are collected from the above tanks for each inch of rainfall.

TRU-contaminated liquid low-level waste

The REDC recovers a variety of radiochemicals produced by irradiation of selected isotopes. The LLLW produced at the REDC [approximately 5678 L/month (1500 gal) in 1991] is primarily generated from disposal of spent off-gas scrubber solutions. The scrubber solutions typically contain low levels of radioactivity. A waste minimization effort was undertaken in FY 1992 to change the scrubber operation to reduce the total LLLW generation rate at the REDC. In addition, small volumes of LLLW are generated as a direct result of isotope processing from operations conducted at the REDC. Although volumes are small, the REDC is the major contributor to the TRU isotopes and mixed-fission-product concentration in the system. The existing LLLW System does not have provisions for segregating and handling TRU-contaminated liquids separately. Modification of the LLLW System to isolate TRU-contaminated liquid waste is currently being studied or implemented.

3.2.2.2 Treatment facilities

Facilities associated with the LLLW System at ORNL consist of collection tanks and piping, a service tank at Building 2531, the evaporator facilities at Building 2531, evaporator storage tanks, and Melton Valley storage tanks. With the exception of these storage tanks (Subsect. 3.2.2.3), the remaining facilities are considered as treatment facilities and are discussed in this subsection.

The waste accumulated in the collection tanks is transferred via underground piping to the LLLW Evaporator Facility (Building 2531) where it is concentrated in one of the two evaporator units that operate at an average volume reduction factor of 30:1. The concentrated waste is then transferred to one of several storage tanks, and the evaporator condensate is transferred to the PWTP for further treatment. Figure 3.16 shows a schematic of the LLLW System.

ORNL's LLLW Tank System is divided into two branches: the Melton Valley Branch and the Bethel Valley Branch. Currently, 40 active collection tanks are used: 10 serve the Melton Valley area, 17 serve the Bethel Valley area, and 13 are associated with the central treatment/storage system. Also, 56 collection and storage tanks are currently inactive: 39 are owned by the Environmental Restoration program; 17 are owned by WMRAD or the generating division. The locations of the active tanks are shown in Fig. 3.17. The capacities of the active collection tanks in Bethel Valley and Melton Valley are given in Table 3.7. The 13 concentrate storage tanks are shown in Table 3.9 in relation to other parts of the LLLW System.

Most of the floor drains, collection tanks, and transfer lines in the system are singly contained. Most of the tanks associated with the centralized treatment system are doubly contained. The system was designed to work approximately 30 years; however, most of the system has surpassed its design life. LLLW solutions that accumulate in the collection tanks are periodically transferred to the Central Treatment/Storage System as shown in Figs. 3.15, 3.16, and 3.18. The waste is collected in the evaporator service tank W-22 (Fig. 3.18) and then fed to evaporators A2 and 2A2 for processing. One of the two evaporators is operated in a semicontinuous manner. The second evaporator is an in-place spare. Dilute LLLW is transferred by steam jet from feed tank W-22, as necessary, to maintain an operating level in the evaporator where the waste is concentrated to a target specific gravity of greater than 1.25. The evaporator condensate, which contains traces of radionuclides, is directed to the PWTP. When the evaporator bottoms or concentrated waste reaches a specific gravity between 1.25 and 1.5, or when no feed is left to process, the evaporator is shut down, the contents are cooled, and the "concentrate" is transferred via steam jet to one of 11 storage tanks. The transfer of the concentrate from the evaporator facility to the storage tanks is accomplished through a doubly-contained stainless steel line that is cathodically protected inside a pipe tunnel and leak-tested before each transfer.

Major areas of the Radioactive Waste Evaporator Facility (Building 2531) (see the plan view in Fig. 3.19) include:

ORNL-DWG 91M-17282

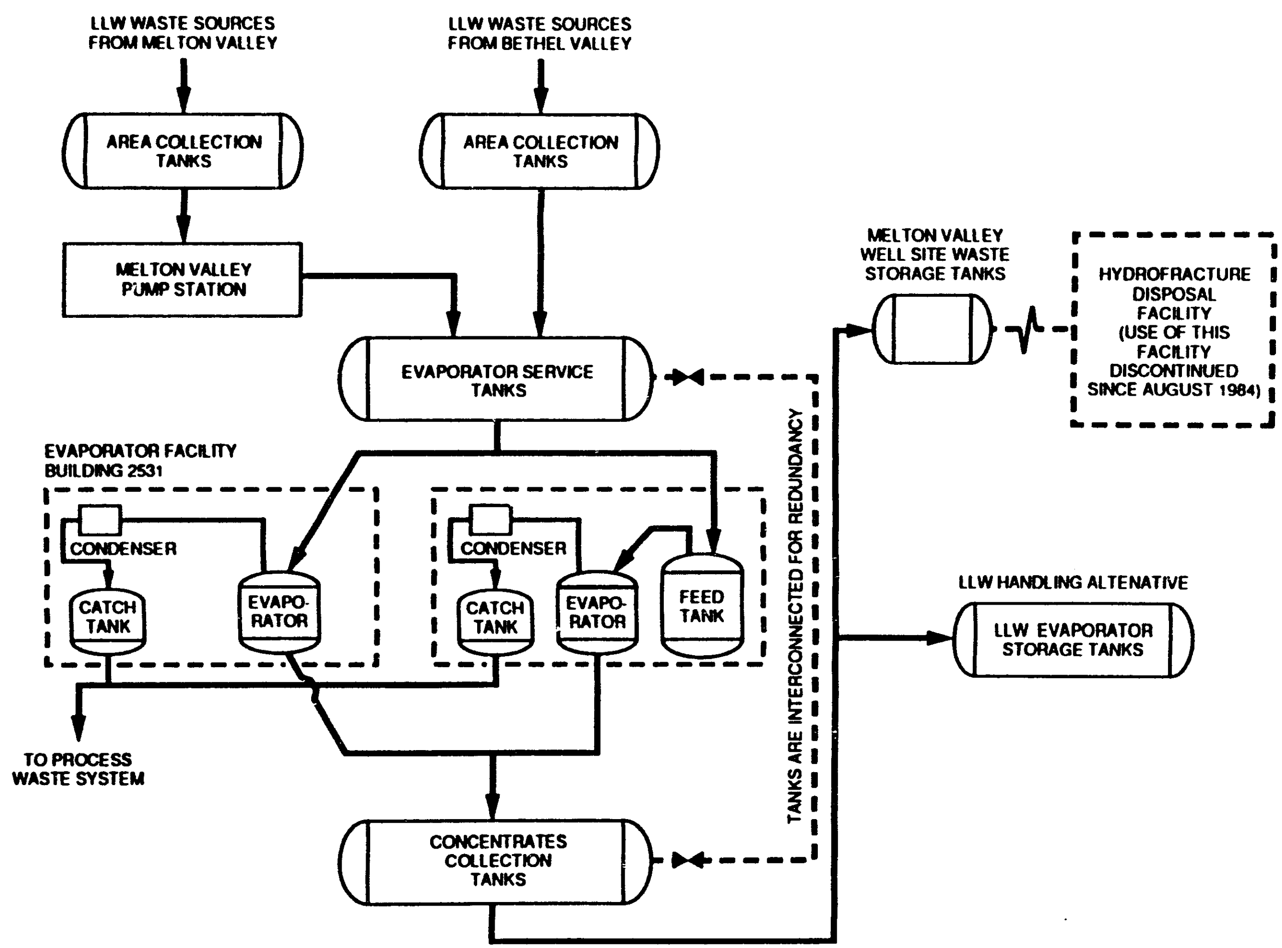


Fig. 3.16. Liquid Low-Level Waste System description.

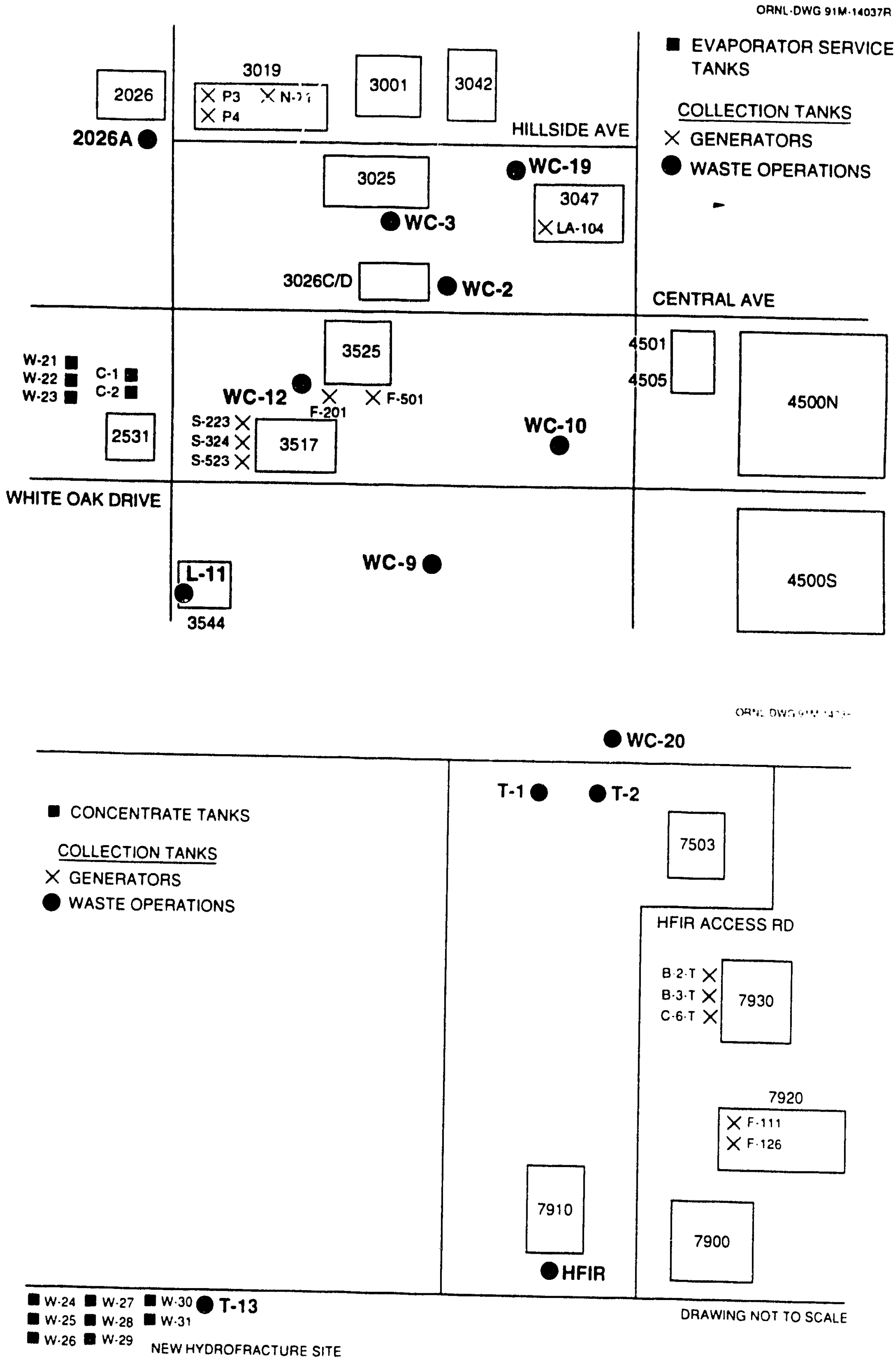


Fig. 3.17. Location of Waste Management Operation's active liquid low-level waste collection tanks.

Table 3.7. ORNL liquid low-level waste active collection tank capacities and source buildings

Tank	Capacity [L (gal)]	Source building(s)
10 Melton Valley collection tanks		
T-13	15,141 (4,000)	NHF
B-2-T	7,878 (1,870)	7930
B-3-T	7,878 (1,870)	7930
C-6-T	2,649 (700)	7930
F-111	473 (125)	7920
F-126	4,542 (1,200)	7920
WC-20	37,854 (10,000)	7920
HFIR	49,210 (13,000)	7900, 7911, 7913, and 7922
T-1	56,781 (15,000)	7900, 7911, 7913, and 7922
T-2	56,781 (15,000)	7900, 7911, 7913, and 7922
18 Bethel Valley collection tanks		
2026A	1,893 (500)	2026
WC-2	3,785 (1,000)	3028, 3038
WC-3	3,785 (1,000)	3025E, 3025M
WC-7[a]	4,163 (1,100)	2533 and 2534 drain lines, 3504
WC-9	8,100 (2,140)	Hot off-gas pot
WC-10	7,571 (2,000)	3028–3033, 3039, 3047, and 3093
WC-19	8,517 (2,250)	3001, 3002, 3109, 3042, and 3119
W-16[a]	3,785 (1,000)	3026D
N-71	908 (240)	3019
P-3	746 (197)	3019
P-4	746 (197)	3019
S-223	9,463 (2,500)	3517
S-324	3,785 (1,000)	3517
S-523	3,785 (1,000)	3517
L-11	1,514 (400)	PWTP
F-201	189 (50)	3525
F-501	757 (200)	3525

[a]No longer in use.

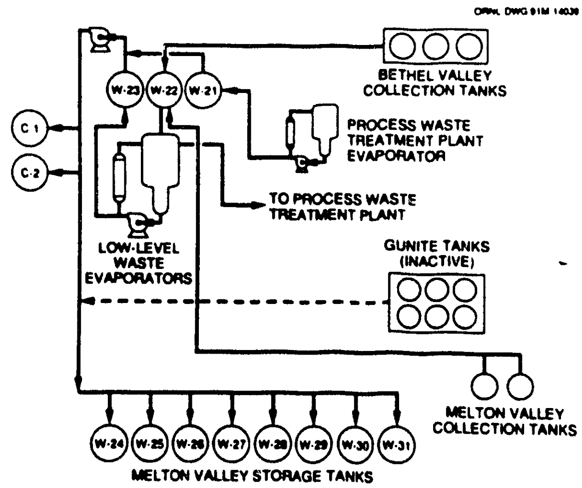


Fig. 3.18. Liquid Low-Level Waste Collection, Treatment, and Storage System.

- Three separate vaults containing (1) the evaporator feed tank W-22 and the converted evaporator feed tank W-21 (now a storage tank for concentrated liquid waste generated by the PWTP); (2) the concentrate storage tank W-23; and (3) associated pumps, pipes, and controls. The evaporator service tanks W-21, W-22, and W-23 are also enclosed in underground stainless steel-lined concrete vaults.
- An underground pipe trench. This is used for the transfer of liquid waste from the feed tank to the evaporator and concentrate to W-23.
- The tank vault containing tanks C-1 and C-2. These are storage tanks for concentrated waste from the evaporator.
- Cells 1 through 4 in Building 2531 that contain the evaporators and associated equipment. Cell 1 contains the original evaporator A-2 and its feed tank, A-1. Cell 2 contains the accompanying evaporator (A-2) process equipment, which includes a condenser, vapor filter, condensate catch tank, off-gas scrubber, emergency condenser, and scrub liquor tank. Cell 4 holds evaporator 2A-2, and cell 3 contains the condensate filter, evaporator condenser, condensate surge tank, off-gas scrubber, and the scrub liquor tank for evaporator 2A-2.

Environmental monitoring

Monitoring of outfalls specified in the National Pollutant Discharge Elimination System (NPDES) permit began in April 1986. The condensate from the LLLW evaporators is treated for removal of small quantities of radionuclides at the PWTP and is mixed with other waste streams and treated at the Nonradiological Wastewater Treatment Plant (NRWTP) before being discharged to White Oak Creek (WOC) through an NPDES discharge point. Each collection tank in the LLLW System is equipped with a sampling device, liquid-level instrumentation, and a filtered vent to the atmosphere or to the off-gas system of the facility that it serves. Underground collection tanks in the Bethel Valley area have "dry wells," which are concrete pads with sumps located at the low point,

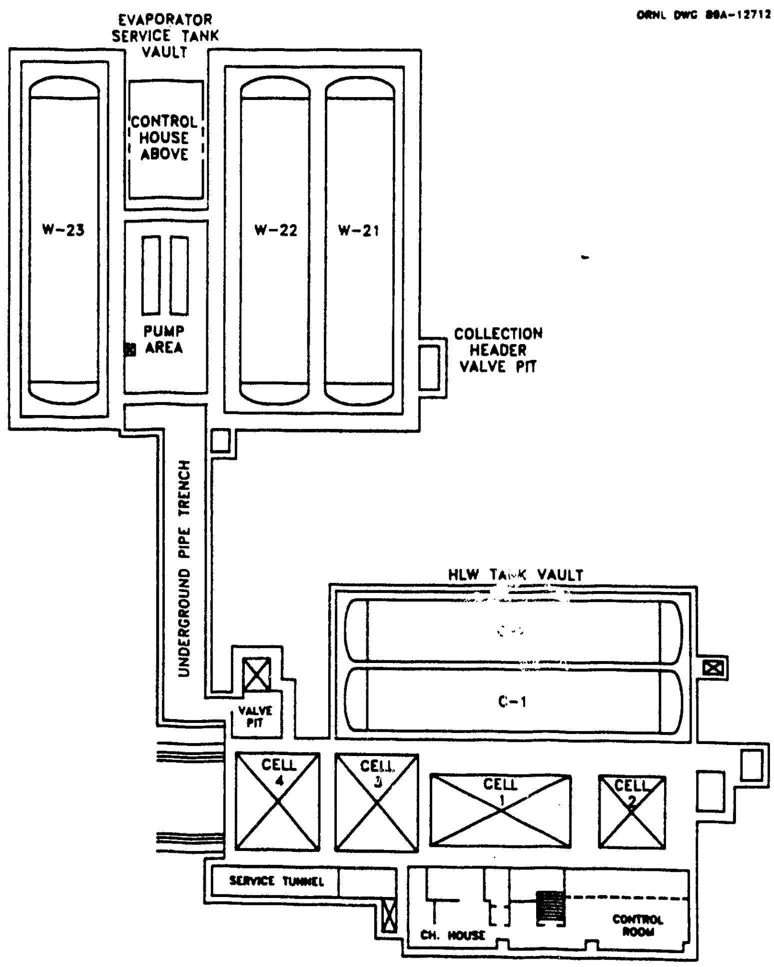


Fig. 3.19. Plan view of the Evaporator Facility Complex (Building 2531).

and wells extending to the surface of the ground where groundwater is sampled to identify tank leakage.

Waste volume can be reduced through maximizing waste treatment efficiency by improved monitoring and control. System operations are enhanced by centralized monitoring at the Waste Operations Control Center (WOCC). When capital projects are implemented to upgrade the LLLW CAT System, instrumentation will be added for both monitoring and controlling the ORNL LLLW Systems from WOCC. In addition, WOCC computers are used to generate reports and to manipulate data.

The ORR FFA has called for instrument upgrades and leak test plans. In addition, further enhancements of instrumentation include correction of generator tank instruments to WOCC.

Permitting status

The RCRA permit-by-rule was updated in 1991 for unit operations that produce a waste stream monitored at an NPDES discharge point. Therefore, all LLLW collection, treatment, and solidification systems (active and inactive) are currently under the RCRA permit-by-rule (Subsect. 3.2.2.3).

Facility status

The primary treatment for LLLW is evaporation; two evaporators (one of mid-1960s design and the other of mid-1970s design) are currently in use. Both are functioning; however, replacement of the evaporators has been planned because both units are nearing the end of their design life.

Treatment of acid waste generated by ion exchange demineralizers is being reviewed for various sites at ORNL. At present, these wastes are treated at the central LLLW Evaporator System. These high-nitrate, acidic wastes generated by the demineralizer systems cause problems in the LLLW Treatment System that increase the total concentrate generation rate because (1) caustic neutralization adds additional salts to the LLLW System, (2) nitrates are difficult to handle in disposal processes, and (3) both parameters negatively impact the effectiveness of the central evaporator to concentrate LLLW.

The LLLW CAT upgrades include installing equipment for more precise measurement and control of the amount of caustic needed to neutralize LLLW in the collection tanks. This procedure will reduce dissolved solid content of LLLW.

The major generators of concentrated LLLW are shown in Table 3.8. REDC operations are being evaluated for possible upgrades to reduce the amount of LLLW, particularly TRU components and dissolved solids generated at the facility. Modifications are being implemented at HFIR and the ORR/BSR to dispose of loaded ion exchange material as solid LLLW wastes rather than regenerating the resin to produce LLLW. More detailed descriptions of these projects are provided in the following subsections.

Pretreatment of REDC LLLW. This proposed FY 1994 GPP will install pretreatment systems at the REDC (Building 7920) to reduce or to eliminate LLLW. The REDC is a major contributor of LLLW (38%) and the main contributor of TRU (99%) in the LLLW System.

Bulk Shielding Reactor/Oak Ridge Research Reactor LLLW upgrade. This FY 1992 GPP will eliminate input to the LLLW System from these two facilities. These modifications are necessary to comply with the draft Federal Facility Agreement (FFA).

3.2.2.3 Storage facilities

Currently, LLLW concentrate is being accumulated and stored in MVSTs and Bethel Valley tanks. ORNL has 12 189,270-L (50,000-gal) tanks for the storage of LLLW concentrate. Eight of these tanks, known as the MVSTs, are located at the NHF site in an underground concrete, stainless steel-lined vault. The other four storage tanks, located near the evaporator facility, are C-1, C-2, W-21, and W-23. Both C-1 and C-2 receive LLLW concentrate. W-21, originally a feed tank for the LLLW evaporator, was converted to a tank for storage of concentrate produced by the PWTP in an effort to decouple the PWTP and LLLW operations. Currently, tank W-22 serves as the sole evaporator feed tank. Tank W-23 receives concentrate directly from the evaporator and is normally used as a collection point for LLLW concentrate before it is transferred to the MVSTs for

Table 3.8. Major generators of concentrated liquid low-level waste (LLLW)

Tank and/or source building	1991 LLLW concentrate generation rate [L/year (gal)]	1990 LLLW concentrate generation rate [L/year (gal)]	1991 percent contribution	1990 percent contribution
Radiochemical Engineering Development Center	21,577 (5,700)	17,791 (4,700)	32	38
Product Waste Treatment				
• Plant feed	7,192 (1,900)	3,406 (900)		
• Plant concentrate	20,441 (5,400)	14,384 (3,800)	31	38
Building 3517	151 (40)[a]	379 (100)[b]	<1	<1
Building 3525	1,892 (500)	2,839 (750)	3	6
Oak Ridge Research Reactor, Bulk Shielding Reactor	1,892 (500)	1,893 (500)	3	4
High Flux Isotope Reactor	9,842 (2,600)[b]	4,542 (1,200)[a]	15	10
Isotopes Circle (WC-10)	757 (200)	189 (50)	1	<1
Others	2,498 (660)	1,893 (500)	4	4
Total	66,244 (17,500)	47,318 (12,500)[c]		

[a]Estimate based on information obtained during shutdown.
[b]Estimate based on information obtained during operation.
[c]Actual concentrate generation during 1990 was 60,567 L (16,100 gal) (including some concentrate generated early in 1991).

storage. The design capacities and current waste volume for these tanks are listed in Table 3.9.

Environmental monitoring

Each storage tank is either equipped with a sampling device, liquid-level instrumentation, and a filtered vent to the atmosphere or connected to off-gas systems (i.e., blowers, filters, etc.) and maintained under negative pressure. Underground storage tanks in the Melton Valley are contained in stainless steel vaults equipped with sumps and level detectors located at the low points to identify and to handle tank leakage.

Permitting status

Operation of the LLLW System is governed by the requirements in several DOE orders as well as regulations of the EPA and the TDEC. Although some components of the ORNL LLLW System handle or store mixed radioactive and hazardous wastes, the system is currently exempt (via an RCRA permit-by-rule applicable to NPDES-permitted

Table 3.9. Liquid low-level waste concentrate storage tank capacities and waste volumes

Tank	Capacity [L (gal)]	Volume stored [L (gal)][a]
Melton Valley storage tanks		
W-24	189,270 (50,000)	167,315 (44,200)
W-25	189,270 (50,000)	163,908 (43,300)
W-26	189,270 (50,000)	159,365 (42,100)
W-27	189,270 (50,000)	171,479 (45,300)
W-28	189,270 (50,000)	170,722 (45,100)
W-29	189,270 (50,000)	177,157 (46,800)
W-30	189,270 (50,000)	175,264 (46,300)
W-31	189,270 (50,000)	169,208 (44,700)
Bethel Valley evaporator service/storage tanks		
W-21[b]	189,270 (50,000)	122,268 (32,300)
W-22	189,270 (50,000)	75,708 (20,000)[c]
W-23	189,270 (50,000)	74,573 (19,700)
C-1	189,270 (50,000)	76,465 (20,200)
C-2	189,270 (50,000)	173,750 (45,900)
Total	2,460,518 (650,000)[d]	1,877,186 (495,900)

[a]Volumes of concentrate stored as of January 1, 1991.

[b]Tank W-21 is currently receiving concentrated waste from the Process Waste Treatment Plant.

[c]Since W-22 is a service tank with fluctuating volumes, an average of 40% of the total capacity is shown as the volume stored.

[d]This is the total capacity of the tanks. The operating capacity is 2,337,492 L (617,500 gal).

wastewater treatment systems) from the technical standards (e.g., integrity testing, leak detection, secondary containment) and permitting requirements of RCRA. However, RCRA land disposal restriction regulations will apply to LLLW concentrates. See Sect. 5 on mixed wastes for details.

The ORR (including ORNL) was placed on the Superfund National Priorities List by the EPA on December 21, 1989. The Superfund Amendments and Reauthorization Act of 1986 (SARA) requires that DOE execute an FFA with the EPA in order to establish schedules for compliance with Superfund requirements. The FFA was signed in November 1991 and became effective on January 1, 1992.

In addition to the more typical Superfund requirements (e.g., schedules for remedial investigations at contaminated sites), the ORR FFA provisions also established additional compliance requirements specific to the ORNL LLLW System (*Environmental Restoration Agreement for the Oak Ridge Reservation*). This action has been undertaken voluntarily by DOE-OR in response to EPA concerns that the ORNL system, even though technically exempt from most RCRA standards, should be subject to equivalent requirements because of the hazardous nature of the radioactive wastes being handled.

During the course of negotiations for the ORR FFA, the EPA, working with DOE-OR and the TDEC, has incorporated interim compliance requirements for the LLLW System. These requirements include (1) integrity assessments including leak testing and inspections for all LLLW tanks, transfer lines, and ancillary equipment; (2) removal from service, along with corrective action, for leaking components; and (3) leak detection and secondary containment for all new or replacement tank systems.

The FFA defines four generic categories of tank systems: (1) new or replacement tank systems, (2) tank systems having secondary containment, (3) tank systems not having secondary containment, and (4) tank systems that have been removed from service. The FFA tank listing that has been submitted to DOE and the regulatory authorities is given in Table 3.10. Thirty-nine of the LLLW tanks are inactive (i.e., do not receive LLLW and are isolated, either physically or administratively, from active waste generating facilities). The FFA requirements for these tanks will be met through the Energy Research (ER) Program. The remaining 57 tanks are owned by WMRAD or the generating divisions. They are currently either active LLLW tanks or tanks that have been permanently removed from service and will be transferred to the ER Program in the near future.

The impact of the FFA to the active LLLW System is shown in Table 3.10. Nine tanks (i.e., W-1I, 4501-C, 4501-D, 3002A, T-14, S-424, WC-4, LA-104, and 4501-P) were removed from service prior to the FFA signing because they were no longer being used. Tanks 4001-C and 4001-D have been remediated; the remainder will be transferred to ERP. Nine tanks (i.e., W-17, W-18, WC-5, WC-6, WC-8, WC-11, WC-12, WC-13, and WC-14) were removed from service when the FFA was signed because the tank systems are known or are suspected to leak (inleak or outleak). W-12 is being repaired and will be restored to active service. Tanks W-16, WC-10, and WC-2 will be used for near-term decontamination activities (i.e., 1991–1994) and will then be removed from service. The W-21 through W-31, C-1, C-2, and T-13 tanks are expected to meet secondary containment standards without upgrades. The remaining tank systems will be upgraded/replaced to comply with the new regulations. Five tank systems (i.e., WC-10, WC-19, T-1, T-2, and HFIR) are considered to be environmental, safety, and health (ES&H) tank systems that cannot be immediately shut down without creating unacceptable ES&H risks. Potential ES&H waste streams include those from regeneration of ion exchange columns at shutdown reactors, decontamination of shutdown hot cells, and other decontamination activities for the Isotope Area Facilities and the Graphite Reactor Canal. Table 3.11 summarizes the facilities that have access to tank systems that were operational as of August 1992.

Facility status

Designed primarily in the 1950s, the ORNL LLLW System was given an expected operating life of approximately 30 years, but much of the system is older. The five tanks and transfer lines associated with the ORNL evaporator facility are of late 1960s to late 1970s vintage, the CWCH dates to around 1980, and the MVSTs and WC-20 in Melton Valley, along with their transfer piping, were installed in the late 1970s. Most of these

Table 3.10. Federal Facility Agreement (FFA) requirements for Oak Ridge National Laboratory Liquid Low-Level Waste (LLLW) Tank System

Existing tank systems with secondary containment				Existing tank systems without secondary containment					
Not requiring upgrades or replacements		Requiring upgrades or replacements		Requiring replacements		Removed from service			
Tank	Facility served	Tank	Facility served	Tank	Facility served	Tank[a]	Facility served	Tank[b]	Tank[b]
C-1	LLLW Evap.	N-71[c]	3019	2026A	2026	3002A	3002	3001-B	W-1
C-2	LLLW Evap.	P-3[c]	3019	WC-3	3025	WC-4	3026D	3001-S	W-13
W-21	LLLW Evap.	P-4[c]	3019	WC-9	HOG pot[d]	W-11	3028	3003-A	W-14
W-22	LLLW Evap.	S-223[c]	3517	WC-7	2533, 3504	WC-5	3508	3004-B	W-15
W-23	LLLW Evap.	S-324[c]	3517	HFIR	HFIR	WC-6	3508	3013	W-1A
W-24	LLLW Evap.	S-523[c]	3517	T-1[e]	HFIR	WC-8	Inactive	WC-1	W-2
W-25	LLLW Evap.	L-11	PWTP[g]	T-2[e]	HFIR	S-424[c]	3517	TH-4	W-3
W-26	LLLW Evap.	B-2-T[c]	REDC[h]	WC-10[e,f]	Isotopes	WC-11	4500	TH-1	W-4
W-27	LLLW Evap.	B-3-T[c]	REDC	WC-2[f]	Isotopes	WC-12	4500	TH-2	T1
W-28	LLLW Evap.	C-6-T[c]	REDC	WC-19[e]	ORR[i]	WC-13	4500	TH-3	T2
W-29	LLLW Evap.	F-111[c]	REDC	W-16[f]	[illegible]	WC-14	4500	H-209	T3
W-30	LLLW Evap.	F-126[c]	REDC	W-12[j]	[illegible]	4501-P[c]	4501	W-19	T4
W-31	LLLW Evap.	WC-20	REDC			T-14	Inactive	W-20	T9
T-13	NHF[k]	F-201[c]	3525			W-17	3026C	WC-15	W-10
		F-501[c]	3525			W-18	3026C	WC-17	W-11
						LA-104[c]	3047	T-30	W-5
								7560	W-6
								7562	W-8
								7503-A	W-9

[a]Waste Management Division.
[b]Environmental Restoration Division.
[c]Generator-owned tanks.
[d]HOG—hot off-gas pot.
[e]Tank systems will be used for decontamination activities in 1991–1994 and removed from service.
[f]Tank systems to be used for collection of wastes for environmental, safety, and health reasons only.
[g]Process Waste Treatment Plant.
[h]Radiochemical Engineering Development Center.
[i]Oak Ridge Research Reactor.
[j]Has been taken out of service for repairs.
[k]New Hydrofracture Facility.

Table 3.11. Facilities supported by active liquid low-level waste tanks[a]

Facility	Tank
Building 3019	N-71, P-3, P-4
Building 3517	S-223, S-324, S-523
Evaporator complex	C-1, C-2, W-21 through W-31
Building 3544	L-11
New Hydrofracture Facility	T-13
Radiochemical Engineering Development Center	B-2-T, B-3-T, C-6-T, F-111, F-126, WC-20
Building 3525	F-201, F-501
Isotopes Circle	WC-10, WC-2, W-12[b]
High Flux Isotope Reactor	HFIR, T-1, T-2
Oak Ridge Research Reactor	WC-19
Bulk Shielding Reactor	WC-19
Oak Ridge Graphite Reactor	WC-19
Building 3025	WC-3
Buildings 2533 and 3504	WC-7
Hot off-gas pot	WC-9
Building 2026	2026A
Building 3026D	W-16

[a]After the Federal Facility Agreement became effective on January 1, 1992, tanks WC-2, W-16, and WC-10 could only receive waste from decontamination activities for Isotopes Facilities shutdown.

[b]This tank will be put back in service after repairs are complete.

newer components of the LLLW System have leak detection and secondary containment capabilities that appear to permit continued operation with little or no modification.

In contrast, most of the building drains, collection tanks (all but WC-20 in the Melton Valley Area), and transfer lines (upstream from the central collection header in Bethel Valley except the Melton Valley transfer line north and south of Haw Ridge and some of the newer lines above the pumping station in the Melton Valley) are singly contained and some are in questionable condition.

A procedure known as in-tank evaporation (ITE) is being utilized to reduce the amount of liquid waste stored in the MVSTs. Each of the eight storage tanks has a tank ventilation system for purging gases from the tanks as well as submersed air sparges used to mix the contents of the tanks. In the ITE scheme, dry air is being introduced into the tanks and will ideally leave the tanks in a saturated state. Several studies have been completed to determine the viability of ITE and its effect on storage volume availability. As determined by these studies, ITE is expected to free approximately 11,356 L/year

(3000 gal) per storage tank. This rate is based on the following assumptions: (1) 80% on-line time, (2) saturation temperature of 10°C (50°F), (3) dry input air to the tanks, and (4) outlet air is saturated with water.

ITE began in FY 1992. This process is expected to continue until the saturation limits of the salt components (predominately $NaNO_3$) in the storage tanks are reached. Preliminary estimates indicate that approximately 30% of the volume in the MVSTs can be evaporated without precipitating these materials. The primary reason for this activity is to ensure that LLLW storage space remains available until start-up of the WHPP Facility. Out-of-tank evaporation is also being implemented to enhance ITE.

Projects currently identified to deactivate and/or to upgrade ORNL LLLW CAT System tanks and piping, together with various filter pit upgrades, are described in the following subsections.

Bethel Valley LLLW CAT System upgrade. This FY 1988 LI project will include LLLW System upgrades to collect radioactive liquid waste from sources within generating facilities in the Bethel Valley Area of ORNL. The existing system must be modified to comply with provisions of the FFA, which require double containment, integrity testing, capability for leak detection, cathodic protection, and other safety features. Phase I of this project included construction of a Monitoring Control Station (Building 2099) and upgrades to the LLLW internal and external piping for the High-Radiation-Level Analytical Laboratory (Building 2026); construction of a new Transported Waste Receiving Facility (Building 2649); construction of a new waste transfer line for the Central Off-Gas Facility (Building 3092); and upgrade of the instrumentation in the Waste Operation Control Center (Building 3130) to provide remote monitoring and control capability. Phase II of this project will include construction of a Monitoring Control Station (Building 3611) and upgrades to the LLLW internal and external piping for the High-Radiation-Level Examination Laboratory (Building 3525) as well as upgrade of the instrumentation in the Waste Operations Control Center (Building 3130) to provide remote monitoring and control capability for these facilities. Activities accomplished as of FY 1992 under Phase I include 90% completion of the Monitoring Control Station, the external piping and the internal piping for hot cells 1–4 in Building 2026, completion of the waste transfer line for the Central Off-Gas Scrubber Facility (Building 3092), and about 40% completion of the Transported Waste Receiving Facility (Building 2649). The host computer system for the Waste Operation Control Center has been procured and is undergoing final checkouts.

Melton Valley LLLW CAT System upgrade. This FY 1992 LI will upgrade the LLLW CAT System for HFIR (Building 7900) and the REDC (Buildings 7920 and 7930) in Melton Valley. The project work will include upgrade and replacement of internal and external piping at the REDC, replacement of 1524 m (5000 ft) of transfer pipe from Melton Valley to Bethel Valley, construction of a new monitoring and control station to provide holdup and treatment prior to pumping to Bethel Valley, and addition of a new ion exchange system for HFIR drains to eliminate the generation of LLLW. The design requirements were completed in September 1991. The Title I/II design was initiated in FY 1992.

Bethel Valley FFA upgrades. This FY 1994 LI project will upgrade several facilities to meet FFA requirements by installing doubly contained piping and tanks, active leak detection, and corrosion protection for underground elements. The project will upgrade the internal and/or external LLLW CAT System for the hot off-gas pot and Buildings 2533, 2534, 2537, 3525, and 3025E. Current plans are to initiate the project design early in FY 1994 and construction in FY 1995. All work is scheduled to be completed by the end of FY 1999.

MVST capacity increase. This FY 1994 LI will provide tanks with 1,703,435 L (450,000 gal) of working capacity in Melton Valley to allow storage of LLLW from active and inactive programs and generator tanks that will be taken out of service by the FFA until treatment facilities can be built to process the wastes prior to disposal and will allow TRU segregation from LLLW.

4500 Area LLLW upgrade. This FY 1992 GPP will provide collection of laboratory quantities of LLLW from small quantity generators in the 4500 Area of ORNL previously served by LLLW tanks WC11, WC12, WC13, and WC14. Waste-bottling facilities and/or pickup stations will be provided. The preliminary proposal was approved by DOE in July 1992, but design may not proceed until a NEPA determination has been made by DOE.

3000 Area LLLW upgrade. This FY 1992 GPP will provide collection of laboratory quantities of LLLW from small quantity generators in the 3000 Area of ORNL. Waste bottling and/or pickup stations will be provided in the glove box, hot cell, and hood area because of the removal from service of the existing LLLW tanks for compliance with the FFA. The preliminary proposal was approved by DOE in July 1992, but design may not proceed until a NEPA determination has been made by DOE.

FFA compliance—Building 3019A. This FY 1992 GPP will reroute Piping Systems that transport LLLW from Building 3019A to the central Waste Evaporator System. The original Piping Systems are not in compliance with the FFA. These activities include the installation of doubly contained pipeline and valve box arrangements and cathodic protection and leak detection devices. The preliminary proposal was approved by DOE in July 1992, but design may not proceed until a NEPA determination has been made by DOE.

Building 3525—LLLW FFA upgrade. This FY 1992 GPP will reroute piping that transports LLLW from Building 3525 to the central Waste Evaporator System. The original Piping System is not in compliance with the FFA. The project activities include installation of doubly contained pipeline and valve box arrangements and cathodic protection and leak detection devices. The preliminary proposal was approved by DOE in July 1992, but design may not proceed until a NEPA determination has been made by DOE.

3108 filter pit enclosure. This proposed 1993 GPP will add an enclosure over the 3108 filter pit for weather protection and contamination control.

Filter pit upgrades. This proposed 1993 GPP will provide containment for the Transuranic Processing Plant area sump pits and filter pits to eliminate inleakage of groundwater and/or rainwater.

NHF filter pits upgrade. This proposed 1994 GPP will provide containment enclosures for cell plugs at the NHF to eliminate inleakage of groundwater and/or rainwater.

3.2.2.4 Disposal facilities

Currently, no routine, direct disposal option exists for LLLW, although hydrofracture has been used in the past. Hydrofracture is no longer considered an acceptable disposal option. Because the LLLW System sludges are TRU wastes under the DOE Order 5820.2A definition, LLLW sludges will be processed in the planned WHPP and disposed of off-site as RH TRU waste.

3.2.2.5 Status of support systems

Training

Management and supervision are responsible for ensuring that all division personnel receive training commensurate with their job assignments. Training requirements shall be established to ensure that job performance is accomplished in a manner that will provide a safe and healthy work environment for both the employee and companion employees. Training requirements must also be directed toward enhancement of the employee's ability to provide quality products or services.

Certification

A certification program is currently being developed for both LLLW and process waste streams at ORNL. The program is in the development stage at this time.

Database management

The WOCC computer-based monitoring system provides real time monitoring and historical data on the operation of the LLLW System at ORNL. The WOCC remotely monitors the operations of the evaporator systems and also provides flow and level data, as well as some gross radioactivity measurements, in the LLLW Piping and Collection System. The WOCC receives and processes approximately 300 signals from field sensors including liquid levels and the conditions of active LLLW tanks.

3.2.2.6 Line item and general plant projects

A listing of proposed LI and GPPs for LLLW facilities at ORNL is provided in Table 3.12. This table indicates the project title, TEC, funding type, and the respective fiscal year for funding.

3.2.3 Process Waste System

Process wastes consist of all liquid wastes that contain slight amounts of radioactive or hazardous materials or that may periodically be contaminated. Process wastes at ORNL include wastes collected from numerous laboratories and facilities in Bethel and Melton

Table 3.12. Line item and general plant projects for the Liquid Low-Level Waste System at Oak Ridge National Laboratory

Title	TEC[a] ($ × 1,000)	Funding type	Fiscal year
Line item projects			
Bethel Valley Liquid Low-Level Waste (LLLW) Collection and Transfer (CAT) System upgrade			
• Phase I	35,000	CA	1988
• Phase II	30,000	CA	1988
Melton Valley LLLW CAT System upgrade	41,000	CA	1992
Bethel Valley Federal Facility Agreement (FFA) upgrades	20,500	EX	1994
Melton Valley storage tank capacity increases	48,000	EW	1994
General plant projects			
Oak Ridge Reactor/Bulk Shielding Reactor LLLW upgrade	1,100	EW	1992
4500 Area LLLW upgrade	886	EX	1992
3000 Area LLLW upgrade	754	EX	1992
FFA compliance—Building 3019A	705	EW	1992
Building 3525—LLLW FFA upgrade	700	EW	1992
FFA compliance work—Building 3025	710	EW	1993
3108 filter pit enclosure	157	EX	1993
7930 filter pit cover	200	EX	1993
Pretreatment of Radiochemical Engineering Development Center (Building 7920) LLLW	1,100	EW	1994
New Hydrofracture Facility cell plug enclosure	1,000	EW	1994

[a]Total estimated cost.

valleys as well as condensate from the LLLW evaporators. This general category of liquid waste can contain small quantities of radionuclides, metals, anions, and organics.

3.2.3.1 Generic description and characteristics of waste

As previously discussed, the PWS is designed for waste streams that are potentially contaminated or that contain very low levels of contamination. The system primarily consists of a series of holding tanks and the PWTP, which is designed to remove radionuclides, and the NRWTP, which became operational in April 1990, to remove heavy metals and organics. In the PWS, wastewater from areas more likely to be contaminated with radioactivity are routinely processed through the PWTP, while other nonradiological waste streams that could potentially be contaminated with organics and heavy metals are routed to the NRWTP. Nonradiological wastewater is currently collected from the 4500 Area, the 2000 Area, the 1500 Area, and the 6000 Area. These streams are monitored for radioactivity and may be diverted to the PWTP should the radioactivity exceed an acceptable level. The PWTP effluent stream combines with the nonradiological waste streams for treatment at the NRWTP. The NRWTP effluent stream is discharged to WOC.

Waste from the 3000 Area is more likely to contain radioactive contaminants and is routinely processed through the PWTP. Each month, approximately 5.8×10^6 gal of contaminated process waste containing 40 nCi/L of gross beta activity are collected in the PWS at ORNL. A typical characterization of the process waste stream may consist of values such as pH of 7.5, total hardness of 110 ppm, calcium hardness of 72 ppm, total alkalinity of 88 ppm, and total solids of 180 ppm. The generation of nonradiological process wastewater averages about 5.2×10^6 gal/month resulting in a total average release of 11×10^6 gal/month from the NRWTP.

3.2.3.2 Treatment facilities

Process waste is collected and treated at the PWTP for radionuclide removal and/or the NRWTP for organics and heavy metals removal. The current PWS is shown schematically in Fig. 3.20. Process wastewater that potentially contains small quantities of radionuclides from the 3000 Area is collected in the 946,353-L (250,000-gal) Bethel Valley storage tanks designated F-2101 and F-2102. Process wastewater from the 4500 Area normally drains to the collection/equalization tank F-1002 at the NRWTP. The 4500 Area wastewater is continuously monitored for radioactivity. If the water becomes contaminated, it is automatically diverted to the Bethel Valley storage tanks for treatment at the PWTP. Process wastewater generated in the Melton Valley Complex is collected in holding tanks. Unless the radioactivity level exceeds set limits, the contents of these tanks are normally discharged to NRWTP F-1002 tank. In the event that the radioactivity limits are exceeded, then the wastewater is pumped to the Bethel Valley storage tanks for treatment at the PWTP.

The PWTP is designed to remove radionuclides. The process flow diagram in Fig. 3.21 shows the processing steps such as softening, clarification, filtration, and ion exchange. The influent is treated by chemical softening, which removes nonradioactive calcium and magnesium as well as radioactive cations. The clarification and filtration steps are needed to remove the precipitated cations prior to ion exchange to avoid frequent column regeneration. The remaining small amount of radioactive material is removed from the waste by the ion exchange columns. The sludge from the clarifier is passed through a filter press to reduce the liquid content and is then packed in drums for SLLW on-site storage. A number of disposal alternatives are being considered for this waste stream. The concentrated radioactive material resulting from the regeneration of the PWTP ion exchange columns is currently evaporated to approximately 40% solids and transferred to the W-21 storage tank in the LLLW System. Nitric acid is recovered in this process and is recycled within the PWTP.

The capacity of the PWTP evaporator requires that a portion of the regenerant solution be sent to the LLLW evaporator for treatment. A project is in place to increase the capacity of the PWTP Evaporator System; this will reduce the amount of LLLW concentrate generated for permanent disposal.

The volume of LLLW generated by the PWTP has been reduced by 80% since a clarifier/precipitator was installed in 1986. Reduction or elimination of this stream is important because the PWTP is the major contributor to the LLLW concentrate presently being stored for future disposal. Tank capacity is limited, and future treatment and disposal of this waste will be expensive.

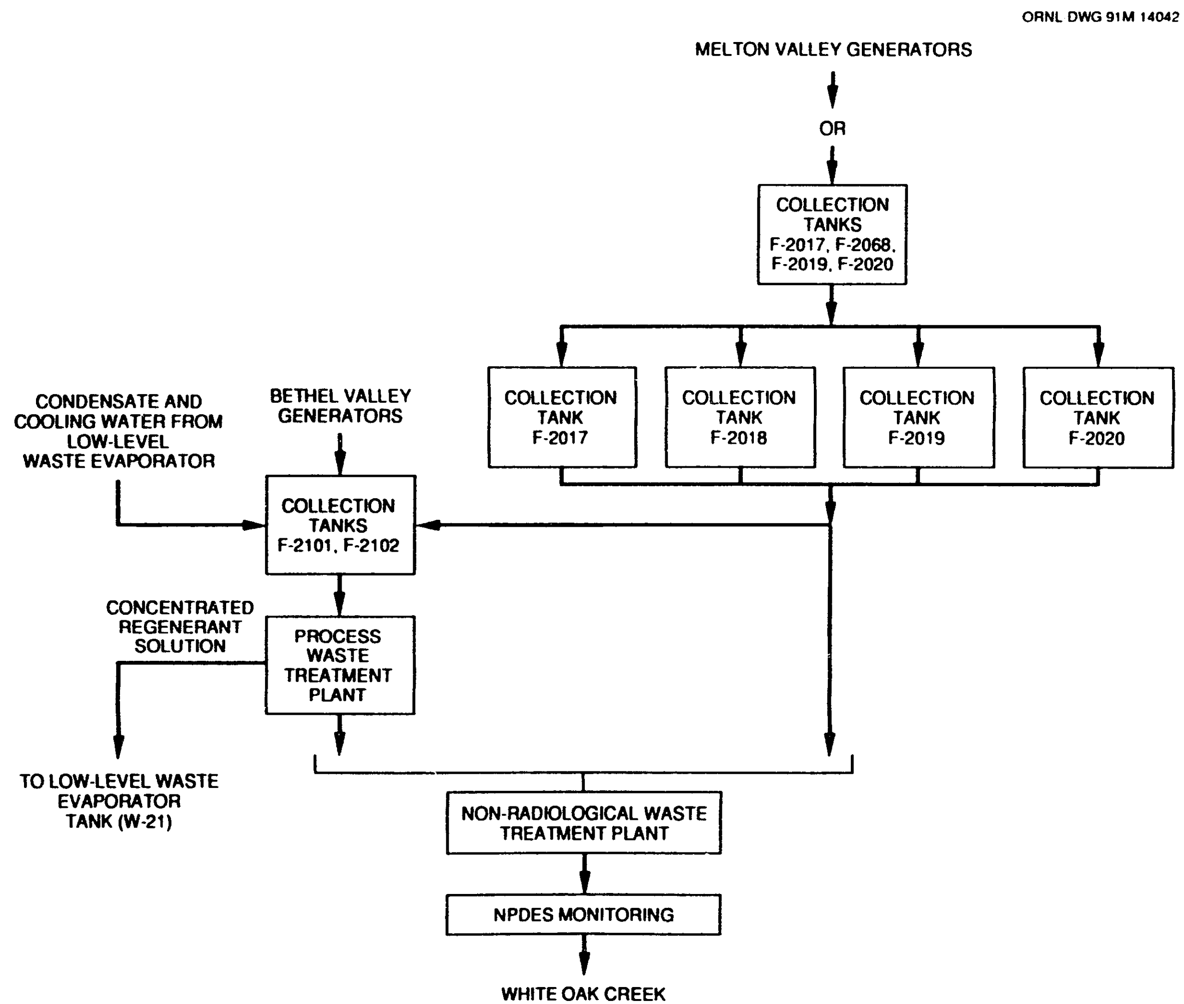


Fig. 3.20. Process Waste System.

ORNL-DWG 91M-14040

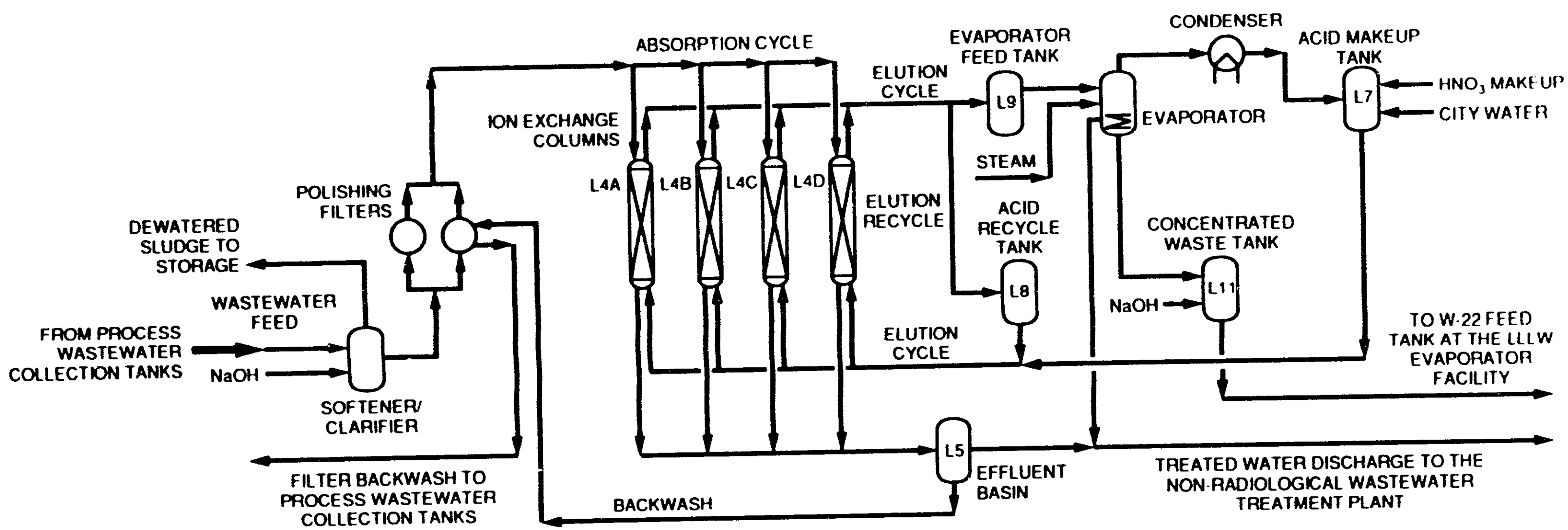


Fig. 3.21. Process flow diagram of the Process Waste Treatment Plant.

Since April 1990, all process wastewater has also been treated in the new NRWTP, as required by the NPDES permit. The flow sheet shown in Fig. 3.22 consists of chemical precipitation, which removes heavy metals, air stripping, which removes volatile organics, and carbon columns, which remove nonvolatile organics. Since only a small percentage of the total influent wastewater to NRWTP requires metals removal, wastewater containing low concentrations of metals is diverted around the clarifier to reduce treatment costs and sludge production. The secondary waste (i.e., sludge and activated carbon) is being stored for disposal as solid low-level radioactive waste. A single NPDES discharge and monitoring point is maintained at the plant outfall and includes discharges from all ORNL process waste generators.

Since the NRWTP is a new facility, it meets existing regulatory and operational needs. However, the NPDES permit for the facility is renegotiated with the TDEC every 5 years. The original NPDES permit for the NRWTP was obtained in 1986 before the plant was operational. Consequently, the discharge limits were set at relatively high values for plant startup. Future permits are likely to be increasingly stringent, and plant upgrades may be required to meet new discharge limits.

Environmental monitoring

Existing outfalls at ORNL include X01, Sewage Treatment Plant; X02, Coal Yard Runoff Facility; X12, Nonradiological Waste Treatment Plant; X13, Melton Branch; X14, White Oak Creek; X15, White Oak Dam; Category I, II, and III outfalls; cooling towers; and a number of miscellaneous outfalls. Each outfall is analyzed in accordance with DOE orders, NPDES permits, and RCRA requirements and noted in an activity field log. Field logs are used to document field measurements including flow, pH, temperature, downstream pH, and downstream temperature; some are used to document sample collection and include the type of sample (i.e., 24-h composite or grab), parameter sampled, and the time of sampling.

Data are collected on a daily, weekly, monthly, quarterly, and/or annual basis as required by the permit and recorded in a registered field log. The data gathered are keyed into a database that is utilized by statistical software and analyzed against the compliance requirements. Flow, temperature, and pH data are also extracted from the field logs and keyed into the database for electronic retrieval. Generalities used in analyzing the database are summarized herein. To report this data on the Form 2C, the following criteria were applied: some pollutants were believed to be absent from the discharge and are excluded from water quality evaluation; and, for conservative purposes, values reported less than the detection limit were considered as the detection limit for calculation purposes.

Available water quality data for parameters monitored at each outfall were compiled into a statistical summary for each outfall. The summary, taken from data gathered for approximately 2 years, includes the number of samples, minimum value detected, maximum value detected, the mean, and the number of times the pollutant was detected. In instances where only one sample exists and the pollutant was not detected, the detection limit is noted as the minimum, the maximum, and the mean.

Permitting status

The PWS operates under RCRA permit-by-rule and is therefore exempt from RCRA permitting requirements. Current regulatory requirements for process waste

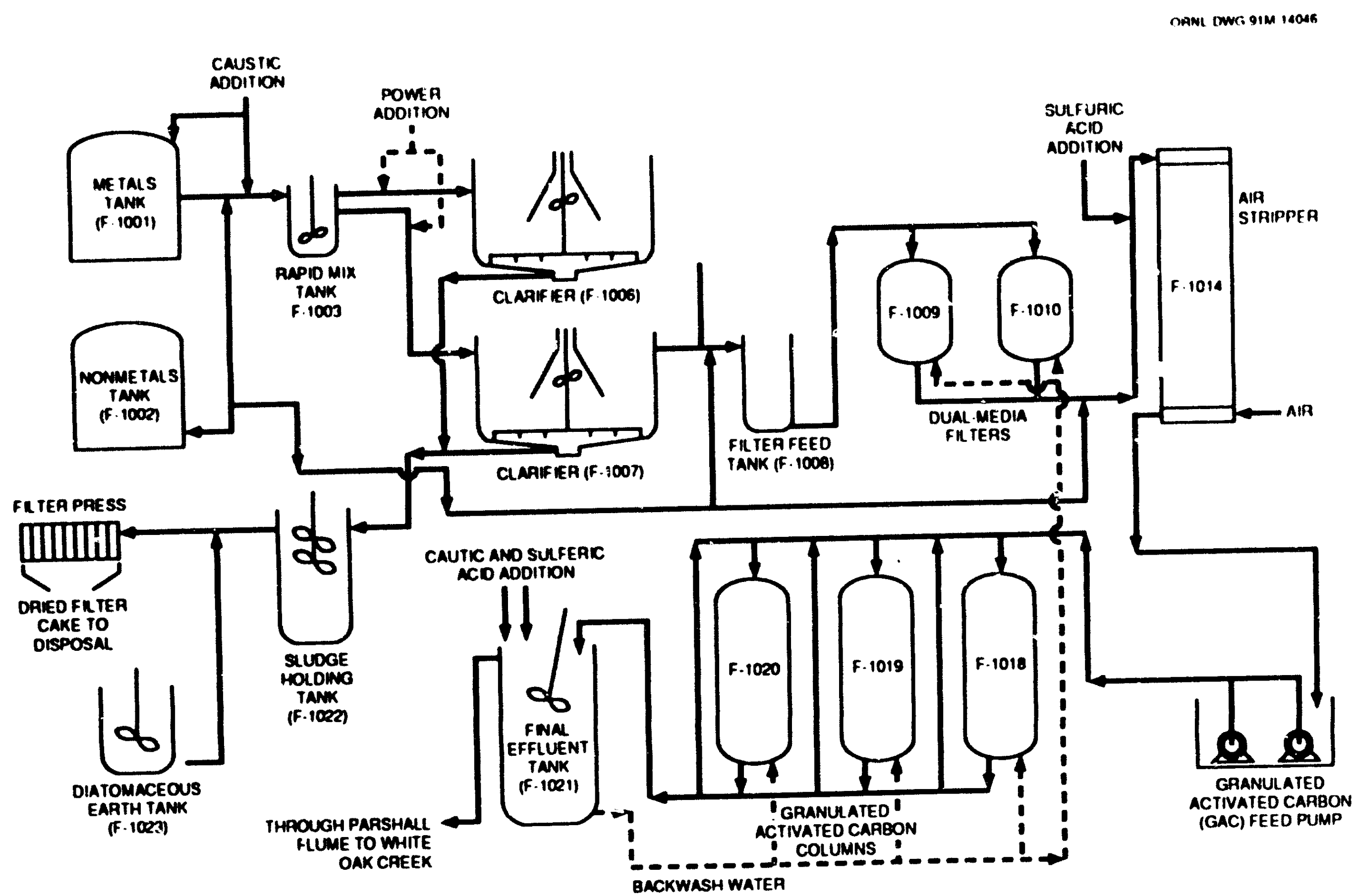


Fig. 3.22. Flow diagram of the Nonradiological Waste Treatment Plant.

generation can be categorized by RCRA waste minimization requirements, NPDES permit requirements, and DOE orders. When the 1984 Hazardous and Solid Waste Amendments to RCRA were written, Congress stipulated the requirements to report annually on waste minimization efforts but established no quantitative limits. ORNL will report activities that control waste at the source and minimize the generation of waste through process improvements. The NPDES permit expired in April 1991 and is being renegotiated. Facility upgrades may be required to meet new discharge limits. Discharges of nitrates to the watershed have been virtually eliminated and have brought ORNL into compliance with NPDES requirements for reduction in nitrate loading.

Facility status

Improved treatment of process waste for the removal of radioactivity is planned through an upgrade of the PWTP. This upgrade is necessary because the plant is nearing its design life expectancy. Research, development, treatability studies, and implementation are necessary to optimize treatment. Analysis of alternatives has been completed, and capital projects are being implemented both to replace the PWTP and to improve the treatment capacity of the existing PWTP in the interim. In the upgraded treatment process, ^{90}Sr and ^{137}Cs will be removed using an inorganic ion exchange zeolite. Spent zeolite will be disposed of as SLLW. This process will eliminate both secondary waste streams (i.e., clarifier sludge and LLLW) that are currently being produced. The process is expected to reduce the secondary waste generation rate by 30%. The primary reason for upgrading the treatment process is to meet more strict discharge limits and to reduce the amount of secondary waste generated by the PWTP.

The following projects are proposed modifications for upgrading the PWS:

ORNL Process Waste Treatment Facility. This FY 1996 LI will ensure installation of a new process water treatment system to replace the PWTP. The new system will add new treatment capabilities not presently available at ORNL for removal of nitrates and ^{60}Co as well as improved capacities for ^{90}Sr and ^{137}Cs removal. Zeolite dewatering equipment and additions (e.g., process waste storage tanks) will also be provided by the project.

Process Waste Treatment System Upgrade. This has been proposed as an FY 1992 reprogrammed line item project that consists of several modifications to correct environmental, safety, and health deficiencies and to upgrade the processing capabilities of the current PWTP. Included in the project are upgraded chemical unloading stations, temporary zeolite columns for cesium removal, modifications to increase the treatment capacity of the PWTP, infrastructure improvements, and other modifications.

Wastewater Piping Replacement. This FY 1988 GPP will ensure installation of a recycle cooling loop in the Materials Testing Laboratory of Building 4500S to eliminate the discharge of chlorinated cooling water to WOC. The detailed design was completed during FY 1992. Construction activities will be initiated during FY 1993.

Manhole Monitors Process Waste. This FY 1989 GPP will ensure installation of a new process waste manhole monitors in Bethel Valley to characterize groundwater inleakage. Construction activities were completed during FY 1992. Test and checkout of the system will be completed during FY 1993.

Outfall 302 Storm Sewer Rehabilitation. This FY 1992 GPP will ensure rehabilitation of the 24-in. storm sewer line around the Equalization Basin to minimize inleakage of contaminated groundwater into the storm sewer line that discharges through outfall 302 into WOC. The Categorical Exclusion for this project was approved during FY 1992. Detailed design activities will begin during FY 1993.

Manhole Monitors Process Waste 3000. This FY 1993 GPP will install several new process waste manhole monitors in the Bethel Valley Area to aid in characterizing groundwater inleakage and to provide data on process waste flows. The functional requirements document was issued approved during December 1991, and the approved preliminary proposal was issued to DOE during August 1992.

Process Waste Flow Monitors. This project has been proposed as an FY 1993 GPP; several new process waste manhole monitors will be installed in Bethel Valley to characterize groundwater inleakage and to provide data on process waste flows.

NRWTP Access Controls. This project has been proposed as an FY 1993 GPP; access control equipment (i.e., fences, gates, and badge readers) will be installed at the NRWTP and the Bethel Valley Collection Tank Facility.

Contaminated Sumps Pumping Modifications. This project has been proposed as an FY 1994 GPP; slightly contaminated wastewater will be segregated in the 4500 Area from the noncontaminated wastewater. The proposed modification will reduce treatment of noncontaminated wastewater in the PWTP and slightly contaminated wastewater in the NRWTP.

Process Wastewater Flow Characterization. This project has been proposed as an FY 1994 GPP; several flow-monitoring systems will be installed in the process waste manholes in Bethel Valley to characterize groundwater inleakage and to provide data on process waste flows.

Clean Water Act Compliance. This project has been proposed as an FY 1994 GPP; piping to route noncontaminated process waste streams will be installed in the 3000 Area to the NRWTP.

Miscellaneous FFA Upgrades in Bethel Valley. This project has been proposed as an FY 1994 GPP; several slightly contaminated sources of LLLW in Bethel Valley such as inleakage, condensate from the hot off-gas system, and rainwater will be eliminated. This project will eliminate these waste streams or divert them to the PWTP.

3.2.3.3 Storage facilities

No facilities for long-term storage of process waste exist at ORNL; however, several ponds have been used in the past for collection prior to treatment. All of the existing ponds at ORNL have been taken out of service but have not been turned over to ERP because they are used as surge capacity for PWTP feed tanks during periods of heavy rainfall. New feed tanks are being installed on the FY 1996 LI to remove them from service completely.

3.2.3.4 Disposal facilities

Solid wastes such as clarifier sludges and spent zeolite will be disposed of as SLLW. Additional treatment requirements will be addressed as the WAC for solid waste disposal sites are developed.

3.2.3.5 Status of support systems

ORNL provides employee training commensurate with job responsibility. As discussed in Subsect. 3.2.2.5, a certification program is currently being developed for LLLW and process waste streams at ORNL. Database management associated with process waste consists of the reporting requirements set forth in the NPDES permit for ORNL. Water and biological monitoring activities at ORNL are defined by the ORNL NPDES permit and by DOE guidelines for environmental monitoring and surveillance around nuclear facilities. In response to DOE guidelines for environmental monitoring, flow and concentration data are collected to determine discharges of nonradiological constituents from ORNL processes. Under the current NPDES permit there are over 150 monitoring stations, and point sources are monitored at their point of discharge into receiving streams. The biological monitoring program includes the collection of fish, milk, soil, and grass for investigation of pollutant movement within the food chain. Implementation of the Best Management Practices (BMP) Plan is also required by the NPDES permit. Continued support of the BMP Plan will ensure that the PWS will not handle "hazardous" wastes. The BMP Plan establishes requirements for the development of a waste tracking system that will track waste from the point of release from ORNL. WOCC also provides database management support for process waste at ORNL. A discussion of the WOCC is provided in Subsect. 3.2.2.5 under "Database management."

3.2.3.6 General plant projects

A listing of proposed LIs and GPPs for the PWS at ORNL is provided in Table 3.13. This table indicates the project title, TEC, funding type, and the respective fiscal year for funding.

3.3 GASEOUS WASTE

Characterization and treatment of air emissions containing radionuclides are of primary importance because most of the major facilities at ORNL are either being used or have been used in the past for work related to nuclear energy. The three general types of radioactive air streams at ORNL include (1) cell ventilation, (2) process off-gas, and (3) laboratory hood and individual vents.

3.3.1 Strategy

ORNL policy dictates that airborne effluents should be decontaminated (where practical) at the source of generation before entering one of the plant ventilation systems. Effluents with a potential for having relatively high concentrations of radionuclides or reactive chemicals go to process off-gas streams that receive special treatment. The

Table 3.13. Line items and general plant projects for the Process Waste System at Oak Ridge National Laboratory

Title	TEC[a] ($ × 1,000)	Funding type	Fiscal year
Line item projects			
ORNL Process Waste Treatment Facility	25,000	EW	1996
Process Waste Treatment System Upgrade	6,000	EW	1992
General plant projects			
Wastewater piping replacement	700	EX	1988
Manhole monitors process waste	450	EW	1989
Chlorine treatment for cooling water	700	AT	1991
Outfall 302 storm rehabilitation	1,065	EX	1992
Manhole monitors process waste—3000	638	EX	1993
Process waste flow monitors	962	EX	1993
Nonradiological Wastewater Treatment Plant access controls	396	EX	1993
Miscellaneous Federal Facility Agreement upgrades in Bethel Valley	1,100	EW	1994
Contaminated sumps pumping modifications	1,000	EX	1993
Process waste flow characterization	600	EX	1994
Clean Water Act compliance	900	EX	1994

[a]Total estimated cost.

current approach for control of radioactive emissions from ORNL facilities is illustrated in Fig. 3.23.

The program strategy is to identify and to implement system upgrades needed to ensure continued regulatory compliance and to meet DOE objectives for as low as reasonably achievable. In addition, potential regulatory changes or new regulations are evaluated to determine if additional upgrades or new equipment will be required for future compliance. This strategy has been in the strategic plan. Technical studies include:

- stack-and-vent surveys to identify potential air emission sources;
- inspection and evaluation of the ventilation ducts, filter houses, emergency power systems, and other pollution control equipment associated with radioactive emission sources;
- preparation of engineering assays and cost estimates for repair of equipment, such as underground ventilation ducts and filter pits, and the installation of new pollution control equipment;

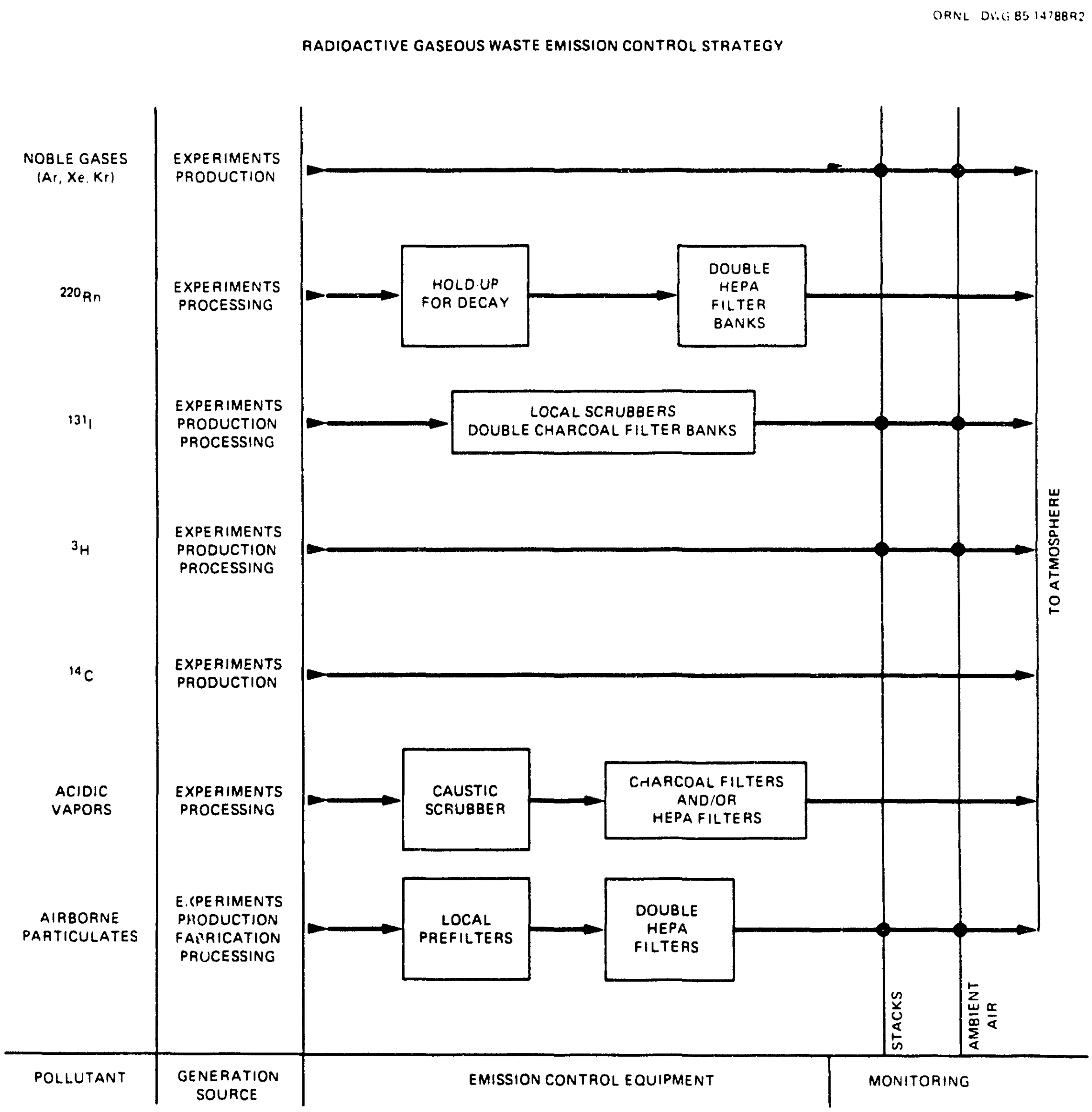


Fig. 3.23. Radioactive gaseous waste emission control.

- determination of flow distribution, particle size distribution, and flow stability and evaluation of the use of new flow instruments in the main ventilation stacks for use in stack sampling and monitoring;
- determination of methods to further reduce emissions as low as reasonably achievable and in a cost-effective manner; and
- evaluation of new programs and changes in existing programs to ensure continued compliance with regulations.

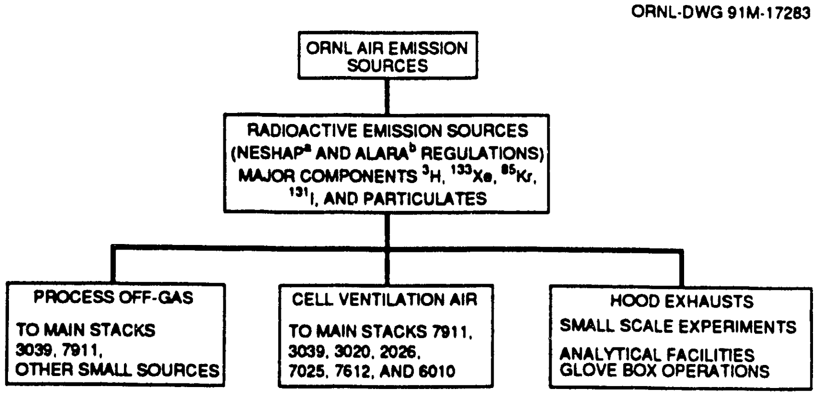
3.3.1.1 FFCA for radionuclide NESHAP

In May 1992 DOE signed on FFCA with the EPA to achieve compliance with respect to radionuclide National Emission Standards for Hazardous Air Pollutants (NESHAP) on the ORR. Specifically, ORNL has been committed to survey all air emissions and to perform system and instrumentation upgrades on stacks 7911, 2026, 3039, and 3020.

3.3.2 Generic Description and Characteristics of Wa'te

The three general types of radioactive air streams at ORNL (Fig. 3.24) include (1) process off-gas streams characterized as low-volume, potentially high-activity gas streams from process vessels and from systems or other sensitive areas where the release of radioactivity may be routine and of relatively high concentration; (2) cell ventilation air streams characterized as high-volume, low-activity gas streams from enclosed areas such as containment or confinement areas, limited-access areas, and hot cells; and (3) laboratory hoods and individual vents that provide controlled ventilation for laboratory-type operations or exhaust from vessels that are vented through appropriate pollution control devices at the source location.

ORNL-DWG 91M-17283



[a] NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS
[b] AS LOW AS REASONABLY ACHIEVABLE, DOE ORDER 5480.11

Fig. 3.24. Emission sources at Oak Ridge National Laboratory.

3.3.3 Treatment Facilities

Essentially all radioactive air streams (including cell ventilation air, process off-gas, and air from hoods and individual sources) are filtered through roughing and HEPA filters to remove particulates before being discharged. Where conditions dictate (particularly for the off-gas emissions), charcoal absorbers or chemical scrubbers are used to remove reactive gases such as halogens and acidic vapors. For short half-life radionuclides, such as radon, holdup is used to allow decay before discharge. Noble gases are diluted with cell ventilation air and discharged to the stacks. Because of the small quantities involved, collection and storage of these gases is not considered practical. The procedures and equipment used in the tritium-handling facilities are designed to minimize the release of tritium. A small amount of ^{14}C is produced at ORNL by the irradiation of nitrides. During processing the ^{14}C is converted to a gaseous form (CO_2) that is removed by process scrubbers. The off-gas from the process is monitored before being discharged to the plant off-gas system.

The basic equipment used in most of the cell ventilation systems that discharge to major stacks includes filters, fans, and the ducts used to transport air. Typically, the filters are located in concrete pits of below-grade level with the top surface exposed. The top of most filter pits is covered with removable concrete slabs that are sealed with an asphalt compound. Air flow is normally provided by electrically driven fans. Upon loss of negative pressure in the ducts, standby fans operated by steam or emergency electrical power start automatically to provide ventilation air. Radiation-monitoring instruments are connected to either the stacks or ducts entering the stacks.

Seven major cell ventilation systems with stacks are currently used for discharging cell ventilation air and process off-gas containing gaseous radioactive effluents. A major emphasis is placed on the use of negative pressure and a positive flow of air through containment areas to the stacks for the control of radioactive air emissions. The location of the stacks is shown in Fig. 3.25. The 3039, 3020, and 2026 stacks are located in the main ORNL area. The 6010 stack is located at the east end of the ORNL area, and the 7025 stack is located east of the 7000 Shop Area. The 7911 and 7512 stacks are located in Melton Valley. Each of the major cell ventilation treatment systems is described in the following paragraphs.

The 3039 stack handles the cell ventilation and process off-gas from most of the facilities in Bethel Valley. The system is illustrated in detail in Fig. 3.26. The stack is connected with the ventilation systems in major areas (4500, 3500, 3025, 3026, Isotopes, Solid State, and the ORR by large underground concrete ducts, by underground transite ducts, and by aboveground steel ducts. Except for the 3025 and 3026 Areas, the gas stream from each area passes through HEPA filters before going to the 3039 stack. Cell exhaust air from Buildings 3025 and 3026 (east) passes through HEPA filters. Cell exhaust from Building 3026 (west) is not filtered.

The 7911 stack system handles the ventilation air and process off-gas from HFIR (7900) and the REDC (Buildings 7920 and 7930) in Melton Valley (Fig. 3.27). The HFIR cell ventilation air goes through 30-in.-diam underground transite ducts to the filter pit located at the base of the 7911 stack. HFIR ventilation air is filtered through silver-coated copper mesh, charcoal, and HEPA filters in series before going through fans and a 48-in.-diam steel duct (located aboveground) to the stack. The cell ventilation air from Building 7920 passes through HEPA filters located in a filter pit adjacent to the building and then goes through a 76.20-cm-diam (30-in.) underground steel pipe (coated on the exterior with an asphalt compound) to fans located at the 7911 stack. Downstream from the fans, the ventilation air from Buildings 7920 and 7930 joins together in a 121.92-cm-diam (48-in.) steel duct (located aboveground) that goes to the 7911 stack.

The 3020 stack provides cell ventilation for the Radiochemical Processing Pilot Plant in Building 3019 (Fig. 3.28). Ventilation air from this facility goes through aboveground stainless steel ducts to single sets of HEPA filters located in two filter pits at the base of the 3020 stack.

The 2026 stack provides cell ventilation air for the High-Radiation-Level Analytical Laboratory. Cell ventilation air from this facility passes through HEPA and charcoal filters located in a filter pit at the base of the stack before being discharged (Fig. 3.29).

ORNL - DWG 81-9115R

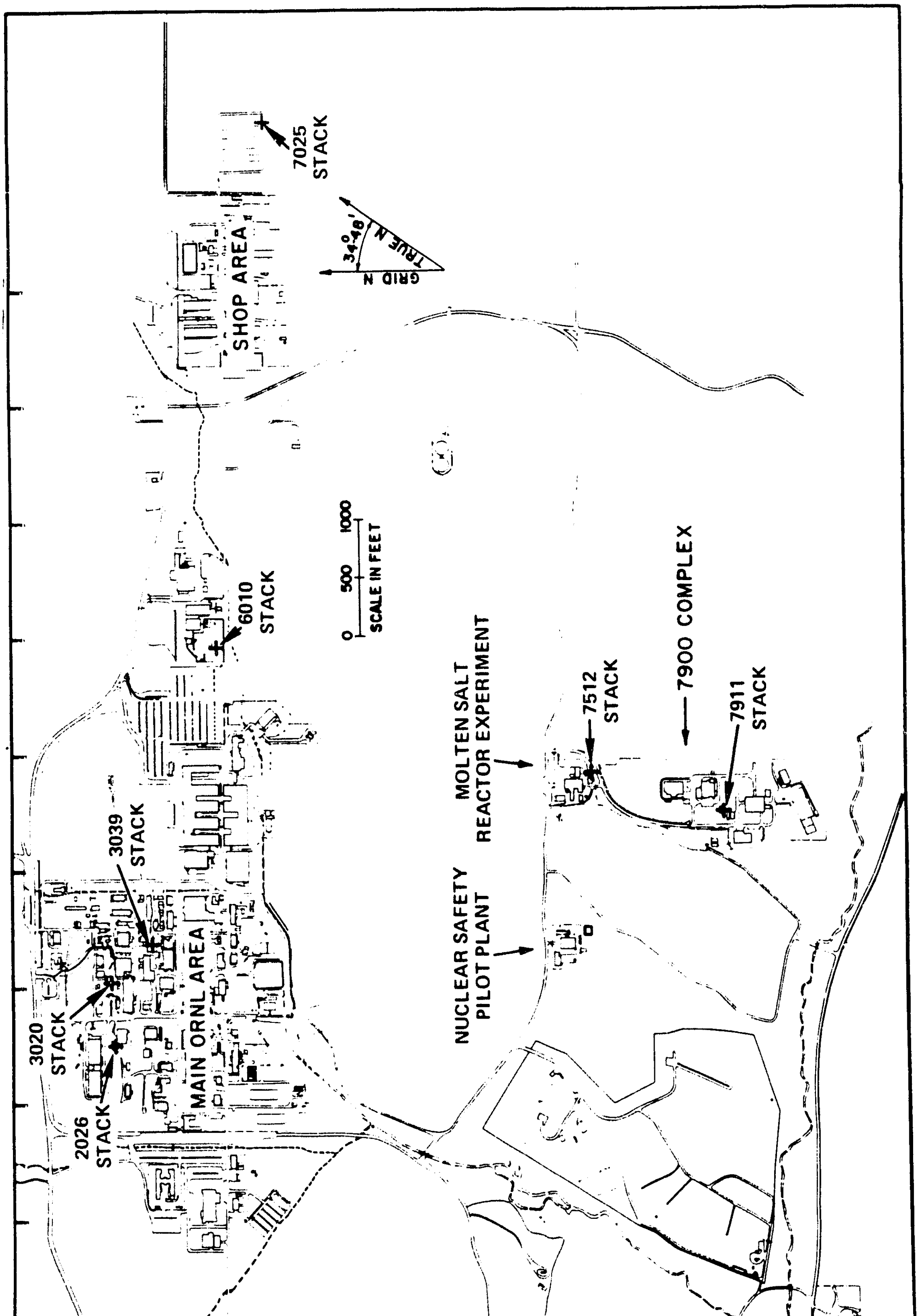


Fig. 3.25. Location of major cell ventilation stacks at Oak Ridge National Laboratory.

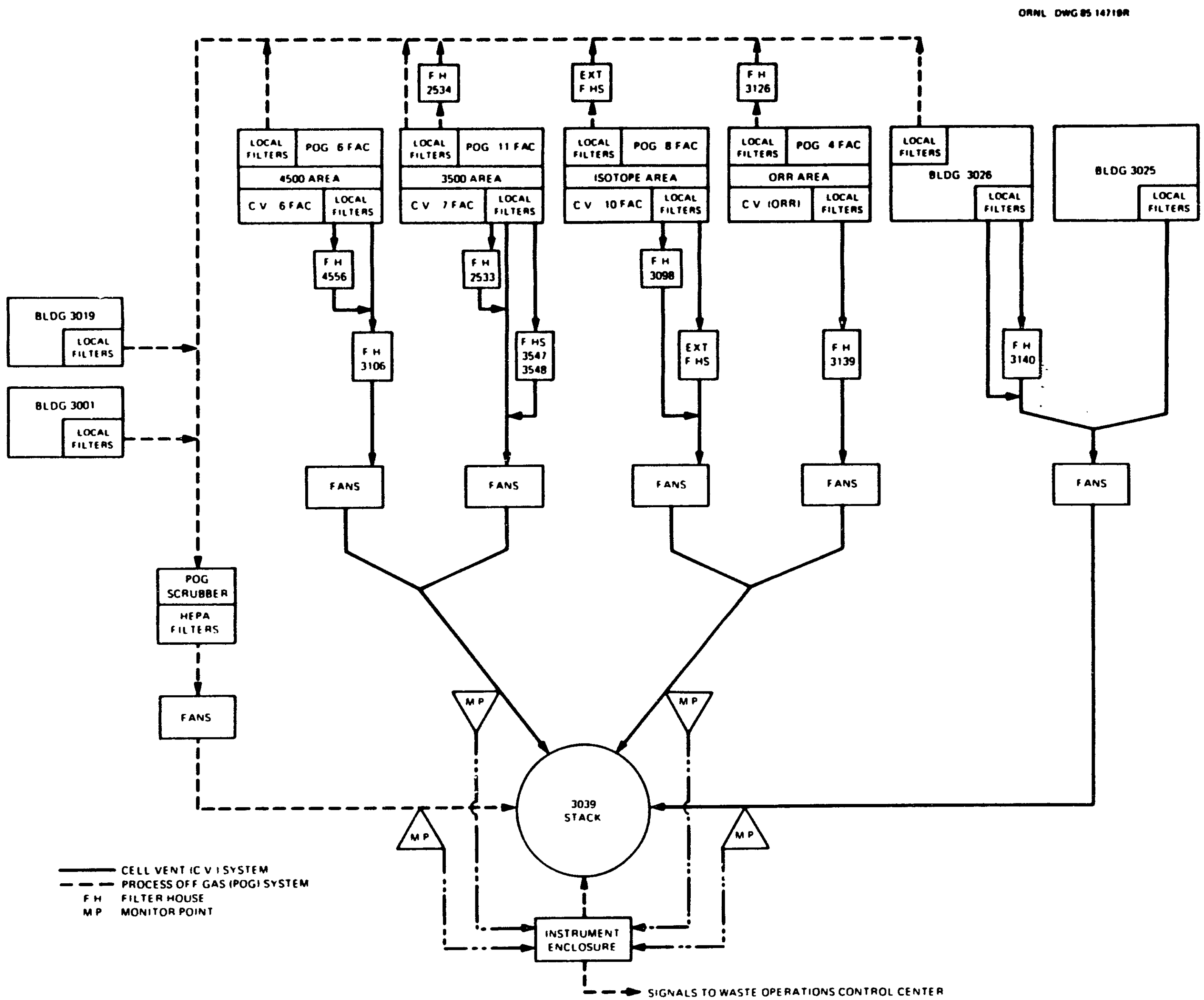


Fig. 3.26. Oak Ridge National Laboratory's Central Ventilation System for Bethel Valley facilities (3039 stack).

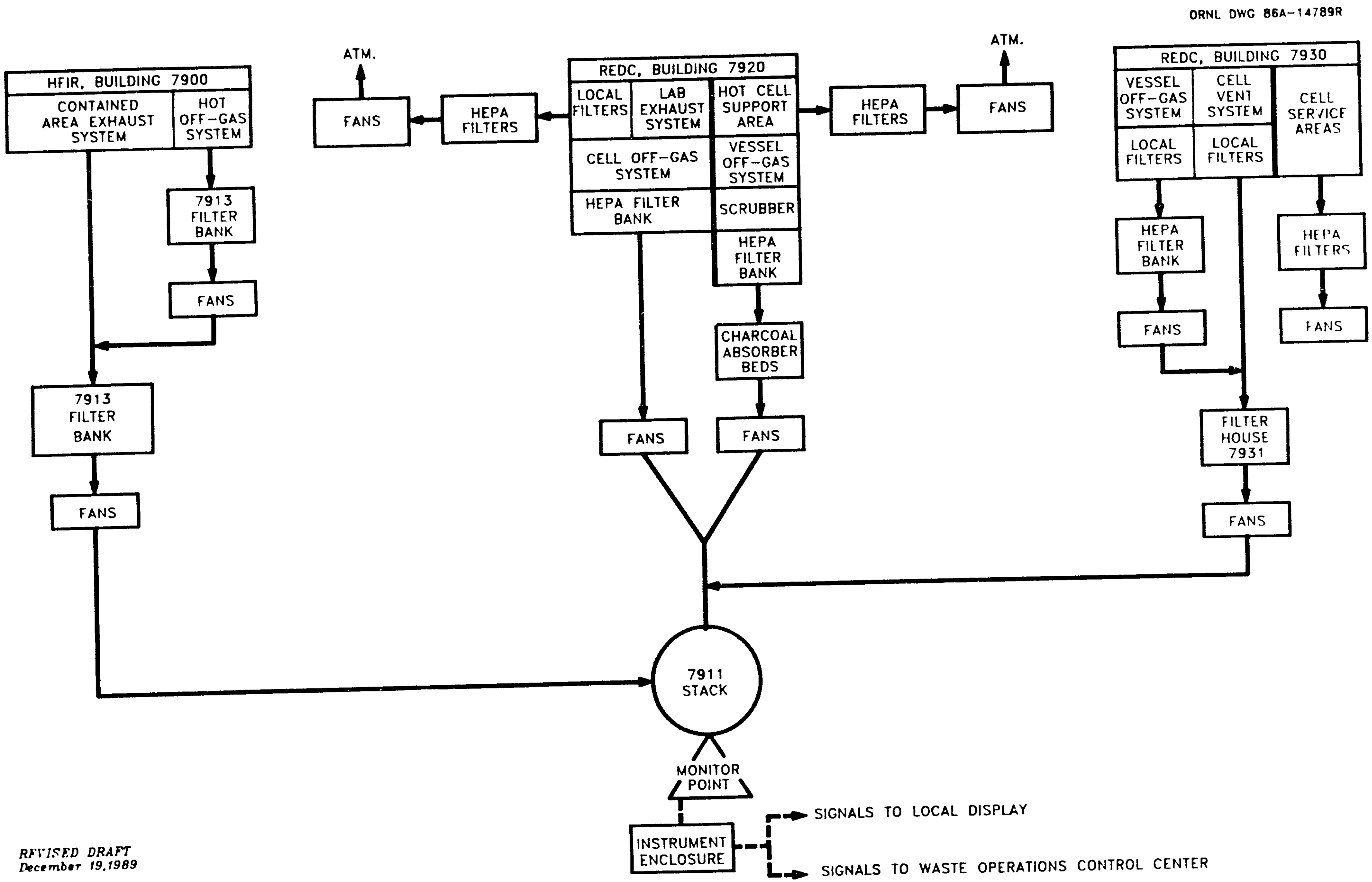


Fig. 3.27. Oak Ridge National Laboratory's Central Ventilation System for Melton Valley facilities (7911 stack).

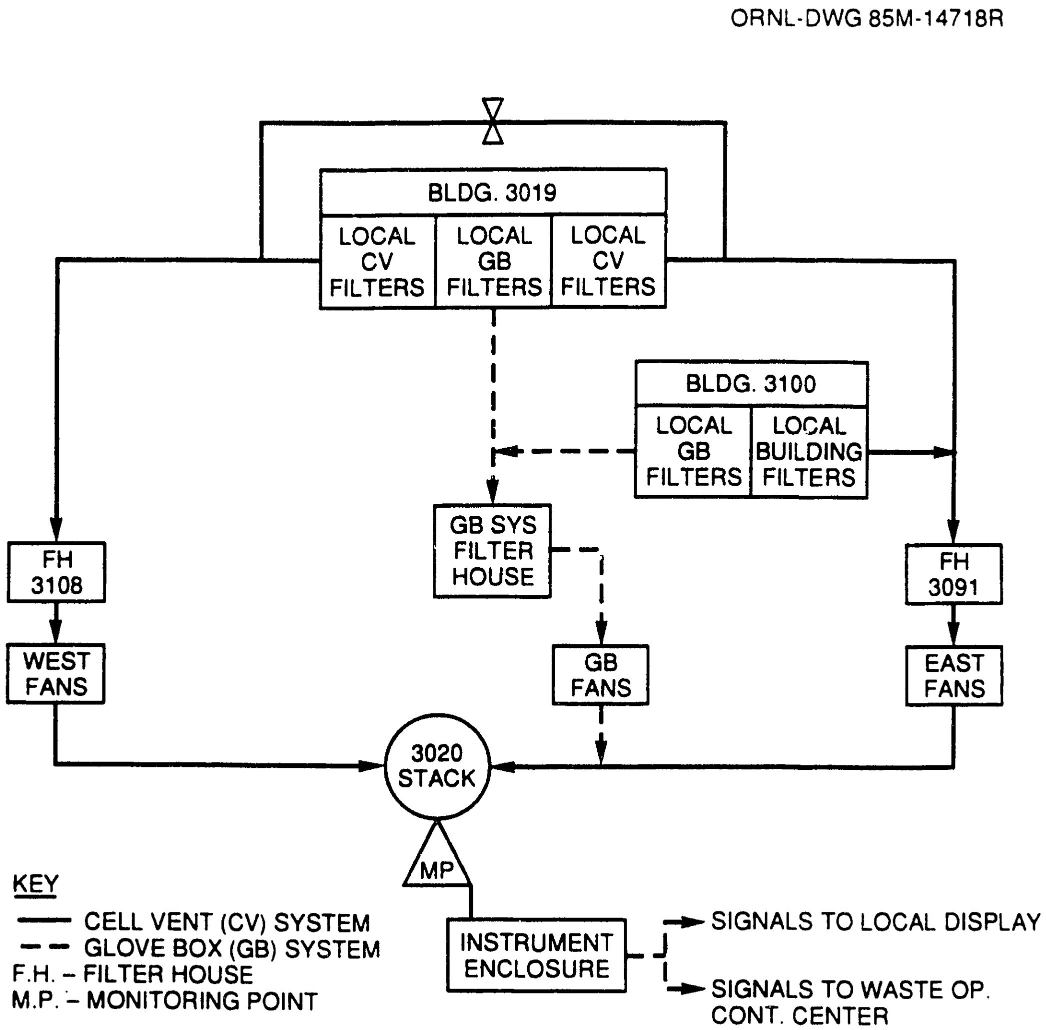


Fig. 3.28. Ventilation system for the Radiochemical Processing Pilot Plant (3020 stack).

The 7512 stack provides a flow of air through the Molten Salt Reactor Experiment building, which is no longer in operation. Aboveground steel ducts are used to convey ventilation air from the building to the HEPA filters and stack (Fig. 3.30).

The 6010 stack serves the Oak Ridge Electron Linear Accelerator. Ventilation air from the target room and the 130-ft flight station passes through HEPA filters before being discharged to the stack (Fig. 3.31).

The 7025 stack serves a Tritium Target Fabrication Facility, which is no longer in operation. Since HEPA filters are not effective for tritium ventilation, air from this facility goes directly to the stack (Fig. 3.32).

An eighth stack, 3018, is no longer in service, although it is used to discharge air from a small fan that maintains a small flow of air through the ORNL Graphite Reactor. The reactor was shut down in 1963.

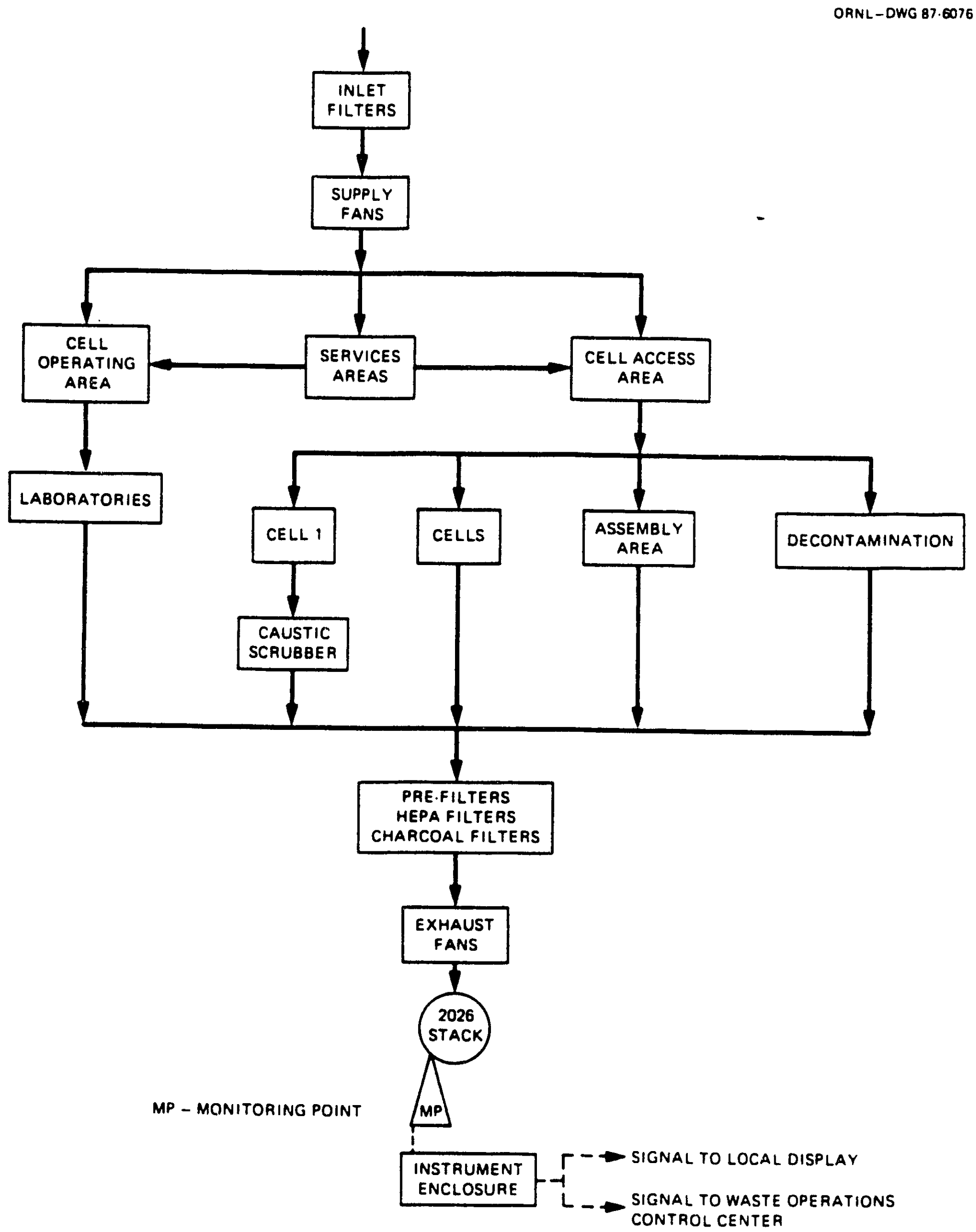


Fig. 3.29. Ventilation System for the High-Radiation-Level Analytical Laboratory (2026 stack).

Process off-gas air emissions are treated by a Central Process Off-Gas System that vents to the 3039 stack. This system serves the Bethel Valley area facilities. A network of underground stainless steel pipes transports the off-gas from facilities throughout the area. Because the process off-gas can contain acidic vapors that could damage HEPA filters, the off-gas is passed through a venturi caustic scrubber before going through roughing and HEPA filters to fans that discharge to the 3039 stack.

Process off-gas from facilities in Melton Valley discharges to the 7911 stack. The HFIR and REDC Facilities have separate process off-gas systems. Hot off-gas from the

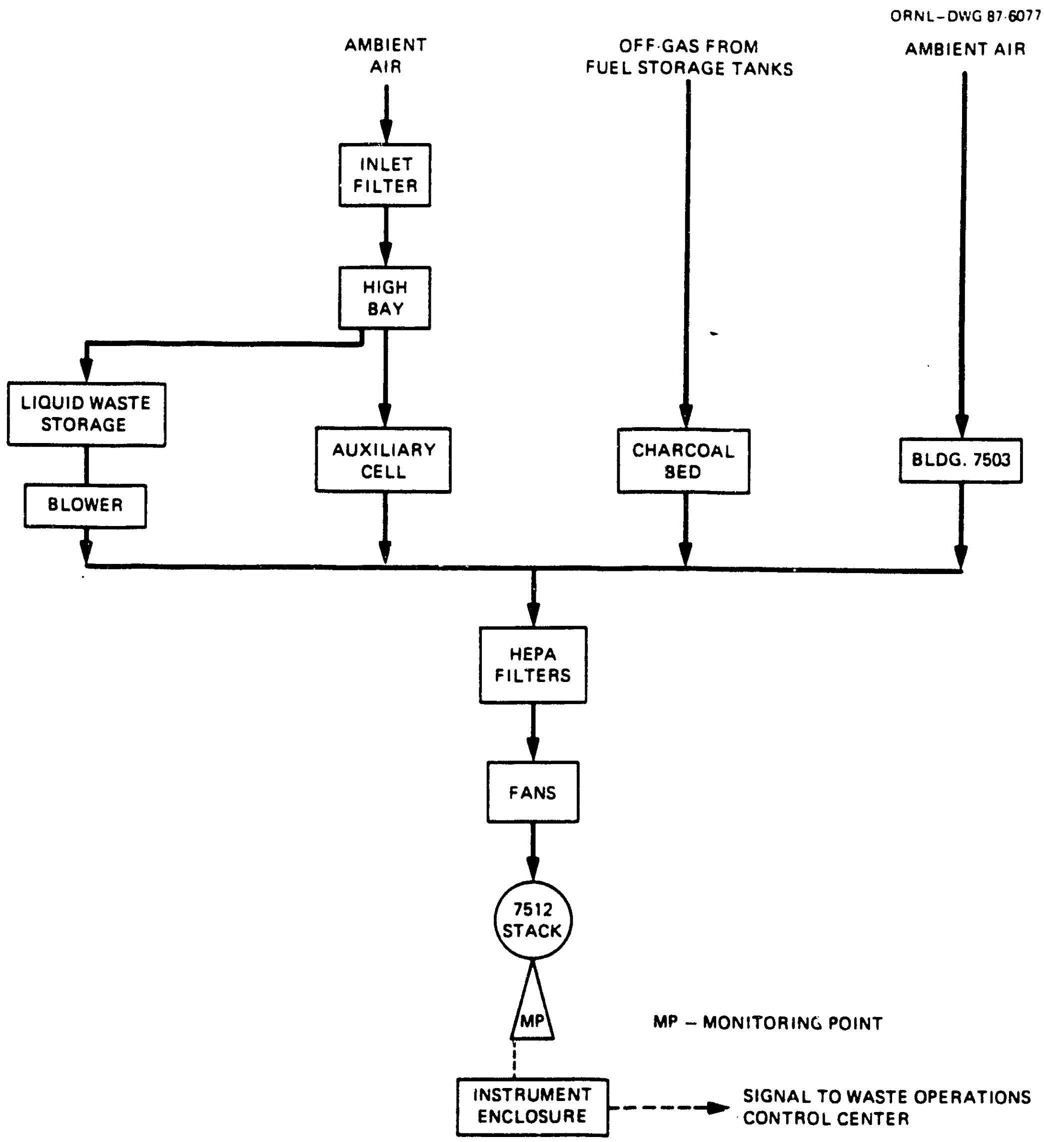


Fig. 3.30. Ventilation System for Molten Salt Reactor Experiment (7512 stack).

HFIR is filtered through silver-copper, charcoal, and HEPA filters before being discharged upstream of the cell ventilation filters. In one part of the REDC (Building 7920), process off-gas discharges through a caustic scrubber and HEPA filters to the stack. A Hopcalite-charcoal iodine retention system and a backup charcoal absorber bed are valved into the off-gas system when irradiated material containing significant amounts of ^{131}I is being processed. After passing through the filters, the off-gas goes through an underground 25.40-cm-diam (10-in.) fiberglass-reinforced pipe to fans at the 7911 stack. Off-gas from the other REDC Facility (Building 7930) passes through HEPA filters and is combined with the ventilation air upstream of the cell ventilation filters before being discharged to the 7911 stack. Provisions for adding a caustic scrubber are available if needed. The process off-gas systems described above are the major systems at ORNL through which most of the process off-gas is discharged and are typical of other smaller systems.

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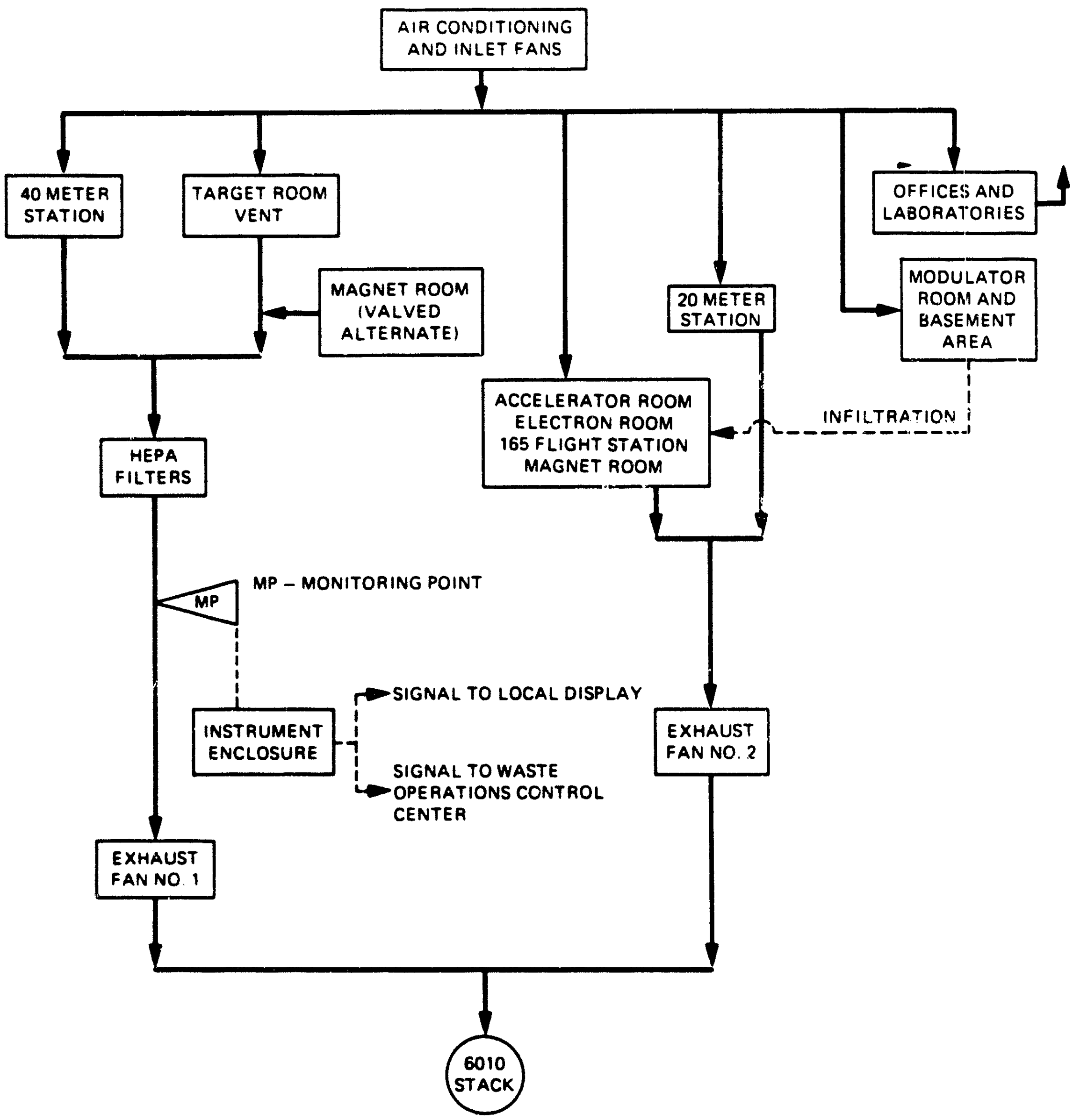

Fig. 3.31. Ventilation System for Oak Ridge Electron Linear Accelerator (Building 6010).

In addition to the major stacks, a number of individual vents are used at ORNL through which small quantities of radioactive material may be discharged. Located throughout the ORNL facilities, these sources are mainly vents from storage tanks and exhausts from hoods and glove boxes used for individual small-scale experiments and analytical chemistry work; however, larger facilities such as the Transuranium Research Laboratory in Building 5505, the Isotope Technology Building (3047), the Electron Linear Accelerator Facility in Building 6010, and the NHF in Building 7860 also have vents.

Major buildings such as the 4500 Area have many laboratories that have hoods with individual exhausts. The individual exhausts have been identified and placed in a

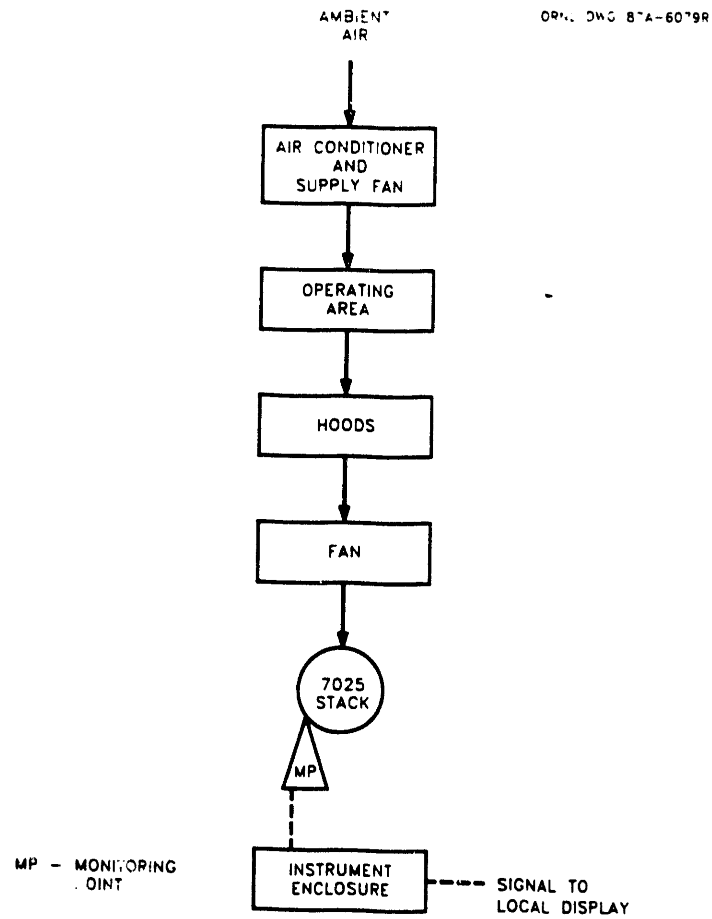

Fig. 3.32. Ventilation System for Tritium Target Fabrication Facility (Building 7025).

computer data base as a result of the recent stack-and-vent survey. This data will be used to identify emission sources for possible equipment upgrade. Individual emission sources are typically discharged through HEPA filters, fans, and short stacks located above roof level. Emissions from most of the systems are limited by administrative controls and do not require radiation monitors in the exhaust streams.

3.3.3.1 Environmental monitoring

Most gaseous wastes from ORNL are released to the atmosphere through stacks. Radioactivity may be present in gaseous waste streams as a solid (i.e., particulates), as an absorbable gas (e.g., iodine), or as a nonabsorbable species (i.e., noble gas). Gaseous wastes that may contain radioactivity are processed to reduce the radioactivity to acceptable levels before they are discharged. In addition to the monitoring of stack effluents, atmospheric concentrations of materials are monitored continuously at 27 stations around ORNL, the ORR, and the surrounding vicinity.

At each real-time monitoring station, monitors are used for five radiation parameters (i.e., gross alpha, gross beta, radioactive iodine, gross gamma, and radioactive noble gases). Also, a rain gauge and three process sensors are used to calculate the volume of the sample collected. A central processor collects 10-min average readings and transmits the data to a VAX computer for further analysis and reporting. The central processor checks the values against alarm limits. All alarms are reported to a printer as they occur. The primary purpose of the monitoring system is to determine if radiation levels on the ORR are above background levels. If radiation levels appear to be higher than normal, additional sampling can be initiated to provide quantitative measures of concentrations in the atmosphere.

Airborne radioactive particulates are collected by pumping a continuous flow of air through a paper filter and then through a charcoal cartridge. The filter papers are collected and analyzed weekly for gross alpha and gross beta activities. To minimize artifacts from short-lived radionuclides, the filter papers are analyzed 3 to 4 days after collection. The airborne ^{131}I is collected weekly using a cartridge that is packed with activated charcoal.

The major stacks are monitored and sampled for radioactive emissions. Samples are withdrawn downstream of pollution control equipment (e.g., HEPA filters) at locations that will give representative samples of the streams being discharged. The 7911, 3039, 3020, and 7512 stacks are sampled at locations 12 or 15 m above the base of the stack. The 2026, 6010, and 7025 stacks are sampled near ground level. The sampling equipment is located near the sample points to minimize losses due to deposition in the lines. The following types of air samplers are used at ORNL to provide environmental monitoring data on gaseous waste streams.

In-stack samplers are used to remove samples of gaseous effluents from the stacks for analysis of radioactive particulate matter, radioiodine, and inert gases. The design of the samplers complies with DOE Orders (per ANSI 13.1, 1969) for isokinetic sampling conditions as much as practical (i.e., sampling velocity in the probe is equivalent to the stack gas velocity). A sample of gaseous effluent from the stack is pumped through a sample cartridge and returned to the stack. The sample cartridge continuously collects a particulate and radioiodine sample from one of three probes for laboratory analysis. These cartridges are removed and analyzed on a routine basis; the time interval depends on the amount of radioactivity discharged by the stack. Two smaller probes are used to transport samples of stack effluent continuously to the alpha and beta-gamma particulate and iodine monitors.

Duct samplers are installed on ducts that discharge to the 3039, 7911, 2026, and 6010 stacks. A sample of gas is pumped from the duct through a sampling probe and a sample holder and is then returned to the duct. The sample holder contains a filter paper or a combination charcoal cartridge and filter paper. Samples collected by the filter paper and charcoal cartridge are analyzed in the laboratory to determine the amounts of radioactive particulate matter and radioiodine passing through the duct.

Beta-gamma particulate monitors consist of a filter paper tape deck, a sample pump, a count-rate meter, a Geiger-Mueller (G-M) tube, and a weatherproof cabinet. A sample of gaseous effluent is pumped from the stack or duct through a sample probe and filter paper and is then returned to the stack or duct. The filter paper exposed to the sample stream is continuously monitored by a G-M tube. The filter paper removes more than 90% of the particles larger than 0.3 μm from the sample stream. The G-M tube also monitors for radioactive gases and radioiodine if they are present in the sample stream.

Alpha particulate monitors are the same as the beta-gamma monitors except for the detector and detector shielding. The detector is a scintillation counter that uses silver-activated zinc sulfide as the scintillator.

Iodine monitors are located on the 3039, 7911, 2026, 3020, and 7512 stacks and are used for monitoring radioiodine in gaseous effluents. The iodine monitor is installed in series with one of the particulate monitors. With this arrangement the gas sample is withdrawn from the stack, passed through filter paper that removes the particulates, and then passed through a charcoal trap. The charcoal removes the radioiodine; this is then monitored by one to four G-M tubes connected in parallel.

Two types of noble gas monitors are used to monitor the isotopes of xenon, krypton and argon; special attention is given to ^{133}Xe and ^{85}Kr. The first type of detector is installed in a lead shield, and the noble gas monitor is installed in the sample stream in series with the particulate monitor and the iodine monitor. The effluent sample is withdrawn from the stack, passed through filter paper in a particulate monitor, through the iodine monitor, and then through the inert gas monitor before being returned to the stack. The detector is an end-window-type G-M tube and is connected to a count-rate meter. The count-rate meter provides a signal output indicating the integrated counts from the detector; this is normally read and recorded every 24 h.

The second type of noble gas monitor is the most recent design of the two inert gas monitors. This monitor is located at the base of the stack rather than at the 15.2-m (50-ft) level. The effluent sample is withdrawn from the stack through one of the in-stack sampler probes at the 1.5-m (5-ft) level and piped to the monitor location. The sample is then passed through a roughing filter, a charcoal trap, and the noble gas detector. After collection, the sample is taken to the laboratory for analysis. Because the collected sample was monitored by the noble gas detector at the same time it was being collected, the data from the laboratory analysis can be compared directly with the monitor readings.

A tritium sampling station is contained in a fiberglass instrument shelter located next to the 7025 stack. Air from the stack is passed through a cartridge containing silica gel that collects any tritiated water vapor. The air flow is then passed through the tritium sampler that contains a catalytic converter to oxidize hydrogen (tritium) gas and tritiated organics to water vapor; this is then collected in a second silica gel cartridge. The silica gel is periodically removed from the cartridges, and the tritium content of the water vapor is determined by beta liquid scintillation techniques.

The high-level gamma monitor is a wide-range monitor that measures gross gamma dose equivalent rates at the detector location. This instrument monitors gamma dose rates in a stack in the event of a major accident in a facility that discharges gaseous effluent to the stack. The range of this instrument is from 25 mrem/h to 106 rem/h in eight log decades. Output signals are provided to operate remote "high-level" and instrument "inoperative" audible and visual alarms. The alarms are telemetered to WOCC.

Flow monitors are installed in gaseous waste effluent streams in stacks and ducts to determine the volume of waste gases being discharged to the atmosphere. The monitor consists of an anemometer, a telemetering transmitter, and a recorder. The anemometer is installed in the effluent stream at a point of average velocity in the steam. The anemometer generator is connected to the telemetering transmitter that supplies a signal proportional to the flow rate to a digital alarm system located in WOCC. Major upgrades are either ongoing or have been completed under the terms of the Clean Air Act (CAA) FFCA (NESHAP).

3.3.3.2 Permitting status

Control of airborne emissions from ORNL facilities is provided in accordance with DOE Orders 5480.1A, 5480.4, 5480.11, 5820.2A, and the CAA. The requirements of the

CAA are being administered through the TDEC Air Pollution Control Regulations. Air permits have been obtained for all emission sources that require permitting under TDEC regulations.

The CAA authorizes the establishment of National Emission Standards for Hazardous Air Pollutants (NESHAP) regulations for pollutants for which Ambient Air Quality Standards are not applicable. Radionuclide emissions are regulated under the NESHAP regulations by the EPA. The state has been authorized to regulate in this area. Under the NESHAP regulations (40 CFR Pt. 61, Subpart H), emission of radionuclides to the ambient air from DOE facilities is limited to those amounts that would cause any member of the public to receive an effective dose equivalent of 10 mrem/year.

3.3.3.3 Facility status

Many of the facilities for handling radioactive gas emissions have been in operation for over 20 years. Generally, the equipment that is accessible has been maintained in good working condition. A considerable amount of upgrading of equipment has been completed. Backup units exist for some equipment to be used in the event of failure. However, much of the equipment, such as underground ducts and filter pits, has not been evaluated for long-term wear, deterioration, or reliability for continued long-term service. The status of upgrade activities for cell ventilation equipment is described in the following paragraph.

Systems that have undergone significant upgrading through an LI capital project initiated in 1981 (Improvement to Radioactive Waste Facilities, 81-T-104) include:

- The 3039 Stack Area. In 1984 the fans and ductwork around the stack were either replaced or refurbished.
- The Isotope Area. In FY 1986 the existing underground ventilation ducts were replaced with a stainless steel, locally filtered overhead system.
- The 3020 Stack Area. Ductwork between Building 3019 filter house and the 3020 stack was replaced, the two electrical fans and steam fan were replaced with four new electrical fans, an existing emergency generator was rewired, and a second emergency generator was added.

The following projects have been proposed as upgrades of the gaseous waste systems at ORNL.

Radiochemical Processing Pilot Plant (3019) and exhaust stack (3020)

The 3019 facility is used primarily as a national repository for storage of ^{233}U. The major stored waste consists of 402 cans containing uranium oxide produced by the Consolidated Edison Uranium Solidification Project campaign. In the past, the facility was used as a fissile material storage area for conducting R&D studies, solvent extraction reprocessing of ^{233}U, and laboratory-scale analytical work. Potential emissions may include nitrous oxide, sulfur dioxide, volatile organic carbon, and carbon dioxide. The FY 1989 GPP was cancelled. Isokinetic sampling of the 3020 stack has been implemented under a FY 1990 GPP, Stack Monitoring Improvements. However, neither the FY 1989 nor the FY 1990 GPP had anything to do with upgrading the 3019 sampling gallery exhaust, installing instrumentation, or running signals to WOCC.

Building 3125 emergency generator

The design for this 1990 GPP was completed and certified for construction in October 1990. Construction was completed in FY 1992.

Upgrade 3039 stack fans

The Central Radioactive Gas Disposal Facility (3039) is the central stack through which cell ventilation air and process off-gas from the main ORNL Complex are discharged. This project replaces three of the steam turbine drive units that provide power for the backup fans in the event the motor drive fans lose electrical power or otherwise fail. Design and procurement of the turbines are scheduled to occur in FY 1993.

Liquid/Gaseous Waste Support Facility

This 1992 GPP would construct a support facility for liquid and gaseous waste operations. The facility would consist of hardware and equipment storage as well as equipment maintenance facilities necessary to support operation of the 3039 stack and other gaseous emission systems, the PWTP, and the NRWTP. The preliminary proposal was approved and sent to DOE-OR in August 1991.

Waste Operations Control Center expansion

This 1991 GPP would construct a change house for Waste Management Operations personnel to replace current facilities. The preliminary proposal was issued in May 1991 and sent to DOE-OR.

Upgrade Hot Off-Gas System at 3039 stack

The Hot Off-Gas System is a critical portion of the Central Radioactive Gas Disposal Facility (3019). This project will relocate and replace fans, electric motors, backup steam turbine, and appropriate ducting that provide motive force for the Hot Off-Gas System. This project has been proposed as a 1994 GPP.

Upgrade 3047 Filter House

Ventilation air from the manipulator cells in the Isotope Technology Building, Building 3047, goes through in-cell HEPA filters before being discharged to the 3039 stack. Sealing problems with the in-cell HEPA filters has allowed contamination (mainly europium and cobalt) to reach the underground duct and second set of HEPA filters. This project will provide an additional set of underground HEPA filters to stop airborne material from reaching the second set of HEPA filters in sufficient quantities to cause a radiation problem. This project will be proposed as an FY 1995 GPP.

Ventilation System upgrade (3500/4500)

Inspection and monitoring of the water flow from the underground ventilation ducts from the 3500 and 4500 Areas to the 3039 stack has shown concrete deterioration and tree root intrusion in some areas. This allows groundwater to be drawn in by the negative pressure in the duct. This project will upgrade the underground concrete cell ventilation duct work to improve the efficiency of the Ventilation System and reduce potentially contaminated water that must be treated at the PWTP. This project has been proposed as a 1995 GPP.

3.3.4 Storage and Disposal Facilities

Air emissions at ORNL are routinely treated and discharged through monitored ventilation stacks on-site. Because radioactive air emissions from ORNL facilities are collected, treated, and discharged via these stack systems, no storage or disposal facilities are required. All solid wastes (e.g., HEPA filters) generated in the treatment and monitoring processes are handled as part of the solid radioactive waste management program, as addressed in Subsect. 3.1 of this plan.

3.3.5 Status of Support Systems

No specific training, certification, or database management system is available at ORNL for radioactive gaseous emissions. Training is generally commensurate with the employee's job responsibility; certification and database management are associated primarily with solid waste streams. WOCC does provide data regarding air flow rates for gaseous waste effluent streams in stacks and ducts. The alarms for the high-level gamma stack monitors are also telemetered to WOCC.

3.3.6 General Plant Projects

A listing of GPPs for gaseous radioactive waste facilities at ORNL is provided in Table 3.14. This table indicates the project title, TEC, funding type (i.e., DOE program budget code), and the respective fiscal year for funding.

Table 3.14. General plant projects for gaseous radioactive waste facilities at Oak Ridge National Laboratory

Title	TEC[a] ($ × 1000)	Funding type	Fiscal year
Upgrade stack fans (3039)	740	EX	1991
Liquid/Gaseous Waste Support Facility	1100	EW	1992
Waste Operations Control Center expansion	1196	EX	1991
Upgrade Hot Off-Gas System at 3039 stack	1100	EX	1994
Ventilation Systems upgrade (3500/4500)	1000	EW	1995
Upgrade 3047 Filter House	1100	EW	1995

[a]Total estimated cost.

4. HAZARDOUS WASTE MANAGEMENT

The objective of the Oak Ridge National Laboratory (ORNL) Hazardous Waste Management Program is the compliant management of all nonradioactively contaminated hazardous wastes as defined by 40 CFR Pt. 261.3 under the Resource Conservation and Recovery Act (RCRA), Toxic Substances Control Act (TSCA) materials, and U.S. Department of Transportation (DOT) regulatory guidelines for poisonous substances that are currently under the control and cognizance of the Waste Management and Remedial Action Division. The management of hazardous waste is administratively regulated by the Tennessee Department of Environment and Conservation (TDEC), which has been authorized by the U.S. Environmental Protection Agency (EPA) to enforce RCRA.

When a waste or waste stream is generated, it must be determined if it is "hazardous" as defined above. This is done by applying the following general criteria (see 40 CFR Pt. 262.11 under "Hazardous Waste Determination"):

- Is the waste excluded from regulation?
- Is the waste listed as a hazardous waste (i.e., the waste or its constituents are specifically listed in the regulations as hazardous)?
- Is the waste a characteristically hazardous waste (i.e., the waste or its constituents exhibit any of the following characteristics: corrosivity, reactivity, ignitability, or toxicity)?

Note that the level of radioactive contamination present in or on a given waste will also have some bearing on how the waste is handled. Hazardous wastes found to contain any levels of radioactive contamination added by U.S. Department of Energy (DOE) operations are referred to as "mixed wastes" and are described in detail in Sect. 5 of this plan.

Because there is currently no procedure to determine absolutely that no radioactivity has been added (the "no-rad-added" policy), the distinction between hazardous waste and mixed waste has been blurred. However, this distinction is still made by the Hazardous Waste Operations Group (HWOG) based on "traditional" acceptable levels of radioactive contamination.

If a waste is determined to be a hazardous waste, it must be handled in strict accordance with RCRA. The principal RCRA requirements include proper characterization, treatment, storage, and disposal of hazardous waste in which all the attendant activities meet the letter of the law under RCRA. It is the policy of ORNL to handle all TSCA wastes in the same manner as RCRA except in those instances where TSCA regulations are more restrictive or require specific action pertaining to polychlorinated biphenyl (PCB) wastes.

4.1 SOLID AND LIQUID WASTES

Many independent research projects at ORNL are supported by numerous small scientific laboratories that store and use hazardous materials. Most of these laboratories are potential generators of hazardous waste such as spent experimental samples, process residuals, and hazardous materials (usually chemicals) that have exceeded their shelf lives or are no longer useful. Waste oil is generated from sources such as motor vehicles, machines, and vacuum pumps. Hazardous waste is also generated by the groups that support the research projects, such as photographic labs and reproduction facilities.

Because liquid and containerized gaseous wastes are considered "solid" wastes by the EPA and are subject to solid waste rules, liquid, containerized, gaseous and solid hazardous wastes are managed similarly at ORNL.

4.1.1 Strategy

The current strategy for hazardous waste management at ORNL is illustrated in Fig. 4.1. This management strategy is in compliance with applicable federal and state regulations, DOE orders, and corporate policies. It is ORNL policy to manage hazardous waste in a manner to protect its employees, public safety and health, and the environment. Cost-effective options for the treatment, storage, and disposal of these waste streams are sought. Currently, ORNL hazardous waste is collected, handled, and stored with off-site treatment/disposal as the major waste management objective. The focus of hazardous waste management is characterization, verification, segregation, repackaging, and storage in preparation for shipment to commercial facilities for treatment and/or disposal. The suspension of off-site shipments in May 1991 severely affected this strategy. Waste reduction, tracking, and documentation are also critical aspects of the ORNL management strategy.

ORNL is committed to the reduction of the quantity and toxicity of the waste generated by its activities including functions directly related to its mission, supporting activities, and environmental remediation activities. Requirements for waste reduction are found in federal regulations and DOE policies and guidelines; motivation for waste reduction stem from increased costs and liabilities associated with the management of wastes and limited disposal options and facility capacities.

4.1.2 Generic Description and Characteristics of Waste

Critical first steps in responsible waste management are the identification of waste streams and determination of the their characteristics. Critical characteristics include physical form (i.e., liquid, solid, or gas), chemical properties, and/or the presence of constituents identified as hazardous by the EPA or the TDEC under the RCRA or by the TSCA. Because ORNL is a research laboratory, its waste generation is quite different from that of a production facility. Generation is not linked to production rates; therefore, well-defined or regularly generated waste streams are rare. Instead, the diverse nature of ORNL's research and development activities produces a large number of widely varied waste streams. The fact that nearly all characteristically hazardous and listed hazardous wastes defined by the EPA and the TDEC appear on ORNL's RCRA Part A permit application illustrates this diversity.

Collection of hazardous waste at ORNL is performed in a proceduralized manner (see Fig. 4.2). The generator of a hazardous waste prepares a request form for waste collection. The request is sent to HWOG, which logs the request, ensures that the waste has been properly identified, and determines its appropriate classification (i.e., toxic, reactive, ignitable, etc.). For example, lab-pack and explosive wastes are collected and delivered directly to Building 7653 for storage in a predesignated area that corresponds to the waste classification. When enough is accumulated, lab-pack waste is packaged by commercial treatment, storage, and disposal (TSD) facility personnel into appropriate shipping containers that meet DOT requirements and is shipped to EPA-permitted commercial treatment or disposal sites. Explosive waste is treated on-site at the Chemical

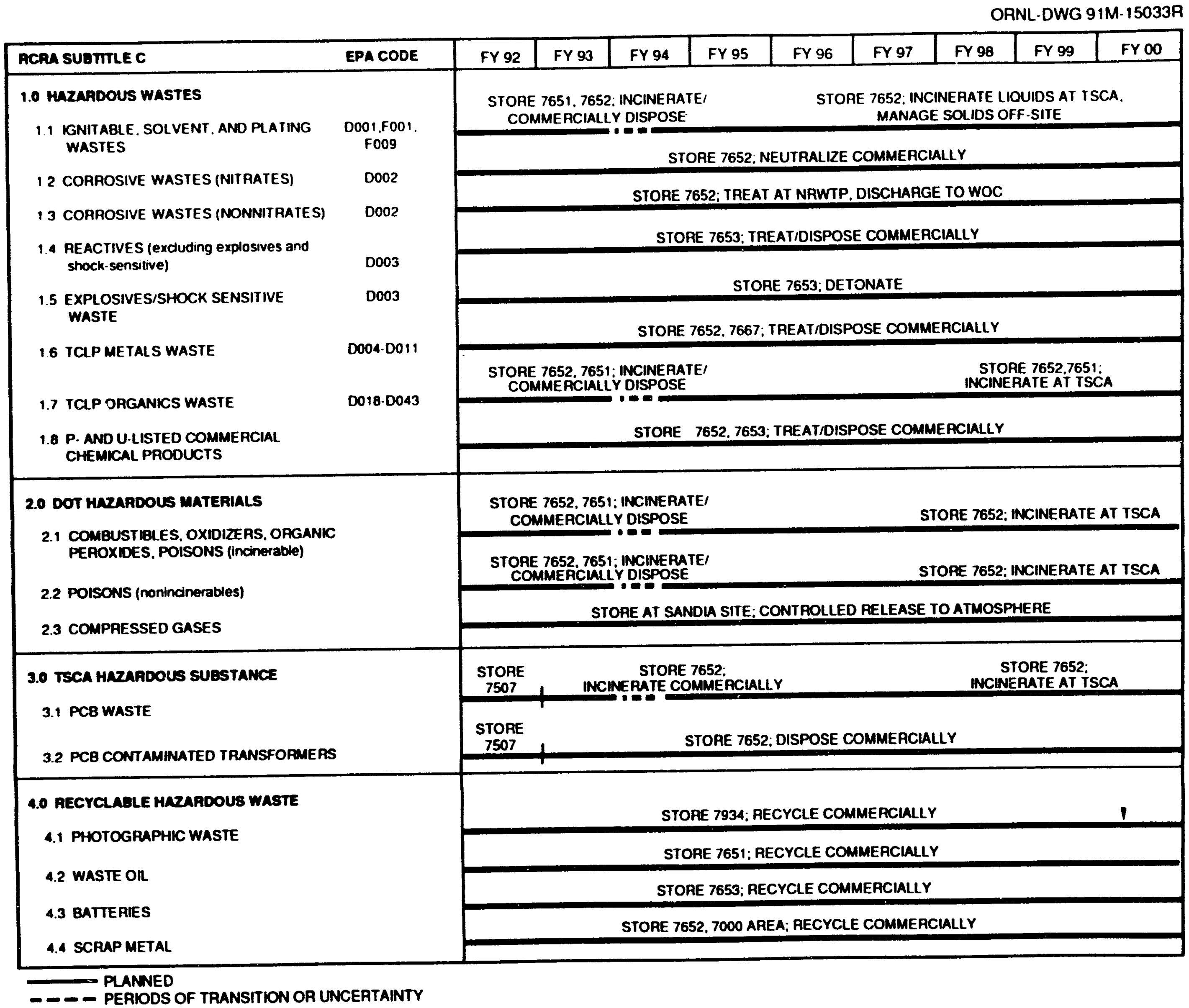

Fig. 4.1. Oak Ridge National Laboratory management strategy for hazardous waste.

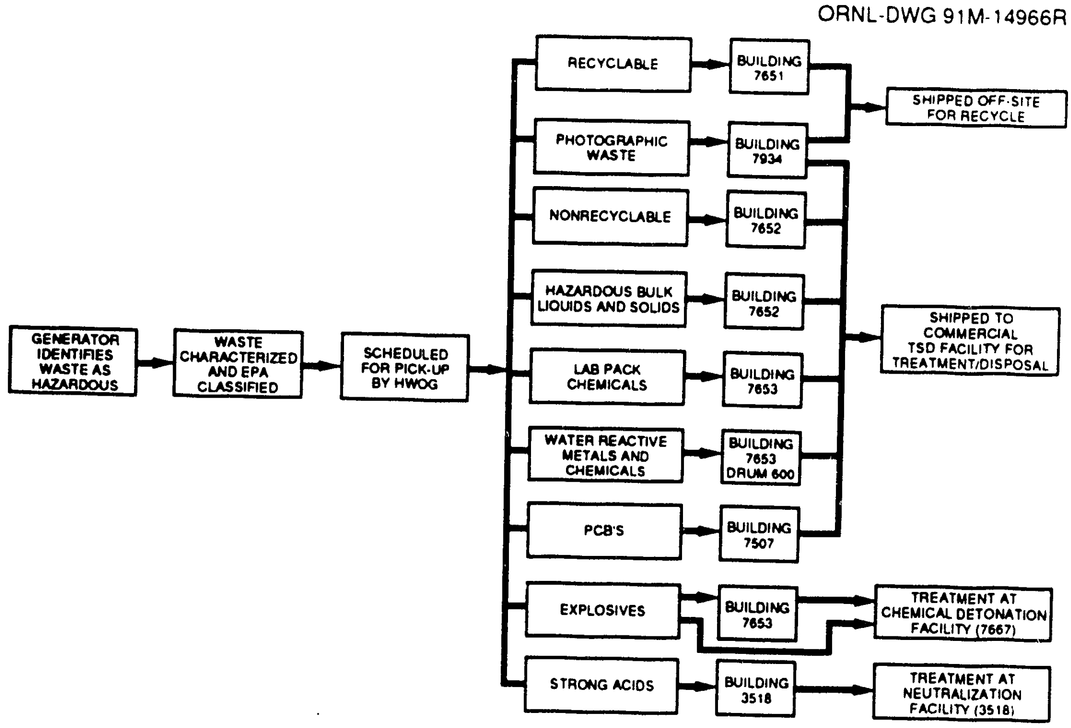

Fig. 4.2. Flowchart of hazardous waste management activities.

Detonation Facility (Building 7667). Following waste classification and collection, bulk (drummed) liquid and solid hazardous wastes are delivered directly to Building 7652 to await off-site treatment or disposal. PCB-contaminated waste is collected for immediate delivery to Building 7507 and subsequent off-site treatment. Similarly, used oil acceptable for off-site recycle is delivered to Building 7651 for off-site processing.

4.1.3 Treatment Facilities

ORNL relies primarily on commercial facilities for the treatment of its hazardous wastes. Some waste treatment is provided on-site for a few waste categories (as discussed in the following paragraphs).

Bulk non-nitrate acids are neutralized at the Nonradiological Wastewater Treatment Plant and discharged to White Oak Creek via the National Pollutant Discharge Elimination System. This facility is a wastewater treatment unit operated under Sect. 402 of the Clean Water Act and is exempt from RCRA permitting requirements for TSD facilities.

The Chemical Detonation Facility (Building 7667) is located approximately 61 m (200 ft) northeast of the Hazardous Waste Management Area. Access to the site is from a gravel road (Chemical Waste Access Road) off the Health Physics Research Reactor access road. The site consists of two storage magazines (one for the detonation sheets and one for the electrical blasting caps), a detonation trench, and a control area (Fig. 4.3). The magazines are approximately 1.2 × 1.2 × 1.2 m (4 × 4 × 4 ft) and are bulletproof, fire-resistant, weather-resistant, theft-resistant, and ventilated. The magazines are separated by an earthen berm about 1.2 m (4 ft) high. The detonation trench is 1.2 × 3 × 1 m

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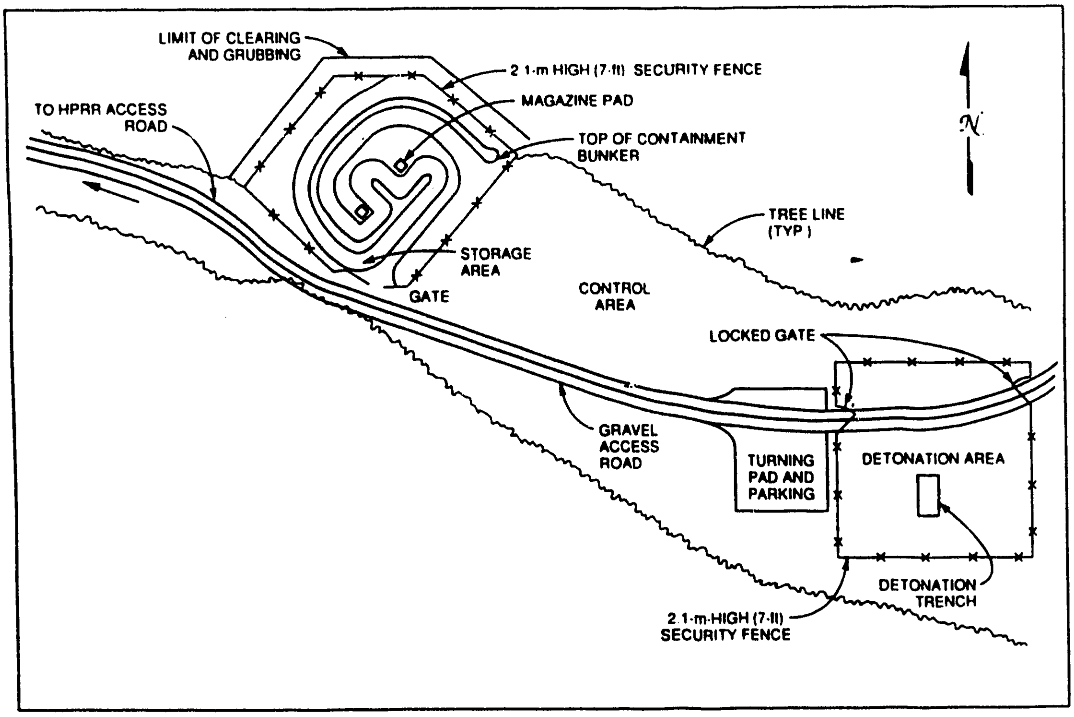

Fig. 4.3. Chemical Detonation Facility (Building 7667).

(4 × 10 × 3½ ft). An 18.3-m (60-ft) radius around the trench is to be kept clear of combustible materials such as trees, brush, shrubs, and tall grass. The cleared area is enclosed by a chain-link fence. The control area is the location from which the waste material is remotely detonated. The cleared area provides good visual line of sight from the control area to the detonation trench.

The Chemical Detonation Facility operates under RCRA interim status permit and an open burning permit under TDEC regulations. A RCRA Part B Subpart X permit application will be prepared and submitted to the TDEC.

4.1.4 Storage Facilities

Several facilities are currently used for the storage of hazardous waste at ORNL, as discussed in the following subsections. The majority of waste is stored in 208-L (55-gal) drums in Building 7652; it has a capacity of 57,254 L (15,125 gal). Inventories of waste in the various storage facilities vary monthly because these areas are used for staging the waste for final disposition. With the exception of Building 7507, the storage facilities are located in the Hazardous Waste Management Area off the Health Physics Research Reactor access road at ORNL (see Fig. 3.13).

4.1.4.1 Building 7652—Hazardous Waste Storage Facility

Building 7652 has an area of approximately 223-m^2 (2400-ft^2) with dimensions of 11.9 × 18.6 m (39 × 61 ft). This area includes an outside covered storage area 6 × 9 m (20 × 30 ft). The building consists of insulated, prefabricated panels and has metal stud walls with a 2-h fire rating. The building floor is 3000-psi concrete and has two coats of an epoxy sealer; curbing is around the building. The enclosed section of the building consists of five storage areas, each of which contains a sump, and each area is separated by curbing. The building layout is shown in Fig. 4.4.

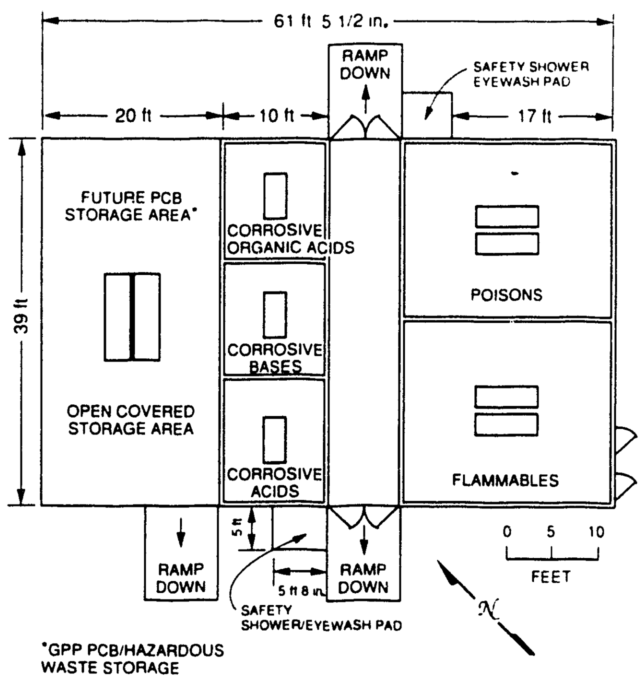

Fig. 4.4. Layout of the Hazardous Waste Storage Facility (Building 7652).

Building 7652 is used to store hazardous wastes that have been packaged, labeled, and marked in accordance with DOT regulations. The bulk waste chemicals are placed in DOT-certified drums either at their point of origin or after transfer to the facility. A maximum of 57,254 L (15,125 gal) [275 208-L (55-gal) drums] can be stored at this facility. Drums stored in this building are segregated according to the compatibility groupings. When a sufficient quantity of waste to facilitate proper management is accumulated, shipment and transfer is arranged to an off-site EPA-permitted TSD facility.

4.1.4.2 Building 7653—Chemical Waste Storage Facility

Building 7653 is 9 × 31 m (30 × 102 ft 8 in.) and has a total area of 285 m^2 (3060 ft^2). The building is divided into eight separate rooms (storage room). The building layout is shown in Fig. 4.5. The building is constructed of insulated prefabricated metal framing, partitioned with metal stud walls having a 2-h fire rating. Curbing with a centralized sump is utilized for each of the storage rooms (except for the water reactive storage room). One of the rooms is used for an office and emergency equipment storage area.

The facility is used for storage of small containers of laboratory chemicals and process chemical wastes. The small containers [less than 18.9 L (5 gal) or 20 lb] of chemical wastes are delivered to the facility and are separated by compatibility grouping for storage in the appropriate room. The storage rooms contain metal shelving or cabinets to hold the containers. The chemicals are generally within the manufacturer's original

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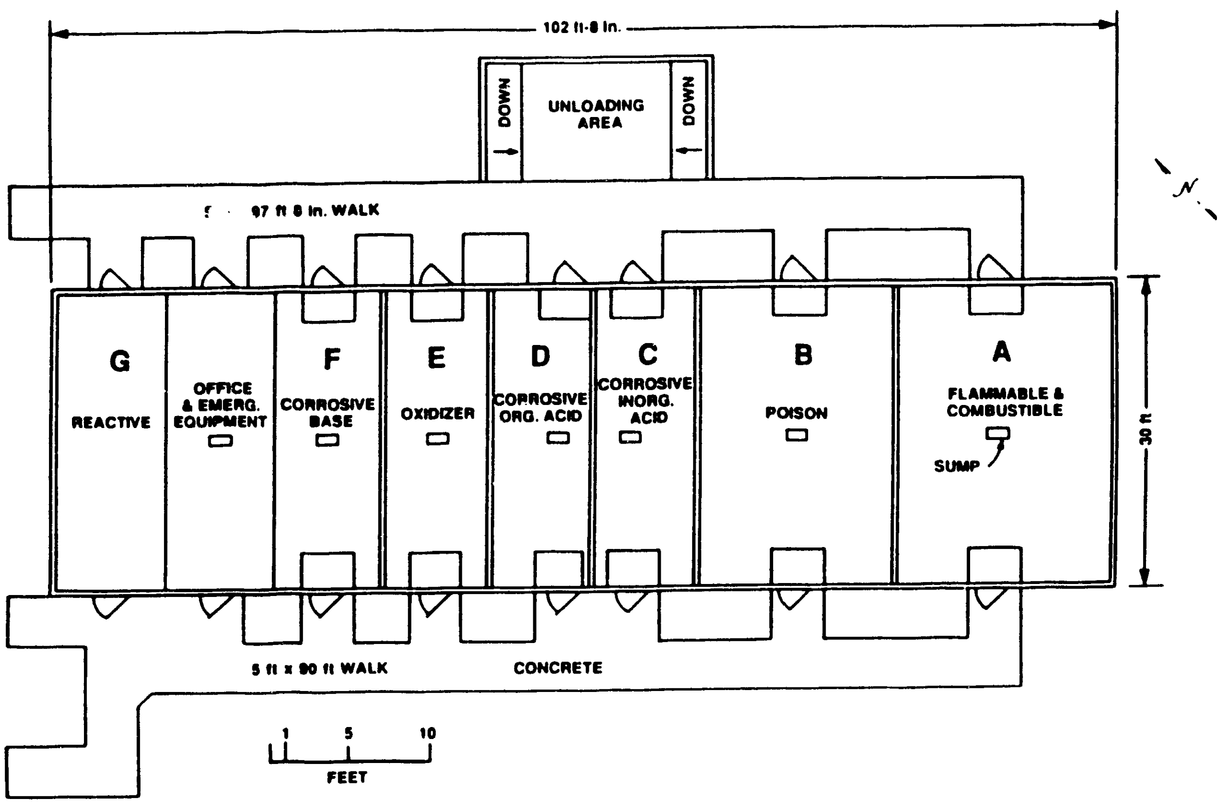

Fig. 4.5. Layout of the Chemical Waste Storage Facility (Building 7653).

container and are identified with the manufacturer's label. When a quantity of waste sufficient to facilitate proper management is accumulated, personnel from an Energy Systems–contracted commercial TSD facility lab-pack the waste into DOT-certified containers. The waste is then shipped off-site to an EPA-permitted TSD facility.

Each storage room is physically limited to contain not more than the equivalent number of small containers constituting 10 208-L (55-gal) drums. The maximum allowed inventory of waste in storage for the facility at any given time is the equivalent of 70 208-L (55-gal) drums, or 11,546 L (3850 gal).

4.1.4.3 Building 7507—Hazardous Waste Storage Facility

Building 7507 is a steel frame, metal siding structure consisting of approximately 136.7 m^2 (1470 ft^2) in an area that has a continuous concrete curb dike around the inside perimeter and no floor drains (Fig. 4.6). Double sliding doors with a metal ramp allow for loading and unloading operations. A portable, plastic containment system forms the storage area.

The maximum allowed inventory of hazardous waste in storage is 150 208-L (55-gal) drums, or 31,230 L (8250 gal). Initially, hazardous waste stored at the facility consisted of lab packs; bulk quantities of ignitable, corrosive, and/or extraction procedure toxic wastes, oxidizers, and poisons; and PCB-contaminated liquids and solids. Currently, the storage facility is utilized to store only PCB and PCB-contaminated waste. However,

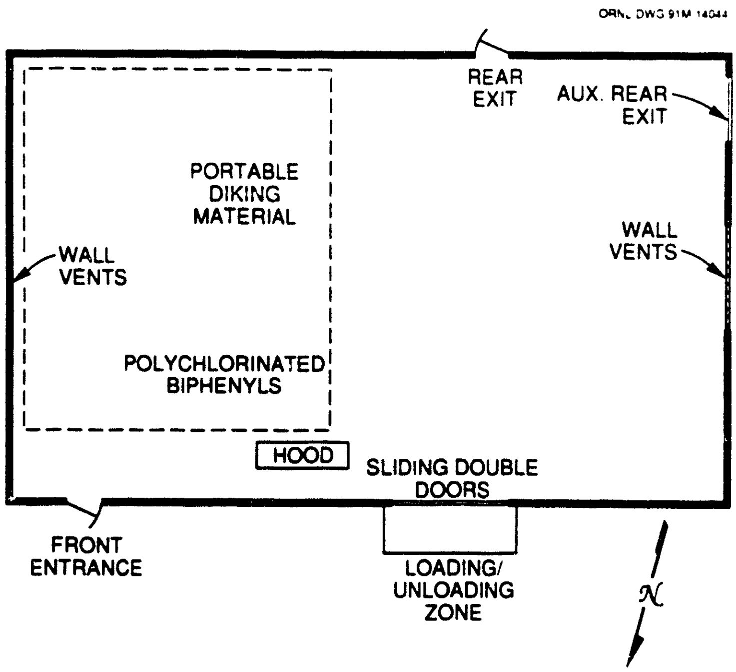

Fig. 4.6. Layout of the Hazardous Waste Storage Facility (Building 7507).

the PCB waste may also be identified as exhibiting a characteristic of hazardous waste.

4.1.4.4 Building 7651—clean oil storage pad

Building 7651 is a 12 × 6 m (40 × 20 ft) concrete pad covered with a ribbed metal decking roof. A continuous concrete curb dike is in place around the perimeter of the pad. No floor drains or sumps exist at the pad. Ramps are provided for equipment access onto the pad (see Fig. 4.7).

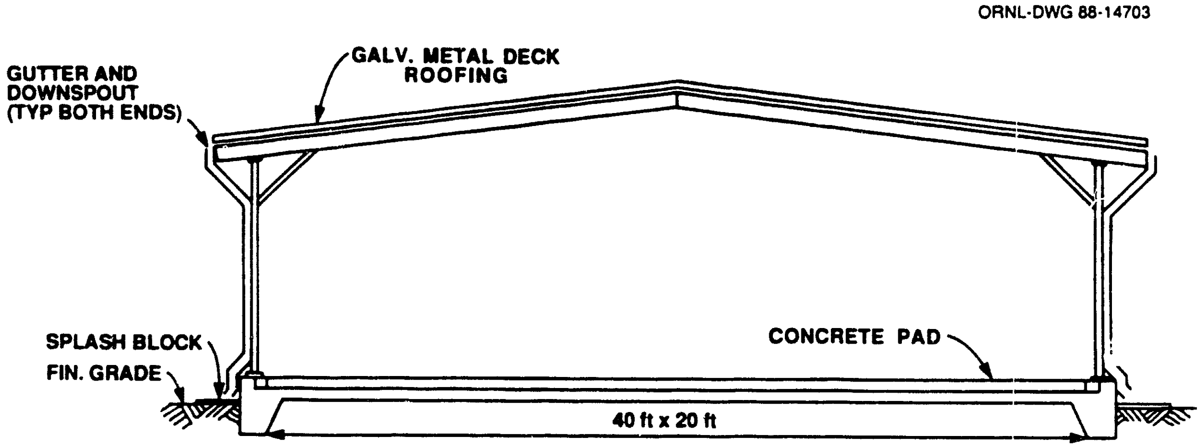

Fig. 4.7. Layout of the Clean Oil Storage Pad (Building 7651).

The storage pad is used to store 208- and 114-L (55- and 30-gal) drums containing used oil acceptable for unrestricted off-site release. The maximum inventory of waste in storage is 128 208-L (55-gal) drums, or 26,649 L (7040 gal). Drums are placed on pallets and double stacked, if required, with pallets between each level. The drums are arranged in rows to provide walkway space for emergency personnel and equipment and conducting inspections.

4.1.4.5 Environmental monitoring

At the various ORNL hazardous waste storage facilities, the building dikes and sumps are maintained to prevent cracks and leaks. Any spill in a drum loading area or storage area is removed immediately to prevent further contamination. Containers are always closed during storage and handled in a manner to prevent leakage. In the event of a spill or release to the environment outside the facility, the ORNL Contingency Plan (discussed in *The Spill Prevention, Control, Countermeasures, and Contingency Plans for Oak Ridge National Laboratory*) would be activated.

4.1.4.6 Permitting status

Building 7652 is one of two RCRA-permitted hazardous waste storage facilities at ORNL. A revised RCRA Part B permit application will be submitted for Building 7652 and will include Buildings 7653, 7654, 7934, and possibly 7507. The unpermitted Buildings 7654, 7653, and 7507 operate under interim status. Building 7651, which stores non-PCB oils in drums, operates under interim status. Building 7934 stores spent photographic solution in drums and has been exempted from RCRA permitting as long as silver is recovered annually. However, Building 7934 is being added to the Part A permit application for hazardous and mixed waste storage. Table 8.1 in Subsect. 8.1 of this plan provides the current operational and permitting status of ORNL TSD facilities.

4.1.4.7 Facility status

An upgrade of Building 7507 is planned to provide additional storage space for contaminated lead awaiting decontamination for reuse (see Subsect. 5.1.4.7, Facility Status for Mixed Waste). Another FY 1990 general plant project (GPP) involves the upgrade of Building 7652 to increase PCB storage space. Previously scheduled for completion by the end of CY 1991, this project has been delayed because the space provided by Building 7652 cannot be spared at present.

4.1.5 Disposal Facilities

Hazardous waste at ORNL is collected, identified, and packaged for off-site shipment to EPA-permitted treatment and/or disposal sites. No on-site disposal facilities for hazardous waste exist at, or are planned for, ORNL. Moreover, no hazardous wastes are allowed to be shipped off-site until the "no-rad-added" policy has been established.

4.1.6 Status of Support Systems

4.1.6.1 Training

The RCRA Waste Management Operations training course is required of all employees working at waste management facilities at ORNL permitted under RCRA. The objective of this training is to familiarize the employees with operating procedures, emergency procedures, emergency equipment, and emergency systems. The training also provides instruction on the procedures for handling of hazardous wastes; procedures for using, inspecting, repairing, and replacing emergency and monitoring equipment; communication or alarm systems; response to fires or explosions; response to hazardous material spills; and shutdown of operations. The training includes a written examination that is retained on file at ORNL.

Hazardous waste generator training is required for generators of hazardous waste. Two courses are provided for hazardous waste generators: (1) "Waste Generator Training for Satellite Accumulation Areas" and (2) "Waste Generator Training for 90-Day Accumulation Areas." Specific guidance is given on identification and segregation of hazardous waste, requirements for management of accumulation areas, and correct completion of form UCN-13698, "Request for Disposal of Hazardous or Mixed Waste."

The waste minimization training course is recommended for generators of all wastes. Specific guidance is given on what waste minimization is, why it is a goal at ORNL, who is responsible for implementing waste minimization efforts, how it can be implemented in the divisions, and what each employee's role is in implementing waste minimization. In addition to the formal training programs, an employee awareness program is in progress. The campaign to heighten sensitivity to waste minimization concerns includes such things as announcements in internal publications and publicity for programs or projects that have been successful in minimizing waste production. Part of this campaign also includes an incentive program that will recognize individual ORNL employees who provide waste minimization suggestions.

4.1.6.2 Certification

ORNL is able to characterize its hazardous waste through (1) knowledge of the generating processes, (2) knowledge of the waste, and/or (3) analysis of the waste. Steps in the waste-handling procedure include (1) request for waste disposal (completion of form UCN-13698), (2) notification for radiation survey, (3) review of form UCN-13698 by the HWOG, (4) waste sampling according to the Waste Analysis Plan, (5) waste analysis using EPA-approved procedures, (6) waste classification according to EPA and DOT classes, (7) waste inspection and preparation for transport, (8) waste pickup by the HWOG, (9) on-site transport to storage facilities, (10) packaging and labeling for off-site shipment, (11) on-site storage or treatment, (12) data entry into the tracking system, and (13) off-site shipment for treatment/disposal.

Detailed procedures for managing hazardous waste including characterization and certification activities are contained in the *ORNL Hazardous Waste Operations Manual.* During FY 1993 a formal certification program for ORNL hazardous waste will be developed. As part of this program, the requirement for generator certification (including training) will be formalized.

4.1.6.3 Database management

Information on hazardous waste handled at ORNL is maintained on a variety of computer databases. In general, these databases track generation, storage, and disposal of hazardous waste. Examples of these databases include the Hazardous Waste Tracking System (HWTS) and the PCB Tracking System (PCBTS). Both bases are on-line, user friendly information systems that operate on the DEC System-10 computer using System 1022 as the data base management system. Each of these is described briefly in the following paragraphs.

ORNL's HWTS was developed in 1982 in response to a recognized need for a system to track hazardous wastes from generation to disposal. The HWTS was designed and developed as a joint effort between staff in the Environmental Compliance Section within the Office of Environmental Compliance and Documentation and the Computing and Telecommunications Division. HWTS management and maintenance functions are now carried out by the HWOG.

The purpose of the HWTS is to aid ORNL staff in managing its waste disposal program and in complying with reporting requirements within safety and environmental regulations. The system provides file maintenance capability, record query, and management information reporting. Monthly billings, annual summaries of waste handling, and division generation quantity totals are among the reports that are generated routinely. The annual summary reports generated by the system include the hazardous waste stream report, the off-site shipping report, and the detailed report for treatment, storage, disposal, and recycle facilities. Other reports required by management can be programmed by Computing and Telecommunications Division personnel. Output can be to the terminal or to a disk file for subsequent printing.

To ensure accuracy of the data within the system for reporting purposes, extensive data validation is conducted by the staff in the Environmental Compliance Section and the HWOG. Four different data files are used within the system including waste item information, waste composition for mixtures, radioactive waste information, and general account information. Data input for the waste item file include (1) item number from the in-house waste disposal form; (2) waste description; (3) radioactivity type and level; (4) EPA hazardous waste number(s); (5) volume or weight; (6) storage site and date; (7) disposal site, date, and container number; (8) and plant of origin. If the waste is a mixture, then several individual components can be listed. The account information is used to bill generators for the costs incurred by the HWOG in the pickup and storage of waste. Because of the large volume of information tracked on the system, users typically have access to 3 calendar years of data. Older data files have been downloaded onto tapes but can be accessed on request to the Computing and Telecommunications Division.

PCBTS, the second hazardous waste database, is comprised of two submodules: one on inventories of equipment in-service, removed from service, or transported for disposal and one on waste generation and disposal. The equipment inventoried includes transformers and large high- and low-voltage capacitors as well as miscellaneous hydraulic equipment that contain >2 ppm PCBs. The records on the PCB-contaminated equipment are maintained by the Environmental Compliance Section. Records for the second module of the PCBTS, the PCB waste database, cover generation and disposal of both PCBs and PCB-contaminated wastes. The PCB waste submodule receives storage and shipment data from the HWTS. The PCB waste data, compiled by the HWOG, include (1) waste descriptions, (2) dates and quantities of PCBs and PCB-contaminated wastes transferred into or out of storage during a given year, and (3) those retained in storage at the end of a year.

4.1.7 General Plant Projects

A listing of the proposed GPPs for hazardous waste facilities at ORNL is provided in Table 4.1. This table indicates the project title, total estimated cost, funding type, and the respective fiscal year for funding.

Table 4.1. General plant project for hazardous waste facilities at Oak Ridge National Laboratory

Title	TEC[a] ($ × 1000)	Funding type	Fiscal year
Polychlorinated biphenyl/hazardous waste storage, Building 7652 Annex	$200	EX	1989

[a]Total estimated cost.

4.2 GASEOUS WASTE

A wide variety of research and operational activities at ORNL utilize compressed gases that are procured in cylinders. When empty, the cylinders are usually returned to the distributor, and a deposit fee is refunded. However, some cylinders become damaged and cannot be returned to the vendors. The most frequent damage is in the form of stuck or leaking valves.

4.2.1 Strategy

The management strategy for the treatment of damaged gas cylinders at ORNL (Fig. 4.2) is to maintain facilities (1) in compliance with RCRA requirements for handling of hazardous gases and disposal of "empty" containers, (2) in compliance with the Clean Air Act (CAA) and National Emission Standards for Hazardous Air Pollutants requirements and associated state permitting requirements and conditions, (3) in compliance with DOT regulations (leaking cylinders cannot be knowingly transported), (4) in compliance with Occupational Safety and Health Administration (OSHA) right-to-know requirements, (5) with protection for workers from physical and chemical hazards, and (6) with a cost-effective solution for treatment. The current strategy involves the venting of compressed gases to the atmosphere in an isolated area in accordance with regulations and in a way that protects worker safety and health as well as the environment.

4.2.2 Generic Description and Characteristics of Waste

The HWOG receives damaged cylinders and manages them as hazardous waste. Excess gas cylinders that are not returnable are also managed as hazardous waste. Data supplied by the generator are entered into the HWTS. Volumes of gas cylinders vary from 0.028 to 1.4 m^3 (1 to 50 ft^3). A wide variety of gases are contained including oxygen, nitrogen, hydrogen, acetylene, propane, chlorine, ammonia, freon, and sulfur hexafluoride. Approximately 12 leaking cylinders are handled per year.

When a gas cylinder is found to be excess, damaged, or leaking, the generator notifies the HWOG. The HWOG determines if the cylinder poses a potential hazard or emergency. If the gas cylinder does not represent an emergency, the HWOG removes the cylinder and transfers it to the Leaking Gas Cylinder Area.

In the event that the gas cylinder does represent an emergency, the HWOG immediately removes the cylinder and places it in the Leaking Gas Cylinder Area. As time permits, the generator completes a Request for Disposal form. After the cylinder has bled off, it is returned to the vendor or stored until disposed of in accordance with applicable requirements. The Leaking Gas Cylinder Area is described in the following paragraphs.

4.2.3 Treatment Facilities

The Leaking Gas Cylinder Area at ORNL is used for the venting of damaged and excess gas cylinders. This area is located at a remote site (i.e., away from inhabited areas) off of Ramsey Drive and the Melton Valley Access Road. The area consists of a cleared site covered with gravel and surrounded by a fence with a locked gate. The cylinders are held in the area until the contents have bled off. Afterwards, the undamaged cylinders are returned to the vendors, and the damaged cylinders are stored until properly disposed of at the Y-12 Site Sanitary Landfill II (SLF II).

4.2.3.1 Environmental monitoring

Other than overall site monitoring requirements, direct monitoring of the environment at the Leaking Gas Cylinder Area is not required. Personnel monitoring is conducted during these operations to ensure worker safety pursuant to OSHA standards.

4.2.3.2 Permitting status

The provisions of the CAA are regulated by the TDEC through the Tennessee Air Pollution Control Regulations. The primary means of control is through the issuance of state air permits. The TDEC has indicated that the Leaking Gas Cylinder Area is exempt from permit requirements. RCRA permitting is not required for the venting of gas cylinders on-site.

4.2.3.3 Facility status

ORNL does not plan to build any new facilities for treating, storing, or disposing of gas cylinders unless specific problems are identified with respect to current air pollution control regulations. Therefore, the current practice of venting cylinders at the Leaking Gas Cylinder Area will continue as previously discussed.

4.2.4 Storage and Disposal Facilities

No storage or disposal facilities currently exist specifically for gaseous hazardous waste at ORNL. Upon generation, gas cylinders are either returned to the vendor or released at the Leaking Gas Cylinder Area. Empty damaged cylinders are discarded in the SLF II.

4.2.5 Status of Support Systems

The training courses, certification information, and data base management systems discussed in Subsect. 4.1.6 (Status of Support Systems) of this plan regarding solid and liquid hazardous waste also pertain to gaseous hazardous waste at ORNL.

4.2.6 General Plant Projects

No GPPs are currently planned for hazardous gaseous wastes.

5. MIXED WASTE MANAGEMENT

Radioactively mixed waste, referred to as mixed waste, is waste that is simultaneously regulated under the Resource Conservation and Recovery Act (RCRA) and under the Atomic Energy Act (AEA) as administered by the U.S. Department of Energy (DOE). Because these two bodies of regulations are not necessarily consistent or in agreement in every aspect of mixed waste management, special problems arise that are not a factor in the management of purely radioactive wastes or hazardous wastes. The majority of these problems stem from the fact that the normal resources available for radioactive or hazardous wastes are not open to mixed wastes. For example, most RCRA treatment, storage, and disposal (TSD) facilities do not accept mixed wastes because they have no treatment or handling capability for radionuclides in their processes. Similarly, mixed wastes may not be routinely disposed in a similar fashion to that of radioactive wastes because of land disposal restrictions imposed by RCRA. As a result of this situation, mixed waste management has become a challenging area in the Waste Management and Remedial Actions Division's overall waste management mission.

5.1 SOLID AND LIQUID WASTES

Typical waste items comprising Oak Ridge National Laboratory's (ORNL's) mixed waste stream are similar to many of the wastes described in Sects. 3 and 4 of this plan. In many cases a known radioactive waste will be determined to be a hazardous waste as well by knowledge of the process that generated it or by testing for a hazardous characteristics. Yet in other cases a waste known to be hazardous will be suspected of containing radioactive contamination and will be handled as a mixed waste. Still, in other situations, such as in the case of scintillation cocktails, a waste will be known to be a mixed waste at the time of generation. Table 5.1 indicates the annual generation rate and storage inventory of mixed waste from the Monthly Operations Report. Figure 5.1 provides a broad categorization of ORNL's mixed waste streams.

Table 5.1. Solid waste generated and handled at Oak Ridge National Laboratory during FY 1991 and FY 1992

Waste stream	Quantity	
	FY 1991	FY 1992
Radioactive:		
• Transuranic waste	8 m^3 (297 ft^3)	23 m^3 (814 ft^3)
• Low-level waste	1,952 m^3 (69,711 ft^3)	2,783 m^3 (99,394 ft^3)
Hazardous	106,343 kg (234,447 lb)	81,902 kg (180,563 lb)
Mixed	22,633 kg (49,898 lb)	19,538 kg (43,074 lb)
Sanitary	13,300 m^3 (474,984 ft^3)	10,310 m^3 (368,199 ft^3)

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RCRA SUBTITLE C	EPA CODE	FY 92 – FY 00 (FY 92, FY 93, FY 94, FY 95, FY 96, FY 97, FY 98, FY 99, FY 00)
1.0 MIXED WASTES *		
1.1 IGNITABLE, TCLP ORGANICS, AND SOLVENT MIXED WASTES	D001, D018-D043, F001-F005	STORE 7507W(1), 7654, 7830a, 7668(2), 7823, 7075(1); INCINERATE AT TSCA
1.2 CORROSIVE MIXED WASTE	D002	STORE 7654, 7507W, 7668, 7823; TREAT AT PWTP OR NRWTP, DISCHARGE TO WOC
1.3 REACTIVE, TCLP METALS, AND PLATING; MIXED P- AND U-LISTED COMMERCIAL PRODUCTS	D003-D0011, F006-F009	STORE 7654, 7823, 7668,7507W; TREATMENT TECHNOLOGY DEVELOPMENT
2.0 DOT HAZARDOUS MATERIALS		
2.1 RAD CONTAMINATED COMBUSTIBLES, OXIDIZERS, PEROXIDES, AND POISONS (incinerable)		STORE 7075,7654, 7823, 7507W, 7830a; INCINERATE AT TSCA
2.2 RAD CONTAMINATED POISONS (nonincinerables)		STORE 7075,7654, 7823, 7507W, 7830a; TREATMENT TECHNOLOGY DEVELOPMENT
2.3 COMPRESSED GASES		STORE 7654, 7668; VENT TO HOT OFF-GAS SYSTEM
3.0 RAD CONTAMINATED TSCA HAZARDOUS SUBSTANCE		
3.1 RAD CONTAMINATED PCB WASTE		STORE 7507W(1), 7823; INCINERATE AT TSCA
4.0 RECYCLABLE MIXED WASTE		
4.1 BATTERIES, SCRAP METAL		STORE 7654; DECONTAMINATE/RECYCLE COMMERCIALLY

——— PLANNED
– – – – PERIODS OF TRANSITION OR UNCERTAINTY
* TRU MIXED WASTES ARE COVERED IN SECT. 3.

(1) INITIATE CLOSURE BY 11/92
(2) CONSTRUCT BY 09/92

Fig. 5.1. Oak Ridge National Laboratory management strategy for mixed waste.

5.1.1 Strategy

The three activities into which the strategy for mixed waste management at ORNL can be summarized are:

- Characterization. Many of the mixed wastes currently being stored in ORNL facilities have not been fully characterized. Some of these wastes may not have a hazardous or radioactive component, in which case they may be removed from mixed waste management. Characterization is also necessary to prepare wastes for eventual treatment either at DOE-owned facilities or in the private sector.
- Waste minimization. Waste minimization or source reduction of waste is being applied at the generator level to reduce the amount of mixed waste generated. This activity is described in more detail in Subsect. 8.2 of this plan.
- Federal Facilities Compliance Agreement (FFCA). On May 8, 1992, the RCRA land disposal restrictions (LDR) rule prohibiting the land disposal of untreated mixed wastes became effective. This development prompted the signing of an FFCA between the U.S. Environmental Protection Agency (EPA) and DOE to provide a system of schedules and milestones intended to bring ORNL into compliance with RCRA LDR. The primary deliverables for the FFCA are a Waste Treatment Plan, a Waste Treatment Strategy Plan, a Waste Minimization Plan, and a Waste Storage Plan.

5.1.2 Generic Description and Characteristics of Waste

The two major types of mixed wastes generated at ORNL are mixed waste oils and scintillation fluids. Mixed waste oils are sometimes generated when oils are removed from systems that have operated in radiation environments. Radiation levels in these oils is typically low (≤ 10 mrem/h). ORNL's generation rate for waste oils is quite variable. These wastes largely consist of vacuum pump oil, axle oil, refrigeration oil, mineral oil, or oil/water mixtures. Radioactive contaminants include ^{14}C, ^{3}H, ^{238}U, ^{239}Pu, ^{232}Th, ^{210}Pb, ^{85}Kr, and others. Radioactive-contaminated oils are being handled as RCRA waste. The strategy for dealing with these oils may continue to change as new EPA regulations on used oils are issued.

The principal components of scintillation fluids are toluene and/or xylene, culture medium, miscellaneous organics, and various radioisotopes including ^{3}H, ^{14}C, ^{32}P, and ^{131}I. The maximum radiation surface dose rate on each container is limited to 10 mrem/h. The flash point is normally less than 60°C (140°F); therefore the waste is classified as ignitable. Other mixed wastes at ORNL include organic wastes, carcinogenic wastes, mercury-contaminated solid wastes, waste solvents, corrosives, poisons, and other process wastes.

No hazardous wastes are permitted in transuranic (TRU) waste packages unless contaminated with TRU material, in which case the package must be labeled appropriately, and the hazardous waste must be treated or packaged to ensure no degradation of the waste container over its design life. Further discussion of the management of TRU mixed waste (generally lead and mercury) is presented in Subsect. 3.1.1 of this plan.

Although little has been generated to date, radioactively contaminated soils with hazardous components are expected to be generated from construction, demolition, and site remediation activities. The potential exits for generation of large quantities of soils containing mercury, lead, and/or organic contaminants.

5.1.3 Treatment Facilities

ORNL has no facilities specifically designed for the treatment of mixed waste. Corrosive mixed waste is scheduled for treatment at the Liquid Low-Level Waste (LLLW) System or the Process Waste Treatment Plant. Organic mixed wastes are planned to be treated at the Toxic Substances Control Act (TSCA) incinerator (Oak Ridge K-25 Site) per the RCRA LDR FFCA Treatment Plan.

5.1.4 Storage Facilities

Mixed waste is stored at several facilities at ORNL. Drum storage for solid and liquid mixed waste is currently being utilized at Buildings 7654, 7507W, and 7823 as outlined in the following subsections. Bulk storage of waste oils is also provided by tanks 7075 and 7830a [total storage capacity 34,826 L (9200 gal)]. Tank 7860a was used for mixed oily waste until early 1991 when the contents were transferred to tank 7830a.

5.1.4.1 Building 7654—Long-Term Hazardous Waste Storage Facility

Building 7654 is located in the Hazardous Waste Management Area off the Health Physics Research Reactor access road and has an area of approximately 158 m^2 (1700 ft^2) with dimensions of 11.9 × 12.8 m (39 × 42 ft). The building consists of insulated, prefabricated panels built on a concrete floor surrounded by 15.3 cm (6 in.) curbing. The inside of the building is divided into five storage areas, each having a centrally located sump and divided by curbing. An elevated aisle divides the building with three storage areas on one side and two storage areas on the other side. The building layout is shown on Fig. 5.2.

Building 7654 is used for storage of mixed LLLWs, the majority of which are bulk scintillation fluids and scintillation vials. The majority of mixed wastes that are transported to Building 7654 are contained in 208-L (55-gal) drums. Occasionally, 114-L (30-gal) drums and smaller containers are received. Containers smaller than 114 L (30 gal) are either combined with compatible waste or lab-packed. The maximum inventory of drums in storage at any given time is 300; total capacity is 62,459 L (16,500 gal). Double stacking of drums is employed to maintain adequate aisle space. Pallets are placed between the double layers of drums.

5.1.4.2 Building 7507W—mixed waste storage pad

Building 7507W, located within the ORNL Complex, is a covered 3.7-m^2 (40-ft^2) concrete pad with a 0.10-cm (4-in.) elevation difference between the middle and the edge of the pad (Fig. 5.3). The middle of the pad contains a sump 0.30 × 1.2 × 0.60 m (1 × 4 × 2 ft). The pad is used for storage of 208- and 114-L (55- and 30-gal) drums of mixed waste. The drums are placed on pallets and double stacked, and are arranged in rows to provide aisle space for personnel and equipment. The total capacity of the pad is 83,279 L (22,000 ga!), or 400 208-L (55-gal) drums.

Wastes stored at this facility are similar to those stored in Building 7654; they consist of scintillation counting vials containing organic and inorganic mixtures contaminated with low levels of radioactivity. Toluene and xylene are regular constituents of the mixtures. Radionuclides present include ^{3}H, ^{14}C, ^{32}P, and ^{131}I. Other waste stored

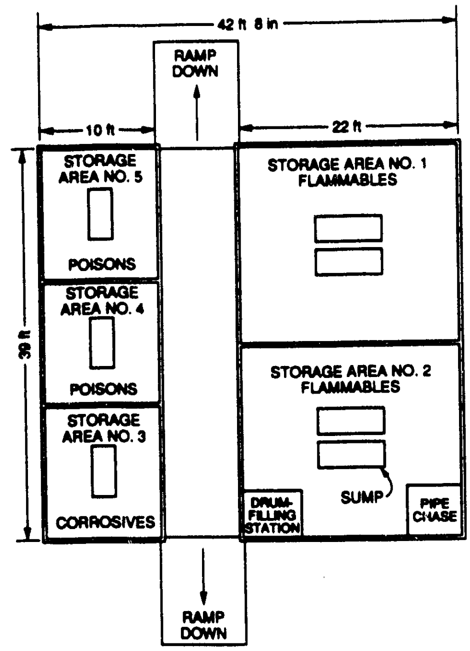

Fig. 5.2. Layout of the Long-Term Hazardous Waste Storage Facility (Building 7654).

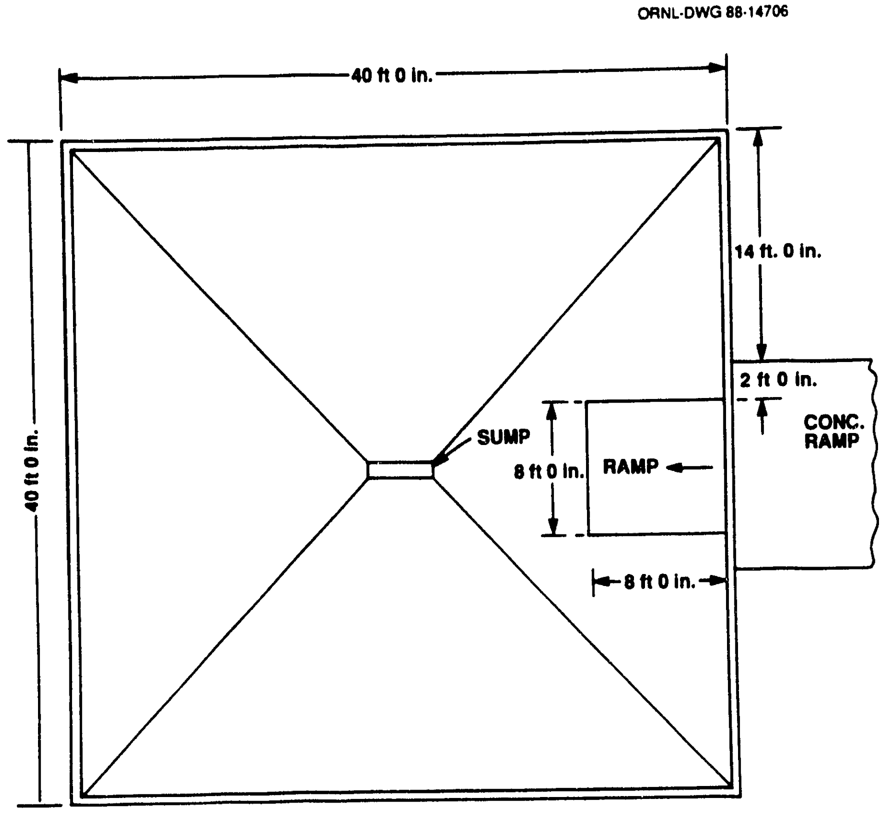

Fig. 5.3. Layout of the Mixed Hazardous Waste Storage Pad (Building 7507W).

includes organic wastes, carcinogenic wastes, mercury-contaminated solid wastes, waste oils, waste solvents, and other process wastes.

5.1.4.3 Building 7823—mixed waste storage

Building 7823, located in Solid Waste Storage Area 5N, is a 390.6-m^2 (4200-ft^2) single-level, semiunderground building with a concrete floor, steel supports, wire fabric ceiling, and metal roof and walls. The facility will hold approximately 1100 208-L (55-gal) drums. Wastes currently stored in this facility include mixed waste oils, solvents, and other process wastes.

5.1.4.4 Tanks 7075 and 7830a—bulk mixed waste oils

Tanks 7075 and 7830a provide a total capacity of 34,825 L (9200 gal) for mixed waste oils. Tank 7830a, located near the New Hydrofracture Facility inside Building 7830a, provides storage for waste oils contaminated with spent solvents, metals, and radiological constituents. The tank has a nominal capacity of 18,927 L (5000 gal). Tank 7075, located in the 7000 Area east of the main ORNL Complex, provides storage for waste oils contaminated with radioactive material. This tank currently contains ^3H contaminated oil. The tank has a nominal capacity of 15,899 L (4200 gal).

5.1.4.5 Environmental monitoring

The facilities used for mixed waste storage at ORNL are maintained to prevent contaminant releases to the environment. The facilities' curbed dikes and sumps are inspected for cracks and leaks; any spill is removed immediately to prevent contamination. Containers are kept closed during storage and handled in a manner to prevent damage and leakage. The bulk storage tanks at ORNL are also inspected and maintained in similar manners according to the requirements outlined in 40 CFR Pt. 265.

5.1.4.6 Permitting status

Buildings 7654, 7507W, 7823 and tanks 7075, 7830a, 7860a are currently operating under interim status. Tanks 7860a and 7075 are scheduled for closure to begin by November 1992. Buildings 7823 and 7934 (currently a hazardous waste storage facility) are to be upgraded and permitted for mixed waste storage. Consolidated RCRA Part B permit applications for the two types of RCRA storage facilities (i.e., TRU mixed and non-TRU mixed) will be submitted to the Tennessee Department of Environment and Conservation (TDEC) in 1992. A Part B permit application for tank 7830a was submitted to the TDEC in November 1991. The status of the TRU-mixed facilities is discussed in Subsect. 3.1.1. Table 8.1 in Subsect. 8.1 of this plan provides the current operational and permitting status of ORNL TSD facilities.

RCRA Sect. 3004(j) prohibits storage of LDR wastes except "solely for the purpose of accumulation of such quantities of hazardous waste as necessary to facilitate proper recovery, treatment, or disposal." Implementing regulations in 40 CFR Pt. 268.50 place the burden of demonstrating noncompliance on the EPA during the first year of waste storage and the burden of demonstrating compliance on the waste generator for waste stored beyond 1 year.

The RCRA LDR FFCA has specified the wastes in storage that do have available treatment (Table 5.2). Those wastes in storage that do not have treatment available are listed in Table 5.3.

Table 5.2. Oak Ridge National Laboratory land disposal restriction mixed waste with identified existing treatment

Waste identification	Primary constituents	Annual generation (kg)[a]	Storage 12/31/91 (kg)	Storage facility[b]	Radioactive category[c]
Commercial chemicals (solids and liquids)	P-listed, U-listed, DOMX[d]	2,937	3,088	*e*	R
Corrosives	D002, DOMX	1,863	3,108	*e*	R
Solvents	FOMX	9,145	30,075	*e*	R
Flammables	D001	9,671	54,564	*e*	R
Oxidizers	D001, DOMX	1,299	1,017	*e*	R
Combustible (solids and liquids)	DOMX, FOMX	11,000	20,000	*e*	R
Poison (PCB)	UOMX	236	236	*e*	R
Solvent (PCB)	FOMX	1,833	1,833	*e*	R
Flammable (PCB)	D001	1	1	*e*	R
Combustible liquid tank 7830A	FOMX, DOMX	6,388	6,500	7830A	R
Oil-contaminated solid	D018, DOMX	0	1,286	7507W, 7654, CH and RH TRU units	R
Oil	D018, DOMX	0	19,495	7507W, 7654, CH and RH TRU units, 7830A, 7075	R
Combustible liquid, tanks 7075 and 7860A	D018, DOMX	0	13,978	7075, 7860A	R
LLW System tanks, liquid	D002, D006, D007, D008, D009	66,300	1,500,000	W21-31, C1, C2[f]	R

[a]Estimated based on 1991 generation.

[b]Storage facility includes proposed units to be built in the future.

[c]"R" indicates waste with known radioactive constituents; an "S" would indicate waste suspected of containing radioacative constituents.

[d]OMX includes all waste codes for that category (D, P, U, and F).

[e]All—7651, 7652, 7653, 7934, 7654, 7507, 7507W, 7823, 7879, 7855, 7668; new mixed waste, 7883, 7884, 7572, 7574.

[f]These tanks are a part of the CERCLA 120 Federal Facility Agreement that became effective 1/1/92. Schedules are negotiated annually in the FFA.

Source: Adapted from Federal Facility Compliance Agreement for RCRA LDR Mixed Waste, Appendix A.

Table 5.3. Oak Ridge National Laboratory land disposal restriction mixed waste without identified existing treatment

Waste identification	Primary constituents	Annual generation (kg)[a]	Storage 12/31/91 (kg)	Storage facility[b]	Radioactive category[c]
EP Tox/TCLP (solids and liquids)	D004-D043, DOMX[d]	11,485	25,213	*e*	R
Commercial chemicals (solids and liquids)	P-listed, U-listed, DOMX	9,585	10,078	*e*	R
Corrosives	D002, DOMX	3,725	6,217	*e*	R
Reactives and unknowns (assumed to be reactives)	D003, DOMX	100	157	*e* Except 7651 or 7507W	R
Photographic wastes	D011	16,911	11,035	*e*	R
LLLW System tanks, sludge	D002, D006, D007, D008, D009	110,600	854,000	Active LLW collection tanks[f]	R
Inactive waste storage tank, contents	D002, D006, D007, D008, D009	0	1,260,000	Inactive waste storage tanks[f]	R
Suspect TRU	FOMX, DOMX	0	191,800	CH TRU and RH TRU units	R

[a]Estimated based on 1991 generation.
[b]Storage facility includes proposed units to be built in the future.
[c]"R" indicates waste with known radioactive constituents; an "S" would indicate waste suspected of containing radioacative constituents.
[d]OMX includes all waste codes for that category (D, P, U, and F).
[e]All—7651, 7652, 7653, 7934, 7654, 7507, 7507W, 7823, 7879, 7855, 7668; new mixed waste, 7883, 7884, 7572, 7574.
[f]These tanks are covered under RCRA permit-by-rule. Wastes are not subject to LDR until removal from the tanks or active tanks are changed to inactive status. These tanks are a part of the CERCLA 120 Federal Facility Agreement effective 1/1/92. Schedules are negotiated annually in the FFA. Not all constituents found in each tank.
Source: Adapted from Federal Facility Compliance Agreement for RCRA LDR Mixed Waste, Appendix A.

5.1.4.7 Facility status

Mixed waste storage availability at ORNL is severely limited at present; approximately 100 drums are generated on an annual basis. Although scintillation fluids are periodically shipped off-site for commercial incineration, all other mixed waste must currently be stored on-site until treatment is available. Building 7507W has reached capacity in the volume of mixed waste currently stored at the facility, and Building 7654 is also nearing capacity. To relieve this congested condition, the near-term use of storage space at the K-25 Site and other options are currently being investigated.

Two new mixed waste storage facilities are planned at ORNL. The first facility is a 1989 general plant project (GPP) having a total estimated cost (TEC) of $485K. The design was completed and certified for construction in May 1991. The project is currently on hold waiting approval of National Environmental Policy Act documentation. The second facility is planned as a 1993 GPP and has an expected TEC of $1050K.

An upgrade to Building 7507 is planned as a 1990 GPP; the TEC is $150K. This upgrade will provide a staging area for contaminated, recyclable lead or hazardous waste; expected operational startup is currently on hold.

5.1.5 Disposal Facilities

ORNL has no disposal facilities for mixed waste. As part of its scope, the Central Waste Management Division will evaluate the need for a mixed waste disposal facility on the Oak Ridge Reservation. Mixed waste disposal facilities must meet the requirements of all applicable RCRA (or TSCA) and AEA regulations and must be permitted to operate as specified in the regulations. In addition, DOE orders contain specific guidance on the handling of radioactive wastes and on occupational exposure to radioactivity.

5.1.6 Status of Support Systems

5.1.6.1 Training

ORNL training courses are offered for both the generators of radioactive and hazardous wastes. Mixed wastes generators are required to participate in the courses outlined in the training sections of this plan pertaining to both radioactive waste and hazardous waste (Subsects. 3.1.2.6 and 4.1.6.1).

5.1.6.2 Certification

Detailed procedures for mixed waste management including characterization and certification activities are contained in the *ORNL Hazardous Waste Operations Manual.* During FY 1993 a formal certification program for ORNL mixed waste will be developed. As part of this program, the requirement for generator certification including training will be formalized.

5.1.6.3 Database management

A computerized database is available for tracking all mixed waste, as well as hazardous waste, processed at ORNL. This database is used primarily for record keeping, accounting and billing, and generating annual reports required by the state and the EPA. The database needs to be expanded to provide periodic (e.g., quarterly) reports of waste generation for determining (1) trends in the types and quantities of waste that are being generated and (2) the identity of the generators. In addition to improving facility planning, this information will be useful in monitoring waste minimization efforts. Additional information on this database system is provided in Subsect. 4.1.6.3 of this plan.

5.1.7 General Plant Projects

A listing of proposed GPPs for mixed waste facilities at ORNL is provided in Table 5.4. This table indicates the project title, TEC, funding type, and the respective fiscal year for funding.

Table 5.4. General plant projects for mixed waste facilities at Oak Ridge National Laboratory

Title	TEC[a] ($ × 1000)	Funding type	Fiscal year
Expand mixed waste storage	485	EX	1989
Upgrade Building 7507	150	EX	1990
Mixed Waste Storage Facility	1050	EX	1993

[a]Total estimated cost.

5.2 GASEOUS WASTE

All mixed gaseous wastes at ORNL are discharged into the 3039 Off-Gas System for treatment (see Subsect. 3.3.3).

6. SANITARY WASTE

Sanitary waste at Oak Ridge National Laboratory (ORNL) includes solid wastes generated from steam plant operations, coal yard runoff, general refuse, and construction debris. Liquid wastes are generated from sanitary sewage waste treatment, area runoff of rainwater, and point sources such as coal yard runoff. Although U.S. Department of Energy (DOE) Order 5820.2A does not specifically require the reporting of sanitary waste as part of the annual Waste Management Plan, ORNL has included pertinent information regarding the management of both solid and liquid sanitary wastes at ORNL in the following subsections. The state of Tennessee regulates these wastes streams at ORNL via the Tennessee Solid Waste Disposal Act and ORNL's National Pollutant Discharge Elimination System (NPDES) permit.

6.1 SOLID WASTE

Sanitary nonradioactive, nonhazardous solid wastes that contain no free liquids include filter cake from the Coal Yard Runoff Treatment System (CYRTS), fly ash from the ORNL steam plant, general refuse collected in trash cans and dumpsters, and construction debris. A brief description of each waste stream is provided in Subsect. 6.1.2; the overall management strategy follows.

6.1.1 Strategy

The strategy for sanitary solid waste disposal at ORNL (illustrated in Fig. 6.1) involves the use of Sanitary Landfill (SLF) II at the Y-12 Site and commercial recycle markets. Waste reduction is becoming an important factor in sanitary waste management. The cost for disposal per unit volume continues to increase as a result of transportation, emplacement, monitoring, and new site development costs. Economic incentives to reduce volume continue to grow.

6.1.2 Generic Description and Characteristics of Waste

The waste streams described in the following paragraphs constitute solid sanitary waste at ORNL. Upon generation, efforts are taken to allow for the segregation of these waste streams so that no free liquids are present prior to subsequent handling. Similar efforts have been established for the segregation and use of raw materials at ORNL.

Acidic rainwater runoff from the ORNL Coal Storage Yard is collected in a clay-lined basin. Neutralization of the acid with lime in the CYRTS causes precipitation of contaminants that have leached from the coal pile. The precipitated solids are removed by clarification and are further processed by vacuum filtration with diatomaceous earth. The resulting filter cake, a special waste generated at an average rate of 2.29 m^3/week (3 yd^3), is disposed of at SLF II.

About 25,480 t/year (28,000 tons) of coal containing about 8% ash is burned for steam generation at the ORNL steam plant. Bottom ash from the fire side of the boilers is pneumatically conveyed to the storage silo, as is fly ash from the electrostatic precipitators that capture the airborne fraction. The ash is loaded from the silo into dump trucks and is

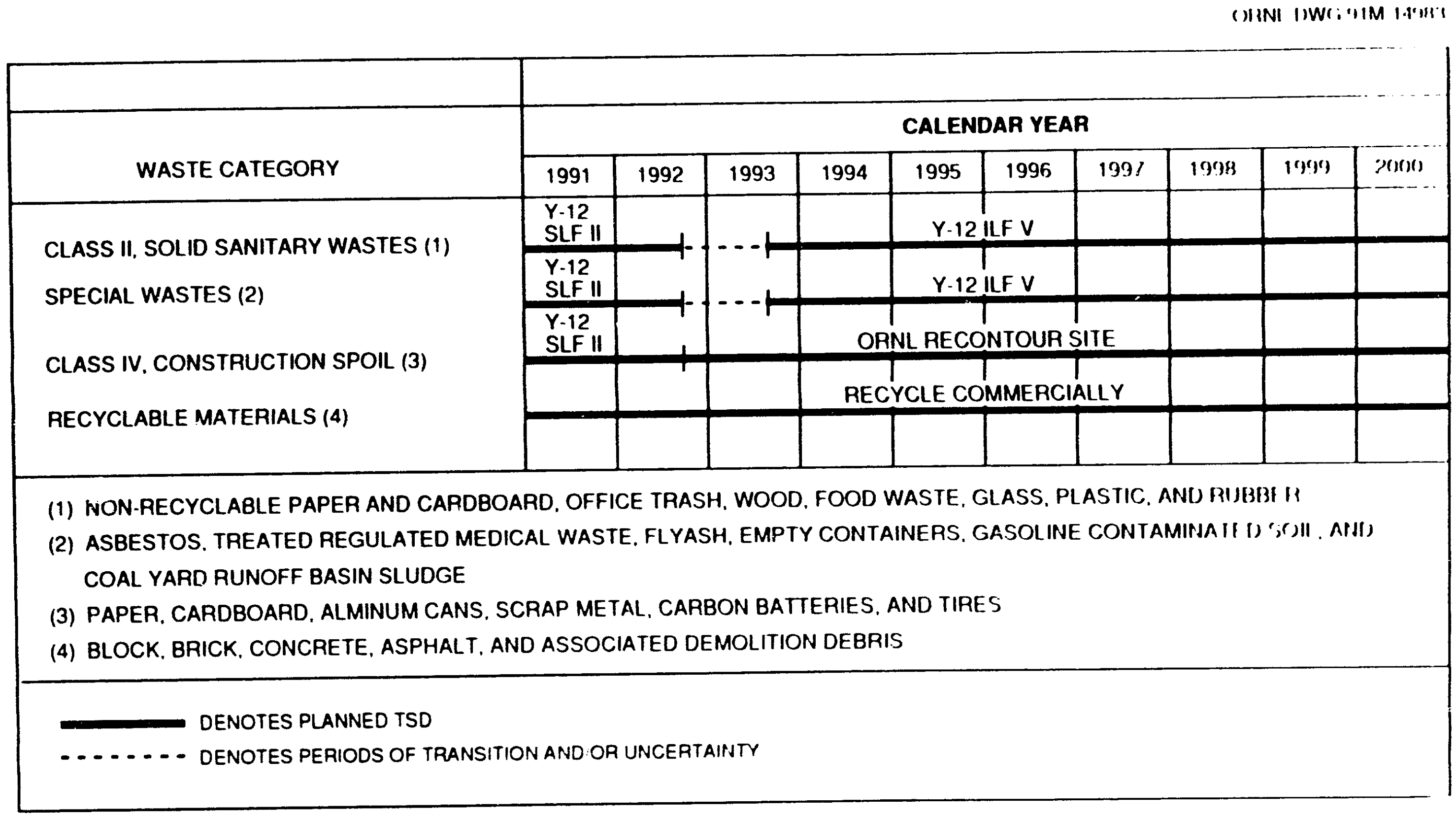

Fig. 6.1. Strategy for Oak Ridge National Laboratory sanitary waste.

transported to SLF II at an average rate of about 9.2 m^3/day (12 yd^3). Steam plant ash is specifically cited in the state permit for SLF II.

General refuse is collected at each ORNL building from trash cans and placed in dumpsters. These dumpsters are transported to an on-site trash compactor, and the refuse is compacted and reloaded onto trucks for transport to SLF II for disposal. The volume of general refuse is estimated to be 28.2 m^3 (37 yd^3) per normal work day.

Varying amounts of nonhazardous, nonradioactive wastes are generated from ongoing construction and demolition activities at ORNL. Nonbiodegradable clean soil and rocks are deposited at the Y-12 Class IV Facility. All other construction/demolition materials including concrete, asphalt, and asbestos are disposed of at SLF II.

6.1.3 Treatment and Storage Facilities

Other than the equipment used for the compaction of general refuse, no treatment or storage facilities currently exist at ORNL for the handling of solid sanitary waste. Following generation, sanitary waste is collected and transported for disposal at the facilities discussed in the following section. Treatment of sanitary sewage and coal yard runoff is discussed in Subsect. 6.2.3 under sanitary liquid waste treatment facilities.

6.1.4 Disposal Facilities

Located on Chestnut Ridge, south of the Y-12 Site and about 9.66 km (6 miles) east of ORNL, SLF II is the primary sanitary waste disposal site for the Oak Ridge Reservation. With the exception of clean soil and rock, ORNL sanitary waste and nonradioactive asbestos waste are now directed to SLF II. Soil and rock are deposited at the Y-12 Site SLF II dirt fill area. Deliveries to the site are carefully controlled and recorded to prevent the introduction of prohibited materials. Generators are charged for the cost of sanitary and construction waste management including costs for collection, transportation, and facility operation.

6.1.4.1 Environmental monitoring

Groundwater monitoring is conducted at SLF II by the Y-12 Site monitoring staff. Three groundwater monitoring wells, one upgradient and two downgradient, have been installed at the site. The groundwater sampling parameters have been established by the Tennessee Department of Environment and Conservation (TDEC) Division of Solid Waste Management by regulation 1200-1-7. - .04(7)(a).

6.1.4.2 Permitting status

The state of Tennessee regulates the operation of sanitary waste landfills in accordance with the Tennessee Solid Waste Disposal Act, as amended, and Rules Governing Solid Waste Processing and Disposal in Tennessee. The two state-permitted facilities that have received sanitary solid waste from ORNL are SLF II at the Y-12 Site, which was permitted on December 20, 1982, and the ORNL Contractor Landfill, which was permitted on January 23, 1986, and is currently closed. The permit for SLF II requires that no liquids, industrial special waste, or waste requiring special handling shall be accepted at the facility unless prior written approval for each individual waste is obtained.

As required by the Tennessee Hazardous Waste Act, no hazardous waste shall be accepted at SLF II.

In addition to these general requirements, the SLF II permit establishes minimum daily and weekly cover requirements. The permit also states that only waste specified in the site operations manual as acceptable for disposal shall be deposited unless prior written approval for each individual waste is obtained. Radioactive waste is specifically excluded from disposal. The permit allows disposal of special waste including asbestos, fly ash, and coal yard runoff sludge. SLF II is projected to be filled to permitted capacity between November 1992 and May 1993. The exact fill date is dependent on the generation rate of construction/demolition wastes and the success of recycling programs that are being instituted.

6.1.4.3 Facility status

Present strategy at the Y-12 Site is to extend the life of SLF II, which is projected to reach capacity in FY 1992, by utilizing alternative disposal methods for selected sanitary/industrial wastes. A new industrial landfill is being planned at the Y-12 Site to provide for the continued disposal of solid sanitary waste. Industrial Landfill V will be constructed as part of an FY 1990 line item (LI) project. The current projection for placing the landfill in service is June 1993. This landfill will be designed with lined trenches and a leachate collection system in response to increased requirements in the proposed Tennessee Solid Waste Regulations. The Melton Valley Clean Spoils Area is planned for management of ORNL Class IV spoil material.

6.1.5 Status of Support Systems

6.1.5.1 Training

No training is provided specifically for sanitary waste generators; however, waste minimization training and other waste management personnel training is provided to employees involved in waste operations at ORNL (Subsect. 4.1.6).

6.1.5.2 Certification

A major issue in sanitary waste management at this time is certification that the waste meets waste acceptance criteria (WAC) for the disposal facility. Exclusion of radioactive and hazardous materials is the primary concern. A certification program is needed to develop and to implement screening methodologies and administrative controls along with attendant generator training and documentation.

6.1.5.3 Data base management

The Asbestos Tracking System provides data on ORNL's removal (via building demolition or renovation) and disposal of asbestos. Information includes volume, weight, waste origin (demolition or renovation), waste type (friable or transite), date of removal, radioactive contamination, and final disposition. Responsibility for the management of this database has recently been transferred from the staff in the Environmental Compliance Section to the Waste Management Operations Group. This system is used to generate quarterly summary reports on asbestos activities and to compile yearly disposal totals for other hazardous waste reports. A database management system does not currently exist for the specific use of sanitary solid waste generators at ORNL.

6.1.6 General Plant Projects

No GPPs are planned for sanitary solid wastes.

6.1.7 Recycling Activities

See Subsect. 8.2, "Waste Reduction."

6.2 LIQUID WASTE

Sanitary liquid waste includes nonradioactive waste streams that are discharged, either directly or following treatment, to White Oak Creek (WOC). These sources at ORNL include (1) sanitary sewage wastes from Bethel and Melton valleys, (2) area runoff of rainwater, and (3) point sources (e.g., coal yard runoff).

6.2.1 Strategy

The management strategy for sanitary liquid waste at ORNL must be designed for compliance with U.S. Environmental Protection Agency (EPA) and TDEC regulations and DOE orders. The concentration of environmentally deleterious materials will be measured at the process wastewater outfalls, and the effect of discharges on the receiving stream will be determined. ORNL will aggressively pursue environmental programs that will keep the concentrations of these materials at the outfalls below the limits specified.

The impact of direct discharges of once-through cooling water on the toxicity of streams has been measured through the Biological Monitoring and Abatement Program. Because potable and process water contains residual chlorine, once-through cooling water contributes to the toxicity of area streams. Facilities are being built to recycle or to treat the major chlorine-containing streams to reduce the amount of residual chlorine entering WOC. Analysis of stream toxicity to aquatic life continues through this program as required by the ORNL NPDES permit.

Sanitary waste is minimized by wastewater segregation and maximizing treatment efficiency by developing improved techniques of characterization, treatability studies, alternatives evaluation, toxicity testing, and process modifications. A programmatic objective is to analyze each source of contamination to develop methods to reduce contaminated effluents requiring treatment prior to discharge.

6.2.2 Generic Description and Characteristics of Waste

Sanitary sewage wastes are collected and treated separately from other waste categories. Sanitary waste at ORNL consists of typical industrial sanitary sewage from the Bethel and Melton Valley facilities, where approximately 5200 people are employed. Wastes from area sources consist of runoff from general use areas such as buildings, roads, and parking areas and once-through cooling water collected by the Storm Sewer System. Point sources include coal yard runoff and discharges from several cooling towers at the ORNL site. The coal yard stores coal for use at the ORNL steam plant. During periods of rainfall, runoff from the coal pile is produced. This runoff, which is actually a leachate, is acidic and contains coal fines as well as some heavy metals. Cooling tower discharges contain algae-retardant chemical additives that can be toxic to aquatic life. All nonradioactive process wastewater is treated at the Nonradiological Wastewater Treatment Plan including the effluent from the Process Waste Treatment Plant.

Segregation of process waste from nonprocess waste according to WAC is being implemented to improve waste treatment efficiency by ensuring that waste is treated by unit operations that remove the primary contaminants of concern. Keeping wastes that require special handling out of the process wastewater stream will ensure that hazardous materials are not released to the watershed. Segregating surface water, rainwater runoff, and once-through cooling water from process waste will reduce the volume of process waste requiring treatment and the amount of radioactive secondary waste generated by the process system waste. Surface water, rainwater, and cooling water not requiring treatment will be discharged directly to the watershed; process waste will be transferred to the appropriate treatment plant. Segregating contaminated from noncontaminated groundwater will reduce the volume that requires treatment. Groundwater that does not require treatment is being eliminated to the extent possible from the Process Waste System by lining pipes to prevent leakage. Contaminated groundwater is being transferred for appropriate treatment facilities.

6.2.3 Treatment Facilities

The storm sewer system for ORNL collects once-through cooling water and water from area runoff of rainwater, roof drains, and parking lot drains. The ORNL watershed consists of First Creek, Fifth Creek, WOC, the Northwest Tributary, and Melton Branch. Figs. 6.2, 6.3, and 6.4 show the location of discharges from the Storm Sewer System to the watershed.

Most of the Storm Sewer System is constructed of reinforced concrete piping that ranges in diameter from 20.32 to 76.20 cm (8 to 30 in.). Piping has been placed in trenches that were typically backfilled with gravel. The system contains catch basins that drain areas in Bethel and Melton valleys. Typically, storm sewer piping has been installed at a higher elevation than other piping systems within the main plant area.

The Sanitary Wastewater Treatment Facility, located in Building 2521 at the west end of ORNL near the steam plant, serves a major part of ORNL. Sanitary wastes from the main plant and from the High Flux Isotope Reactor, which are trucked to the plant, are treated by the facility before release to WOC. The facility consists of an influent pumping station equipped with comminutors (to break up solids) and level controls, chlorination equipment, flow recording and effluent sampling equipment, a Parshall flume and chlorine contact basin, and a control/laboratory building (Fig. 6.5). Upgrading of the Sewage Treatment Plant was completed in September 1985. This involved the addition of a packaged extended-aeration treatment plant, an average/peak flow Head Box System, a sewage pumping station, a tertiary Filter System, inflow/infiltration rehabilitation of the sewage piping, and modifications to existing facilities including the West Lagoon, the sludge-drying beds, and the influent pump station.

The wastewater to be treated in the Coal Yard Runoff Treatment Facility (CYRTF) is pumped into the pH adjustment tank where it is mixed with a lime slurry

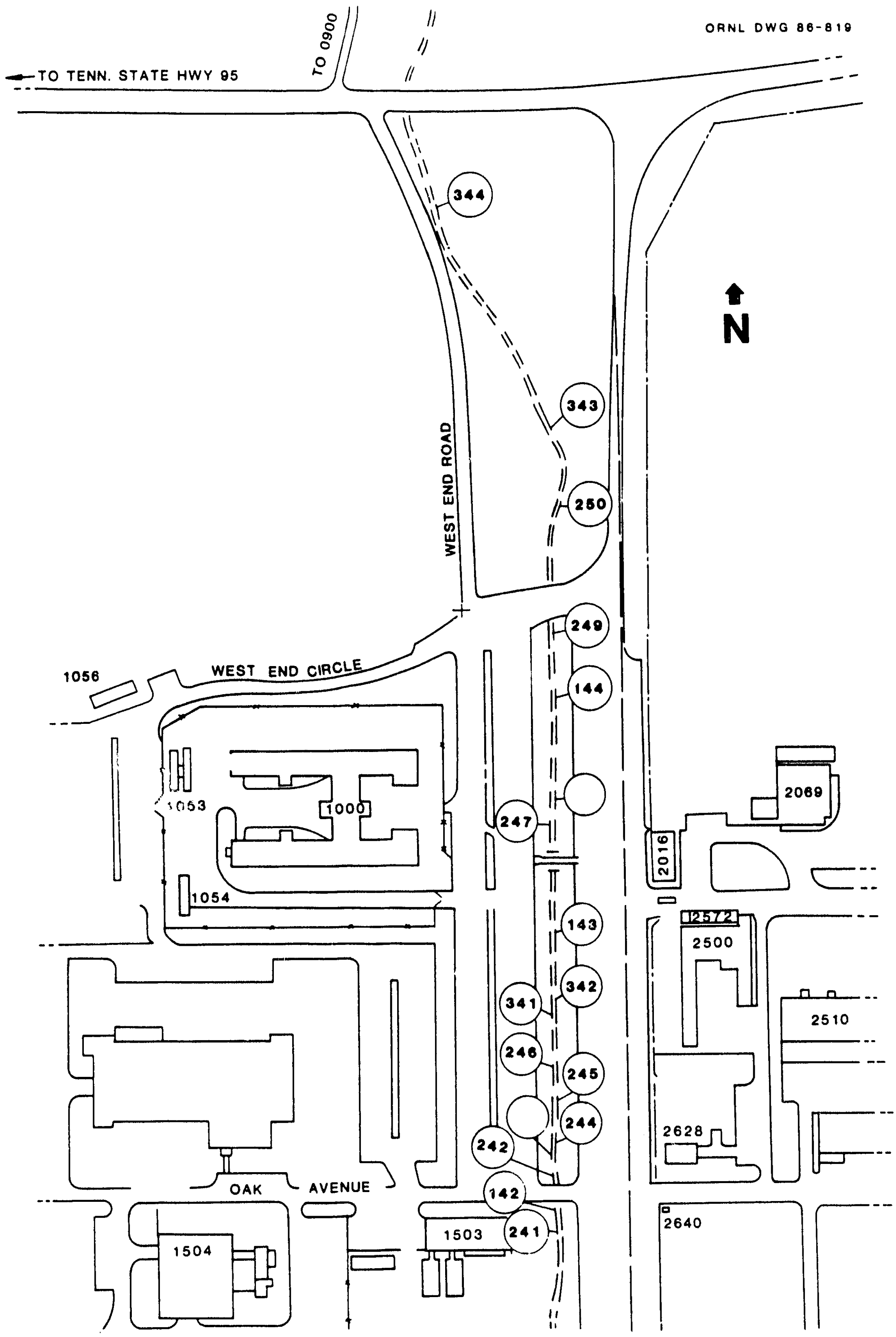

Fig. 6.2. First Creek storm sewer outfalls.

ORNL DWG 86-818

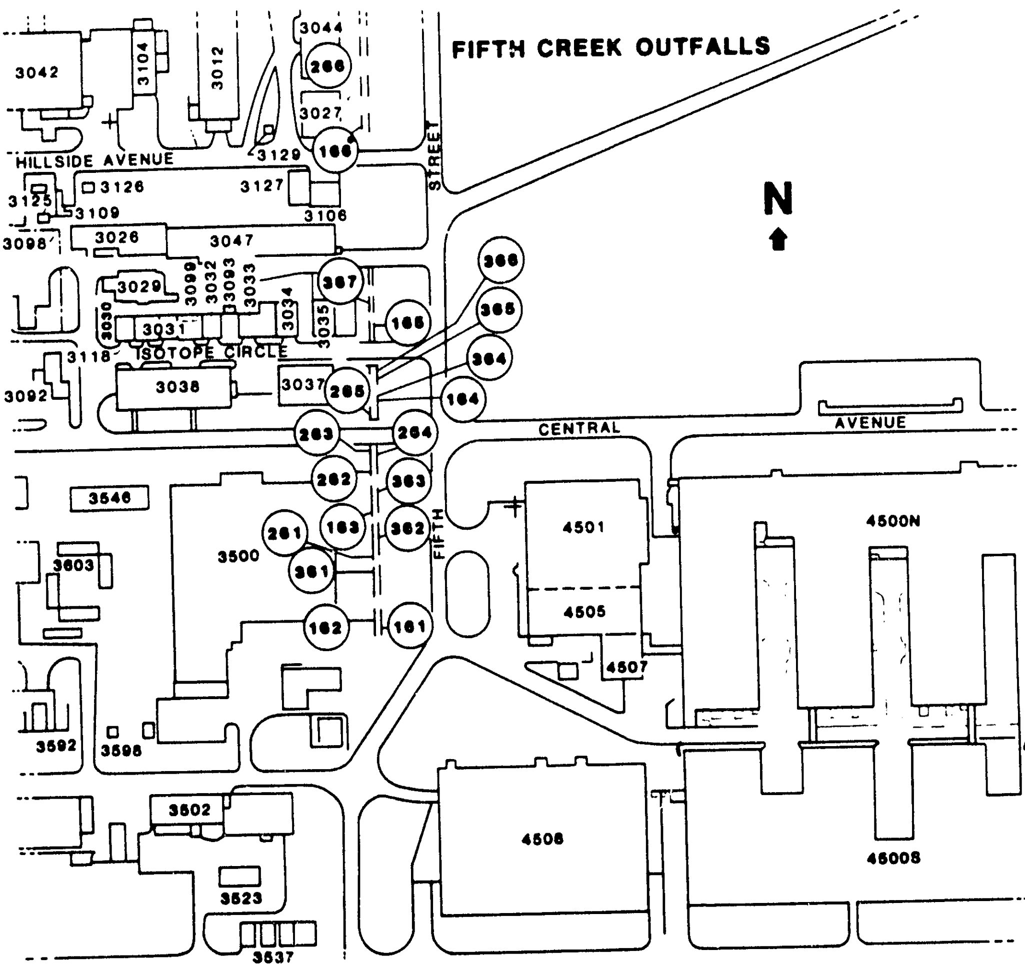

Fig. 6.3. Fifth Creek storm sewer outfalls.

from the lime slurry tank until a pH of about 10.5 is obtained (Fig. 6.6). Studies are under way to replace lime with magnesium hydroxide to reduce effluent toxicity. From the pH adjustment tank, the wastewater flows to the clarifier where polymer is added and the solids are settled. The solids from the settler are stored in the sludge storage tank until enough sludge has been collected to be dewatered by the rotary drum vacuum filter. The liquid effluent from the clarifier enters a recycle tank where sulfuric acid is added to adjust the pH of the wastewater to the 6.0 to 9.0 range. The effluent from the recycle tank flows to a discharge basin before being discharged to WOC through an NPDES discharge point. The facility is designed to recycle the wastewater automatically to a collection pond should the pH recorder or turbidity meter indicate that the wastewater does not meet effluent criteria.

6.2.3.1 Environmental monitoring

Environmental monitoring at ORNL includes surveillance of surface water and groundwater quality. Implementation of this system involves not only the location and operation of appropriate sensor devices but also the facilities and equipment for receipt and presentation of the data and appropriate modeling and predictive capability.

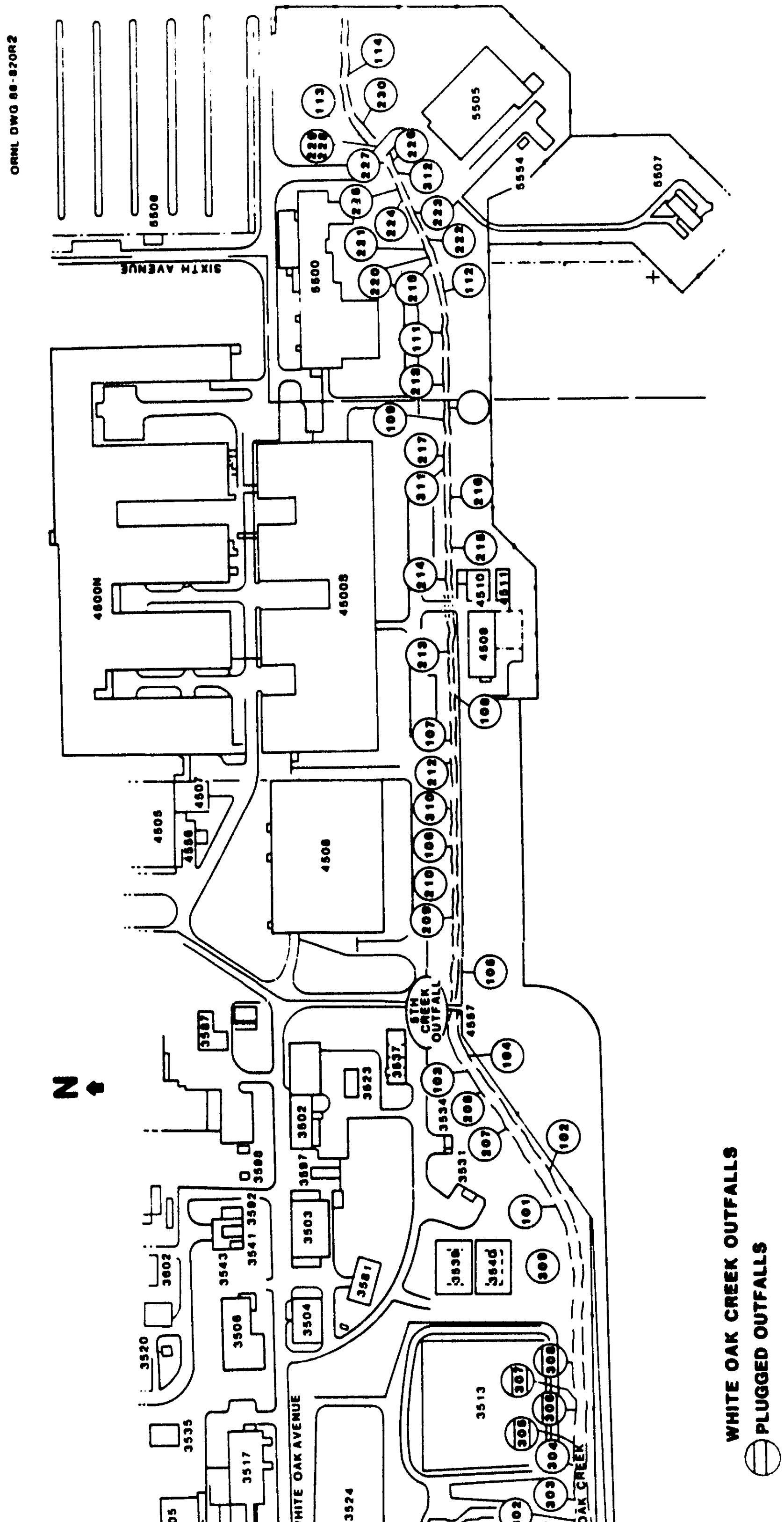

Fig. 6.4. White Oak Creek storm sewer outfalls.

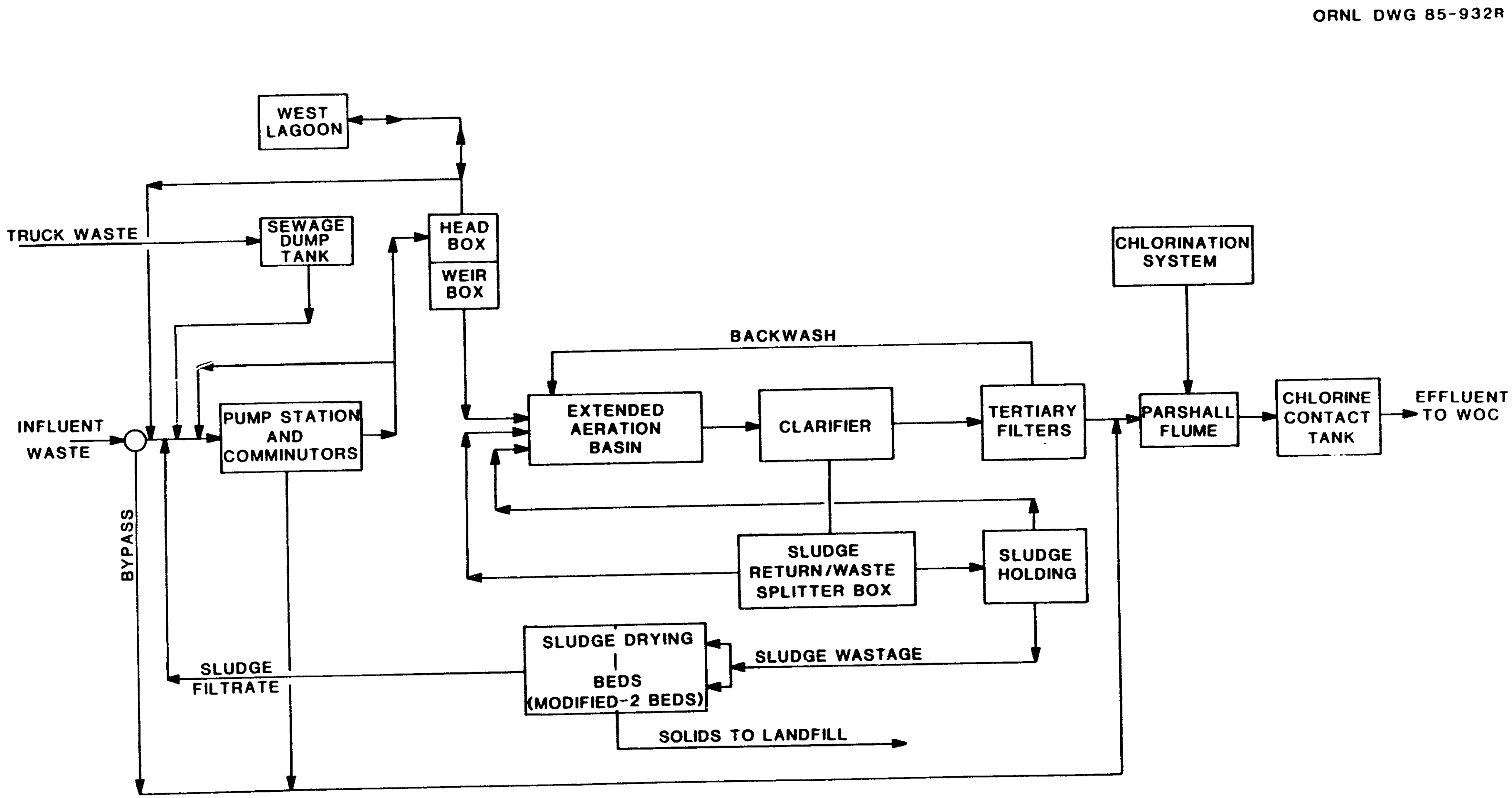

Fig. 6.5. Block flow diagram for the Sewage Treatment Plant.

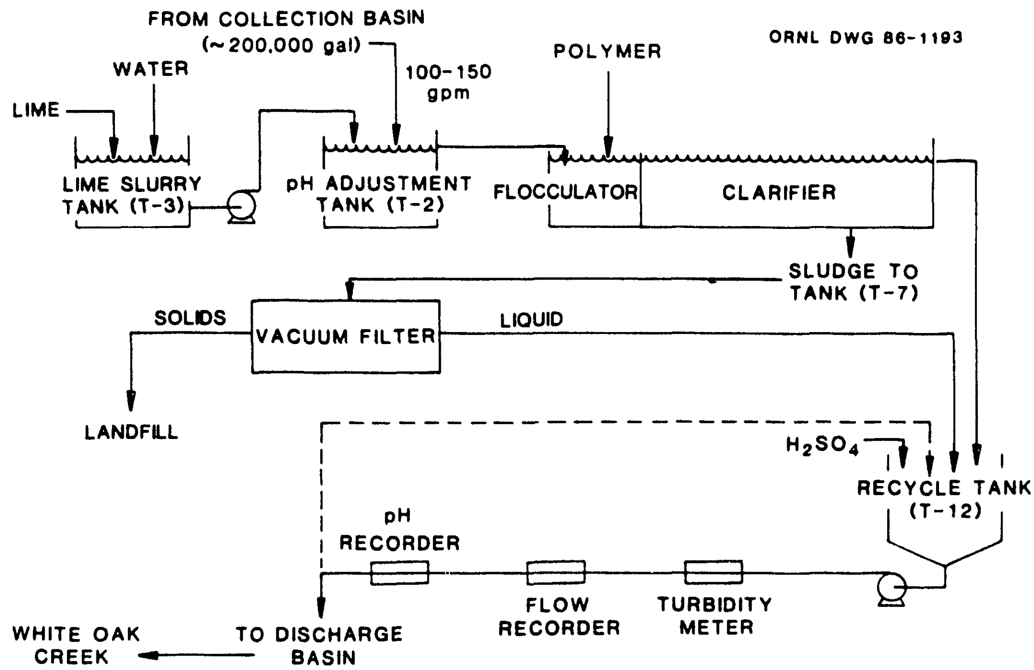

Fig. 6.6. Flow diagram of the Coal Yard Runoff Treatment Facility.

Water and biological monitoring activities at ORNL are defined by the ORNL NPDES permit and by DOE guidelines for environmental monitoring and surveillance around nuclear facilities. In response to DOE guidelines for environmental monitoring, flow and concentration data are collected to determine discharges of nonradiological constituents from ORNL processes. Under the current NPDES permit there are over 150 monitoring stations, and point sources are monitored at their point of discharge into receiving streams. The biological monitoring program includes the collection of fish, milk, soil, and grass for investigation of pollutant movement within the food chain.

6.2.3.2 Permitting status

Facilities for waste treatment must be available for both current and future activities. Environmental risks, as well as risks to the health and safety of the public, will be minimized by ensuring that all discharges from ORNL sources comply with the requirements of all applicable environmental regulations.

Current regulatory requirements for ORNL include the Clean Water Act, the Safe Drinking Water Act, and DOE orders. At present, the water and biological monitoring activities are in compliance with applicable regulatory requirements. However, this situation could change should any or all of the following conditions develop: (1) authority to regulate radiological discharges is granted to the EPA and the state of Tennessee, (2) guidelines for environmental surveillance are changed by DOE, or (3) monitoring of surface waters from solid waste management units at ORNL is determined to lie within Resource Conservation and Recovery Act provisions. Consequently, the strategy for water and biological monitoring is to evaluate potential regulatory changes or new regulations to determine whether additional capabilities or new equipment will be required for future compliance.

The original ORNL NPDES permit, which became effective April 1, 1986, authorized ORNL to discharge to the Clinch River, WOC, Northwest Tributary, Melton Branch, Fifth Creek, First Creek, and Bearden Creek Embayment of Melton Hill Lake in accordance with effluent limitations, monitoring requirements, and other conditions set forth in the permit. The original permit expired in April 1991. It is currently being renegotiated, which may involve some degree of facility upgrading to meet new discharge requirements. ORNL also observes a Federal Facilities Compliance Agreement that sets forth plans and dates for the elimination of untreated discharges and construction of treatment facilities.

6.2.3.3 Facility status

Studies are being performed to determine if the CYRTF should be upgraded to use magnesium hydroxide instead of lime to reduce the toxicity of the effluent from the facility. The CYRTF may also be used for treatment of regenerant solutions from the steam plant boiler makeup-water demineralizers. Feasibility studies have been conducted, and an engineering study and estimate will be performed. If the results are cost-effective, the CYRTF will be upgraded to handle this waste stream, which will result in increased use of the treatment system; otherwise, this waste stream will continue to be treated at the Nonradiological Wastewater Treatment Plant.

6.2.4 Storage and Disposal Facilities

Sanitary liquid waste at ORNL is collected, treated, and discharged according to the parameters set forth in the NPDES permit for the site. Storage and disposal facilities for this type of waste have been addressed in the discussion of the sanitary liquid waste treatment facilities (i.e., collection tanks/basins and discharge points).

6.2.5 Status of Support Systems

ORNL provides training commensurate with the employee's job responsibility. No specific certification or database management program currently exists to address sanitary liquid waste at ORNL other than the reporting requirements established in the NPDES permit.

6.2.6 General Plant Projects

Table 6.1 lists the LI for sanitary waste facilities at ORNL.

Table 6.1. Line item project for sanitary waste facilities at Oak Ridge National Laboratory

Title	TEC[a] ($ × 1000)	Funding type	Fiscal year
Sanitary Sewer System upgrade	16,650	EX	1993

[a]Total estimated cost.

7. DECOMMISSIONING OF RADIOACTIVELY CONTAMINATED FACILITIES

Oak Ridge National Laboratory (ORNL) has many radioactively contaminated facilities, both operational and inactive, that must be managed in a manner that protects the health and safety of personnel and the general public as well as the environment and that eventually will require decontamination and decommissioning (D&D). Also, future facilities will require D&D after operation. In general, D&D activities are concerned with facilities such as reactors, hot cells, processing plants, some liquid low-level waste storage tanks, and other structures from which no known releases have occurred. The D&D Program is very closely associated with the Environmental Restoration Program (ERP). The ERP is primarily responsible for inactive waste sites and for soil and groundwater contamination from facilities where releases have occurred. At ORNL the Waste Management and Remedial Action Division (WMRAD) is directly responsible for surveillance and maintenance (S&M) activities at inactive waste sites and S&M and decommissioning activities for surplus facilities. Management of these sites and facilities is coordinated through the Energy Systems ERP and the D&D Program (Fig. 7.1). The ORNL waste management activities associated with decontamination of radioactively contaminated facilities can be divided into four areas: operational facilities, inactive or surplus facilities, future facilities planning, and D&D activities.

7.1 OPERATIONAL FACILITIES

Radioactively contaminated facilities that are currently operational are the responsibility of the line management organization assigned the facility. Funding for operation and maintenance of these facilities is provided by various program organizations within the U.S. Department of Energy (DOE). The operating organizations are responsible for maintaining the records for assigning fiscal responsibility for D&D.

The operational safety of all active facilities are under the purview of the ORNL director of the Office of Operational Readiness and Safety. This office and various Director Review Committees review the safety aspects associated with the operation of all new facilities and modifications to existing facilities. In addition, this office conducts periodic safety reviews and audits of all operational facilities. The Director Review Committees include the Radioactive Operations Committee, the Reactor Operations Review Committee, and the Accelerators and Radiation Sources Review Committee. In operating facilities where, as the result of past facility operation, contamination is detected outside the facility proper (e.g., groundwater contamination), the ERP will be responsible for the planning and management of the necessary remedial actions.

7.2 INACTIVE FACILITIES

ORNL, which has been an operational site since the 1940s, has many inactive or surplus facilities. The overall strategy for the management of these inactive facilities is (1) to maintain and to monitor these facilities to ensure that the radioactivity is contained in a manner that limits exposure to personnel and the general public and protects the environment from potential hazards and (2) to plan for D&D of these facilities.

The Surplus Facilities Management Program (SFMP) was established at ORNL in 1976 to provide collective management of all the surplus sites under ORNL control on the

Oak Ridge Reservation. The program originally contained both civilian- and defense-related facilities and was administered by the SFMP office in Richland, Washington, through the SFMP identification. The defense surplus facilities program temporarily assumed the Defense Decontamination and Decommissioning Program (DDDP) title to differentiate it from its civilian counterpart. The SFMP and the DDDP did not include facilities that have been removed from service since 1976, and the need existed for a companion program that would include ER facilities and those that were utilized by several programs within ORNL. Therefore, the Surplus Contaminated Facilities Program (SCFP) was organized during the second half of FY 1985 to encompass the needs of surplus contaminated facilities at ORNL that were not part of the national SFMP. In 1989 these programs were integrated into the ER (EM-40) D&D Program (EM-423), which is coordinated through the DOE Oak Ridge Field Office and managed by the ORNL Remedial Action Section in WMRAD. The D&D Program has established criteria for acceptance of new facilities into the program; not all of the SCFP facilities have been accepted. Table 7.1 lists those facilities that have been included in the D&D Program since 1976. Former ER-supported surplus facilities that will be transferred to the D&D Program in FY 1992 are listed in Table 7.2. The Oak Ridge Research Reactor will be transferred to the D&D Program at the beginning of FY 1993. Table 7.3 lists ER-supported surplus facilities that are expected to be transferred into the D&D Program in FY 1993 following the complete review of acceptance criteria. Former ER-supported surplus facilities that do not meet the D&D Program acceptance criteria are listed in Table 7.4. Table 7.5 lists inactive sites that are supported and will ultimately be remediated by the Environmental Restoration Remedial Action Program. At ORNL, inactive facilities supported by EM-40 are managed by the Remedial Action Section in WMRAD. This responsibility includes evaluating current facility conditions, monitoring site surveillance information, and reviewing applicable environmental regulations to ensure that current decommissioning priorities reflect the requirement. Significant changes in these areas that impact decommissioning plans are conveyed routinely to the respective DOE program sponsor. The Office of Operational Readiness and Safety is responsible for reviewing and auditing surplus facilities.

7.3 FUTURE FACILITIES

Planning for D&D, an integral part of the design of all future facilities at ORNL, will be the responsibility of the Energy Systems line organization responsible for operating the facility and will be in conjunction with architectural-engineering organizations involved in the design process. Funding for D&D planning will be part of the design funding provided by the program sponsoring the facility.

7.4 DECONTAMINATION AND DECOMMISSIONING

The goals of D&D are (1) to decontaminate facilities designated for reuse to the extent necessary for compliance with approved health and safety standards and (2) to decommission all other facilities in accordance with the requirements set forth in DOE-approved project plans and environmental compliance documentation. The ORNL D&D Program is implemented by the Remedial Action Section in WMRAD. Coordination of D&D planning is also the responsibility of the Remedial Action Section. This organization will also ensure compliance with the requirements of DOE Order 5820.2A. Coordination

Table 7.1. Facilities included in the Decontamination and Decommissioning Program since 1976

Building number	Facility name/description
3001	Oak Ridge Graphite Reactor (OGR)
3002	OGR Filter House
3003	OGR Fan House
3005	Low-Intensity Test Reactor (LITR)
3018	Exhaust stack for 3003 (OGR stack)
3042	Reactor experiments (ORR)[a]
3077	Air cooler (LITR)
3087	Heat exchanger (ORR)
3505	Metal Recovery Facility
3506	Waste evaporator
3515	Fission Product Pilot Plant
3517	Fission Product Development Laboratory (inactive cells)
7500	Homogeneous Reactor Experiment (HRE)
7502	Waste evaporator (HRE)
7503	Molten Salt Reactor Experiment (MSRE)
7511	Filter pit (MSRE)
7512	Exhaust stack (MSRE)
7513	Cooling tower (MSRE)
7514	Supply Air Filter House (MSRE)
7554	Cooling tower (HRE)
7555	Diesel Generator House (MSRE)
7557	Charcoal absorber pit (HRE)
7558	Waste evaporator loading pit (HRE)
7559	Charcoal absorber valve pit (HRE)
7561	Waste valve pit (HRE)
7852	Old Hydrofracture Facility
----	Shielded transfer tanks ST1, ST2, ST3, ST4, ST5

[a]Oak Ridge Research Reactor.

Table 7.2. Former Energy Research-supported surplus facilities to be transferred to the Decontamination and Decommissioning Program in FY 1992

Facility number	Facility name/description
4507	High-Radiation-Level Chemical Development Laboratory
9201-3	Molten Salt Reactor Experiment Fuel-Handling Facility
9201-3	Coolant Salt Technology Facility
9201-3	Storage tank
9419-1	Decontamination Facility

Table 7.3. Former Energy Research-supported surplus facilities expected to be transferred to the Decontamination and Decommissioning Program in FY 1993

Facility number	Facility name/description
3110	Filter House (and underground ductwork)
3121	Off-Gas Filter House
7819	Interim Decontamination Facility

Table 7.4. Former Energy Research-supported surplus facilities not meeting Decontamination and Decommissioning Program acceptance criteria

Facility number	Facility name/description
3019-B	High-Radiation-Level Analytical Facility
3028	Strontium-90 power generators
3029	Cobalt-60 storage garden
3503	Storage pad
9201-2	ORNL 218-cm (86-in.) cyclotron
9204-3	Plutonium Processing Facility
9204-3	Curium-handling glovebox
9204-1	Attic
9204-1	East End basement

Table 7.5. Facilities or sites under the Environmental Restoration Program

Facility number	Facility name/description
	Defense programs
1001	Solid Waste Storage Area 3
2624	Solid Waste Storage Area 1
3023	North Tank Farm
3075	Decommissioned Low-Intensity Test Reactor Ponds
3507	South Tank Farm
3512	Decommissioned waste-holding basin
3513	Waste-holding basin
4003	Solid Waste Storage Area 2
7556	Settling pond (HRE)[a]
7560	Waste tank, HRE [3785 L (1000 gal)]
7562	Waste condensate tank, HRE [45,425 L (12,000 gal)]
7800	Solid Waste Storage Area 4
7802	Solid Waste Storage Area 5
7805-7808	Chemical waste pits 1–4
7809	Chemical waste trench 5
7810	Chemical waste trench 6
7818	Chemical waste trench 7
7835	Sludge waste pond (SWSA 5)
7852A	Old Hydrofracture Facility (OHF) Pond
7854	Drilling equipment storage (OHF)
----	Hydrofracture Experimental Site 1
----	White Wing scrap yard
----	Fission Products Development Laboratory low-level waste transfer line
----	SWSA 6 RCRA-capped areas
----	OHF tanks (T-1, T-2, T-3, T-4, T-9)
----	Other LLW tanks (WC-1, TH-1, TH-2, TH-3, TH-4, WC-15, WC-17, T-30)
	Energy Research
0800	Environmental Study Area (^{137}Cs plots)
7658	Closed Contractor's Landfill
----	Transfer Line Leak Site (Bldg. 7819 to pit)
----	LLW Line Leak Site 1 (SE of trench 6)
----	LLW Line Leak Site 2 (N of trench 7)
----	Chestnut Ridge cesium plots

[a]Homogeneous Reactor Experiment.
[b]New Hydrofracture Facility.
[c]Resource Conservation and Recovery.

and implementation technology developed at other DOE sites and the private sector are a part of the responsibility. A list of facilities currently scheduled for D&D is provided in Table 7.6.

Table 7.6. Decommissioning of surplus facilities: long-range schedule

Decommissioning project	Projected schedule (FY)
Metal Recovery Facility	1991-2002
Waste Evaporator Facility	1993-1998
Fission Product Pilot Plant	1993-1999
Old Hydrofracture Facility	1993-2001
Shielded transfer tanks	1995-1998
Decontamination Facility	1995-1999
Oak Ridge Research Reactor heat exchangers	1995-2000
Homogeneous Reactor Experiment	1995-2003
Molten Salt Corrosion Loop	1997-2001
Low-Intensity Test Reactor	1997-2004
Molten Salt Reactor Experiment	1997-2019
Fission Products Development Laboratory inactive cells	1998-2002
Coolant Salt Technology Facility	1998-2002
ORNL Graphite Reactor	1999-2007
Oil storage tank	1999-2002
High-Level Chemical Development Laboratory	1999-2007
Oak Ridge Research Reactor and Experimental Facilities	2000-2014

7.5 UPDATE OF IMPLEMENTATION SUMMARY TABLE

Appendix A provides an update to the original implementation summary for decommissioning of radioactively contaminated facilities that was provided in the *ORNL Waste Management Plan for DOE Order 5820.2A*. The format in Appendix A duplicates the format of the requirements for the decommissioning of radioactively contaminated facilities contained in DOE Order 5820.2A. Many activities planned for achieving compliance with the order are applicable to more than one requirement. To avoid duplication of costs for achieving compliance, cross-referencing between requirements is used extensively.

8. ORNL WASTE MANAGEMENT SUPPORT ACTIVITIES

Developing the capabilities necessary for Oak Ridge National Laboratory (ORNL) to achieve and to maintain full compliance with environmental regulations and waste management objectives requires the integration of a large number of individual projects and activities. The following subsections provide information on ORNL waste management support activities.

8.1 TREATMENT, STORAGE, AND DISPOSAL PLAN

Temporary storage of transuranic (TRU), hazardous, and mixed wastes has been part of the ORNL waste management strategy since the 1970s. Solid low-level waste (SLLW) was added to the category of stored waste beginning in 1986 when these wastes were first shipped to the K-25 Site. TRU, mixed, and SLLW storage is expected to be a critical part of ORNL plans for the foreseeable future until treatment and/or disposal facilities are developed and made available.

Table 8.1 lists the ORNL treatment, storage, and disposal facilities, along with the status of each, and includes information on wastes in temporary staging as well as those in long-term storage modes. Capacity concerns exist for contact-handled (CH) TRU, remote-handled (RH) TRU, hazardous, and mixed wastes. Table 8.1 also indicates the Resource Conservation and Recovery Act (RCRA) permit status for each storage facility. Several of the interim status facilities must have closure initiated by November 8, 1992. Closure plans must be revised and submitted to the Tennessee Department of Environment and Conservation (TDEC) for approval.

Based on the current understanding of the storage needs, the need for additional storage facilities for SLLW, CH TRU, RH TRU, hazardous, and mixed waste is anticipated. Currently planned facilities for ORNL wastes are presented in Table 8.2. The CH TRU, RH TRU, hazardous, and mixed waste facilities will require RCRA permitting.

8.2 WASTE REDUCTION

Waste reduction has received significant publicity in recent years and will be an important goal for the generating community during the next decade. Federal regulations, U.S. Department of Energy (DOE) policies and guidelines, increased costs and liabilities associated with the management of wastes, limited disposal options and facility capacities, and public consciousness have been motivating factors for comprehensive waste reduction programs.

DOE Order 5820.2A, Subsect. 3.c.2.4, requires the establishment of an auditable waste reduction program for all low-level waste (LLW) generators. In addition, it further states that any new facilities or changes to existing facilities will incorporate waste minimization into design considerations. More recently, DOE Order 5400.1, Sect. 4.b, requires the preparation of a waste reduction program plan to be reviewed annually and updated every 3 years. In 1990 the Tennessee Hazardous Waste Reduction Act was passed. The act requires a rigorous plan and more detailed annual reporting. A waste reduction plan for ORNL was prepared in August 1985 and updated in May 1991. A major revision to the plan was issued in November 1992 to comply with the state act.

Table 8.1. Current operational status of Oak Ridge National Laboratory waste treatment, storage, and disposal facilities

A. Treatment facilities

Facility	Waste treated	Type of treatment	RCRA permit status[a]	Plans for future
Building 7860 (New Hydrofracture Facility—surface facilities)	Liquid low-level waste	Inactive	Interim status	Scheduled for RCRA closure (to be initiated by November 1992). Closure plan is being updated and will be submitted to the Tennessee Department of Environment and Conservation (TDEC)
Building 7667	Explosive chemicals	Detonation	Interim status; Part B permit application submitted to the TDEC in 1989	Continue to operate
Building 7659B	Reactive chemicals	Inactive	Interim status	Scheduled for RCRA closure (to be initiated by November 1992). Closure plan to be updated and submitted to the TDEC

B. Storage facilities

Facility	Waste currently stored	Type of storage	Permitted capacity	Current inventory	RCRA permit status[a]	Formal WAC in place[b]	Plans for future
Hazardous Waste							
Building 7507	Polychlorinated biphenyl (PCB) oils (drum)	Temporary staging building	31,230 L (8,250 gal) (150 drums)	52,882 L (13,970 gal)[c] (254 drums)	Interim status	Yes[d]	Move PCB oil staging to Building 7652 Annex when completed (FY 1992) and upgrade and permit
Building 7651	Recyclable oils (drum)	Temporary staging building	26,649 L (7,040 gal) (128 drums)	9,274 L (2,450 gal)[c] (44 drums)	Interim status	Yes[d]	Scheduled for RCRA closure in November 1992[e]
Building 7652	Bulk solids/liquid (drum)	Temporary staging building	57,254 L (15,125 gal) (275 drums)	47,128 L (12,540 gal)[c] (228 drums)	Part B permitted	Yes[d]	Continue to operate for foreseeable future
Building 7653	Lab-pack chemicals (small container)	Temporary staging building	26,025 L (6,875 gal) (125 drums)	9,387 L (2,480 gal)[c] (45 drums)	Interim status; Part B to be resubmitted	Yes[d]	Continue to operate for foreseeable future

Table 8.1 (continued)

Facility	Waste currently stored	Type of storage	Permitted capacity	Current inventory	RCRA permit status[a]	Formal WAC in place[b]	Plans for future
B. Storage facilities							
Building 7934	Spent photographic solution (drum)	Temporary staging building	56,781 L (15,000 gal) (273 drums)	54,094 L (14,290 gal)[c] (260 drums)	Currently exempt-recycle materials; will be added to Part A for interim status	Yes[c]	Will be permitted for mixed wastes
Mixed Waste							
Building 7507W	Mixed solids/ liquids (drums)	Long-term covered pad	83,279 L (22,000 gal) (400 drums)	76,087 L (20,100 gal) (365 drums)	Interim status	Yes[d]	Continue to operate for the foreseeble future
Building 7654	Mixed solids/ liquids (drum)	Long-term building	72,869 L (19,250 gal) (350 drums)	52,996 L (14,000 gal) (255 drums)	Interim status;Part B resubmitted	Yes[d]	Continue to operate for foreseeable future at full capacity
Building 7823	Mixed solids/ liquids (drum)	Long-term building	840 m^3 (30,000 ft^3)	68,081 L (17,985 gal) (327 drums)	Interim status; Part B submitted	Yes[d]	Continue to operate for foreseeable future.
Tank 7075	Mixed oils	Long-term tank	15,899 L (4,200 gal)	15,899 L (4,200 gal)[c]	Interim status	Yes[d]	Initiate closure by November 8, 1992[e]
Tank 7830a	Mixed oils	Long-term tank	18,927 L (5,000 gal)	18,927 L (5,000 gal)[c]	Interim status; Part B submitted	Yes[d]	Will be permitted[e]
Solid low-level waste							
Building 7879	Solid low-level waste (SLLW) (drum/box)	Temporary staging building	560 m^3 (20,000 ft^3)	N/A[c]	Part B submitted	Yes[f,g]	Continue to operate for foreseeable future
Building 7842	SLLW (drum/box)	Temporary staging building	1,400 m^3 (50,000 ft^3)	N/A[c]	N/A	Yes[f]	Continue to operate as SLLW staging facility for tumulus and greater confinement disposal silos; also use for storing contaminated lead pending recycle program implementation (FY 1992)

Table 8.1 (continued)

B. Storage facilities

Facility	Waste currently stored	Type of storage	Permitted capacity	Current inventory	RCRA permit status[a]	Formal WAC in place[b]	Plans for future
K-25 Site	SLLW (drum/box)	Long-term building	*h*	875 m^3 (31,250 ft^3)	N/A	Yes	Continue to use K-25 Site storage for Process Waste Treatment Plant sludges and boxed, compactible waste
Solid TRU Waste							
Building 7879	Solid contact-handled transuranic (CH TRU) (drum/box)	Temporary staging building	560 m^3 (20,000 ft^3)	98 m^3 (3,500 ft^3)	Interim status;Part B submitted	Yes[d,g]	Continue to operate for foreseeable future
Buildings 7826 and 7834	Solid CH TRU (drum/box)	Long-term underground cells	716 m^3 (25,574 ft^3)	525 m^3 (18,750 ft^3)	Interim status	Yes[g]	Initiate closure by November 8, 1992
Building 7855	Solid remote-handled (RH) TRU	Long-term underground bunker	175 m^3 (6,234 ft^3) (108 casks)	155 m^3 (5,541 ft^3) (96 casks)	Part B permitted	Yes[d,f]	Continue long-term storage until the Waste Handling and Packaging Plant begins processing RH TRU in FY 1999 along with ultimate shipment to WIPP
Solid Waste Storage Area 5N trenches	Solid RH TRU	Long-term trench	84 m^3 (3,000 ft^3)	84 m^3 (3,000 ft^3)	Interim status	No	Remove from Part A permit and close under CERCLA[i]
Liquid TRU waste							
3001 Canal	Presumed TRU	Long-term tank	75,708 L (20,000 gal)	946 L (250 gal)	Interim status	No	Completed RCRA closure

Table 8.1 (continued)

C. Disposal						
Facility	Waste disposal	Type of disposal	Capacity	Current inventory	Formal WAC in place[b]	Plans for future
Solid Waste Storage Area 6	SLLW	Near-surface disposal in engineered disposal units (i.e., tumulus, silos, and wells)	j	j	Yes[f]	Continue to operate until RCRA/CERCLA closure begins (currently scheduled for December 1993)
Solid Waste Storage Area 7	SLLW	Tumulus	j	j		Site under development; operational start date in 2000

[a]Resource Conservation and Recovery Act.
[b]Waste acceptance criteria.
[c]Inventory varies by month, current inventory as of October 1992.
[d]Included in RCRA Part A or B permit application.
[e]Plans may change after the EPA issues used oil regulations in 1993.
[f]*ORNL Health Physics Manual,* Martin Marietta Energy Systems, Oak Ridge National Laboratory, Aug. 21, 1991.
[g]*Oak Ridge National Laboratory Transuranic Waste Certification Program.* ORNL/TM-10322/R2, Martin Marietta Energy Systems, Oak Ridge National Laboratory, August 1990.
[h]Capacity full until new areas are prepared and placed in service.
[i]Comprehensive Environmental Response, Compensation, and Liability Act.
[j]Not determined.

Table 8.2. Planned storage facility construction/upgrades

Project	Project type	Expected operational startup	Planned use
		Hazardous waste	
Polychlorinated biphenyl (PCB) Annex to Building 7652	FY 1989 GPP[a]	TBD	Staging area for PCB waste prior to off-site shipment
		Mixed waste	
Expand mixed waste storage (Building 7668)	FY 1989 GPP	FY 1995	Long-term storage of drummed/boxed mixed waste
Mixed Waste Storage Facility	FY 1993 GPP	FY 1996	Long-term storage of drummed/boxed mixed waste
		Recyclable material	
Upgrade Building 7507	FY 1990 GPP	TBD	Upgrade building to provide staging area for contaminated recyclable lead and/or hazardous waste storage
		Solid low-level waste (SLLW)	
Bulk Contaminated Soil Facility	FY 1991 GPP	FY 1994	Provide storage for radioactively contaminated soils
Class L-III and L-IV Below-ground Storage Facility	FY 1991 GPP	FY 1995	Provide storage for Class L-III/L-IV SLLW in stainless steel wells prior to off-site shipment for disposal
Class L-III and L-IV Above-ground Storage Facility	FY 1992 GPP	FY 1995	Provide storage for Class L-III/L-IV SLLW in aboveground concrete modules prior to off-site shipment for disposal
Class L-III and L-IV Below-ground Storage Facility II	FY 1993 GPP	FY 1996	Expanded Class L-III/L-IV retrievable storage wells
SLLW Staging Facility	FY 1993 GPP	TBD	Provide staging/storage for SLLW and mixed waste
Class L-III and L-IV Above-ground Storage Facility II	FY 1994 GPP	TBD	Expanded aboveground storage for Class L-III/L-IV SLLW
Dry Cask Storage Facility	*b* LI[c]	*b*	Provide long-term storage of Class L-III/L-IV SLLW prior to off-site shipment for disposal
		Transuranic (TRU) waste	
Contact-handled transuranic (CH TRU) Storage Facility	FY 1990 GPP	FY 1994	Provide RCRA-approved[d] storage for CH TRU drums prior to repackaging/shipment to the Waste Isolation Pilot Plant (WIPP)
Nuclear Fuel Services, Inc. (NFS) CH TRU Storage Facility	FY 1992 GPP	FY 1994	Provide RCRA-approved storage for NFS CH TRU drums prior to repackaging/shipment to WIPP
TRU Waste Storage Facility	FY 1995 GPP	TBD	Provide RCRA-approved storage for CH TRU drums prior to repackaging/shipment to WIPP
Remote-handled TRU Storage Bunker	FY 1989 GPP	FY 1995	Provide RCRA-approved storage for RH TRU casks prior to processing at the Waste Handling and Packaging Plant
Retrieved RH TRU Cask Storage Bunker	FY 1997 LI	FY 2000	Provide temporary storage of retrieved RH TRU waste prior to repackaging/shipment to WIPP

[a]General plant project.
[b]Out-year project; no completion on start date has yet been assigned.
[c]Line item.
[d]Resource Conservation and Reco[illegible]y Act.

Recognizing the emphasis on waste reduction requirements, DOE Headquarters Defense Programs has established a Waste Reduction Steering Committee. Their charter includes ensuring consistency by the coordination of Defense Programs waste reduction activities, maximizing information exchange, identifying current and future data needs and reporting requirements, and guiding future activities between the programs and their respective sites. In 1989 ORNL created the position of waste reduction coordinator to handle the increased emphasis and requirements for waste minimization. The waste reduction coordinator meets with divisional waste reduction representatives periodically to exchange information, to provide updates on waste reduction, to discuss problems, to elicit suggestions, and to review the program.

As the certification programs are being established at ORNL, they will be closely coupled with the Waste Reduction Program. Waste generator certification officials have been appointed who will provide waste generation, characterization, and processing information. The information will be used to determine methods for reducing waste generation and to identify areas where efforts are required for compliance with federal regulations.

8.3 DOCUMENT CONTROL

The Document Management Center (DMC) of the Waste Management Operations Section is responsible for maintaining the Document Management System (DMS). The DMS was conceived, designed, and configured to meet requirements of NQA-1 specified document control and quality records for the Waste Management Operations Section. The scope, requirements, and user guidelines of this quality assurance-based (QA) system operation are contained in the *Documentation Management System Users Guide*. The identification of documentation to be managed is the responsibility of the Waste Management Operations Section head, department heads, or their designee(s). These documents may be identified in a documentation plan and/or a QA Plan.

Following authorization of each project, program, or activity, a documentation plan may be generated by the responsible manager or his/her designee. Those documents to be generated are listed giving document sponsor, stage, document management level, and retention period. Reviewers for procedures are determined on a case by case basis by the document review officer. Procedures must also be accompanied by a Review/Approval Form and a Distribution Control List.

Any document generated within the Waste Management Operations Section or generated in support of activities requested, coordinated, or managed by Waste Management Operations may be submitted to the DMC if accompanied by a completed Document Entry Request Form or a Document Change Request Form. DMS levels are described in Table 8.3.

When modification/revisions are necessary or desirable in any documentation original maintained in the DMS, a Document Exchange Request Form (TX 5308) must be completed and approved. Also, when modifications are to be made to DMC-held original documentation, the modifications shall be made within or coordinated through the DMC.

Review and approval of modifications shall, except for procedures, be the same as for the document it supersedes. The original Document Entry Request Form is filed in the DMC and may be referred to as a guide. Also, management of revised documents should include the same distribution and document management level as the document it supersedes.

Table 8.3. Documentation Management System levels

Level	Description
1	Records or documents that are managed for storage and retrieval only
2	DMC distributed records or documents whose review, approval, content, *hand* distribution, retention, and storage, are strictly controlled according to specified requirements for controlled documentation
2.5	DMC distributed records or documents whose review, approval, content, *mailed* distribution, retention, and storage are strictly controlled according to specified requirements for controlled documentation
3	Records or documents that are managed for storage and limited retrieval because information they contain may be sensitive; retention is ensured and content protected
3.5	Records or documents that are managed for storage and retrieval and for limited distribution to affected organizational personnel; retention is ensured and content protected

8.4 QUALITY ASSURANCE

The objective of the Waste Management and Remedial Actions Division QA Program is to develop, to implement, and to maintain QA practices that will ensure that activities are (1) conducted with the highest regard and assurance for the health and safety of personnel and the surrounding population, (2) designed and executed for both short- and long-term protection of the environment, and (3) in compliance with the requirements of state and federal regulatory agencies as well as sponsors. Work is ongoing to bring programmatic elements of the division into compliance with American National Standards Institute and American Society of Mechanical Engineers NQA-1 QA standards and with other requirements mandated by DOE, Energy Systems, and ORNL.

A QA manual that provides procedures and instructions for implementing NQA-1 has been issued. The manual addresses elements of the NQA-1 standard and ensures that all requirements are met. A QA Evaluation is made of each project or activity, and project-specific QA plans are developed, implemented, and overseen through a cooperative effort of division, line, and QA staff. Audit, review, inspection, and surveillance activities form an integral part of each project. QA training activities have been initiated and will continue for division personnel. The QA staff interfaces regularly with line personnel and division management at ORNL.

8.5 NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) COMPLIANCE AND DOCUMENTATION

NEPA was enacted to declare a national policy that would encourage harmony between man and his environment. Major points covered by the act are as follows:

- The federal government should use all practical means to ensure a safe environment and act as a trustee of the environment for future generations.
- The federal government should ensure that the widest range of beneficial uses of the environment is attained without degrading its quality. The environment, in this sense, includes cultural and historical as well as natural resources.

- The federal government should include in every proposal a detailed statement of its environmental impact and alternatives to it.
- The Council on Environmental Quality (CEQ) was created (1) to generate data on the conditions and trends on the quality of the environment, (2) to review federal government activities in light of those conditions and trends, and (3) to prepare an Environmental Quality Report annually for the president and Congress.

To implement this policy at ORNL, an environmental review and documentation program is maintained that is applicable to all ORNL facilities, programs, and operations as well as subcontractor activities or other work performed for or at ORNL under contractual arrangements. The following subsections provide examples of NEPA documentation.

8.5.1 Action Description Memorandum (ADM)

This document containing a concise written description of a proposed action and a brief discussion of relevant potential environmental issues is prepared for use in the DOE NEPA process to determine the appropriate level of NEPA documentation for a proposed action. It is prepared only for actions not listed in Subpart D of 10 CFR Pt. 1021.

8.5.2 Environmental Assessment (EA)

Defined in 40 CFR Pt. 1508.9, this document is prepared to assess whether a proposed action is a "major Federal action significantly affecting the quality of the human environment." It serves as the basis for a determination of whether an Environmental Impact Statement (EIS) is required. If an EIS is not considered necessary, a document called a Finding of No Significant Impact is prepared by DOE to record the DOE decision.

8.5.3 Environmental Impact Statement

Defined in 40 CFR 1508.11, this document is prepared in accordance with the requirements of Sect. 102(2)(C) of NEPA as delineated by CEQ regulations and DOE guidance.

8.5.4 Categorical Exclusion Determination

This document is prepared to record a DOE decision that the action is categorically excluded and therefore does not require the preparation of an EA or an EIS.

8.5.5 Finding of No Significant Impact

Defined in 40 CFR Pt. 1508.15, this document is prepared to record a DOE decision that the environmental impacts of an action considered in an EA are not significant and that an EIS is not required for the proposed action.

8.5.6 Record of Decision

Prepared in accordance with the requirements of 40 CFR 1505.2, this document provides a concise public record of DOE's decision on a proposed action for which an EIS was prepared. It identifies the alternatives considered in the related EIS, the environmentally preferable alternative, factors weighed in making the decision, and any mitigation or monitoring measures necessary to minimize adverse impacts.

8.6 CLEAN WATER ACT (CWA) DOCUMENTATION

Documentation is also required to support CWA compliance activities at ORNL. The following subsections provide examples of ORNL's CWA documentation.

8.6.1 National Pollutant Discharge Elimination System (NPDES) Permit

This is a liquid waste discharge permit issued to ORNL by the TDEC and the U.S. Environmental Protection Agency (EPA) under the CWA. An NPDES permit targets specific discharge points and allows discharges from the listed facilities exclusively; it also sets limits on both the types and quantities of effluents that may be discharged. Violation of these limits constitutes a noncompliance, which is subject to legal action.

8.6.2 Best Management Practices (BMP) Plan

A BMP Plan is a report required for submittal along with the NPDES permit application. BMP Plans are authorized under the 1977 CWA, as amended in 1987 by the Water Quality Act Amendments, for the control of nonroutine discharges from sources such as plant site runoff, spillage and leaks, sludge and waste disposal, drainage from material storage areas, and laboratory drains. Documentation of the effectiveness of the BMP Plans is one of the conditions under which the NPDES permit is issued.

8.6.3 Activities Description Memorandum (AcDM)

An AcDM is a written report documenting the environmental review of an existing facility or a planned or ongoing activity or operation (i.e., any action that does not involve construction). Like the ADM, the AcDM is a formal agreement document, which is required by the BMP Plan of ORNL's NPDES permit and becomes part of the permanent environmental record at ORNL. Unlike the ADM, the AcDM is not transmitted to DOE. AcDMs are made available for in-house use as well as for external state and EPA audits. AcDMs provide documentation that the planned activity or operation does not have any environmental impact.

8.7 TECHNOLOGY DEMONSTRATIONS

ORNL has the personnel and equipment available to develop and to treat waste streams at the bench and pilot scales using biological, physical, and chemical processes including reverse osmosis, chemical precipitation, filtration, ion exchange, adsorption, ozonation, air stripping, and biodegradation as well as through solidification in cement, polymer, asphalt, or glass waste forms. ORNL has personnel experienced in conducting processes and systems-analysis studies needed to determine the most appropriate and economical method of treatment of radioactive, hazardous, and mixed waste streams.

Previous ORNL experience includes characterization studies, fundamental process research and development, treatability studies, process alternative assessments, flowsheet development, and equipment-design studies for gaseous or liquid waste streams containing radioactivity, heavy metals, volatile and nonvolatile organics, and anionic species such as nitrates and phosphates. ORNL research divisions are experienced in the transition of bench- and pilot-scale systems to full-scale design and construction of capital facilities. Several waste certification projects conducted at ORNL are briefly discussed in the following sections.

8.7.1 Demonstration Project for Solid Low-Level Waste (SLLW) Certification

By definition, waste certification is the process used to verify that wastes are being handled, stored, disposed, or otherwise managed in a manner compatible with defined acceptance criteria appropriate to the operation. An effective certification program provides a high degree of assurance that the required parameters are being accurately measured and that waste packages fall within the boundaries set by those parameters.

For SLLW, one of the parameters that will be included in acceptance criteria is the concentration of radioactive material in waste. Certification against this particular criterion requires that the program provide both qualitative and quantitative description of the radionuclides in any individual waste package.

While many of the techniques developed elsewhere in the DOE system or in private industry are appropriate for inclusion in the ORNL Waste Certification Program, the ORNL program must also incorporate additional means of providing assurance that waste acceptance criteria are being met. This is particularly difficult when the waste stream composition varies over time. This variation involves changes in both the specific radionuclides that may appear in the waste as well as their relative concentrations.

Because of these difficulties, this demonstration project is designed to provide information on what capabilities are required for certifying the specific waste streams at ORNL. The focus on the demonstration is in two areas:

- developing the capability to measure the concentration of radionuclides accurately in specific waste streams and
- developing the capability (in conjunction with measurement techniques) to segregate radioactively contaminated waste reliably from uncontaminated waste.

The following subsections provide a brief discussion of the demonstration projects conducted at ORNL to provide information to fulfill the requirement in these two areas.

8.7.1.1 Demonstration project for characterization of Interim Waste Management Facility (IWMF) waste

This project is designed to develop and to demonstrate the capability to measure the concentration of radioactive contaminants in waste intended for disposal on the IWMF at ORNL. Waste streams generating isotopes of particular interest (with regard to the

SWSA-6 performance assessment) will be the first priority. To develop a useful characterization method, demonstration activity will focus on implementing statistical methods to determine radionuclide concentrations, to reduce the associated uncertainty of those concentrations, and to put in place QA elements to increase the validity of characterization methods. Initially the nuclides of interest will be ^{232}Th, ^{233}U, and ^{237}Np.

8.7.1.2 Demonstration project for segregation of radioactive waste from sanitary waste

This project is part of the effort to develop and to implement an effective program to increase the level of assurance that material going from ORNL to SLF II does not contain prohibited material such as radioactive material. Once the waste stream is segregated, the first step of the characterization process is to screen the bulk waste for the presence of radioactive contamination. The screening can be done with a relatively simple instrument designed to indicate only whether or not material is present without quantification. If the instrument does not detect radiation emanating from the waste, the waste will be assumed to contain radioactive material at levels below those of regulatory concern. The lower limit of detection for the screening instrument must be below a corresponding concentration limit. However, if the screening instrument indicates that radioactive material is present in the waste, further characterization of the waste will be required.

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Appendix A. DOE ORDER 5820.2A IMPLEMENTATION SUMMARY

(The tables in this appendix were reprinted and updated from J. S. Baldwin et al., *Oak Ridge National Laboratory Implementation Plan for DOE Order 5820.2A*, ORNL/TM-11166, Martin Marietta Energy Systems, Oak Ridge National Laboratory, April 1989.)

DOE Order 5820.2A, Chapter II, Management of Transuranic Waste
(Underlining denotes updating of the original 1989 table)

Requirement/Status	Current practice	Current plans	Completion date	Estimated cost	
				Expense	Capital
a. Waste Classification					
(1) Partial Compliance	Administrative and process controls are used to segregate TRU waste at generation. ^{233}U, ^{244}Cm, and ^{252}Cf are managed as TRU waste at ORNL.	Get DOE-OR to formally declare ^{244}Cm, ^{233}U, and ^{252}Cf to be TRU.	FY 1990	NA	NA
(2) Partial Compliance	TRU radionuclide concentration of drummed CH at the time of assay is utilized. Container mass is not used to calculate specific activity. ORNL does not yet have the capability to assay boxed CH- or RH-TRU waste.	Upgrade new master algorithm for drummed CH-TRU. Install box CH-TRU assay system. Include assay capabilities for RH-TRU in WHPP. See b.(1).	FY 1992	120K	1.5M
(3) Partial Compliance	See a.(2).	See a.(2).		See a.(2).	
(4) Partial Compliance	Process flow sheets, materials lists, and RTR provide data on hazardous components that will be included in the data package sent with the waste to WIPP.	RTR is being installed for CH-TRU boxes. RH-TRU data will be generated at WHPP. See a.(2).	FY 1992	70K	490K
b. Waste Generation and Treatment					
(1) Partial Compliance	Technical and administrative controls and generator training are utilized to reduce waste.	Expand TRU waste minimization focus. Construct and operate (1) WCCF and (2) WHPP for RH-TRU treatment, reduction, and shipment.	FY 1994 (1) 2002' (2) 2002	600K 1.7M 125M	NA 18M 280M
(2) Partial Compliance	See a.(2–4).	See a.(2–4).		See a.(2–4).	
(3) Compliance	Treatment of hazardous components is not feasible; however, source reduction is being implemented.	Continue current practice.	NA	NA	NA
(4) NA	ORNL does not generate TRU waste that is classified for security reasons.	NA	NA	NA	NA

Requirement/Status	Current practice	Current plans	Completion date	Estimated cost	
				Expense	Capital
c. Waste Certification					
(1) Partial Compliance	TRU waste is or will be certified according to the WIPP WAC, placed in interim storage, and eventually shipped to WIPP.	Construct and operate facilities to repackage RH-TRU and certify CH- and RH-TRU waste and eventually ship to WIPP.		See b.(1).	
(2) Compliance	ORNL does not intend to send uncertified TRU waste to WIPP.	NA	NA	NA	NA
(3) Partial Compliance	ORNL's NG CH-TRU Certification Plan has been approved by WIPP WACCC. Stored CH-TRU and NG RH-TRU plans have been reviewed by WIPP WACCC.	Revise CH-TRU certification documents to include stored waste and certification plans for transportation.	FY 1992	150K	NA
(4) Partial Compliance	Certification plans contain or will contain controls to ensure adherence to plan.	See c.(3).		See c.(3).	
(5) Partial Compliance	See c.(3).	See c.(3).		See c.(3).	
(6) NA	NA	NA	NA	NA	NA
(7) NA	NA	NA	NA	NA	NA
(8) Partial Compliance	Generator's procedures are in place to implement the approved NG CH-TRU Certification Plan.	Revise generator's procedures as needed to implement additional certification plans as approved.	FY 1994	150K	NA
(9) Compliance	Support will be provided to audit teams as required.	NA	NA	NA	NA
(10) NA	NA	NA	NA	NA	NA
(11) Partial Compliance	Several findings were reported by the 1991 WIPP WACCC audit.	Resolve remaining 1991 findings.	FY 1992	100K	NA
d. Waste Packaging					
(1) Partial Compliance	All NG CH-TRU waste is packaged in noncombustible containers that meet DOT requirements.	NG RH-TRU waste will be repackaged in the WHPP. NG RH-TRU will be placed in improved storage casks.		See b.(1).	

DOE Order 5820.2A, Chapter II (continued)

Requirement/Status	Current practice	Current plans	Completion date	Estimated cost	
				Expense	Capital
(2) Partial Compliance	Some pressure relief devices have been utilized.	Utilize pressure relief devices in repackaging.		See b.(1).	
(3) Partial Compliance	All waste to be shipped to WIPP will be sealed, marked, and labeled in accordance with applicable requirements.	Generators will seal and Waste Management Operations will mark and label CH-TRU containers. RH-TRU sealing and labeling will be done at WHPP.		See b.(1).	
e. Temporary Storage at Generating Sites					
(1) Partial Compliance	All CH-TRU drums are clearly identified and physically segregated from LLW to the extent practical. RH-TRU casks are separately stored.	See a.(1).		See a.(1).	
(2) Partial Compliance	TRU and LLW containers are stored in the same buildings but are clearly distinguished.	Provide upgraded RCRA-permitted storage facilities to meet requirements of the Order.	FY 1997	150K	5.3M
(3) Partial Compliance	Access is controlled for current TRU storage facilities.	Access controls will be included as needed in new storage projects.		See e.(2).	
(4) Partial Compliance	Limited monitoring is performed to detect releases.	New storage facilities will provide improved monitoring capabilities.		See e.(2).	
(5) Compliance	Existing facilities constructed to appropriate design criteria and subjected to safety evaluations.	New storage facilities will be designed, constructed, and operated to minimize potential for accidents.		See e.(2).	
(6) Compliance	ORNL has a general RCRA contingency plan, as well as specific contingency plans for facilities planned to be kept operational after 1992, but no specific plans exist for facilities to be closed.	Develop contingency plans for planned facilities.	FY 1992	NA	NA
(7) Compliance	Facility design and operation helps keep exposures ALARA.	ALARA principles will be incorporated into design and operation of new facilities.		See e.(2).	

Requirement/Status	Current practice	Current plans	Completion date	Estimated cost	
				Expense	Capital
f. Transportation/Shipping to WIPP					
(1) Compliance	Current ORNL shipment practices are in compliance with applicable federal regulations.	Extend current practices to TRU waste when shipments to WIPP begin.		See b.(1).	
(2) Compliance	NA	ORNL will utilize the TRUPACT II for CH-TRU and the DOE-authorized package for RH-TRU.		See b.(1).	
(3) Compliance	NA	ORNL will provide required shipping papers.		See b.(1).	
(4) Compliance	NA	ORNL will distribute shipping papers as specified.		See b.(1).	
(5) Compliance	ORNL has required current authorization/permits for shipments.	Additional authorizations/permits will be obtained if necessary.		See b.(1).	
(6) Compliance	ORNL properly placards all current shipments.	ORNL will properly placard TRU waste shipments when they begin.		See b.(1).	
(7) Compliance	NA	ORNL will utilize "exclusive use" vehicles and the System to be used for tracking TRU waste shipments from ORNL to WIPP (TRANSCOM) tracking system.		See b.(1).	
(8) NA	NA	NA	NA	NA	NA
g. Interim Storage					
(1) Partial Compliance	Current interim storage buildings are sufficient for current waste inventory but inadequate to meet projected needs.	Construct new storage facilities. See e.(2).		See e.(2).	
(2) Partial Compliance	RCRA permit applications have been prepared for two planned storage facilities.	Prepare RCRA permit applications for the remaining facilities. All four new facilities will be designed and operated in compliance with items a-j.		See e.(2) and e.(6).	

Requirement/Status	Current practice	Current plans	Completion date	Estimated cost	
				Expense	Capital
(3) Noncompliance	Permit applications have been submitted for existing facilities meeting RCRA requirements. Existing facilities not meeting requirements will be closed.	Close inadequate existing facilities. Construct new facilities	FY 1994	1M See e.(2).	NA
(4) Compliance	Current storage facilities protect the certification status of the waste.	Continue to store certified waste in such a manner that the certification is unaltered.	See e.(2).		
(5) Partial Compliance	Currently, ORNL receives no TRU waste generated off-site.	After WHPP becomes operational, store and process data packages from off-site generators and use them to prepare final data packages.	See b.(1).		
(6) Compliance	See g.(5).	See g.(5).	See b.(1).		
(7) Partial Compliance	Currently ORNL receives no TRU waste generated off-site.	Not all responsibilities outlined in this requirement will apply, since ORNL will not only store, but also repackage TRU waste generated off-site.	2013	See b.(1).	
(8) Partial Compliance	See g.(7).	See g.(7).	See g.(7).	See b.(1).	
h. WIPP					
(1-8)	Requirements h (1-8) are applicable to WIPP.	NA	NA	NA	NA
i. Buried TRU Waste					
(1) Compliance	ORNL helped develop the referenced document and has developed additional internal documents to be used in complying with this requirement.	Continue implementing the ORNL RAP, through DOE ER Program.	NA	NA	NA
(2) Compliance	Potential buried TRU waste sites will be investigated and evaluated under the RI/FS program according to the requirements of RCRA 3004(u) <u>and CERCLA (as amended by SARA)</u>	Continue RI/FS for sites containing TRU wastes, as part of DOE ER Program.	TBD	TBD	TBD

DOE Order 5820.2A, Chapter II (continued)

Requirement/Status	Current practice	Current plans	Completion date	Estimated cost	
				Expense	Capital
(3) Compliance	Closure strategies will be developed under the RI/FS program. See i.(2).	Continue RI/FS for sites containing TRU wastes, as part of DOE ER Program.	TBD	TBD	TBD
(4) Compliance	See i.(2–3).	Continue RI/FS for sites containing TRU waste, as part of DOE ER Program.	TBD	TBD	TBD
j. Quality Assurance					
(1) Partial Compliance	TRU waste management activities are being performed under active QA programs. However, significant upgrades to this program must be made in accordance with applicable elements of ANSI/ASME NQA-1 and DOE Order 5700.6B.	Continue to bring all TRU waste activities into compliance. New facilities will be brought on-line with NQA-1 programs in place.	1992	200K	NA
		TOTALS	FY 2013	129M	300.7M

DOE Order 5820.2A, Chapter III, Management of Low-Level Waste

Requirement/Status	Current practice	Current plans	Completion date	Estimated cost	
				Expense	Capital
a. Performance Objectives					
(1) Compliance Status to be Determined	Implementing new LLW disposal strategy to protect public health and safety according to applicable EH Orders and other DOE Orders.	Satisfy this requirement as part of a.(2–4), and b. (1–3) below.		See b.(1–2).	
(2) Compliance Status to be Determined	See a.(1).	See b.(1–2).		See b.(1–2).	
(3) Compliance Status Uncertain	Status of present waste disposal practices with regard to inadvertent intruder is unknown at this time.	NA	NA	NA	NA
(4) Compliance Status to be Determined	See a.(1).	Future LLW disposal facilities are currently being designed to meet this requirement.		See b.(1–3).	
b. Performance Assessment					
(1) <u>Partial Compliance</u>	<u>Draft PA completed for SWSA 6. Final PA to be completed in FY 1993.</u>	Perform PAs on future LLW disposal facilities (SWSA 7) to demonstrate compliance with this requirement.	<u>FY 1994</u>	<u>1.1M</u>	NA
(2) Noncompliance	Waste management systems performance assessment has not been performed for the ORNL.	Waste management systems performance assessments will be conducted.	<u>FY 1994</u>		NA
(3) Partial Compliance	Monitoring of facility and disposal site performance is presently performed on a reconnaissance level.	To be determined after SWSA 6 PA is completed.	TBD	TBD	NA

DOE Order 5820.2A, Chapter III (continued)

Requirement/Status	Current practice	Current plans	Completion date	Estimated cost	
				Expense	Capital
c. Waste Generation					
(1) Partial Compliance	Waste minimization program has been initiated.	A waste minimization coordinator has been established for ORNL and program implementation is underway. The waste reduction plan for generators was revised in FY 1989 in accordance with DOE Order 5400.1. Additional emphasis will be given to LLW minimization at the source.	FY 1994	500K	NA
(2) Partial Compliance	Incentives are provided to generators to encourage waste reduction.	See c.(1).		See c.(1).	
(3) Partial Compliance	Incentive for waste segregation provided through cost differential for disposal of LLW versus uncontaminated waste. Some suspect waste generated.	Continue current practice. Suspect waste category to be eliminated.	FY 1993	300K	NA
(4) Partial Compliance	Waste Management Plans are required for all new waste generating projects. Waste reduction must be addressed in this plan.	See c.(1).		See c.(1).	
d. Waste Characterization					
(1) Partial Compliance	Current certification program relies heavily on generator estimates and administrative or process controls.	Future program will bring waste characterization and certification program into full compliance.	FY 1994	1.5M	2M
(2) Partial Compliance	Waste manifests currently used contain entries for characterization data cited in this requirement, except for radionuclide concentration data.	Improve current practice and record keeping procedures.	FY 1993	50K	NA
(3) Noncompliance	Diversity and inconsistency in radionuclide concentrations in ORNL waste streams find indirect methods of limited value.	Demonstrations underway and planned to assess applicability of direct and indirect measurement techniques.		See d.(1).	

DOE Order 5820.2A, Chapter III (continued)

Requirement/Status	Current practice	Current plans	Completion date	Estimated cost	
				Expense	Capital
e. Waste Acceptance Criteria					
(1) Compliance	ORNL does not routinely receive LLW from off-site nor does ORNL ship LLW off-site for disposal at the present time.	Future planning for shipment of waste off-site will ensure compliance with this requirement.	NA	NA	NA
(2) Partial Compliance	WAC have been established for existing LLW TSD facilities. Draft WAC has been developed for IWMF.	Finalize WAC for IWMF and submit to DOE-OR	FY 1992	300K	NA
(3) Partial Compliance	Certification program assures conformance with current WAC through administrative controls and NDA/NDE techniques. However, modifications to the program and development of measurement techniques are necessary to meet WAC for LLWDDD waste classes.	See d.(1).		See d.(1).	
(4) Compliance	ORNL waste generators are subject to routine audits from waste management operations staff through the use of RTR system, waste manifests approvals, and periodic formal QA audits.	Continue current practice.	NA	NA	NA
(5) Partial Compliance	Concentrations will be determined by radiological performance assessments (see b.1). Hazards and Safety Analysis; otherwise ORNL is in compliance with this requirement.	Phase in radionuclide concentration WAC with operation of IWMF	FY 1992	50K	See e.(2).
f. Waste Treatment					
(1) Partial Compliance	LLW is compacted to achieve volume reduction and greater stability and grouted to prevent contact with water and to increase stability.	Implement improved waste treatment methods (i.e., grout stabilization and sludge drying) once final WAC are established.	FY 1994	500K	1,700K

Requirement/Status	Current practice	Current plans	Completion date	Estimated cost	
				Expense	Capital
(2) Partial Compliance	Cement grouting, compaction, and super compaction will be used to achieve waste form stability and improve long-term facility performance.	See f.(1).		See f.(1).	
(3) Compliance	ORNL currently has no plans for constructing large-scale waste treatment facilities.	NA	NA	NA	NA
(4) Partial Compliance	See F.(1 and 3) and e.5 above. Before any facility, handling LLW, is permitted to initiate operation, required documentation must be in place and approved.	Continue current practice as required. Develop required documentation.	FY 1994	100K	NA
g. Shipment					
(1) Partial Compliance	ORNL currently does not ship LLW off-site for disposal.	Class L-III/IV LLW will eventually be shipped for off-site disposal and plans and procedures put in place for implementing those future shipments in compliance with this Order.	FY 1996	250K	NA
(2) Partial Compliance	Shipment forecast will be provided as part of the annual ORNL Waste Management Plan development.	Annual forecast will be provided as required.	FY 1989	NA	NA
(3) Compliance	Before ORNL ships any waste off-site for processing or storage, advance approval is obtained and WAC are met.	See d.(1).	FY 1992	NA	NA
(4) Compliance	Ship LLW within ORR on public highways for interim storage. ORNL is in compliance with all applicable DOT and DOE regulations for shipments to K-25 and Y-12.	Meet all applicable DOT and DOE regulations for shipping LLW on-site to SWSA 5 and 6. For future off-site shipments, labeling requests will be met as part of g.(1).	FY 1992	NA	NA

DOE Order 5820.2A, Chapter III (continued)

Requirement/Status	Current practice	Current plans	Completion date	Estimated cost	
				Expense	Capital
h. Long-Term Storage					
(1) Partial Compliance	Store LLW <50 mrem/h on contact at ORGDP on interim basis. Store Class C waste retrievably in SWSA 5. EASC/LWSP waste is stored on an interim basis. Mixed waste is stored in RCRA-permitted facilities.	Each storage facility in use will be assessed in terms of the performance objectives stated in this Order in the Waste Management Systems PA. New facilities will be developed to meet the performance objectives.	FY 1994	400K	2M
(2) Compliance	Waste manifests accompany each LLW package and are kept on permanent file.	Continue current practice for all future storage operations.	NA	NA	NA
(3) Partial Compliance	Safety documentation is in place for the existing storage facilities.	New facilities documentation needs will be met under h.(1).	FY 1992	300K	NA
(4) Compliance	Store limited volumes of biological waste to allow for nuclide decay.	Continue current practice.	NA	N. .	NA
i. Disposal					
(1) Compliance	Dispose of LLW using above-grade and below-grade technologies. Draft PA indicates above-grade technology may achieve performance objectives; below-grade doubtful.	PAs will be conducted for each disposal technology currently in use or planned for use in SWSA 6. New disposal facilities will be developed and implemented to meet the performance objectives.	FY 1993	750K	2M
(2) Partial Compliance	Engineered GCD above- and below-grade technologies used for disposal of LLW.	LLW classification limits will be established for all LLW disposal facilities.	FY 1992	See e.(2).	
(3) Compliance	ORNL has a representative on Oversight and Peer Review Panel.	A performance assessment team has been formed which has the responsibility for conducting performance assessments for all DOE-OR sites.	FY 1989	See b.(1).	
(4) Partial Compliance	Store greater-than-Class C waste on-site in retrievable stainless steel wells.	Class L-III/IV Below-Grade Storage Facilities are planned for construction.	FY 1994	500K	2.2M
(5) Compliance	Additional disposal requirements are currently in practice.	Requirements will be included in final WAC being developed under e.(2).	FY 1992	See e.(2).	

Requirement/Status	Current practice	Current plans	Completion date	Estimated cost: Expense	Estimated cost: Capital
(6) Handle waste below BRC limit as nonradioactive material	BRC waste has not been officially defined by Federal regulations. Suspect landfill operations is most applicable area.	Continue to follow BRC status of regulations proposed by NRC.	FY 1994	See e.(2).	
(7) Partial Compliance	The IWMF is being constructed in conformance with this requirement.	Begin operation of IWMF.	FY 1992		NA
(8) Partial Compliance	The IWMF is being constructed in conformance with this requirement.	Construct IWMF in accordance with this requirement.	FY 1992		1.1M
(9) Partial Compliance	Operation of disposal facilities are generally in compliance with this requirement, although improvements need to be made in administrative controls.	Discontinue disposal of LLW in excavations. Upgrade operations procedures and training programs.	FY 1992	200K	NA
j. Disposal Site Closure/Post Closure					
(1) Partial Compliance	Closure/post closure plans are being developed for the active areas of SWSA 6, but not the Class II IWMF.	Closure/post closure plans will be developed for Class II IWMF.	FY 1996	250K	NA
(2) Partial Compliance	Residual radioactivity levels are considered in closure planning for inactive portions of SWSA 6 and will be considered for the rest of the site in compliance with this requirement.	Incorporate residual radioactivity requirements in development of closure plans under j.(1).	FY 1992	See j.(1).	
(3) Partial Compliance	Maintenance and surveillance, and performance monitoring systems in place to determine if corrective measures are required for disposal sites or individual units. Corrective actions for current GCD silos are being implemented.	Continue to implement corrective actions for SWSA 6 GCD silos and other disposal units, as required.	FY 1993	2M	NA
(4) Compliance	The EPA has elected to enforce regulatory requirements for remedial response activities to inactive disposal facilities, sites, and units through RCRA 3004(u) and CERCLA (SARA).	Inactive site closure and post-closure care is provided through the DOE Energy Research Program.	FY 1989	NA	NA

DOE Order 5820.2A, Chapter III (continued)

Requirement/Status	Current practice	Current plans	Completion date	Estimated cost	
				Expense	Capital
(5) Partial Compliance	Existing protocol requires that all closure plans for inactive, active, and new LLW disposal facilities be reviewed by DOE-OR	Continue current practice.	FY 1994	See j.(1).	
(6) Compliance	This requirement will be included as part of closure/post closure plans for existing and new disposal sites and facilities.	Continue current practice.		See j.(1).	
k. Environmental Monitoring					
(1) Partial Compliance	ORNL LLW TSD operational facilities have environmental monitoring programs that provide adequate control over environmental releases. Improvements to this program must be made, however, to conform to DOE Order 5484.1, k.(2–4) of this Order, and the recently issued DOE Order 5400.1.	Entire environmental monitoring program undergoing review. Will eventually come into compliance with DOE Order 5400.1 and requirements of this Order.	FY 1994	2M	2M
(2) Partial Compliance	Majority of LLW TSD operational facilities have environmental programs that assess effluent releases, radionuclide migration, and changes affecting long-term performance.	See k.(1).	FY 1994	See k.(1).	
(3) Partial Compliance	Preoperational monitoring determines operational monitoring requirements. Operational monitoring status reevaluated on periodic basis.	See k.(1).	FY 1994	See k.(1).	
(4) Partial Compliance	Majority of LLW TSD operational facilities have environmental monitoring programs designed to detect significant changes that may compromise performance so corrective actions may be implemented.	See k.(1).	FY 1994	See k.(1).	

DOE Order 5820.2A, Chapter III (continued)

Requirement/Status	Current practice	Current plans	Completion date	Estimated cost	
				Expense	Capital
l. Quality Assurance					
(1) Partial Compliance	LLW management activities are being performed under an active QA program. However, significant upgrades to this program must be made in accordance with applicable elements of ANSI/ASME NQA-1 and DOE Order 5700.6B.	Continue to bring all LLW waste management activities into compliance. New facilities will be brought on-line with NQA-1 QA programs in-place.	FY 1994	800K	NA
m. Records and Reports					
(1) Partial Compliance	ORNL maintains a record keeping system that documents waste was properly classified, treated, stored, shipped, or disposed of.	Upgrade data system to increase reliability and retrievability of data.	FY 1992	500K	400K
(2) Partial Compliance	Waste manifests accompany all waste packages from initial generation to final disposition and contain the information necessary to determine adherence with WAC for TSD activities.	Improved manifest will be developed to conform with new WAC and data base management requirements.	FY 1993	See d.(1).	
		TOTALS		13 M	11.4M

DOE Order 5820.2A, Chapter V, Decommissioning of Radioactively Contaminated Facilities

Requirement/Status	Current practice	Current plans	Completion date	Estimated cost	
				Expense	Capital
a. General					
(1) Partial compliance	The D&D Program maintains list of inactive contaminated facilities. Major radioactive operations maintained on file and reviewed by appropriate committees periodically.	Increasing emphasis will be given to obtaining information on programmatic association of operational contaminated facilities during periodic safety-related reviews.	FY 1991	NA	NA
(2) Compliance	Pertinent operational records for future use in preparing decommissioning plans are in permanent files.	Continue current practices.	NA	NA	NA
(3) Partial Compliance	Decontamination and decommissioning activities are taken into consideration for new facilities (see b. below). Existing facilities nearing shutdown are scrutinized very closely with respect to decontamination and decommissioning activities.	See a.(6) and b.	NA	NA	NA
(4) Compliance	Inactive facilities have been identified and assigned a program sponsor. Maintenance and surveillance and decommissioning responsibilities have been assigned.	Update specific program planning documents.	FY 1991	NA	NA
(5) Compliance	Responsibilities for contaminated facilities have been assigned specific programs through negotiation.	Maintenance and surveillance plans and decommissioning plans are updated periodically to reflect most recent changes in responsibility.	NA	NA	NA
(6) Compliance	Facilities identified as DP, NE (Nuclear Energy), or ER are pending acceptance into appropriate programs.	Pursue existing agreements and initiate new agreements.	NA	NA	NA
(7) Compliance	ORNL provides information, as available, to update the decommissioning technology data base Remedial Action Program Information Center (RAPIC) as part of the ORNL D&D Program.	Continue current practices.	NA	NA	NA

DOE Order 5820.2A, Chapter V (continued)

Requirement/Status	Current practice	Current plans	Completion date	Estimated cost	
				Expense	Capital
b. Facility Design					
(1) Compliance	All new facilities at ORNL are designed with decontamination and decommissioning activities taken into consideration. New facilities are designed and constructed according to applicable requirements of DOE 6430.1	Continue current practices.	NA	NA	NA
c. Post-Operational Activities					
(1) Compliance	Methodologies and procedures are in place for identifying contaminated facilities and evaluating potential reuse or recovery of real property.	Continue current practices.	NA	NA	NA
(2) Compliance	Inactive facilities are evaluated for acceptance through set standards and practices. Adequate maintenance and surveillance is performed before decontamination and decommissioning.	Continue current practices.	See a.(4).	11.7M	See a.(4).
d. Decommissioning Project Activities					
(1) Partial Compliance	ORNL collects characterization baseline data to fulfill NEPA, RCRA, CERCLA, SARA, and detailed engineering requirements.	Continue current practices.	FY 2010	240M	10M
(2) Partial Compliance	ORNL has submitted a RCRA Facility Assessment (RFA) to proper federal agencies. Conduct environmental reviews when required.	See d.(1).		See d.(1).	
(3) Partial Compliance	Decommissioning Project Plans are prepared for approval by appropriate program offices.	See d.(1).		See d.(1).	

Requirement/Status	Current practice	Current plans	Completion date	Estimated cost	
				Expense	Capital
(4) Partial Compliance	Facilities are decommissioned in accordance with DOE-HQ guidance. Proper approvals are obtained and status reports submitted.	See d.(1).		See d.(1).	
(5) Partial Compliance	Final decommissioning reports are prepared. Maintenance and surveillance is supplied if required, project data packages prepared.	See d.(1).		See d.(1).	
e. Quality Assurance					
(1) Partial Compliance	Decontamination and decommissioning activities are conducted in accordance with applicable elements of ANSI/ASME NQA-1 and DOE Order 5700.6B.	Continue current practices. Project QA costs are reflected in project budgets in d.(1).	NA	NA	NA
		TOTALS		255.7M	10M

APPENDIX B: WASTE MANAGEMENT DOCUMENTATION REQUIREMENTS

WASTE MANAGEMENT DOCUMENTATION REQUIREMENTS

DISCUSSION

This appendix addresses the principle documentation requirements as identified in the DOE Order 5820.2A. The original appendix was provided in the *ORNL Implementation Plan for DOE Order 5820.2A* and will be updated annually and included in this *ORNL Waste Management Plan*. The format of the original appendix has been maintained for comparison purposes, with revisions denoted in the right hand margin. Reporting is limited to documents issued in the previous fiscal year unless the most recent revision of an existing document was issued earlier.

(1) Sect. 2.0—High-Level Waste

Not applicable to ORNL.

(2) Sect. 3.0—Transuranic Waste

(a) Sect. 3.2.c.3. Cite the Transuranic Waste Certification Plan and dates of issue. If not issued, give schedule for preparation.

J. H. Smith et al., *Oak Ridge National Laboratory Transuranic Waste Certification Program*, ORNL/TM-10322/R2, August 1990. R

M. W. Tull, *Waste Acceptance Criteria for Transuranic Waste from Nuclear Fuel Services, Inc.*, WM-WMCO-202, January 21, 1991.

(b) Sects. 3.2.g and 3.2.h. Cite the closure plan for interim storage facilities. If not issued, give schedule for preparation.

RCRA Closure Plan, Transuranic Retrievable Drum Storage Facility, Building 7826, Oak Ridge National Laboratory (TN 1890090003), prepared by International Technology Corporation for Environmental Compliance and Documentation Section, Martin Marietta Energy Systems, Oak Ridge National Laboratory, September 1991.

RCRA Closure Plan, Transuranic Retrievable Drum Storage Facility, Building 7834, Oak Ridge National Laboratory (TN 1890090003), prepared by International Technology Corporation for Environmental Compliance and Documentation Section, Martin Marietta Energy Systems, Oak Ridge National Laboratory, September 1991.

Environmental Compliance and Health Protection Division, *Part B RCRA Permit Application for Existing Remote-Handled Transuranic Concrete Cask Storage Facility, Building 7855*, Rev. 1, Martin Marietta Energy Systems, Oak Ridge National Laboratory, June 1989.

(c) Sect. 3.2.i. Index major documentation developed under the Buried Transuranic-Contaminated Waste Program. Show schedule for preparation of documents in the current fiscal year.

J. R. Trabalka, *Buried TRU Waste and TRU-Contaminated Soils and ORNL Remedial Action Program Sites; Program Strategy and Long-Range Planning*, ORNL/RAP-8, July 1987.

Buried TRU Waste and TRU-Contaminated Soils at Oak Ridge National Laboratory, ORNL/RAP-24, September 1987.

(3) **Sect. 4.0—Low-Level Waste**

(a) Sect. 4.2.b.1. Cite documentation on radiological performance assessment of disposal facilities. If not issued, provide schedule for preparation in Sect. c. (3) of the Waste Management Plan.

Performance Assessment for Continuing and Future Operations at SWSA 6, draft, Martin Marietta Energy Systems, Oak Ridge National Laboratory, September 1990.

(b) Sect. 4.2.e.1. Cite Waste Acceptance Criteria for each LLW treatment, storage, and disposal facility. List anticipated additions to this list for the fiscal year.

Internal Correspondence, *Warehousing of Wastes*, W. R. Golliher, July 12, 1988, Attachment: Waste Acceptance Criteria for Storage, (K-25 Building)

Waste Acceptance Criteria for Radioactive Solid Waste Disposal at SWSA 6, WM-WMCO-203, July 1, 1991. R

(c) Sect. 4.2.e.3. Report the status of audits of certification activities by operators of disposal facilities. Report status of follow-up reports.

M. W. Tull, et al., *Oak Ridge National Laboratory Waste Certification Program Plan for Solid Low-Level Radioactive Waste*, draft, ORNL/TM-11600, August 1990.

(d) Sect. 4.2.g.2. List document(s) forecasting waste to be shipped by generators to off-site disposal facilities.

No documents prepared this fiscal year.

(e) Sect. 4.2.i.4. List reports justifying on-site disposal of waste exceeding Class C limits. Such disposal cases anticipated for the next year should be forecast.

No GTCC waste was disposed at ORNL this fiscal year.

(f) Sect. 4.2.i.8. Cite major NEPA documentation supporting selection of any new disposal sites. Give schedule of preparation for appropriate documentation for the next year.

A draft EIS is currently in preparation by NUS Corporation for DOE-OR that will address waste management activities on the ORR. This draft EIS will include the siting of proposed new LLW facilities.

(g) Sect. 4.2.j.1. Cite closure plans for LLW disposal sites and dates of issue. Give schedule of preparation for anticipated reports.

Closure Plan Revision for Solid Waste Storage Area 6, draft, Lee Wan & Associates, Inc., April 1991. R

(4) Sect. 6.0—Decommissioning of Radioactively Contaminated Facilities

(a) Sect. 6.2.a.1. Cite field organization documentation where the complete listing and the jurisdictional program responsibility for all contaminated facilities is recorded.

T. W. Burwinkle, et al., *Maintenance and Surveillance Plan for the ORNL Surplus Facilities Management Program and Defense Facilities Decommissioning Program FY 1990-1999*, ORNL/RAP-51, January 1989.

Memorandum, Troy E. Wade II to Theodore J. Garrish, James F. Decker, and Joe La Grone; Subject: Approval of Memorandum of Agreement Concerning Management of ORNL Remedial Action Program, dated May 16, 1988.

(b) Sect. 6.2.c.1. Cite the post-operational documentation that records the potential for reuse and recovery of materials and equipment and the schedule for decommissioning contaminated facilities.

T. W. Burwinkle et al., *The ORNL Surplus Facilities Management Program Long-Range Plan Revision 1*, ORNL/TM-8957/R1, draft, June 1987.

(c) Sect. 6.2.d.3 List Decommissioning Project Plans and date of issue. Show schedule for preparation of plans in the current fiscal year.

T. E. Myrick, R.W. Schaich and J. R. DeVore, *Metal Recovery Facility Decommissioning Project Plan-April 1984*, ORNL/TM-9018, April 1984.

T. E. Myrick, R. W. Schaich and F. W. Williams, *Fission Product Development Laboratory Cell Decommissioning Project Plan-August 1983*, ORNL/TM-8779, August 1983.

Storage Garden (3033) Decommissioning Project Plan, December 1990.

Metal Recovery Facility Cell G Decontamination Project Plan, December 1991.

(d) Sect. 6.2.d.5. List final radiological and chemical survey reports and project final reports, and show dates of issue. Show anticipated additions to this list for the coming year.

R. W. Schaich, *Final Report on the Decontamination of the Curium Fabrication Facility*, ORNL/TM-8276, December 1983.

3033 Storage Garden Decommissioning Project: Final Report, ORNL/ER/INT-3, May 1990.

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