ORNL/TM-11433

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OAK RIDGE NATIONAL LABORATORY

MARTIN MARIETTA

Oak Ridge National Laboratory Waste Management Plan for Department of Energy Order 5820.2A

December 1989

OPERATED BY
MARTIN MARIETTA ENERGY SYSTEMS, INC.
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

ORNL/TM-11433

OAK RIDGE NATIONAL LABORATORY
ENVIRONMENTAL AND HEALTH PROTECTION DIVISION
WASTE MANAGEMENT COORDINATION OFFICE

OAK RIDGE NATIONAL LABORATORY WASTE MANAGEMENT PLAN FOR DEPARTMENT OF ENERGY ORDER 5820.2A

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Date published: December 1989

PREPARED BY
EBASCO SERVICES INCORPORATED
225 S. TULANE AVENUE
OAK RIDGE, TENNESSEE 37830
UNDER CONTRACT NO. 90X-SE422C
FOR THE
OAK RIDGE NATIONAL LABORATORY
OPERATED BY
MARTIN MARIETTA ENERGY SYSTEMS, INC.
FOR THE
U. S. DEPARTMENT OF ENERGY
UNDER CONTRACT NO. DE-AC05-84OR21400

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LIST OF ACRONYMS

ACD	Analytical Chemistry Division
AcDM	Activities Description Memorandum
ADM	Action Description Memorandum
ADS	Activity Data Sheets
AEA	Atomic Energy Act
ALARA	as low as reasonably achievable
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
ATS	Asbestos Tracking System
BMAP	Biological Monitoring and Abatement Program
BMP	Best Management Practices
BRC	below regulatory concern
BSR	Bulk Shielding Reactor
C&TD	Computing and Telecommunications Division
CAA	Clean Air Act
CAT	collection and transfer
CDR	Conceptual Design Report
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CEUSP	Consolidated Edison Uranium Solidification Project
CFR	Code of Federal Regulations
CH	contact-handled
CH-TRU	contact-handled transuranic
COM	commercially held, DOE-owned radioactive material
COR	Contractor Officer Representative
CSLF II	Centralized Sanitary Landfill II
CTD	Chemical Technology Division
CV	cell ventilation
CWA	Clean Water Act

CWCH	central waste collection header
CWMO	Central Waste Management Office
CWSF	Conventional Waste Storage Facilities
CY	Calendar Year
CYRTF	Coal Yard Runoff Treatment Facility
CYRTS	Coal Yard Runoff Treatment System
CYWP	Current Year Work Plan
D&D	decontamination and decommissioning
DCR	document change request
DDDP	Defense Decontamination and Decommissioning Program
DER	document entry request
DF	disposal facility
DMC	Documentation Management Center
DMS	Documentation Management System
DOE	Department of Energy
DOE-HQ	Department of Energy-Headquarters
DOE-ORO	Department of Energy-Oak Ridge Operations
DOT	Department of Transportation
DP	Defense Programs
DSO	Division Safety Officer
EA	environmental assessment
EASC	Emergency Avoidance Solidification Campaign
EDE	effective dose equivalent
EH	Environmental, Safety and Health
EHPD	Environmental and Health Protection Division
EIS	Environmental Impact Statement
EMC	Environmental Monitoring and Compliance
EMP	Environmental Monitoring Plan
EP	extraction procedure
EPA	U.S. Environmental Protection Agency
EPO	Environmental Protection Officer
ER	Energy Research

ESA	Environmental and Safety Activities
FFA	Federal Facility Agreement
FPDL	Fission Products Development Laboratory
FUSRAP	Formerly Utilized Sites Remedial Action Program
FR	Federal Register
FWP	Field Work Proposal
FY	fiscal year
GB	Glove box
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 Actions 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
HPRR	Health Physics Research Reactor
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
IWMF	Interim Waste Management Facility
LDR	land disposal restrictions
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)
LTHWSF	Long-Term Hazardous Waste Storage Facility
M&S	maintenance and surveillance
MSRE	Molten Salt Reactor Experiment
MV	Melton Valley
MVST	Melton Valley Storage Tanks
NARM	naturally occurring and accelerator-produced radioactive material
NCP	National Contingency Plan
NDA	nondestructive assay
NDE	nondestructive examination
NE	Nuclear Energy
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NG	newly generated
NHF	New Hydrofracture Facility
NPDES	National Pollutant Discharge Elimination System
NPL	National Priority List
NQA	nuclear quality assurance
NRWTP	Nonradiological Wastewater Treatment Plant
OD	outer diameter
OGR	Oak Ridge Graphite Reactor
OHF	Old Hydrofracture Facility
OOS	Office of Operational Safety
ORGDP	Oak Ridge Gaseous Diffusion Plant
ORMWI	Oak Ridge Mixed Waste Incinerator
ORNL	Oak Ridge National Laboratory
ORO	Oak Ridge Operations
ORR	Oak Ridge Reservation or Oak Ridge Research Reactor
OSHA	Occupational Safety and Health Administration
PA	performance assessment
PAL	performance assessment limiting

LIST OF ACRONYMS (cont'd.)

PAM	Performance Assessment Manager
PCB	polychlorinated biphenyl
PCBTS	PCB Tracking System
PSAR	Preliminary Safety Analysis Report
PVC	polyvinylchloride
PWS	process waste system
PWTDF	Process Waste Treatment Disposal Facility
PWTP	Process Waste Treatment Plant
QA	quality assurance
R&D	research and development
RAP	Remedial Action Program
RAPIC	Remedial Action Program Information Center
RCO	Radiation Control Officer
RCRA	Resource Conservation and Recovery Act
REDC	Radiochemical Engineering Development Center
RFA	RCRA Facility Assessment
RH	remote-handled
RH-TRU	remote-handled transuranic
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RPAT	Radiological Performance Assessment Team
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
SEG	segregation
SFMP	Surplus Facilities Management Program
SI	special interest

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
TDDP	Tumulus Disposal Demonstration Project
TDHE	Tennessee Department of Health and Environment
TEC	total estimated cost
THWMR	Tennessee Hazardous Waste Management Rules
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
TSA	Technical Safety Appraisal
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
WM	Waste Management
WMO	Waste Management Operations
WMOG	Waste Management Operations Group
WMTC	Waste Management Technology Center
WOC	White Oak Creek
WOCC	Waste Operations Control Center
WSSRAP	Weldon Springs Site Remedial Action Project

ACKNOWLEDGMENTS

This plan was prepared by J. S. Baldwin (ORNL), and D. L. Jones and J. D. Sease (Ebasco Environmental). This plan represents an integration of material and data from numerous sources. The preparers of this plan gratefully acknowledge the following individuals for their contributions, review comments, and patience. In alphabetical order: N. S. Dailey; S. M. Depaoli; K. G. Edgemon; C. M. Kendrick; C. D. Massey; B. C. McClelland; S. M. Robinson; R. M. Schultz; C. B. Scott; M. A. Smith; K. R. Spence; R. C. Stewart; J. R. Trabalka; C. K. Valentine; and J. M. Wolfe (ORNL); and L. A. Dolan; K. A. Eyman; T. E. Fager; L. Skoski; N. T. Troutt; and D. A. Waite (Ebasco).

EXECUTIVE SUMMARY

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 submit updates on the Waste Management Plans for all operations under their purview according to the format in Chapter VI of the Order (Waste Management Plan Outline). These plans are to be submitted in December of each year and distributed to the DP-12, EH-1, and other appropriate DOE-Headquarters (HQ) organizations for review and comment. The Oak Ridge National Laboratory (ORNL) Waste Management Plan was prepared in response to this requirement.

The paramount 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 Health and Environment (TDHE) 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 ORNL Waste Management Plan is to compile and consolidate, on an annual basis, information concerning 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 which minimize, treat, store, and dispose of all radioactive, hazardous, mixed and conventional wastes generated as a result of operations at active facilities. Routine waste management operations at ORNL are the direct responsibility of the Waste Management Operations Section within the Environmental and Health Protection Division (EHPD).

The quantities of solid waste generated and handled at ORNL during FY 1989 are shown in Table 1. In addition to newly generated (NG) wastes, significant quantities of solid transuranic (TRU)

waste and some low-level waste (LLW) and mixed waste from past operations have been placed in long-term storage at ORNL.

Table 1. Quantities of solid waste generated at ORNL during FY 1989

Waste type	Quantity
Radioactive:	
TRU	1,750 ft^3
LLW	71,000 ft^3
Hazardous	270,000 lbs
Mixed	61,000 lbs
Conventional	780,000 ft^3

Radioactive Waste Management

ORNL radioactive waste management activities are primarily concerned with TRU waste and 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 a special-case (SC) waste. TRU waste is principally solid sludge stored from previous operations, with a small amount of solid TRU waste currently being generated. Radioactive waste management operations include solid, liquid, and gaseous waste management activities.

Solid TRU Waste. Since 1970, under DOE guidance, ORNL has been segregating and retrievably storing solid alpha-contaminated waste, pending the availability of approved permanent disposal. 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 the WIPP and has employed the Waste Examination and Assay Facility (WEAF) for non-destructive assaying (NDA) and non-destructive examination (NDE) of stored contact handled (CH) TRU waste. Significant quantities of sludges contaminated with TRU

radionuclides from past liquid waste operations are stored at ORNL. These sludges, which are primarily residual heels in tanks, are considered solid waste and will be processed as remote-handled (RH) TRU waste in the planned Waste Handling and Packaging Plant (WHPP) at ORNL.

TRU waste at ORNL is stored in various facilities in the north area of solid waste storage area (SWSA) 5. Sludges are stored in the Melton Valley Storage Tanks (MVST), the gunite tanks, and other active and inactive tanks in the liquid low-level waste (LLLW) system at ORNL.

Solid Low-Level Waste. Until 1986, all solid low-level waste (SLLW) including LLW mixed with hazardous 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 SLLW disposal area at ORNL, has been used for LLW disposal since the early 1970s. Starting in 1984, the practice of shallow land disposal on the 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 (including lead) for 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 Oak Ridge Gaseous Diffusion Plant (ORGDP) and all mixed waste at ORNL. Currently, the LLW operating strategy at ORNL is the one initiated in 1986. Because of the disposal practices in SWSA 6 prior to 1986, some areas in SWSA 6 are being remediated under a Resource Conservation and Recovery Act (RCRA) interim status closure agreement, incorporating RCRA Section 3004 (u) provisions, with the TDHE.

Current plans involve the phase out of the GCD below-grade disposal operations in SWSA 6 by May 1992 and the implementation of the Low-Level Waste Disposal Development and Demonstration (LLWDDD) strategy. The strategy developed by LLWDDD established "classes" of disposal technologies for managing on-site generated LLW, depending upon the specific isotopic composition and concentration in the waste. The five classes of LLW disposal technologies identified in the LLWDDD are as follows:

(1) Below Regulatory Concern Waste - LLW that is suitable for disposal in a sanitary/industrial landfill facility and will not expose any member of the public to an effective dose equivalent of more than 4 mrem/year at the time of disposal,

(2) Class I Waste - LLW that is suitable for disposal using sanitary/industrial landfill technology and will not expose any member of the public to an effective dose equivalent of more than 10 mrem/year at the time of disposal,

(3) Class II Waste - LLW primarily containing fission product radionuclides with half-lives of 30 years or less that is suitable for disposal in engineered facilities designed to isolate the waste from the environment and public for a period of time sufficient to allow the decay of radionuclides to such a level that any member of the public will not be exposed to an effective dose equivalent of more than 10 mrem/year,

(4) Class III Waste - LLW consisting of radionuclides that have long half-lives and will be disposed of in facilities having intruder protection,

(5) Class IV Waste - LLW not suitable for disposal on the Oak Ridge Reservation (ORR) and which would require either treatment to reduce contamination to a level consistent with any of the other four waste classifications or shipment to an off-site disposal facility.

Future disposal operations at SWSA 6 will gradually incorporate the LLWDDD strategy and utilize above-grade engineered tumulus disposal for the majority of SLLW disposed in SWSA 6. In the late 1990s, Class I and II Disposal Facilities will be placed into operation on the ORR, and SWSA 6 will be closed.

Solid Special-Case Waste. SC wastes do not fit into typical management plans for the three major waste types, and may therefore require special management and disposal schemes. Five categories of SC waste and one category of special interest DOE-owned materials have been identified for management as SC waste. These five categories of SC waste include: (1) DOE comparable Greater-Than-Class-C (GTCC); (2) performance assessment limiting (PAL); (3) uncertified or uncharacterized (UC); (4) noncertifiable, nontransportable TRU; and (5) high-level incidental waste (HLI). The special interest (SI) 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 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 LLWDDD Program at ORNL, PA limitations for on-site disposal have been the principle consideration for SC waste, which includes Class III and Class IV waste. The exact segregation, storage, and disposal requirements for various categories of SC waste at ORNL have not been determined. During FY 1990, ORNL will conduct an inventory of all existing and anticipated waste that falls into the SC categories.

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 a significant amount of radioactivity, including waste streams originating from hot sinks and drains in research and development (R&D) facilities and from other facilities such as the radiochemical pilot plants, nuclear reactors, and the Process Waste Treatment Plant (PWTP). The LLLW system, which uses an evaporation system for volume reduction, processed approximately 340,000 gal of waste and produced 11,500 gal of concentrate in FY 1989. The effluent was discharged to the PWS and the sludges were placed in storage in the MVST.

Process Waste. The PWS handles all liquid waste that contains trace amounts of radioactivity, heavy metals, and organics or has the potential to be contaminated with these constituents. The process waste (PW) solutions generated by various program activities throughout ORNL are collected into central holding tanks and processed through a treatment plant which employs softening and ion exchange units to remove radionuclides. Effluent is released to White Oak Creek (WOC) via a National Pollutant Discharge Elimination System (NPDES) monitoring station. The system throughput is approximately 70,000,000 gal/year. Beginning in March 1990, the treatment plant effluent will be "polished" at the new Nonradiological Wastewater Treatment Plant (NRWTP) prior to being released to WOC. In this same time frame, the nonradioactive process wastewater currently released to WOC will begin being collected and treated at the NRWTP prior to release to the surface stream through a NPDES monitoring station. Operations and operational data for both the LLLW system and the PWS are monitored, controlled and recorded at the Waste Operations Control Center (WOCC).

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 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 (CV) air streams which are 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 which 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. Because of the small quantities involved, collection and storage of these gases are not considered practical. The off-gas from the process is monitored before being discharged to the plant off-gas system.

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.

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 (LI) capital project initiated in 1981. Since radioactive air emissions from ORNL facilities are in compliance with existing regulations, the program strategy is to identify and implement system upgrades needed to ensure continued regulatory compliance and to meet DOE "as low as reasonably achievable" (ALARA) 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.

<u>Hazardous Waste Management</u>

The RCRA is the primary force guiding ORNL hazardous waste management operations. The State of Tennessee has developed and implemented regulations essentially equivalent to those of the EPA, which are addressed in the Tennessee Hazardous Waste Management Rules (THWMR). At ORNL, hazardous wastes include those regulated by the RCRA and the Toxic Substances Control Act

(TSCA), medical and infectious wastes, and other wastes that ORNL determines as representing a substantial 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 widely varied waste streams, with nearly all the characteristically hazardous and listed hazardous wastes defined by the EPA and/or TDHE appearing on ORNL's RCRA Part A permit application. Typically, hazardous wastes consist of spent experimental chemicals, waste oils, and process chemicals that have exceeded their shelf lives. Since containerized liquid or gaseous wastes are considered "solid" wastes by EPA/TDHE and are subject to solid waste rules, liquid and gaseous (containerized) and solid hazardous wastes are managed similarly at ORNL. Approximately 270,000 lbs of hazardous waste was generated at ORNL in FY 1989.

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 55-gal drums in Building 7652, with a capacity of 15,120 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 (HPRR) Access Road at ORNL.

Gaseous 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 is defined and regulated under RCRA and the radioactive components under the AEA. 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 deals specifically with mixed wastes. DOE Order 5400.3 states that "whenever any hazardous waste identified or listed in 40 CFR 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."

Common examples of mixed waste at ORNL are cleaning fluids removed from systems operated in contaminated environments, as well as scintillation fluids which 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 polychlorinated biphenyls (PCBs), corrosives, poisons, and other flammables. Since containerized liquid wastes are considered "solid" wastes by EPA/TDHE and are subject to respective solid waste regulations, both solid and liquid mixed wastes are managed in similar manners at ORNL.

ORNL generates about 100 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 or planned at this time. Until 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 Oak Ridge Mixed Waste Incinerator (ORMWI) at ORGDP.

Mixed waste storage availability at ORNL is severely limited at the present time. Drum storage for mixed waste is currently provided in Building 7654 and Facility 7507W. Bulk storage of mixed waste oils is provided by three tanks at Buildings 7075, 7830, and 7860. Building 7654 has been filled to capacity and Facility 7507W is nearing capacity. To relieve this congested condition, the near-term use of storage space at ORGDP and other options are being investigated.

Conventional Waste Management

Conventional waste at ORNL includes both the solid and liquid portions of wastes generated from sanitary sewage, steam plant operations, coal yard runoff, general refuse, and construction debris. The State of Tennessee regulates these waste streams at ORNL via the Tennessee Solid Waste Disposal Act and ORNL's NPDES permit under the Clean Water Act (CWA).

Solid waste. Conventional solid wastes which contain no radioactive or hazardous materials or 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, sewage sludge and construction debris. The volume of general refuse is estimated to about 60 yd^3 per normal working day, with fly ash and sludge from coal pile runoff accounting for approximately 12 yd^3/day.

Other than the equipment used for the compaction of general refuse, no treatment or storage facilities currently exist at ORNL for the handling of conventional solid waste. The majority of ORNL conventional waste is now directed to the Centralized Sanitary Landfill II (CSLF II), which is located on Chestnut Ridge, south of the Y-12 Plant site and about six miles east of ORNL. Approximately 400-500 yd^3 of soil, rock, and concrete mixtures are deposited in the ORNL Recontour Area near Building 1000.

Liquid waste. Conventional liquid waste includes non-radioactive waste streams which are discharged, either directly or following treatment, to WOC. These sources at ORNL include: (1) sewage treatment plant effluent from Bethel and Melton Valleys; (2) area runoff of rainwater; and (3) point sources (e.g., coal yard runoff).

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. Upgrading the sewage treatment plant was completed in September 1985. Most of the storm sewer system is constructed of reinforced concrete piping and contains catch basins that drain areas in Bethel and Melton Valleys.

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 been leached from the coal pile. The precipitated solids are disposed of in the CSLF II.

Decommissioning of Radioactively Contaminated Facilities

ORNL has many radioactively contaminated facilities, both operational and inactive, that must be managed in a manner that protects the health, safety and environment, and that eventually will require decontamination and decommissioning (D&D). In general, D&D activities are concerned with

facilities such as reactors, hot cells, processing plants, some LLLW storage tanks and other structures from which there have been no known releases.

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 management responsibility of the organization assigned 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 many inactive or surplus facilities. The overall strategy for the management of these inactive facilities is to: (1) maintain and monitor these facilities to ensure 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) plan for D&D of these facilities. ORNL has approximately 70 identified surplus facilities.

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

Regulatory/Environmental Compliance Issues

Over the past several years, the awareness of environmental concerns has increased, and major environmental legislation has been enacted at both the Federal and State levels for controlling existing and potential sources of pollution. As a result of this changing regulatory environment, recent inspections, audits, and reviews have been conducted. 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 ALARA directives. Facilities for treatment of discharges are being constructed or upgraded, and results of earlier disposal practices are being addressed.

Waste management requirements at ORNL are imposed by Federal and State regulations as well as Executive and DOE orders. The AEA and RCRA are the principal 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 RCRA, the EPA is given the responsibility for implementing a nationwide program that regulates hazardous waste management. States, however, are given the option of establishing programs that can operate in lieu of the Federal program. The State of Tennessee has exercised this option and has an approved hazardous waste management program.

Several regulatory and institutional uncertainties will impact waste management activities at ORNL in the future. The delay in the operation of the WIPP will require the construction of new storage facilities for CH-TRU waste. Currently, the facilities used to store CH-TRU are permitted under RCRA interim status. Closure of these facilities is required to be initiated by November 1992. The construction of new RCRA-permitted storage facilities is planned; however, meeting the November 1992 deadline may be difficult. Due to recent changes in the WIPP Waste Acceptance Criteria (WAC), transportation requirements, and the recent specification for sealing TRU waste packages, virtually all of ORNL's CH-TRU waste (2,400 55-gal drums) will require repackaging prior to shipment. This effort will require the construction of a new repackaging facility.

SLLW at ORNL is currently disposed of in SWSA 6 which is regulated under RCRA Section 3004(u). Regulatory compliance requirements under RCRA will cause the cessation of all disposal operations in SWSA 6, with the exception of the above-grade engineered disposal (tumulus) by May 1992. During FY 1990, a preliminary radiological PA will be conducted for continuing operations in SWSA 6. The purpose of the PA is to determine if active and planned disposal operations in SWSA 6 meet the performance objectives stated in DOE Order 5820.2A. If the performance objectives are not met, these disposal operations will require modification. Some portion of the SLLW currently being disposed of in SWSA 6 may be categorized as PA limiting, and require storage until suitable sites become available for disposal.

The DOE Oak Ridge Operations (ORO), EPA Region IV, and the TDHE are presently negotiating a Federal Facilities Agreement (FFA) prior to the final listing of the ORR on the National Priority List (NPL) scheduled for December 21, 1989. The agreement establishes a procedural framework and schedule for developing, implementing, and monitoring appropriate response actions at the site in accordance with the Comprehensive Environmental Response Compensation and Liability Act (CERCLA), National Contingency Plan (NCP), National Environmental Policy Act (NEPA), and Tennessee regulations.

This agreement deals primarily with issues related to environmental restoration which are not covered within the scope of this plan. However, the agreement establishes requirements for the LLLW system with regard to integrity and containment release/detection assessments. Most of the LLLW system at ORNL consists of singly-contained tank systems that were installed over 25 years ago. Although the tank systems were designed in a manner to prevent releases to the environment, small leaks were considered acceptable. In addition, most components comprising individual tank systems were never designed with the objective of providing the capability for performing high precision leak testing analysis, as required in the FFA. ORNL anticipates that many tank systems may fail to meet the requirements contained in the FFA, which will require their removal from service. In response to this impending regulatory issue, contingency planning and impact assessments have been initiated.

With regard to mixed waste, DOE is required by the land disposal restrictions (LDR) of 40 CFR 268 to treat hazardous wastes to specified concentration levels or by EPA-specified methods before land disposal. Many types of mixed waste generated at ORNL require treatment methods that provide sufficient shielding to protect workers from high levels of radiation. Adequate treatment methods for these types of waste have not been developed. Therefore, ORNL must store mixed waste until appropriate treatment methods become available. However, RCRA Section 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 268.50 places the burden of demonstrating noncompliance upon EPA during the first year of mixed waste storage, and the burden of demonstrating compliance upon the waste storer (DOE) after one year. The LDR regulations are being implemented in five phases, and the first two phases are already in effect. ORNL has identified limited quantities of mixed waste in storage which has been determined to be noncompliant with the current LDR storage requirments. This information has been furnished to DOE-HQ in support for the preparation of the national report on radioactive mixed waste, as required by the Rocky Flats Federal Facilities Compliance Agreement.

The above description identifies a few of the major regulatory issues and institutional uncertainties that will impact waste management activities at ORNL during FY 1990 and many years thereafter. The ORNL Waste Management Operations Section attempts to respond to these issues and uncertainties in a proactive manner. Many capital projects that will be required to address these issues have already been identified and are in various stages of design and construction.

Major Waste Management Accomplishments for FY 1989

During FY 1989, significant accomplishments were achieved in the treatment, storage and disposal (TSD) of solid radioactive waste. The TRU Waste Certification Program continued to participate in national program activities to remain abreast of developments that will affect eventual shipment of ORNL waste to the WIPP. Certification documents for stored CH-TRU and NG RH-TRU waste were revised and reissued in response to comments from the WIPP Waste Acceptance Criteria Certification Committee (WACCC). A status report of the ORNL TRU Certification program was issued in FY 1989. The ORNL draft SLLW certification strategy was also issued in FY 1989. This strategy outlines an innovative approach to meeting the challenge of segregating and certifying ORNL's diverse waste and puts ORNL in the lead in the development of such a program for national laboratories.

Installation of the box real-time radiography (RTR) unit at the WEAF was completed. After check-out and calibration of the unit is completed, ORNL will have the capability to non-destructively inspect SLLW and TRU waste packaged in either drums or boxes.

Development support for the WHPP continued as a high priority item. WHPP is now scheduled as an FY 1993 LI project. Significant progress has been made on the slurry flowsheet development effort with respect to microwave processing, sludge mobilization, slurry transport, slurry processing, and conventional evaporation techniques. Planning for development efforts related to solids and mechanical processing in the WHPP has also been initiated. The Preliminary Conceptual Design Report (CDR) and the Preliminary Safety Analysis Report (PSAR) for the WHPP have been completed and transmitted to DOE for review.

Loading of Tumulus I continued without operational incident or impact on the environment, with over 200 vaults having been placed on the pad. The tumulus demonstration annual monitoring reports for 1988 were issued in June 1989. These reports covered both environmental and personnel monitoring, and concluded that no evidence of environmental impact was detected through the reporting period and that craft personnel exposures were limited to ALARA. The excellent operating and monitoring record to date continues to support the selection of the tumulus concept as the reference disposal technology for the ORR.

With the recognition that some early GCD concrete silos were deficient in providing isolation of disposed waste from the groundwater, a corrective action demonstration was planned and executed in FY 1989 that filled the void space of one silo with a particulate grout. A similar demonstration using a chemical grout was delayed by a TDHE assessment of its acceptability. The results of the demonstration will dictate the approach used to prevent the leakage of groundwater into the concrete silos.

Strategy development and planning for the upgrade of the LLLW system and the PWS continued during FY 1989. Design continued on various systems for the Bethel Valley LLLW Collection and Transfer (CAT) System Upgrade. This FY 1988 LI project is now scheduled for design completion in March 1990.

Sampling of the active LLLW concentrate tanks was performed in September 1989. This task was performed in support of forthcoming waste solidification regulatory issues and WHPP development efforts. Samples of both the supernatant and sludge from each tank were obtained, with results currently pending.

The LLLW and TRU waste sludge management strategy continued to be implemented, with near-term focus on contingency planning and implementation of the in-tank evaporation process for LLLW volume control. A contingency plan was issued to DOE in May 1989 that discusses prioritization of selected contingency plans/options under each scenario. The first phase of in-tank evaporation (operation at ambient temperature) was initiated in September 1989.

ORNL also developed an innovative strategy to upgrade the process waste treatment system that will result in significant cost reductions, more timely implementation of upgrades, and improved effluent quality. The strategy will coordinate the functions of the NRWTP and the PWTP to more effectively utilize equipment and eliminate the need for a LI project.

Hazardous, mixed, and conventional waste operations continued to perform in an exemplary manner. During FY 1989, the hazardous, SLLW mixed, and TRU mixed waste management activities received excellent reviews by the TDHE and EPA in RCRA compliance audits.

The tie-in and operational start-up of the NRWTP Collection System was completed in May 1989. Start-up of the facility allowed the open collection ponds in Melton Valley and the equalization pond in Bethel Valley to be eliminated as active components of the process waste system. Work is

continuing toward completion of NPDES attainment levels for water discharges from the facility. "Compliance Attainment" is scheduled for March 30, 1990.

Surveillance at all ORNL inactive waste management areas and surplus radioactively contaminated facilities was conducted during FY 1989 without any unusual occurrences or reportable incidents. An updated (1990-1999) maintenance and surveillance (M&S) plan for the ORNL Surplus Facilities Management and Defense D&D Programs was completed and published during 1989. New upgraded facility radiation and contamination monitoring equipment has been installed at the Homogeneous Reactor Experiment (HRE). The cleanup and removal of contaminated materials and other sludges from the Graphite Reactor fuel transfer canal was completed. Inventory and removal of the radioactive sources remaining in the canal is scheduled for FY 1990. Funding was received mid-year to D&D the 3033 Storage Garden Facility. Planning documents for this project are in preparation, and the preliminary site assessment work began in August 1989. The project is scheduled to be complete in mid-FY 1990. Both CV stack fans at the Molten Salt Reactor Experiment (MSRE) were replaced in addition to upgrading surveillance instrumentation.

The ORNL Implementation Plan for DOE Order 5820.2A was developed and issued in April 1989. This plan outlines the actions, with corresponding schedules and budgets, for bringing ORNL into compliance with the Order by FY 1994. The 1988 annual report of ORNL waste reduction activities was expanded to include all waste categories, and the Waste Reduction Plan was also updated and reissued to be consistent with EPA regulations and DOE orders.

During FY 1989, five RCRA permit applications were extensively revised and/or updated. Permit applications for the RH-TRU Retrievable Storage Facility and the Chemical Detonation Facility were completely rewritten. Draft permits for both facilities have been issued by TDHE providing ORNL with the specific criteria for operation in accordance with applicable regulations. Final permits have not been issued for these facilities.

As increased importance is focused on waste certification, ORNL's program for certifying waste generator personnel has served as an important interface between the waste management organization and ORNL generators. ORNL has programs for TRU waste, SLLW, hazardous/mixed waste, and waste minimization. During FY 1990, modules will be presented regularly, and graded tests will serve as the basis for certifying the generator. Also, personnel responsible for completing environmental safety and health forms have been given specific training on the requirements of form preparation.

A study of ORNL's solid waste data base systems was initiated during FY 1989. An evaluation of user needs and systems capabilities was completed. Discrepancies between needs and capabilities will be addressed during FY 1990.

The quality assurance (QA) status report for waste management operations was issued in FY 1989. This report indicated that QA activities are being effectively integrated into the operational activities ensuring compliance with Nuclear Quality Assurance (NQA)-1 and DOE Order 5700.6B.

Significant progress was made during FY 1989 in writing, updating, and issuing formal operating procedures for waste management activities at ORNL. Procedures for hazardous waste operations were issued in April 1989. Revised solid waste operating procedures were issued in August 1989. Updated liquid and gaseous waste operating procedures are in various stages of preparation, review, or approval.

Planned Waste Management Activities for FY 1990

During FY 1990, the TSD of radioactive, hazardous, mixed, and conventional wastes will continue to be managed as described in this plan. Activities for managing TSD waste management systems include routine operations, maintenance, and operational monitoring. Comprehensive strategic planning will continue and the design and construction of new facilities or the upgrading of existing facilities will proceed in order that ORNL may continue to manage these wastes in a compliant manner. Some key waste management activities scheduled for FY 1990 are summarized below.

The certification and preparation for shipment of CH-TRU waste to the WIPP for ultimate disposal will continue and the TRU Waste Management Strategic Plan for ORNL will be issued. Technology development for the WHPP will proceed as scheduled. Waste in the MVST will be characterized and microwave evaporation and solidification will be demonstrated. Technology development will continue for the slurry treatment, mobilization, and solidification for the RH-TRU sludges contained in the MVST. These sludges will be processed at the WHPP when operational. Construction of the TRU-SLLW Staging Facility, as well as the preliminary design for the new CH-TRU Storage Facility and the RH-TRU Storage Bunker I, will be completed in FY 1990.

Construction of Tumulus II will be completed, with operations scheduled to begin by July 1990. The design of the SWSA 6 Staging Facility will be completed and the contract for the construction of the proposed Class II IWMF will be awarded in FY 1990.

An FFA Compliance Plan for the Active LLLW Tank Systems will be developed and implementation initiated during FY 1990. LI project upgrades to the LLLW system are required for compliance with the anticipated provisions of the FFA. These projects are required to replace major sections of the existing singly-contained LLLW tank systems which have been in service for more than 30 years. During 1990, the detailed design for the Bethel Valley LI project will be completed, and the CDR for the Melton Valley LI project will be completed. The LLLW systems analysis has been initiated to optimize treatment and identify stabilized waste forms acceptable for on-site SLLW disposal.

Activities supporting design for PWTP improvements are currently underway. Several facility upgrades will be implemented during FY 1990 to reduce the quantities of secondary wastes generated by these facilities. Sludge drying and handling improvements will be investigated for the PWS sludge and volume reduction and handling improvements will be investigated for the sludge resulting from the CYRTS. Also, the NRWTP will be considered for secondary waste stream handling upgrades.

Capital project planning will continue during FY 1990 for the upgrade of stack fans and monitoring equipment, the installation of new liners for the sanitary sewage treatment ponds, and the upgrade of the meteorological and ambient air monitoring network. The ORNL Stack and Vent Survey will be updated and remote inspection of ventilation ducts will be conducted to evaluate their structural integrity.

Routine M&S will also continue for surplus facilities at ORNL. Routine M&S consists of scheduled inspections, radiological surveillance, and periodic maintenance as a result of inspections and monitoring.

ORNL waste certification programs encompass TRU waste, SLLW, LLLW, process waste, hazardous and mixed waste, and medical/infectious waste. The goals of the programs are generally to develop and document WAC that include all regulatory considerations for each waste category and ensure that wastes are segregated and packaged to meet these criteria. ORNL's programs for certification of different types of wastes are in varying stages of development. During FY 1990, draft certification plans will be issued for SLLW, solid conventional waste, and hazardous and mixed waste. A certification plan for medical/infectious wastes will be developed.

ORNL formally established a waste reduction program in 1985. Since that time, increased priority has been given to this area, with the appointment of a Waste Reduction Coordinator, Waste Reduction Representatives from each division, and increased funding. A major challenge in this area is the quantification of waste reduction in a non-production facility that is composed of over 350 individual R&D laboratories. Waste streams are small and diverse, and research activities change frequently, with no quantifiable "product" against which to measure waste generation. ORNL has thus based its Waste Reduction Program primarily on educating and motivating its staff. During FY 1990, the annual Waste Reduction Report will be issued and the ORNL Waste Reduction Plan will be revised.

Demonstrations of GCD technologies for SLLW will continue for both the tumulus (above-grade) and the concrete silo (below-grade) techniques in SWSA 6. These disposal assessments include the operational and environmental performance of the technologies over a multiyear demonstration period. The disposal capacity for Tumulus I will be depleted during FY 1990.

Regulatory compliance for the operation of waste management systems will be ensured during FY 1990 through the development and continued revision of the required regulatory permits and reports, internal audits, certification programs, operational and active systems effluent monitoring. In addition, activities for FY 1990 waste management support systems include preparation of enhanced safety and QA documentation, and continued operator training.

1. INTRODUCTION

Waste management requirements at ORNL are imposed by Federal and State regulations, as well as Executive and DOE orders. The AEA and the 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 RCRA, the EPA is given the responsibility for implementing a nationwide program that regulates hazardous waste management. States, however, are given the option of establishing programs that can operate in lieu of the Federal program. The State of Tennessee has exercised this option and has an approved hazardous waste management program.

The basic regulation that governs management of radioactive waste at ORNL is DOE Order 5820.2A, Radioactive Waste Management. This order establishes requirements to assure that all DOE operations involving management of radioactive waste, waste byproducts, and surplus facilities are conducted in a manner that will ensure protection of public health and safety in accordance with DOE Order 5480.1B, Environmental Protection, Safety, and Health Protection Program for DOE Operations. Order 5820.2A has four major subsections which address specific implementing procedures and requirements related to decontamination and decommissioning of surplus facilities. Several other DOE orders referred to in Order 5820.2A have supplemental and related requirements. The ORNL Waste Management Plan has been prepared to comply with the specific requirements outlined in DOE Order 5820.2A.

1.1 OBJECTIVES

Waste management operations are activities which minimize, treat, store, and dispose of all radioactive, hazardous, mixed, and conventional wastes generated as a result of operations at active facilities. These operations are based on a series of waste management objectives. The objectives of the ORNL Waste Management Program are:

- to manage the TSD of solid, liquid, and gaseous wastes in a 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, treatment, storage, transportation, and/or disposal of all wastes and is accomplished in a manner that minimizes the generation of such wastes, and
- to ensure that the generation, treatment, storage, transportation, and/or disposal of all wastes comply with all applicable Federal, State and local environmental, safety and health regulations.

The objective of the ORNL Waste Management Plan is to compile and consolidate, on an annual basis, 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 FY; and to provide information on how all of these activities are documented.

1.2 PURPOSE

DOE Order 5820.2A, Radioactive Waste Management, which was promulgated in final form on September 26, 1988, requires ORNL to prepare and submit a plan outlining its waste management activities for the minimization, treatment, storage, and disposal of waste to appropriate DOE-HQ program organizations. This plan has been prepared to fulfill this requirement.

1.3 SCOPE

This plan addresses all applicable requirements of DOE Order 5820.2A and other applicable DOE orders pertaining to waste management activities for low-level radioactive, TRU, hazardous, and mixed waste. Although not specifically required by Order 5820.2A, this plan also addresses SC waste and conventional waste (e.g., sanitary waste). ORNL does not generate HLW, but does store a small quantity as SC waste. ORNL generates small volumes of waste containing NARM. NARM wastes at ORNL are managed as LLW in accordance with DOE Order 5820.2A guidelines.

This plan is organized into eight primary sections with a supporting appendix. The first two sections provide basic information about the ORNL site and the principal organizations at ORNL and DOE-ORO involved in waste management activities. The remaining sections address the management of the various types of waste (i.e., radioactive, hazardous, mixed and conventional), 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 waste, 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 updated listing of principal ORNL waste management documents generated since the issuance of the ORNL Implementation Plan for Department of Energy Order 5820.2A.

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 below.

The RCRA of 1976, as amended by the HSWA of 1984, regulates the multifaceted problems associated with hazardous waste management. The primary objective of RCRA is to protect human health and the environment. The secondary objective is to conserve valuable material and energy resources by providing assistance to State and local governments for prohibiting open dumping, regulating the management of hazardous wastes, encouraging recycling and treatment of hazardous wastes, providing guidelines for solid waste management and promoting beneficial solid waste management, resource recovery, and resource conservation systems. RCRA provides cradle-to-grave tracking of the fate and disposal of hazardous waste from generator to transporter to treatment, storage, or disposal. Those disposal sites that were closed or abandoned before November 19, 1980 (effective date of RCRA regulations) are regulated under the CERCLA of 1980.

Anyone, including a Federal facility, who generates, transports, treats, stores, or disposes of hazardous waste and anyone who produces, burns, distributes, or markets any hazardous waste-derived fuels, or stores hazardous material in underground tanks must comply with RCRA by notifying the EPA or authorized States of their activities.

As amended by HSWA, RCRA Section 3004(u) requires corrective actions for releases of hazardous constituents. RCRA Section 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. RCRA will impact all major categories of tasks contemplated by this plan, including waste management operations.

The State of Tennessee is authorized to administer its own RCRA program in lieu of the Federal program, except for those RCRA provisions imposed by HSWA, and to regulate mixed hazardous and radioactive wastes. The Tennessee Hazardous Waste Management Act and its implementing regulations are administered by the TDHE. EPA Region IV administers the Federal RCRA program, including the HWSA provisions.

CERCLA of 1980, as amended by the SARA of 1986, 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 funding (the "Superfund") which 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 four other major environmental statutes, including the CAA, under which toxic or hazardous substances are identified. Thus, CERCLA regulates releases of radioactive source, special nuclear, or byproduct material while RCRA does not. EPA is authorized to expand the CERCLA list by adding compounds or mixtures which, 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 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 EPA to designate sites for inclusion of sites requiring remedial action on the 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 evaluating remedies. The draft FFA between EPA Region IV, TDHE, and DOE requires ORR cleanups to be conducted in compliance with both RCRA and CERCLA/SARA.

The 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 EAs or EISs, which are made available to the public and are circulated to other interested agencies. DOE Notice 5400.4 establishes DOE policy on integrating NEPA and CERCLA processes for Environmental Restoration projects.

The TSCA regulates, among other things, the use and disposal of materials containing more than 50 parts per million of PCBs. TSCA applies to waste management operations' projects that deal with PCBs. PCB-related projects may also be regulated by CERCLA and RCRA.

The CAA is a comprehensive and complex Federal statute designed to prevent and control air pollution from stationary and mobile sources. The CAA authorizes 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 ARARS for CERCLA cleanups. Radionuclides are also regulated under the CAA.

Air emissions from ORR facilities are managed in accordance with DOE Orders (5480.1A, 5480.4, and 5820.2A) and guidelines of the CAA as regulated by the TDHE Division of Air Pollution Control. TDHE 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. TDHE's Division of Air Quality administers the air permits program.

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 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 TDHE.

The 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.

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 below.

DOE Order 5820.2A, Radioactive Waste Management, 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. Waste management systems PA of all aspects of waste generation is required, including waste reduction, segregation, minimization, and characterization; waste acceptance criteria; waste treatment, storage, shipment, and disposal; and disposal site selection, design, operation, and closure/post-closure.

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 assure adequate funding availability. Decommissioning project activities include facility characterization, the environmental review process (NEPA, RCRA, CERCLA, 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.

Post-decommissioning 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 QA be maintained by using the applicable requirements of ANSI/ASME, NQA-1, 1983, "Quality Assurance Program Requirements for Nuclear Facilities."

DOE Order 5400.2A, Environmental Compliance Issue Coordination, 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, Hazardous and Radioactive Mixed Waste Management, establishes DOE hazardous and radioactive mixed waste policies and requirements. The Order clarifies DOE's interpretation of the definition of "byproduct material" (10 CFR 962) as it relates to RCRA regulation of mixed wastes, and establishes the lines of authority at DOE-HQ 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.

Other relevant DOE Orders include DOE Order 5400.1, General Environmental Protection Program, which establishes the environmental protection program for DOE operation, and DOE Order 5480.1B, Environment, Safety, and Health Program for DOE Operations, which outlines: (1) environmental protection safety and (2) health protection policies and responsibilities.

DOE, EPA, and TDHE are now negotiating an FFA prior to the final listing of the ORR on the NPL (scheduled for December 21, 1989). The FFA is intended to satisfy the requirements for an interagency agreement under Section 120 of CERCLA. The agreement recognizes DOE's responsibilities under NEPA and the impact the NEPA process may have on developing schedules retained under the agreement. 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, 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 RI/FSs and identifies the nature, objective, and schedule of response actions to be taken at the site. The agreement identifies 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 LLW tank systems pending final remedial action at the site.

1.5 OVERALL GOALS

The paramount 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 the recently issued 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 TDHE 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 to 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 WIPP, near Carlsbad, New Mexico, is designed to demonstrate the feasibility of proper disposal of 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 can be minimized. Conventional waste facilities are managed with the goal of landfilling solid conventional wastes, in compliance with all applicable regulations. Operational goals are to develop cost-effective improvements to ensure regulatory compliance and reduce expenditures.

2. GENERAL SITE INFORMATION

This section provides the general characteristics of ORNL operations. These characteristics include ORNL's organization and administration, documentation, support activities, and site description, pursuant to the requirements of DOE Order 5820.2A.

2.1 ORGANIZATION AND ADMINISTRATION

2.1.1 ORNL Mission

ORNL is a multi-program laboratory operated for the DOE by Martin Marietta Energy Systems, Inc. ORNL's mission is to conduct 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 efforts 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 formed the nucleus of the multi-disciplinary research laboratory that now exists. Similarly, waste management requirements have changed over the years. Many of the existing waste management sites and facilities have evolved from what would now be classified as crude disposal practices. Early waste management, which left significant environmental concerns unsatisfied, was a product of the limited scientific knowledge of the day and the urgency of the early mission. Control and treatment of waste streams from ORNL facilities is and has been the continuing responsibilities of DOE and its managing site contractors since the beginning of ORNL operations.

Over the past several years, the awareness of environmental concerns has increased and major environmental legislation has been enacted at both the Federal and State levels for controlling existing and potential sources of pollution. As a result of this changing regulatory environment, recent inspections, audits, and reviews have been conducted. 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 ALARA directives. Facilities for treatment of discharges are being constructed or upgraded, and results of earlier disposal practices are being addressed. Timely action is being taken and will have to continue to bring ORNL into conformance 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 Organizational Waste Management Structures

2.1.3.1 Martin Marietta Energy Systems, Inc.

The three sites on the ORR are operated for the DOE by Energy Systems. As the operating contractor, Energy Systems manages the environmental, safety, and health programs at the sites and supports the DOE-ORO organization in the management of the overall environmental, safety, and health program. Energy Systems has a strong environmental management organization and has further reorganized to parallel recent changes in the DOE-ORO Environmental Restoration and Waste Management Organization.

Within Energy Systems, total oversight of all environmental, health and safety activities, as well as interface roles on behalf of Energy Systems, is the responsibility of Environmental and Safety Activities, a Central Staff organization reporting directly to the President of Energy Systems. All oversight, policy, and regulatory interaction within Energy Systems is the responsibility of this organization. ESA has direct interface with the DOE-ORO Assistant Manager for Safety and Environment and with the Assistant Manager for Environmental Restoration and Waste Management.

At each site, environmental, safety, and health organizations are charged with ensuring that the site meets the goals of full compliance with all current regulations and anticipation of, participation in, and planning for complying with future regulations. Although these organizational units report to the respective Energy Systems site manager, they also report in a matrix manner to the central ESA organization. An organizational overview for the Energy Systems Environmental Restoration and Waste Management Program is shown in Figure 1.

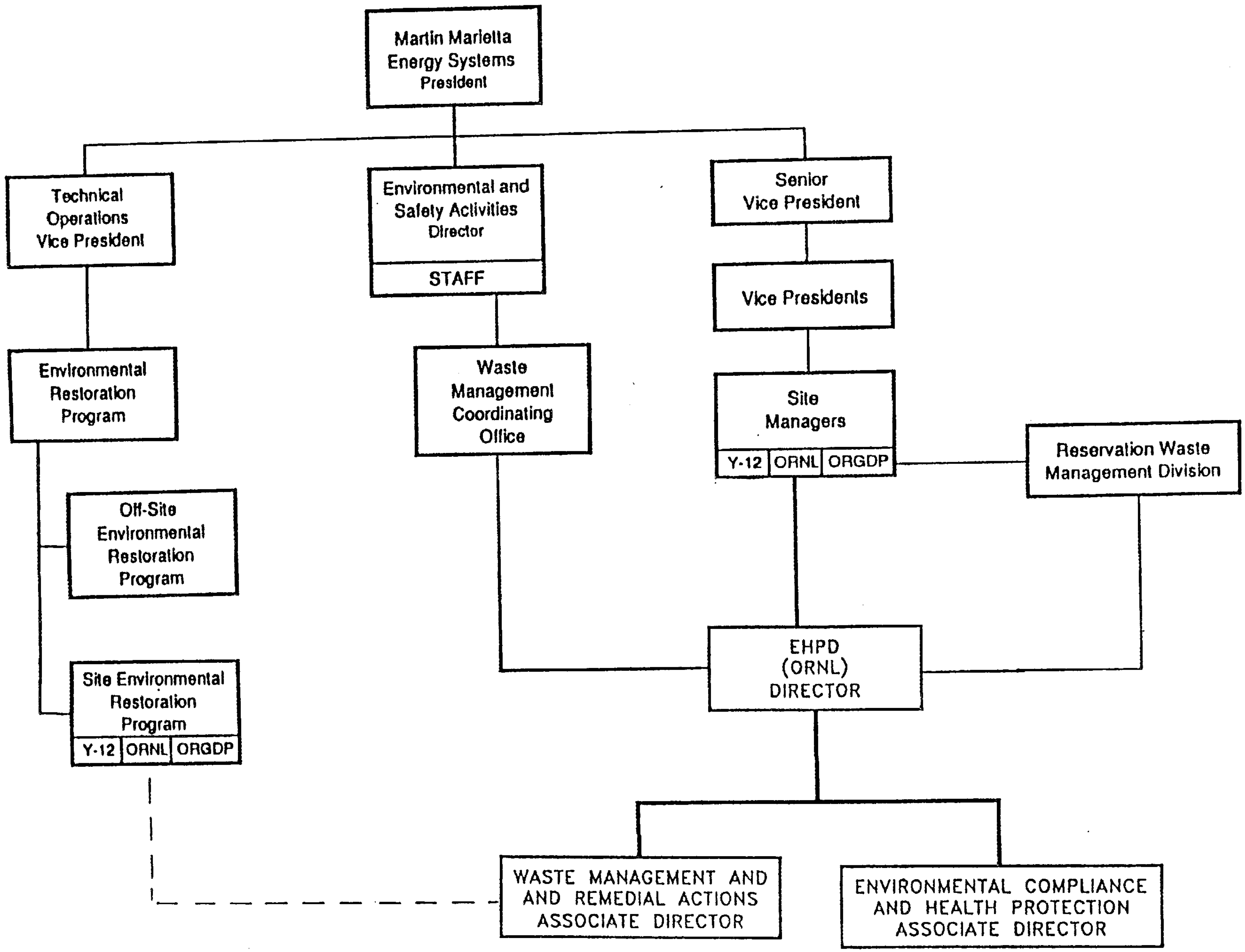

Fig. 1. Organizational overview for the Energy Systems Environmental Restoration and Waste Management Program.

Energy Systems ESA is responsible for oversight of corrective activities and waste management from the standpoints of policy and regulatory interaction. Within ESA, the Waste Management Coordination Office has oversight for the waste management program including planning for future waste disposal and participation of the private sector.

2.1.3.2 Central Waste Management Organization

The CWMO resides in the Corporate Energy Systems organization directing ESA (Figure 2). The CWMO has been assigned the overall Corporate responsibility for coordinating waste management programs at DOE-ORO installations and is responsible for developing and issuing guidance and policy statements regarding waste management activities for the Energy Systems installations. The CWMO is responsible for overseeing that each DOE-ORO installation integrates the issues and tasks identified by the LLWDDD and HAZWDDD Programs into their respective waste management programs. All issues relating to strategic options or regulatory interactions are the primary responsibility of the CWMO with support from appropriate Energy Systems waste management organizations. The CWMO is also responsible for coordination of Energy Systems reporting requirements, system performance assessments, and regulatory interface with and through DOE.

2.1.3.3 DOE-ORO

DOE-ORO has placed the overall responsibility for all environmental restoration and waste management activities under the AMERWM. Within the AMERWM organization are four divisions: Environmental Restoration, Waste Management and Technology Development, Formerly Utilized Sites Remedial Action Program, and the Weldon Springs Site Remedial Action Project (Figure 3).

Responsibility for overall planning, budget development, and program management of corrective activities and waste management operations rests with the Waste Management Division under the AMERWM. The AMERD is the COR for ORNL. The Laboratory Operation Branch within AMERD is responsible for the direct daily management and implementation of corrective activities and waste management activities ar ORNL. These activities are implemented by the Energy Systems site manager who is responsible to the DOE-ORO COR for reporting on status and supporting the COR on meeting the planning, status, and monitoring requirements of the DOE-ORO Waste Management Division

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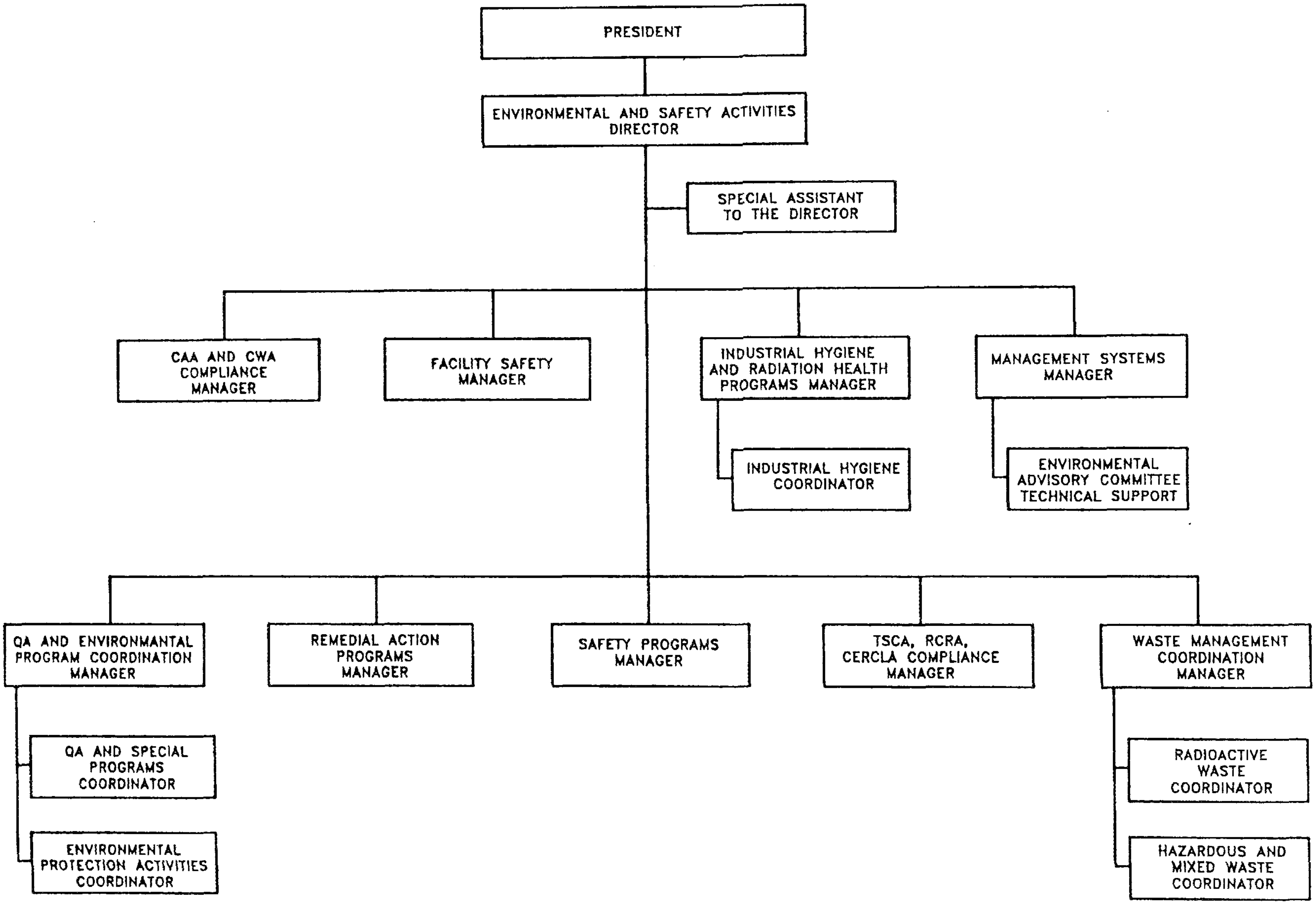

Fig. 2. Central Waste Management Organizati~~ directing Environmental and Safety Activities.

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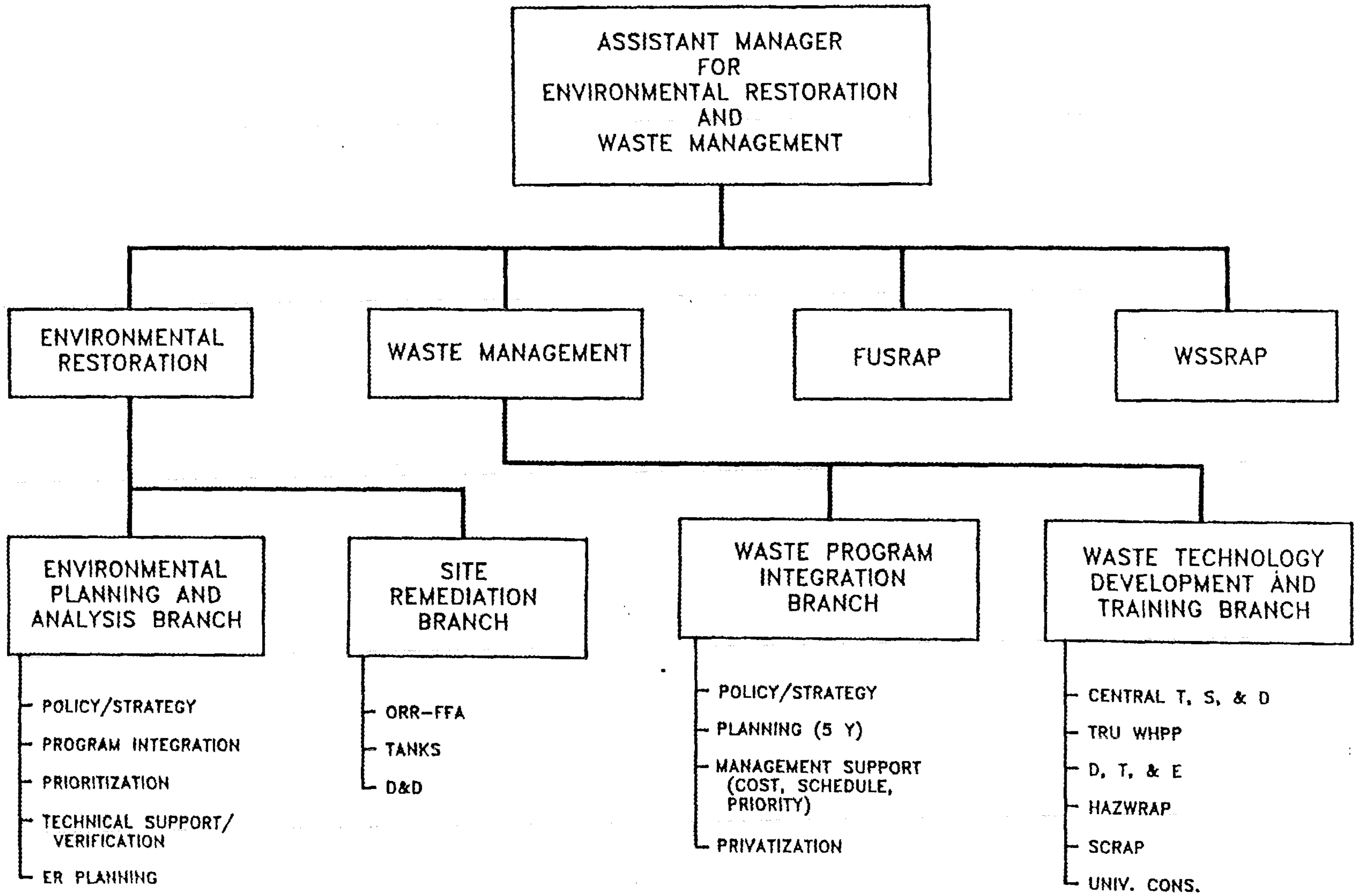

Fig. 3. AMERWM organization for DOE-ORO.

Director. Conduct of corrective activities and waste management operations at each of the sites is the responsibility of the respective Energy Systems site manager.

2.1.3.4 ORNL Waste Management

At ORNL, most functions supporting waste management activities are provided by the EHPD. The EHPD is divided into two functional areas (Figure 4), one dealing with environmental compliance and health protection and the other dealing with waste management and remedial actions.

Waste management operations at ORNL is the direct responsibility of the Waste Management Operations Section within the EHPD (Figure 5). This section is responsible for the continued operation of the radioactive, hazardous, mixed, and conventional 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 proper conduct of waste management systems operations is assured through the Environmental Compliance and Health Protection organizations shown in Figure 6. This is accomplished through the development of regulatory permits and reports, internal audits, personnel training, active systems effluent monitoring, and worker exposure monitoring.

The Environmental Projects Section (Figure 5) provides engineering support to manage LI and GPP during functional/systems requirements definition, feasibility studies, conceptual design, detailed design, procurement, and construction. The LI and GPP are required to upgrade, replace, or construct new facilities or systems required to conduct waste management operations in an efficient, safe, and compliant manner. The Environmental Programs Coordination Office provides integration for strategic and long-range planning activities, project tracking, fiscal analysis, and periodic progress reporting. Planning documents include the development of the DOE Environmental Restoration and Waste Management Five-Year Plan, the supporting Site-Specific Plan, and the Current Year Work Plans. This office also issues the Environmental and Waste Management Long-Range Plan, which identifies and projects needs in these areas for the next 20 to 30 years.

The Waste Management Coordination Office (Figure 5) provides detailed intermediate and short-term 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

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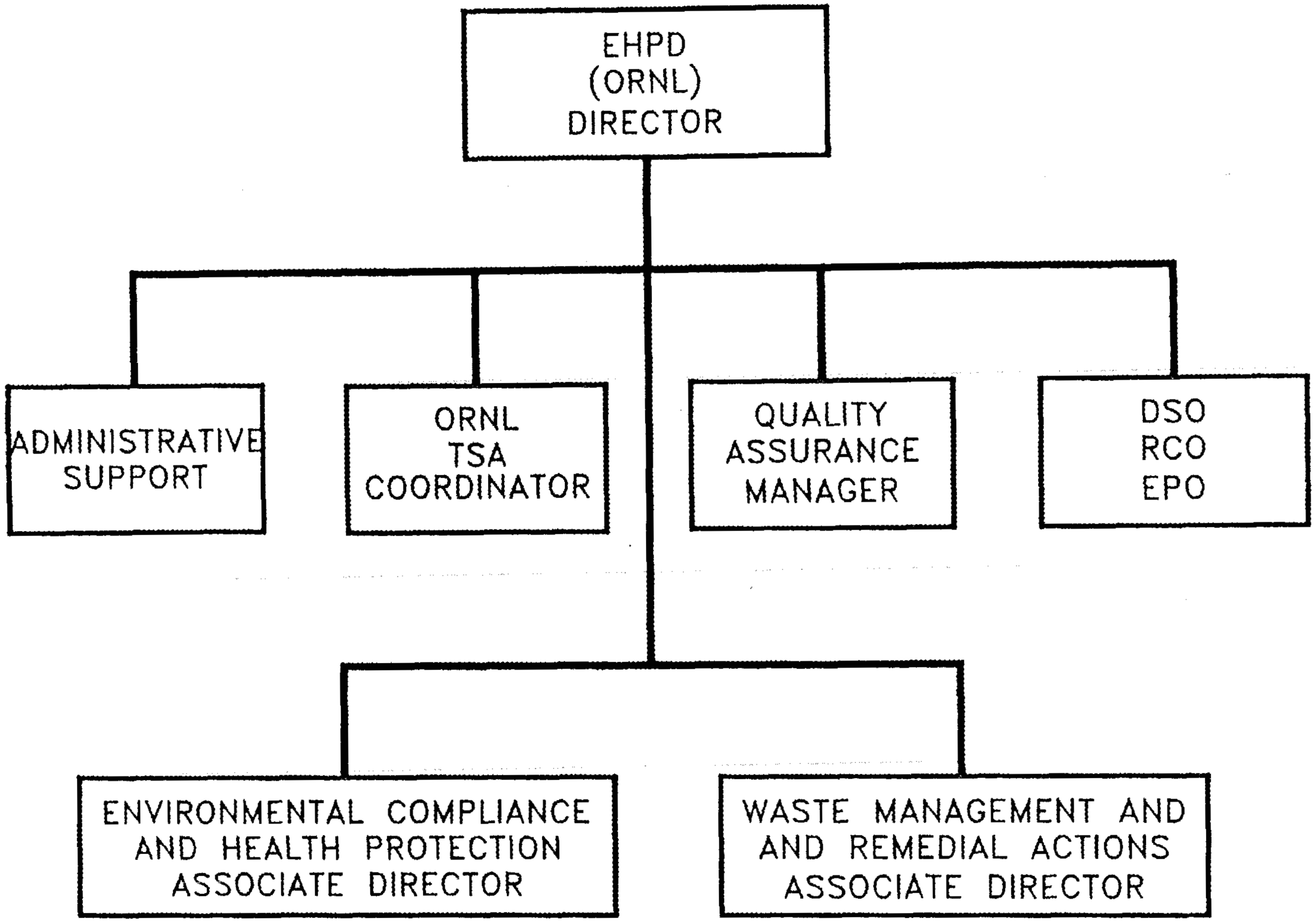

TSA – TECHNICAL SAFETY APPRAISAL
DSO – DIVISION SAFETY OFFICER
RCO – RADIATION CONTROL OFFICER
EPO – ENVIRONMENTAL PROTECTION OFFICER

Fig. 4. Environmental and Health Protection Division at ORNL.

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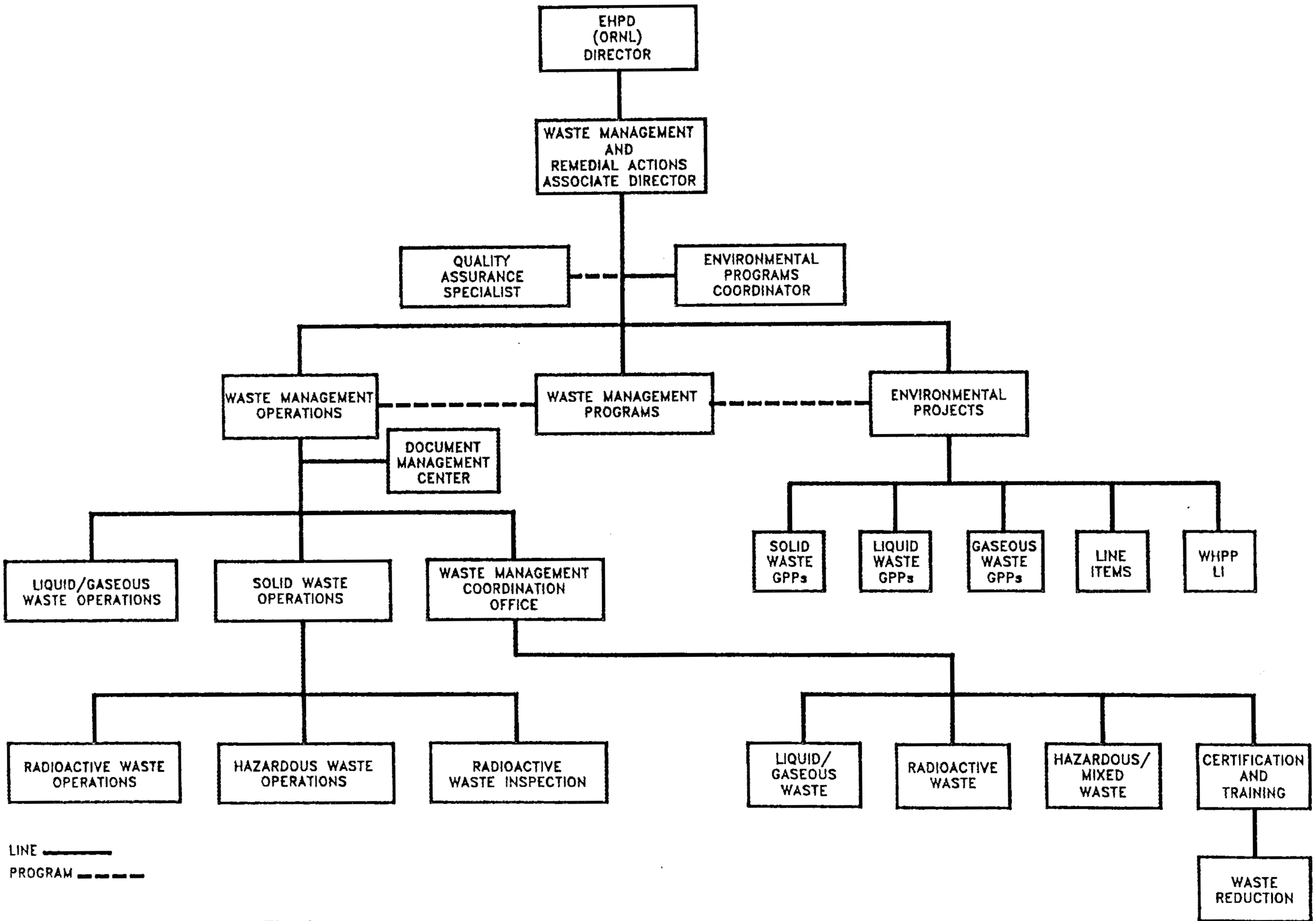

Fig. 5. Waste Management Operations and Environmental Projects Sections of the EHPD.

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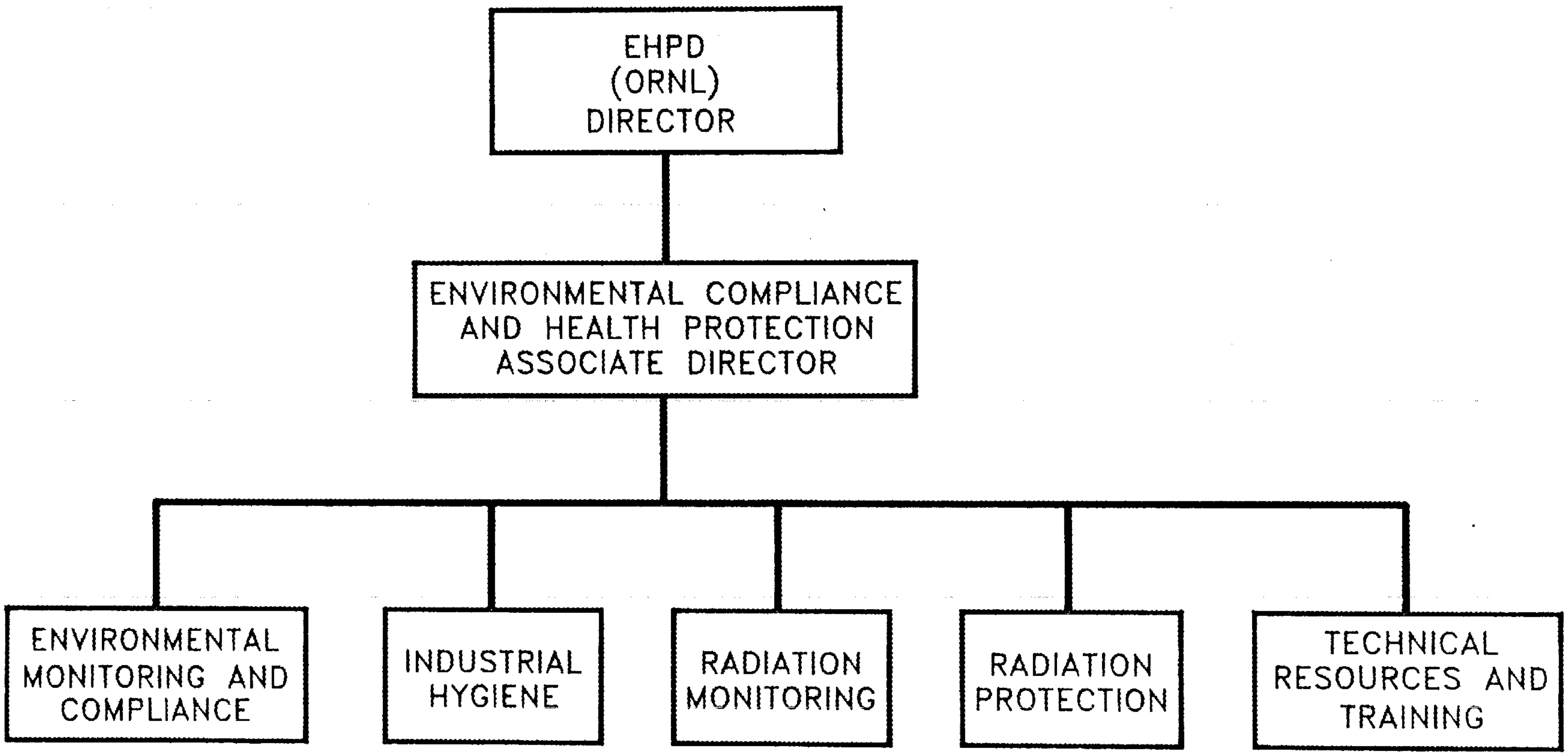

Fig. 6. Environmental Compliance and Health Protection organization at ORNL.

waste operations and to identify the need for the upgrade, replacement, and construction of new facilities. This office also develops and maintains central programs for waste certification, generator training, waste reduction, and costs for providing waste management services to generators.

Environmental restoration implementation is the responsibility of the Remedial Action Section which reports to the Associate Director for Waste Management and Remedial Actions in the EHPD (Figure 7). Responsibility for the D&D of radioactively contaminated facilities resides with this Section. The Section receives funding and program guidance from the ORNL Facility Management Programs Office.

2.1.3.5 Status of LLWDDD and HAZWDDD Programs

Energy Systems, in cooperation with the DOE-ORO, developed strategies and program plans for the management of LLW and hazardous and mixed wastes. The first effort was the establishment of the LLWDDD Program in 1986. The LLWDDD 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 the DOE-ORO in July 1987. A summary of both the strategy and the implementation plans for the Energy Systems installations was prepared and submitted to DOE-ORO on December 16, 1988. Shortly after the draft LLWDDD strategy was prepared in 1987, efforts began later that year to establish the HAZWDDD Program. A HAZWDDD Program Plan was developed in 1988 and published in February 1989. The objective of the HAZWDDD Program Plan was to ensure that the Energy Systems needs for TSD of hazardous and mixed wastes have been identified and that efforts are underway to meet those needs.

In April 1989, the DOE-ORO 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 disposal organization was to be separate from the generator organizations. In May 1989, the RWMD was established and was to report to the ORGDP Plant Manager. In establishing the RWMD, the roles and responsibilities of the RWMD, CWMO, and the DOE-ORO installations, with respect to waste management activities, were identified. A decision was made by Energy Systems to phase out the LLWDDD and HAZWDDD Programs. Issues and tasks identified by the two programs have been assigned to appropriate Energy Systems organizations for implementation.

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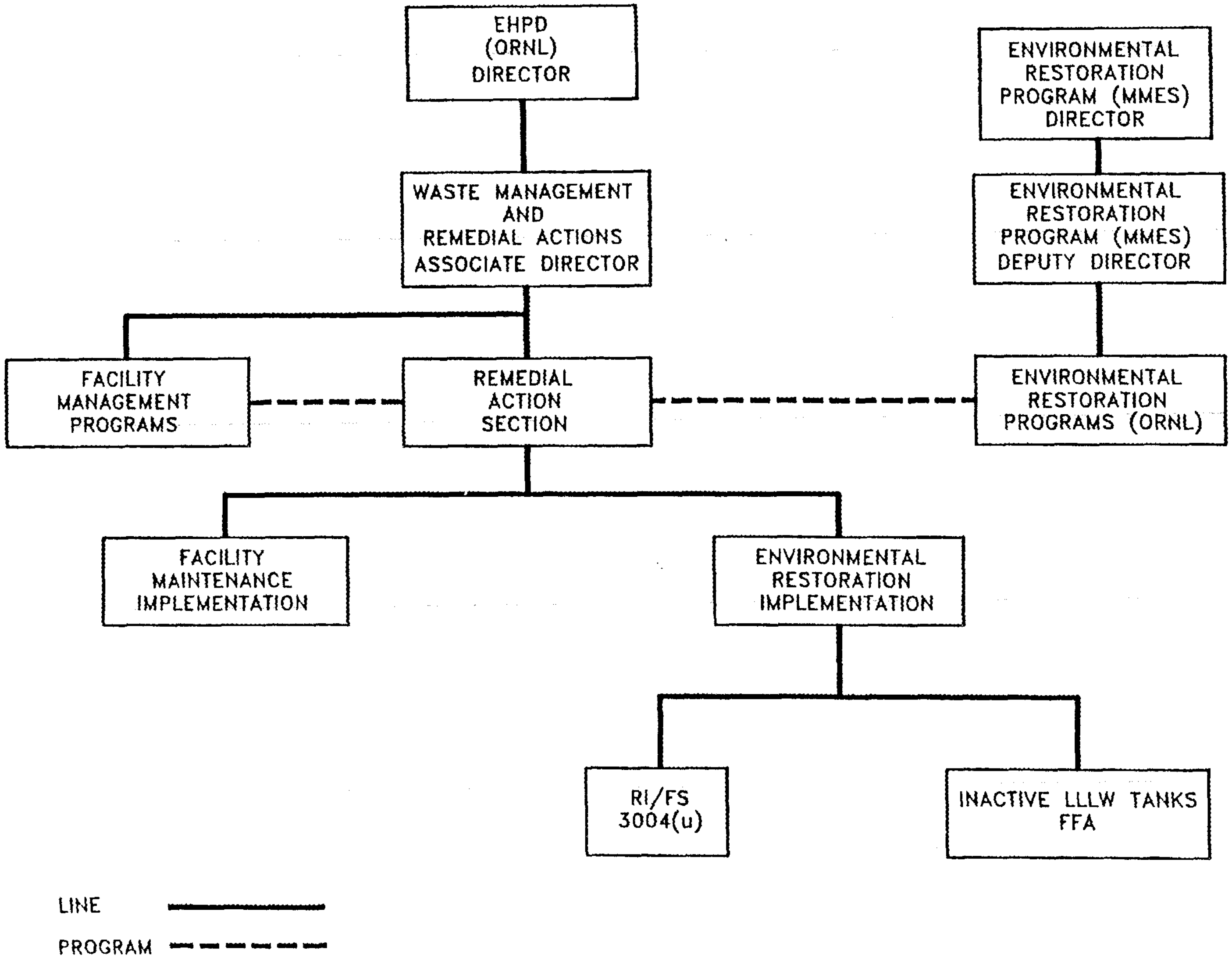

Fig. 7. Environmental restoration responsibilities at ORNL.

2.1.3.6 Reservation Waste Management Division

As previously stated, the RWMD was established in May 1989. Responsibilities assigned to the RWMD include the siting, design, construction, operation, and monitoring of new solid waste disposal facilities (Figure 8). The RWMD has the lead in developing the Class I and Class II LLW Disposal Facilities. The RWMD also provides support to the PWTDF, which includes the development of the Class III LLW disposal facility and the proposed Mixed Waste Disposal Facility. The feasibility study/engineering study to support the PWTDF project will be managed by Y-12 staff through completion in FY 1990. Beginning in FY 1991, the disposal facilities portion of the PWTDF scope will be transferred to the RWMD.

The RWMD provides support to the DOE-ORO Reservation Waste Management EIS. This EIS will assess the potential environmental impacts from waste management activities related to all three installations on the ORR: the Y-12 Plant, the ORGDP, and ORNL. The acceptability of continued disposal of LLW on the ORR will be assessed. The draft EIS is scheduled to be released for public comment by the end of March 1990, and a ROD is anticipated by the end of September 1990. ORNL Waste Management Operations Section provides the RWMD with technical input and review during development of the EIS.

The RWMD has also been assigned the responsibility for the preparation and the issuance of the radiological PAs, as required under the DOE Order 5820.2A, for existing and new LLW disposal sites for all applicable Energy Systems installations. The RWMD has formed a RPAT which has been delegated the responsibility for the preparation of the radiological PAs. Each Energy Systems installation has a representative on the RPAT who is referred to as the PAM. The PAM is responsible for the content and completion of the radiological PA, and for providing the RPAT with the data required for conducting the PA related to site characterization, waste inventories, and disposal technologies in use or planned for use at their respective sites. The PAM for ORNL resides in the Waste Management Operations Section. A radiological PA will be conducted for continuing LLW disposal operations in SWSA 6 and the proposed Class II IWMF. The schedule for the preparation of this PA is provided in Appendix A of this plan.

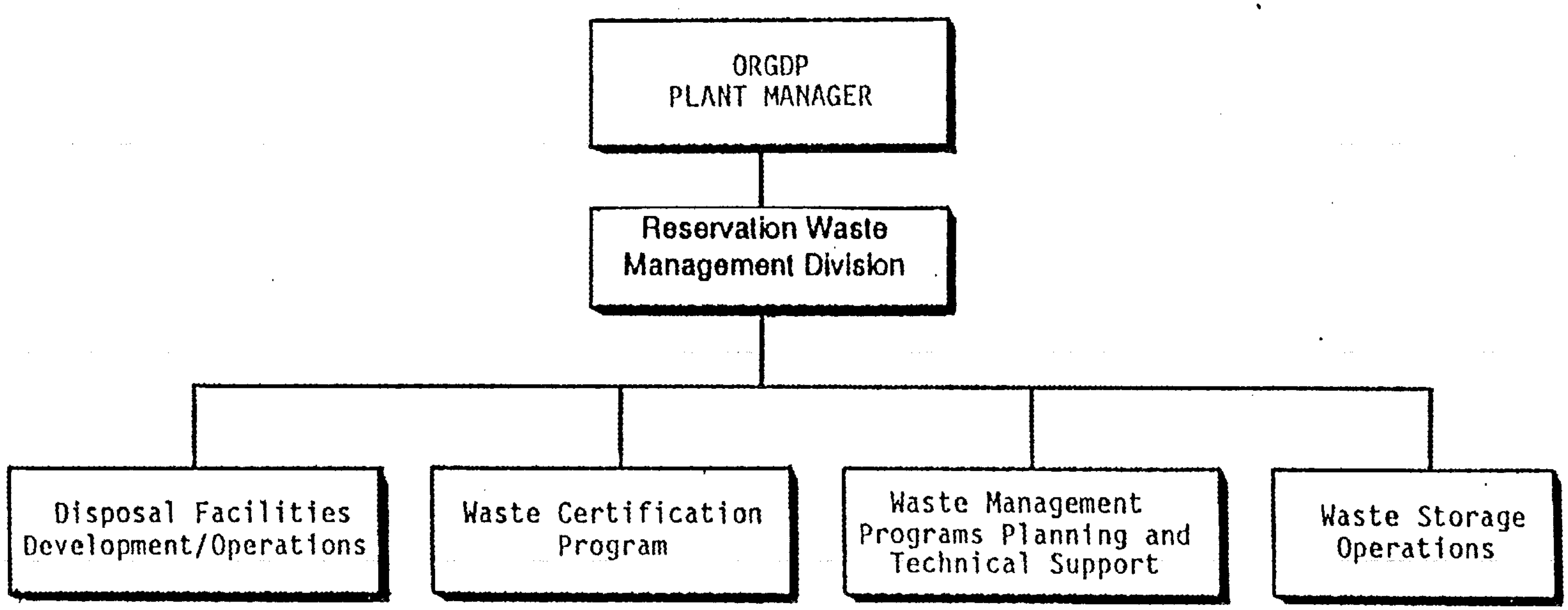

Fig. 8. Reservation Waste Management Division.

The RWMD has also been given the responsibility for preparing a report integrating the HAZWDDD and LLWDDD Program activities and identifying key issues and tasks for assignment to appropriate Energy Systems installations. This report has been submitted to DOE-ORO for review and approval. The HAZWDDD and LLWDDD programs will be discontinued upon approval of the report.

2.2 DOCUMENTATION

Various documents are developed to guide and support the waste management program at ORNL, with the DMC at ORNL responsible for maintaining current revisions of all waste management documents. Information regarding both the applicable documents and the DMC is provided in the following sections.

2.2.1 ORNL Waste Management Guidance and Support Documents

The following documents are used to guide and support the ORNL waste management program:

- DOE Environmental Restoration and Waste Management Five-Year Plan,
- Site-Specific Plan for the ORO Environmental Restoration and Waste Management Program,
- Activity Data Sheets,
- ORNL Long-Range Environmental and Waste Management Plan,
- Field Work Proposals, and
- Current Year Work Plan.

2.2.1.1 DOE Environmental Restoration and Waste Management Five-Year Plan

The Five-Year Plan is the cornerstone of the 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 will be 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 sanitary waste activities, including applied R&D activities to accelerate the deployment of new technologies achieving better results at lower costs.

The Five-Year Plan encompasses three discrete compliance-related 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 Site-Specific Plan for the ORO Environmental Restoration and Waste Management Program

Upon issuance of the DOE Environmental Restoration and Waste Management Five-Year Plan, DOE-ORO prepares and issues a detailed implementation plan entitled the Site-Specific Plan for the ORO Environmental Restoration and Waste Management Program. This plan encompasses environmental restoration and waste management activities at ORO facilities, including ORNL. This first site specific plan will be issued by December 31, 1989, based on the FY 1991 ADSs. The ORO-SSP describes projected FY 1990 activities and provides funding summaries, as well as descriptions of organizational structures, regulatory issues, reporting requirements, and QA programs. The SSP also provides the specific details on how the DOE Environmental Restoration and Waste Management Five-Year Plan will be implemented at the ORO.

In support of the ORO-SSP, ORNL also prepares the ORNL portion of the Site-Specific Plan. The ORNL SSP is combined with those from ORGDP and the Y-12 Plant to form the Site-Specific Plan for the ORO Environmental Restoration and Waste Management Program.

2.2.1.3 Activity Data Sheets

ADS are used by ORNL to identify all environmental restoration, waste management, and corrective actions projects, with appropriate information on priority and funding levels, budget reporting codes, and a short narrative description. ADS are the basic unit of description necessary to develop the comprehensive, DOE Environmental Restoration and Waste Management Five-Year Plan and will be updated annually. The 1992 ADS are scheduled to be completed by March 1990 to support the 1992 budget submission.

2.2.1.4 ORNL Long-Range Environmental and Waste Management Plan

The ORNL Long-Range Environmental and Waste Management Plan has been issued annually to provide a thorough and systematic planning document to reflect the continuing process of site assessment, strategy development, and planning for the current and long-term control of environmental issues, waste management practices, and remedial action requirements. The document also provides an estimate of the resources required to implement the current plan. This document is not intended to be a budget document; however, the Plan is intended to provide guidance to both Energy Systems and the DOE management as to the appropriate magnitude of the resources (primarily funding requirements) and the time required to execute the strategy in the present revision of the plan. As with any document of this nature, the near-term (one to three years) part of the plan is a realistic assessment of the current program and ongoing capital projects and reflects the efforts perceived to be necessary to comply with all current State and Federal regulations and DOE Orders. Continued preparation of the ORNL Long-Range Environmental and Waste Management Plan is uncertain because of the introduction of the ORNL Waste Management Plan and the Five-Year Plan, respectively.

2.2.1.5 Field Work Proposals

FWPs are annual budget documents developed for the ORNL Waste Operations Program from DOE-HQ guidance to DOE-ORO. These budget requests reflect the major effort underway by DOE to establish an effective and compliant program consistent with applicable Federal and State regulations and other authoritative guidelines. For a given FY, FWPs are developed to include both operating and capital equipment costs for various projects targeted for funding. Budgetary figures are provided to support the different program activities for each waste type and funding level.

2.2.1.6 Current Year Work Plan

Each fiscal year, CYWPs are prepared for programmatic waste management tasks. The following information is provided in each work plan:

- Task Control Information
- Task Description
- Task Budget
- Quality Assurance
- Task Schedule
- Milestones

The budget information provided in each CYWP is developed to be consistent with guidance received from DOE-ORO.

2.2.2 Documentation Management Center

The DMC has the responsibility of maintaining quality records for the Waste Management Operations Section at ORNL. The DMC developed the DMS to perform this function.

The DMS was conceived, designed, and configured to meet requirements for NQA-1 document control and quality records for the Waste Management Operations Section. 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 Section 8.3 of this Plan.

2.3 SITE DESCRIPTION

This section briefly describes the physical characteristics of the ORNL site that are relevant to waste management activities. A detailed environmental description is given in Environmental Analysis of the Operation of Oak Ridge National Laboratory (Boyle 1982) and Environmental Surveillance of the Oak Ridge Reservation and Surrounding Environs During 1985 (ORNL 1986).

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 8 miles southwest of the city of Oak Ridge (Figure 9) in eastern Tennessee. The ORR 38,306 acres is in a rural setting and is bounded by the Clinch River and TVA land on its eastern, southern, and western borders. ORNL is located on the southern border of the

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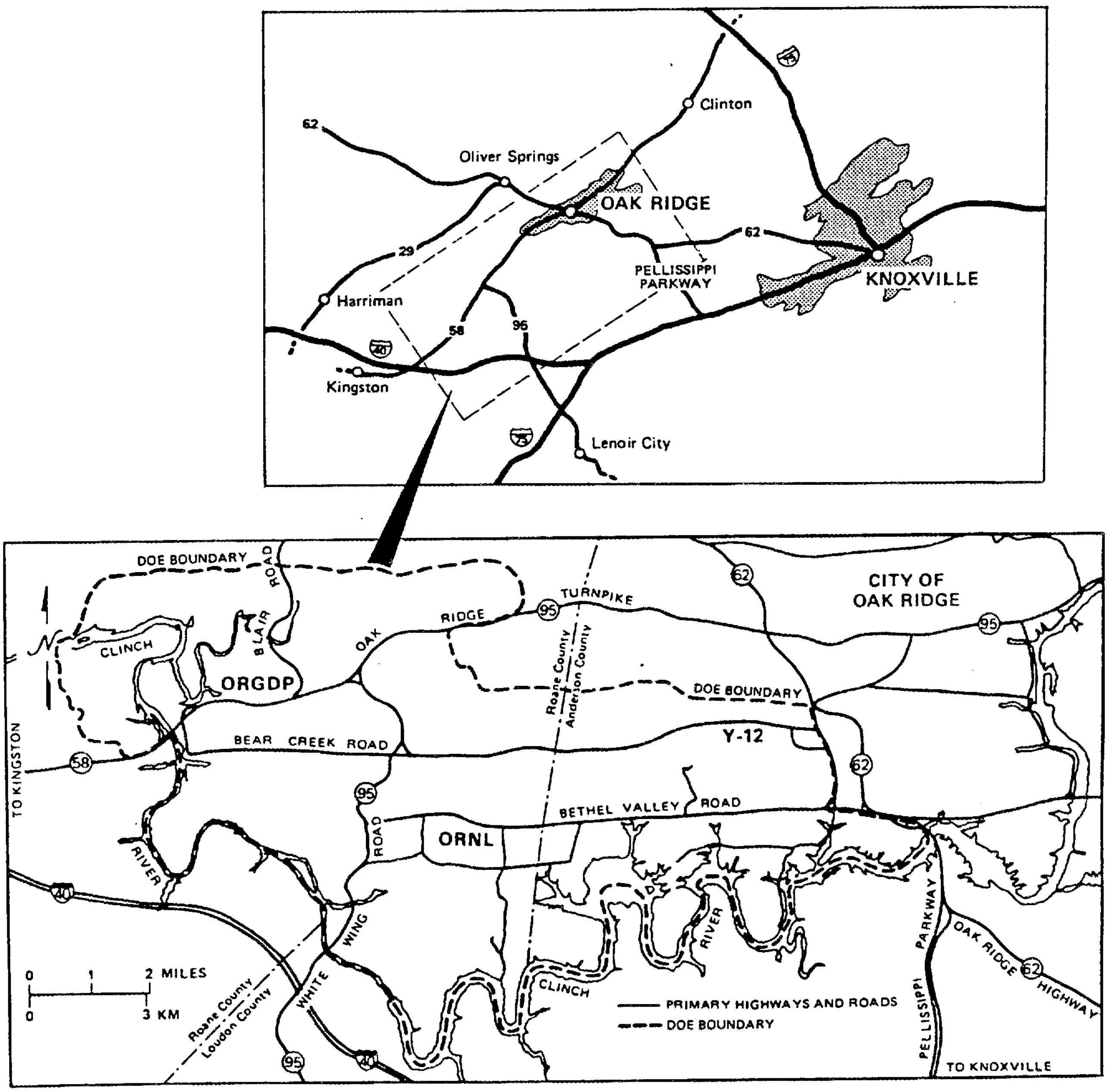

Fig. 9. Area map indicating location of ORNL.

federal reservation. Its principal R&D facilities consist of nuclear research reactors, particle accelerators, hot cells, engineering process development facilities, and research facilities in physics, chemistry, biology, and the environmental sciences.

ORNL and its accompanying buffer zone, encompassing 8,771 acres, lie almost entirely within the 6.5-mi^2 WOC drainage basin. The central ORNL complex area is located in Bethel Valley (Figure 10) 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 few ORNL facilities, including the Biology Division, are located at the Y-12 site.

The central ORNL complex, the SWSAs, and the outlying facilities (Figure 10) occupy about 1,754 acres, or approximately 20 percent of the entire ORNL site. The remaining 7,017 acres, or 80 percent of the entire ORNL site, is predominantly forested buffer zone.

Most of the land on the ORR is subject to forest management administered through the Plant and Equipment 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.

2.3.2 Demography

Except for the city of Oak Ridge, the land within 5 miles of the ORR is predominantly rural, 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. 3,600), 6.8 miles to the northwest; Clinton (pop. 5,300), 10 miles to the northeast; Lenoir City (pop. 5,400), 6.8 miles to the southeast; Kingston (pop. 4,400), 6.8 miles to the southwest; and Harriman (pop. 8,300), 8 miles to

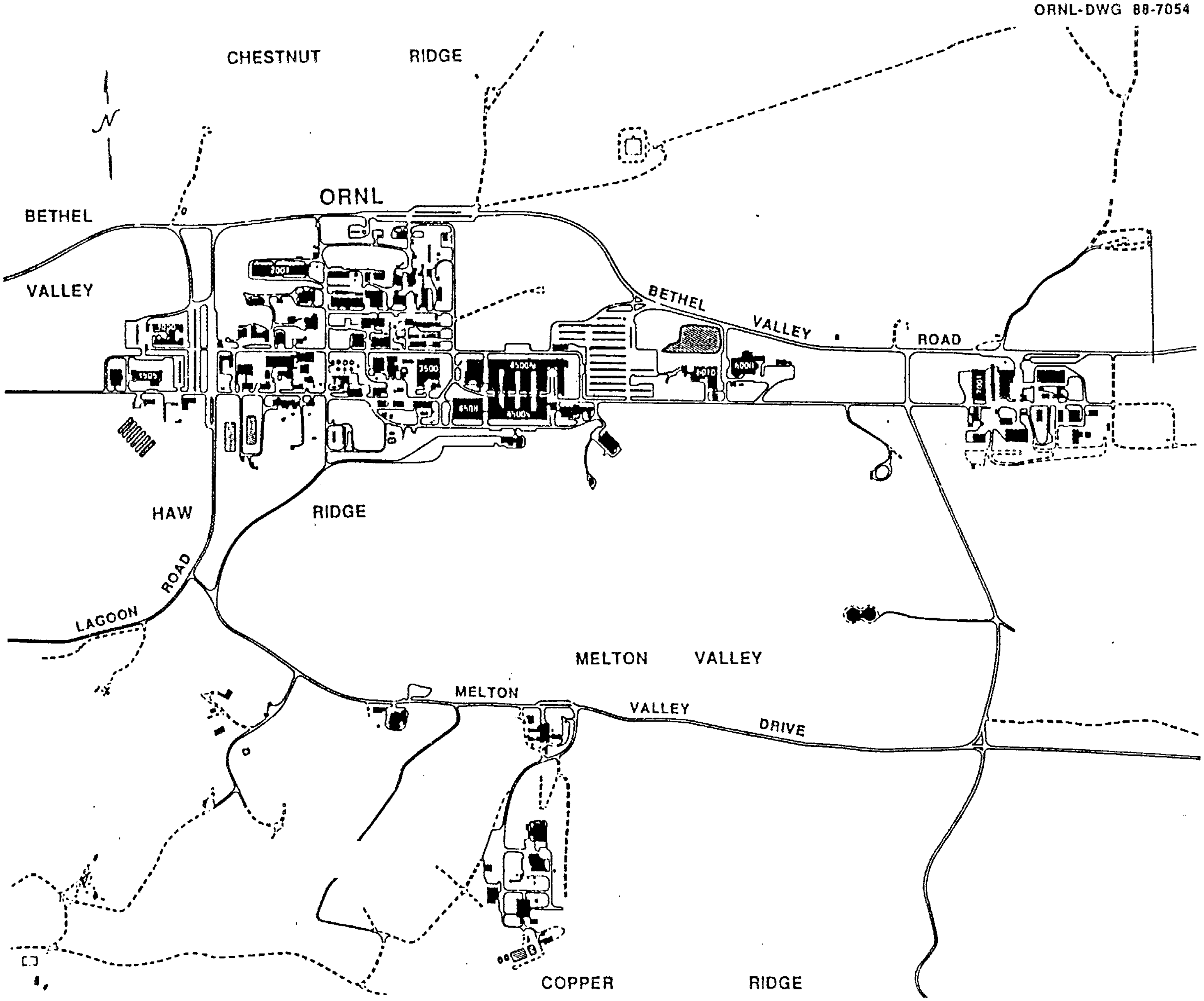

Fig. 10. Layout of the central C   'L complex in Bethel Valley.

the west. Knoxville, the major metropolitan area nearest Oak Ridge, is located about 25 miles to the east and has a population of about 183,000. Fewer than 5,000 people live within 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, whereas the ridges are underlain by more resistant sandstone, shale, and cherty dolomite formations.

Surface elevations range from about 740 ft at the Clinch River to about 1,356 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 5.2 ft/s in October to 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 54.4 in, ranging from 37.4 in to 76.3 in. A trace or more of snow has been reported each winter on record, with an annual average snowfall of 10.4 in.

2.3.5 Geologic and Hydrogeologic Conditions

Nine geologic formations (Figure 11) 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

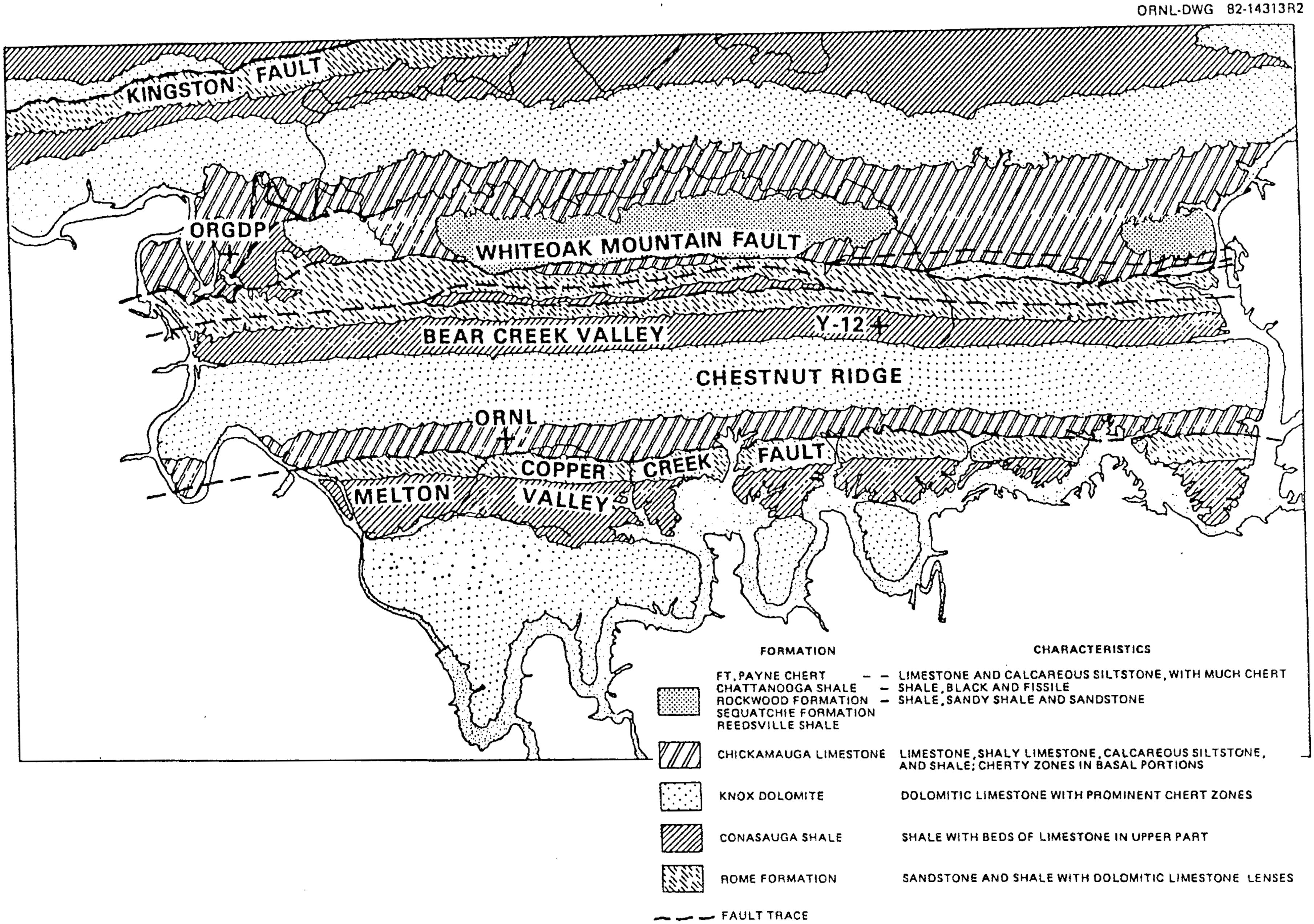

Fig. 11. Geologic formations within the ORR.

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 are from northwest to southeast, (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 100 ft thick. Soils developed on the Rome, Conasuauga, and Chickamauga are generally thin (less than 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 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 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 1 to 35 ft; whereas in Melton Valley the range is from 1 to 67 ft. Seasonal fluctuations tend to be greatest beneath hillsides. A seasonal variation of as much as 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.

3. RADIOACTIVE WASTE MANAGEMENT

ORNL radioactive waste management activities are primarily concerned with TRU waste and LLW. Small quantities of NARM are generated and managed as LLW. ORNL does not generate HLW, but stores a small quantity as a special-case waste. TRU waste is principally solid waste stored from previous operations, with a small amount of solid TRU waste currently being generated. 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 Figure 12. The following sections describe the strategy, generic description and characteristics of the waste, and the status of treatment, storage and disposal facilities for TRU waste, LLW, and SC waste at ORNL.

3.1.1 Transuranic Waste

TRU waste is defined in DOE Order 5820.2A as radioactive waste which, without regard to source or form at the end of the institution control period, is contaminated with alpha-emitting TRU radionuclides which 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 must be managed as TRU waste. Waste contaminated with ^{252}Cf and ^{244}Cm in concentration greater than 100 nCi/g are also handled as TRU waste at ORNL, although they have not been formally declared such by DOE-ORO. The majority of TRU waste at ORNL is stored from past operations. Currently, ORNL activities generate small quantities of TRU waste (i.e., NG-TRU waste). Most of the existing TRU waste storage facilities at ORNL are located in the north area of SWSA 5 (Figure 13).

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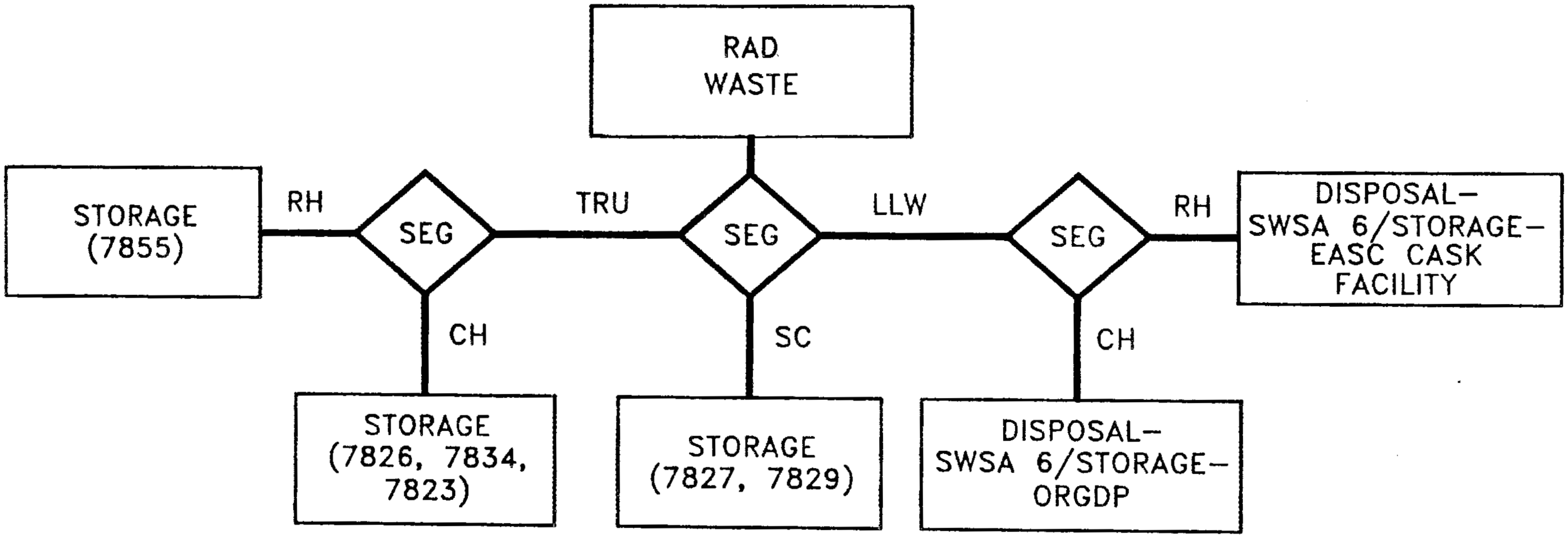

Fig. 12. Decision tree for the segregation and disposition of solid radioactive waste at ORNL.

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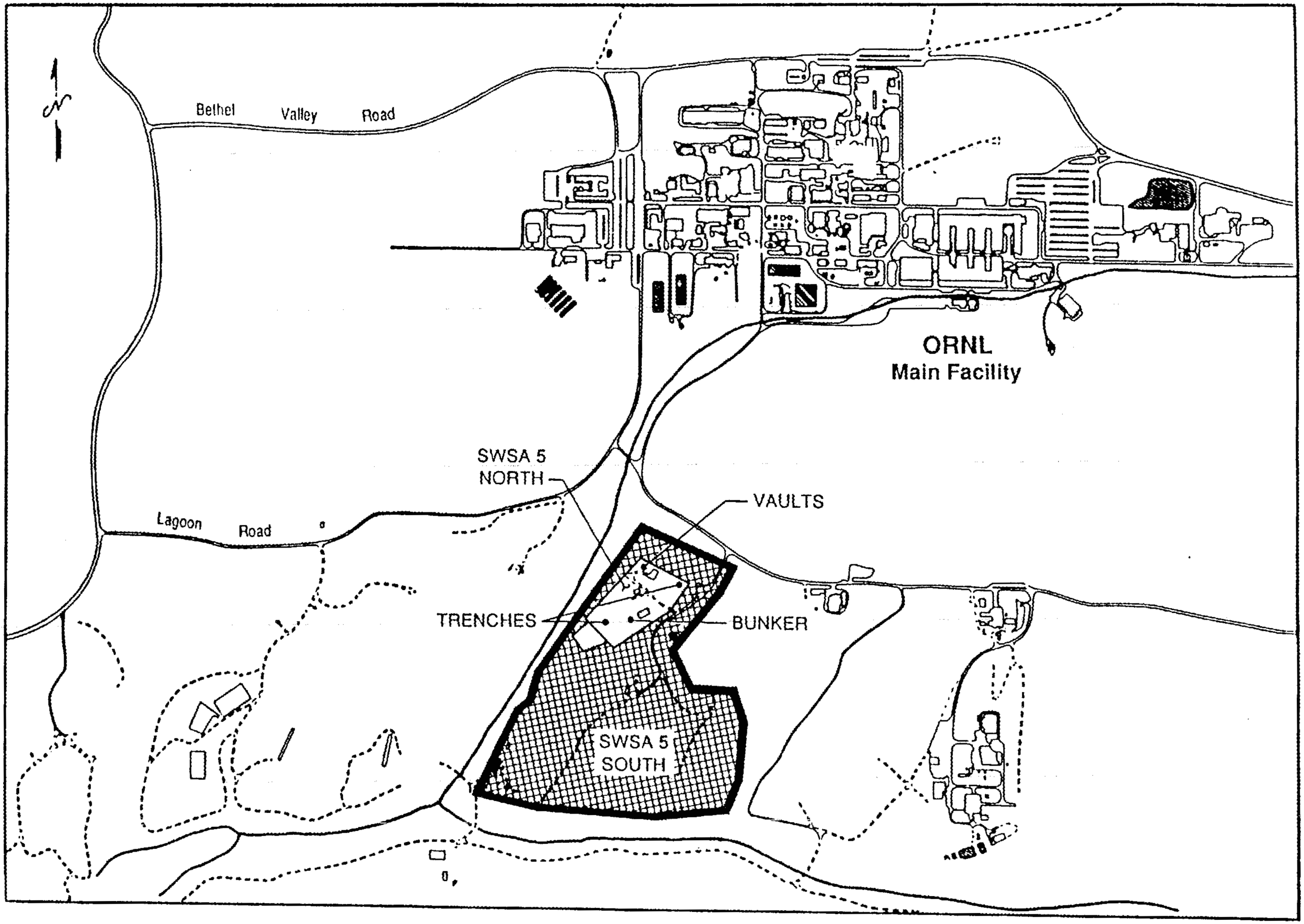

Fig. 13. TRU waste storage facilities in the north area of SWSA 5.

3.1.1.1 Strategy

Since 1970 in compliance with Directive DOE-TRU 8201 guidelines, ORNL has been segregating and retrievably storing solid alpha-contaminated waste, pending the development of an approved strategy for permanent disposal. The WIPP, located in New Mexico, is the planned DOE disposal facility for all TRU waste, including ORNL's. TRU waste to be shipped to the WIPP must be certified to the WAC of the WIPP. Over the past several years, ORNL has been developing the procedures for certifying TRU waste for disposal at the WIPP.

3.1.1.1.1 Disposal at the Waste Isolation Pilot Plant

According to DOE Order 5820.2A, TRU waste will be disposed of at the WIPP located in Carlsbad, New Mexico. The WIPP is under development by the DOE with the express purpose of providing an R&D facility to demonstrate the safe disposal of radioactive wastes resulting from defense activities. After the successful demonstration of the safe disposal of defense TRU wastes, the WIPP will be the planned destination for all certified CH- and RH-TRU waste, including mixed TRU waste.

Prior to shipment of waste, WIPP personnel will validate the data package for each waste shipment. Upon 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 waste will be stored retrievably during a period of up to 5 years from the first emplacement of waste in the WIPP. This phase is called the Operations Demonstration Period. In the event that the decision is made not to use the WIPP as the repository, the stored waste will be retrieved, repackaged if necessary, and handled as directed by the DOE. At that time, the WIPP will be decontaminated and decommissioned, and the plant will be closed per agreement with the State of New Mexico.

3.1.1.1.2 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 TRU waste that has a surface dose rate of ≤200 mrem/hr and can be handled by direct means without extensive shielding.

3.1.1.1.2.1 Stored CH-TRU waste. ORNL has a significant backlog of stored CH-TRU waste. The majority of the stored CH-TRU waste is contained in 55-gal stainless steel drums with a small quantity contained in 4-ft X 4-ft X 6-ft boxes. The CH-TRU waste is stored in below-grade concrete block-type facilities in SWSA 5 North Area. Approximately 18,400 ft^3 of CH-TRU waste is currently stored at ORNL.

The strategy for stored CH-TRU waste is to certify the waste to the WIPP-WAC and store the certified waste at ORNL awaiting shipment to WIPP. Because of recent changes in transportation requirements, almost all of the CH-TRU waste stored at ORNL will require repackaging. This accounts for approximately 2,400 55-gal drums and 40 boxes.

3.1.1.1.2.2 Newly Generated CH-TRU waste. Currently, ORNL has only a few sources of NG CH-TRU waste. The five ORNL facilities which generate this waste are: (1) Building 7920, the REDC; (2) Building 3019, the Radiochemical Processing Pilot Plant; (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 the least, each producing, in some cases, less than one 55-gal drum per year. The estimated annual 1989-2014 CH-TRU waste generation rate is expected to be 425-530 ft^3/year from normal facility operations and an additional 565 ft^3/year from D&D waste.

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.

3.1.1.1.3 RH-TRU Waste

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

3.1.1.1.3.1 Stored RH-TRU waste. The majority of the RH-TRU waste stored at ORNL are contained in large cylindrical concrete cask containers (approximately 4.5-ft in diameter by 7.5-ft in length). Approximately 9,540 ft^3 of RH-TRU waste is currently in storage at ORNL. In addition, some stored RH-TRU waste contained in concrete casks and various other box containers are buried in trenches in SWSA 5. The concrete casks buried in trenches in SWSA 5 North Area are currently considered retrievable. Concrete casks buried in trenches in SWSA 5 South Area are considered non-retrievable and buried.

The strategy of stored RH-TRU waste is to certify the waste to WIPP-WAC by retrieving and processing in the proposed WHPP facility. The mission of the WHPP is to retrieve, receive, repackage, certify and ship RH- and SC-TRU waste. The WHPP is a FY 1993 LI project at ORNL.

3.1.1.1.3.2 Newly generated RH-TRU waste. The majority of NG RH-TRU waste is generated during the normal process operations of Building 7920. The current generation rate is minimal. D&D and remedial-action activities will also likely produce NG RH-TRU waste. The strategy for NG RH-TRU waste is to process the waste at the proposed WHPP for WIPP disposal certification.

3.1.1.1.4 TRU Sludges

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

3.1.1.1.4.1 NG-LLLW system sludges. TRU contaminated sludges currently being generated at ORNL are primarily the result of operations at the REDC (Building 7920). In the past, the TRU concentration in the evaporator sludge was maintained below 100 nCi/g by dilution with other liquid waste streams. This sludge was then disposed of by hydrofracture. The existing LLLW system does not have provisions for handling TRU contaminated liquids separately. Modification of the LLLW system to isolate TRU contaminated liquid waste is currently being studied.

3.1.1.1.4.2 Past LLLW system sludges. Recently, about 1.16 X 10^5 gal of sludge that is currently stored in the gunite tanks and the MVST was reclassified as RH-TRU waste. These sludges are the result of waste accumulation from the past 40 years of ORNL waste operations. The sludges in the gunite tanks are residuals from sluicing operations conducted several years ago when the majority of the gunite tank contents were removed for hydrofracture disposal. The sludges in MVST also resulted from this process.

Also, various active and inactive tanks in the LLLW system contain residual heels contaminated with TRU radionuclides. Evaluation of these sludge is currently underway for inactive tanks by the Remediation Action Program and 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.

3.1.1.1.5 Buried TRU Waste

Buried TRU waste at ORNL consists of the following:

1) Solid TRU waste commingled with SLLW and disposed in shallow-land-burial trenches prior to 1970 (SWSAs 3, 4, and 5);
2) Waste in pits and trenches from past liquid processing waste operations (4 pits and 3 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 NHF contain TRU radionuclides.

The final disposition of buried TRU waste is a part of the ORNL RI/FS currently in progress 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

TRU waste is classified as either CH- or RH-TRU waste. Sludges are a special category of solid TRU waste that will be solidified, certified, and disposed of as a solid TRU waste. Sludges will be disposed of as CH- or RH-TRU waste and are discussed separately in this section. The ORNL sludges are currently classified as RH-TRU waste.

3.1.1.2.1 CH-TRU Waste

CH-TRU waste consists of miscellaneous waste from glove box operations (e.g., paper, glassware, plastic, shoe covers, and wipes), discarded 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/hr, usually around 10 mrem/hr or less.

CH-TRU waste is generally contained within polyethylene bags inside 55-gal stainless steel drums. Metal paint cans, plastic buckets, and other similar containers are also used to package waste inside the 55-gal drums. The flow sheet for handling newly generated CH-TRU waste is shown in Figure 14.

The current inventory of CH-TRU waste at ORNL is approximately 2,400 55-gal drums placed in storage facilities or awaiting processing in the WEAF in SWSA 5. Also, a small quantity of CH-TRU waste is stored in 40 4-ft X 4-ft X 6-ft boxes.

3.1.1.2.2 RH-TRU Waste

Solid RH-TRU waste consists primarily of miscellaneous cell waste (e.g., paper, glass, plastic tubing, shoe covers, wipers, etc.), HEPA filters from off-gas clean up systems, and discarded equipment (e.g., processing racks, vacuum pumps, furnaces). The unshielded individual waste packages within the casks have radiation levels that measure between 10-10,000 rem/hr, with the majority below 100 rem/hr. RCRA materials in RH-TRU waste primarily consists of lead shielding and limited amounts of mercury from discarded lights.

RH-TRU waste is typically contained in cylindrical concrete casks 4.5-ft in diameter by 7.5-ft long. Wall thickness of the casks vary from 4.5-in to 12-in thick, depending upon the radiation level of the contents. Metal boxes (4-ft X 4-ft X 6-ft) are used for containing some RH-TRU waste. The majority of the RH-TRU waste inside the concrete casks are also contained inside polyethylene bags and 3-gal plastic buckets, one-gallon paint cans, 5-gal metal cans, and 30- and 55-gal carbon and stainless steel drums. The RH-TRU waste currently stored within SWSA 5 at ORNL consists of the following: (1) 199 buried casks; (2) 13 buried boxes; and (3) 90 cylindrical concrete casks stored in Building 7855.

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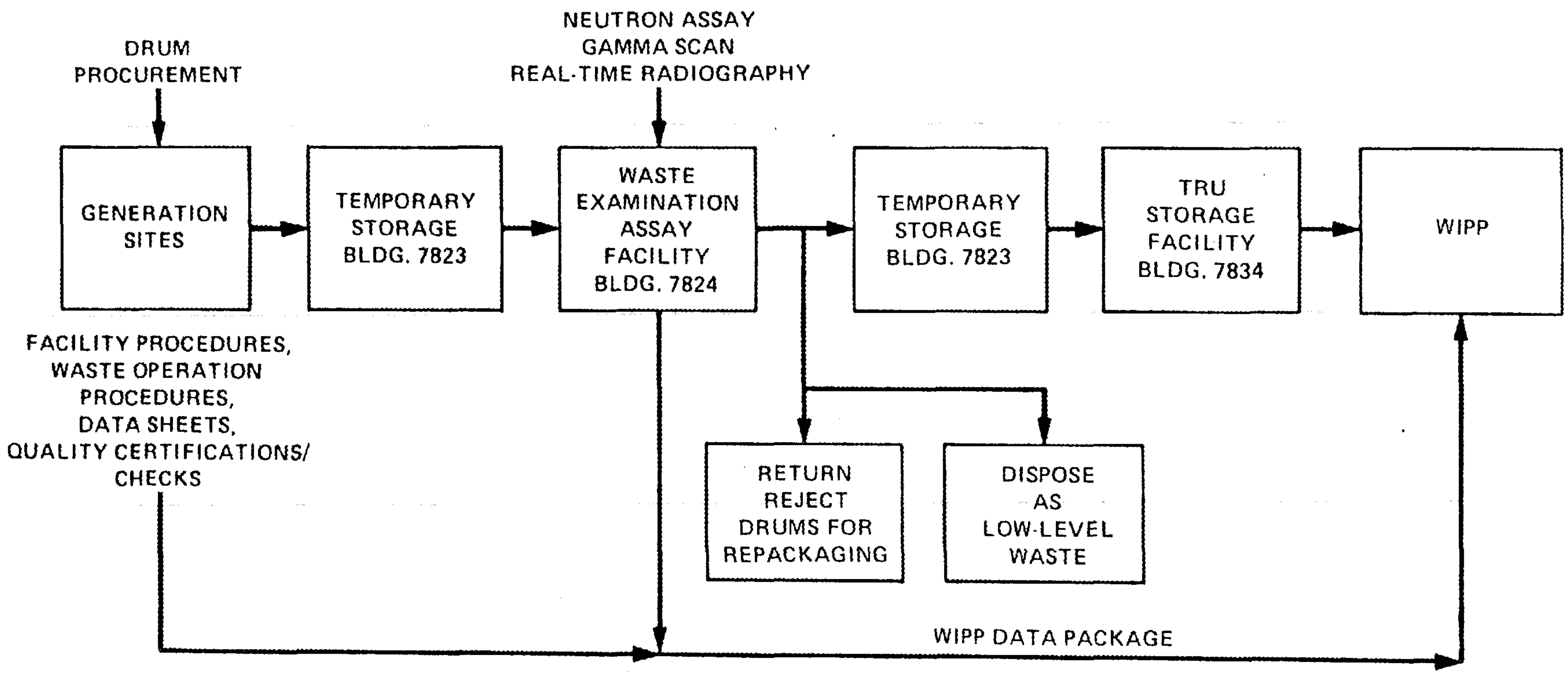

Fig. 14. ORNL NG CH-TRU waste flow sheet.

3.1.1.2.3 Sludges

TRU sludges in storage in the MVST and gunite tanks are residual heels from the gunite-hydrofracture disposal project completed in 1984. These sludges have a relatively high water content and a density of about 1.2-1.5 g/cm^3. The surface dose rates of these sludges are in the order of about 10 rem/hr (unshielded).

After processing, 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 MVST is estimated to be 1.16 X 10^5 gal. The quantity of RH-TRU sludges contained in the remaining active LLLW tanks has not been evaluated. The current treatment method for LLLW may produce a sludge that will require classification as RH-TRU. Sludges from the Waste Evaporation Facility have a density of about 1.2 g/cm^3.

3.1.1.3 Treatment Facilities

Treatment facilities for solid TRU waste do not currently exist at ORNL. However, the WEAF and the proposed WCCF will serve as inspection facilities for the examination of TRU waste and SLLW. These facilities are included in this section describing treatment facilities to remain consistent with the prescribed plan format.

3.1.1.3.1 CH-TRU Waste

The proposed treatment facility for CH-TRU waste is the CH-TRU Waste Repackaging Facility. The WEAF and the proposed WCCF are described in this section as stated above.

3.1.1.3.1.1 Waste Examination and Assay Facility. The WEAF is a 50-ft wide by 100-ft long facility located approximately 300-ft south of Building 7831 in SWSA 5 North Area. The facility houses equipment for nondestructive examination and assay of CH-TRU (≤200 mrem/hr) and LLW, as well as personnel offices and a control room. NDE/NDA equipment located in the WEAF includes the RTR unit, the Passive/Active Neutron Assay System, and the Segmented Gamma Scanner.

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

Permitting status. A RCRA permit is not required to operate the WEAF.

Facility status. The WEAF is currently operational.

3.1.1.3.1.2 CH-TRU Waste Repackaging Facility. The CH-TRU Waste Repackaging Facility is proposed as a GPP for FY 1992. The specific objective of this facility is to repackage approximately 2,400 55-gal drums and 40 boxes of CH-TRU waste to meet WIPP-WAC and TRUPACT transportation requirements.

This facility will provide alpha containment for repackaging the waste. The facility will include: (1) a storage area for waste awaiting processing; (2) a liquid hot-drain system; and (3) a processing and repackaging glove box or hot cell-type alpha containment system. Processing equipment will mainly consist of a compactor or similar reduction equipment and a drum loading station.

Environmental monitoring. The proposed facility will be designed to incorporate monitoring equipment for ensuring the safety of the workers and the protection of the environment.

Permitting status. A RCRA permit will not be required for operating the facility, provided that RCRA wastes are not stored longer than 90 days. An AcDM will be prepared for this facility. An EA is not expected to be required if an existing facility is upgraded or modified.

Facility status. This project is currently in the early feasibility study phase. Efforts are directed towards identifying existing facilities and hot cells that could be used or modified for this facility. The facility has a projected cost of $1.1M.

3.1.1.3.1.3 Waste Characterization and Certification Facility. This facility is planned to replace the WEAF for nondestructive examination and assay of waste, as required to meet WAC for storage and disposal of TRU waste and SLLW. The facility will house non-destructive inspection equipment for real-time radiography and assay of drummed and boxed waste. Handling equipment will be provided to move waste containers within the building. 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 is not anticipated. An EA will be prepared to meet NEPA documentation requirements.

Facility status. This facility is planned as a 1993 LI project, with an expected TEC of $9.0M. The functional design requirements for the facility are currently being finalized. The facility is planned to be located in SWSA 7.

3.1.1.3.2 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.

3.1.1.3.2.1 Waste Handling and Packaging Plant. The WHPP is a FY 1993 LI project designed to process stored RH-TRU waste and TRU-containing sludges. The WHPP will be designed to immobilize sludge stored in the MVST, to process solid RH-TRU waste, and to certify and package waste for shipment to the WIPP. The WHPP will be capable of receiving different size casks, off-site wastes and liquid and sludge from ORNL's MVST. The main processing hot cell will be remotely operated and have the capacity to unpackage, examine, size reduce, assay, and repackage the waste.

The proposed site of the WHPP, showing its relationship with the main ORNL complex and other TRU waste facilities, is depicted in Figure 15. A major function of the WHPP will be to process the RH-TRU sludges stored in the MVST. A conceptual cutaway of WHPP showing equipment layout and process flow is shown in Figure 16.

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

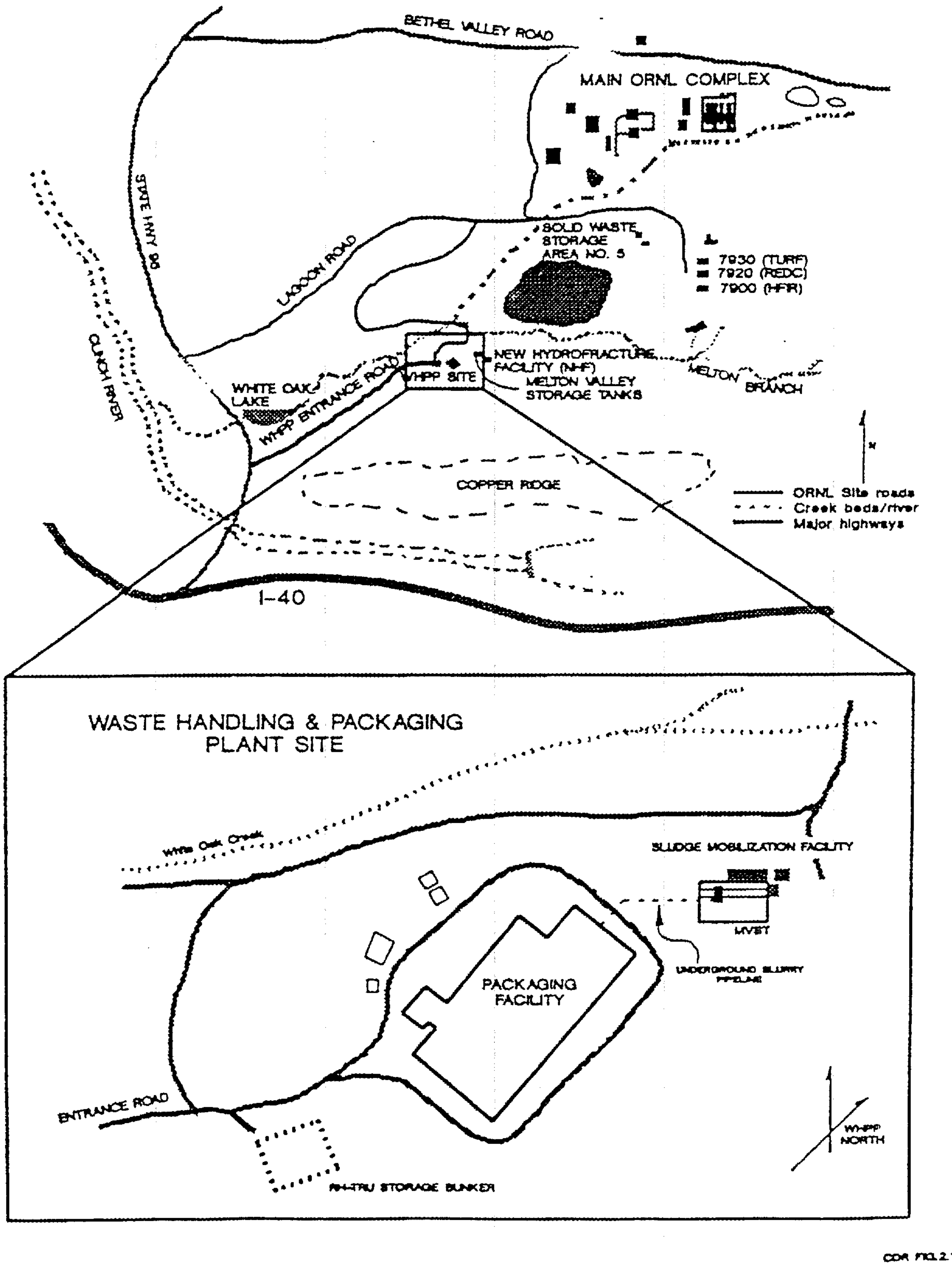

Fig. 15. WHPP site and its relationship to main ORNL complex and other TRU waste facilities.

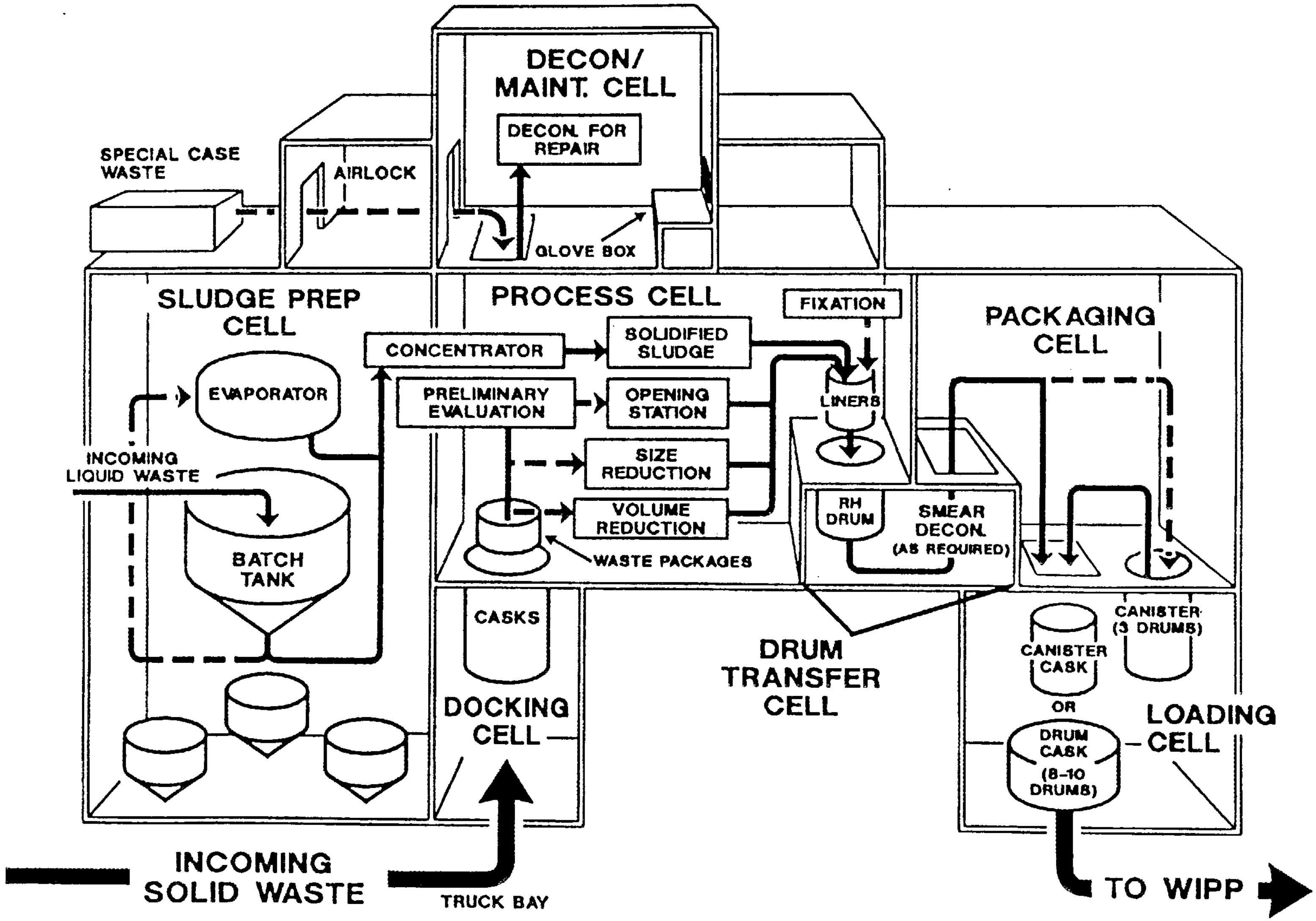

Fig. 16. WHPP conceptua' ·quipment layout and process flow.

Permitting status. An EA will be submitted in FY 1992 to meet NEPA requirements. The need for an EIS is not anticipated. The WHPP will be a RCRA-permitted facility.

Facility status. The WHPP is a FY 1993 LI project. The CDR and the long-form construction data sheet, which is currently being prepared by Energy Systems engineering personnel, will be submitted in FY 1991 with the DOE-ORO budget submittal. Preliminary cost estimates for WHPP indicate a TEC of $245M.

3.1.1.4 Storage Facilities

The locations of TRU waste storage facilities and trenches in the north area of SWSA 5 are shown in Figure 17. Sludges are stored in the MVST 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 tanks are located in the main ORNL complex.

3.1.1.4.1 CH-TRU Waste

CH-TRU waste is currently stored in Buildings 7834 and 7826. Building 7823 is a staging facility for drummed waste and for the temporary storage of boxed waste. A new staging facility is a 1989 GPP scheduled for completion in March 1990. A new CH-TRU storage facility is planned as a 1990 GPP.

3.1.1.4.1.1 Building 7823. Building 7823 is a single-level, semi-underground building of approximately 4,200-ft^2 with a concrete floor, steel supports, wire fabric ceiling, and metal roof and walls. The building is located at SWSA 5 and is used for the temporary storage of TRU glove boxes and 55-gal drums of LLW.

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

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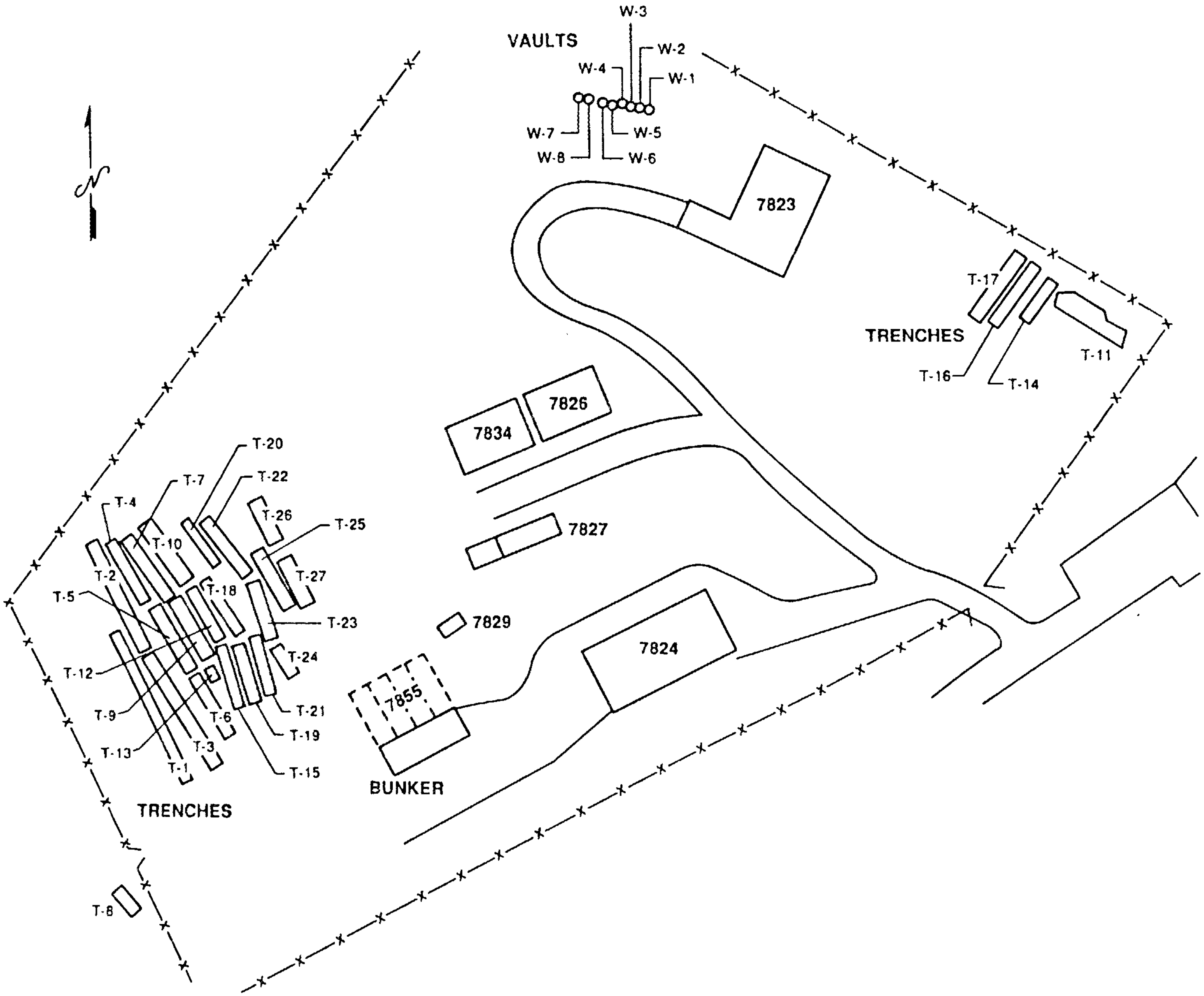

Fig. 17. Locations of TRU waste storage ar and facilities in the north area of SWSA 5.

Permitting status. The facility is currently operating under RCRA interim status. The interim status permit ends November 1992, and closure of this facility for storage of RCRA wastes will be initiated.

Facility status. Building 7823 will be phased out as a TRU-SLLW staging facility prior to November 1992.

3.1.1.4.1.2 **Buildings 7826 and 7834.** Current facilities for storage of drummed (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 one-story concrete block structure built approximately 85 percent below-grade. The facility has 24 storage compartments or cells, each of which will hold 64 55-gal drums for a total capacity of 1,536 drums. The drums are stacked four layers high in each cell.

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 1,920 drums. Also, this newer facility has removable concrete roof plugs instead of the sheet metal roof covers used in the 7826 facility.

Environmental monitoring. Monitoring of Building 7834 and 7826 is primarily conducted through the sampling of sumps located in each of the storage cells. Each cell 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 in November 1992, and closure of these facilities must be initiated at that time.

Facility status. These facilities will be phased out when the new CH-TRU storage facility is completed prior to November 1992.

3.1.1.4.1.3 **TRU-SLLW Staging Facility.** This replacement facility, which is currently under construction in the north area of SWSA 5, is a metal Butler-type building (50-ft X 100-ft). The facility will have a sealed concrete floor with curbing to meet RCRA requirements. The facility is designed to store about 700 drums and 20 boxes, or 960 drums for an indefinite period of time.

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

Permitting status. The RCRA Part B permit application has been prepared and submitted to the State for approval. The permit application was extensively revised in CY 1989 and is to be resubmitted for TDHE review and approval. An AcDM was prepared for this facility.

Facility status. The facility is currently under construction with an estimated completion date of March 1990.

3.1.1.4.1.4 New CH-TRU Waste Storage Facility. A new CH-TRU waste storage facility is planned to replace existing CH-TRU storage facilities. The new facility be will an aboveground metal Butler-type building, with a sealed concrete floor and curbing to meet RCRA and DOE requirements. The facility will have a storage capacity of approximately 3,000 55-gal drums.

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 has not been listed on ORNL's RCRA Part A permit application. A RCRA Part B permit application must be prepared. An EA will be prepared to meet NEPA requirements. Preparation of the EA has not been initiated.

Facility status. Functional design requirements and a conceptual design for the facility have been prepared. Siting of the facility is tentatively planned for SWSA 7, but no final decision has been made. Construction will begin in 1991.

3.1.1.4.2 RH-TRU Waste

RH-TRU waste at ORNL is currently stored in a earth-mounded building (7855) and in trenches in SWSA 5. The locations of the RH-TRU waste storage facility and the trench containing stored RH-TRU wastes are shown in Figures 13 and 17. Two new RH-TRU waste storage facilities are planned to be located near the WHPP. The facilities used for the storage of the RH-TRU sludges are discussed under the LLLW section of this plan (Section 3.2.2).

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

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 15-ft wide, 45-ft long and 10-ft high. 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. If the dose rate at the entrance to an open bay becomes too high, an intermediate wall is constructed, then the remainder of the bay is filled with TRU containers. An outside wall is then constructed across the bay to close off that bay. When retrieval becomes necessary, the walls will be removed and the TRU containers will be retrieved.

Environmental monitoring. Each bay contains a sump and a drain system for collection of ground water 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 interim status permit. A RCRA Part B permit application was submitted and TDHE has issued a draft permit. A final operating permit, however, has not been issued.

Facility status. Pending approval of the extension of the RCRA interim status permit, the facility will continue to be used until the WHPP becomes operational and the inventory of the RH-TRU waste stored in the facility is processed in the WHPP.

3.1.1.4.2.2 RH-TRU Waste Storage Bunker I. The RH-TRU Waste Storage Bunker I project is a 1989 GPP to provide additional storage capacity of RH-TRU waste in concrete casks. The facility will be an earth-mounded structure similar to the configuration of Building 7855. A front elevation view of a typical RH-TRU storage bunker is shown in Figure 18. Bunker I will have four bays and a storage

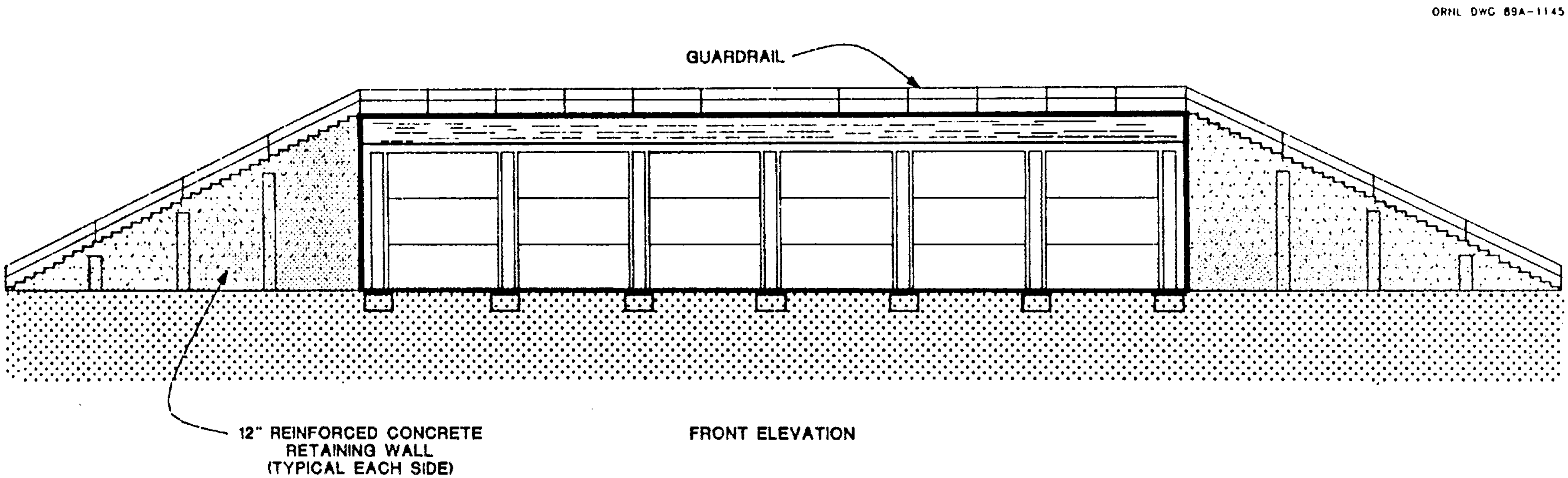

Fig. 18. Front elevation of a typical RH-TRU storage bunker.

capacity of 108 casks, with each bay holding 27 casks. Bunker I will be located adjacent to proposed WHPP and near the new hydrofracture facility. The proposed location of TRU storage Bunkers I and II at ORNL is shown in Figure 19.

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 A permit application and the RCRA Part B requirements have been identified. A RCRA Part B permit application will be prepared that will encompass both new storage bunkers. An EA will be prepared to meet NEPA requirements.

Facility status. Design requirements are currently being reviewed. Construction is expected to begin in early 1990, with completion scheduled by September 1990. The estimated construction costs of the facility is expected to be $840K.

3.1.1.4.2.3 RH-TRU Waste Storage Bunker II. Bunker II will be almost identical to Bunker I, except design consists of six bays with a storage capacity of 162 casks. The facility will be located adjacent to the WHPP, as depicted in Figure 19. The facility is planned as a 1991 GPP, with an estimated cost of $900K.

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

Permitting status. The facility will be a RCRA permitted facility. The facility is listed on the Part A permit application and RCRA requirements have been identified. A RCRA Part B permit application will be prepared that will encompass both new storage bunkers.

Facility status. The functional requirement document has been prepared.

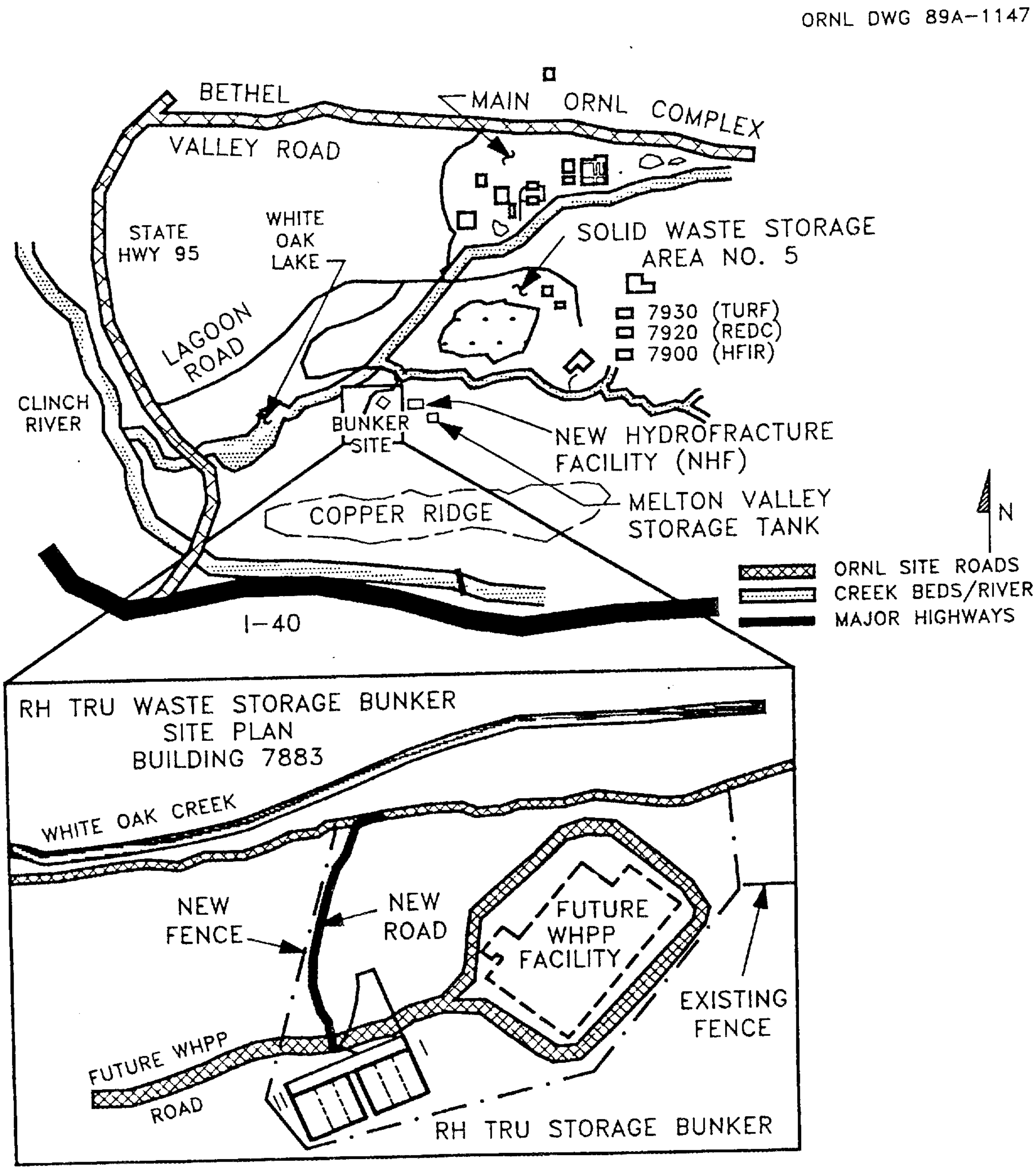

Fig. 19. Location of new RH-TRU storage bunkers I & II.

3.1.1.4.2.4 RH-TRU in Burial Trenches. The general location for RH-TRU waste stored in burial trenches in the north area of SWSA 5 is shown in Figure 17. The trenches, which were used between 1970 and 1979, contain waste in concrete casks and in various boxes. The estimated quantity of RH-TRU waste buried in this manner is 199 concrete casks and 13 wooden boxes.

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 5 North Area is considered to be stored under RCRA interim status. The interim status ends in November 1992.

Completion of the RCRA-required closure of the retrievably buried RH-TRU waste in SWSA 5 North Area by the November 1992 deadline is uncertain due to the complexity of the task. The RH-TRU casks and boxes have very high radiation levels, and considerable safety measures and documentation will be required prior to initiation of closure.

Facility status. Current plans are to apply interim corrective measures to the trench areas and to request an extension of the interim status until the WHPP is operational. The buried waste would then be retrieved and processed in the WHPP.

3.1.1.5 Status of Support Systems

3.1.1.5.1 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 the WIPP.

Training courses on the "Proper Packaging of Transuranic Waste" were held in November 1988, March 1989, September 1989, and December 1989. All personnel who package TRU waste at ORNL are required to satisfactorily complete this course every two years, which includes attending a two hour lecture and passing a written examination. RCRA training is required annually for personnel involved in handling TRU mixed wastes at ORNL (see Section 4.1.6.1 of this plan).

3.1.1.5.2 Certification

The first TRU waste certification plan at ORNL was developed in May 1984. In May 1985, the WIPP-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 the ORNL TRU Waste Program was conducted during December 1985 and January 1986. In January 1986, following a recommendation of the audit team, all TRU waste activities at ORNL were consolidated under a single Program Manager, with additional emphasis on the certification program. The certification program was found to be acceptable and approved by WIPP in June 1986.

An internal QA audit was performed on the NG CH-TRU Waste Certification Program on December 13-14, 1988. Specific areas addressed by this audit were the Isotopes Production Area (Buildings 3033, 3038, and 3047), Mass Spectroscopy (Building 9735), drum procurement and distribution, and the results of previous audits. New findings and observations were related to the need for formal QA plans, document control, drum identification and traceability, drum labeling, and waste operations procedures.

A draft QA plan for the ORNL TRU Waste Certification Program was prepared and distributed for comments in July 1989. The new QA plan was developed as a result of a recommendation from the December 1988 internal QA audit of the CH-TRU Waste Certification Program at ORNL. This document, which was finalized September 29, 1989, provides an independent QA plan to be used in conjunction with the ORNL TRU waste certification document.

During FY 1989, investigations into the facility requirements for loading and leak testing the TRUPACT II shipping package were conducted at ORNL. The TRUPACT II is a NRC-approved CH-TRU waste shipping package that will fit on a flat bed trailer which will be used for shipping CH-TRU waste from ORNL and other DOE sites to the WIPP. The scope of the investigation was to determine what facilities, equipment, and personnel were needed to package and ship ORNL's TRU waste to the WIPP. A plan is being evaluated for WIPP to provide the fixtures and trained personnel needed to perform this packaging function for those sites that generate small amounts of CH-TRU waste. Five generator sites, including ORNL, plan to share the TRUPACT II loading fixtures, sharing the initial cost for the fixtures and associated equipment. At this time, the Mobile Loading System is planned to be used for loading TRUPACT II carriers at ORNL.

3.1.1.5.3 Data Base Management

A computer data base is currently being used at ORNL to monitor the generation rates of radioactive wastes. The SWIMS is the repository of information on the generation of solid radioactive waste, both LLW and TRU waste.

3.1.1.6 Update of Implementation Summary Table

Table 2 provides an update to the original implementation summary for management of transuranic waste that was provided in the ORNL Implementation Plan for DOE Order 5820.2A issued April 28, 1989. The format in Table 2 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 latest TEC for the WHPP has been increased from $130 to $245M and the start date has been moved from FY 1992 to FY 1993. 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. This table indicates the project title, TEC, funding type (i.e., DOE program budget code), and the respective FY for funding.

Table 2. Implementation summary for management of transuranic waste

Requirement/Status	Current practice	Current plans	Completion Date	Estimated Cost Expense	Estimated Cost Capital
a. Waste Classification					
(1) Partial Compliance	Administrative and process controls are used to segregate TRU waste at generation. ^{233}U, ^{224}Ra, ^{252}Cf, and ^{244}Cm are managed as TRU waste at ORNL.	Determine whether ^{244}Cm, ^{233}U, and ^{252}Cf should be formally declared to be TRU.	FY 1990	10K	a
(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.[b]	FY 1992	120K	1.5M
(3) Partial Compliance	c	c	c	c	c
(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[c].	FY 1989	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 repackaging facility for CH-TRU and WHPP for RH-TRU treatment, reduction and shipment.	FY 1994 2005 2013	600K 1.7M 125M	a 6M 245M
(2) Partial Compliance	d	d	d	d	d
(3) Compliance	Treatment of hazardous components is not feasible; however, source reduction is being implemented.	Continue current practice.	a	a	a
(4) a	ORNL does not generate TRU waste that is classified for security reasons.	a	a	a	a

[a]Not applicable.
[b]See b. (1).
[c]See a. (2).
[d]See a. (2-4).

Table 2. (contd).

Requirement/Status	Current practice	Current plans	Completion Date	Estimated Cost Expense	Estimated Cost 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 and certify CH- and RH-TRU waste and eventually ship to WIPP.	b	b	b
(2) Compliance	ORNL does not intend to send uncertified TRU waste to WIPP.	a	a	a	a
(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 and NG RH-TRU documents. Issue stored RH-TRU document. Prepare certification plans for transportation.	FY 1994	150K	a
(4) Partial Compliance	Certification plans contain or will contain controls to ensure adherence to plan.	e	e	e	e
(5) Partial Compliance	e	e	e	e	e
(6) a	a	a	a	a	a
(7) a	a	a	a	a	a
(8) Partial Compliance	Generators' procedures are in place to implement the approved NG CH-TRU Certification Plan.	Revise generators' procedures as needed to implement additional certification plans as approved.	FY 1994	150K	a
(9) Compliance	Support will be provided to audit teams as required.	a	a	a	a
(10) a	a	a	a	a	a
(11) Partial Compliance	Several findings were reported by the last WIPP WACCC audit.	Establish document control system, and resolve remaining findings.	FY 1990	100K	a

[a]See c. (3).

Table 2. (contd).

Requirement/Status	Current practice	Current plans	Completion Date	Estimated Cost Expense	Estimated Cost Capital
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.	b	b	b
(2) Partial Compliance	Some pressure relief devices have been utilized.	Utilize pressure relief devices in repackaging.	b	b	b
(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 will mark and label CH-TRU containers. RH-TRU sealing and labeling will be done at WHPP.	b	b	b
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.	f	f	f	f
(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 1994	150K	2.75M
(3) Partial Compliance	Access is controlled for current TRU storage facilities.	Access controls will be included as needed in new storage projects.	g	g	g
(4) Partial Compliance	Limited monitoring is performed to detect releases.	New storage facilities will provide improved monitoring capabilities.	g	g	g
(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.	g	g	g
(6) Partial 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 1993	50K	a
(7) Compliance	Facility design and operation helps keep exposures ALARA.	ALARA principles will be incorporated into design and operation of new facilities.	g	g	g

[f]See a. (1).
[g]See e. (2).

Table 2. (contd).

Requirement/Status	Current practice	Current plans	Completion Date	Estimated Cost Expense	Estimated Cost 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.	b	b	b
(2) Compliance	a	ORNL will utilize the TRUPACT II for CH-TRU and the DOE-authorized package for RH-TRU.	b	b	b
(3) Compliance	a	ORNL will provide required shipping papers.	b	b	b
(4) Compliance	a	ORNL will distribute shipping papers as specified.	b	b	b
(5) Compliance	ORNL has required current authorization/permits for shipments.	Additional authorizations/permits will be obtained if necessary.	b	b	b
(6) Compliance	ORNL properly placards all current shipments.	ORNL will properly placard TRU waste shipments when they begin.	b	b	b
(7) Compliance	a	ORNL will utilize "exclusive use" vehicles and the TRANSCOM tracking system.	b	b	b
(8) a	a	a	a	a	a

Table 2. (contd).

Requirement/Status	Current practice	Current plans	Completion Date	Estimated Cost Expense	Capital
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.[g]	g	g	g
(2) Partial Compliance	RCRA permit applications have been prepared for two planned storage facilities.	Prepare RCRA permit applications for the remianing facilities. All four new facilities will be designed and operated in compliance with items a-j.	g	g,h	g
(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 g	1M g	a g
(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.	g	g	g
(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.	b	b	b
(6) Compliance	i	i	b	b	b
(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	b	b
(8) Partial Compliance	j	j	j	b	b
h. WIPP					
(1-8)[a]	Requirements h. (1-8) are applicable to WIPP.	a	a	a	a

[g]See e. (6).
[i]See g. (5).
[j]See g. (7).

Table 2. (contd).

Requirement/Status	Current practice	Current plans	Completion Date	Estimated Cost Expense	Estimated Cost Capital
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.	a	a	a
(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) and CERCLA (as amended by SARA).	Continue RI/FS for sites containing TRU wastes, as part of DOE ER Program.	k	k	k
(3) Compliance	Closure strategies will be developed under the RI/FS program.[l]	Continue RI/FS for sites containing TRU wastes, as part of DOE ER Program.	k	k	k
(4) Compliance	m	Continue RI/FS for sites containing TRU waste, as part of DOE ER Program.	k	k	k
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	a
		TOTALS	FY 2013	129M	256M

[a]TBD. The toal scope of the ORNL RAP is estimated at $1.3 billion, to be completed by year 2010.
[k]See i. (2).
[m]See i. (2-3).

Table 3. Line Item and General Plant Projects for TRU waste facilities at ORNL

Title	TEC	Funding type	Fiscal year
Line Item projects:			
Waste Handling and Packaging Plant	$245,000,000	GF	FY 1993
Waste Characterization and Certification Facility	9,000,000	KG	FY 1993
General Plant Projects:			
RH-TRU Waste Storage Bunker I	840,000	KG	FY 1989
TRU-SLLW Staging Facility SWSA 5	425,000	GF	FY 1989
CH-TRU Storage Facility	900,000	GF	FY 1990
WEAF Upgrade	100,000 700,000	GF	FY 1990 FY 1991
RH-TRU Waste Storage Bunker II	900,000	GF	FY 1991
CH-TRU Repackaging Facility	1,100,000	GF	FY 1992

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 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 SLLW and extremely small volumes of waste containing NARM. Past and current waste management practices did not differentiate NARM waste from LLW. However, unresolved issues exist regarding whether NARM wastes may be regulated under RCRA or TSCA regulations. This is an area in which DOE-HQ is preparing regulatory guidance for field sites. According to DOE Order 5820.2A, small volumes of NARM waste can continue to be managed as LLW. The decision tree for the segregation and disposition of various types of LLW is shown in Figure 12 (Section 3.1).

3.1.2.1.1 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 SLLW segregation categories are presented in Table 4.

Until 1986, all SLLW 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 currently active disposal area at ORNL, has been used for LLW disposal since the early seventies. Starting in 1984 the practice of shallow land disposal on the ORR has come under closer scrutiny by Federal and State regulators and DOE officials. 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 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 ORGDP and of all mixed waste at ORNL. Currently, the LLW operating strategy at ORNL is the one

Table 4. Current SLLW segregation categories

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

initiated in 1986. Because of the disposal practices in SWSA 6 prior to 1986, some areas in SWSA 6 are being remediated under an interim status RCRA compliance closure agreement with the TDHE. These remediation activities are coordinated with current waste disposal operations.

Estimates indicate that up to 10 years of disposal capacity exist in SWSA 6, using current below-grade technologies and assuming current waste disposal generation rates. Because of RCRA compliance agreements, plans are now to phase out the GCD below-grade disposal operations in SWSA 6 by May 1992.

3.1.2.1.2 LLWDDD Program

In 1986 Energy Systems established the LLWDDD Program to develop a comprehensive strategy for managing LLW on the ORR. The strategy developed by LLWDDD established "classes" of disposal technologies for managing on-site generated LLW, depending upon the specific isotopic composition and concentration in the waste. The five classes of LLW disposal technologies identified in the LLWDDD strategy are as follows:

(1) BRC Waste - LLW that is suitable for disposal in a sanitary/industrial landfill facility and will not expose any member of the public to an effective dose equivalent of more than 4 mrem/year at the time of disposal,

(2) Class I Waste - LLW that is suitable for disposal using sanitary/industrial landfill technology and will not expose any member of the public to an effective dose equivalent of more than 10 mrem/year at the time of disposal,

(3) Class II Waste - LLW primarily containing fission product radionuclides with half-lives of 30 years or less that is suitable for disposal in engineered facilities designed to isolate the waste from the environment and public for a period of time sufficient to allow the decay of radionuclides to such a level that any member of the public will not be exposed to an effective dose of more than 10 mrem/year,

(4) Class III Waste - LLW consisting of radionuclides that have long half lives and will be disposed of in facilities having intruder protection, and

(5) Class IV - LLW not suitable for disposal on the ORR and which would require either treatment to reduce the contamination to a level consistent with any of the other four waste classifications for shipment to an off-site disposal facility.

A draft of the proposed LLWDDD strategy was submitted to the DOE-ORO in July 1987. A summary of both the strategy and the implementation plans prepared by Energy Systems installations was prepared and submitted to DOE-ORO on December 16, 1988. ORNL was assigned the responsibility for the design and construction of the Class II IWMF and the overall management responsibility for the TDDP.

In the implementation of the LLWDDD strategy, the PAs will establish the specific waste classification requirements for the various waste disposal technologies. ORNL plans to phase the LLWDDD strategy into operations before 1992. Figure 20 provides the anticipated schedule and the expected duration of the availability of treatment, storage, and disposal facilities for managing ORNL's SLLW.

3.1.2.1.3 Performance Assessments

DOE Order 5820.2A requires a site-specific PA on all new disposal facilities and for any disposal facility that was in operation as of September 26, 1988. The RWMD has been assigned the responsibility for the preparation and the issuance of the radiological PAs, as required under DOE Order 5820.2A, for existing and new LLW disposal sites for all applicable Energy Systems installations. The RWMD has formed a RPAT which has been delegated the responsibility for the preparation of the radiological PAs. Each Energy Systems installation has a representative on the RPAT who is referred to as the PAM. The PAM is responsible for the content and completion of the radiological PAs, and for providing the RPAT with the data required for conducting the PA, such as information on site characterization, waste inventories, and disposal technologies in use or planned for use at their respective site.

Each PA will be submitted to the DOE for review by the DOE Peer Review Team. A final PA report will be issued that reflects the resolution of comments received by the DOE Peer Review Team. For ORNL, a radiological PA will be prepared for disposal technologies and active units (as of September 26, 1988) in SWSA 6, and for the proposed Class II IWMF to be located in the southwestern portion of SWSA 6. The final PA report for both disposal facilities is scheduled to be delivered to DOE-ORO for submittal to DOE-HQ during June 1990. The PA is scheduled for review by the DOE Peer Review Team during the first quarter of FY 1991, with final release set for September 1991. The actions and schedule for completing the SWSA 6 (GCD/IWMF) PA are contained in Table A.1 of this plan (Appendix A).

3.1.2.2 Generic Description and Characteristics of Waste

Approximately 50,000-80,000 ft^3/year of SLLW is routinely handled at ORNL. The major volume of LLW is CH waste, with a radiation level less than 50 mrem/hr. As presented in Table 4, the various categories of LLW at ORNL are discussed in the following sections.

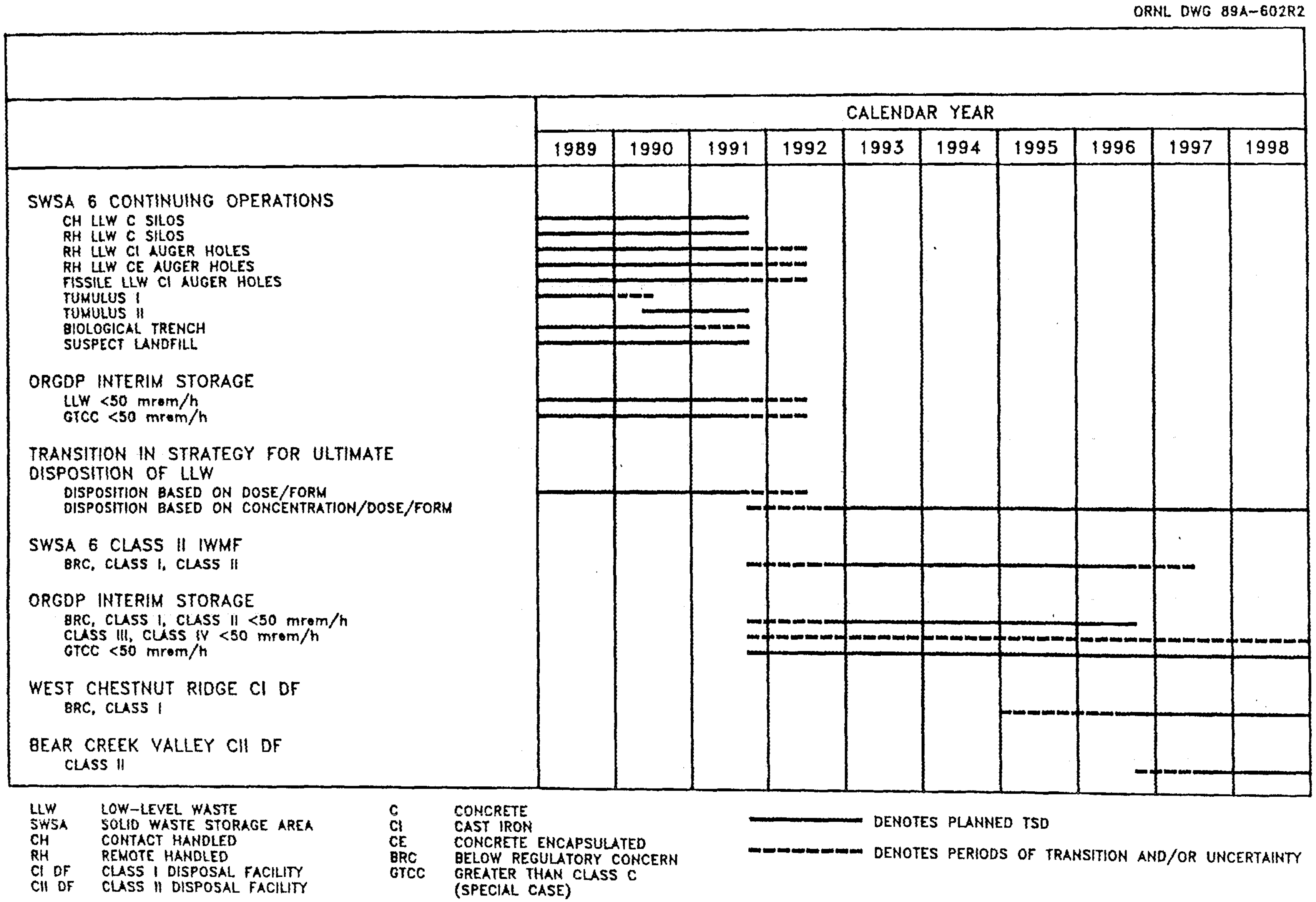

Fig. 20. Projected availability of LLW TSD facilities.

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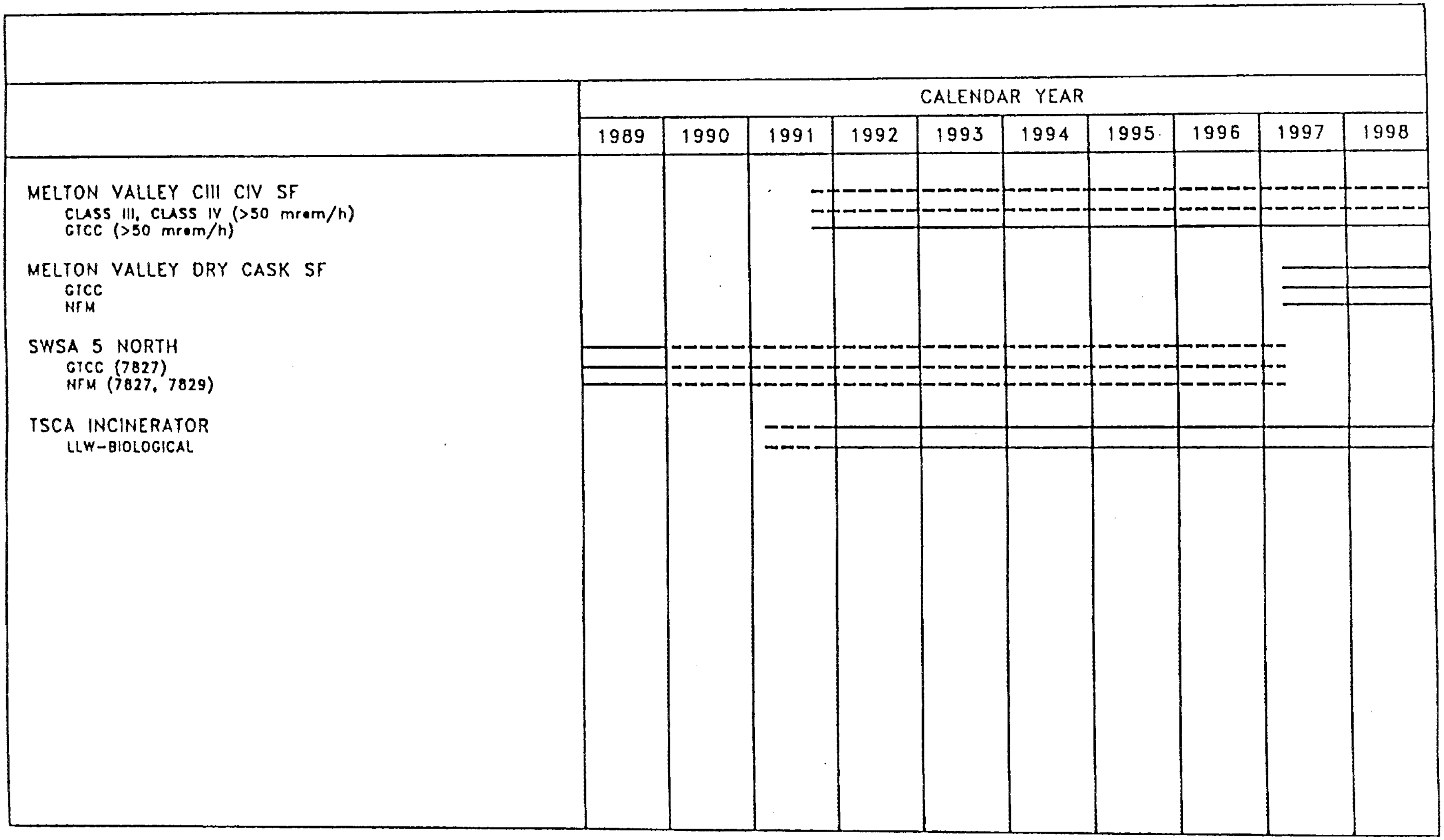

SF	STORAGE FACILITY	NFM	NUCLEAR FUEL MATERIAL
GTCC	GREATER THAN CLASS C	LLW	LOW-LEVEL WASTE
SWSA	SOLID WASTE STORAGE AREA	CIII	CLASS III
TSCA	TOXIC SUBSTANCE CONTROL ACT	CIV	CLASS IV

Fig. 20. (contd).

3.1.2.2.1 CH-LLW

CH-LLW is waste that has a radiation dose rate at the surface of the package of ≤200 mrem/hr 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 PWTP.

3.1.2.2.1.1 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/hr. Most compactible waste has a surface dose rate less than 10 mrem/hr. CH-LLW which is to be shipped to ORGDP for storage is limited to a dose rate no greater than 50 mrem/hr. For handling purposes, compactible CH-LLW is segregated and collected in separate containers throughout ORNL.

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

3.1.2.2.1.3 Solidified sludges. The principle source of CH-LLW sludges is ferrous hydroxide from the PWTP.

3.1.2.2.2 RH-LLW

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

3.1.2.2.2.1 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 by remote means. 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 rem/hr.

3.1.2.2.2.2 Solidified sludges. Special campaigns for solidification of sludges from the LLLW system will produce a RH-LLW.

3.1.2.2.2.3 ^{235}U-LLW. ^{235}U-LLW usually consists of debris from production operations where enriched uranium is processed. For criticality and security reasons, waste containing greater than 1 g of ^{235}U is handled and disposed of separately.

3.1.2.2.2.4 Biological LLW. Biological LLW mainly consists of animal excrements and animal bodies or parts that were generated when radionuclides were used in biological research. The activity of this type of waste is usually very low (i.e., much less than 10 mrem/hr).

3.1.2.2.2.5 Asbestos 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 LLW is usually very low (i.e., much less than 10 mrem/hr).

3.1.2.2.2.6 Suspect LLW. Suspect LLW usually consists of construction debris waste that is generated during the demolition of facilities. Because of the history and location of these facilities, the debris may be contaminated even though radiation surveys do not reveal contamination.

3.1.2.3 Treatment Facilities

Extensive facilities for the treatment of SLLW do not currently exist or are planned at ORNL. Existing treatment facilities at ORNL for treating SLLW consist of the WEAF (inspection facility) and the waste compaction facility (Bldg. 7831) in SWSA 5. A concrete waste grouting facility and the WCCF (inspection facility) are planned facilities.

Treatment facilities at other plant sites within the ORR may be used to treat a portion of ORNL's SLLW in the future. For instance, ORMWI at the ORGDP may be used for the thermal treatment of biological waste. This document only addresses existing or planned treatment facilities at ORNL.

3.1.2.3.1 Waste Examination and Assay Facility (Bldg. 7824)

The WEAF is an existing facility located in SWSA 5 that is used for examination of both solid CH-LLW and CH-TRU waste. This facility is discussed under the section of this plan regarding TRU waste treatment facilities (see Section 3.1.1.3.1.1).

3.1.2.3.2 Waste Compaction Facility (Bldg. 7831)

Building 7831, which is located in the north area of SWSA 5 is a metal Butler-type building approximately 40-ft X 43-ft with a personnel area and a 15-ft high compactor area. The compactor area occupies half of the building and houses a box compactor and a compactor-baler. The box compactor is used to reduce compactible CH-LLW waste into 4-ft X 4-ft X 6-ft metal boxes with a compression force of 1,750 psi. The compactor-baler (50-ton compression force), which is no longer in service, was previously used to compact and bale CH-LLW in cardboard boxes.

3.1.2.3.2.1 Environmental monitoring. Two continuous air monitors are provided to monitor and 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.

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

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

3.1.2.3.3 Waste Grouting Facility (Bldg. 7878)

This planned facility will be used for filling voids in waste packages and the annular space around metal boxes placed in concrete boxes for tumulus disposal. The facility will utilize an existing Butler-type metal building (approximately 40-ft X 80-ft in size) in SWSA 6. The existing building was built on a concrete slab with a sump for collection of any spill. Upgrade to the facility will consist of the construction of a covered concrete pad with curbing for housing a grout pump, grout feed hopper, and HEPA filter housing and fan system. The grouting equipment will consist of a grout pump and hopper. Grout will be delivered to a grout work station inside the building through flexible lines. Special grout injection lids for the waste containers will be utilized for injecting the grout. The grout work station will be equipped with a HEPA filtered exhaust hood.

3.1.2.3.3.1 **Environmental monitoring.** Continuous air monitors will be utilized for monitoring and alarming if airborne contamination exceeds prescribed limits. Monitoring of the area for radiation levels will be performed using portable survey instruments during operations.

3.1.2.3.3.2 **Permitting status.** A RCRA permit is not required to operate this facility. An AcDM has been prepared for this capital project.

3.1.2.3.3.3 **Facility status.** The project title is "SWSA 6 Staging Area Upgrade" and the facility is a planned FY 1990 GPP. A preliminary proposal has been prepared and construction is expected to begin in late 1990. The TEC for the facility is $525K.

3.1.2.3.4 Waste Characterization and Certification Facility

This facility is a planned FY 1993 LI project to be located in SWSA 7 to replace the WEAF. This inspection facility is discussed under the section of this plan regarding CH-TRU waste treatment facilities (see Section 3.1.1.3.1.3).

3.1.2.4 Storage Facilities

Interim storage of SLLW 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 two interim storage facilities: the ORGDP K-25 storage vaults, and the EASC cask storage area. Building 7842 in SWSA 6 has been used as a temporary storage facility for SLLW prior to placement on the Tumulus I Pad. The intention is to utilize interim storage only until suitable permanent disposal can be developed.

3.1.2.4.1 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 I Pad. Storage in this facility is usually limited to less than 90 days. Building 7842, which was originally constructed to store SWSA 6 heavy equipment, is a pre-fabricated metal structure on a reinforced concrete pad. The building, which is approximately 40-ft X 80-ft in size, is equipped with electricity and telephone lines.

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

3.1.2.4.1.2 Permitting status. A RCRA permit is not required.

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

3.1.2.4.2 ORGDP Storage Facility

Some CH-LLW activity is currently being stored at ORGDP in Building K310-2. The ORGDP storage facility, which can only accommodate CH-LLW with a surface dose rate of <50 mrem/hr, utilizes the surplus K-25 building at the ORGDP for storage. The first waste stream shipped to ORGDP for interim storage was dewatered sludge from the PWTP (Building 3544). This waste stream is fairly homogeneous and of very low activity. Currently, the PWTP waste and compactible waste in metal boxes are being shipped to ORGDP for interim storage. To date, approximately 1,400 drums of SLLW and 100 4-ft X 4-ft X 6-ft boxes from ORNL are being stored at ORGDP.

3.1.2.4.2.1 Environmental monitoring. SLLW is being shipped to the ORGDP that meets the facility storage WAC. Overall monitoring of the facility is the responsibility of ORGDP.

3.1.2.4.2.2 Permitting status. Permitting of the storage facility is under purview of the ORGDP.

3.1.2.4.2.3. Facility status. The facility is expected to be utilized until the LLWDDD strategy is implemented and the ORR Class I and II disposal facilities are available.

3.1.2.4.3 EASC Cask Storage

An interim storage facility for storing solidified waste from the EASC of 1987 is located near the NHF. This storage facility was designed specifically for storing the cement solidified LLW generated during the processing of 47,000 gal of LLLW.

The solidified waste is contained in interim storage casks which 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 1-ft thick steel-reinforced concrete with an inner liner of corrosion-resistant synthetic, vinyl ester, fiber-reinforced plastic laminate. Each cask is about 9-ft in diameter and about 9-ft high, and has a precast waterproof reinforced concrete cask lid 1-ft thick. A total of 60 casks were used during the campaign.

The storage facility consists of a graveled-pad interim-storage yard. The storage area is approximately 300-ft X 400-ft in size. 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.

3.1.2.4.3.1 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.

3.1.2.4.3.2 Permitting status. The facility is being operated per an agreement with TDHE. The agreement with TDHE limits storage at the site to a maximum of five years, (i.e., 1992). A RCRA permit is not required for this facility.

3.2.1.4.3.3 Facility status. The facility will be closed as required by agreement with TDHE.

3.1.2.5 Disposal Facilities

ORNL is currently operating SWSA 6 as a disposal site for SLLW. This site has been used by ORNL for approximately the last twenty years for the disposal of on-site generated SLLW. ORNL has also been developing SWSA 7 for the last 10 years as an additional disposal site for SLLW.

Future disposal operations at SWSA 6 will gradually incorporate the LLWDDD strategy and utilize above-grade engineered tumulus disposal for the majority of SLLW disposed in SWSA 6. Long range ORR Class I and II disposal facilities will be placed into operation and SWSA 6 will be closed. SWSA 7 is a candidate site for planned treatment facilities and possibly Class II waste disposal.

SWSA 6 is located south of Lagoon Road and immediately east of White Wing Road. Development of this 68-acre site was started in 1959. An 8-ft high chain link fence with 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-1990s (see Section 3.1.2.5.4). Less than 30 acres of usable land is available in this 68-acre tract.

Since 1986, SWSA 6 has utilized a variety of GCD techniques for the disposal of ORNL SLLW. These techniques include 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 5.

The majority of CH- and RH-LLW being disposed of in SWSA 6 would likely be classified as Class II LLW under the 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 underway. Details on the specific disposal methods employed in SWSA 6 are discussed in the following sections.

Table 5. Disposal method for waste currently disposed in SWSA 6

Waste type	Disposal method
CH-LLW	.Concrete silos/tumulus
RH-LLW (≤1 rem/hr)	Concrete silos
RH-LLW (>1 rem/hr)	Double-walled pipe wells, wells in silos
^{235}U (Fissile waste)	Lined auger holes
Biological waste	Unlined trenches
Asbestos	Concrete silos
Suspect construction debris	Landfill

3.1.2.5.1. 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/hr 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.

3.1.2.5.1.1 Concrete silos. Concrete silos are used for most CH-LLW and some RH-LLW (<1 rem/hr). These concrete silos are located in separate areas of SWSA 6. A concrete silo is constructed of two 16-gauge, corrugated steel pipes, one 8-ft diameter and the other 9-ft 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 14-ft to 20-ft in length, depending upon the depth of the water table at a given location. A wire reinforced, 12-in thick, 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 2-ft above the maximum water table elevation. A 3-in diameter 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 2-3 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 as TL-XXX (Trench/low-range). The silo is capped with a 12-in thick, steel-reinforced concrete cap. A section view of a typical silo used for CH- and RH-LLW is shown in Figure 21.

3.1.2.5.1.2 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/hr). A concrete silo is constructed in the same manner as for CH-LLW. In addition, seven to eleven, 20-in diameter by 20-ft long, cast iron pipes are placed vertically in a geometric array within the 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 12-18-in concrete base is poured into the pipes. When the pipes are filled within 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 Figure 22. No limits exist on the amount of radioactive material placed in the well, provided the radiation reading over the top for the well does not exceed 200 mrem/hr.

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

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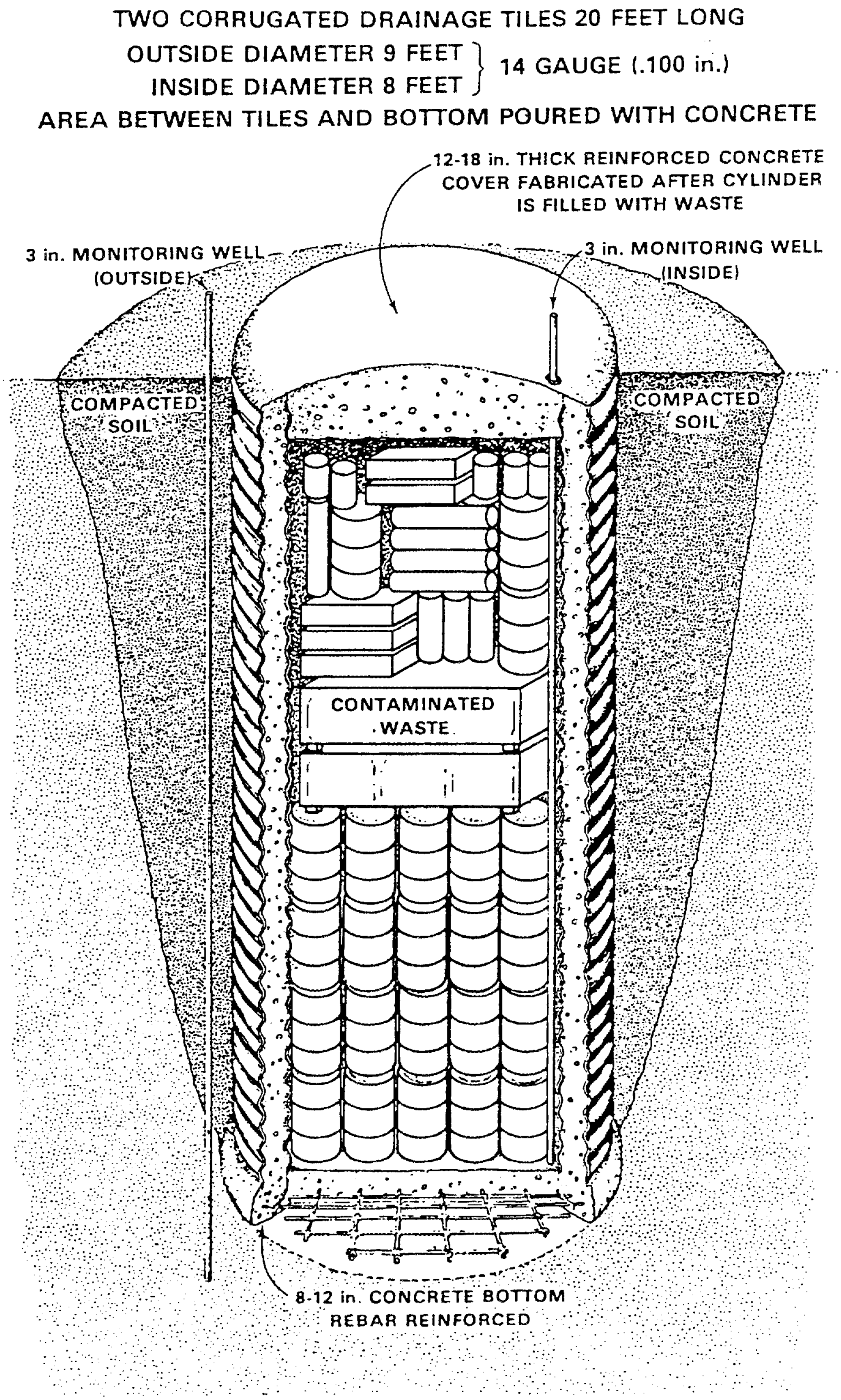

Fig. 21. Schematic of concrete silo in SWSA 6.

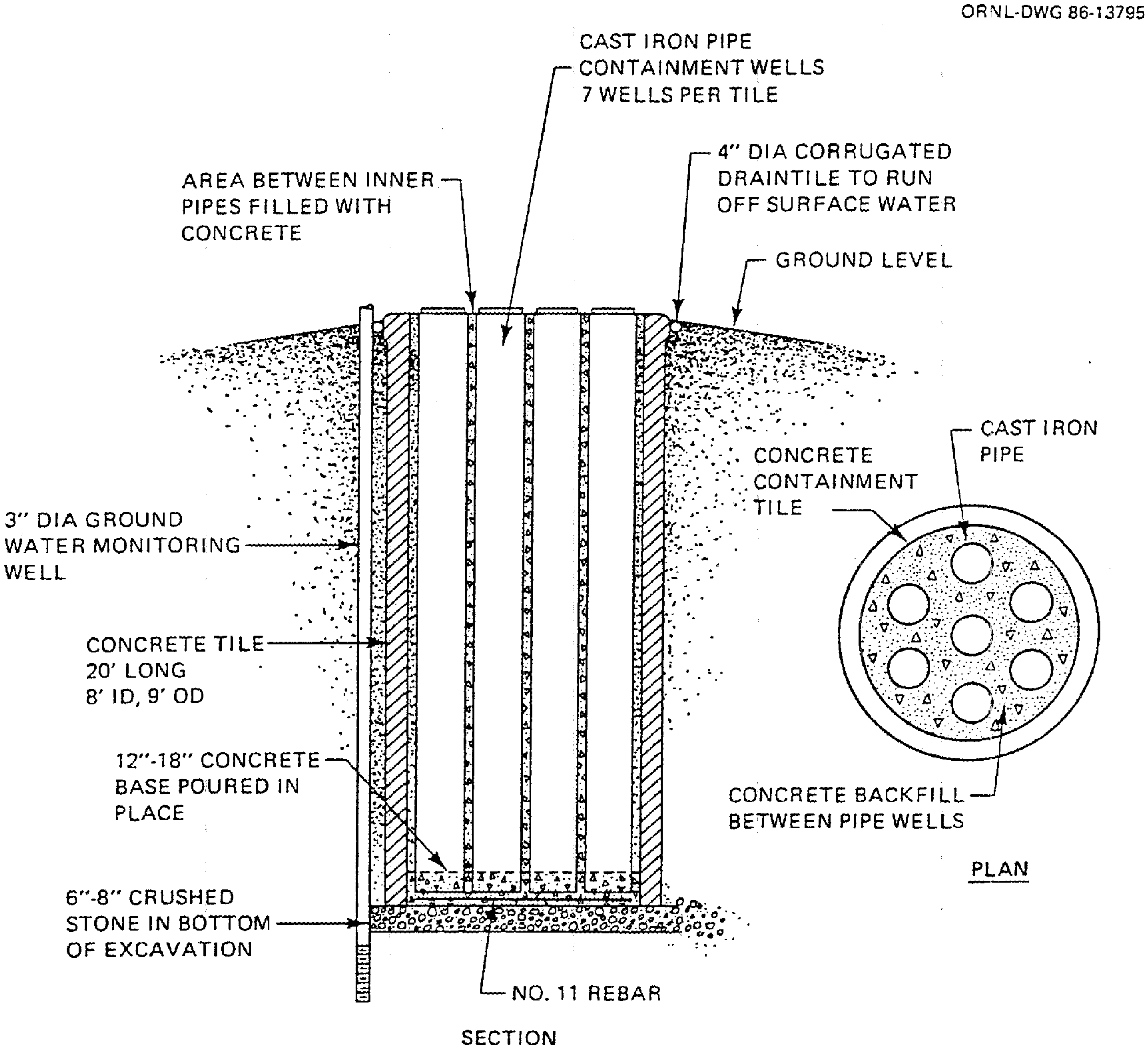

Fig. 22. Cross-section of concrete silos with containment wells.

A monitoring well, made from a 3-in diameter PVC pipe, with a bottom cap slotted 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 as WH-XXX (Well/high-range).

Only radioactive waste packaged in 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/hr. 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 12-in thick by 48-in OD concrete collar. After closure and capping of the well, the radiation reading over the top of the well must be less than 2.5 mrem/hr.

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

A monitoring well, made from a 3-in diameter PVC pipe, with a bottom cap and slotted 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 as WH-XXX (Well/high-range). Very high activity (>1 rem/hr) RH-LLW in waste containers 20-in diameter are placed in these wells. After an auger hole is filled, the hole is then capped with a 12-in thick by 48-in OD 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/hr.

3.1.2.5.1.5 **^{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 numbered as WF-XXX, (Well/fissile). The fissile disposal wells are spaced so that a minimum of 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, with the top at ground level. The pipe is normally 20-ft long with a 30-in ID, with dirt backfilling around the outside of the pipe. A bottom cap of at least 12-in of concrete is poured in the bottom. All below-grade fissile disposal wells are constructed with their lowest point a minimum of two feet above the maximum known water table elevation. When the fissile disposal well is filled, a top cap 12-in deep by 48-in OD collar is poured around the top.

3.1.2.5.1.6 Trench disposal. Biological waste is disposed of in trenches that are nominally 50-ft long by 10-ft wide and the depth varies depending upon the water table elevation. The lowest point in the trench is at least 2-ft above the known maximum water table elevation. Spacing between adjacent trenches is at least 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 as TB-XXX (Trench/biological). Surface water drainage is controlled by separate ditching around the trench which 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 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 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 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.

3.1.2.5.1.7 Asbestos waste disposal. Contaminated asbestos waste containers are disposed of in dedicated concrete silos. The concrete silos are constructed as described in Section 3.1.2.5.1.2 of this plan.

3.1.2.5.1.8 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 one acre and is an open landfill-type site. Only waste classified as suspect waste is disposed of in this area.

3.1.2.5.2 Above-Grade Tumulus Disposal

Above-grade tumulus disposal is the preferred method for disposal of LLW in SWSA 6 and will be completely phased into operation over the next several years. Currently, Tumulus I is being used for the disposal of some SLLW in SWSA 6. The planned Tumulus II and the Class II IWMF will be used for SLLW disposal in SWSA 6 until the ORR Class I and II disposal facilities are operational. The site layout of SWSA 6 showing the location of Tumulus disposal is shown in Figure 23.

3.1.2.5.2.1 Tumulus I Demonstration Disposal Project. Tumulus is the disposal technology that has emerged as the preferred option for disposal of Class II LLW on the ORR. The basic concept involves the placement of containerized SLLW into concrete rectangular box-type casks which are subsequently loaded and stacked on a curbed concrete pad and capped with natural materials (Figure 24). The TDDP was developed and implemented as part of the LLWDDD Program. The Tumulus I pad was constructed in SWSA 6 during early 1987. Actual loading of concrete casks onto the pad began on April 11, 1988.

The Tumulus I pad is approximately 65-ft wide and 105-ft long. The pad was constructed using high strength (6,000 psi) concrete and reinforced using epoxy-coated rebar. The concrete pad varies in thickness from 8-in at the center to 16-in along the perimeter of the pad. The pad has a concrete curb 6-in high 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 casks that are loaded and stacked on the concrete pad are designed to be used as structurally stable overpacks for containerized SLLW. The concrete casks outer dimensions are 7-ft, 10-in long, with an inner cavity that is sized to receive a standard box 6-ft long, 4-ft wide, and 4-ft high and leave a 4-in annular space. After the containerized solid LLW is placed in the cask, the annular space is filled with concrete and a pre-cast concrete lid is placed on the cask and sealed with bitumen. The loaded and sealed concrete casks are subsequently placed and stacked on the tumulus pad in rows abutting each other.

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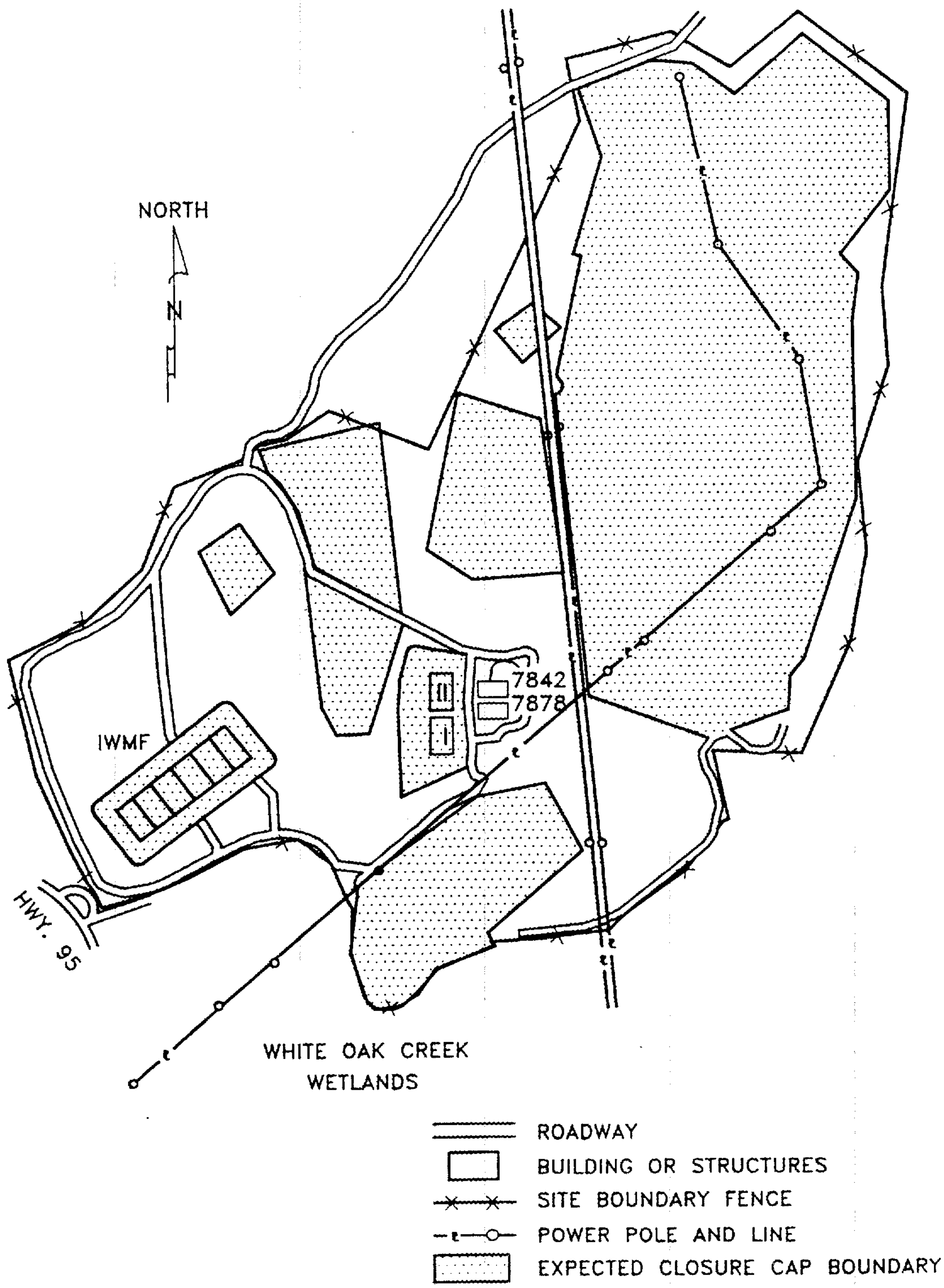

Fig. 23. Location of tumulus disposal (Tumulus I, Tumulus II, Class II IWMF) in SWSA 6.

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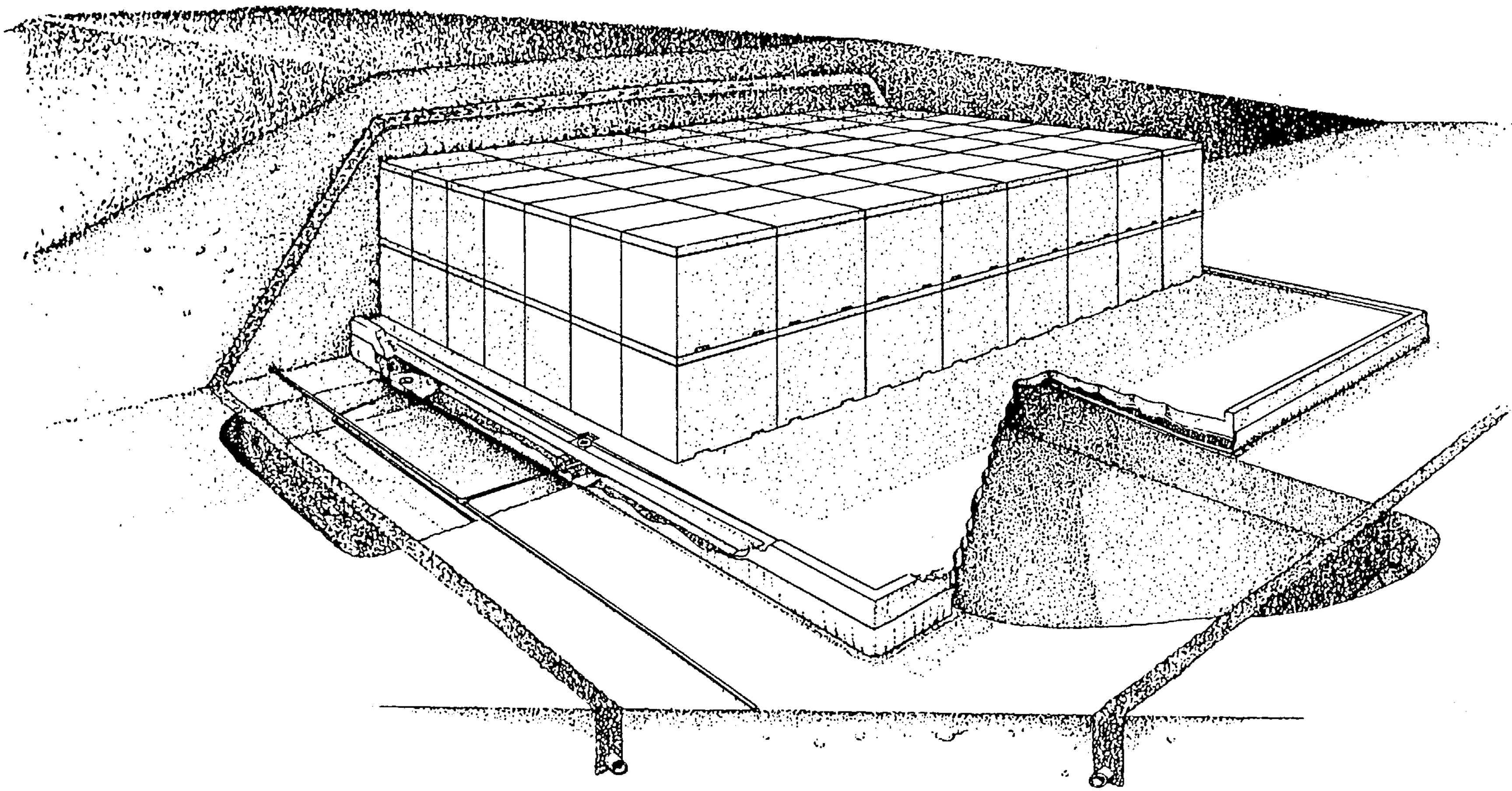

Fig. 24. TDDP showing casks of ¯ ¯W, drain lines, and final cover.

As of October 1989, 217 concrete casks have been placed on the pad. The pad will accommodate a total of 290 casks using the revised cask orientation plan. The disposal capacity of the fully loaded pad will be approximately 28,000 ft^3. The pad is anticipated to the fully loaded during the early part of 1990.

3.1.2.5.2.2 **Tumulus II disposal.** Tumulus II is a facility planned to provide a means for disposing of SLLW in SWSA 6, with an anticipated operational start date beginning during the third quarter of 1990. The disposal capacity of Tumulus II is anticipated to be depleted by the third quarter of 1991. This period will follow the depletion of disposal capacity for Tumulus I and precede the operation of the proposed Class II IWMF to be constructed in the southwestern portion of SWSA 6.

The Tumulus II pad will be located on an approximately one acre site just north of the Tumulus I pad (Figure 18). The tumulus pad will be approximately 60-ft wide, 90-ft long, and 12-in thick. The pad will be constructed of high density concrete and reinforced with epoxy-coated steel. The pad will have concrete curbs 1-ft high on the south, east, and west sides. The north side will not have a curb, and will be used for vehicle access during cask unloading operations. The loading area will be adjacent to the north side of the pad and will be constructed of crushed stone. Surface drainage channels will be constructed north and east of the pad. These channels will be connected to the existing surface drainage channels for Tumulus I.

3.1.2.5.2.3 **Class II IWMF.** As currently planned, the Class II IWMF will provide the means for disposing of SLLW in SWSA 6, with an anticipated operational start date beginning during the fourth quarter of 1991. The disposal capacity of the Class II IWMF is anticipated to be depleted by the third quarter of 1996. This is the period following the termination of all disposal operations in the other portions of SWSA 6, due to RCRA closure requirements, and preceding the operation of the planned FY 1992 LI projects for the proposed Class I and II Disposal Facilities proposed for construction in West Bear Creek Valley.

The Class II IWMF will occupy an area of approximately 9.5 acres in the southwest portion of SWSA 6. Construction will be phased, and will occur over a period of five to six years. The first phase will include the construction of two tumulus pads, loading area, surface drainage channels, under- and surface-pad drainage systems, 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 60-ft wide, 90-ft long, and 12-in thick. The pads will be constructed using high density concrete and reinforced with epoxy-coated steel.

3.1.2.5.3 Environmental Monitoring

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

The entire environmental monitoring program at ORNL is undergoing review and will culminate in a revised EMP meeting the requirements of DOE Order 5400.XY, Radiological Effluent Monitoring and Environmental Surveillance. The revised EMP will cover all activities at ORNL, not just those related to LLW. The revised EMP and its associated program will coordinate all environmental monitoring and surveillance activities at ORNL to: (1) assure compliance with all Federal, State, and DOE requirements for the prevention, control, and abatement of environmental pollution; (2) assess facility performance; (3) monitor the adequacy of containment and effluent controls; and (4) assess impacts of releases from ORNL facilities on the environment. As a result, ORNL's plan for compliance with Order 5400.XY implicitly ensures compliance with the environmental monitoring requirement for 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.

3.1.2.5.3.1 **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.

3.1.3.5.3.2 **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 Tumulus I, the sealed concrete pad is the primary barrier from the groundwater. The pad is sloped 1 percent 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 to receive, monitor, and collect samples from flows received from both the surface pad drain and under-pad liner drain systems.

3.1.2.5.4 Permitting Status

SWSA 6, which has both active and inactive disposal units, is currently operating under a RCRA interim status closure agreement with the TDHE, which incorporates RCRA Section 3004(u) provisions. Regulatory compliance requirements under RCRA will cause the cessation of all below-grade disposal technologies as early as May 1992. Closure activities in SWSA 6 under RCRA are expected to occur during 1991 through 1993 depending on the number and complexity of corrective measures implemented. Closure activities are not expected to affect the construction and operation of the proposed Class II IWMF in the southwestern portion of SWSA 6.

An ORR EIS for all waste activities is currently being prepared by the RWMD. This EIS will specifically address the Class I and II disposal facilities being planned by RWMD. Two sites in the ORR that will be evaluated for the Class I disposal facility are located in East Chestnut Ridge and West Chestnut Ridge. The two sites within the ORR being evaluated for the Class II disposal facility are West Bear Creek Valley and SWSA 7. The ORR EIS is scheduled to be released for public comment by the end of March 1990. A ROD is anticipated by September 1990.

3.1.2.5.5 SWSA 7

As previously discussed, SWSA 7 is a disposal site at ORNL that has been under development for the last 10 years for the disposal of SLLW. The site is located to the east of the current disposal site in an area east of HFIR (Figure 25). The site is relatively hilly with only about 17 acres of usable space. SWSA 7 is also the proposed site of several planned TRU waste and SLLW treatment and storage facilities, as well as a candidate site for tumulus disposal.

3.1.2.5.6 ORR Class I Disposal Facility

The RWMD has been assigned the responsibility for the development of new Class I and II SLLW facilities on the ORR. Candidate sites for the new Class I DF include East Chestnut Ridge and West Chestnut Ridge (Figure 25). Conceptually, the Class I DF will consist of a series of below-grade trenches with an average depth of 30-ft, length of 150-ft, and width of 60-ft. Trench dimensions will vary in an effort to optimize space available for disposal. The trenches will be lined on the sides and the bottom with a synthetic membrane. The bottom of the trench will have an additional liner under the synthetic liner and both liners will have associated sumps and leachate collection systems. Each trench will be designed to handle approximately 1.6×10^6 ft^3 of Class I waste (assuming 50 percent trench disposal efficiency). Sediment basins will be constructed to catch and hold uncontaminated water originating from the trenches during operations. Leachate collected from the liner systems will be transferred to an on-site leachate treatment facility for processing and release to surface waters.

Ancillary facilities will include an administration building, a waste verification station, a waste staging area, a heavy equipment storage facility, a decontamination vehicle monitoring station, and a guard portal. The Class I DF is anticipated to be operational by the end of 1995.

3.1.2.5.7 ORR Class II Disposal Facility

Candidate sites for the new Class II DF include West Bear Creek Valley and SWSA 7 (Figure 25). The preferred site is West Bear Creek Valley. Conceptually, the Class 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 proposed for the Class II IWMF. The Class II IWMF, while creating disposal capacity for ORNL during 1992-1996, will also serve as a

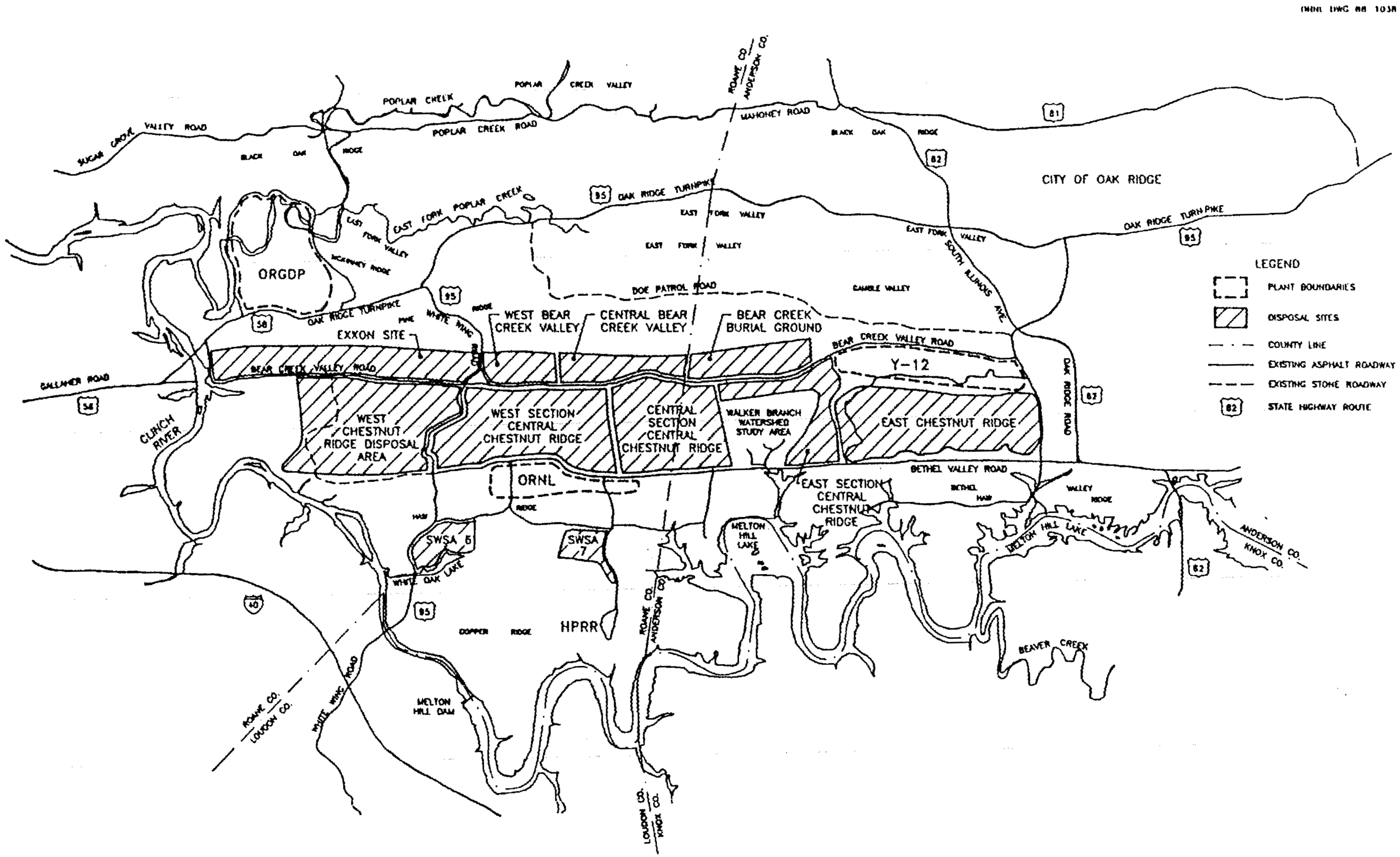

Fig. 25. Location of waste disposal sites on the Oak Ridge Reservation.

prototype for the Class II DF. The Class II DF will have ancillary facilities similar to those for the Class 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 Class II DF is anticipated to be operational by the end of 1996.

3.1.2.6 Status of Support Systems

3.1.2.6.1 Training

The SLLW generator training course is required for waste generators at ORNL in order 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 low-level waste; 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).

3.1.2.6.2 Certification

The strategy for a new certification program was published in September 1989. The current program is being revised to meet the requirements of DOE Order 5820.2A. Several certification demonstration projects are currently underway at ORNL. These projects are discussed in Section 8.6 of this plan.

3.1.2.6.3 Data Base Management

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

3.1.2.7 Update of Implementation Summary Table

Table 6 provides an update to the original implementation summary for management of low-level waste that was provided in the Oak Ridge National Laboratory Implementation Plan for DOE Order 5820.2A issued April 28, 1989. The format in Table 6 duplicates the format of the requirements for the management of LLW contained in DOE Order 5820.2A. Many activities planned for achieving

Table 6. Implementation summary for management of low-level waste

Requirement/Status	Current practice	Current plans	Completion Date	Estimated Cost Expense	Estimated Cost 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.	a	a	a
(2) Compliance Status to be Determined	d	a	a	a	a
(3) Compliance Status Uncertain	Status of present waste disposal practices with regard to inadvertent intruder is unknown at this time.	e	e	e	e
(4) Compliance Status to be Determined	d	Future LLW disposal facilities are currently being designed to meet this requirement.	f	f	f
b. Performance Assessment					
(1) Noncompliance	Active operations in SWSA 6 will be phased out by FY 1992 except as noted.	Perform performance assessments on future (FY 1992) LLW disposal facilities to demonstrate compliance with this requirement.	FY 1991	500K	c
(2) Noncompliance	Waste management systems performance assessment has not been performed for the ORNL.	Waste management systems performance assessments will be conducted.	FY 1994	500K	c
(3) Partial Compliance	Monitoring of facility and disposal site performance is presently performed on a reconnaissance level.	Evaluate monitoring data from Tumulus operations in SWSA 6 to evaluate facility performance. Detailed monitoring data will be gathered for the GCD silo area that will remain operational post FY 1992.	FY 1992	150K	c

[a]See b. (1-2).
[b]TBD.
[c]Not applicable.
[d]See a. (1).
[e]See b. (1).
[f]See b. (1-3).

Table 6. (contd).

Requirement/Status	Current practice	Current plans	Completion Date	Estimated Cost Expense	Estimated Cost 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	c
(2) Partial Compliance	Incentives are provided to generators to encourage waste reduction.	g	g	g	g
(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 1991	300K	c
(4) Partial Compliance	Waste Management Plans are required for all new waste generating projects. Waste reduction must be addressed in this plan.	g	g	g	g
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	1,500K	2,000K
(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 1990	50K	c
(3) Noncompliance	Diversity and inconstancy 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.	h	h	h

[g]See c. (1).
[h]See d. (1).

Table 6. (contd).

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.	c	c	c
(2) Partial Compliance	WAC have been established for existing LLW TSD facilities. Preliminary WAC are being developed for proposed LLW TSD facilities.	Finalize WAC for proposed LLW TSD facilities and submit to DOE-ORO	FY 1992	300K	c
(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.	h	h	h	h
(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.	c	c	c
(5) Partial Compliance	Concentrations will be determined by radiological performance assessments (see b.1), Hazards and Safety Anaylsis; otherwise ORNL is in compliance with this requirement.	i	i	i	i
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
(2) Partial Compliance	Cement grouting, compaction, and super compaction will be used to achieve waste form stability and improve long-term facility performance.	j	j	j	j
(3) Compliance	ORNL currently has no plans for constructing large-scale waste treatment facilities.	c	c	c	c
(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	c

[i]See e. (2).
[j]See f. (1).

Table 6. (contd).

Requirement/Status	Current practice	Current plans	Completion Date	Estimated Cost Expense	Capital
g. Shipment					
(1) Partial Compliance	ORNL currently does not ship LLW off-site for disposal.	Class 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 1992	250K	c
(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	c	c
(3) Partial Compliance	Before ORNL ships any waste off-site for processing or storage, advance approval is obtained and WAC are met.	h	FY 1992	h	h
(4) Compliance	Ship LLW within ORR on public highways for interim storage. ORNL is in compliance with all applicable DOT and DOE regulations.	Continue to meet all applicable DOT and DOE regulations for shipping LLW on-site. For future off-site shipments, labeling requests will be met as part of g. (1).	FY 1989	c	c
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 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	2,000K
(2) Compliance	Waste manifests accompany each LLW package and are kept on permanent file.	Continue current practice for all future storage operations.	c	c	c
(3) Partial Compliance	Documentation is in place for most of the existing storage facilities, although required scope and rigor is below current standards.	Upgrades to existing documentation will be provided as part of ongoing improvements to the waste management system. New facilities documentation needs will be met under h. (1).	FY 1992	300K	c
(4) Compliance	Store limited volumes of biological waste to allow for nuclide decay.	Continue current practice.	c	c	c

Table 6. (contd).

Requirement/Status	Current practice	Current plans	Completion Date	Estimated Cost Expense	Capital
i. Disposal					
(1) Partial Compliance	Dispose of LLW using above-grade and below-grade technologies. Performance monitoring indicates above-grade technology achieving performance objectives; below-grade uncertain.	Performance assessments 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 criteria.	FY 1992	750K	2,000K
(2) Partial Compliance	Engineered GCD above- and below-grade technologies used for disposal of LLW.	LLW classification limits will be determined for all new LLW facilities.	FY 1992	i	i
(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-ORO sites.	FY 1989	e	e
(4) Partial Compliance	Store greater-than-Class C waste on-site in retrievable stainless steel wells.	Class III/IV Retrievable Storage Facilities are tentatively planned for construction.	FY 1994	500K	25,000K
(5) Compliance	Additional disposal requirements are currently in practice.	Requirements will be included in final WAC being developed under e. (2).	FY 1992	i	i
(6) f	BRC waste has not been officially defined by Federal regulations. Suspect landfill operations is most applicable area.	Continue to pursue BRC concept with TDHE.	FY 1992	i	i
(7) Partial Compliance	A site for the proposed IWMF has been selected in conformance with this requirement	Continue site characterization studies.	FY 1990	50K	c
(8) Partial Compliance	The proposed IWMF has been selected in conformance with this requirement.	Plan and construct IWMF in accordance with this requirement.	FY 1991	100K	
(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 1991	200K	c

Table 6. (contd).

Requirement/Status	Current practice	Current plans	Completion Date	Estimated Cost Expense	Estimated Cost Capital
j. Disposal Site Closure/Post Closure					
(1) Partial Compliance	Closure/post closure plans have not been developed for the active areas of SWSA 6 or the Class II IWMF.	Closure/post closure plans will be developed for active areas in SWSA 6 and Class II IWMF under RCRA 3004(u).	FY 1992	250K	c c
(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	k	k
(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 1992	2,000K	c
(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	c	c
(5) Partial Compliance	Existing protocol requires that all closure plans for inactive, active, and new LLW disposal facilities be reviewed by DOE-ORO.	Continue current practice.	FY 1994	k	k
(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.	k	k	k

[c]See j. (1).

Table 6. (contd).

Requirement/Status	Current practice	Current plans	Completion Date	Estimated Cost Expense	Estimated Cost Capital
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	2,000K	2,000K
(2) Partial Compliance	Majority of LLW TSD operational facilities have environmental programs that assess effluent releases, radionuclide migration, and changes affecting long-term performance.	i	FY 1994	i	i
(3) Partial Compliance	Preoperational monitoring determines operational monitoring requirements. Operational monitoring status reevaluated on periodic basis.	i	FY 1994	i	i
(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.	i	FY 1994	i	i
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	c
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 1990	h	h
		TOTALS	FY 1994	14,650K	35,700K

[i]See k. (1).
[h]See d. (2).

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 Section 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. The core group for the LLWDDD Program was comprised entirely of personnel from ORNL and received management oversight under the auspices of the WMTC which received programmatic guidance from the CTD of ORNL. This was the primary reason the CWMO directed ORNL to include projected LLWDDD programmatic funds in the original aforementioned table. 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 7. This table indicates the project title, TEC, funding type (i.e., DOE program budget code), and the respective FY for funding.

3.1.3 Special-Case Wastes

With the issuance of DOE Order 5820.2A (September 1988), the DOE enacted a comprehensive plan for managing radioactive wastes at all DOE facilities. Three major categories of radioactive waste (HLW, LLW, and TRU waste), were key features around which the DOE Order was developed. It was recognized, however, that not all wastes would 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 which prevent them from being managed as typical HLW, LLW, or TRU waste. Because of these characteristics, such wastes are potential problems to generators, handlers

Table 7. General Plant Projects for SLLW facilities at ORNL

Title	TEC	Funding type	Fiscal year
Class II Interim Waste Management Facility	$1,100,000	GF	FY 1989
SWSA 6 Staging Area Upgrade	525,000	GF	FY 1990
SWSA 6 Improvements	309,000	GF	FY 1990
IWMF Upgrade	500,000	GF	FY 1992
Certification and Segregation of NG Solid Waste	1,000,000	KG	FY 1992

and disposal facility operators. DOE has termed these wastes 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.

Five categories of special case waste and one category of special interest DOE-owned materials have been identified for management as SC waste. These five categories of SC include: (1) PAL; (2) GTCC; (3) UC; (4) HLI; and (5) noncertifiable, nontransportable TRU 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 to identify SC wastes or potential waste materials that may fall within these six categories and, if possible, to provide a detailed characterizations of each category of waste.

3.1.3.1 Strategy

Under the LLWDDD program at ORNL, the development of waste management strategies for waste not suitable for on-site disposal due to PA limitations had been the principle consideration for SC waste. The LLWDDD Class III and Class IV waste are SC-PAL waste and would include SC-GTCC and SC-HLI as subsets of Class IV waste.

The exact segregation, storage and disposal requirements for various categories of SC waste at ORNL have not been determined. During FY 1990, ORNL will conduct an inventory of all existing and anticipated waste that falls into the SC categories. Information on SC waste is intended as a guide in determining 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.

3.1.3.2.1 SC-PAL

Most SC-PAL waste at ORNL would fall into the LLWDDD Class III and IV waste classes. The Class 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 III limits. Other isotopes comprising the Class III designation include those of Th, Np, Am, Be, C, and Tc. ORNL currently generates less than 1,000 ft^3/year of Class III waste. Currently most LLW that would be classified as Class III is being disposed in SWSA 6.

The Class IV waste designation applies to isotopes having both short and long half-lives. Isotopic concentrations in waste exceeding either the Class II limits, or depending on the isotope, the Class III limits, will prohibit the disposal of that waste on the ORR. Currently ORNL generates about 5,000 ft^3/year of waste that would be classified as Class IV waste. Most of this waste is currently being disposed of in SWSA 6.

3.1.3.2.2 SC-GTCC

ORNL SC-GTCC waste is a subset of Class 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.

3.1.3.2.3 SC-UC

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

3.1.3.2.4 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. This waste is highly radioactive and must be handled and transported in shielded containers.

3.1.3.2.5 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.

3.1.3.2.6 SI-COM

ORNL may be responsible for managing limited volumes of SI-COM waste for DOE in the future.

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 currently stored in facilities in the north area of SWSA 5. Planned SC waste storage projects include the Class III/IV Retrievable Storage Facility and the Dry Cask Storage Facility.

3.1.3.4.1 Building 7827 Shielded Dry Well

The facility is located in SWSA 5 and provides retrievable storage of SC waste. Building 7827 is a two-section structure built in the ground, consisting 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 8, 16, or 30-in in diameter with 15 wells 10-ft deep and the other 15 wells 15-ft deep. Section 2 wells are all 8-in in diameter and 15-ft deep. A 3-ft thick 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 ground water by the closed-bottom well and its waste container.

3.1.3.4.2 **Building 7829 Shielded Dry Well**

The facility is located adjacent to Building 7827 and provides retrievable storage of SC waste. Currently, only spent fuel elements 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 12-in in diameter by 15-ft deep.

3.1.3.4.3 **Class III/IV Retrievable Storage**

Because of the likely unsuitability of on-site disposal of Class III/IV waste and the absence of off-site disposal options, retrievable storage facilities for Class III/IV waste are being planned. ORNL currently generates about 6,000 ft^3/year of waste which will likely be classified as Class III/IV waste with 5,000 ft^3 as CH waste and 1,000 ft^3 as RH waste. Most of Class III/IV CH waste could be stored in the ORGDP storage vaults; however, the ORGDP facility is not considered a long-term storage option. Storage facilities for Class III/IV RH-LLW are not available. Conceptually, a Class III/IV storage facility could utilize concrete box containers retrievably stored on a tumulus pad similar to the proposed tumulus disposal of Class II LLW.

3.1.3.4.3.1 Environmental monitoring. Environmental monitoring capabilities to meet all current and anticipated regulatory requirements will be provided.

3.1.3.4.3.2 Permitting status. A RCRA permit is not anticipated. An EA will likely be required to meet NEPA.

3.1.3.4.3.3 Facility status. The facility is currently in the conceptual design phase. The planning and conceptual design for this facility is supported by a FY 1990 GPP. The construction of this facility is supported by a FY 1991 GPP. The TEC of this facility is $1,200K. The proposed site is near the NHF.

3.1.3.4.4 **Dry Cask Storage Facility**

Planning for the design and construction of the Dry Cask Storage Facility was recently initiated. The 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 1990. The facility is projected as a 1994 LI project with a magnitude cost estimate of $25M.

3.1.3.5 Line Item and General Plant Projects

A listing of proposed LI and GPPs for SC waste facilities at ORNL is provided in Table 8. This table indicates the project title, TEC, funding type (i.e., DOE program budget code), and the respective FY for funding.

Table 8. Line Items and General Plant Projects for SC waste facilities at ORNL

Title	TEC	Funding type	Fiscal year
Line Item projects:			
Dry Cask Storage Facility	$25,000,000	GF	FY 1994
General Plant Projects:			
Class III/IV Retrievable Storage Facility	150,000 1,050,000	GF	FY 1990 (design) FY 1991 (construction)

3.2 LIQUID WASTE

ORNL employs two systems for handling and processing liquids that contain radioactive constituents; the LLLW system and the 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 the radiochemical pilot plants, nuclear reactors, and the concentrate from the PWTP (Bldg. 3544). The PWS handles all liquid waste that contains trace amounts of radioactivity, heavy metals, and organics, or have 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 Figure 26. 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. Figure 26 summarizes both the existing and proposed facilities and actions, the details of which are described separately later.

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.

3.2.2 Liquid Low-Level Waste System

The LLLW system is an assemblage of 100 tanks, associated transfer pipelines, and ancillary equipment (e.g., pumps, evaporators) designed to collect, neutralize, concentrate, and store 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 an activity of 20 Ci/gal. Surveys of 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., for mixed radioactive and hazardous chemical wastes).

Major generators of LLLW include the HFIR and REDC (Building 7920) in the Melton Valley Area, the 3039 off-gas scrubber, the FPDL (Building 3517), the isotope processing facilities, and the PWTP. In addition, leakage of rainwater and groundwater into the LLLW system accounts for approximately 20-30 percent of the waste volume collected. Annual LLLW generation is on the order of 3×10^5 gal.

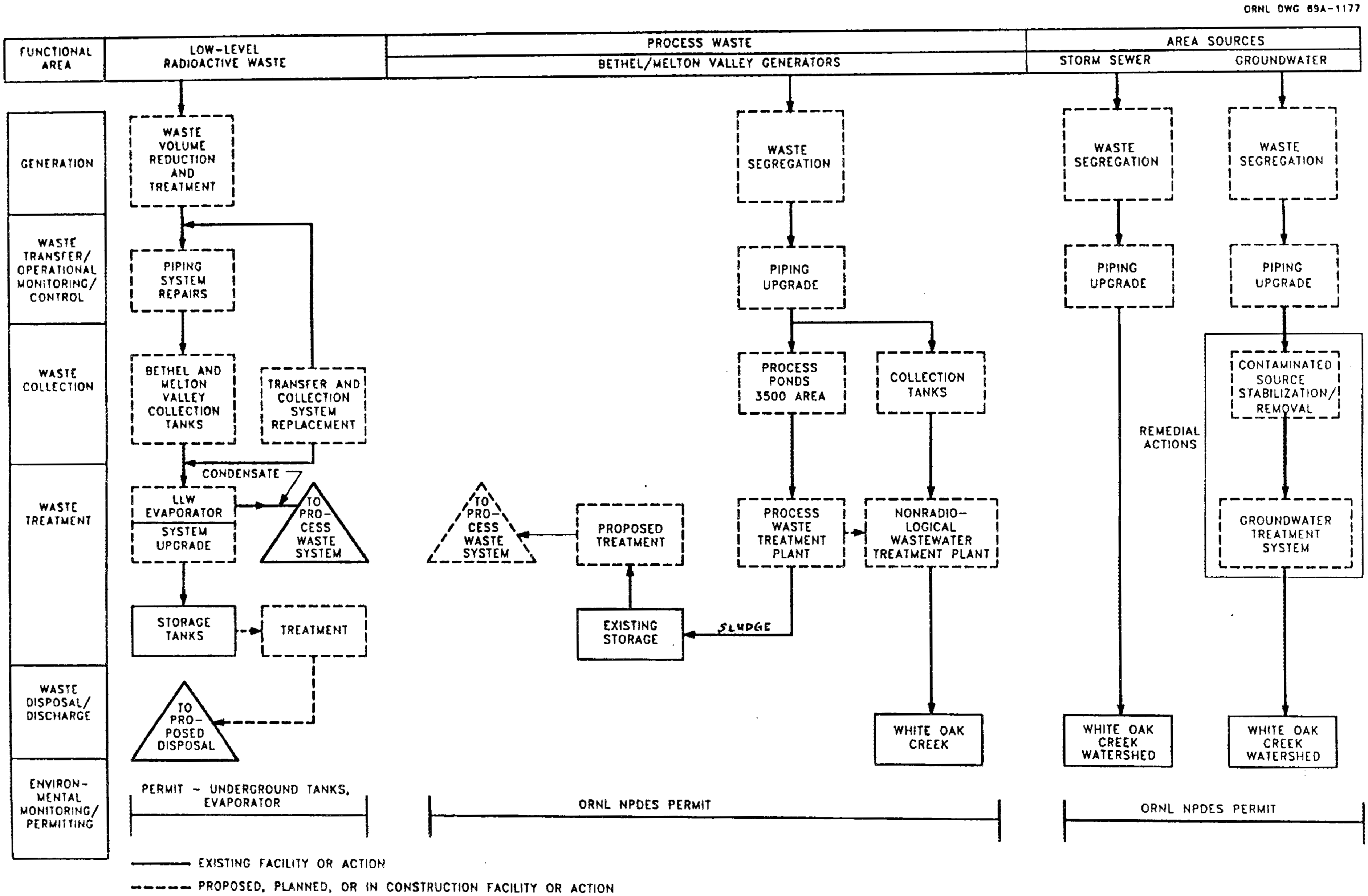

Fig. 26. Water pollution control program strategy for LLLW, process waste, and area sources.

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

(1) Small tanks and lines, located in/near individual source building, used for initial accumulation or transfer of LLLW,

(2) Waste-collection vehicles that serve a few facilities (i.e., containerized waste and tank truck capabilities),

(3) Intermediate collection tanks and lines in the main ORNL complex in Bethel Valley for CAT of wastes received from the accumulation subsystem to a CWCH,

(4) Four intermediate collection tanks and transfer lines in the Melton Valley Area that discharge to a central pumping station,

(5) Melton Valley pumping station and transfer line that move LLLW received from the four intermediate collection tanks to the CWCH in the main ORNL complex,

(6) CWCH which 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),

(7) Waste evaporators and their associated service and storage tanks (five tanks, in all), and

(8) 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 changing regulatory requirements forced shutdown of the ORNL hydrofracturing process in 1984. The stored concentrates are to be processed (starting in FY 1999) in a new WHPP and disposed of off-site. Interim measures, including waste solidification campaigns as necessary, are being implemented to ensure adequate storage volume is maintained until the WHPP becomes available.

The system receives LLLW from 60 source buildings (including seven in the Melton Valley Area) via local accumulation tanks and/or floor drains. Transfer piping (typically unvalved) connects these components with one or more of the stainless steel collection tanks (500-15,000 gal capacity, median <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 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 (50,000-gal stainless steel, underground in concrete vault) or to one of the MVST (eight 50,000-gal stainless steel, underground in stainless steel-lined concrete vault).

3.2.2.1 Generic Description and Characteristics of Waste

3.2.2.1.1 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 which 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 34 percent of the dilute LLLW generated since 1986. Decontamination activities have generated about 45 percent of the waste, and other activities, including R&D activities and rainwater/groundwater infiltration, account for the remaining 21 percent of the dilute LLLW generation in the past 3 years.

With the exception of LLLW generation from the REDC and the 3039 Stack Area, all generators seem to have substantially decreased their LLLW generation rates in recent years.

During 1988, inleakage in the form of rainwater/groundwater was much lower than normal because 1988 was the last year of an approximately four-year local drought. An increase of approximately 20 percent would result in the average monthly generation rate during a year of normal rainfall. As an example of LLLW generation at ORNL, the annual summary of the LLLW collected from specific generators for 1988 is provided in Table 9.

The isotope facilities at ORNL are used primarily for producing and distributing various radionuclides. A wide range of radionuclides are handled. Major activities at the facilities include tritium processing, ^{85}Kr enrichment, short-lived fission products processing, ^{137}Cs and ^{90}Sr source fabrication, ^{60}Co storage, ^{99}Tc processing, and some TRU isotope processing. In the Isotope area, very little LLLW is generated as a direct result of processing activities. Most of the waste production is a result of routine and non-routine hot-cell decontamination. The primary radionuclides expected to be in the waste streams generated from these facilities are ^{137}Cs, ^{90}Sr, ^{131}I, ^{154}Eu, ^{155}Eu, and ^{238}Pu. Since 1987, the level of LLLW generation from the Isotope facilities has remained approximately 3,800 gal/month.

The scrubbing operation for the Central Off-gas Collection System (Bldg. 3039) produces a spent caustic solution that is slightly radioactively contaminated. The 3039 Stack Area produces approximately 3,700 gal/month of dilute LLLW and accounts for approximately 11 percent of the total LLLW collected since 1986.

LLLW collected from the 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. Since the HFIR shutdown, the LLLW generation rate has fallen to approximately 2,700 gal/month. When in operation, the system may be the largest generator at ORNL. During HFIR operations, the most significant LLLW generation source is the regeneration and backwashing of the primary and pool demineralization systems. These regeneration solutions account for approximately 17,250 gal of LLLW annually and also represent the primary source of ^{60}Co in the LLLW system at ORNL.

Table 9. Average monthly dilute LLLW generation for 1988

Generator	Monthly generation (gal)	Percent of total
Isotopes[a]	3,766	16
3039 stack area	3,275	14
FPDL	3,150	13
HFIR	2,996	12
High-Radiation-Level Examination Laboratory	1,857	8
REDC	1,242	7
4500 complex	1,605	7
Reactors[b]	1,378	6
Tank W1-A[c]	1,161	5
Building 3019	899	4
PWTP spent acid[d]	652	3
Tank WC-8 pump pit	537	2
All others	1,064	3
TOTAL	23,582	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 ORR Reactor and the BSR.
[c]Tank W1-A is abandoned and the collections are considered to be primarily rain water.
[d]The PWTP is actually the largest single contributor to LLLW concentrate storage because it provides another highly concentrated waste stream directly to storage.

The ORR Reactor was shut down permanently in 1987 and will not be restarted. Current and future waste generated from the ORR Reactor are the result of D&D activities and ion-exchange column regenerant solutions. The BSR is expected to continue operation at ORNL. Sources of LLLW from the BSR are cooling water and ion-exchange column spent regeneration solutions.

Large quantities of ^{137}Cs (approximately 350,000 Ci/year) and ^{90}Sr (approximately 500,000 Ci/year) are processed at the FPDL (Bldg. 3517). Other materials that might be processed at the FPDL are ^{60}Co and ^{192}Ir. Materials that have been handled in the past include ^{144}Ce and ^{147}Pm. The FPDL is the primary source of both cesium and strontium in the LLLW system. Estimated losses of each material to the LLLW system are on the order of 5,000-15,000 Ci/year. The activities that produce LLLW are not directly related to isotope processing. LLLW is primarily generated from routine decontamination of the hot cells that are used in cesium and strontium purification. Recently, improvements have been made to the building's tank vault which reduced groundwater inleakage, and consequently, the LLLW generation rates.

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 1,800 gal since 1986.

The 4500 Complex (Bldgs. 4500N, 4500S, 4501, and 4508) is a multi-purpose research facility. A large variation in the radioactive materials are handled in the complex, and trace quantities of any radionuclide used at the laboratory could originate at one of many active hot drains in the facility. Approximately 89 active hot drains exist in the 4500 Complex. The 4500 Complex has historically accounted for 7-8 percent of all LLLW collected at ORNL. Since 1986, the average LLLW generation rate has been approximately 2,600 gal/month.

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 processed by the LLLW. However, a quantitative estimate of the effects of rainfall on the volume of LLLW collected at ORNL has not been previously evaluated. 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, Bldg. 3517 tanks, WC-8, WC-5, and W-17 and W-18. It was estimated that approximately 1,500 gal of LLLW are collected from the above tanks for each inch of rainfall. In addition, several filter pits and sumps throughout the lab collect rainfall which is sent to the LLLW system. Considering these other sources, approximately 1,500 gal of dilute LLLW are collected in the CAT system for each inch of rainfall.

3.2.2.1.2 TRU-Contaminated Liquid Waste

The REDC recovers a variety of radiochemicals produced by irradiation of selected isotopes. The LLLW produced at the REDC (approximately 1,300 gal/month) is primarily generated from disposal of spent off-gas scrubber solutions. The scrubber solutions typically contain low levels of radioactivity. In addition, small volumes of waste are generated as a direct result of isotope processing from operations conducted at the REDC. These wastes are sent to the LLLW system and are a major contributor to the TRU isotope concentration in the system. The existing LLLW system does not have provisions for handling TRU-contaminated liquids separately. Modification of the LLLW to isolate TRU-contaminated liquid waste is currently being studied.

3.2.2.2 Treatment Facilities

Facilities associated with the LLLW system at ORNL consist of collection tanks and piping, a service tank at Bldg. 2531, the evaporator facilities at Bldg. 2531, evaporator storage tanks, and storage tanks for Bethel Valley and Melton Valley Branches. With the exception of these storage tanks (Section 3.2.2.3), the remaining facilities are considered as treatment facilities and discussed in this section.

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 20:1. The concentrated waste is then transferred to one of several storage tanks and the condensate is transferred to the PWTP for further treatment. Figure 27 shows a schematic of the LLLW system.

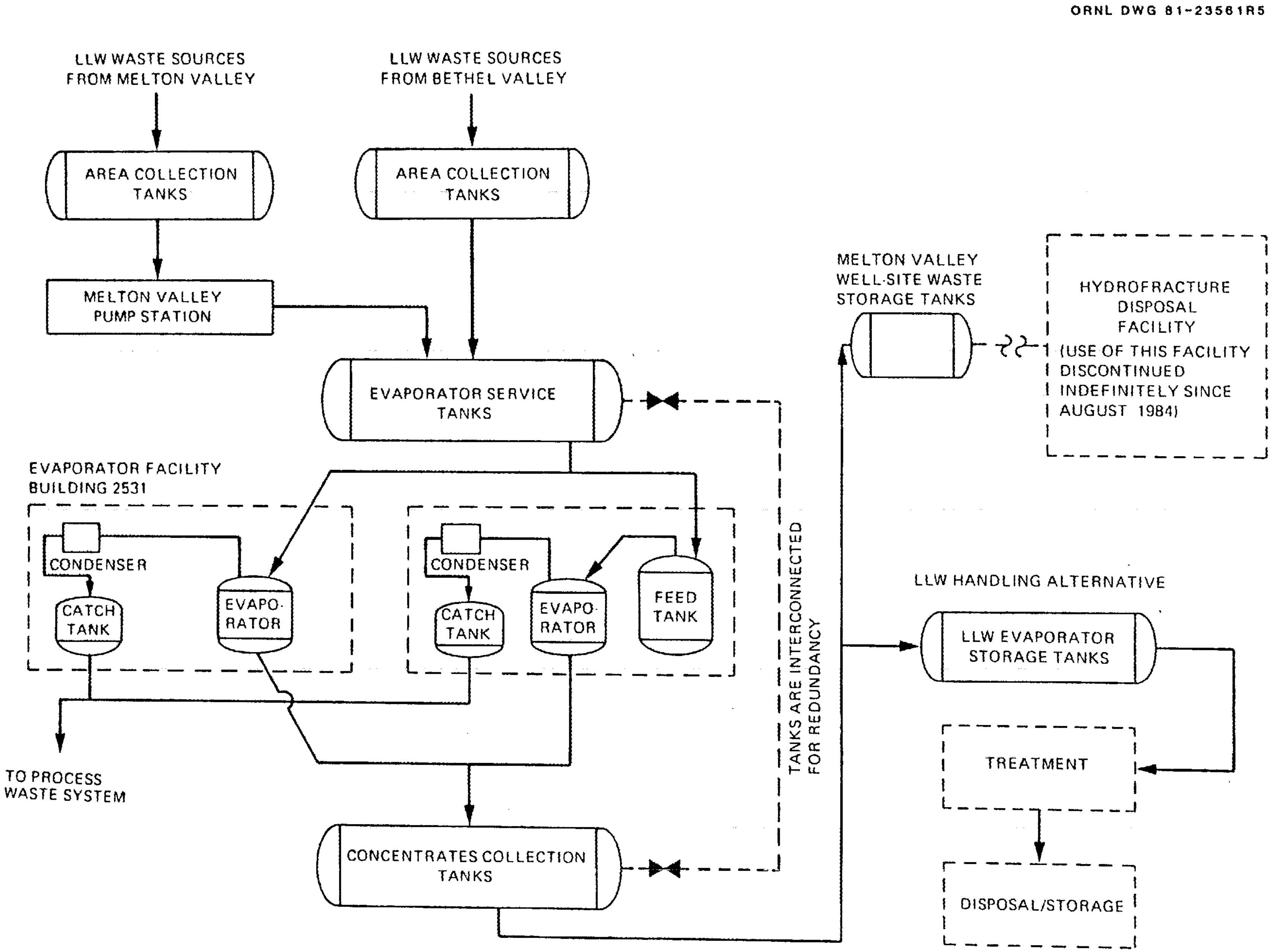

Fig. 27. LLLW system description.

ORNL's LLLW collection and transfer system is divided into two branches, the Melton Valley Branch and the Bethel Valley Branch. Currently, 22 active collection tanks are used, four of which serve the Melton Valley area and the remaining 18 tanks serve the Bethel Valley area. Also, 39 collection and storage tanks are currently inactive. The locations of the active collection tanks are shown in Figure 28. Also shown in the figure is the inactive tank W-1A, which is periodically pumped to the evaporator system because of rainwater infiltration. The capacities of the collection tanks are given in Table 10. Most of the floor drains, collection tanks, and transfer lines in the system are singly-contained. The system is 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 evaporator service tank W-22, and then fed to evaporators A2 and 2A2 for processing. One of the two evaporators is operated in a semi-continuous 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 there is no feed left to process, the evaporator is shut down, the contents cooled, and the "concentrate" jetted 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. The transfer route to the Melton Valley area (where the storage tanks are located) is shown in Figure 29.

The Radioactive Waste Evaporator Facility (Bldg. 2531) is shown in plan view of Figure 30, and includes the following major areas:

(a) 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; (3) and 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.

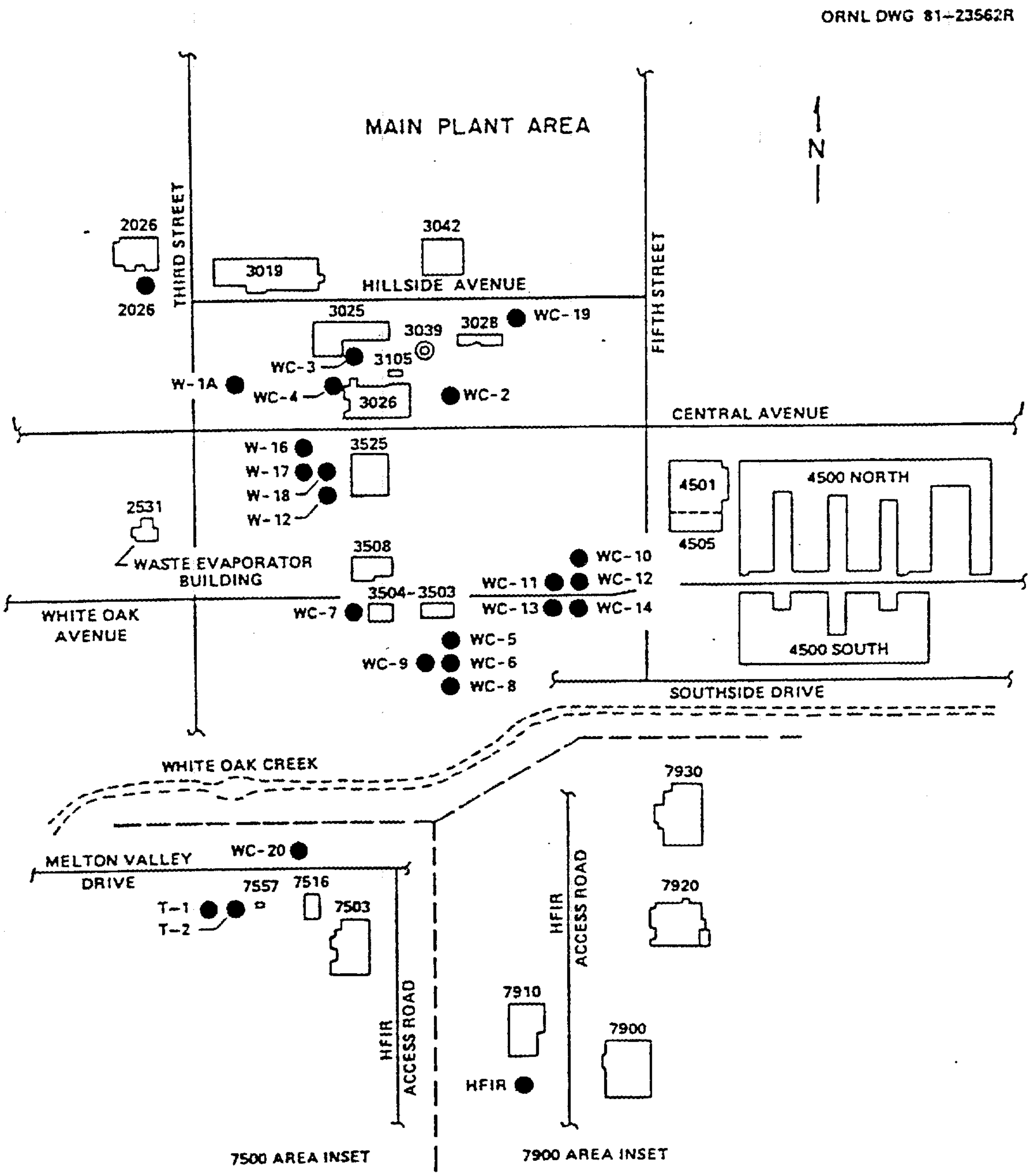

Fig. 28. Location of waste management operations active LLLW collection tanks.

Table 10. Waste management operations active LLLW collection tank capacities and source buildings

Tank	Tank capacity (gallons)	Operating capacity (gallons)	Source building(s)
Bethel Valley Collection Tanks			
2026[a]	500	350	2026
WC-2[a]	1,000	700	3028 3038
WC-3[a]	1,000	700	3025E 3025M 3098
WC-4[a,c]	1,700	1,200	(abandoned)
WC-5[a]	1,000	750	3508
WC-6[a]	500	350	3508
WC-7[a]	1,100	750	3504
WC-8[a]	1,000	750	Pump pit
WC-9[a]	2,140	1,550	3503 Off-gas
WC-10[b]	2,300	1,650	3028 3029 3030 3031 3032 3033 3047 3093

[a]Vertical tank.
[b]Horizontal tank.
[c]WC-4 is not actively used, but does contain LLLW. The tank will be assigned to the RAP after the transfer equipment is repaired to allow the liquid contents to be removed.

Table 10. (contd).

Tank	Tank capacity (gallons)	Operating capacity (gallons)	Source building(s)
WC-11[b]	4,600	2,900	4500N 4501 4505 4507
WC-12[a]	1,000	700	4505
WC-13[a]	1,000	700	4500N 4500S 4501 4508
WC-14[a]	1,000	700	4501 4508
WC-19[b]	2,100	1,500	3001 3002 3003 3004 3005 3008 3019 3042 3119
W-12[a]	700	400	3525E
W-16[a]	1,000	700	3026D
W-17[a]	1,000	700	3026C
W-18[a]	1,000	700	3026C

Table 10. (contd).

Tank	Tank capacity (gallons)	Operating capacity (gallons)	Source building(s)
		Melton Valley Collection Tanks	
WC-20	10,000	7,000	7920 7930
T-1	15,000	10,500	7500 7503 7900 7911 7913 7920 7930
T-2	15,000	10,500	7500 7503 7900 7911 7913 7920 7930
HFIR	13,000	9,100	7900 7911 7913

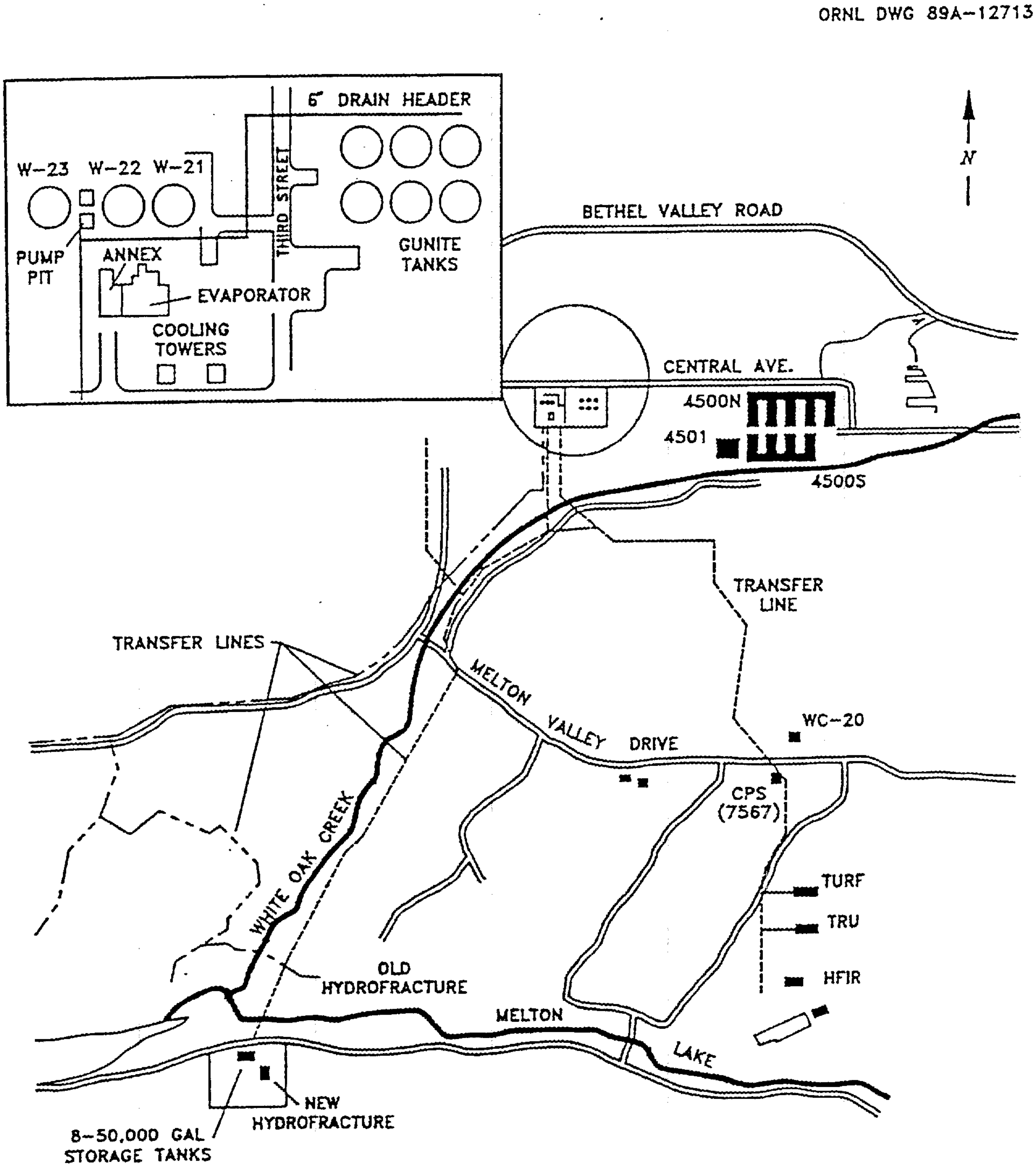

Fig. 29. Transfer line to the Melton Valley hydrofracture site.

ORNL DWG 89A-12712

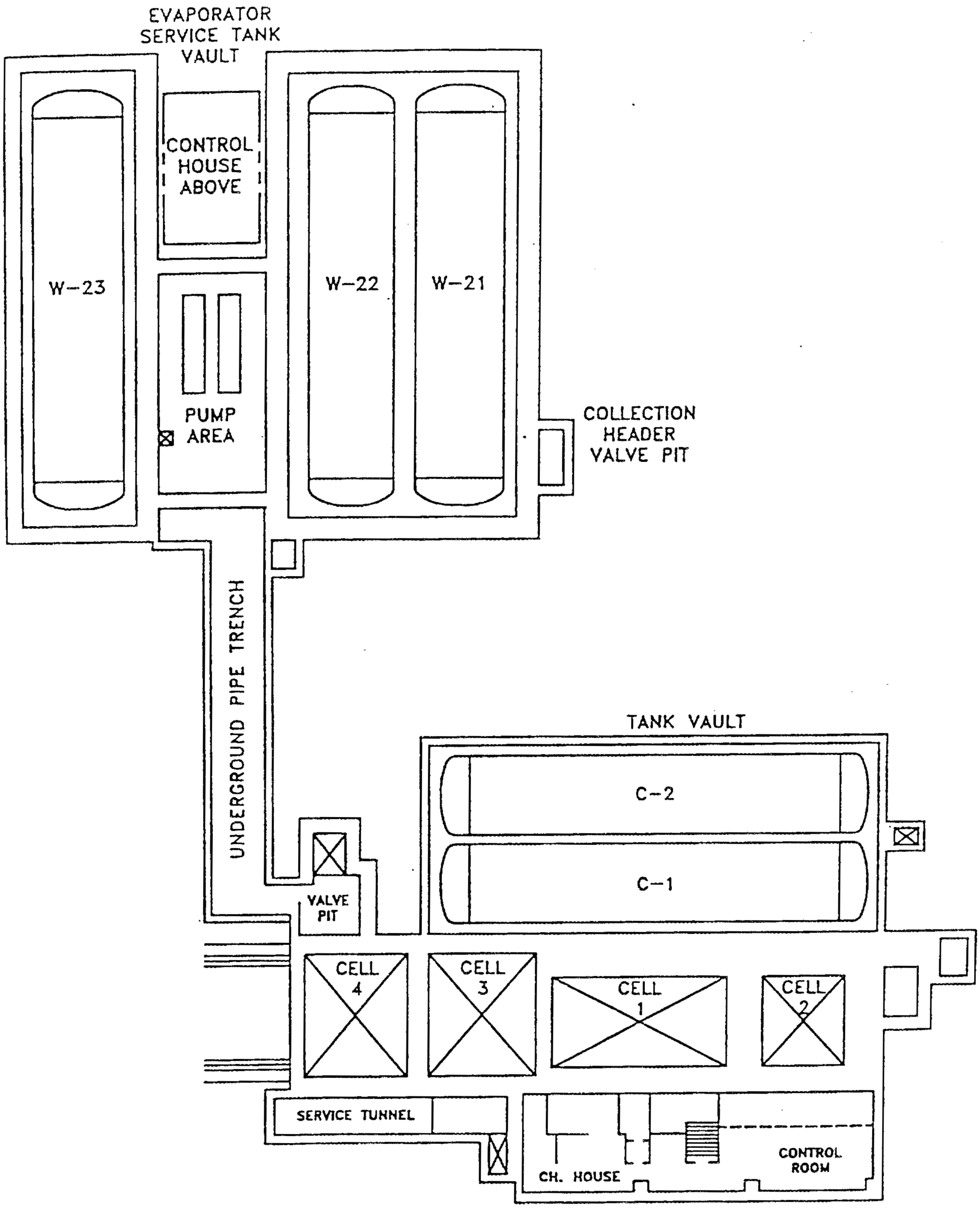

Fig. 30. Plan view of the Evaporator Facility Complex, Bldg. 2531.

(b) Underground pipe trench, for the transfer of liquid waste from the feed tank to the evaporator and concentrate to W-23.

(c) The tank vault containing tanks C-1 and C-2 which are storage tanks for concentrated waste from the evaporator.

(d) Cells 1 through 4 in Building 2531 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.

3.2.2.2.1 Environmental Monitoring

Monitoring of outfalls specified in the 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 discharged to WOC at 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 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 WOCC. When capital projects are implemented to upgrade the LLLW CAT system, instrumentation will be added for both monitoring and controlling the ORNL LLLW system from the WOCC. In addition, WOCC computers are used to generate reports and manipulate data.

3.2.2.2.2 Permitting Status

An application for a RCRA permit-by-rule was submitted for unit operations that produce a waste stream monitored at an NPDES discharge point. Therefore, all LLLW collection, treatment, and solidification systems are currently permitted-by-rule under RCRA (see Section 3.2.2.3.2 of this plan).

3.2.2.2.3 Facility Status

The primary treatment for LLLW is evaporation, with two evaporators (one of mid-1960s design and the other of mid-1970s design) 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. The evaporators will be replaced when Waste Management Operations determines that replacement is necessary.

Treatment of acid waste generated by ion exchange demineralizers is being reviewed for various sites at ORNL. These wastes are presently treated at the central LLLW evaporator system. These high-nitrate, acidic wastes generated by the demineralizer systems cause problems in the LLLW treatment system which 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 to more precisely measure and control the amount of caustic needed to neutralize LLLW in the collection tanks. This procedure will reduce dissolved solid content of LLLW.

REDC Facility operations are being evaluated for possible upgrades to reduce the amount of LLLW, particularly TRU components generated at the facility. The FPDL is one of the major contributors of LLLW and a main contributor of ^{137}CS and ^{90}Sr to the LLLW system. On-site pretreatment systems and/or improved processing systems are being evaluated to reduce the volume and activity in the concentrated LLLW which must be stored and eventually treated prior to permanent disposal.

3.2.2.3 Storage Facilities

Currently, LLLW concentrate is being accumulated and stored in the MVST and Bethel Valley tanks. ORNL has 12 50,000-gal capacity tanks for the storage of LLLW concentrate. Eight of these tanks, known as the MVST, 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 MVST for storage. The design capacities and current waste volume for these tanks are listed in Table 11.

3.2.2.3.1 Environmental Monitoring

Each storage tank is equipped with a sampling device, liquid-level instrumentation, and a filtered vent to the atmosphere. The storage tanks are 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 handle tank leakage.

3.2.2.3.2 Permitting Status

Operation of the LLLW system is governed by the requirements in several DOE orders, as well as regulations of the EPA and TDHE. Although some components of the ORNL LLLW system handle or store mixed radioactive and hazardous wastes, the system is currently regulated under the ORNL NPDES permit. The ORNL LLLW system is thus currently exempt (via a RCRA permit-by-rule applicable to NPDES-permitted wastewater treatment systems) from the technical standards (e.g., integrity testing, leak detection, secondary containment) and permitting requirements of RCRA.

Table 11. LLLW concentrate storage tank capacities and waste volumes

Tank		Capacity (gal)	Volume stored (gal)[a]
		Melton Valley Storage Tanks	
W-24		50,000	45,700
W-25		50,000	45,700
W-26		50,000	45,700
W-27		50,000	46,190
W-28		50,000	44,630
W-29		50,000	47,200
W-30		50,000	47,200
W-31		50,000	45,420
		Bethel Valley Evaporator Service/Storage Tanks	
W-21[b]		50,000	17,300
W-22		50,000	20,000[c]
W-23		50,000	16,200
C-1		50,000	6,939
C-2		50,000	45,220
	TOTAL	650,000[d]	473,399

[a]Volumes of waste stored as of November 1, 1989.
[b]Tank W-21 is currently receiving concentrated waste from the PWTP.
[c]Since W-22 is a service tank with fluctuating volumes, an average of 40 percent of the total capacity is shown as the volumes stored.
[d]This is the total capacity of the tanks. The operating capacity is 617,500 gal.

Approximately one-third of the LLLW system is already out of service due to advanced age, leaks, etc., and is thus subject to remediation under other RCRA requirements, as well as those of Superfund. The portions of the LLLW system that are still in service are being upgraded to meet all substantive RCRA requirements through a series of capital projects scheduled for completion in FY 1997.

The ORR, including ORNL, will be placed on the Superfund NPL by the EPA on December 21, 1989. The SARA of 1986 requires that the DOE execute a FFA with the EPA within six months of final listing in order to establish schedules for compliance with Superfund requirements. Negotiations for the Superfund FFA actually began many months prior to the listing of the ORR on the NPL.

In addition to the more typical Superfund requirements (e.g., schedules for remedial investigations at contaminated sites), the ORR-FFA provisions will also establish additional compliance requirements specific to the ORNL LLLW system (Environmental Restoration Agreement for the Oak Ridge Reservation, September 15, 1989 Draft). This action is being undertaken voluntarily by DOE-ORO 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-ORO and TDHE, has incorporated interim compliance requirements for the LLLW system that meet the spirit, if not the exact letter, of RCRA technical standards during the period of the planned upgrade of the ORNL 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) secondary containment for all new or replacement tank systems.

The FFA agreement 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. A listing of the LLLW tank systems, by category, tentatively applicable to the FFA is provided in Table 12.

Table 12. LLLW tank systems subject to the FFA

Category 2	Category 3	Category 4
W-21	W-16	W-1A
W-22	W-17	W-1
W-23	W-18	W-2
W-24	WC-2	W-3
W-25	WC-3	W-5
W-26	WC-4	W-6
W-27	WC-5	W-7
W-28	WC-6	W-8
W-29	WC-7	W-9
W-30	WC-8	W-10
W-31	WC-9	W-11
C-1	WC-10	W-12
C-2	WC-11	W-13
T-13	WC-12	W-14
WC-20	WC-13	W-15
3002-A	WC-14	W-19
2026	W-11(isotopes)	W-20
S-223	W-12	WC-1
S-324	T-1	WC-15
S-523	T-2	WC-17
F 201	HFIR	TH-1
F 501	WC-19	TH-2
F-111	T-14	TH-3
F-126	23 tanks	TH-4
B-2-T		T-30
B-3-T		H-209
4501-C		3013
4501-D		3001-A
P 23		3001-B
P 24		3003-A
N 2		3004-B
N 4		T-1(OHF)
N 7		T-2(OHF)
N 16		T-3(OHF)
N 71		T-4(OHF)
P 3		T-9(OHF)
P 4		7503-A
P 6		7560
S 12		7562
V 7		4501-P
L-11		39 tanks
41 tanks		

3.2.2.3.3 Facility Status

The ORNL LLLW system was designed primarily in the 1950s, with 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 MVST and WC-20 in Melton Valley, along with their transfer piping, were installed in the late 1970s. Most of these newer components of the LLLW system have leak detection and secondary containment capabilities that appear to permit continued operation with little or no modification. Two of the evaporator tanks need vault seals and the transfer line upstream from WC-20 is singly contained (but routinely pressure-tested to determine its integrity).

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, with the exception of the Melton Valley transfer line north and south the 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 number of tanks and sections of transfer lines have been taken out of service and the number of known past leak sites totals 39. Remediation of out-of-service components and replacement or upgrade of active subsystems has been planned for a considerable time.

ORNL tanks (and associated ancillary equipment) are divided into four categories for illustration. Table 13 lists ORNL LLLW tanks that will be taken out of service. All of these tanks are singly-contained vessels without leak detection capabilities and/or are located in a vault that does not meet the secondary containment criteria in the FFA. Each will be replaced or otherwise taken out of service by one or more of a series of capital projects. Table 14 provides data regarding tank systems for which no capital project currently exists. Many or most of these tanks will be removed from service permanently and replacement or upgrading will not be necessary.

A procedure known as in-tank evaporation will be utilized to reduce the amount of liquid waste stored in the MVST. 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 in-tank evaporation scheme, dry air will be introduced into the tanks and will ideally leave the tanks saturated. Several studies have been completed to determine the viability of in-tank evaporation and its effect on storage volume availability. As determined by these studies, in-tank evaporation is expected to free

Table 13. Planned capital projects for removal from service of ORNL active LLLW tanks that do not meet FFA containment criteria

Tank	Service facility(ies)	Containment	Capital project
2026	2026	Vault	Bethel Valley LI
WC-7	3504	Single	Bethel Valley LI
S-223	3517	Vault	Bethel Valley LI
S-324	3517	Vault	Bethel Valley LI
S-523	3517	Vault	Bethel Valley LI
W-12	3525	Single	Bethel Valley LI
F 201	3525	Vault	Bethel Valley LI
F 501	3525	Vault	Bethel Valley LI
WC-2	3028, 3038	Single	Isotopes Area LI
WC-10	3028, 3029, 3030, 3031, 3032, 3033, 3047, 3093	Single	Isotopes Area LI
W-1 I	3028	Single	Isotopes Area LI
WC-20	7920, 7930	Lined Vault	Melton Valley LI
T-1	7500, 7503, 7900, 7911, 7913, 7920, 7930	Single	Melton Valley LI
T-2	7500, 7503, 7900, 7911, 7913, 7920, 7930	Single	Melton Valley LI
HFIR	7900, 7911, 7913	Encapsulated in concrete	Melton Valley LI
WC-11	4500N, 4501, 4505, 4507,	Single	4500 Area GPP
WC-12	4505	Single	4500 Area GPP
WC-13	4500N, 4500S, 4508	Single	4500 Area GPP
WC-14	4501	Single	4500 Area GPP
4501-C	4501	Basement	4500 Area GPP
4501-D	4501	Basement	4500 Area GPP
WC-19	3001, 3002, 3003, 3004, 3005, 3008, 3019, 3042, 3119	Single	Graphite Reactor GPP
3002-A	3002	Vault	BSR/ORR GPP

Table 14. Active LLLW collection tanks for which capital projects do not currently exist

Tank	Service facility(ies)	Containment
WC-3	3025, 3098	Single
WC-4	Not Applicable	Single
WC-5	3508	Single
WC-6	3508	Single
WC-8	Pump pit	Single
WC-9	3503	Single
W-16	3026D	Single
W-17	3026C	Single
W-18	3026C	Single
T-14	NHF	Single
P 23	3019	Vault
P 24	3019	Vault
N 2	3019	Vault
N 4	3019	Vault
N 7	3019	Vault
N 16	3019	Vault
N 71	3019	Vault
P 3	3019	Vault
P 4	3019	Vault
P 6	3019	Vault
S 12	3019	Vault
V 7	3019	Vault

approximately 3,000 gal/year per storage tank. This rate is based on the following assumptions: (1) 80 percent on-line time; (2) saturation temperature of 50°F; (3) dry input air to the tanks; and (4) outlet air is saturated with water. At an ambient temperature of 90°F, this liquid evaporation rate per tank should increase to about 10,000 gal/year.

In-tank evaporation is scheduled to begin in FY 1990. 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 40 percent of the volume in the MVST can be evaporated without precipitating these materials. The primary reason for this activity is to ensure that facilities for LLLW storage are available pending start-up of the WHPP Facility. Projects currently identified to deactivate and/or upgrade ORNL LLLW tanks are described in the following sections.

3.2.2.3.3.1 **Bethel Valley LLLW CAT Systems Upgrade.** This project will upgrade a significant portion of the LLLW-CAT system located in Bethel Valley. The project will also deactivate WC-7, WC-12 tanks and Building 2026, 3517, and 3525 tanks. This project involves the installation of approximately one mile of 2-in within 3-in doubly-contained stainless steel pipeline and five collection and neutralization tanks. Stainless steel-lined underground concrete vaults will be constructed to house the new tanks. The new system will be equipped with state-of-the-art cathodic protection, leak detection, and process control systems. Project completion is anticipated by late 1991.

3.2.2.3.3.2 **Isotopes Area LLLW CAT System Upgrade.** This LI project is currently scheduled for FY 1992; however, it may be delayed or cancelled due to the uncertainty of the Isotopes program at ORNL. The project involves the deactivation of tanks WC-10, WC-2, and W-11 (isotopes) and the installation of new stainless steel lines, underground vaults, collection tanks, and double-walled stainless steel transfer lines. The new system will be equipped with state-of-the-art cathodic protection, leak detection, and process control systems. Project completion is anticipated by 1997.

3.2.2.3.3.3 **Melton Valley LLLW CAT System Upgrade.** This LI project is currently scheduled for FY 1992. The project is designed to deactivate T-1, T-2, WC-20, and HFIR tanks and provide new stainless steel lines, underground concrete vaults, collection tanks, and double-walled stainless steel transfer lines. The new facilities will be equipped with state-of-the-art cathodic protection, leak detection, and process control systems. Completion of the project is scheduled by 1996.

3.2.2.3.3.4 Graphite Reactor Canal LLLW Storage and Transfer. This capital project will provide the installation of a 500-gal storage tank, doubly-contained stainless steel piping, pumps, electrical and electronic systems, and improvements to the current truck access area west of Bldg. 3001. Truck access improvements will include the installation of diking and filling equipment to be used in the transfer of LLLW. The project will contribute to the deactivation of tank WC-19, with completion anticipated by 1993.

3.2.2.3.3.5 Hot Cell Consolidation. This expense-funded project will evaluate the feasibility of consolidating activities from Buildings 3025, 3026D, 3042 (south cell), and 3525 into facilities in Buildings 3025 and 3525. Generator facility upgrades are expected to be completed in 1992.

3.2.2.3.3.6 4500 Area LLLW CAT. This capital project will install central bottling stations within selected 4500 Area buildings to collect CH-LLLW waste. These waste streams are generated by experiments conducted within hooded enclosures and contain only trace quantities of radionuclides which emit soft beta radiation. All remaining manipulator cell drains will be permanently sealed, as will many of the hood drains which are presently in use within this complex of buildings. This project will deactivate WC-11, WC-12, WC-13, WC-14, and Building 4501 tanks. Completion is anticipated in 1996.

3.2.2.3.3.7 Low-Level Waste Storage/Transfer BSR and ORR Reactor. This capital project is a FY 1992 GPP. Alternatives for the project are being evaluated and the scope of work, including contributions to the deactivation of WC-19 and 3002-A, is to be re-examined. Completion is expected in FY 1995.

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 not considered an acceptable disposal option. LLLW sludges are currently planned to be solidified for disposal as SLLW. Because a portion of the LLLW sludges contain concentrations of TRU radionuclides, some LLLW sludges will be processed in the planned WHPP and disposed of off-site as RH-TRU waste. Operation of the WHPP is not planned before 1999. On-site disposal of solidified LLLW sludge will utilize the disposal facilities for SLLW, as outlined in Section 3.1.2.5 of this plan.

3.2.2.5 Status of Support Systems

3.2.2.5.1 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 which 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.

3.2.2.5.2 Certification

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

3.2.2.5.3 Data Base 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 15. This table indicates the project title, TEC, funding type (i.e., DOE program budget code), and the respective FY for funding.

Table 15. Line Item and General Plant Projects for LLLW system at ORNL

Title	TEC	Funding type	Fiscal year
Line Item projects:			
Bethel Valley LLLW-CAT System Upgrade	$35,300,000	KG	FY 1988
Isotopes Area LLLW-CAT	41,000,000	NE	FY 1992
Melton Valley LLLW-CAT System Upgrade	20,000,000	KG	FY 1992
General Plant Projects:			
Reactor Waste Minimization	1,000,000	AT	FY 1991
LLLW Treatment Alternatives	1,000,000	AT	FY 1992
BSR/ORR Reactor LLLW Upgrade	1,100,000	KG	FY 1992
Pretreatment of REDC (Building 7920) LLLW	1,100,000	KG	FY 1992
Containment Seal for Evaporator Service Tanks	500,000	KG	FY 1992
4500 Area LLLW Upgrade	1,100,000	KG	FY 1992
Pretreatment of FPDL (Building 3517) LLLW	500,000	KG	FY 1992
Graphite Reactor Canal LLLW Storage and Transfer	1,000,000	KG	FY 1992
Contaminated Sump Pumping Modifications	900,000	KG	FY 1992
Replacement of WC-9 Pumping Station	650,000	KG	FY 1992

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 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 periodically 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 cations by ion exchange, and the NRWTP which will go on line in April 1990 to remove heavy metals and organics. In the PWS, waste from areas more likely to be contaminated are routinely processed through the PWTP, while other waste streams are collected, monitored, and discharged directly to the watershed if found to be free of contaminants or within acceptable levels. Some of the waste streams which are not normally processed by the PWTP are occasionally radioactive and directed to treatment.

Much of the waste collected by the PWS is categorized as nonradioactive. Approximately 40 percent of the waste received by the PWS is collected in holding tanks or ponds, monitored for radioactivity, and discharged to the watershed if the release criteria are met. Nonradioactive process waste is currently discharged untreated to the watershed from the 4500 Area, 2000 Area, 1500 Area, and 6000 Area.

Waste from the 3000 Area is more likely to contain contaminants and is routinely processed through the PWTP. Each month, approximately 6.3 x 10^6 gal of process waste containing 65 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, Ca hardness of 72 ppm, total alkalinity of 88 ppm, and total solids of 180 ppm.

3.2.3.2 Treatment Facilities

Process waste is collected and treated at the PWTP for radionuclide removal. The current PWS is shown schematically in Figure 31. Process waste from the 3000 Area is collected in holding tanks. Process waste from the 4500 Area drains to unlined ponds 3539 and 3540 (also called the 190 ponds). The contents of ponds 3539 and 3540 are normally discharged to WOC because the radioactivity level is acceptably low; otherwise, the wastes are pumped to the PWTP prior to discharge to WOC. Process waste 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 Melton Branch. In the event that the limits are exceeded, then the waste is pumped to Bethel Valley and treated at the PWTP.

The PWTP is designed to remove radionuclides. The process flow diagram in Figure 32 shows the processing steps, such as clarification, filtration, and ion exchange. The influent is treated by ion exchange, which removes nonradioactive calcium and magnesium as well as radioactive cations. Thus, the clarification step is needed to reduce the bulk of these cations prior to ion exchange to avoid frequent column regeneration. The bulk of the radioactive material is removed from the waste by the PWTP clarifier and 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 storage at the ORGDP. The concentrated radioactive material resulting from the regeneration of the PWTP ion exchange columns is currently evaporated to approximately 40 percent solids at the PWTP and transferred to storage tanks 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, which will reduce the amount of LLLW concentrate generated for permanent disposal.

The volume of LLLW generated by the PWTP has been reduced by 80 percent 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.

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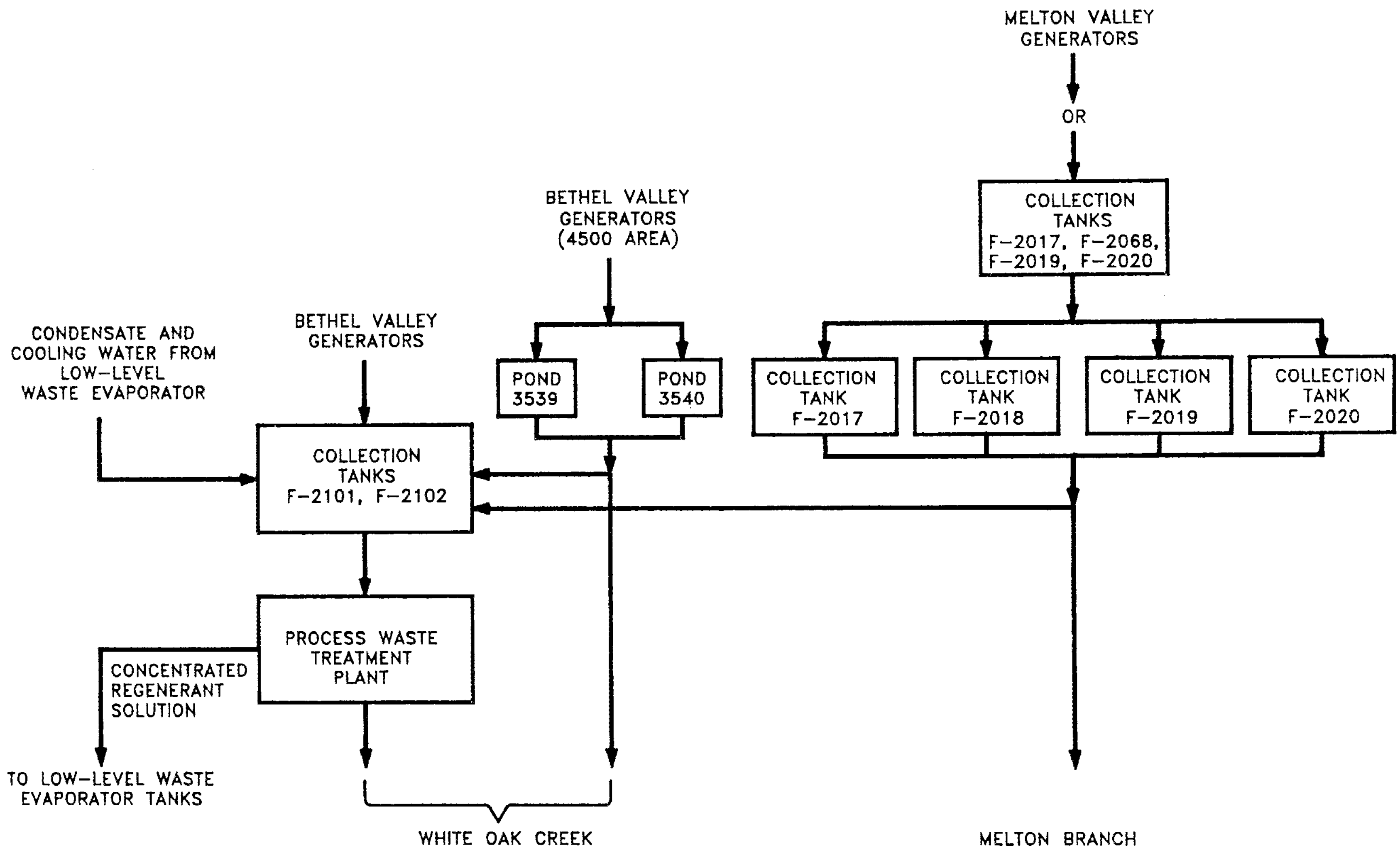

Fig. 31. Process waste system.

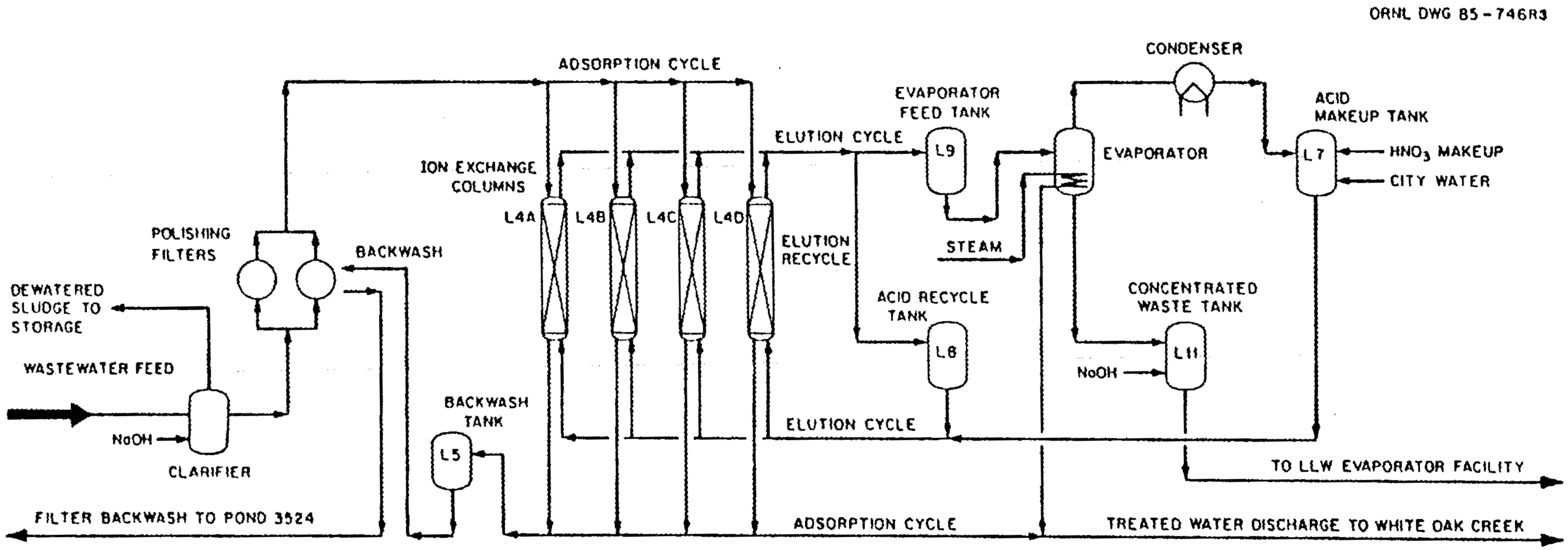

Fig. 32. Process flow diagram of Process Waste Treatment Plant.

3.2.3.2.1 Environmental Monitoring

Monitoring of outfalls specified in the NPDES permit began in April 1986. In the area of NPDES surface water monitoring, currently 13 compliance (point source or ambient) outfalls are monitored. In addition, the flow rate and radioactivity of process waste are monitored at 12 monitoring stations in Bethel Valley and four monitoring stations in Melton Valley. Data are continuously transmitted to the WOCC and monitored by a chemical operator. Monthly reports are prepared describing the volume and total activity content of process waste generated at specific buildings. Monitoring of effluents from process waste operations is also critical to ensure compliance with NPDES permit requirements. To avoid potential violations, waste operations receive timely feedback of data for review.

3.2.3.2.2 Permitting Status

This facility operates under RCRA permit-by-rule and is therefore exempt from RCRA permitting requirements. Current regulatory requirements for process waste generation can be categorized by RCRA waste minimization requirements, NPDES permit requirements, and DOE orders. When the 1984 HSWA 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.

A comprehensive investigation of the generation of process waste that contains nitrates was completed, and a series of corrective measures have been implemented, including:

- replacement of the makeup water demineralizer at ORR Reactor,
- replacement of the makeup water demineralizer at HFIR,
- recovery of nitric acid at the Experimental Gas-Cooled Reactor Site, and
- upgrade of PWTP to reduce ion exchange column regeneration, with a subsequent reduction in nitric acid use.

These actions have virtually eliminated discharges of nitrates to the watershed and brought ORNL into compliance with NPDES requirements for reduction in nitrate loading.

3.2.3.2.3 Facility Status

Improved treatment of process waste for the removal of radioactivity is planned through an upgrade of the PWTP. Research, development, treatability studies, and implementation are necessary to optimize treatment. Analysis of alternatives has been completed, and capital projects are being implemented to upgrade the PWTP. In the upgraded plant, ^{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) which are presently being produced. The process is expected to reduce the secondary waste generation rate by 30 percent. The primary reason for upgrading the PWTP is to meet more strict discharge limits and to reduce the amount of secondary waste generated by the PWTP.

Beginning in April 1990, all process wastewater will be treated in the new NRWTP, as required by the NPDES permit. The NRWTP will provide the removal of suspended solids, heavy metals, and organics. A simple flow diagram of the NRWTP is shown in Figure 33. A single NPDES discharge and monitoring point will be maintained at the Plant outfall and will include discharges from all ORNL process waste generators.

The following projects are proposed modifications for upgrading the PWS. Expense funds are used for characterization, problem analysis, and implementation of short-term projects. Capital funds are used to implement long-term or complex upgrade projects.

3.2.3.2.3.1 Concrete Dike. Construction of a concrete spill-containment dike will be completed and support equipment for containment of any spills that may occur during the unloading of large volumes of nitric acid will be procured. The dike will be constructed on the east side of the PWTP.

3.2.3.2.3.2 Cobalt Removal System at the HFIR. This project involves the installation of a treatment system for the removal of cobalt-contaminated process waste generated at HFIR. Levels of cobalt presently in the HFIR Process Waste will be above the new proposed discharge limits. Since no treatment facility can effectively remove ^{60}Co, this project will install equipment to eliminate this waste stream.

ORNL DWG 86-777

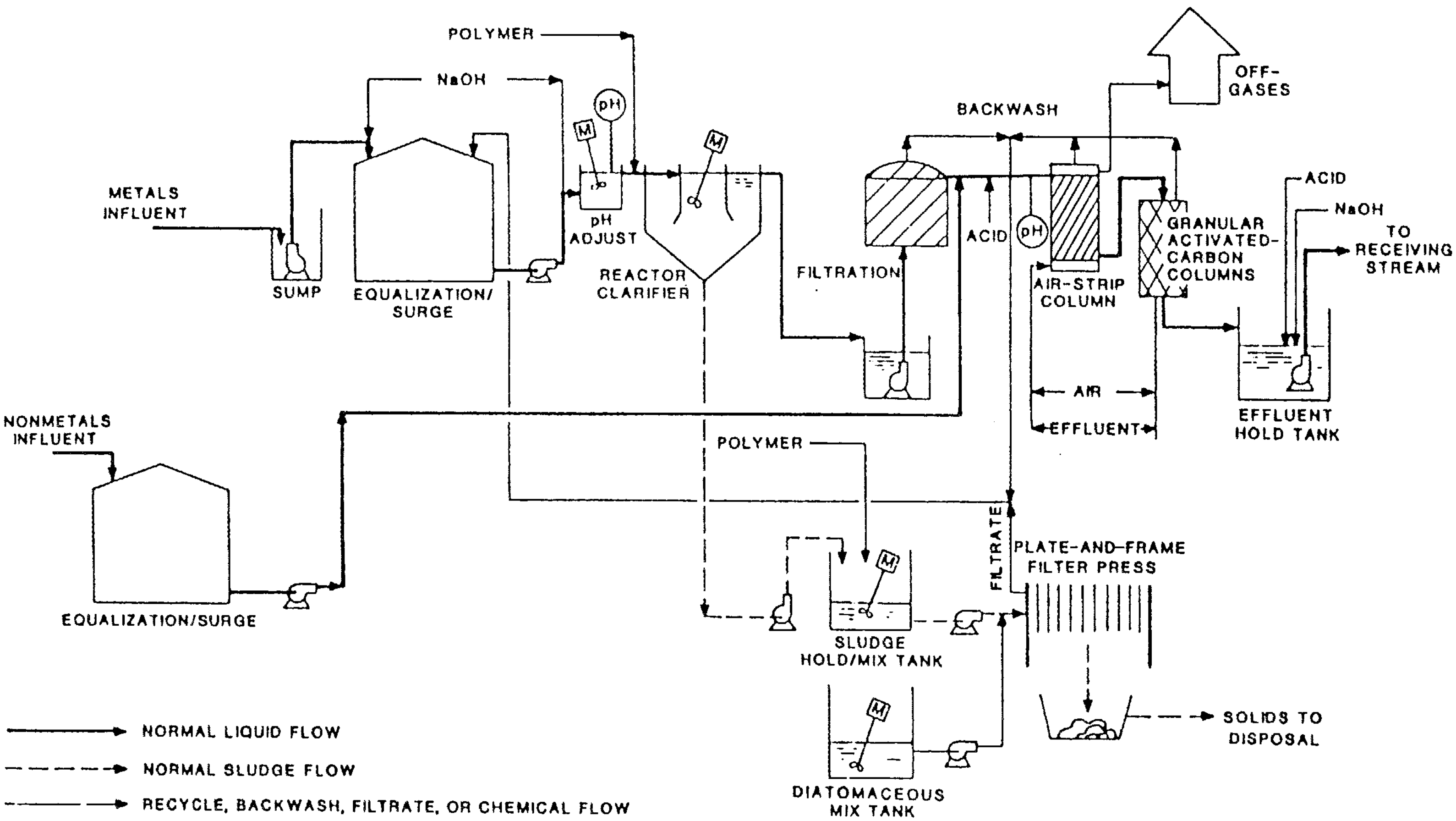

Fig. 33. Flow diagram of the NRWTP.

3.2.3.2.3.3 Manhole Monitors. The purpose of this project is to install six new process-waste manhole monitors in the Building 4500 Area to characterize groundwater leakage and provide sufficient data for chargeback of process waste costs. In addition, another project involves a similar manhole monitor installation in Bethel Valley. The manhole receiving this monitor is known to be contaminated and will require special control measures during construction.

3.2.3.2.3.4 Process Waste Treatment Plant. The ORNL PWTP will be upgraded to meet more stringent discharge requirements, improve efficiency, provide increased waste treatment capabilities, and decouple the process and LLLW treatment systems. The new treatment facility will require that a new pad, ion exchange columns, and associated piping be installed. The only secondary waste generated by the plant will be zeolite (an inorganic ion exchange material) which will contain significant quantities of ^{137}Cs and ^{90}Sr. Currently, no facility exists on the ORR that is capable of dewatering this material to meet solid waste disposal requirements. A zeolite dewatering station would provide the storage and treatment facilities needed to prepare the waste for disposal.

The existing PWTP will be operated until the new zeolite treatment system can be installed. Simple modifications to the PWTP are being implemented to increase the plant capacity, to reduce the waste byproducts generated, and to reduce worker exposure. The installation of a pH adjustment station and acid storage tank, will reduce the spent acids sent to the LLLW system by up to 50 percent. A zeolite loading station is being installed to control the dusts created when the zeolite is loaded.

The addition of piping and a pump to transfer waste from the Bethel Valley Storage Tanks to the NRWTP clarifier will allow the PWTP clarifier to be replaced with an extra clarifier located at the NRWTP site. This modification is needed to increase the feed capacity at peak flow rates and to prevent direct discharges of radioactive wastewater to the watershed.

3.2.3.3 Storage Facilities

Facilities are not implemented for the long-term storage of process waste at ORNL; however, several ponds have been used for collection prior to treatment. All of the existing ponds at ORNL, with the exception of the 190 ponds, have been taken out of service. The 190 ponds will be eliminated after the NRWTP becomes operational in April 1990.

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 Section 3.2.2.5, a certification program is currently being developed for LLLW and process waste streams at ORNL. Data base management associated with process waste consists of the reporting requirements set forth in the NPDES permit for ORNL. Implementation of the BMP Plan is also required by the NPDES permit. Continued support of the BMP Plan will ensure that the process waste system 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. The WOCC also provides data base management support for process waste at ORNL. A discussion of the WOCC is provided in Section 3.2.2.5.3 (Data Base Management).

3.2.3.6 General Plant Projects

A listing of proposed GPPs for the PWS at ORNL is provided in Table 16. This table indicates the project title, TEC, funding type (i.e., DOE program budget code), and the respective FY 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.

Table 16. General Plant Projects for the PWS at ORNL

Title	TEC	Funding type	Fiscal year
West Addition to Building 3544	$ 593,000	GF	FY 1988
Building 3544 Ion Exchange Evaporator Room Upgrade	1,000,000	GF	FY 1989
BSR Process Drain Segregation	145,000	KG	FY 1989
Manhole Monitors Process Waste	415,000	GF	FY 1989
Manhole Monitors Process Waste - Phase II	600,000	GF	FY 1991
PWTP Wastewater Feed Capacity Increase	150,000 800,000	KG	FY 1991 FY 1992
Nitric Acid Unloading Dike PWTP	200,000	KG	FY 1992
Zeolite Dewatering Station	1,100,000	KG	FY 1992
Increase PWTP ^{137}Cs Removal Capacity	150,000	KG	FY 1992
Cobalt Removal System/HFIR	700,000	GF	FY 1992
Manhole Monitors Process Waste - 4500	300,000	GF	FY 1992

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 current approach for control of radioactive emissions from ORNL facilities is illustrated in Figure 34.

Because radioactive air emissions from ORNL facilities are in compliance with existing regulations, the program strategy is to identify and implement system upgrades needed to ensure continued regulatory compliance and to meet DOE objectives for ALARA. 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 is being implemented through a series of technical studies and capital projects. Technical studies are listed below, with the capital projects discussed in Section 3.3.3.3 (Facility Status):

1. Continuation of the stack-and-vent survey to identify emission types;
2. Inspection and evaluation of the ventilation ducts, filter houses, emergency power systems, and other pollution control equipment associated with radioactive emission sources;
3. Engineering studies and cost estimates for repair of equipment, such as underground ventilation ducts and filter pits, and the installation of new pollution control equipment;
4. Performing studies to determine flow distribution, particle size distribution, and flow stability and to evaluate the use of new flow instruments in the main ventilation stacks for use in stack sampling and monitoring;
5. Performing ALARA studies to determine methods to further reduce emissions in a cost-effective manner; and
6. Evaluating new programs and changes in existing programs to ensure continued compliance with regulations.

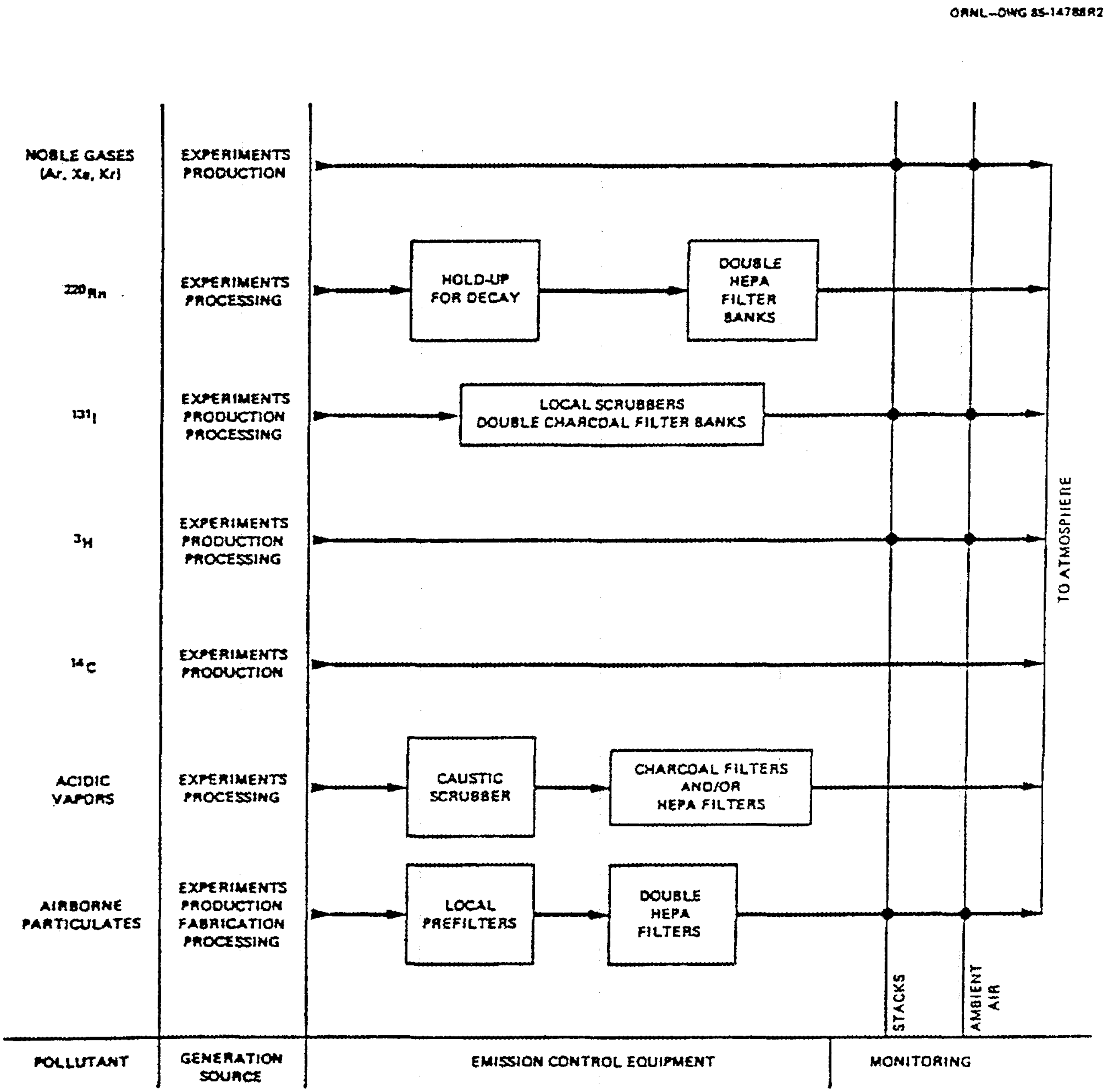

Fig. 34. Radioactive gaseous waste emission control.

3.3.2 Generic Description and Characteristics of Waste

The three general types of radioactive air streams at ORNL, as shown in Figure 35 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 which are 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 which provide controlled ventilation for laboratory-type operations or exhaust from vessels that are vented through appropriate pollution control devices at the source location.

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) which 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 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.

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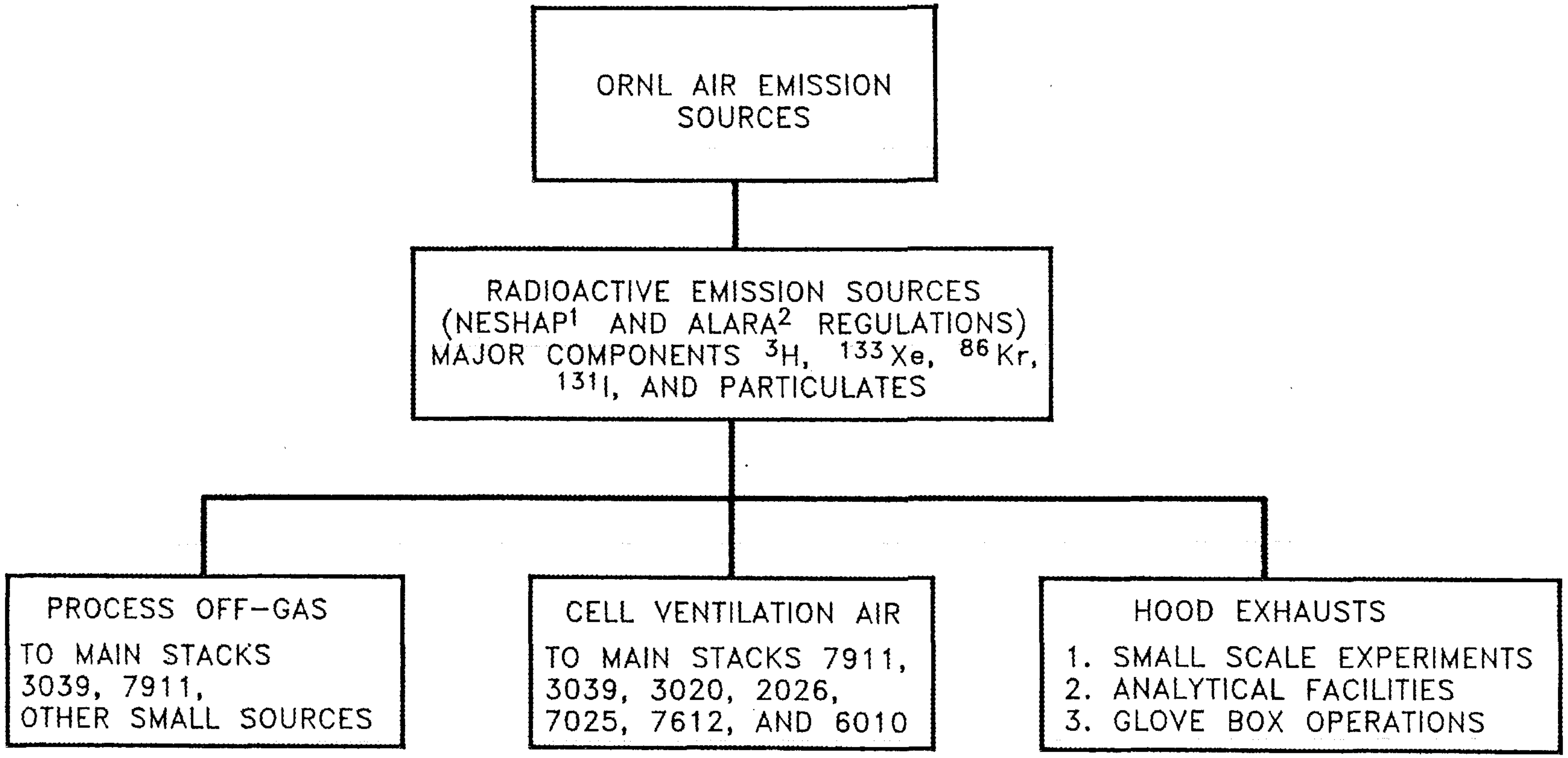

[1] NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS
[2] AS LOW AS REASONABLY ACHIEVEABLE, DOE ORDER 6480.1
[3] OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION

Fig. 35. Emission sources at ORNL.

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 Figure 36. 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 Figure 37. The stack is connected with the ventilation systems in major areas (4500, 3500, 3025-26, Isotopes, Solid State, and the ORR Reactor) by large underground concrete ducts, by underground transite ducts and aboveground steel ducts. Except for the 3025-26 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) pass 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 the HFIR (7900), the REDC (Buildings 7920 and 7930) in Melton Valley (Figure 38). The HFIR cell ventilation air goes through 30-in diameter 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 diameter 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 30-in diameter 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 48-in diameter 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 (Figure 39). 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.

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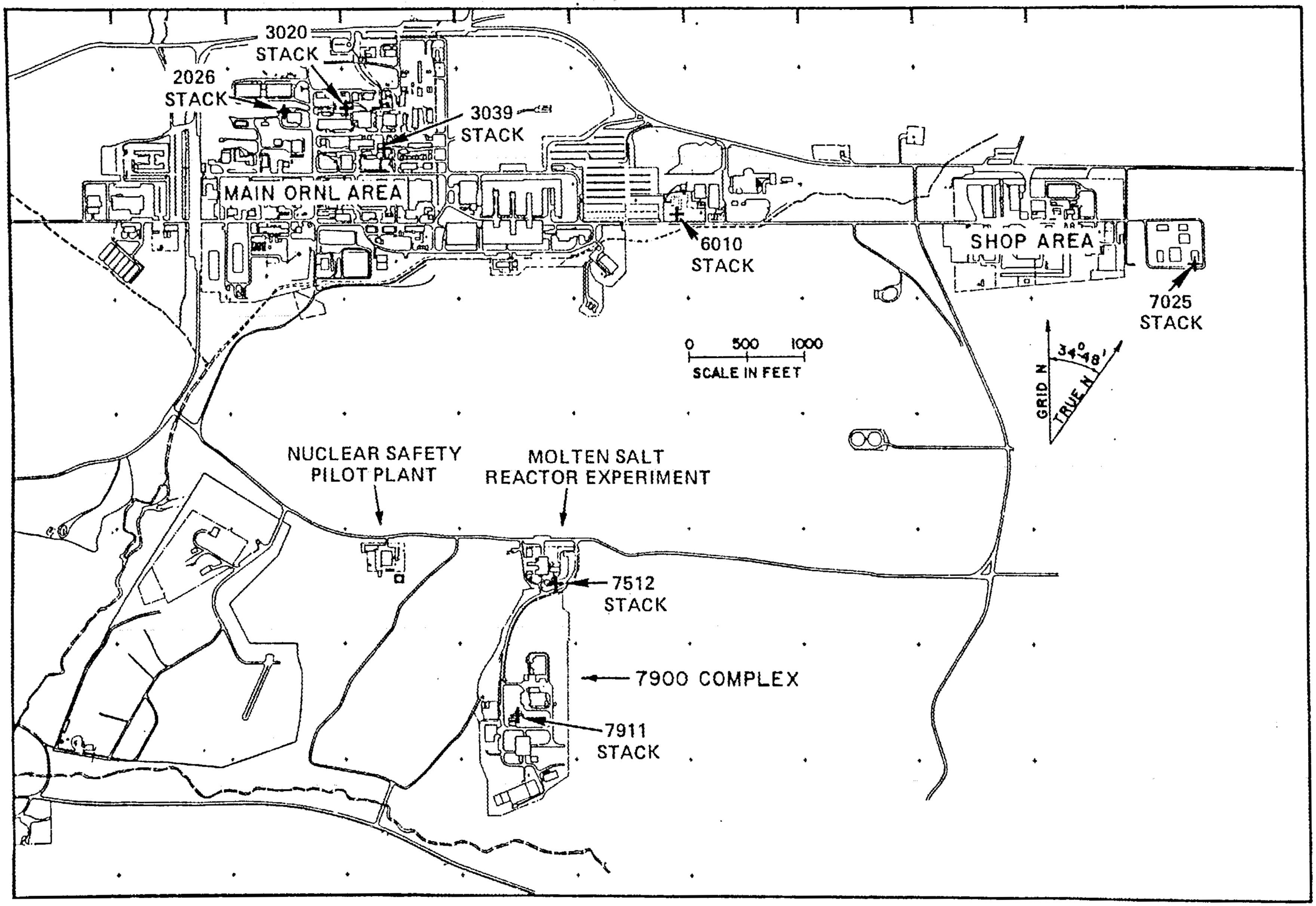

Fig. 36. Location of major cell ventilation stacks at ORNL.

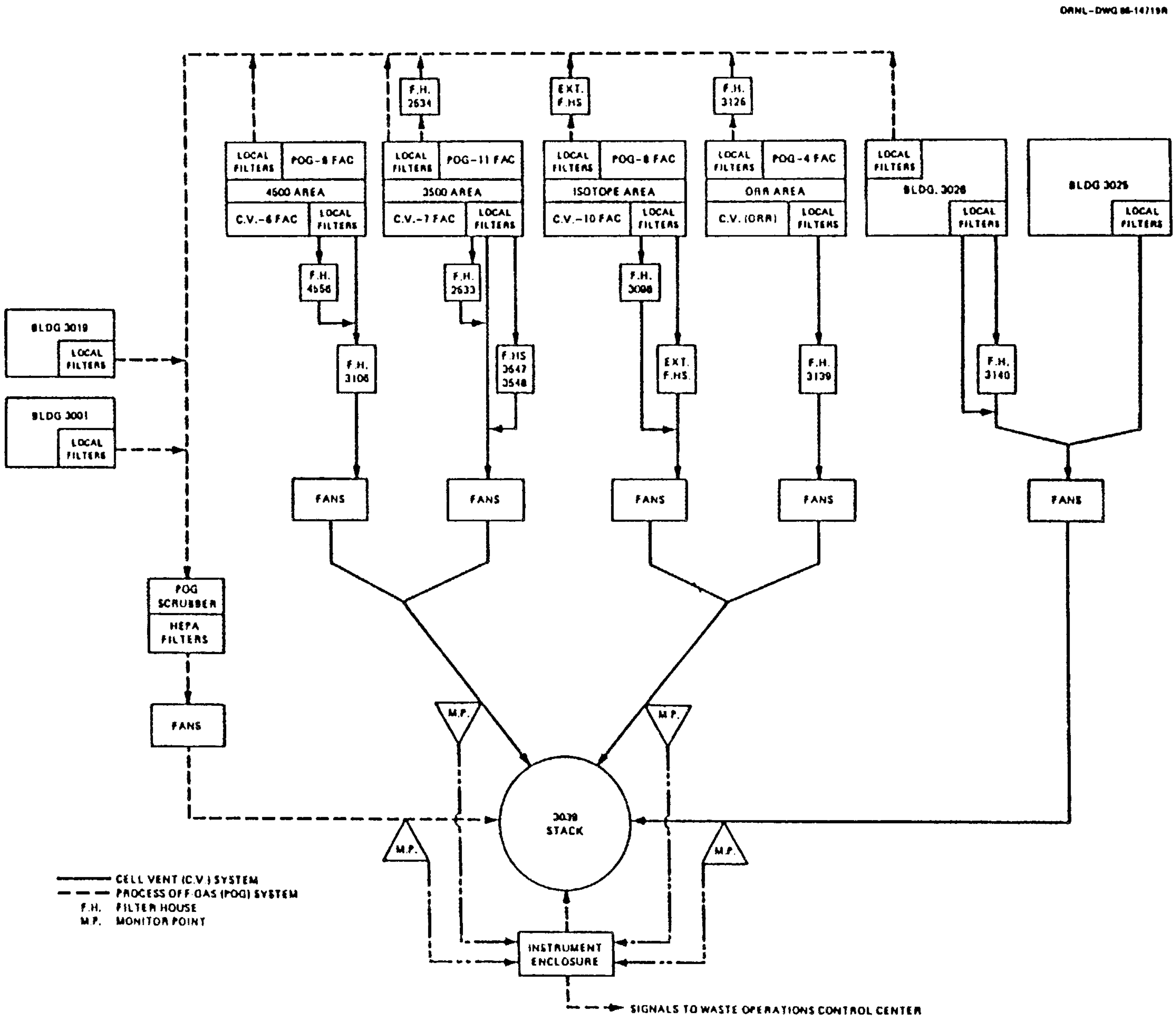

Fig. 37. ORNL central ventilation em for Bethel Valley facilities (3039 stack).

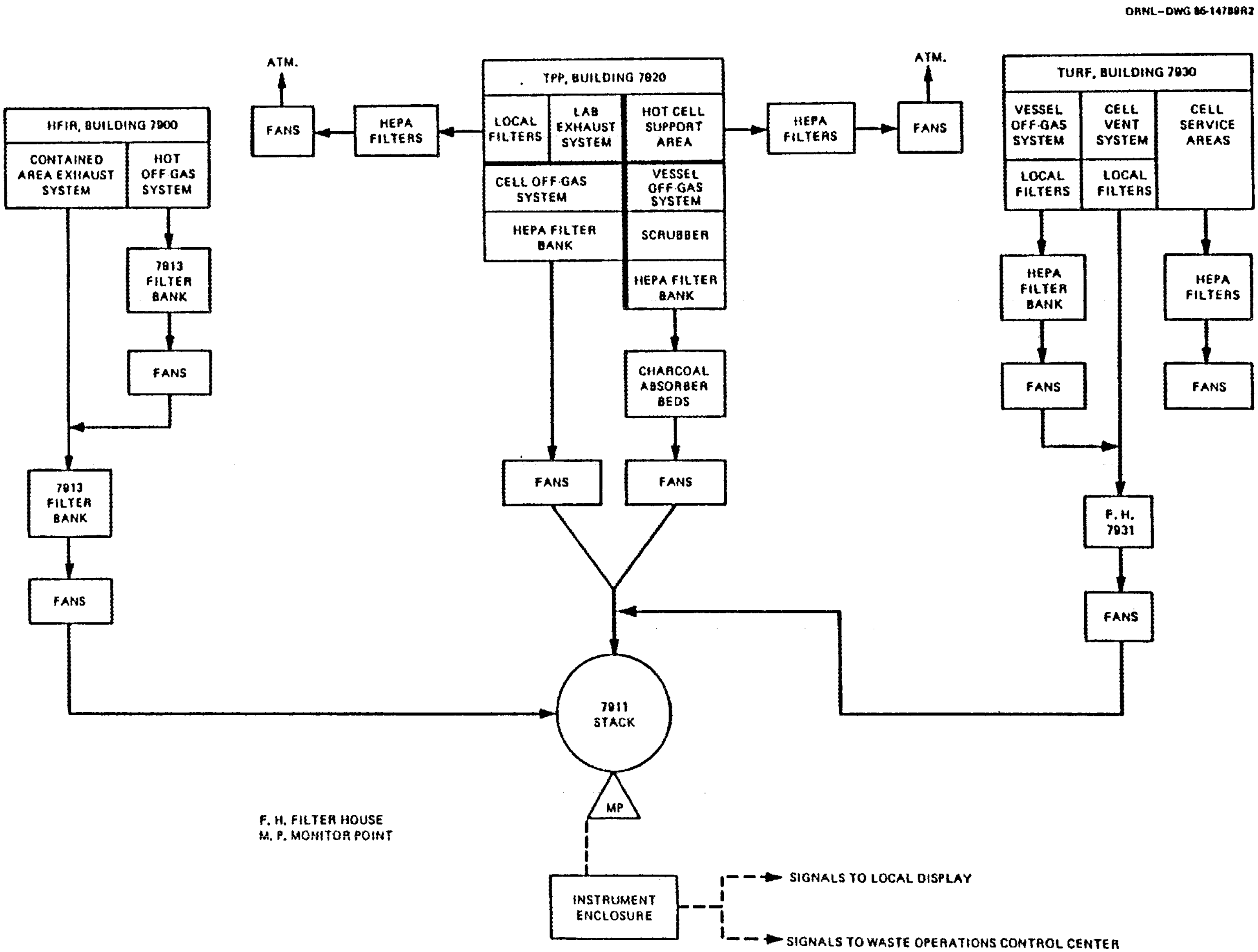

Fig. 38. ORNL central ventilation system for Melton Valley facilities (7911 stack).

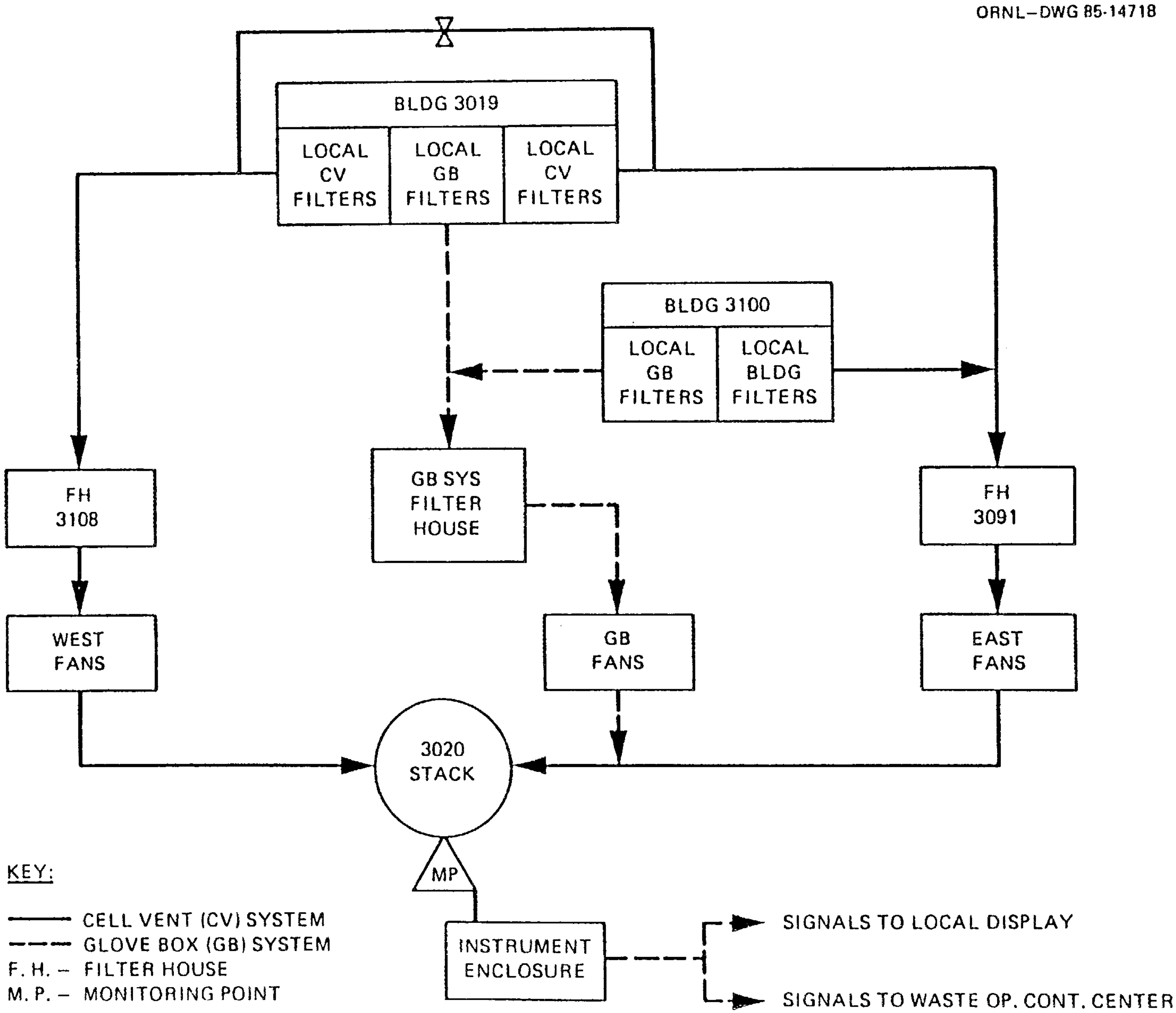

Fig. 39. Ventilation system for the Radioch al Processing Pilot Plant (3020 stack).

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 (Figure 40).

The 7512 stack provides a flow of air through the MSRE 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 (Figure 41).

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 (Figure 42).

The 7025 stack serves a Tritium Target Fabrication Facility. Since HEPA filters are not effective for tritium ventilation, air from this facility goes directly to the stack (Figure 43). Planning is underway to shut down and abandon this facility.

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.

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 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

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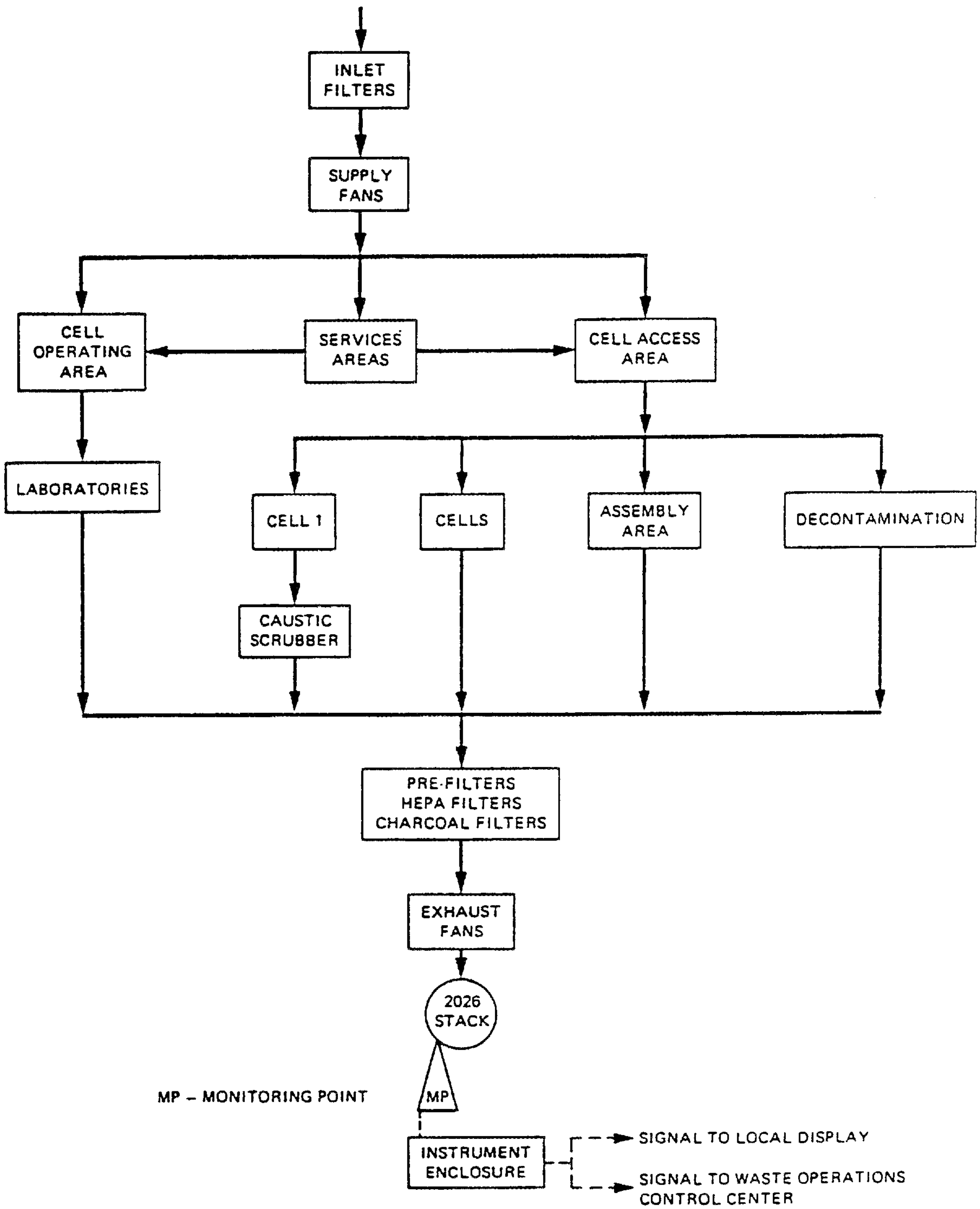

Fig. 40. Ventilation system for the High-Radiation-Level Analytical Laboratory (2026 stack).

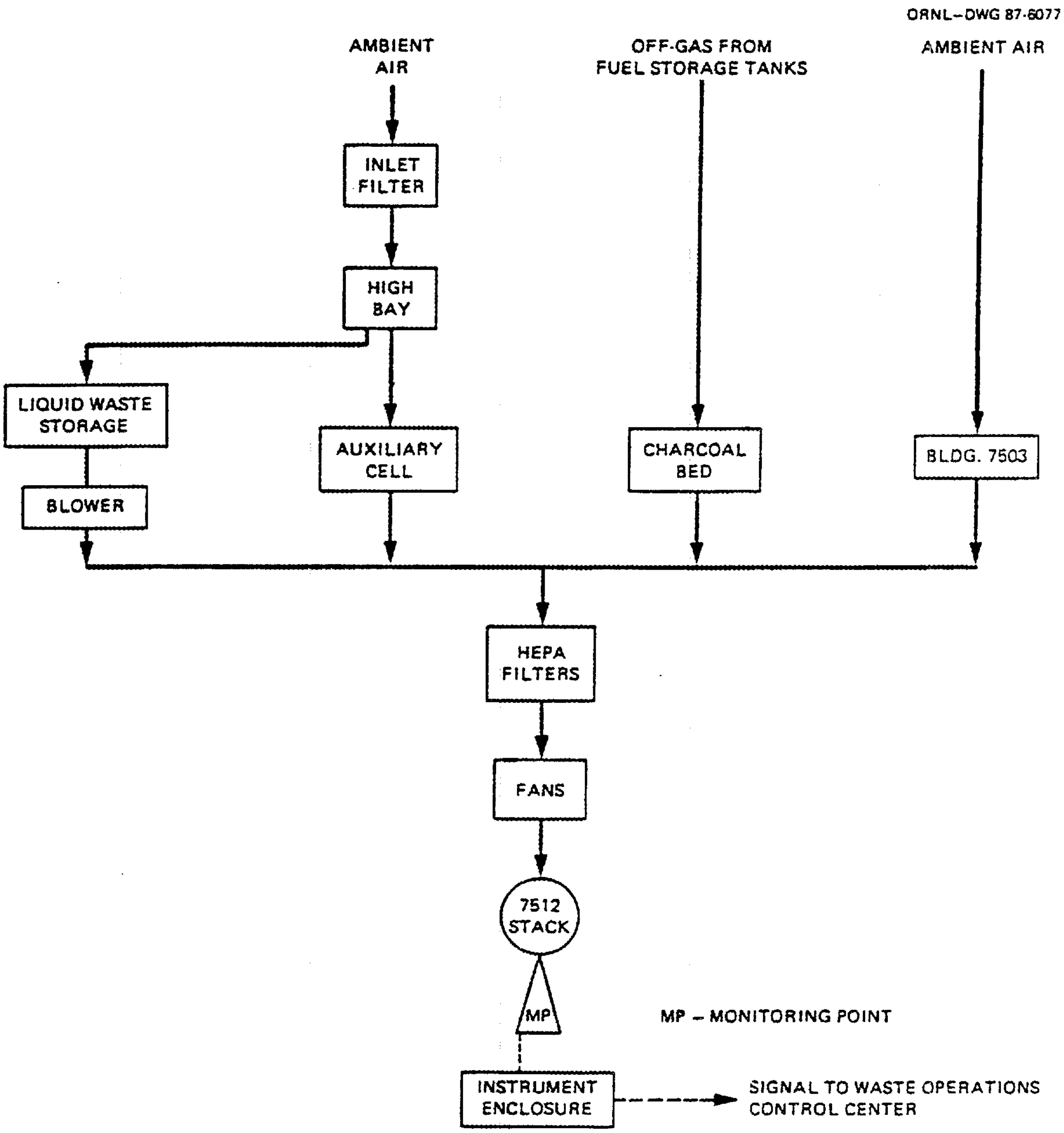

Fig. 41. Ventilation system for Molten Salt Reactor Experiment (7512 stack).

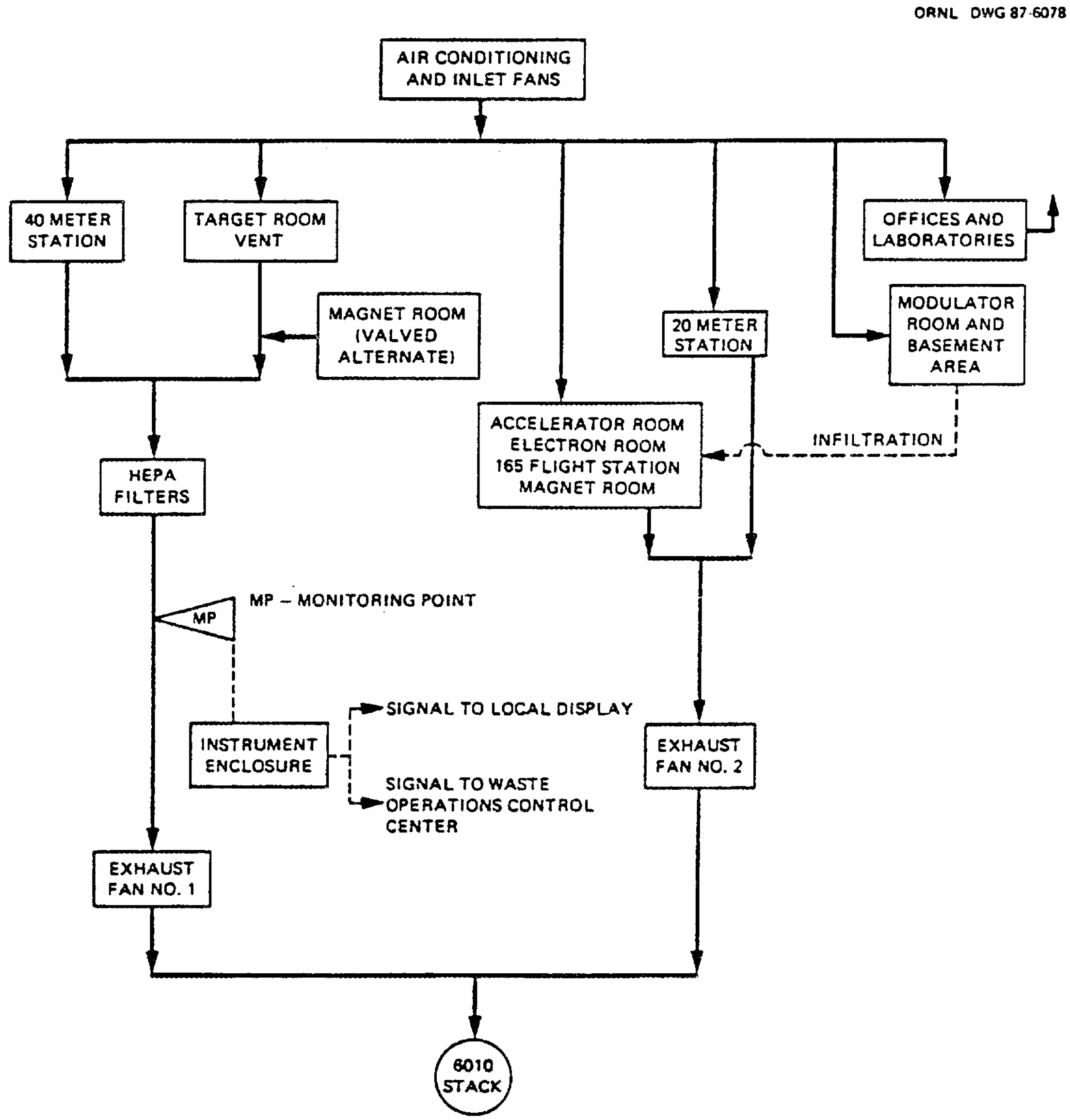

Fig. 42. Ventilation system for Oak Ridge Electron Linear Accelerator (Building 6010).

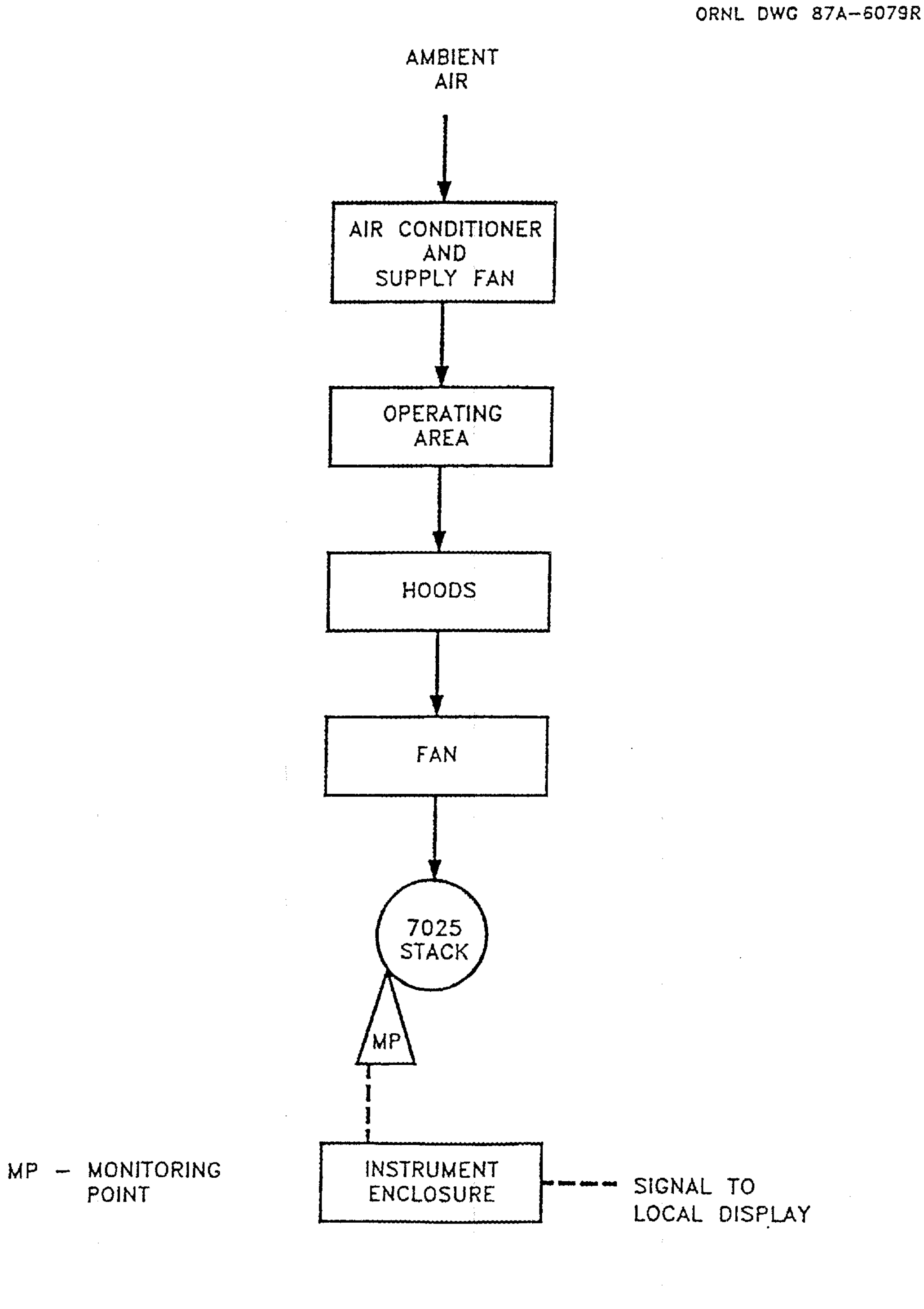

Fig. 43. Ventilation system for Tritium Target Fabrication Facility (Building 7025).

being processed. After passing through the filters, the off-gas goes through an underground 10-in diameter 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.

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 facilities in Building 3047, the Electron Liner Accelerator Facility in Building 3047, 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 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 the these 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 (particulates), as an absorbable gas (iodine), or as a nonabsorbable species (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 (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-minute 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 3-4 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, with the time interval depending on the amount of radioactivity discharged by the stack. Two smaller probes are used to continuously transport samples of stack effluent 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, sample pump, count-rate meter, 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 percent 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, which 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 on series with one of the particulate monitors. With this arrangement, the gas sample is withdrawn from the stack, passed through filter paper which removes the particulates, and then passes through a charcoal trap. The charcoal removes the radioiodine, which 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, with special attention 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, which indicates the integrated counts from the detector, and is normally read and recorded every 24 hours.

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 50-ft level. The effluent sample is withdrawn from the stack through one of the in-stack sampler probes at the 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. Upon collection, the sample is taken to the laboratory for analysis. Since 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, which 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, which 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/hr to 106 rem/hr 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 the 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, 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, which supplies a signal proportional to the flow rate to a digital alarm system located in the WOCC.

3.3.3.2 Permitting Status

Control of airborne emissions from ORNL facilities is provided in accordance with DOE Orders 5480.1A (Environmental Protection, Safety, and Health Protection Plan for DOE Operations), 5480.4 (Environmental Protection, Safety, and Health Protection Standards), 5820.2A (Radioactive Waste Management), and the CAA. The requirements of the CAA are being administered through the TDHE

Air Pollution Control Regulations. Air permits have been obtained for all emission sources which require permitting under TDHE regulations.

The CAA authorizes the establishment of NESHAP regulations for pollutants which Ambient Air Quality Standards are not applicable. Radionuclide emissions are regulated under the NESHAP regulations by the EPA. Currently, the State does not regulate radionuclide air emissions; however, the TDHE has asked the EPA for authority to do so in the future. Under the NESHAP regulations (40 CFR 61), emission of radionuclides to the air from DOE facilities is limited to a dose-equivalent rate of 25/75 mrem/year (whole body/critical organ) to a critical organ of any member of the public. The NESHAP regulations will be revised in the near future. Regardless of NESHAP requirements, DOE facilities are operated under a policy of keeping the exposure to radiation ALARA and meeting EPA standards.

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 as described below. 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 below.

Some systems have undergone significant upgrading through a LI capital project initiated in 1981 (Improvement to Radioactive Waste Facilities, 81-T-104), which included three separate upgrades: 3039 stack area ventilation improvements, isotope area ventilation improvements, and 3020 stack area ventilation improvements.

- During the 3039 stack area ventilation improvements completed in 1984, the fans and ductwork around the stack were either replaced or refurbished.
- The isotope area ventilation improvements, completed in FY 1986, replaced existing underground ventilation ducts with a stainless steel, locally filtered overhead system.

- The 3020 stack area improvement project includes replacement of ductwork between Building 3019 filter house and the 3020 stack, replacement of the two electrical fans and steam fan with four new electrical fans, rewiring of an existing emergency generator, and the addition of a second emergency generator.

Additional improvements are also being made through GPPs. These improvements include an upgrade of the cell ventilation system in Building 3517, a replacement of the 3140 filter house that serves the cells in Building 3026-D, and an installation of enclosures over the 7913 and 3108 filter pits. These projects are currently in the design/construction stage.

Radioactive ventilation systems are being evaluated to determine if additional upgrades are necessary. For example, water leakage into underground ventilation ducts and filter pits adds to the process wastewater load and is a potential source of groundwater contamination. Also, the condition of equipment (e.g., ducts, filters, pits, fans, etc.) associated with radioactive emission sources needs to be further addressed. Much of this equipment is contaminated but serves operable systems, and therefore, access for inspection is extremely difficult and requires remote inspection methods.

Major underground ventilation ducts to the 3039 stack have been inspected and a portion was determined to have problems with water leakage and deterioration of the concrete and joint packing material. Studies are being conducted to determine methods of repair. Filter pits associated with the main stacks are being evaluated during normal filter changes for water leakage and filter sealing problems. An evaluation will be made by vibration analysis to determine the condition of the fans and motors associated with the main stacks. The following projects have been identified as additional potential upgrades of the gaseous waste systems at ORNL.

3.3.3.3.1 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 CEUSP campaign. In the past, the facility was used as a fissile material storage area for conducting research and development 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 sampling gallery exhaust of the 3019 facility needs to be upgraded and connected to the 3020 stack. This modification would involve installing instrumentation, isokinetic sampling equipment, and monitoring connections to the WOCC. An FY 1989 GPP was initiated to address the 3020 stack monitoring improvements.

3.3.3.3.2 Central Radioactive Gas Disposal Facility (3039)

This facility is the central stack through which cell ventilation air and process off-gas from the main ORNL complex are discharged. A ventilation upgrade includes the replacement of off-gas fans and two cell off-gas fans that discharge from the REDC (Building 7920) to the 7911 stack. This project is presently scheduled as a FY 1990 GPP.

3.3.3.3.3 Isotope Technology Building (3047)

The filter house of Building 3047 services hot cells for isotope production and has the potential for emitting radionuclides. An additional set of HEPA filters is required to improve cell ventilation. This upgrade was initiated as a FY 1989 GPP.

3.3.3.3.4 Cell Ventilation Filter Facility (3548)

Cell filtration for the Filter Facility at Building 3517, FPDL, needs to be upgraded to meet DOE efficiency requirements. This task must be completed by 1990, or the facility will be shut down. An FY 1988 GPP will address this problem.

3.3.3.3.5 MVST Facility (7830)

The two ventilation and two off-gas stacks of the MVST need monitoring and sampling additions and upgrades in order to control the emission of radionuclides and particulates and to provide representative sampling of the air stream.

3.3.3.3.6 New Hydrofracture Facility Stack (7860)

Equipment needs to be installed in the NHF stacks to provide capabilities for radionuclide monitoring and sampling. The stack also needs to be instrumented for flow and velocity pressure monitoring and to be equipped with provisions for sampling for particulates. This upgrade is included under the same FY 1990 GPP that addresses Building 7830.

3.3.3.3.7 Process Waste Treatment Plant (3544)

The ventilation system for the PWTP requires several types of upgrading, including the remediation of water leakage into the system. The scrubber emits nitrous oxide, sulfuric oxide, volatile organics, and carbon dioxide. An existing FY 1990 GPP (Ventilation System Upgrade) 3500, 4500, partially addresses this problem.

3.3.3.3.8 MSRE Building (7503)

Some MSRE fuel remains in tanks located within the facility. Fuel salt and flush salt containing primarily ^{233}U and ^{239}Pu are present in the drain tanks. The MSRE stack (7512) needs to be instrumented to provide real-time monitoring and sample collection capabilities for radionuclides.

3.3.3.3.9 Graphite Reactor (3001)

The ORNL Graphite Reactor, the world's first uranium chain reactor with production potential, is presently inactive but requires stack monitoring for the residual radioactive material stored within the building. The current plan is to use monitors from the renovation of Building 7503. In the event that the old MSRE monitors cannot be used or are not entirely sufficient, then new monitoring equipment would be provided.

3.3.3.3.10 Lead Shop (7005) and Metal Storage and Cutting Facility (7015)

The Lead Shop smelting furnaces, which emit some lead-contaminated vapors, need a ventilation upgrade, insulation replacement, and reduction of high noise levels.

3.3.3.3.11 Melton Valley Collection Tank WC-20 (7569)

Tank WC-20, a 10,000-gallon LLLW tank that collects liquid waste from the REDC (Buildings 7920 and 7930), and transfers the waste to the LLLW Evaporator feed tanks, requires stack monitoring and an isokinetic sampling system.

3.3.4 Storage and Disposal Facilities

Air emissions at ORNL are routinely treated and discharged through monitored ventilation stacks on-site. Since 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 Section 3.1 of this plan.

3.3.5 Status of Support Systems

No specific training, certification, or data base management system is available at ORNL for radioactive gaseous emissions. Training is generally commensurate with the employee's job responsibility, with certification and data base management associated primarily with solid waste streams. The 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 the WOCC.

3.3.6 General Plant Projects

A listing of GPPs for gaseous radioactive waste facilities at ORNL is provided in Table 17. This table indicates the project title, TEC, funding type (i.e. DOE program budget code), and the respective FY for funding.

Table 17. General Plant Projects for gaseous radioactive waste facilities at ORNL

Title	TEC	Funding type	Fiscal year
Upgrade Cell Filtration, 3517	$ 630,000	GF	FY 1988
Upgrade 7913 Filter Pit	450,000	GF	FY 1988
3020 Stack Monitoring Improvements	500,000	KG	FY 1989
Upgrade Stack Fans (3039)	550,000	AT	FY 1990
Liquid/Gaseous Waste Support Facility	600,000	KG	FY 1991
Waste Operations Control Center Expansion (also used for LLLW)	800,000	KG	FY 1991
NHF/MVST Stack Monitoring Improvements	1,100,000	AT	FY 1991
3108 Filter Pit Enclosure	500,000	AT	FY 1992
Filter Pits Upgrade	600,000	AT	FY 1992
Ventilation Systems Upgrade, (3500/4500)	1,000,000	GF	FY 1992
Upgrade 3047 Filter House	1,100,000	GF	FY 1992
Upgrade Hot Off-Gas System at 3039 Stack	1,100,000	KG	FY 1992

4. HAZARDOUS WASTE MANAGEMENT

RCRA is the primary force guiding ORNL hazardous waste management operations. The EPA has regulatory authority over RCRA, with the States given the option of adopting at least as strict hazardous waste management regulations. The State of Tennessee has developed and implemented regulations essentially equivalent to those of the EPA, which are addressed in the THWMR. It should be emphasized that these requirements apply only to hazardous and mixed wastes, not to radioactive waste that do not have a hazardous constituent. Hazardous waste management at ORNL is discussed in this section, with ORNL mixed waste management activities discussed in Section 5 of this plan.

A waste is classified as hazardous by EPA if it is corrosive, reactive, toxic, or ignitable as defined in 40 CFR 261, Part C of the RCRA regulations. A waste can also be classified as hazardous if any of its constituents are included in the over 400 hazardous wastes listed by the EPA in 40 CFR 261, Part D. As defined by ORNL, hazardous wastes include those regulated by both RCRA and TSCA, medical and infectious wastes, and other wastes that ORNL determines as representing a substantial hazard to personnel or to the environment if improperly managed.

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 such hazardous waste as spent experimental samples, process residuals, and hazardous materials (usually chemicals) that have exceeded their shelf lives or usefulness. 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. Since containerized liquid and gaseous wastes are considered "solid" wastes by EPA and are subject to solid waste rules, liquid and gaseous (containerized) 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 Figure 44. This management strategy must be in compliance with applicable Federal and State regulations, DOE

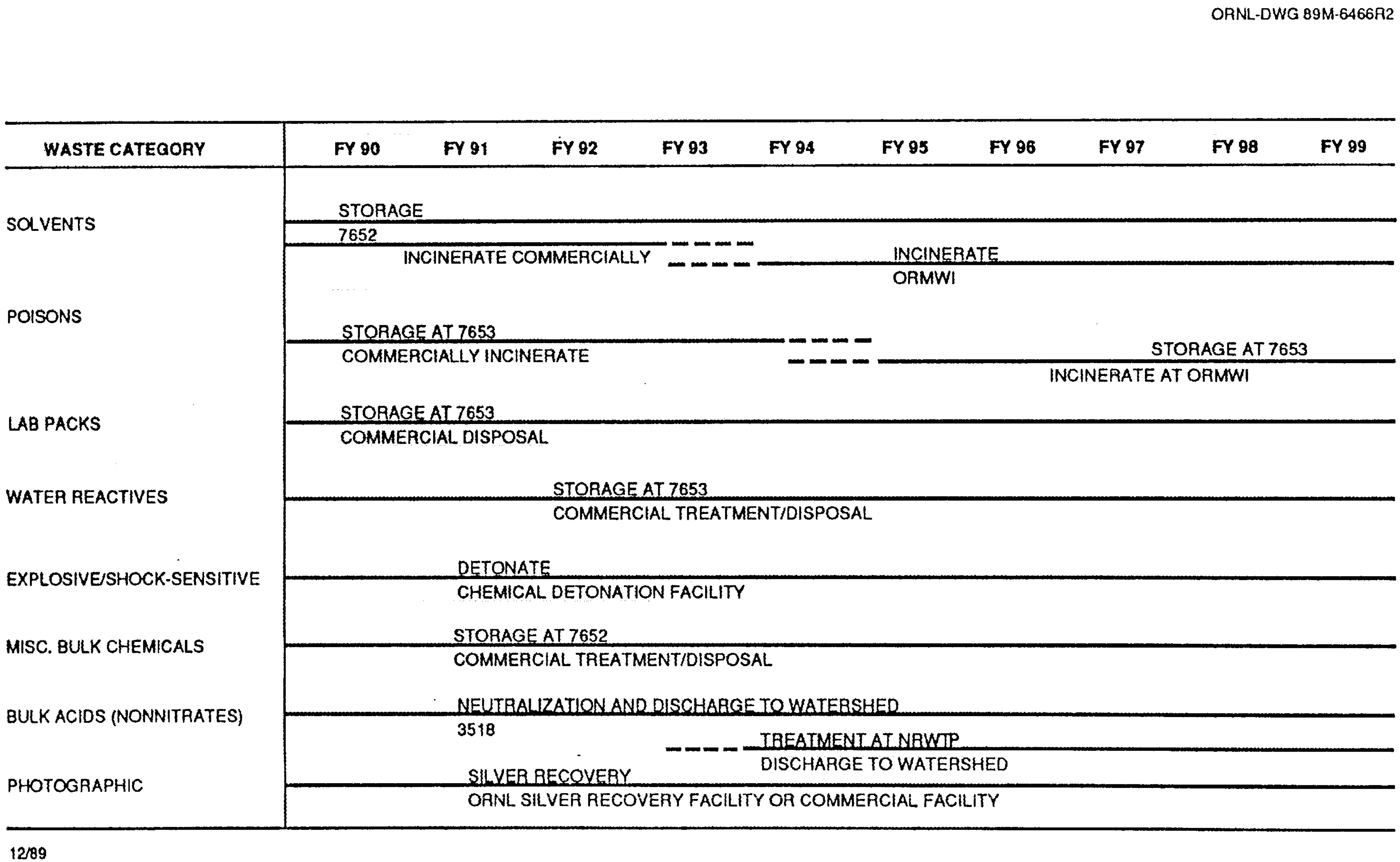

Fig. 44. ORNL management strategy for hazardous waste.

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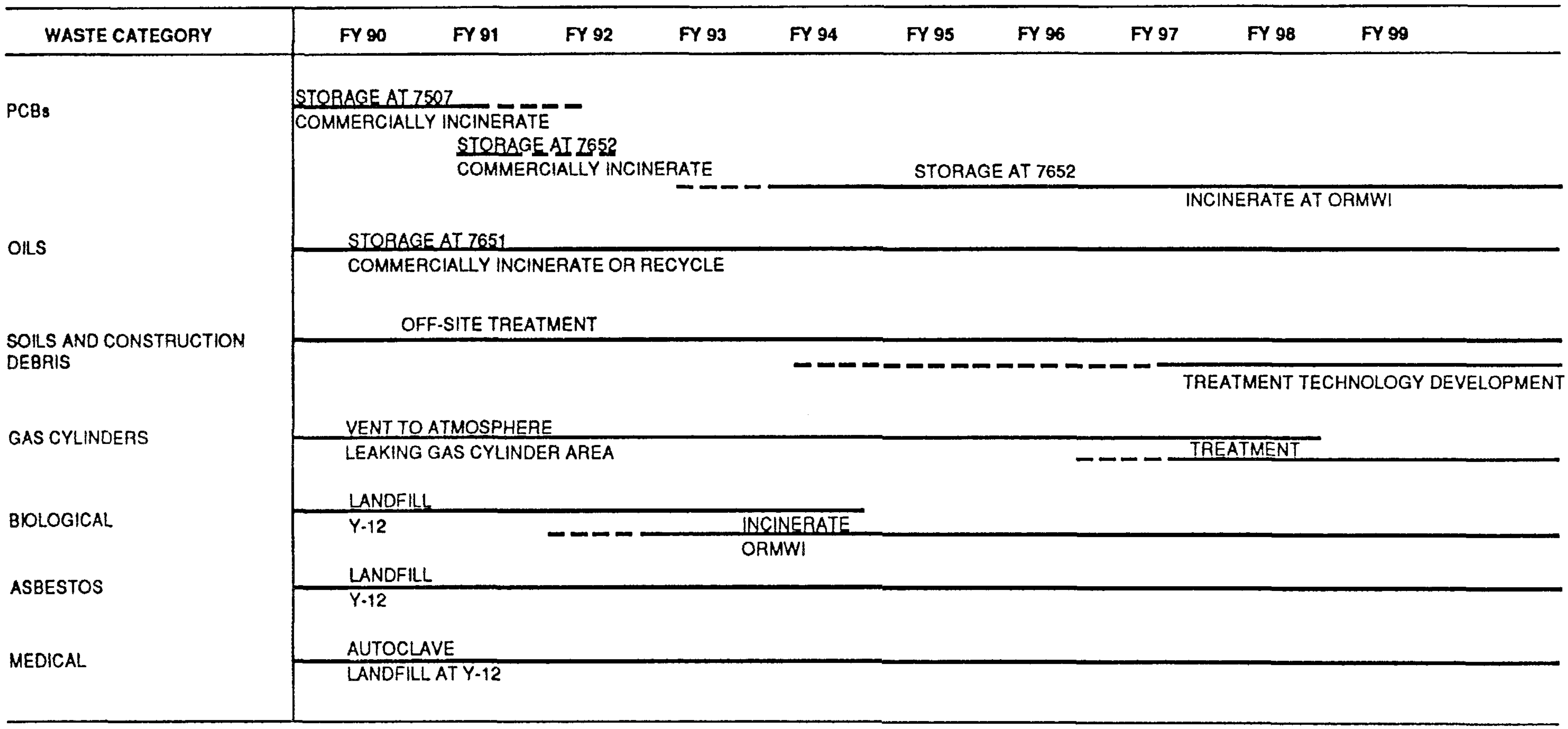

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Fig. 44. (contd).

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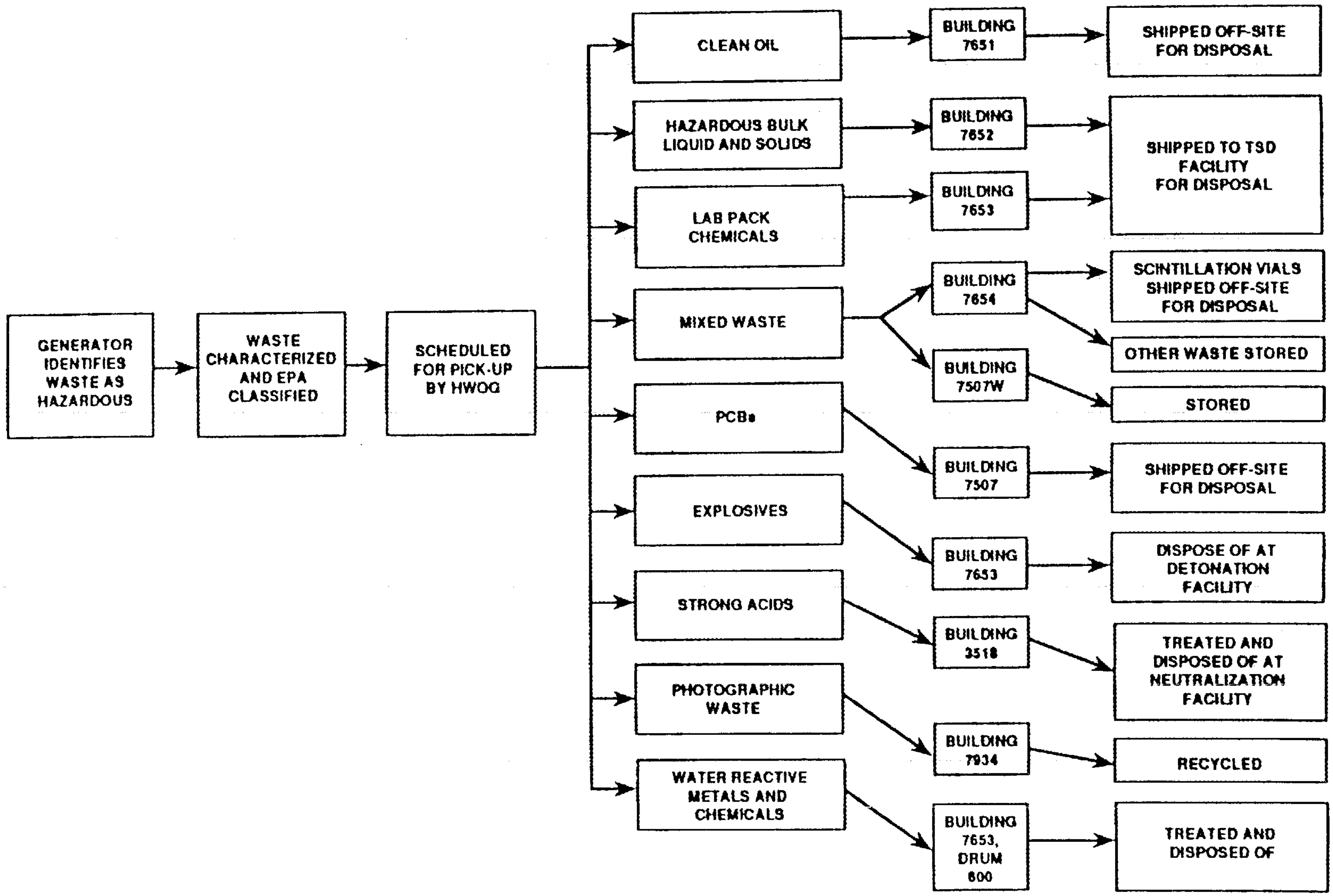

Fig. 45. Flowchart of hazardous waste management activities.

orders, and Corporate policies. Employees, public safety and health, and the environment must be protected. The solution for the treatment, storage and disposal of these waste streams should be a cost-effective one from the perspective of ORNL and Energy Systems. 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 segregation, repackaging, and storage in preparation for shipment to commercial facilities for treatment and/or disposal. Waste minimization, tracking, and documentation is a critical aspect of the ORNL management strategy.

ORNL is committed to the minimization 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. Motivation for waste reduction is found in Federal regulations, DOE policies and guidelines, 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 characteristics associated with each. Critical characteristics include physical form (liquid, solid, gas), hazardous chemical properties, and/or the presence of constituents identified as hazardous by the EPA under RCRA, CERCLA, or TSCA. Since 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 appear on ORNL's RCRA permit application illustrates this diversity.

Collection of hazardous waste at ORNL is performed in a controlled manner (see Figure 45). The generator of a hazardous waste prepares a request form for waste collection. The request is sent to the HWOG which logs the request, ensures that the waste has been properly identified, and determines its appropriate classification (i.e., toxic, reactive, flammable, 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 packed by commercial TSD facility personnel into approved shipping containers that meet both DOT and EPA requirements and is periodically shipped to EPA-approved commercial treatment or disposal sites. Explosive waste is treated on-site at the Chemical Detonation Facility (Building 7667). Upon waste classification and collection, bulk 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, clean used oil (i.e., oil free of PCBs, radionuclides, or other contaminants) is delivered to Building 7651 for off-site treatment.

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 below.

Bulk non-nitrate acids are neutralized at the Acid Neutralization Facility (Building 3518) and discharged to WOC via the NPDES system. This facility is operated under permit-by-rule and is exempt from RCRA regulations for TSD facilities.

The Chemical Detonation Facility (Building 7667) is located approximately 200 ft northeast of the Hazardous Waste Management Area. Access to the site is from a gravel road (Chemical Waste Access Road) off the HPRR 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 (Figure 46). The magazines are approximately 4-ft by 4-ft by 4-ft and are bulletproof, fire-resistant, weather-resistant, theft-resistant, and ventilated. The magazines are separated by an earthen berm about 4-ft high. The detonation trench is 10-ft long, 4-ft wide, and 3½-ft deep. A 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 in a chain link fence. The control area is the location from which the waste material is detonated. The cleared area provides good visual access to the detonation trench.

The Chemical Detonation Facility operates under RCRA interim status permit and an open burning permit under TDHE regulations. A RCRA Part B permit application has been prepared and a draft permit has been issued, however, a final permit has not been issued.

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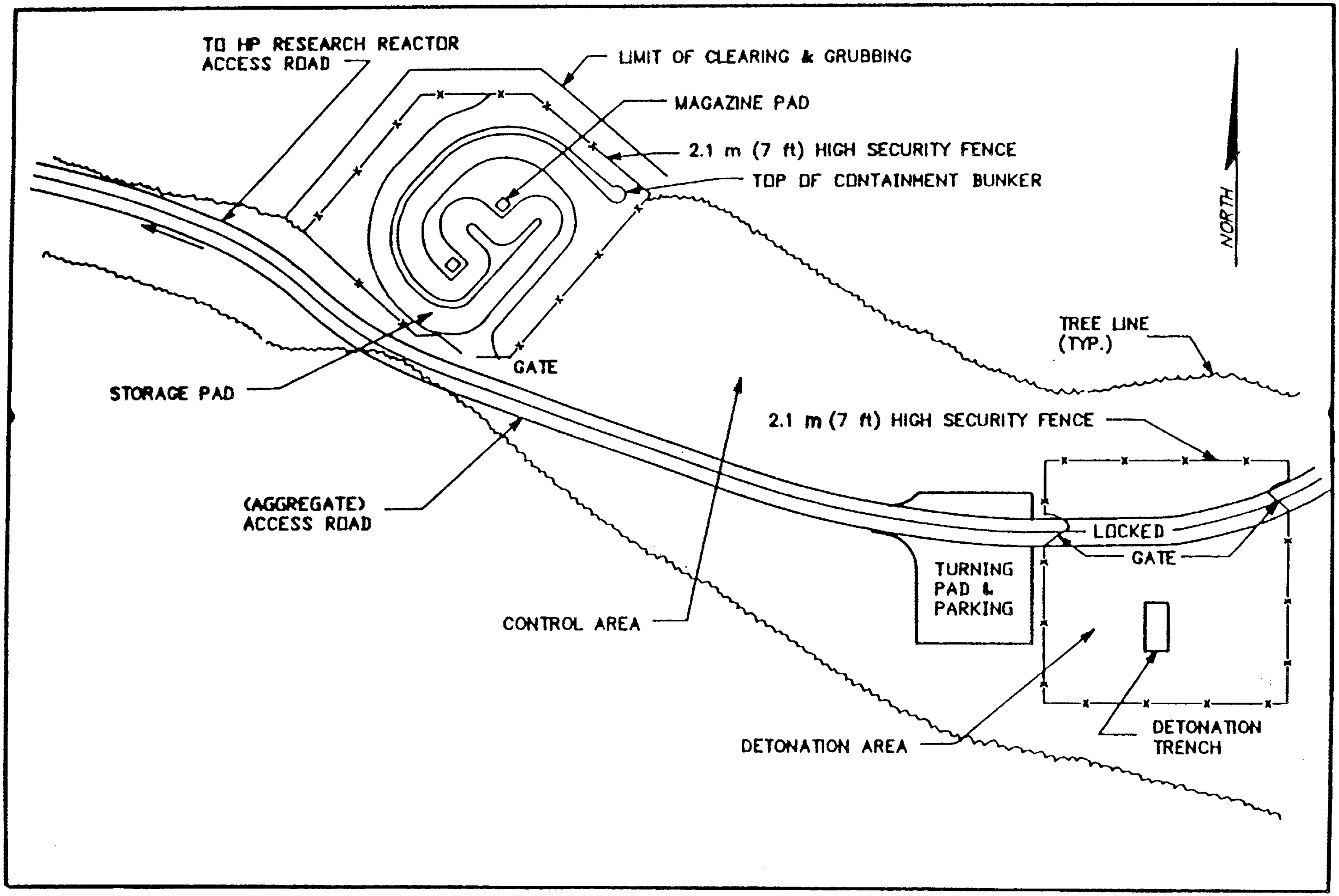

Fig. 46. Chemical De[illegible]ation Facility.

4.1.4 Storage Facilities

Several facilities are currently used for the short-term storage of hazardous waste at ORNL, as discussed in the following sections. The majority of waste is stored in 55-gal drums in Building 7652, with a capacity of 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. With the exception of Buildings 7507 and 7934, the storage facilities are located in the Hazardous Waste Management Area off the HPRR access road at ORNL.

4.1.4.1 Building 7652 - Hazardous Waste Storage Facility

Building 7652 has an area of approximately 2,400-ft^2 with dimensions of 39-ft by 61-ft. This area includes an outside covered storage area (30-ft long by 20-ft wide). The building consists of insulated, prefabricated panels with metal stud walls with a 2-hr fire rating. The building floor is 3,000 psi concrete with two coats of an epoxy sealer and curbing around the building. The enclosed section of the building consists of five storage areas, each containing a sump, with each area separated by curbing. The building layout is shown in Figure 47.

Building 7652 is used to store hazardous wastes which have been packaged, labeled, and marked in accordance with DOT regulations. The bulk waste chemicals are placed in DOT-approved drums, either at their point of origin or after transfer to the facility. A maximum of 15,125 gal (275 55-gal drums) can be stored at this facility. All drums stored in this building are segregated according to the RCRA hazard classes. When enough drums are accumulated, shipment and transfer is arranged to an off-site EPA-approved TSD facility.

4.1.4.2 Building 7653 - Chemical Waste Storage Facility

Building 7653 is 30-ft wide and 102-ft 8-in long with a total area of 3,060-ft^2. The building is divided into eight separate rooms (storage cells). The building layout is shown in Figure 48. The building is constructed of insulated prefabricated metal framing, partitioned with metal stud walls with a 2-hr fire rating. Curbing with a centralized sump is utilized for each of the storage cells (except for the water reactive storage cell). One of the cells is used for an office and emergency equipment storage area.

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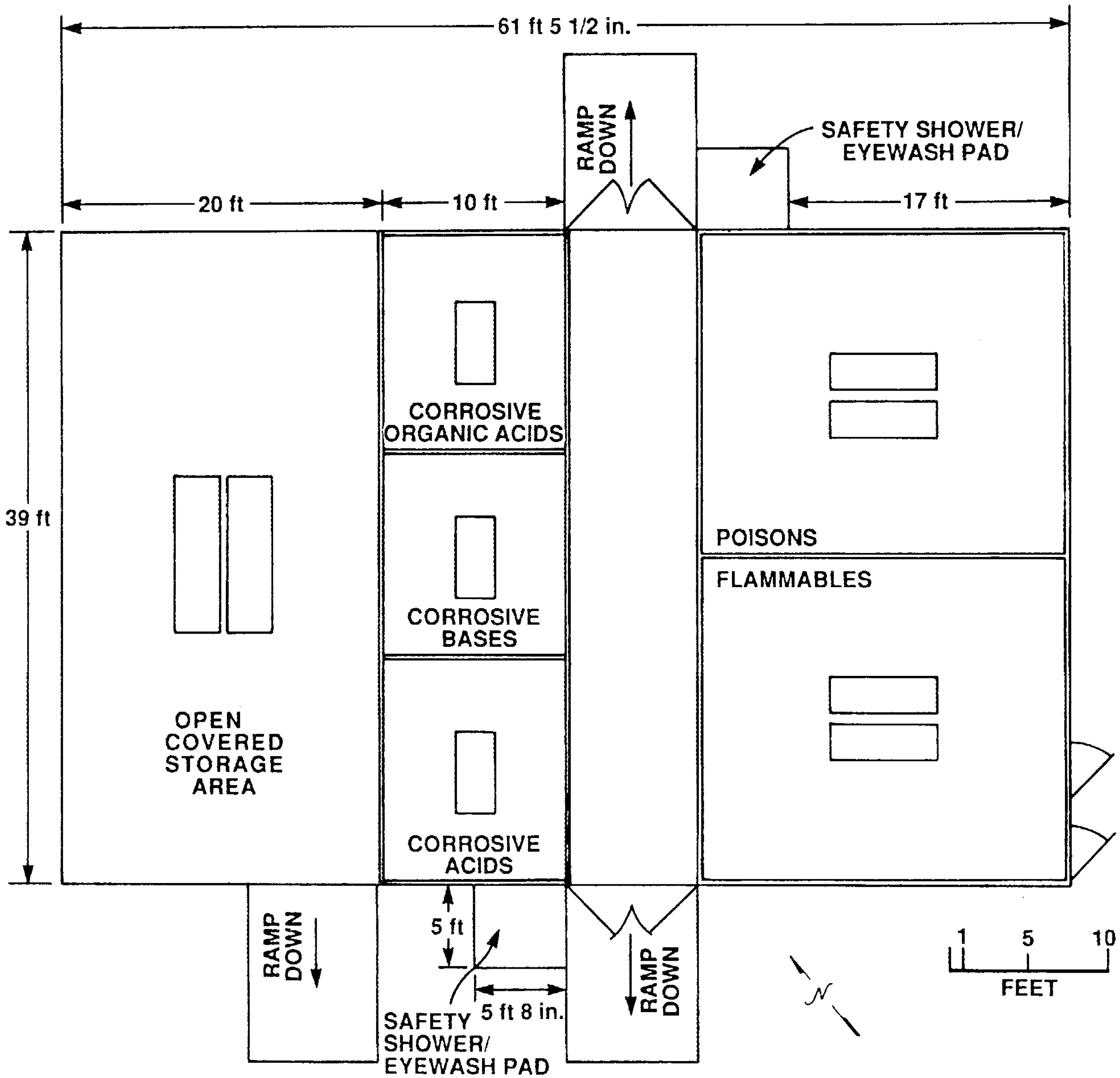

Fig. 47. Layout of Building 7(. Hazardous Waste Storage Facility.

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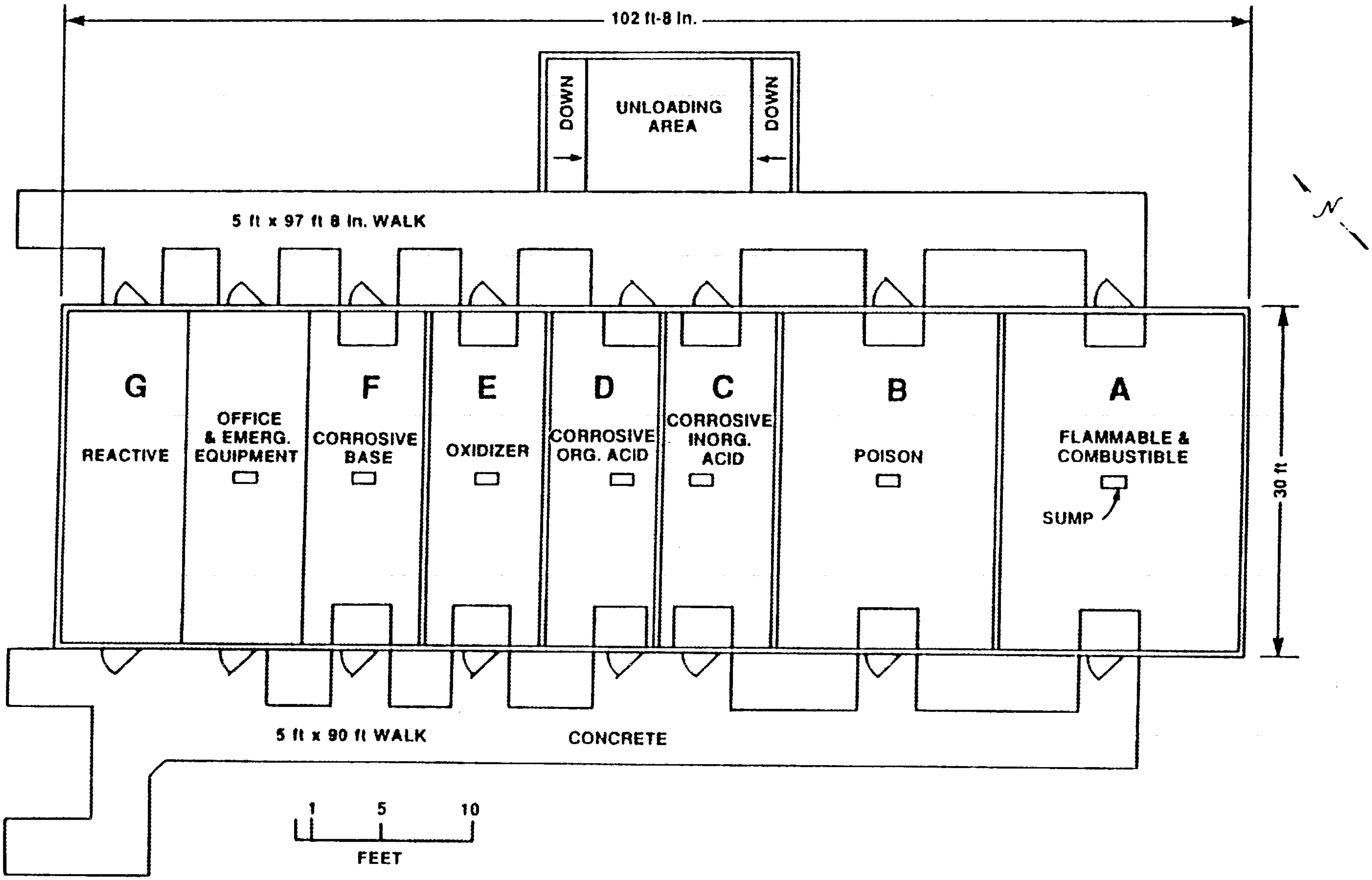

Fig. 48. Layout of Building 7653, Chemical Waste Storage Facility.

The facility is used for storage of small quantities of laboratory chemicals and process chemical wastes. The small containers (less than 5-gal or 20-lb) of chemical wastes are delivered to the facility and are separated by hazard class for storage in the appropriate cell. The storage cells contain metal shelving or cabinets to hold the containers. The chemicals are generally within the original container and identified with the manufacturer's label. When sufficient quantities of waste have accumulated, personnel from a commercial TSD facility lab-pack the waste into DOT-approved containers. The waste is then shipped off-site to an EPA-approved TSD facility.

Each storage cell is limited to contain not more than the equivalent number of small containers constituting 10 55-gal lab packs. The maximum allowed inventory of waste in storage for the facility at any given time is 60 55-gal drums (3,300 gal).

4.1.4.3 Building 7507 - Hazardous Waste Storage Facility

Building 7507 is a steel frame, metal siding structure consisting of approximately 1,470-ft^2 in area, with a continuous concrete curb dike around the inside perimeter and no floor drains (Figure 49). Double sliding doors with a metal ramp allow for loading and unloading operations. The building has been partitioned into four compartments by using 8-ft high walls constructed of 2-in by 4-in wood and gypsum wall board.

The maximum allowed inventory of hazardous waste in storage is 150 55-gal drums (8,250 gal). Initially, hazardous waste stored at the facility consisted of lab packs; bulk quantities of ignitable, corrosive, and/or EP toxic wastes, oxidizers, and poisons; PCB-contaminated liquids and solids. Currently, the storage facility is utilized only to store PCB-contaminated waste. All other hazardous waste is stored in Buildings 7652 and 7653.

4.1.4.4 Building 7651 - Clean Oil Storage Pad

Building 7651 is a 40-ft by 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 Figure 50).

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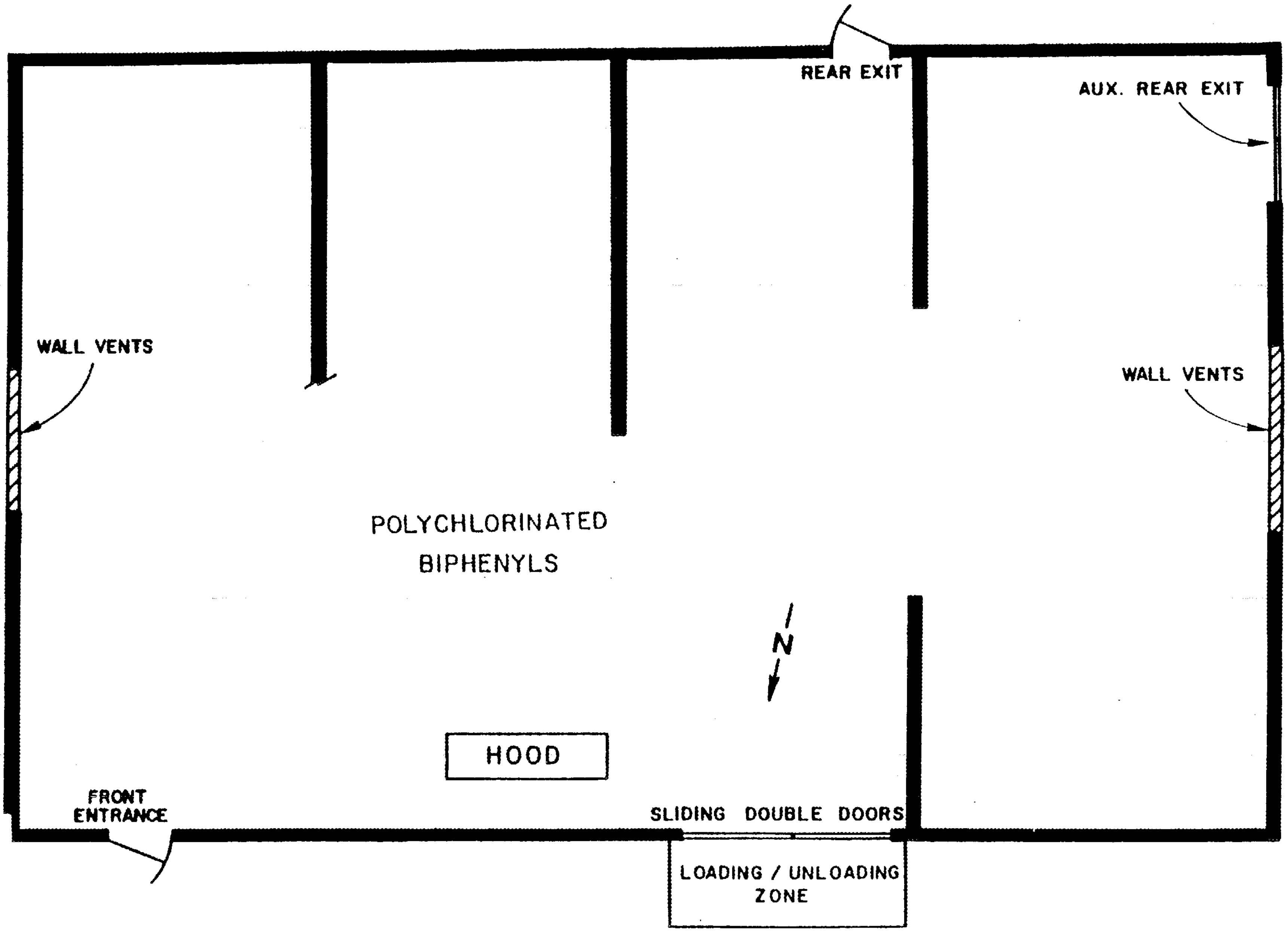

Fig. 49. Layout of Bulding 7507, Hazardous Waste Storage Facility.

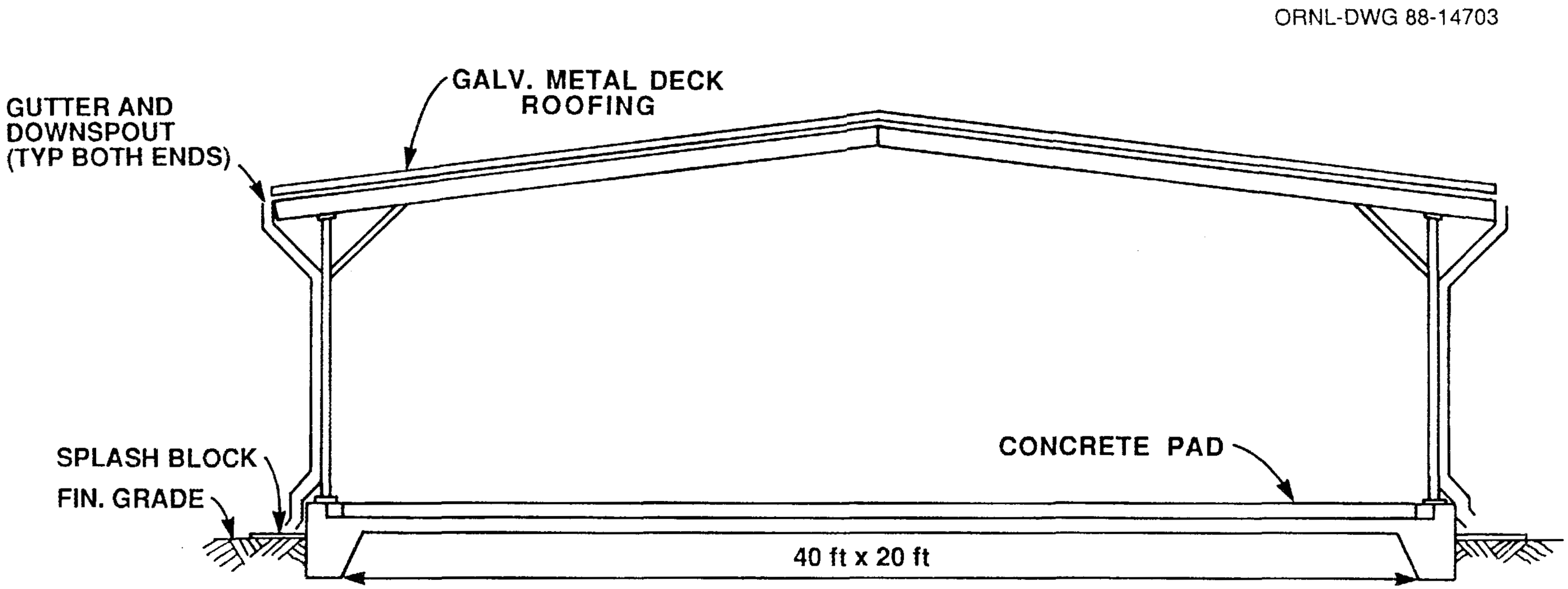

Fig. 50. Layout of Building 7651, Clean Oil Storage Pad.

The storage pad is used to store 55- and 30-gal drums containing uncontaminated used oil. The maximum inventory of waste in storage is 128 55-gal drums (7,040 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.

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 contamination. Containers are always closed during storage and handled in a manner to prevent leakage.

4.1.4.6 Permitting Status

Building 7652 is the only RCRA-permitted ORNL hazardous waste storage facility at the present time. A RCRA Part B permit application has been submitted for Building 7653. Building 7507 operates under interim status. Building 7507 is scheduled for closure under RCRA by November 1992. Building 7651, which stores non-PCB oils in drums, is not required to be permitted under RCRA. Building 7934 stores spent photographic solution in drums and is exempt from RCRA permitting as long as this waste is recycled. Table 28 in Section 8.1 (Storage Plan Update) of this plan provides the current operational and permitting status of ORNL Waste Storage facilities.

4.1.4.7 Facility Status

An upgrade of Building 7507 is planned to provide safe, regulated storage space for contaminated lead awaiting decontamination for reuse. This project is an FY 1990 GPP, with an expected operational startup date of September 1991. Another FY 1990 GPP involves the upgrade of Building 7652 by the end of CY 1990 in order to improve PCB storage conditions at ORNL.

4.1.5 Disposal Facilities

Hazardous waste at ORNL is collected, identified, and packaged for off-site shipment to EPA-approved treatment and/or disposal sites. No on-site disposal facilities exist or are planned for hazardous waste at ORNL.

4.1.6 Status of Support Systems

4.1.6.1 Training

The RCRA Waste Operations training course is required of all employees working at waste management facilities permitted under RCRA at ORNL. 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 is concluded with a written examination which is retained on file at ORNL.

The Hazardous/Mixed Waste Generator Training course is recommended for generators of hazardous waste. Specific guidance is given on identification and segregation of hazardous waste; requirements for management of accumulation areas; and correct completion of the form, "Request for Disposal of Hazardous Waste Material".

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 which have been successful in minimizing waste production. Part of this campaign also includes an incentive program which will recognize individual ORNL employees who provide waste minimization suggestions.

4.1.6.2 Certification

ORNL is able to characterize hazardous waste generated 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 (using 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) storage or on-site treatment; (12) data entry into the tracking systems; and (13) off-site shipment for treatment/disposal.

Detailed procedures for hazardous waste management, including characterization and certification activities, are contained in the ORNL Hazardous Waste Operations Manual, WM-HRWO-401. During FY 1990, a formal certification program for ORNL hazardous and mixed waste will be developed. As part of this program, the requirement for generator certification, including training, will be formalized.

4.1.6.3 Data Base Management

Information on hazardous waste handled at ORNL is maintained on a variety of computer data bases. In general, these data bases track generation, storage, and disposal of hazardous waste. Examples of these data bases include the HWTS, the PCBTS, and the ATS. All three data bases are on-line, user friendly information systems which operate on the DEC System-10 computer using System 1022 as the data base management system. Each of these is described briefly below.

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 Monitoring and Compliance Section within the Occupational and Environmental Safety Division (now EHPD) and the Computing and Telecommunications Division. HWTS management and maintenance functions are now carried out by the HWOG of the EHPD.

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, manifest attachments, and division totals are among the reports that are generated routinely. The annual summary reports which are generated by the system include the Hazardous Waste Generation Report, the Annual Shipping Report for Hazardous Waste Generators, and the Annual Report for Treatment, Storage and Disposal Facilities. Other reports required by management can be programmed by C&TD 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 EMC and 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 HWOG in the pickup and storage of waste. Because of the large volume of information tracked on the system, users typically have access to three calendar years of data. Older data files have been downloaded onto tapes but can be accessed upon request to C&TD.

The second hazardous waste data base is the PCBTS. The PCBTS 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, 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 EMC. Records for the second module of the PCBTS, the PCB waste data base, 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.

The ATS 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 data base has recently been transferred from the staff in the EMC to the WMOG. The ATS is used to generate quarterly summary reports on asbestos activities and to compile yearly disposal totals for other hazardous waste reports.

4.1.7 General Plant Projects

A listing of the proposed GPP for hazardous waste facilities at ORNL is provided in Table 18. This table indicates the project title, TEC, funding type (i.e., DOE program budget code), and the respective FY for funding.

Table 18. General Plant Project for hazardous waste facilities at ORNL

Title	TEC	Funding type	Fiscal year
PCB/Hazardous Waste Storage, Bldg. 7652	$ 145,000	KG	FY 1989

4.2 GASEOUS WASTE

A wide variety of research and operational activities at ORNL utilize compressed gases, which 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 (Figure 44) is to maintain facilities: (1) in compliance with RCRA requirements for handling of hazardous gases and disposal of "empty" containers; (2) in compliance with CAA and NESHAP requirements and associated State permitting requirements and conditions; (3) in compliance with DOT regulations (leaking cylinders cannot be knowingly transported); (4) in compliance with 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 and protects 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 which 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 1-50 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 temporarily stored until disposed of in accordance with applicable requirements. The Leaking Gas Cylinder Area is described below.

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 temporarily stored until properly disposed of at CSLF 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 in order to ensure worker safety pursuant to OSHA standards.

4.2.3.2 Permitting Status

The provisions of the CAA are regulated by the TDHE through the Tennessee Air Pollution Control Regulations. The primary means of control is through the issuance of State air permits. TDHE 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 to treat, store, or dispose 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 treated at the Leaking Gas Cylinder Area. Empty damaged cylinders are discarded in the CSLF II.

4.2.5 Status of Support Systems

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

5. MIXED WASTE MANAGEMENT

Mixed waste contains both hazardous and radioactive components as defined by the RCRA and the AEA, respectively. Currently, the hazardous components of mixed wastes is regulated under RCRA and the radioactive components under the AEA. Regulation under both of these acts has evolved because the handling and disposing of mixed wastes involves both toxic and radioactive hazards and because there is no regulatory program that deals specifically with mixed wastes. DOE Order 5400.3 (draft) states that "whenever any hazardous waste identified or listed in 40 CFR 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." At ORNL, the term "mixed waste" is commonly used to denote wastes that are both hazardous (including PCBs regulated under TSCA) and radioactive.

5.1 SOLID AND LIQUID WASTES

Common examples of mixed waste at ORNL are cleaning fluids and oils removed from systems operated in contaminated environments, as well as, scintillation fluids which 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, poisons, and other flammables. Since containerized liquid and gaseous wastes are considered "solid" wastes by EPA and are subject to respective solid waste regulations, solid, liquid, and gaseous mixed wastes are managed in similar manners at ORNL.

5.1.1 Strategy

ORNL's management strategy regarding the handling of mixed waste (Figure 51) is subject to RCRA (and occasionally TSCA) regulations regarding TSD requirements, as well as DOE regulations covering radioactive wastes (e.g., DOE Order 5820.2A), DOT regulations governing transport of radioactive and hazardous wastes, CAA and NESHAP regulation (if air emissions are generated), and OSHA Worker Right-to-Know requirements. The Section 84 AEA requirements regarding by-product material were clarified in a May 1, 1987, DOE interpretive rule (52 FR 15937). This rule provided that the "by-product material", as well as source and special nuclear material, that can also be classified as hazardous waste under RCRA will be subject to regulation under RCRA, TSCA, and the AEA.

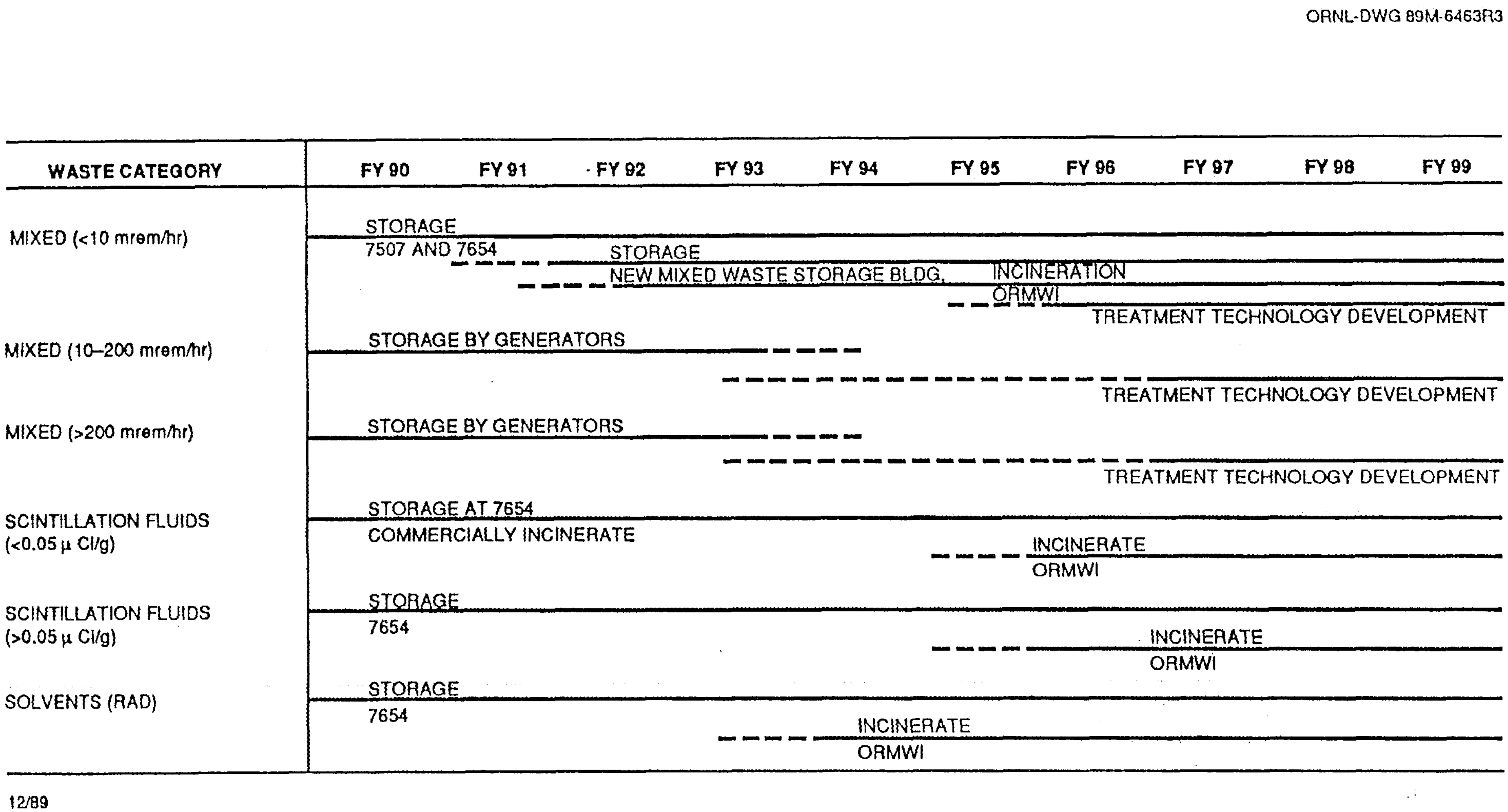

Fig. 51. ORNL management strategy for mixed waste.

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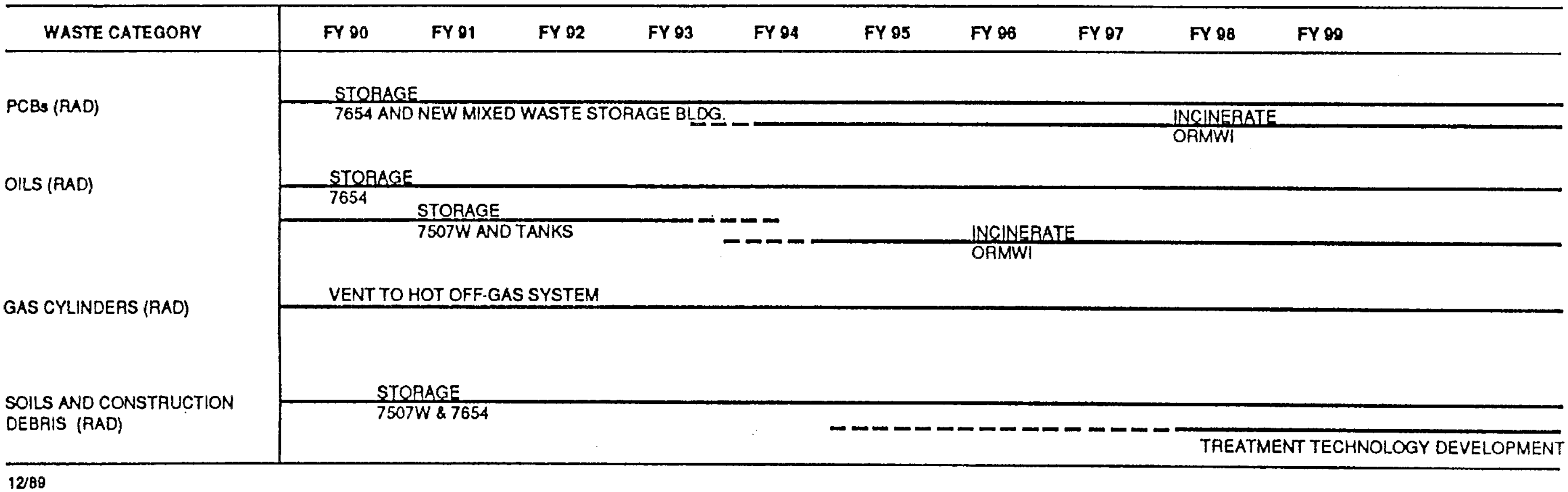

Fig. 51. (contd).

This rulemaking provides the EPA or the state agency (if authorized) with an oversight role in the management of by-product materials containing RCRA hazardous wastes.

The strategy must also provide worker protection from the physical, chemical, and radiological hazards and represent an environmentally-sound, cost-effective solution from the perspective of both ORNL and Energy Systems. Destruction or treatment to render the wastes nonhazardous is preferred. Currently, commercial treatment is available only for some scintillation wastes. No on-site treatment is available or planned at this time. Until 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 ORMWI.

ORNL is currently storing two categories of mixed waste (spent solvents and acids) that are subject to RCRA LDR, including storage prohibition. Storage of these two mixed wastes for greater than one year constitutes noncompliance under the RCRA regulations. In May 1990, when the final "third" of the LDR (which contain numerous constituents found in ORNL mixed waste) becomes effective, much of the remaining mixed waste stored at ORNL will also be prohibited from storage unless DOE can reach an alternative agreement with EPA and TDHE. Meanwhile, thorough characterization and segregation of the waste is planned, as well as evaluation of treatment options.

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 ($\leq$10 mrem/hr). 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, alpha, beta, gamma, etc. 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/hr. The flash point is normally less than 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 TRU waste packages unless contaminated with TRU material. If the hazardous waste is co-contaminated with TRU material, 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 waste is presented in Section 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 for the treatment of mixed waste.

5.1.4 Storage Facilities

Mixed waste is stored at several facilities at ORNL. Drum storage for both solid and liquid mixed waste is currently being utilized at Building 7654 and Facility 7507W, as outlined in the following sections. Bulk storage of waste oils is also provided by three tanks at Buildings 7075, 7830, and 7860 located within the ORNL complex. These tanks provide a total storage capacity of 13,700 gallons.

5.1.4.1 Building 7654 - Long-Term Hazardous Waste Storage Facility

Building 7654 is located in the Hazardous Waste Management Area off the HPRR Access Road and has an area of approximately 1,700-ft^2 with dimensions of 39-ft by 42-ft. The building consists of insulated, prefabricated panels built on a concrete floor surrounded by 6-in high curbing. The inside of the building is divided into five storage areas, each with 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 Figure 52.

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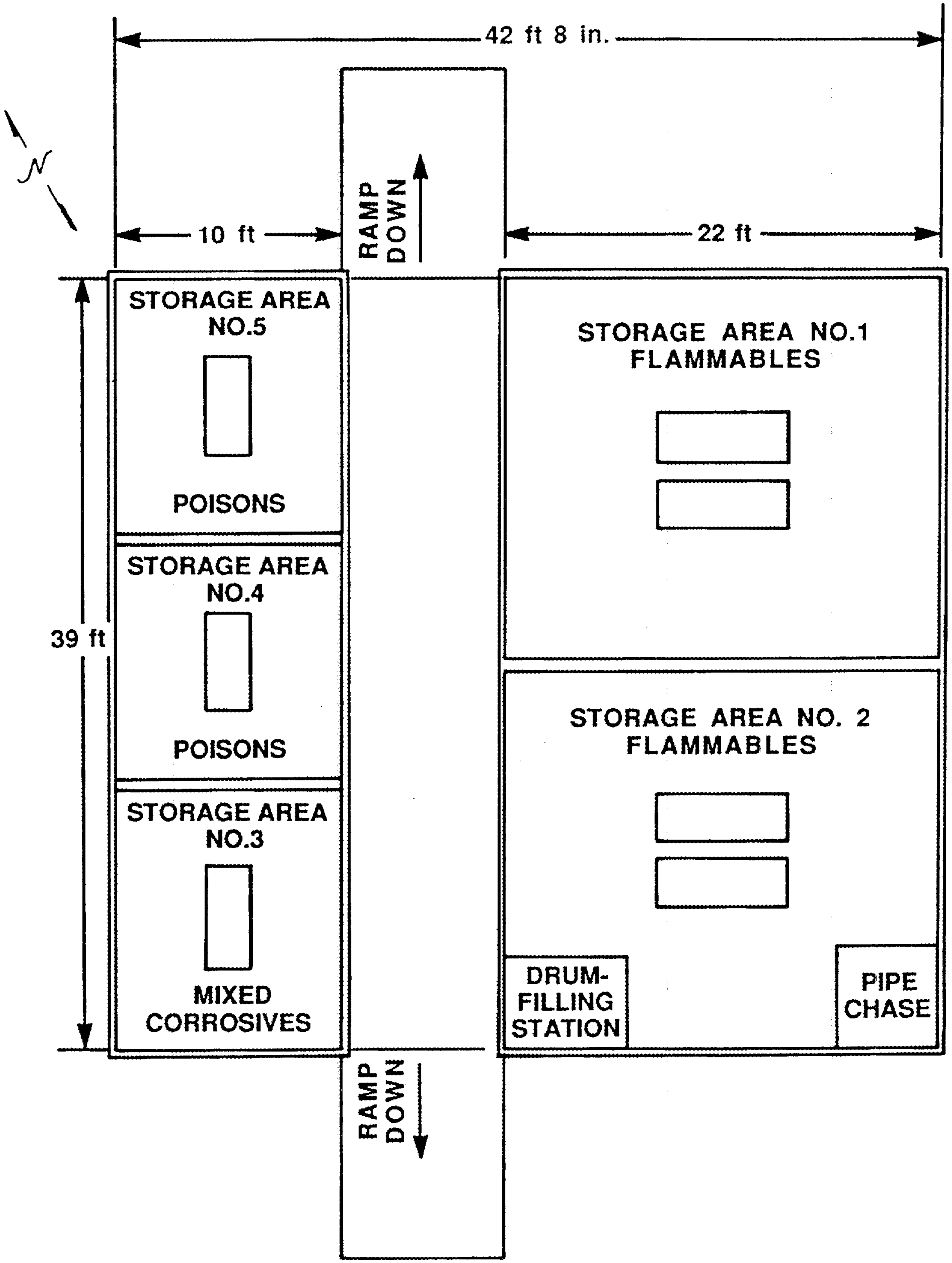

Fig 52. Layout of Building 7654, Long-Term Hazardous Waste Storage Facility.

Building 7654 is used for storage of mixed hazardous/radioactive waste. The majority are bulk scintillation fluids and scintillation vials. The majority of mixed wastes are transported to Building 7654 in 55-gal drums. Occasionally, 30-gal drums and smaller containers are received. Containers smaller than 30-gal are either combined with compatible waste in 55-gal drums or lab packed. The maximum inventory of drums in storage at any given time is 300, with a capacity of 16,500 gal. Double stacking of drums is employed, if needed, 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 40-ft square concrete pad with a 4-in elevation difference between the middle and the edge of the pad (Figure 53). The middle of the pad contains a sump (1-ft wide by 4-ft long by 2-ft deep). The pad is used for storage of 55- and 30-gal drums of mixed waste. The drums are placed on pallets and double stacked (if required), and are arranged in rows to provide walkway space for personnel and equipment. The drums are also covered with a tarp. The total capacity of the pad is 22,000 gal, or 400 55-gal drums.

Wastes stored at this facility are similar to those stored in Building 7654, consisting 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 includes organic wastes, carcinogenic wastes, mercury-contaminated solid wastes, waste oils, waste solvents, and other process wastes.

5.1.4.3 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, with any spill 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 264.

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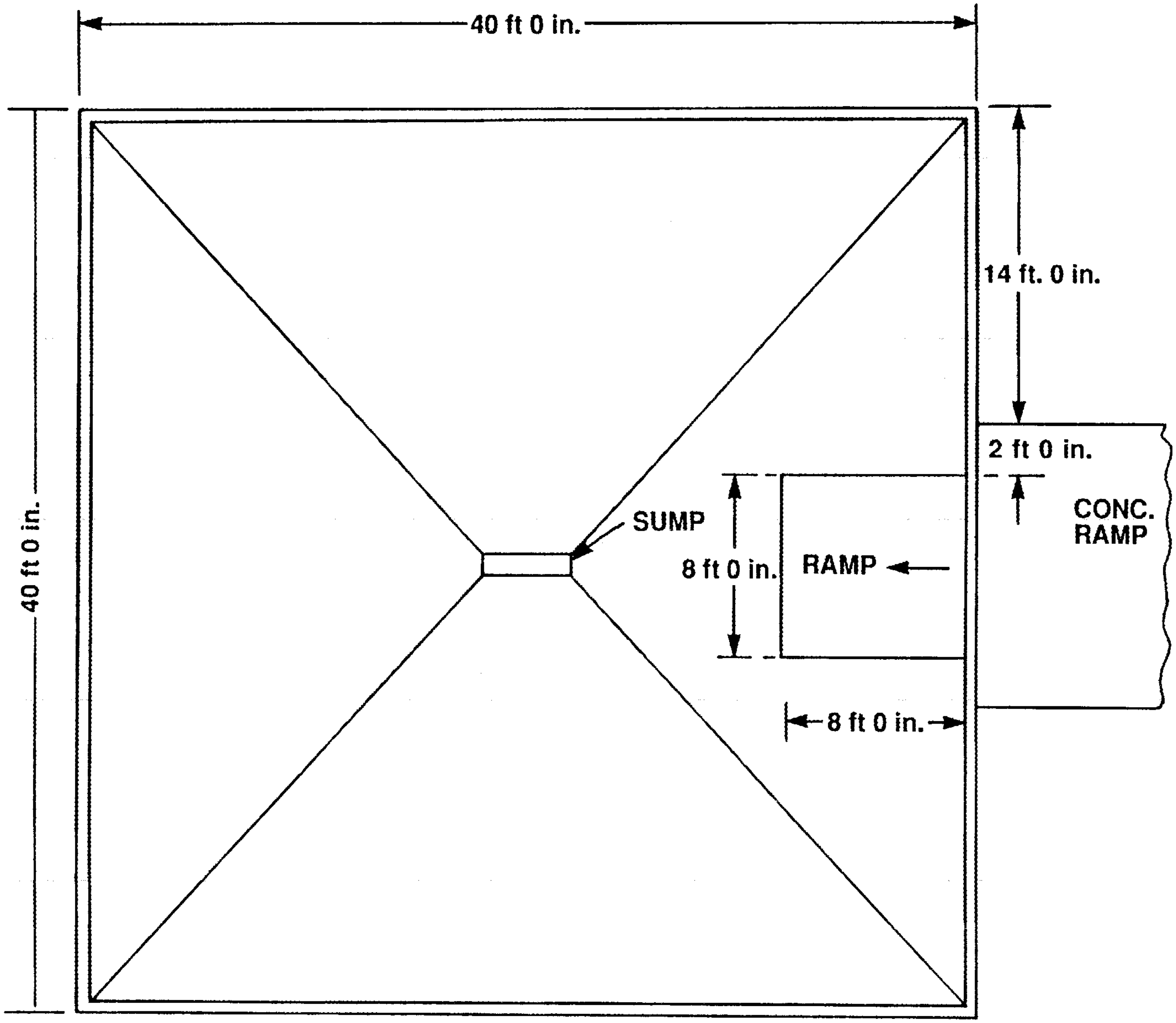

Fig. 53. Layout of Facility 7507W, Mixed Hazardous Waste Storage Pad.

5.1.4.4 Permitting Status

A RCRA Part B permit application has been submitted to TDHE for Building 7654. The Mixed Waste Storage Pad (Facility 7507W) is currently operating under interim status, with closure of the facility scheduled for November 1992. Table 28 in Section 8.1 (Storage Plan Update) of this plan provides the current operational and permitting status of ORNL waste storage facilities.

RCRA Section 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 268.50 place the burden of demonstrating noncompliance upon EPA during the first year of waste storage and the burden of demonstrating compliance upon the waste stored after one year.

ORNL mixed wastes that have been determined to be stored in excess of the one year limitation imposed by the LDR due to the unavailability of treatment or disposal facilities are listed in Table 19. These waste streams are comprised of radioactively contaminated acids (i.e., corrosives on the California List) and radioactively contaminated solvents (including scintillation fluids). Mixed wastes in Table 19 include only those mixed wastes (and amounts of those wastes) placed in storage after the LDR effective dates. This information has been furnished to DOE-HQ in support for the preparation of the national report on radioactive mixed waste as required by the Rocky Flats Federal Facilities Compliance Agreement.

5.1.4.5 Facility Status

Mixed waste storage availability at ORNL is severely limited at the present time, with approximately 100 drums 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 7654 has reached capacity in the volume of mixed waste currently stored at the facility, with the Mixed Waste Storage Pad also nearing capacity. To relieve this congested condition, the near-term use of storage space at ORGDP and other options are currently being investigated.

Table 19. Mixed waste placed in storage from applicable LDR effective dates through September 1988

Common name	EPA code	Quantity
Spent Solvents (including scintillation fluids)	F001, F002, F0033, F004, F005	859 kg
Acids (liquid)	D002	951 kg

A FY 1989 GPP is proposed to expand mixed waste storage at ORNL. This project, with an expected operational start-up date of September 1991, involves the modification of Building 7654 by extending foundations, floor pads, secondary containment, etc. The TEC for this expansion is $415,000.

5.1.5 Disposal Facilities

ORNL has no disposal facilities for mixed waste. As part of its scope, the RWMD will evaluate the need for a mixed waste disposal facility on the ORR. 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 (see Sections 3.1.2.6 and 4.1.6.1 of this plan).

5.1.6.2 Certification

Detailed procedures for hazardous and mixed waste management, including characterization and certification activities, are contained in the ORNL Hazardous Waste Operations Manual, WM-HRWD-401.

5.1.6.3 Data Base Management

A computerized data base is available for tracking all mixed waste, as well as hazardous waste, processed at ORNL. This data base is used primarily for record keeping, accounting and billing, and generating annual reports required by the State and EPA. The data base 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 data base system is provided in Section 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 20. This table indicates the project title, TEC, funding type (i.e., DOE program budget code), and the respective fiscal year for funding.

5.2 GASEOUS WASTE

All mixed gaseous wastes at ORNL are discharged into the 3039 off-gas system for treatment. The 3039 off-gas system is discussed in Section 3.2.3.3 of this plan.

Table 20. General Plant Projects for mixed waste facilities at ORNL

Title	TEC	Funding type	Fiscal year
Expanded Mixed Waste Storage	$ 415,000	KG	FY 1989
Upgrade Bldg. 7507W Mixed Waste	75,000	KG	FY 1990

6. CONVENTIONAL WASTE

Conventional waste at ORNL includes both the solid and liquid wastes generated from sanitary sewage treatment, steam plant operations, coal yard runoff, general refuse, and construction debris. Although DOE Order 5820.2A does not specifically require the reporting of conventional waste as part of the annual Waste Management Plan, ORNL has included pertinent information regarding the management of both solid and liquid conventional wastes at ORNL in the following sections. The State of Tennessee regulates these wastes streams at ORNL via the Tennessee Solid Waste Disposal Act and ORNL's NPDES permit.

6.1 SOLID WASTE

Conventional solid wastes which contain no radioactive or hazardous materials or free liquids include filter cake from the CYRTS, fly ash from the ORNL steam plant, general refuse collected in trash cans and dumpsters, sewage sludge and construction debris. A brief description of each waste stream is provided in Section 6.1.2 with the overall management strategy presented below.

6.1.1 Strategy

The strategy for conventional solid waste disposal at ORNL is illustrated in Figure 54 and involves the use of the CSLF II at the Y-12 Plant. Based on current plans, ORNL should not have any significant conventional waste disposal problems other than the additional cost of transporting waste to the CSLF II and any increase in fees levied by the Y-12 Plant for waste disposal operations.

Waste reduction has not been as important a factor for conventional waste as it has been for radioactive and hazardous waste because the cost for disposal per unit volume is significantly less. However, the cost for disposal per unit volume will continue to increase with time as a result of transportation, emplacement, monitoring, and new site development costs. Therefore, economic incentives to reduce volume will continue to grow, especially in the area of bulky general refuse.

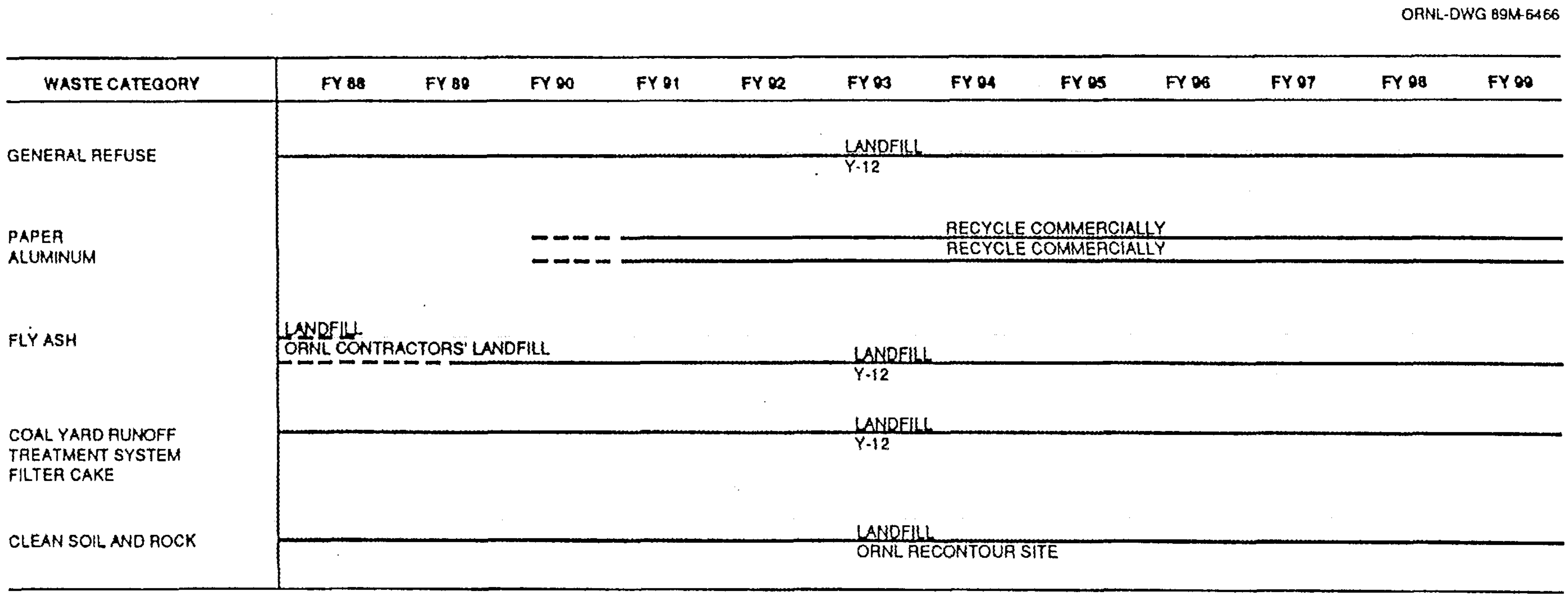

Fig. 54. Strategy for ORNL conventional waste.

6.1.2 Generic Description and Characteristics of Waste

The waste streams described in the following paragraphs constitute solid conventional waste at ORNL. Upon generation, efforts are taken to allow for the segregation of these waste streams so that no radioactive or hazardous constituents or 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 been 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 nonhazardous material generated at an average rate of 3 yd^3/week, is disposed of at the CSLF II. In addition, acidic waste from the ORNL steam plant demineralizers are planned to be diverted from Building 3518 to the CYRTS.

About 28,000 tons per year of coal containing about 8 percent 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 transported to the CSLF II at an average rate of about 12 yd^3/day. Steam plant ash is specifically cited in the State permit for the CSLF II.

General refuse is collected at each ORNL building from trash cans and placed in dumpsters at each site. These dumpsters are transported to an on-site trash compactor, and the refuse is compacted and reloaded onto trucks for transport to the CSLF II for disposal. The volume of general refuse is estimated to be 37 yd^3 per normal work day. Bulky material, such as large cardboard boxes that cannot conveniently fit into dumpsters, is temporarily stored at the building loading docks until the boxes are carried (uncompacted) to the CSLF II. The generation rate of this material is estimated to be 24 yd^3 on a 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 ORNL Recontour Site; however, this site has nearly reached capacity. All other conventional construction/demolition materials, including concrete and asphalt, are disposed of at the CSLF II.

About 2.0 X 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 (outfall number X01) produces a sludge from this process that is dewatered on sludge drying beds.

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 conventional solid waste. Upon generation, conventional solid 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 Section 6.2.3 under conventional liquid waste treatment facilities.

6.1.4 Disposal Facilities

Currently, the primary conventional solid waste disposal site, the CSLF II, receives waste from ORNL operations. The ORNL Contractor's Landfill, located at the west end of ORNL, was developed to receive conventional solid wastes from on-site construction and upgrade projects. This facility has reached its permitted capacity and is being closed. With the exception of clean soil and rock, ORNL conventional waste is now directed to the CSLF II at Y-12. Soil and rock are deposited at the ORNL Recontour Site, located northwest of Building 1000 at ORNL. Deliveries to the site are carefully controlled and recorded to prevent the introduction of prohibited materials.

Located on Chestnut Ridge, south of the Y-12 Plant site and about six miles east of the ORNL site, the CSLF II is the primary conventional waste landfill operation for the ORR. 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

Other than overall site monitoring requirements, separate groundwater monitoring is not currently conducted at the ORNL Contractor's Landfill or the CSLF II. However, the State Division of Solid Waste Management reserves the right to require implementation of a groundwater monitoring program if required at a later date.

6.1.4.2 Permitting Status

The State of Tennessee regulates the operation of solid, 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 conventional solid waste from ORNL are the CSLF II at the Y-12 Plant, which was permitted on December 20, 1982, and the ORNL Contractor Landfill, which was permitted on January 23, 1986, and is currently being closed. The permit for the CSLF 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 the CSLF II.

In addition to these general requirements, the CSLF 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. The CSLF II is projected to be filled to capacity by FY 1993.

6.1.4.3 Facility Status

Present strategy at Y-12 is to extend the life of the CSLF II, which is projected to reach capacity in FY 1993, by utilizing alternative disposal methods for selected sanitary/industrial wastes. A new Landfill (Industrial Landfill IV) is being planned at Y-12 to provide for the continued disposal of solid conventional waste. This landfill is to be constructed as part of an FY 1990 project. 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.

6.1.5 Status of Support Systems

6.1.5.1 Training

No training is provided specifically for conventional waste generators; however, waste minimization training and other waste management personnel training is provided to employees involved in waste operations at ORNL (see Section 4.1.3 of this plan).

6.1.5.2 Certification

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

6.1.5.3 Data Base Management

A data base management system does not currently exist for the specific use of conventional solid waste generators at ORNL.

6.2 LIQUID WASTE

Conventional liquid waste includes nonradioactive waste streams which are discharged, either directly or following treatment, to 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 conventional liquid waste at ORNL must be designed for compliance with proposed regulations and DOE orders. This strategy can be realized by following the environmental policies that are determined through negotiations with the TDHE. The concentration of environmentally deleterious materials will be measured at the process wastewater outfall, and the effect of discharges on the receiving stream will be determined. ORNL will aggressively pursue environmental programs that will reduce the concentrations of these materials at the outfall to the limits specified.

The impact of direct discharges of once-through cooling water on the toxicity of streams will be measured through the Biological Monitoring and Abatement Program. Because potable and process water contains residual chlorine, once-through cooling water may contribute to the toxicity of area streams and groundwater. Analysis of stream toxicity to marine life continues through the BMAP required by the ORNL NPDES permit. Steps are being taken to recycle or treat these streams for direct discharge to the watershed.

Conventional waste is minimized by identifying and characterizing sources of unnecessarily contaminated groundwater and storm sewer outfalls and maximizing efficiency through improved techniques of characterization, research, development, 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 5,200 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.

Segregation of process waste from non-process 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 untreated, 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 from the process waste system by lining pipes to prevent leakage. Groundwater that is contaminated is being transferred for appropriate treatment.

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, White Oak Creek, the Northwest Tributary, and Melton Branch. Figures 55, 56, and 57 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 8-30 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 HFIR, 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 (Figure 58). 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

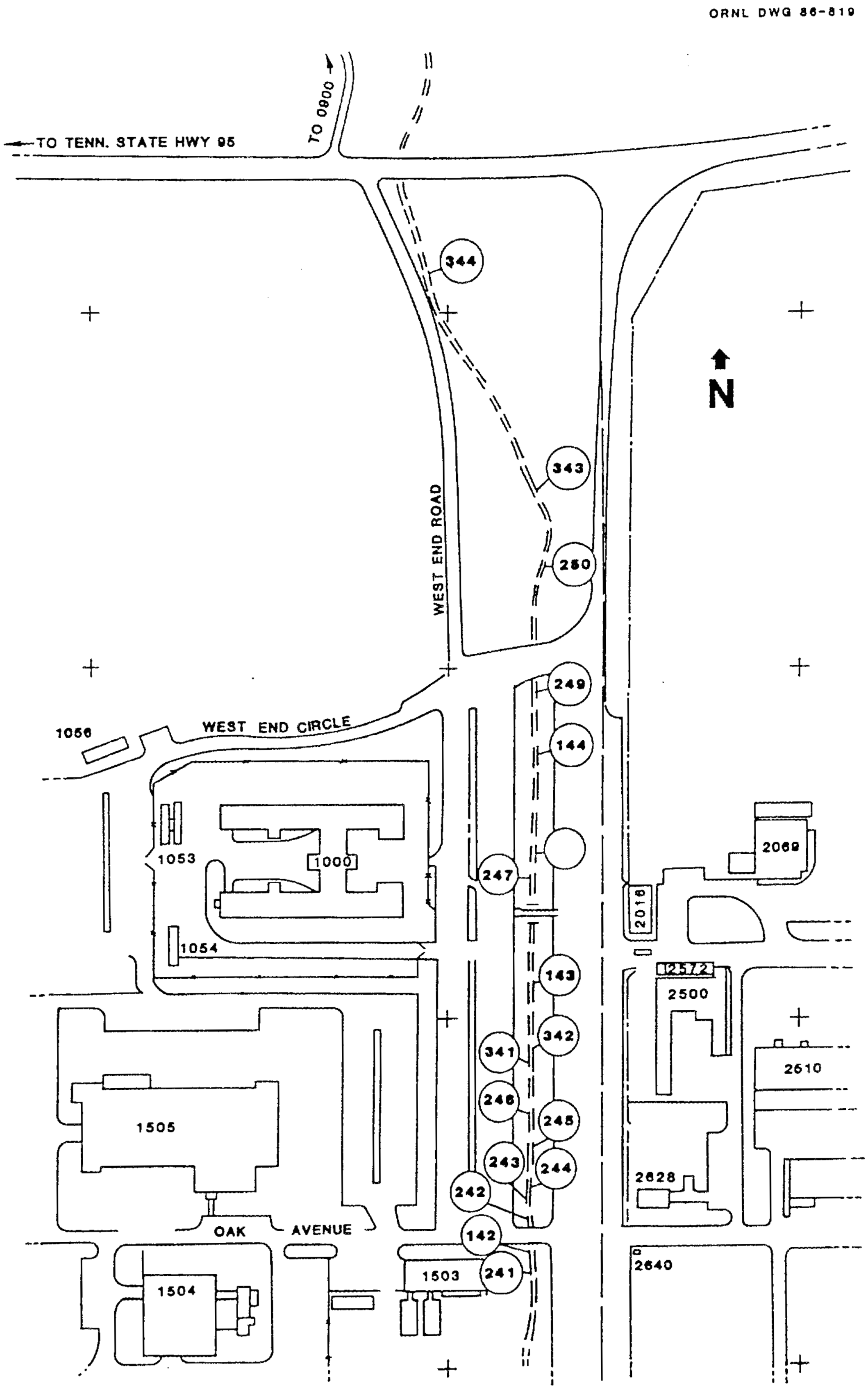

Fig. 55. First Creek storm sewer outfalls.

ORNL DWG 86-818

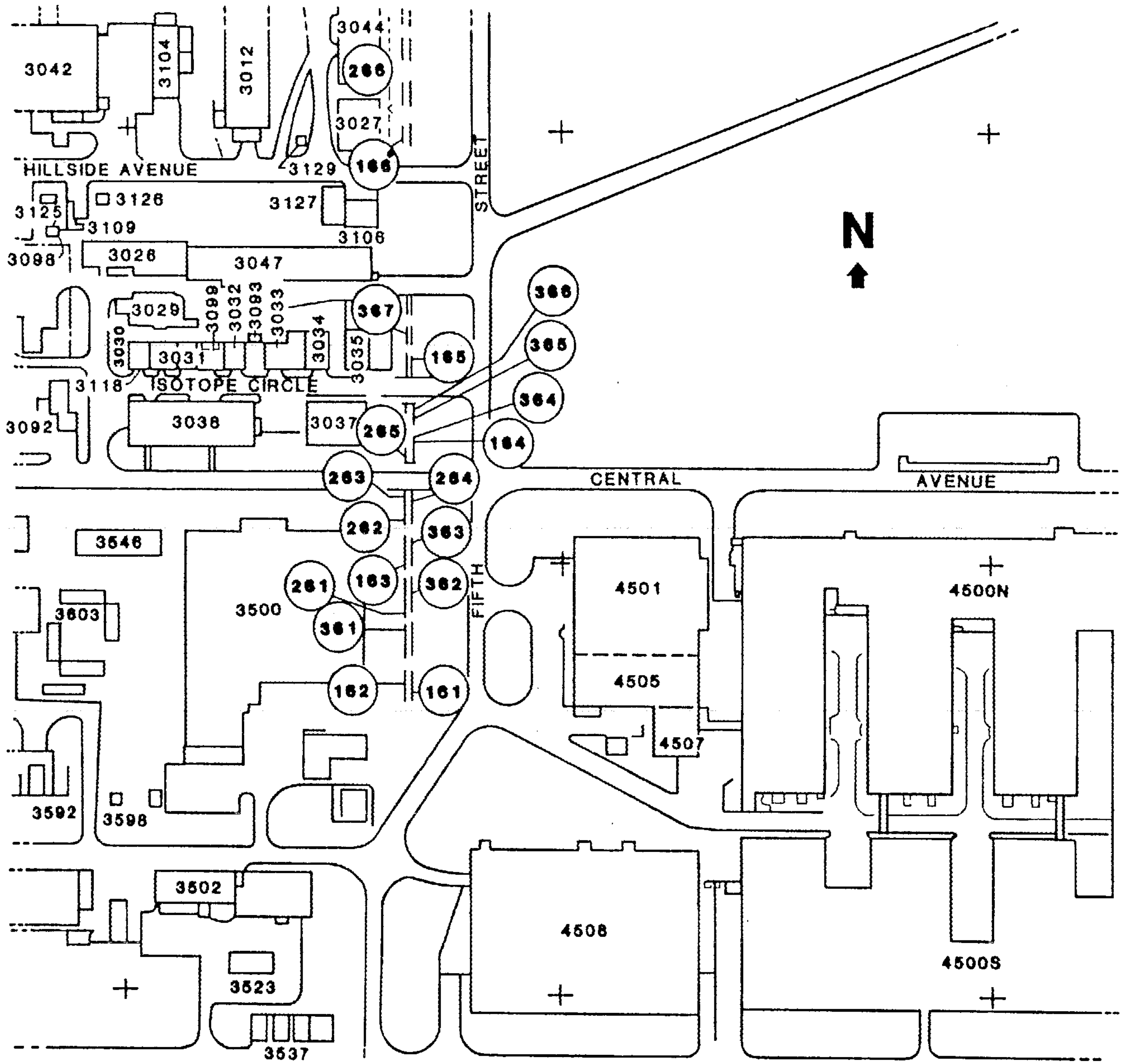

Fig. 56. Fifth Creek storm sewer outfalls.

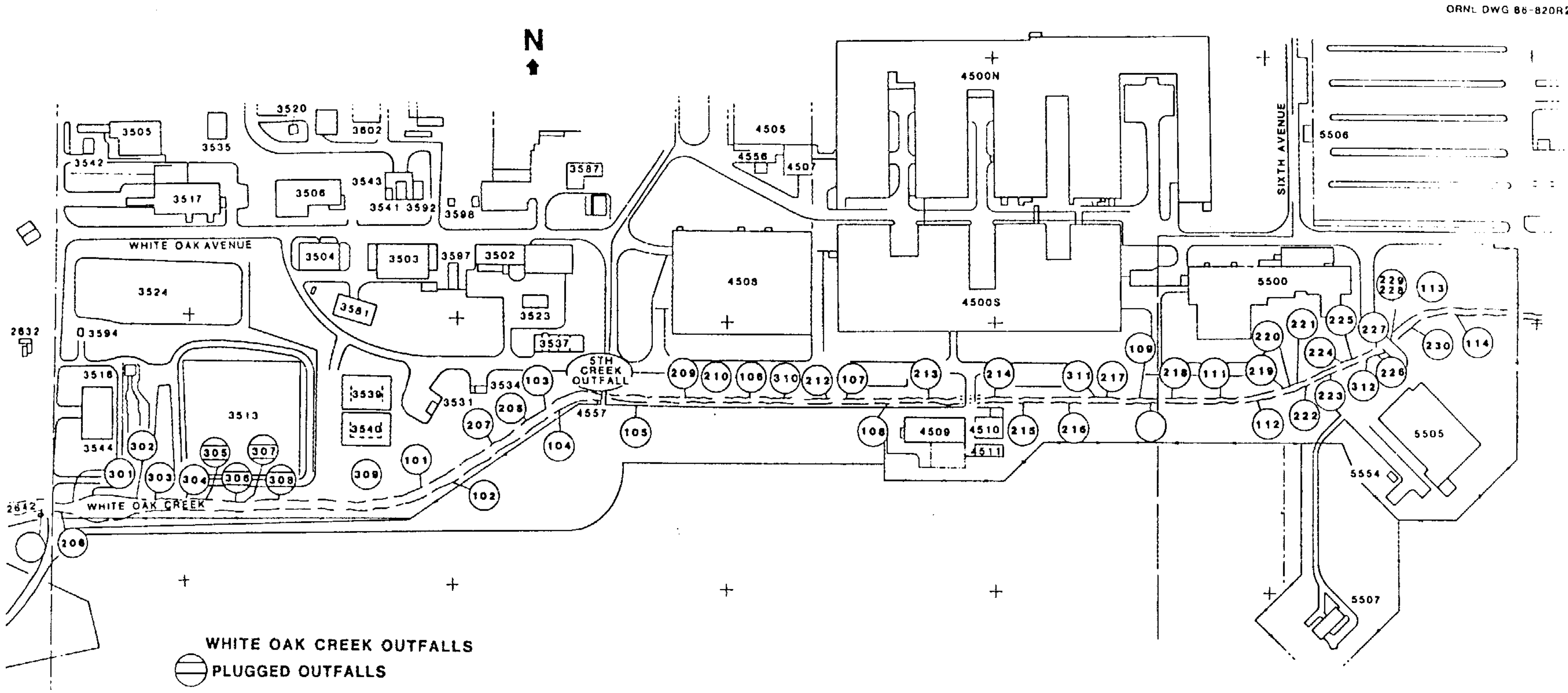

Fig. 57. White Oak Creek storm sewer outfalls.

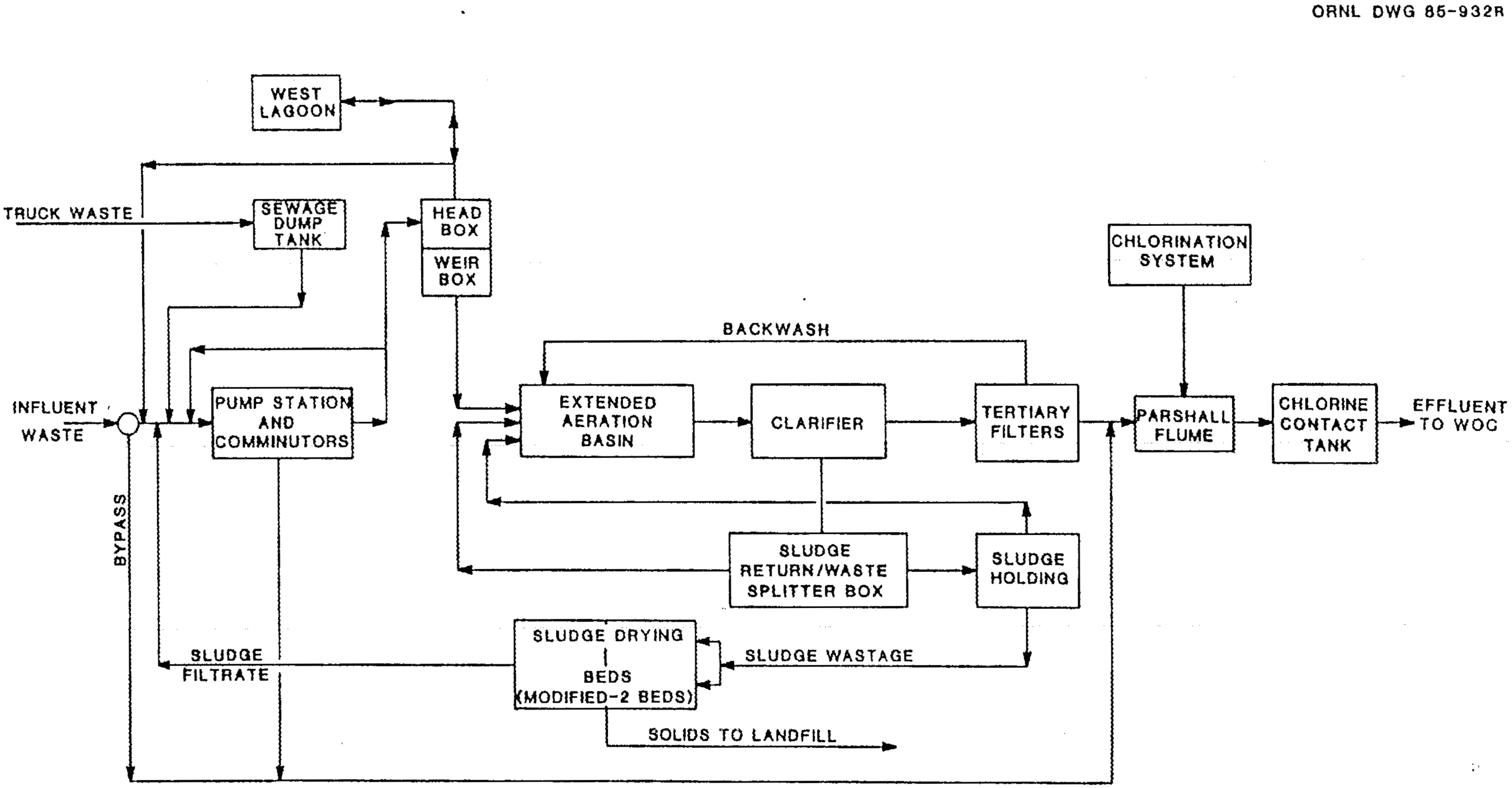

Fig. 58. Block flow diagam for new Sewage Treatment Plant.

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 CYRTF is pumped into the pH adjustment tank where it is mixed with a lime slurry from the lime slurry tank until a pH of about 10.5 is obtained (Figure 59). 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 treated 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 a NPDES discharge point. The facility is designed to automatically recycle the wastewater to the recycle tank 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.

Until recently, much of the surface water monitoring capability was inadequate both functionally and from a maintenance perspective. The ORNL NPDES permit requires additional monitoring points and capability. Substantial upgrading of the environmental monitoring system has been achieved, and improvements will continue to maintain compliance.

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 in order to determine discharges of nonradiological constituents from ORNL processes. Prior to receiving a new NPDES permit in April 1986, only three stations at ORNL were sampled for compliance with permit limits. Under the new permit there are over 150 stations, and point sources are monitored at

ORNL DWG 86-1193

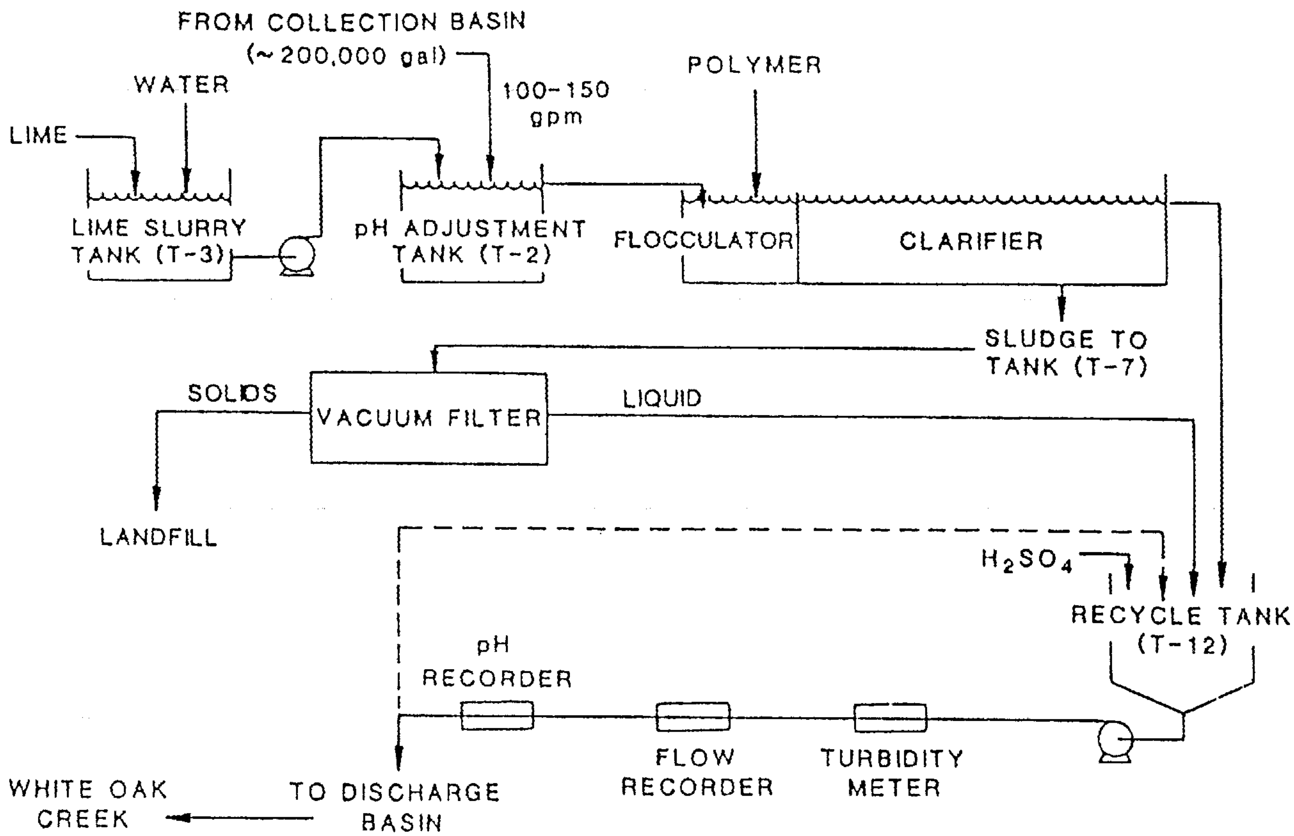

Fig. 59. Flow diagram of the CYRTF.

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 CWA, SDWA, 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 to mandatory monitoring requirements; or (3) monitoring of surface waters from SWMUs at ORNL is determined to lie within RCRA 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 ORNL NPDES permit became effective April 1, 1986. The permit authorizes ORNL to discharge to the Clinch River, White Oak Creek, 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. ORNL also observes a Federal Facilities Compliance Agreement which sets forth plans and dates for the elimination of untreated discharges and construction of treatment facilities.

Characterization of the sources of process waste discharged into the storm sewers has begun. An initial sampling program identified outfalls containing levels of radiation, total organic content, and/or other components that could have originated within the process waste system. These outfalls were classified as Category III in the NPDES permit. Follow-up sampling of these outfalls, generator surveys, and tracing of pipes have been used to determine actions needed to eliminate all Category III discharges. Actions currently in progress include routing process waste streams to treatment facilities, plugging abandoned lines, and recategorizing mislabelled outfalls.

6.2.3.3 Facility Status

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. In the event that 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 be treated at the NRWTP.

6.2.4 Storage and Disposal Facilities

Conventional 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 conventional 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 data base management program currently exists to address conventional liquid waste at ORNL other than the reporting requirements established in the NPDES permit.

6.2.6 Line Item and General Plant Projects

A listing of proposed LI and GPPs for conventional waste facilities at ORNL is provided in Table 21. This table indicates the project title, TEC, funding type (i.e., DOE program budget code) and the respective FY for funding.

Table 21. Line Item and General Plant Projects for conventional waste facilities at ORNL

Title	TEC	Funding type	Fiscal year
Line Item projects:			
Nonradiological Wastewater Treatment Project	$ 18,000,000	KG	FY 1986
General Plant Projects:			
Steam Plant Wastewater Project	450,000	AT	FY 1986
Wastewater Storm Drain Isolation	450,000	AT	FY 1988
Clean Water Act Compliance	650,000	KG	FY 1989
Chlorine Treatment for Cooling Water	700,000	AT	FY 1991
Sanitary Sewer System Improvements	800,000	AT	FY 1992

7. DECOMMISSIONING OF RADIOACTIVELY CONTAMINATED FACILITIES

ORNL has many radioactively contaminated facilities, both operational and inactive, that must be managed in a manner which protects the health and safety of personnel and the general public, and protects the environment, and that eventually will require 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 LLLW storage tanks and other structures from which there have been no known releases. The D&D program is very closely associated with the RAP. The RAP is primarily responsible for inactive waste sites and for soil and groundwater contamination from facilities where releases have occurred. The RAP is managed through Energy Systems Environmental Restoration Programs (Figure 1) and D&D programs are managed through the EHPD at ORNL.

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 management responsibility of the line management organization assigned the facility. Funding for the operation and maintenance of these facilities is provided by various program organizations within 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 Safety. This office and its various committees review the safety aspects associated with the operation of all new facilities and modifications to existing facilities. In addition, the OOS conducts periodic safety reviews and audits of all operational facilities. The committees of the OOS include the Radioactive Operations Committee, Reactor Operations 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 RAP 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 to: (1) maintain and monitor these facilities to ensure 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) plan for D&D of these facilities.

The SFMP was established at ORNL in 1976 in order to provide collective management of all the surplus sites under ORNL control on the ORR. 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 continues to be administered through DOE-Richland Operations Office and has assumed the DDDP title to differentiate from its civilian counterpart. Both programs continue to be coordinated through DOE-ORO and are managed by the ORNL RAP in the EHPD. Tables 22 and 23 list those facilities assigned to the SFMP and DDDP, respectively.

The SCFP was organized during the second half of FY 1985 to encompass the needs of surplus contaminated facilities at ORNL which were not part of the national SFMP. The SFMP and DDDP have not included facilities which have been removed from service since 1976. The need existed for a companion program which would include Energy Research facilities and those which were utilized by several programs within ORNL. The SCFP currently manages 17 facilities under this program. Table 24 lists those facilities currently assigned to the SCFP.

The SCMP includes a large number of sites, many of which have been out of service for a number of years. Almost all of these sites are physical sites which will be remediated under the RAP. Only a small number are facilities that will require D&D activities. Table 25 lists those sites and facilities currently assigned to the SCMP.

Table 22. Listing of facilities under the Surplus Facilities Management Program

Facility number	Facility name/description
3033	Storage Garden
3087	Heat Exchanger (ORR)
7503	Molten Salt Reactor Experiment
7511	Filter Pit (MSRE)
7512	Exhaust Stack (MSRE)
7513	Cooling Tower (MSRE)
7514	Supply Air Filter House (MSRE)
7555	Diesel Generator House (MSRE)
----	Shielded Transfer Tanks ST1, ST2, ST3, ST5

Table 23. Listing of facilities or sites under the Defense D&D Programs

Facility number	Facility or site name/description
3001	Oak Ridge Graphite Reactor
3002	OGR Filter House
3003	OGR Fan House
3005	Low-Intensity Test Reactor
3018	Exhaust Stack for 3003 (OGR Stack)
3077	Air Cooler (LITR)
3506	Waste Evaporator
3507	South Tank Farm
3515	Fission Product Pilot plant
7500	Homogeneous Reactor Experiment
7502	Waste Evaporator (HRE)
7554	Cooling Tower (HRE)
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

Table 24. Listing of facilities under the Surplus Contaminated Facilities Program

Facility number	Facility name/description
3019-B	High-Radiation-Level Analytical Facility
3028	Strontium-90 Power Generators
3029	Cobalt-60 Storage Garden
3110	Filter House/Isotope Area Ductwork
3121	Off-Gas Filter House
3503 SW	Storage Pad
4507	High-Radiation-Level Chemical Dev. Lab.
4508	Remote Coating Furnace Loop
7819	Interim Decontamination Building
ORNL Facilities at Y-12	
9201-2	ORNL 86-Inch Cyclotron
9204-3	Plutonium Processing Facility
9204-3	Curium Handling Glovebox
9201-3	MSRE Fuel Handling Facility
9201-3	Coolant Salt Technology Facility
9201-3	Storage Tank
9204-1	Attic
9204-1	East End Basement
9419-1	Decontamination Facility

Table 25. Listing of facilities or sites under the Site Corrective Measures Program

Defense Programs		Energy Research	
Facility number	Facility or site name/description	Facility number	Facility or site name/description
1001	Solid Waste Storage Area No. 3	0800	Environmental Study Area (Cs-137 Plots)
2624	Solid Waste Storage Area No. 1	7658	Closed Contractor's Landfill
3507	South Tank Farm	----	Transfer Line Leak Site (Bldg. 7819 to Pit 1)
3512	Decomissioned Waste Holding Basin	----	LLW Line Leak Site No. 1 (SE of Trench 6)
3513	Waste Holding Basin	----	LLW Line Leak Site No. 2 (N of Trench 7)
3023	North Tank Farm		
4003	Solid Waste Storage Area No. 2		
7556	Settling Pond (HRE)		
7560	Waste Tank (HRE 1,000 gals)		
7562	Waste Condensate Tank (HRE 12,000 gal)		
7800	Solid Waste Storage Area No. 4		
7802	Solid Waste Storage Area No. 5		
7805-7808	Chemical Waste Pit Nos. 1-4		
7808	Chemical Waste Trench No. 5		
7810	Chemical Waste Trench No. 6		
7818	Chemical Waste Trench No. 7		
7835	Sludge Waste Pond (SWSA 5)		
7852A	OHF Pond		
7860A	Contaminated Oil Storage Tank (NHF)		
----	Hydrofracture Experimental Site No. 1		
----	White Wing Scrap Yard		
----	FPDL LLW Transfer Line		

At ORNL, facilities declared inactive are managed by the Remedial Action Section in EHPD. This responsibility includes evaluating current facility conditions, monitoring site surveillance information, and reviewing applicable environmental regulations to insure current decommissioning priorities reflect the requirement. Significant changes in these areas which impact decommissioning plans are conveyed routinely to the respective DOE program sponsor. The OOS is responsible for reviewing and auditing surplus facilities.

7.3 FUTURE FACILITIES

Planning for D&D will be an integral part of the design of all future facilities at ORNL. D&D planning for new facilities will be the responsibility of the line organization responsible for operating the facility, as well as the supervising division within Energy Systems. Funding for D&D planning will be part of the design funding provided by the program sponsoring the facility.

7.4 DECONTAMINATION AND DECOMMISSIONING

This activity is primarily responsible for the actual D&D of facilities. The goals of D&D are to: (1) decontaminate facilities designated for reuse to the extent necessary for compliance with approved health and safety standards; and (2) decommission all other facilities in accordance with the requirements set forth in an approved environmental compliance plan.

The ORNL D&D program is also the responsibility of the Remedial Action Section in EHPD. Coordination of D&D planning will be the responsibility of the Remedial Action Section in EHPD. This organization will also ensure compliance with the requirements of DOE Order 5820.2A. Coordination 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 26.

7.5 UPDATE OF IMPLEMENTATION SUMMARY TABLE

Table 27 provides an update to the original "Implementation Summary for Decommissioning of Radioactively Contaminated Facilities" that was provided in the Oak Ridge National Laboratory Implementation Plan for DOE Order 5820.2A issued April 28, 1989. The format in Table 27 duplicates the format of the requirements for the decommissioning of radioactively contaminated facilities contained

Table 26. Surplus facilities decommissioning long-range schedule

Decommissioning Project	Projected Schedule
Metal Recovery Facility	1989-1992
Storage Garden	1989-1990
ORR Experimental Facilities	1991-1996
FPDL Cell Decommissioning	1991-1993
Homogeneous Reactor Experiment	1992-1998
Shielded Transfer Tanks	1993-1995
Fission Product Pilot Plant	1993-1995
Molten Salt Reactor Experiment	1993-1998
Waste Evaporator Facility	1994-1995
Old Hydrofracture Facility	1995-1998
Graphite Reactor	2001-2006
Low-Intensity Test Reactor	2003-2007

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. Only a few minor revisions have been made to this table. The revisions are the result of recent changes to the organizational structure at ORNL.

Table 27. Implementation summary for decommissioning of radioactively contaminated facilities

Requirement/Status	Current practice	Current plans	Completion Date	Estimated Cost Expense	Estimated Cost 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 1990	a	a
(2) Compliance	Pertinent operational records for future use in preparing decommissioning plans are in permanent files.	Continue current practices.	a	a	a
(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.	b	a	a	a
(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	a	a
(5) Compliance	Responsibilities for contaminated facilities have been assigned specific programs through negotiation.	Maintenance and surveillance plans and decommissioning plans are updated perodically to reflect most recent changes in responsibility.	a	a	a
(6) Compliance	Facilities identified as DP, NE, or ER are pending acceptance into appropriate programs.	Pursue existing agreements and initiate new agreements.	a	a	a
(7) Compliance	ORNL provides information, as available, to update the decommissioning technology data base RAPIC as part of the ORNL D&D Program.	Continue current practices.	a	a	a
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.	Evaluate application of previous criteria. Provide better definitive guidance for the design process.	FY 1990	a	a

[a]Not applicable.
[b]See a. (6) and b.

Table 27. (contd).

Requirement/Status	Current practice	Current plans	Completion Date	Estimated Cost Expense	Estimated Cost Capital
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.	a	a	a
(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.	c	11.7M	c
d. Decommissioning Project Activities					
(1) Partial Compliance	ORNL collects characterization baseline data to fulfill NEPA, RCRA, CERCLA, SARA, and detailed engineering requirements.	Continue current RAP practices on a project specific basis.	FY2010	240M	10M
(2) Partial Compliance	ORNL has submitted a RFA to proper federal agencies. Conduct environmental reviews when required.	d	d	d	d
(3) Partial Compliance	Decommissioning Project Plans are prepared for approval by appropriate program offices.	d	d	d	d
(4) Partial Compliance	Facilities are decommissioned in accordance with DOE-HQ guidance. Proper approvals are obtained and status reports submitted.	d	d	d	d
(5) Partial Compliance	Final decommissioning reports are prepared. Maintenance and surveillance is supplied if required, project data packages prepared.	d	d	d	d
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.	Develop program level NQA-1 QA document and implement for all facility decommissioning projects. Project QA costs are reflected in project budgets in d. (1).	FY 1990	50K	a
		TOTALS	FY 2010	250M	10M

[a]See a. (4).
[d]See d. (1).

8. ORNL WASTE MANAGEMENT SUPPORT ACTIVITIES

Developing the capabilities necessary for ORNL to achieve and maintain full compliance with environmental regulations and waste management objectives requires the integration of a large number of individual projects and activities. The following sections, as listed below, provide information on ORNL waste management support activities:

- Storage Plan Update,
- Waste Reduction,
- Document Control,
- Quality Assurance,
- NEPA Documentation,
- CWA Documentation, and
- Technology Demonstrations.

8.1 STORAGE PLAN UPDATE

Temporary storage of TRU, hazardous, and mixed wastes has been part of the ORNL waste management strategy since the 1970s. SLLW was added to the category of stored waste beginning in 1987 when these wastes were first shipped to ORGDP. 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.

The status of the storage program at ORNL is summarized in Table 28 by waste category and storage facility. The table includes information on wastes in temporary staging, as well as those in long-term storage modes. As shown in Table 28, capacity concerns exist for CH-TRU, RH-TRU, and mixed wastes. Current facilities for other waste types appear adequate to meet expected needs. Storage costs are not tracked separately from other waste management costs. All routine storage costs are included in the costs that are charged back to generators. Table 28 also indicates the RCRA permit status for each storage facility. Several of the interim status facilities must have closure initiated by November 1992.

Table 28. Current operational status of ORNL waste storage facilities

Category/Facility	Waste stored	Type of storage	Capacity	Current inventory	RCRA permit status	Formal WAC in place	Plans for future
HAZARDOUS WASTE							
BLDG. 7507	PCB oils (drum)	Temporary staging building	8,250 gal	N/A[a]	Interim Status	Yes[b]	Move PCB oil staging to Bldg. 7652 Annex when completed (FY 1990) and close per RCRA standards.
BLDG. 7651	Non-PCB oils (drum)	Temporary staging building	7,040 gal	N/A[a]	Not required	Yes[b]	Continue to operate for foreseeable future.
BLDG. 7652	Bulk solids/liquid (drum)	Temporary staging building	15,125 gal	N/A[a]	Permitted	Yes[b]	Continue to operate for foreseeable future.
BLDG. 7653	Lab-pack chemicals (small container)	Temporary staging building	3,300 gal	N/A[a]	Part B submitted	Yes[b]	Continue to operate for foreseeable future.
BLDG. 7934	Spent photographic solution (drum)	Temporary staging building	15,000 gal	N/A[a]	Exempt-Recycle materials	Yes[b]	Continue to operate for foreseeable future.
MIXED WASTE							
BLDG. 7507W	Mixed solids/ liquids (drum)	Long-term covered pad	22,000 gal	15,200 gal	Interim status	Yes[b]	Move waste to new mixed waste storage facilities when completed (FY 1992) and close per RCRA standards.
BLDG. 7654	Mixed solids/ liquids (drum)	Long-term building	16,500 gal	16,500 gal	Part B submitted	Yes[b]	Continue to operate for foreseeable future at full capacity.

[a]Used for staging only; inventory varies by month.
[b]Included in RCRA permit/application

Table 28. (contd).

Category/Facility	Waste stored	Type of storage	Capacity	Current inventory	RCRA permit status	Formal WAC in place	Plans for future
SOLID LOW-LEVEL WASTE							
BLDG. 7823	SLLW (drum/box)	Temporary staging building	30,000 ft^3	N/A[a]	Interim status	Yes[c,d]	Discontinue staging operations when new staging facility is constructed (FY 1990) and close per RCRA standards.
BLDG. 7842	SLLW (drum/box)	Temporary staging building	50,000 ft^3	N/A[a]	N/A	Yes[c]	Continue to operate as SLLW staging facility for tumulus and GCD silos; also storing contaminated lead pending recycle program implementation (FY 1990).
ORGDP	SLLW (drum/box)	Long-term building	[e]	10,600 ft^3	N/A	Yes[c]	Continue to use ORGDP storage for PWTP sludges and boxed, compactible waste.
SOLID TRU WASTE							
BLDG. 7823	Solid CH-TRU (drum/box)	Temporary staging building	30,000 ft^3	N/A[a]	Interim status	Yes[d]	Discontinue staging area operations when new staging facility is constructed (FY 1990) and close per RCRA standards.
BLDG. 7826/7834	Solid CH-TRU (drum)	Long-term underground bunkers	25,574 ft^3	18,500 ft^3	Interim status	Yes[d]	Continue storage until shipment to WIPP; must move drums to permitted storage facilities by FY 1992 and close existing structures.
BLDG. 7855	Solid RH-TRU (concrete cask)	Long-term underground bunker	6,234 ft^3	5,200 ft^3	Part B submitted	Yes[d]	Continue long-term storage until WHPP begins processing RH-TRU in FY 1999, with ultimate shipment to WIPP.
SWSA 5 North trenches	Solid RH-TRU (concrete cask)	Long-term retrievable trench	3,000 ft^3	3,000 ft^3	Interim status	Yes[d]	RCRA closure must be initiated by November 1992. Casks must be exhumed and placed in new permitted storage building.

[c] ORNL Health Physics Manual.
[d] Oak Ridge National Laboratory Transuranic Waste Certification Program. ORNL/TM-10322/R1. August 1988.
[e] Unknown

Based on the current understanding of the storage needs, the need for additional storage facilities for SLLW, CH-TRU, RH-TRU, and mixed waste is anticipated. Currently planned facilities for ORNL wastes are presented in Table 29. The CH-TRU, RH-TRU, and mixed waste facilities will require RCRA permitting. Future storage facility operating costs have not been estimated but will be funded via the charge back mechanism upon completion of the facilities' design, development, and construction.

Alternatives for providing additional storage capacity for CH-TRU, RH-TRU, and mixed wastes are being explored. Storage of TRU waste at ORGDP is not viewed as a practical option; however, storage at ORGDP is being considered as an alternative to the construction of an additional waste facility at ORNL. The preferred option for mixed waste is to provide treatment of inventoried waste to eliminate the need for additional storage. Since mixed waste treatment technologies are not currently available, storage will be required for an indefinite time period.

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, 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, Section 3.c.2.4 requires the establishment of an auditable waste reduction program for all LLW generators. In addition, it further states that any new facilities or changes to existing facilities incorporate waste minimization into design considerations. More recently, DOE Order 5400.1, Section 4.b, requires the preparation of a waste reduction program plan which shall be completed by May 1990, reviewed annually and updated every three years. A waste reduction plan for ORNL was prepared in August 1985 and updated (draft) in 1989.

Recognizing the emphasis on waste reduction requirements, DOE-HQ DP has established a Waste Reduction Steering Committee. Their charter includes assuring consistency by the coordination of Defense Programs waste reduction activities, maximizing information exchange, identifying current and

Table 29. Listing of planned storage construction/upgrade

Project	Project type	Expected operational start-up	Planned use
Hazardous Waste			
PCB Annex to Bldg. 7652	FY 1990 GPP	FY 1990	Staging area for PCB oils prior to off-site shipment.
Mixed Waste			
Expand mixed waste storage	FY 1989 GPP	FY 1991	Long-term storage of drummed/boxed mixed waste.
Bulk mixed waste storage	FY 1990 GPP	FY 1992	Long-term storage of large bulk mixed waste.
Upgrade Bldg. 7507W	FY 1990 GPP	FY 1992	Upgrade building to provide staging area for contaminated recyclable lead.
SLLW			
LLW-TRU Staging Facility	FY 1989 GPP	FY 1991	Provide RCRA-approved staging area for LLW-CH-TRU waste prior to shipment/storage/disposal.
Class IV Storage Facility	FY 1990 GPP	FY 1992	Provide storage for Class IV SLLW in add-on stainless steel wells.
Class III/IV Long-Term Storage Facility	FY 1994 LI	FY 2002	Provide long-term storage of Classes III and IV SLLW prior to off-site shipment.
TRU Waste			
CH-TRU Storage Facility	FY 1991 GPP	FY 1992	Provide RCRA-approved storage for CH-TRU drums prior to repackaging/shipment to WIPP.
RH-TRU Storage Bunkers	FYs 1989, 1991 and 1993 GPPs	FYs 1991 and 1994	Provide RCRA-approved storage for RH-TRU casks prior to processing at WHPP.

future data needs and reporting requirements, and guiding future activities between the programs and their respective sites. In 1989, ORNL appointed a Waste Reduction Coordinator to handle the increased emphasis and requirements for waste minimization. The Waste Reduction Coordinator meets with this group periodically to exchange information, provide updates on waste reduction, discuss problems, elicit suggestions, and review the program.

As the certification programs are being established at ORNL, they will be closely coupled with the Waste Reduction Program. Waste GCOs have been appointed who will provide waste generation, characterization and processing information. The information will be used in a systems-analysis data base to determine methods for reducing waste generation and identifying areas where efforts are required for compliance with Federal regulations.

8.3 DOCUMENT CONTROL

The DMC of the Waste Management Operations Section is responsible for maintaining the 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 and requirements of this QA-based system operation are contained in the Waste Management Operations Section Procedure WM-DMC-101.

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 QA Plan.

Upon 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 Procedure 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 the WMO may be submitted to the DMC if accompanied by a completed Document Entry Request Form or a Document Change Request Form.

The following constitutes the various Documentation Management Levels:

Level I: Records or documents that are managed for storage and retrieval only.

Level II: DMC distributed records or documents whose review, approval, content, distribution, retention, and storage, are strictly controlled according to specified requirements for CONTROLLED documentation. Controlled documents issued by other than the DMC may be entered for storage and retrieval purposes, but will not be managed by the DMC as a Level II document.

Level III: Records or documents that are managed for storage and limited retrieval because information they contain may be sensitive; retention is ensured and content protected.

When modification/revisions are necessary or desirable in any documentation original maintained in the DMS, a DCR 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 supercedes. The original DER 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 supercedes.

8.4 QUALITY ASSURANCE

The objective of the EHPD QA system is to develop, implement, and maintain QA practices that will ensure that all 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 all programmatic elements of the division into compliance with ANSI/ASME NQA-1 QA standards and with all 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 all elements of the NQA-1 standard and assures 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 all division personnel. The QA staff interfaces regularly with line personnel and division management at ORNL.

8.5 NEPA DOCUMENTATION

The 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:

1. The Federal government should use all practical means to ensure a safe environment and act as a trustee of the environment for future generations.

2. 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.

3. The Federal government should include in every proposal a detailed statement of its environmental impact and alternatives to it.

4. The Council of Environmental Quality was created to:
   - generate data on the conditions and trends on the quality of the environment,
   - review Federal government activities in light of those conditions and trends, and
   - 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, and is applicable to all ORNL facilities, programs, and operations, as well as subcontractor activities or other work performed for or at the ORNL under contractual arrangements. The following sections provide examples of ORNL's NEPA documentation.

8.5.1 Action Description Memorandum

An ADM is a written report documenting the environmental review of planned construction projects. The ADM is a formal agreement document which is: (1) part of the BMP Plan of ORNL's NPDES permit; (2) incorporated into the permanent environmental record at ORNL; (3) retained in DOE-ORO files; and (4) transmitted to DOE-HQ in partial fulfillment of DOE's NEPA compliance obligations; and (5) used as a basis for DOE to prepare a memorandum to file concerning an activity. The ADM provides the measures that will be taken during both project construction and project operations to ensure the protection of the environment.

8.5.2 Environmental Assessment

An EA is a written document which provides the evaluation of the environmental impacts of proposed ORNL/Energy Systems/DOE activities on the ORR. The EA is intended to ensure that environmental values are considered at the earliest meaningful point in the decision-making process and to determine whether an environmental impact statement should be prepared.

8.5.3 Environmental Impact Statement

An EIS is a document written in accordance with 40 CFR 1500 which provides the analysis of the environmental impacts associated with a proposed ORNL/Energy Systems/DOE action when compared to reasonably available alternatives. An EIS is prepared when the EA written for the proposed action indicates the activity will have a significant impact on the environment and reflect responsible public and government views and concerns.

8.6 CWA DOCUMENTATION

Documentation is also required to support CWA compliance activities at ORNL. The following sections provide examples of ORNL's CWA documentation.

8.6.1 NPDES Permit

An NPDES Permit is a liquid waste discharge permit issued to ORNL by the EPA under the CWA. An NPDES permit targets specific discharge points, allows discharges from the listed facilities exclusively; and 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 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

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 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, 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 R&D, 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 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 which 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 WAC are being met. This is particularly difficult when the waste stream composition varies over time. This variation involves changes in both the specific radionuclides which 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:

1. Developing the capability to accurately measure the concentration of radionuclides in specific waste streams, and

2. Developing the capability, in conjunction with measurement techniques, to reliably segregate radioactively contaminated waste from uncontaminated waste.

The following sections provide a brief discussion of the demonstration projects conducted at ORNL to provide information to fulfill the requirement of (1) and (2) above.

8.7.1.1 Demonstration Project for Characterization of Radioactively Contaminated Soils

The Environmental Projects Section collected several soil samples during the development and site assessment phases of the Bethel Valley LLLW-CAT System Upgrade project. As a development project in characterization of contaminated soils, the ACD performed a series of tests on the soil. These assay results constitute a preliminary technique for rapid soil characterization.

The technique involves assay of soil aliquots, approximately 50-75 grams, using field laboratory techniques. No sample preparation is involved, other than transferring the aliquot into the appropriate plastic container. Three different counting systems were used:

1. Gamma emitters - NaI(Tl),
2. Alpha emitters - ZnS (Ag) scintillation detector, and
3. Beta emitters - plastic scintillation detector.

Several samples were analyzed both by the field characterization technique using the NaI(Tl) well counter and by a standard laboratory analysis using a hyper-pure germanium detector. In order to apply this technique to the characterization of radioactively contaminated soils in field situations, additional research or development is needed in the following areas:

1. More rigorous validation of the proposed technique,
2. Expansion of the technique to more radionuclides,
3. Qualitative analysis of beta emitters,
4. Quantitative analysis of beta emitters, and
5. Inclusion of alpha emitters.

8.7.1.2 Demonstration Project for Characterization of Isotope Production Waste

This project is designed to develop and demonstrate the capability to measure the concentration of radioactive contaminants in waste resulting from the production of commercial radionuclides at ORNL. This waste stream is varied in the type and quantities of material which may be present and, under the ORNL SLLW certification strategy, would be categorized as a physically heterogeneous waste of inconstant composition, operationally generated. In order to develop a useful characterization method, a specific waste stream from the Isotopes area was chosen for this project.

Before beginning to develop measurement capability, the waste stream of interest must be segregated from other, interfering radioactive wastes. The radionuclide concentrations can be determined through measurement of the gamma emissions only, with no attempt at measuring beta emissions. 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 can be assumed to contain radioactive material at levels that are exempt from regulatory control, assuming that the lower limit of detection for the screening instrument is below the concentration limit for that classification. However, if the screening instrument indicates that radioactive material is present in the waste, further characterization of the waste is required.

For those waste packets that receive a positive reading from the screening instrument (i.e., indication that radioactive material is present), qualitative and quantitative analysis of the waste is performed. The most likely method for this to be accomplished is to use a solid state (HPGe) detector for gamma spectroscopic analysis. The spectroscopy station is established such that the individual waste packets could be assayed prior to being placed into the SLLW drum or box. This increases both the accuracy and precision of quantification over what would be possible performing bulk assay of the filled drum or box, as well as presenting fewer problems in calibration and operation of the respective instruments.

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3. J. S. Baldwin et al., Oak Ridge National Laboratory Long-Range Environmental and Waste Management Plan: Program Overview and Summary, (Draft) ORNL-6536, August 1989.

4. J. S. Baldwin et al., Oak Ridge National Laboratory Long-Range Environmental and Waste Management Plan: Detailed Management Plan, (Draft) ORNL-6537, August 1989.

5. J. S. Baldwin et al., Comprehensive Plan for Management of Hazardous and Mixed Waste at Oak Ridge National Laboratory, (Draft) ORNL/CF-89/224, July 1988.

6. J. S. Baldwin, T. E. Myrick, C. M. Kendrick and L. D. Bates, Oak Ridge National Laboratory Implementation Plan for DOE Order 5820.2A, ORNL/TM-11166, April 1989.

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8. J. B. Berry, Environmental Restoration and Facilities Upgrade Program: Water Pollution Control Strategy, ORNL/TM-10343, June 1987.

9. G. E. Butterworth, III, et al., Low-Level Waste Disposal Development and Demonstration Program FY 1989 Integrated Implementation Plan for the Oak Ridge Reservation Facilities, (Draft) ES/ESH-7, December 16, 1988.

10. L. S. Dickerson, Engineering Analysis of the Oak Ridge National Laboratory Stack and Vent Survey, ORNL/CF-88/328, December 1988.

11. Letter, R. L. Egli to G. C. Tidwell, dated June 27, 1989; Subject: Low-Level Waste Tanks at the Oak Ridge Reservation.

12. Environmental Assessment of the Shipment of Oak Ridge National Laboratory's Contact-Handled Transuranic Waste to the Waste Isolation Pilot Plant, DOE/EA-0349, U. S. Department of Energy, July 1989.

13. Environmental Protection and Health Protection Division Safety and Health Manual, Oak Ridge National Laboratory, ORNL/M-805, July 14, 1989.

14. Environmental Restoration and Waste Management - Five-Year Plan, DOE/S-0070, U.S. Department of Energy, 1989.

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16. J. J. Ferrada et al., Contingency Plan for the Oak Ridge National Laboratory Liquid Low-Level Waste System, (Draft) ORNL/TM-11227, September 1989.

17. Memorandum, W. R. Golliher to O.B. Morgan, and W. F. Morgan, dated May 26, 1989; Subject: Organizational Plans for the New Reservation Waste Management Division.

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20. C. P. McGinnis et al., Hazardous Waste Development, Demonstration, and Disposal Program Plan, ES/ESH-5/V1, February 1989.

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23. Oak Ridge National Laboratory Quality Assurance Manual, "Environmental Assessment," EMP-10.0, July 15, 1981.

24. Oak Ridge National Laboratory Quality Assurance Manual, "Environmental Review and Documentation Program," EMP-22.0, December 16, 1985.

25. Memorandum, C. E. Pepper to R. L. Smith, dated August 10, 1989; Subject: Management Review Data Sheets for Environmental Projects.

26. R. E. Pudelek, Environmental Restoration and Facilities Upgrade Program: Environmental Monitoring Strategy, ORNL/TM-10345, June 1987.

27. S. M. Robinson, ORNL Liquid Waste Management, (Draft), ORNL WMCO/RAP Interface Meeting, August 15, 1989.

28. R. M. Schultz, Waste Reduction Plan for the Oak Ridge National Laboratory, (Draft), ORNL/TM-11050, August 1989.

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32. Memorandum, A. W. Trivelpiece to M. E. Mitchell, dated May 31, 1989; Subject: Oak Ridge National Laboratory Interim Storage Plan.

33. Memorandum, A. W. Trivelpiece to W. R. Golliher, dated July 11, 1989; Subject: Update of Oak Ridge National Laboratory Plans for Use of the Toxic Substances Control Act Incinerator.

34. Memorandum, A. W. Trivelpiece to W. R. Golliher, dated January 13, 1989; Subject: Warehousing of Waste for Oak Ridge National Laboratory.

35. Memorandum, R. S. Wiltshire to Distribution, dated January 9, 1986; Subject: Environmental Protection Procedure, EMP 22.0: Environmental Review and Documentation Program.

36. E. L. Youngblood and T. F. Scanlan, Environmental Restoration and Facilities Upgrade Program: Air Pollution Control Program Strategy, ORNL/TM-10342, June 1987.

37. E. L. Youngblood, S.P. duMont and R. E. Helms, Upgrade of the Radioactive Air Emission Systems at Oak Ridge National Laboratory, Presentation at the DOE/NRC Nuclear Air Cleaning Conference, August 1988.

APPENDIX A: 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 the ORNL Waste Management Plan each December. 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/R1 (Draft), August 1988.

J. H. Smith et al., Oak Ridge National Laboratory Transuranic Waste Certification Program, Addendum 1 -Stored Contact-Handled Transuranic Waste, ORNL/TM-10322/R1/A1 (Draft), May 1989. R

J. H. Smith et al., Oak Ridge National Laboratory Transuranic Waste Certification Program, Addendum 2 -Newly Generated Remote-Handled Transuranic Waste, ORNL/TM-10322/R1/A1 (Draft), June 1989. R

Oak Ridge National Laboratory Transuranic Waste Certification Program, Addendum 3 - Stored Remote-Handled Transuranic Waste, to be published September 1994.

(b) Sects. 3.2.g and 3.2.h. Cite the closure plan for interim storage facilities. If not issued, give schedule for preparation.

Oak Ridge National Laboratory Transuranic Retrievable Waste Storage Facilities (Buildings 7823, 7826, and 7834 and the RH-TRU Retrievable Storage Area) Closure Plan, December 23, 1987.

Part B RCRA Permit Application for Cell 4 Solids Storage Facility, December 23, 1987.

Revised Part B RCRA Permit Application for Existing Remote-Handled Transuranic Concrete Cask Storage Facility (Building 7855) and Proposed Transuranic/Solid Low-Level Waste Staging Facility, (Draft), May 11, 1989. R

(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.

No documents are scheduled for preparation this fiscal year.

(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.

See attached Table A.1. R

(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.

WAC for Interim Storage at ORGDP.

Internal Correspondence, Warehousing of Wastes, W. R. Golliher, July 12, 1988, Attachment: Waste Acceptance Criteria for Storage, (K-25 Building)

WAC for SWSA 6 for ORNL.

Waste Acceptance Criteria for Radioactive Solid Waste Disposal at SWSA 6, WM-HRWO-502, August 21, 1989. R

No additions are anticipated this fiscal year.

(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. A. Smith, Solid Low-Level Waste Certification Strategy, (Draft), ORNL/TM-11307, September 1989. R

(d) Sect. 4.2.g.2. List document(s) forecasting waste to be shipped by generators to off-site disposal facilities.

Not applicable to ORNL.

(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.

ORNL does not intend to dispose of GTCC waste on the ORR.

(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 that will address waste management activities on the ORR. This draft EIS will include the siting of proposed new LLW facilities. The draft EIS is scheduled to be released for public comment by the end of March 1990. A ROD is expected by September 1990. R

(g) Sect. 4.2.j.1. Cite closure plans for LLW disposal sites and dates of issue. Give schedule of preparation for anticipated reports.

No final closure plans have been developed for any active or inactive LLW disposal site at ORNL. Closure plans for SWSA 6 and all other inactive LLW sites will be developed by the RAP under RCRA interim status closure, incorporating Section 3004(u) provisions. The RAP has submitted a closure plan/post-closure permit application in response to this federal regulation.

Closure Plan/Post-Closure Permit Application for Solid Waste Storage Area 6, ORNL/RAP-Sub/87-99053C/5, April 1988.

(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, expected date of issue: December 1990. R

(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.

Final Report on the Decommissioning of the Storage Garden (3033), expected date of issue May 1990. R

Table A.1 SWSA 6 (GCD/IWMF)

The actions and schedule for completing the SWSA 6 (GCD/IWMF) PA are as follows:

Description	Scheduled date of completion
Identify the data needed from the ORNL Waste Management organization.	October 15, 1989 (completed)
Requested data provided to the RPAT.	November 15, 1989
Complete preliminary scoping analysis of the disposal unit and refine PA model, if appropriate	December 15, 1989
Identify additional data needs based on the results of the preliminary scoping analysis.	December 29, 1989
Prepare rough draft of PA for Energy Systems review.	April 15, 1990
Prepare final review draft of PA for Energy Systems review.	June 30, 1990
Final PA report to DOE-ORO for submittal to DOE-HQ.	September 15, 1990
Peer Review Panel Meeting on the PA.	September 1990
Respond to the Peer Review Comments.	December 1990
Complete a draft of the revised PA for review.	June 1991
Issue final PA documentation.	September 1991

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