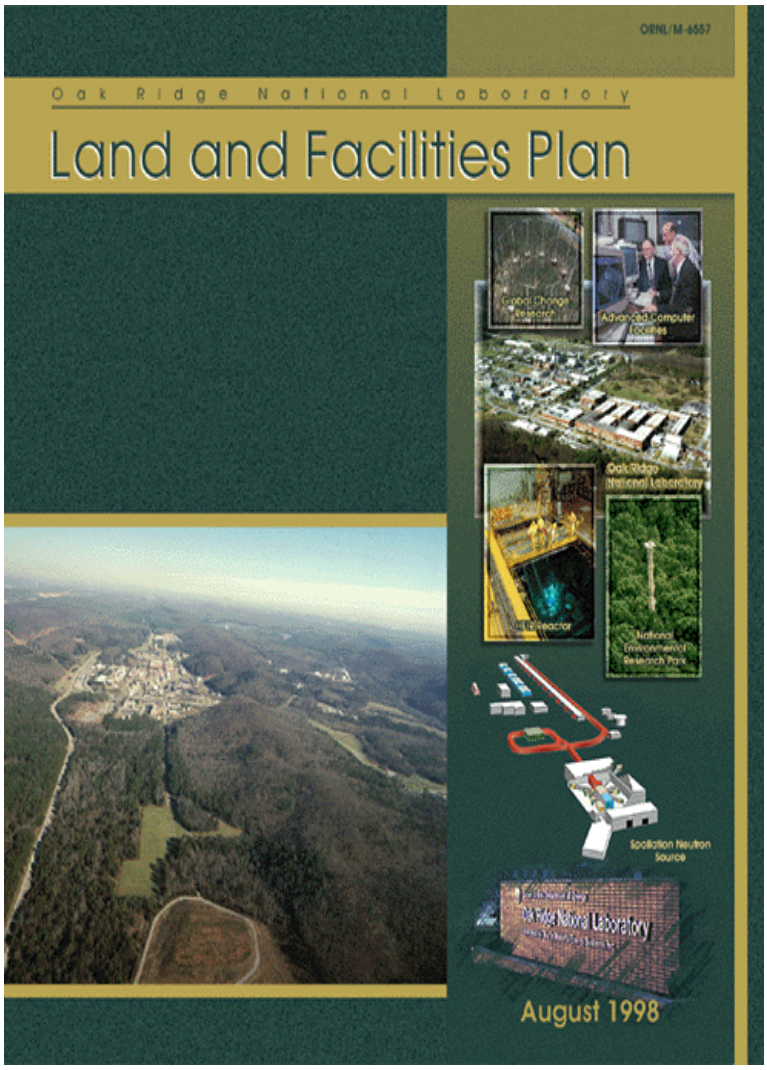
ORNL/M-6557

OAK RIDGE NATIONAL LABORATORY

LAND AND FACILITIES PLAN



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OAK RIDGE NATIONAL LABORATORY
LAND AND FACILITIES PLAN

August 1998

Prepared by
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for the
U.S. DEPARTMENT OF ENERGY
under contract DE-AC05-96OR22464

The information in the *Oak Ridge National Laboratory Land and Facilities Plan* was obtained with the cooperation of the professional staff of the Oak Ridge National Laboratory. For additional information, contact

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Comments on the *Oak Ridge National Laboratory Land and Facilities Plan* have been addressed and resolved within time constraints. Recognizing that land and facilities planning is not a static process, this document will address additional comments with updates electronically published as needed.

An electronic version of this document is available on the World Wide Web:
http://www.ornl.gov/~dmsi/landUse/

Front cover designed by LeJean Hardin, ORNL Computing, Information, and Networking Division.

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ACRONYMS AND ABBREVIATIONS

ADS	Activity Data Sheet
AEC	U.S. Atomic Energy Commission
BIO	Basis for Interim Operation
BMAP	Biological Monitoring and Abatement Program
BSR	biological significance ranking
BTC	Building Technology Center
CAS	Condition Assessment Survey
CCII	Computational Center for Industrial Innovation
CDR	conceptual design report
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESAR	Center for Engineering Systems Advanced Research
CFC	chlorofluorocarbon
CFR	*Code of Federal Regulations*
CH8	Corehole 8
CIP	Comprehensive Integrated Plan
CO_2	carbon dioxide
CTF	Central Training Facility
CWA	Clean Water Act
d	day
D&D	decontamination and decommissioning
DOE	U.S. Department of Energy
DOSAR	Dosimetry Applications Research Facility
DOT	U.S. Department of Transportation
ED&C	Engineering Design and Construction
EM	Environmental Management
EPA	U.S. Environmental Protection Agency
ES&H	environment, safety, and health
ESH&Q	environment, safety, health, and quality
ESHQ&I	environment, safety, health, quality, and infrastructure
ET	evapotranspiration
ETNGC	East Tennessee Natural Gas Company
ETTP	East Tennessee Technology Park
FACE	Free-Air CO_2 Enrichment
FAMMIS	Facility and Maintenance Management Information System
FDDI	Fiber Distributed Data Interface
FFA	Federal Facilities Agreement
FTS	Federal Telecommunications System
FY	fiscal year
GAAT	Gunite and Associated Tanks
gal	gallon
gpd	gallons per day
GPE	general-purpose equipment
gpm	gallons per minute

GPP	general plant project
h	hour
HEPA	high-efficiency particulate air
HFIR	High Flux Isotope Reactor
HOG	hot off-gas
HPRR	Health Physics Research Reactor
HRIBF	Holifield Radioactive Ion Beam Facility
HVAC	heating, ventilation, and air conditioning systems
IRA	interim remedial action
ISOL	Isotope Separator On-Line
IT&M	Inspection, Testing, and Maintenance
IWMF	Interim Waste Management Facility
JINS	Joint Institute for Neutron Sciences
kV	kilovolt
LAN	local area network
LCAM	Life Cycle Asset Management
LERC	Laboratory Emergency Response Center
LI	line item
LLLW	liquid low-level (radioactive) waste
LLW	low-level (radioactive) waste
LMER	Lockheed Martin Energy Research Corporation
LMES	Lockheed Martin Energy Systems, Inc.
M&I	management and integration
MAA	Material Access Area
MAB	Man and the Biosphere
Mgd	million gallons per day
MS&E	Materials Science and Engineering
MSL	mean sea level
MSRE	Molten Salt Reactor Experiment
MVST	Melton Valley Storage Tanks
MW	megawatt
NESHAP	National Emission Standards for Hazardous Air Pollutants
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRWTP	Nonradiological Wastewater Treatment Plant
ORAU	Oak Ridge Associated Universities
ORFICN	Oak Ridge Federal Integrated Communications Network
ORISE	Oak Ridge Institute for Science and Education
ORNL	Oak Ridge National Laboratory
ORO	Oak Ridge Operations Office (DOE)
ORR	Oak Ridge Reservation
OSHA	Occupational Safety and Health Act of 1970
P&E	Plant and Equipment
PCB	polychlorinated biphenyl
PCSD	President’s Council on Sustainable Development
PdM	predictive maintenance

PM	preventive maintenance
PMF	probable maximum flood
psi	pounds per square inch
PVC	polyvinylchloride
PWTP	Process Waste Treatment Plant
R&D	research and development
RCRA	Resource Conservation and Recovery Act
REDC	Radiochemical Engineering Development Center
RIBs	radioactive ion beams
RI/FS	Remedial Investigation/Feasibility Study
RMO	Reservation Management Organization
ROD	Record of Decision
RPSC	Robotics and Process Systems Complex
SAMS	Space Allocation Management System
SARs	Safety Analysis Reports
SARUP	Safety Analysis Report Update Program
SDI	Shared Data Initiative
SLLW	solid low-level (radioactive) waste
SNS	Spallation Neutron Source
STP	sewage treatment plant
SWSA	Solid Waste Storage Area
TDEC	Tennessee Department of Environment and Conservation
TO	teraops
TRU	transuranic
TS	Treatability Study
TSC	Technical Support Center
TSCA	Toxic Substances Control Act
TSDF	hazardous waste treatment, storage, and disposal facility
TSF	Tower Shielding Facility
TSRs	Technical Safety Requirements
TVA	Tennessee Valley Authority
TWRA	Tennessee Wildlife Resources Agency
UL	Underwriters' Laboratories, Inc.
URL	Uniform Resource Locator
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
VOC	volatile organic compound
WAC	Waste Acceptance Criteria
WM	Waste Management
WMOD	Waste Management Operations Division

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ACKNOWLEDGMENTS

Development of this *Oak Ridge National Laboratory Land and Facilities Plan* involved coordination with a number of individuals whose input and contributions have helped shape and improve the plan. Although everyone cannot be named, special appreciation is expressed to the following individuals:

Susan Anderson
Bob Atchley
Jan Berry
Helen Braunstein
Wayne Chance
Jeannette Cox
Patty Cox
Harold Cromwell
Nancy Dailey
Danny Davis
Tom Etheridge
Rick Forbes
Ingrid Gurney
Harriet Hardee
LeJean Hardin
Greg Herdes
Nancy Holcombe
Juanita Hunt
Greg Irby
Linda Kaiser
David Kendall
Dave Kennard
Ed Krieg
Elizabeth Krispin
Mack Lakumb
Jim Loar
Jim Mathys
Tony Medley
Tim Myrick
Pat Parr
Wayne Pope
Barbara Rosensteel
Bo Saulsbury
Tom Scanlan
Dave Shriner
Lorene Sigal
Grant Stradley
Leroy Stratton
Darrell Tullock
Mike Turpin
Charlie Valentine
Bob Walker
Warren Webb
Barbara Wojtowicz
and numerous reviewers

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1. INTRODUCTION

Oak Ridge National Laboratory (ORNL) is the nation's largest and most diverse energy research and development (R&D) institution. Its activities are focused on basic and applied R&D to advance the nation's energy resources, environmental quality, and scientific knowledge. Major Department of Energy (DOE) Office of Energy Research scientific research programs depend on the land base of the Oak Ridge Reservation (ORR) to meet mission objectives. ORNL is managed by Lockheed Martin Energy Research Corporation, which has the management and planning responsibility for ORNL facilities and for most of the ORR's undeveloped land area. This responsibility includes planning for approximately 23,800 acres of undeveloped and developed land (Fig. 1.1).

The ORR land area currently supports multiple uses, and there is an increasing demand for additional uses (Fig. 1.2). With major changes in mission at the East Tennessee Technology Park (ETTP) and the Y-12 Plant, demonstrating current land use (by ORNL as well as other users) and planning for future land use needs by DOE and ORNL are critical. An irreplaceable asset, the reservation is a vital part of ORNL. Decisions on how to use the land area impact not only at local and regional levels but also nationally and internationally.

Information on ORNL land and facilities use and planning is contained in this *ORNL Land and Facilities Plan*. Section 2, "ORNL Land Use Plan," provides information on current reservation uses (ORNL and others) and addresses ORNL plans for use of the land outside the ORNL fenced, developed site. Information on planned uses by non-ORNL projects (Bechtel Jacobs Company LLC, Tennessee Department of Transportation, etc.) is included when known. Section 3, "ORNL Integrated Facilities Plan," provides information on planning for facilities and uses within the ORNL developed area. This plan complements and draws from recommendations provided in the DOE *Comprehensive Land-Use Planning Process Guide* (DOE 1996a) and feeds into the ORR comprehensive integrated planning document, *Comprehensive Integrated Planning: A Process for the Oak Ridge Reservation, Oak Ridge, Tennessee*, herein referred to as the *ORR Comprehensive Integrated Plan* (May 1998).

1.1 LAND USE HISTORY OF THE OAK RIDGE RESERVATION

The land area now known as the ORR was established on September 19, 1942, when General Groves, Commander of the wartime "Manhattan Project," ordered the immediate purchase of a tract of land along the Clinch River between the cities of Kingston and Clinton, Tennessee, to be converted into a government reservation. The 58,575-acre military reservation (17 miles long by 7 miles wide) was to contribute to the manufacture of an atomic bomb within 3 years. It became the site of rapid construction of three separate production facilities (code named X-10, Y-12, and K-25) and a remote residential Townsite, all of which were managed behind a heavily guarded barbed-wire fence under strict military security (Souza et al. 1997).

Fig. 1.1

Fig. 1.2

1.2 A SHIFT TO PUBLIC OWNERSHIP

Of the original 58,575 acres of land purchased in 1942 by the federal government, 24,062 acres were disposed of and 34,513 acres remain as indicated in Fig. 1.3. Approximately 25% of the disposed land was conveyed to the City of Oak Ridge for developmental purposes (almost 6,000 acres). It includes 2,371 acres of self-sufficiency parcels for residential, commercial, and industrial development; 270 acres for school sites; 1,083 acres for electrical, water, sanitary and storm sewer, drainage, roads and streets; 1,475 acres for municipal properties; and 29 acres for public housing. Land was also conveyed to Anderson County (28 acres), Oliver Springs (9 acres), the Tennessee Valley Authority (2,992 acres), and other federal agencies (63 acres). Land conveyed to the State of Tennessee was for health, forestry, agricultural research, and a biomedical graduate school (2,315 acres). Land conveyed for private entities and homeowners (12,692 acres) includes permanent road easements granted to the city, counties, and state to provide access to the area; 108 acres conveyed for rail service; 123 acres for area churches; 11,000 acres for house lots, country club and golf course development, sportsman's clubs, quarry operations, cemetery association, Girl and Boy Scout organizations, and the hospital association for the medical complex. Self-sufficiency land requests from the City of Oak Ridge are discussed and identified in Appendix F.

Fig. 1.3

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2. ORNL LAND USE PLAN

2.1 ORNL VISION FOR LAND USE

The Oak Ridge Reservation (ORR) is a unique and irreplaceable resource for the Department of Energy (DOE) to use for its national science and technology missions. Land use planning identifies and prioritizes needs for preservation of reservation land to meet the requirements of existing and future scientific facilities, environmental research, education, and other compatible uses.

2.2 DEVELOPMENT OF THE LAND AND FACILITIES PLAN

The ORR is vital because the ability and/or opportunity to acquire another land area such as this is not feasible. In November 1996, an Oak Ridge National Laboratory (ORNL) land use planning team was charged with developing a land use plan and a process for reviewing and evaluating proposed land uses. The team included representatives from ORNL, Lockheed Martin Energy Systems (LMES), and the ORR Environmental Management (EM) Site Specific Advisory Board. In addition, input to the plan was solicited from external stakeholders.

The land uses identified in the plan include

- land for future DOE mission initiatives,
- areas for maintaining DOE mission objectives,
- diverse areas for pursuing new DOE initiatives for ORNL,
- areas for regulatory compliance,
- areas for preservation of biological diversity,
- areas for educational and recreational activities, and
- controlled access areas for public recreation.

The ORNL philosophy for land use planning and decision making incorporates responsible stewardship, wise use of taxpayers' money, and informed decision making.

2.3 LAND USE DECISION MAKING AND PLANNING

Prerequisites to any decision include ensuring the health and safety of ORR employees and the public. Beyond health and safety and regulatory compliance, land use decision making and planning reflect the ORNL vision for land use. Recommendations on land use are made by an ORNL Land and Facilities Use Committee (Section 2.3.4) based on the land use vision

statement and on guidelines for wise land use planning, land use priorities, and input by subject matter experts through a review process.

2.3.1 Guidelines for Land Use Planning

The following guidelines are used in planning and evaluating land uses:

- ensure compatibility with DOE mission and ORNL vision for land use,
- cluster like uses,
- preserve clean areas,
- reuse disturbed areas,
- prevent pollution,
- protect natural and cultural resources,
- balance costs and benefits,
- consider future generations,
- optimize appropriate recreational use,
- ensure compatibility with surrounding landscape, and
- consider stakeholder input.

2.3.2 Land Use Priorities

For any parcel of land, potentially competing uses may or may not be compatible with each other. The following priorities for land use have been established so that conflicts between competing uses, particularly those that are not compatible, can be resolved:

1. Preserve and protect land for meeting the requirements of existing and future scientific facilities and research programs so that DOE can continue to address its national science and technology missions.

2. Preserve and protect land to meet the requirements of environmental research by ensuring that adequate areas within the ORR are protected and preserved for their biological and physical diversity.

3. Preserve and protect land to meet the requirements of scientific and technical education by ensuring that suitable land is available for facilities and research areas needed to support educational opportunities on the ORR.

4. Allow for land uses that may not directly meet requirements for priorities 1, 2, and 3 for scientific facilities, environmental research, and scientific and technical education, but that would be compatible with these uses. Decisions concerning these other uses are made on a case-by-case basis to ensure compatibility with higher-priority uses.

2.3.3 Review by Subject Matter Experts

The decision-making process includes review and evaluation of proposed land uses by subject matter experts. Review includes the potential to impact the following:

- current land uses,
- opportunities to pursue future initiatives,
- natural and cultural resources,
- health and safety,
- emergency preparedness,
- compliance,
- access control/security,
- real estate agreements,
- neighboring lands,
- utilities,
- public relations,
- transportation, and
- maintenance activities.

2.3.4 ORNL Land and Facilities Use Committee

The ORNL Land and Facilities Use Committee plans, reviews, and approves for recommendation to DOE all (ORNL and non-ORNL) proposed changes in the use of land and facilities within the ORNL developed area and ORNL projects proposed for the ORR outside the ORNL developed area (see Fig. 1.1). Review of proposed projects includes evaluation by appropriate subject matter experts. All projects are assessed to ensure compatibility with this *ORNL Land and Facilities Plan* and the *ORR Comprehensive Integrated Plan* (May 1998). Review through the ORNL Land and Facilities Use Committee ensures coordination of the site planning process described in Section 3.4. Planning goals and projects approved by the ORNL Land and Facilities Use Committee are incorporated into the *ORNL Land and Facilities Plan* and the *ORR Comprehensive Integrated Plan* updates. Approved ORNL projects for areas outside the ORNL developed area are submitted to the Reservation Management Organization (RMO) for review and concurrence and to the DOE ORR Management Team as described in the *ORR Comprehensive Integrated Plan*.

2.3.5 Review Process

Proposals for changes in land and facility use are submitted first to the ORNL Land and Facilities Use Committee for screening. This includes proposals from anyone planning activities within the ORNL developed area as well as proposals initiated by ORNL projects or activities for areas outside the ORNL developed area.

Proposed actions within the ORNL developed area. Once approved by the ORNL Land and Facilities Use Committee, the proposed changes in land or facility use are then discussed with the DOE ORNL Site Office. If approved, an ORNL project review (i.e., National Environmental Policy Act) and other required reviews are initiated.

Proposed actions by ORNL outside the ORNL developed area. Once approved by the ORNL Land and Facilities Use Committee, the proposals are submitted to the RMO. If approved by the RMO, the proposals are submitted to the DOE ORR Management Team as described in the *ORR Comprehensive Integrated Plan* (May 1998).

Actions proposed within ORNL developed area → ORNL Land and Facilities Use Committee → DOE ORNL Site Office

Actions proposed by ORNL outside ORNL developed area → ORNL Land and Facilities Use Committee → RMO → Process in CIP

2.3.6 Overlapping Land Use/Management Responsibilities

Some land areas for which ORNL has contractual responsibility (e.g., the National Environmental Research Park) overlap the Y-12 Plant, Oak Ridge Associated Universities (ORAU), and East Tennessee Mechanical Contractors, Inc., areas of responsibility. Within the overlap areas, the DOE contractors have day-to-day responsibility for management, operation, and maintenance as described in the *Oak Ridge Reservation Management Plan*, February 1997. Any proposed changes in land use within these overlap areas are reviewed by the RMO.

2.4 DESCRIPTION OF THE OAK RIDGE RESERVATION

2.4.1 Location

The ORR consists of 34,513 acres of federally owned lands within Anderson and Roane counties, Tennessee (Fig. 2.1). Most of the ORR is within the corporate limits of the City of Oak Ridge, Tennessee, and is located approximately 2 miles southwest of the population center of Oak Ridge. The ORR is bordered on the north and east by the population center of the City of Oak Ridge and on the south and west by the Clinch River/Melton Hill Lake impoundment. Knoxville, the largest city in east Tennessee, is located approximately 15 miles east of the ORR (Fig. 2.1).

2.4.2 DOE Facilities

About one-third of the ORR is occupied by the three major DOE facilities: ORNL, ETTP (formerly the K-25 Site), and the Y-12 Plant. About 3500 acres are waste sites or remediation areas. The large land area surrounding the developed areas and waste sites serves as a buffer between the City of Oak Ridge and the DOE activities. Use of this buffer area has been primarily for environmental research, remediation, education, compliance monitoring, utilities, protection of natural and cultural resources, wildlife management, and limited recreation.

Fig. 2.1

2.4.3 Physical Characteristics

2.4.3.1 Topography, Geology, and Hydrology

The ORR is the most complex geologically and hydrologically of all the DOE sites. Located in the Valley and Ridge Physiographic Province, the ORR is characterized by a series of narrow, elongated ridges and slightly broader intervening valleys that follow a northeast to southwest trend (ORNL 1992). Major valleys within the ORR include East Fork Valley, Bear Creek Valley, Bethel Valley, and Melton Valley. Major ridges within the ORR include Blackoak Ridge, East Fork Ridge, Pine Ridge, Chestnut Ridge, Haw Ridge, and Copper Ridge.

Topography is shown in Fig. 2.2. Elevation within the ORR ranges from a low of 750 ft mean sea level (MSL) along the Clinch River to a high of 1260 ft MSL along Pine Ridge (DOE 1989). Topographic relief between valley floors and ridge crests within the ORR is generally about 300 to 350 ft (ORNL 1992).

Valleys within the ORR are underlain by bedrock formations predominated by calcareous siltstones and limestones. Ridges within the ORR are underlain by bedrock formations predominated either by weathering-resistant sandstones and siliceous shales and siltstones or by siliceous dolostones that weather to form thick, residual, silty clay soils rich in chert and resistant to erosion (ORNL 1992). The width of these valleys and ridges is determined by geologic factors such as the dip angle and formation thickening due to thrust faulting of underlying geologic formations. Weathering and erosion processes, coupled with the general dipping attitude of bedrock underlying the area, result in rather steep (commonly steeper than 45^{o}) northwest-facing slopes, while southeast-facing slopes are commonly gentler, with inclinations of 5 to 25% (Fig. 2.2) (ORNL 1992).

The topographical features of the ORR reflect geological structures and processes beneath the surface. While groundwater flow in bedrock and, to some degree, surface water flow are controlled by widespread fractures in all bedrock formations on the ORR, the carbonate bedrock also displays dissolutional features and landforms collectively referred to as karst. Karst features represent a spectrum ranging from minor solutional enlargement of fractures to conduit flowpaths to enterable caves. All of these are evidenced on the ORR, associated with the carbonate strike belts along ridge lines and valley bottoms.

All three ORR facilities are situated on carbonate bedrock to some extent such that groundwater flow and contaminant transport are at least in part controlled by solution conduits in the bedrock.

A recent inventory of karst features on the reservation has identified numerous indications of karst development which vary from site to site. Karst features are displayed on Fig. 2.3. Surface evidence of karst development includes sinking streams (swallets) and overflow swallets, karst springs and overflow springs, enterable caves, and numerous sinkholes of varying size.

Fig. 2.2

Fig. 2.3

In general terms, karst appears most developed in association with the Cambro-Ordovician Knox group carbonate bedrock which underlies Copper Ridge, Chestnut Ridge, McKinney Ridge at the ETTP, and Blackoak Ridge. The highest density of sinkholes occurs in the Knox group, and drilling data suggest the largest solution cavities are associated with these formations, ranging up to 22 ft in height at the ETTP. Enterable caves on the reservation are almost exclusively restricted to the Knox group bedrock. Large springs in the Knox typically occur along the base of the ridges underlain by the Knox. Many appear to have been used for water supply purposes prior to DOE presence.

In contrast with the Knox, karst is less developed in the Chickamauga group carbonates which underlie the ORNL facilities area and much of the ETTP facilities area in a valley-bottom topographic position. Cavities encountered in drilling are typically smaller and often clay-filled. Caves developed in the Chickamauga regionally, as well as on the ORR, are sparse and typically small.

Recent problems related to property damage to residential homes on neighboring properties due to settlement have highlighted the potential for collapse in areas underlain by cavernous limestone. While it is not possible to quantify the risk of collapse on the ORR, it should be considered a potential condition but not necessarily an imminent one. Considering that the karst features are best developed in the Knox group carbonates, it stands to reason that collapse potential would be greatest in areas underlain by these formations.

The Clinch River is believed to represent the base level to which all groundwater in carbonate bedrock on the ORR would ultimately discharge if not to surface water features on the ORR. The Tennessee Valley Authority (TVA) has performed probable maximum flood (PMF) studies along the Clinch River, which is the southern boundary of the ORR PMF is the flood that can be expected from the most severe combination of critical hydrometeorological conditions that are reasonably possible over the entire watershed (ORNL 1992). The PMF level along the Clinch River at the mouth of Bearden Creek occurred at elevation 814.7 ft, while the PMF level at the mouth of White Oak Creek occurred at elevation 779.3 ft (ORNL 1992). Fig. 2.4 indicates that most of the ORR is located above the PMF elevation along the Clinch River.

Surface water hydrology on the ORR is characterized by a network of small streams that are tributary to the Clinch River (Fig. 2.4). Water levels in the Clinch River are regulated by TVA, and fluctuations in the river have an effect on tributary creeks and streams draining the ORR. The three DOE facilities on the ORR affect different subbasins of the Clinch River. Drainage from the ETTP enters Poplar Creek, which has a total drainage area of 136 sq miles. Drainage from ORNL has its greatest effect on White Oak Creek, which has a total drainage area of 6.0 to 6.4 sq miles. Drainage from Y-12 enters both Bear Creek and East Fork Poplar Creek, which have total drainage areas of 7.4 and 30 sq miles, respectively (DOE 1989).

Fig. 2.4

2.4.3.2 Vegetation and Wildlife

The ORR is mostly contiguous native eastern deciduous forest. Prior to government acquisition as a security buffer for military activities, the ORR's approximately 1000 individual farmsteads consisted of forest, woodlots, open grazed woodlands, and fields. Results of remote-sensing analyses show that in 1994 about 70% of the ORR was in forest cover and about 20% was transitional, consisting of old fields, agricultural areas, cutover forest lands, roadsides, and utility corridors (Washington-Allen et al. 1995). Forested (hardwood and pine) areas (many in blocks greater than 100 acres) are identified in Fig. 2.5. Cutover forest land includes about 1100 acres of pine plantations killed by southern pine beetles (now regenerating or replanted). Less than 2% of the reservation remains as open agricultural fields (Mann et al. 1996). The forests are mostly oak-hickory, pine-hardwood, or pine. Minor areas of other hardwood forest cover types are found throughout the ORR, including northern hardwoods, a few small natural stands of hemlock or white pine, and floodplain forests.

This large, relatively unfragmented area of mature eastern deciduous hardwood forest provides habitat for numerous wildlife species. Such blocks of forested area are increasingly uncommon in the Ridge and Valley Province and nationwide. In addition to the forested habitats and pine plantations, the ORR contains seminatural grasslands (hay) and forest edge (e. g., transmission line corridors through forest) which provide diversity of habitats suitable for a great variety of wildlife. Other wildlife habitats on the ORR include, but are not limited to, the following: old-field successional areas; unique or important vegetational communities; seminatural corridors; planted hardwoods and pines; bottomlands and wetlands, including an increasing number of beaver ponds; caves; and developed and semideveloped areas and roads.

The resulting diversity of wildlife species range from common species found in urban and suburban areas of eastern Tennessee to species with more restrictive requirements, such as interior forest bird species. The ORR hosts about 63 species of fish, 59 species of reptiles and amphibians, up to 260 species of migratory, transient, and resident birds, and 38 species of mammals, as well as innumerable invertebrate species. Among these, 20 species of federal- or state-protected vertebrate species have been confirmed in recent surveys (Mitchell et al. 1996). Furthermore, appropriate habitat for approximately 20 additional species has been identified.

All areas of the ORR are relatively pristine when compared with the surrounding region, especially in the Ridge and Valley province (Mann et al. 1996). From the air, the ORR is clearly a large and nearly continuous island of forest within a landscape fragmented by urban development and agriculture. Many ecological communities (e.g., cedar barrens, river bluffs, and wetlands) with unique biota, often including rare species, are known to exist within the larger framework of mixed hardwood and pine forest on the ORR (Pounds et al. 1993).

Fig. 2.5

2.4.3.3 Caves, Open Sinkholes, and Quarries

Caves, sinkholes, and quarries are found on the ORR. In addition to providing important habitat for some plants and animals, including sensitive species, these features are often attractive to people, yet can be hazardous. The numerous caves on the reservation are not open to the public, and access has been restricted to research and monitoring uses (Fig. 2.3). A large, open sinkhole is located near the Tower Shielding Facility Highway 95 entrance in an area maintained by periodic mowing. The sinkhole is fenced, and access is restricted. The area is not open to the public (Fig. 2.3).The three inactive quarries (Lambert, Kerr Hollow, and Rogers) are all in restricted areas and are not open to the public (Fig. 2.3).

2.4.4 Cultural Resources

Cultural resources on the ORR include (1) surface and buried archeological materials (artifacts) and sites dating to the Prehistoric, Historic, and Ethnohistoric periods; (2) standing structures that are over 50 years of age or are important because they represent a major historical theme or era; (3) cultural and natural places, selected natural resources, and sacred objects with importance for Native Americans; and (4) American folk life traditions and arts. Fig. 2.6 shows general locations of cemeteries, churches, national historic landmarks, and old home structures. Additional information that may be considered sensitive is available in the cultural resource database for planning and evaluation purposes. A resource management plan for the ORR has been prepared (Souza 1997).

2.4.5 Environmental Designations

The ORR has evolved into a biologically rich resource over the last 55 years. When acquired in 1942, aerial photos indicate that about half of the land was cleared. These cleared and cultivated areas have returned to forest through planted seedlings and natural succession with about 75% of the ORR now in mature or maturing native forest. Ecological communities found within the larger framework of mixed hardwood and pine forests on the ORR include cedar barrens, river bluffs, and wetlands. As a result of urbanization, these communities are now absent or uncommon in areas surrounding the reservation.

Over 1100 vascular plant species are found on the ORR (compare this to The Great Smoky Mountains National Park, the most biologically diverse with respect to vascular plants of all the national parks in the contiguous U.S.; they list approximately 1650 species). Twenty-six plants listed by the state as rare (endangered, threatened, or special concern) are found on the ORR (Awl et al. 1996). The population of tall larkspur on the ORR is one of the largest populations known to occur anywhere in the world. The species is listed as “globally rare” by The Nature Conservancy and as “endangered” by the State of Tennessee.

Over 315 wildlife species are known to occur on the ORR. Twenty of the species listed as rare by the state have been verified as occurring on the ORR, with an additional 20 that may be here because the habitat is appropriate (Mitchell et al. 1996). The Tennessee Dace (listed

Fig. 2.6

by the state as in need of management) is found in numerous streams and tributaries on the reservation in contrast to declining or absent populations in streams outside the ORR. Listed rare species occur across the ORR in over 50 different locations which are protected as Research Park Natural Areas. Seven of these special areas are also registered State Natural Areas.

The combination of long-term protection for the land area and the biological richness of the ORR with the available research capability and proximity of diverse scientific expertise has resulted in the following state, regional, national, and international associations:

- DOE National Environmental Research Park
- member of ParkNet (network of seven DOE National Environmental Research Parks)
- National Environmental Research Park Biosphere Reserve
- unit of the Southern Appalachian Biosphere (with Great Smoky Mountains National Park, Coweeta Hydrologic Laboratory, and others)
- member of Southern Appalachian Man and the Biosphere Cooperative [with U.S. Department of Agriculture (USDA), Forest Service, TVA, Economic Development Administration, U.S. Environmental Protection Agency (EPA), U.S. Fish and Wildlife Service, U.S. Geological Survey, National Park Service, U.S. Forest Service, Appalachian Regional Commission, and others]
- Oak Ridge Wildlife Management Area managed by the Tennessee Wildlife Resources Agency (TWRA)
- State Natural Areas (registered)
- ORNL User Facility

2.4.5.1 State Natural Areas

Seven State Natural Areas were registered on the ORR in 1986 through an agreement between DOE and the Tennessee Department of Conservation [now the Tennessee Department of Environment and Conservation (TDEC)]. These areas qualified as State Natural Areas because of rare plant species, animal species, or community types (Fig. 2.7). Additional areas found to have significant biological species are being proposed for State Natural Area registration.

2.4.5.2 Oak Ridge Wildlife Management Area

The ORR is a Tennessee Wildlife Management Area through an agreement between DOE and TWRA. The agreement provides for protection of wildlife habitat and species (including several threatened and endangered species) and restoration of other wildlife habitat and species. Management of the ORR for wildlife is also a type of land use (see Section 2.5.7).

2.4.5.3 Wetlands

The ecological functioning of approximately 580 acres of wetlands on the ORR provides water quality benefits, stormwater control, wildlife habitat, rare species habitat, and landscape and biological diversity (Fig. 2.4).

Fig. 2.7

Wetlands occur across the ORR in low-elevation positions primarily in the riparian zones of headwater streams and their receiving streams, as well as in Clinch River embayments. Most of the wetlands on the ORR are classified as palustrine forested, scrub-shrub, and emergent wetlands (Cowardin et al. 1979). Wetlands identified to date range in size from several square yards at small seeps and springs to approximately 25 acres at White Oak Lake. A high percentage of the wetlands on the ORR are less than one acre in size and occur in headwater areas. Wetlands greater than one acre are typically associated with river embayments, other areas affected by the fluctuating water levels of the Clinch River reservoirs (e.g., Poplar Creek), areas in which water has been artificially impounded (e.g., White Oak Lake), and beaver ponds.

Activities that affect wetlands are regulated under federal law [Section 404 of the Clean Water Act (CWA), Federal Water Pollution Control Act, 33 USC1251] and state law (Tennessee Water Quality Control Act, TN Code Annotated 70-324). Federal and state permits are required to conduct dredge and fill activities in a jurisdictional wetland. Compensatory mitigation is required, under certain circumstances, as a permit condition.

2.4.5.4 Nature Conservancy Biodiversity Ranked Areas

Over 270 occurrences of significant plant and animal species were recognized by The Nature Conservancy in their preliminary report of biodiversity on the ORR as part of Common Ground, the DOE Future Land Use Initiative (The Nature Conservancy 1995).

In addition, using a national ranking system, over 69 preliminary conservation sites were identified with occurrences of rare species and communities and other important features (e.g., caves, springs). These sites generally had clusters of important species or communities, with special emphasis placed on those species and elements designated as globally imperiled, rare, or uncommon in The Nature Conservancy and Natural Heritage Network ranking system. The sites also include the landscape features and ecological processes (i.e., watersheds) believed to be important for sustaining the occurrences of important species and communities. The sites were evaluated and given a biological significance ranking (BSR) based on their conservation significance. Sites on the ORR were rated BSR2 (very high significance), BSR3 (high significance), and BSR4 (moderate significance). The BSR5 category (of general biodiversity interest) was not used in The Nature Conservancy's report, although it notes that "forested land on ORR would fit in this or an above category." The Nature Conservancy areas of biological significance are identified in Fig. 2.8.

2.4.5.5 Nature Conservancy Landscape Complexes

The Nature Conservancy report also recommended protection of three large land areas on which are found many highly ranked conservation sites [i.e., those with rare communities and rare species, hardwood forests greater than 100 acres, and critical watersheds (The Nature Conservancy 1995) (Fig. 2.8)].

Fig. 2.8

2.4.5.6 Research Park Endangered Species Habitats (Natural Areas)

Rare plant and animal species (state and/or federal candidate, and/or listed) are provided protection through preservation of the habitat that is required for their survival. Such critical habitat is established on the best available information about the need of the rare species and is protected through Research Park Natural Area designations. Fig. 2.9 shows the ORR areas designated as habitat for rare species.

2.4.5.7 Research Park Endangered Species Potential Habitats (Reference Areas)

Reference areas serve two functions. They provide protection to habitat with high potential for rare plant or animal species, and they provide protection for common or representative plant or animal communities that can serve as baseline areas for research and monitoring. Many of the areas originally designated as Research Park Reference Areas have been found to contain rare plant or animal species and have been changed to a Research Park Natural Area designation. Fig. 2.9 shows these areas as potential habitat for rare species.

2.4.5.8 Biosphere Reserve

In 1989, the Oak Ridge National Environmental Research Park Biosphere Reserve (Fig. 2.7) was designated. Biosphere reserves are areas of terrestrial and coastal ecosystems which are internationally recognized within the framework of the United Nations Educational, Scientific, and Cultural Organization Man and the Biosphere (MAB) Program. Collectively, they constitute a World Network. Each Biosphere Reserve is intended to fulfill three functions: a conservation function (contributing to the conservation of landscapes, ecosystems, species, and genetic variation); a development function (fostering economic and human development which is socioculturally and ecologically sustainable); and a logistic function (providing support for research, monitoring, education, and information exchange related to local, national, and global issues of conservation and development).

In addition, the Oak Ridge National Environmental Research Park Biosphere Reserve is a unit of the Southern Appalachian Man and the Biosphere Program, which serves as a regional model for MAB and includes the Great Smoky Mountains National Park, Coweeta Hydrologic Laboratory, and others.

2.4.6 Maps - Physical Characteristics and Natural Resources of the Oak Ridge Reservation

Maps included in this document were prepared on MapInfo software using data from the ORNL Shared Data Initiative (SDI). The SDI database is updated as data are available from ORNL projects as well as other ORR projects. Table 2.1 lists maps showing physical characteristics and natural resources on the ORR.

Fig. 2.9

Table 2.1. Physical characteristics and natural resources of the ORR

Fig. no.	Map Type	Main components
	Physical	
2.1		Location of Oak Ridge Reservation
2.2		Topography with slope
2.3		Geology with karst features including sinks, springs, caves, and quarries
2.4		Hydrologic features including water, wetlands, floodplains
	Environmenta	
2.5	l	Research areas and forested areas
2.8		The Nature Conservancy Biodiversity Rankings and Landscape
2.9		Complexes
		Research park confirmed and potential habitats for rare species

2.5 CURRENT LAND USE ON THE OAK RIDGE RESERVATION

2.5.1 National Environmental Research Park

Major DOE Office of Energy Research scientific research programs use the ORR land base to meet mission objectives. In 1980, DOE established the Oak Ridge National Environmental Research Park. Consisting of approximately 22,175 acres, the Research Park serves as an outdoor laboratory for studying the nature of present and future environmental consequences stemming from DOE's scientific mission (Fig. 1.1). It provides a protected land area for research and education in environmental sciences and is used to demonstrate that environmental quality can be compatible with energy technology development. Furthermore, the ORR is one of very few sites in the nation where large-scale ecological research, environmental technology, and measurement science intersect against a backdrop of 30 years of environmental monitoring and research.

The availability of the ORR protected lands and field research sites allows DOE [and its predecessor agencies, the U.S. Atomic Energy Commission (AEC) and the Energy Research and Development Administration] to support major field experiments that could not be done if the lands and associated ecological systems had not been protected and secured for such long-term studies. This research addresses fundamental questions about the effects of energy-related activities on ecological systems and compares such effects to the natural variation of ecological systems.

In addition, the EM program supports a variety of monitoring programs on the ORR to assess the effectiveness of remedial actions for reducing the release and transport of radiological and chemical contaminants from waste disposal sites. In the mid-1980s, long-term ecological monitoring programs were implemented for five ORR watersheds to assess the health and monitor the recovery of streams. Conventional monitoring approaches (laboratory toxicity

tests, biota contaminant analyses, and benthic invertebrate and fish surveys) are combined with innovative, state-of-the-art techniques (biochemical indicators of fish health, biomarkers of genotoxicity, and in situ bioassays with endemic mollusks). Remote sensing information, current and historical aerial photography, and natural resource inventories developed in this program provide broad-scale information needed to characterize ecosystem status and dynamics over time.

The National Environmental Research Park is also an ORNL User Facility with more than 700 users from colleges, universities, industries, ORNL, and other state and federal government agencies over the past 5 years. The National Environmental Research Park also serves as the umbrella for coordinating natural resource management on the entire ORR.

2.5.1.1 Environmental Field Research Areas

Lands of the ORR are used for research to meet the mission goals and objectives of DOE in many substantive ways. The research addresses major national issues and contributes to national and international collaborative initiatives on global climate change, tropospheric air quality, sustainable development, and biodiversity. These uses require protected blocks of land ranging from a few acres to more than 250 acres (Fig. 2.5).

The Oak Ridge National Environmental Research Park contains intensive, long-term ecological research areas, most notably Walker Branch Watershed, which is a gaged, 250-acre deciduous forest catchment with a 30-year record of forest and stream ecosystem experiments and monitoring. This research includes studies of hydrology, atmospheric chemical deposition, forest biogeochemical cycling, plant physiology and community dynamics, and stream ecology and nutrient cycling. Ongoing research includes (1) the Throughfall Displacement Experiment, a large-scale ecosystem manipulation experiment designed to assess the effects of climate-related changes in precipitation on forest growth and productivity, (2) continuous measurements of trace gas fluxes between the forest and the atmosphere, and (3) an experimental study of the rates and pathways of nitrogen cycling in the stream. Walker Branch is also a site in several national research networks, including the National Atmospheric Deposition Program. Several other streams on the ORR have been used for manipulative experiments to investigate the limitation of primary productivity and the ecological effects of ultraviolet-B radiation. In addition, several large lysimeters located west of the Y-12 Plant in Bear Creek Valley are the site of manipulative, ecosystem-level experiments that use Genetically Engineered Microorganisms to investigate contaminant biodegradation in soil.

The thousands of acres of eastern hardwood forests on the ORR also support several large-scale ecological manipulation experiments which have established ORNL's national leadership role in global change impacts research. Diverse, complex, and large-scale experimental approaches are used to understand how forest ecosystems respond to the changes in temperature, precipitation, and atmospheric carbon dioxide (CO_2) concentrations expected from global climate change. For example, the Free-Air CO_2 Enrichment (FACE) Facility in the 0800 Area was completed in 1997 to investigate the response of a forest ecosystem to increased CO_2 concentrations. This unique global change research is providing a growing nucleus for researchers from all over the U.S. to seek opportunities for collaborative research at facilities designed to simulate the effect of increased or decreased

precipitation amount or elevated CO_2 on the long-term development of these forest communities.

Major research areas shown on the map (Fig. 2.5) include the

- Walker Branch Watershed
- Free-Air CO_2 Enrichment Facility
- Global Change Field Research Facility
- Bear Creek Valley Hydrology Field Sites
- Melton Branch Watershed Field Sites
- National Oceanic and Atmospheric Administration Field Research Facility

Additional information on environmental research is found in *Environmental Sciences: Research, Assessment, and Technology to Understand and Meet the Challenges of the Future* (Environmental Sciences Division 1998).

In addition to DOE, past and present sponsors of research on the site include the National Science Foundation, the Department of Defense, the EPA, the USDA, the Forest Service, the Nuclear Regulatory Commission, and the Electric Power Research Institute. Ongoing research collaborations also exist with the National Oceanic and Atmospheric Administration and TVA.

2.5.2 Safety

To ensure employee and guest safety, buffer areas around training facilities and other hazard areas are identified with highly visible signage. Employees and guests are expected to comply with signage and are encouraged to report unsafe conditions observed in the field.

2.5.2.1 Training Facilities with Surface Danger Zones

Two contiguous major firing ranges are located within the ORNL area of responsibility: the Southeastern Couriers Transportation and Safeguards Training Facility (operated by DOE Albuquerque) and the Central Training Facility (CTF) operated by LMES (Fig. 2.10). The ranges and their surface danger zones or buffer areas encompass about 2500 acres. Public entry into these areas is prohibited and strictly controlled. The two range areas, which are located on the south side of Bear Creek Road about 5 miles west of the Y-12 Plant, extend from the DOE ORR boundary on the west to Highway 95 on the east and from Bear Creek Road on the north to the Clinch River on the south. The eastern portion of the site is operated by DOE's Transportation Safeguards Division Southeastern Courier Section and consists of four individual live-fire ranges and associated support facilities. The western portion of the range site is operated for DOE by the Lockheed Martin Safeguards and Security Protective Forces Training and Development Division as a CTF and consists of an indoor range, five outdoor ranges, a shooting tower, three live-fire facilities, a tear gas training facility, and assorted tactical facilities. Fire is directed to the south and southeast into an approximately 200-ft-high ridge. Safety analyses for the firing range activities were based on the absence

Fig. 2.10

of a permanent population in the downrange areas. Any change in land use in the vicinity of the firing ranges would entail a change in the safety analyses.

2.5.2.2 Emergency Planning Zones

Federal statutes [40 *Code of Federal Regulations* (*CFR*) parts 301, 302, 304, and 355] require each state, tribal, or local government to protect its citizens from releases of hazardous materials. Emergency planning zones for the ORR were developed by examination of the broad range of hazards presented by ongoing operations and activities. For ORNL, consequences of potential release scenarios were examined during the process of preliminary hazard screening of each individual facility. The ORNL Emergency Planning Zone was set at 5 miles in accordance with the DOE *Emergency Management Guide* (DOE 1997).

Two-mile and 5-mile emergency planning zones are defined around ORNL, ETTP, and the Y-12 Plant (*Oak Ridge Reservation Emergency Plan* 1998). These zones are subdivided into emergency planning sectors, with each sector defined by easily recognizable terrain features. A hazard assessment supports the designation of emergency planning zones in which special planning is required to ensure that prompt and effective protective actions can be taken to minimize the risk to on-site personnel, the general public, and the environment in the event of an emergency.

2.5.3 Compliance and Monitoring

Operations at all facilities on the ORR must comply with environmental requirements established by federal and state statutes and regulations, executive orders, some DOE orders, and legal compliance and settlement agreements. The TDEC and EPA are principal among the regulatory agencies that issue permits, inspect operations, and oversee environmental compliance on the ORR. Changes in land use have the potential for impacting not only widespread ongoing compliance activities, but also operations at the EPA- and TDEC-regulated facilities. The facilities were intentionally located away from population centers with unpopulated land area between the facilities and local residents. Changes in the unpopulated land area could alter dose calculations required for meeting radiological requirements, such as those in the Clean Air Act National Emission Standards for Hazardous Air Pollutants (NESHAP) [40 *CFR* 61, Subpart H], and thereby impact facility operations. An annual summary, prepared for the ORR environmental activities (Hamilton et al. 1996), can be found internally on the World Wide Web at http://www.ornl.gov/Env_Rpt/aser96/ aser.htm. Fig. 2.11 shows environmental compliance and monitoring locations on the reservation.

2.5.3.1 Environmental Monitoring

Environmental monitoring on the ORR consists of two major activities: effluent monitoring and environmental surveillance. Effluent monitoring consists of the collection and analysis of liquid, gaseous, or airborne effluents at their sources. Environmental surveillance consists of the collection and analysis of samples of air, surface water, groundwater, soil, foodstuffs, biota, and other environmental media downstream from the effluent sources. Data from the

Fig. 2.11

analyses are used to assess chemical and radiation exposures to members of the public and to demonstrate compliance with environmental permits and regulations.

2.5.3.2 Air Monitoring

The ORR has approximately 600 sources of potential airborne contaminants covered by 72 air emission permits. Each source is permitted in accordance with regulations developed and enforced by TDEC. Point sources that emit radionuclides are regulated through EPA's NESHAP program, and the ORR has approximately 70 of these sources with potential doses greater than 0.1 mrem/year (DOE 1995). NESHAP requires the use of dispersion modelling to calculate population exposures. Dispersion modelling requires local meteorological data.

Meteorological conditions on the ORR are provided by seven widely spaced meteorological towers. The data are used in dispersion modelling to predict impacts of facility operations. In addition, these data are essential as input to emergency response atmospheric models used in the event of accidental releases from a facility. The towers range from 100 to 330 ft in height, and data are collected at 16 intermediate levels to determine the vertical structure of the atmosphere and the possible effects of vertical variations on releases from the facilities.

In addition to monitoring the sources of effluent release (e.g., stacks), ambient air is monitored at various locations on the ORR to determine whether effluents from the facilities are increasing levels of radiation or air contaminants. The ambient air monitoring program, which assesses the impact to air quality of operations on the entire ORR, includes operation of a network of perimeter air monitoring stations. These stations incorporate gamma radiation detectors as well as instrumentation for quantifying alpha-, beta-, and gamma-emitting radionuclides, tritium, beryllium, and total radioactive strontium. Ambient air also is monitored for uranium particulate, mercury, total suspended particulate, particulate matter less than 10 microns in size, lead, hazardous air pollutant carcinogen metals (arsenic, beryllium, cadmium, and chromium), and organic compounds (polychlorinated biphenyls, Furan, Dioxin, and hexachlorobenzene) associated with operation of the Toxic Substances Control Act incinerator.

2.5.3.3 Surface Water Monitoring

The ORR surface water environmental surveillance program was revised recently in anticipation of the new federal regulation 10 *CFR* 834, which codifies radiological surveillance program requirements. However, the primary statute governing the monitoring of effluent discharges to surface waters on the ORR is the CWA, which requires the issuance of National Pollutant Discharge Elimination System (NPDES) permits. The ORNL NPDES Permit lists 161 point-source discharges that require compliance monitoring, the Y-12 permit lists 100 sources, and the K-25 permit lists about 150, for a total of approximately 400 CWA discharge points for the ORR.

To assess the impact of ongoing, as well as past, discharges to receiving streams, surface water samples are collected from 22 stream locations on and around the ORR. Water quality measurements serve as guides to the health of the environment, and measurements therefore include sampling of reference streams upstream of operations on the ORR. Reference data

are used to establish the baseline against which the health of ORR streams is assessed for regulatory purposes. These reference streams, which are located in undeveloped portions of the ORR, have been sampled for years and provide a long-term baseline against which current data can be evaluated. The sites were carefully selected, have been approved by the regulatory agencies, and must remain undisturbed for the indefinite future.

2.5.3.4 Groundwater Monitoring

Two geological units on the ORR, the Knox group and the Maynardville limestone of the Conasauga group, both consisting of dolostone and limestone, constitute the Knox aquifer. A combination of fractures and solution conduits in this aquifer control groundwater flow over substantial areas, and relatively large quantities of water may move relatively long distances. Active groundwater flow can occur at substantial depths in the Knox aquifer (300 to 400 ft), which is the primary source of groundwater to many streams (base flow) and most large springs on the ORR. Yields of some wells penetrating larger solution conduits exceed 1000 gal/min.

The direction of groundwater flow through an aquifer system is determined by the permeability of the strata containing the aquifer and by the hydraulic gradient, which is a measure of the hydraulic head over a specified distance. This difference in head constitutes the driving force for groundwater movement, whereas aquitards, which are geological units of lower permeability that deflect groundwater movement, constrain groundwater movement on the ORR, usually in a horizontal direction. The typical yield of a well in the aquitards is less than 1 gal/min. Potential groundwater exit pathways are shown to follow the path of the permeable strata.

Since contamination follows groundwater movement, information regarding the direction and rates of groundwater flow is needed for assessing the potential for contamination exposure. However, the geohydrology of the ORR is sufficiently complex that contaminant transport is difficult to predict on a local scale. For example, the leading edge of a contaminant mass such as tritium may migrate along fractures at a typical rate of 3 ft/d, whereas the center of mass of the contaminant plume migrates at less than 0.2 ft/d. Also, the center of mass of the volatile organic compound (VOC) plume east of the Y-12 Plant lies at a depth of 300 ft, and transport takes place at this depth because VOCs are denser than water. Because of the geohydrologic complexity of the ORR and the many different regulations governing groundwater monitoring requirements [e.g., the Resource Conservation and Recovery Act, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), TDEC Solid Waste Management regulations, DOE Order 5400.1 to be incorporated into 10 *CFR* 834, and regulatory requirements for groundwater monitoring for petroleum underground storage tanks, an integrated groundwater monitoring program has been established.

To fully comply with regulatory requirements, to delineate and predict the extent of groundwater contamination on the ORR, and to protect the public and the environment, a groundwater surveillance monitoring program is in effect. The program includes several hundred groundwater monitoring wells on the ORR. Although most wells are located at the

facility sites, where contamination is greatest, the areas on the ORR containing groundwater monitoring wells are essential for providing regulatory compliance data and supporting monitoring program objectives.

2.5.3.5 Terrestrial Vegetation Monitoring

Contaminants released from facilities on the ORR can accumulate in food crops and in terrestrial animals that feed on vegetation on the ORR. Because the primary exposure pathway for contaminants in humans is the ingestion of crops, meat (e.g., deer, geese, and wild turkey), and milk, both hay and food crops grown on the ORR are collected and analyzed to evaluate potential radiation doses.

Rights to cut hay on the ORR are leased. Cut hay is sold to area farmers for fodder. Six areas from which hay is cut have been identified as potential depositional areas for airborne materials from ORR sources, and hay is collected from each of these sites and analyzed for gross alpha and beta radiation, gamma emitters, iodine, and fluorides.

Vegetables, such as tomatoes, lettuce, and turnips, are grown on nine soil plots located at the ORR ambient air monitoring stations. Samples are harvested from each plot and analyzed for gross alpha and beta radiation, gamma emitters, and uranium. The results are compared to crops grown at a reference site outside the ORR.

Because radionuclides can be transferred to humans from the environment through the food chain (e.g., grass to cow to milk to human), milk is considered a significant potential exposure source. Even small amounts of radionuclides deposited from airborne emissions can be significant because of the large surface area that can be grazed by a cow, the rapid transfer of milk from producer to consumer, and the importance of milk in the human diet. Milk is collected monthly at five locations from local producers and analyzed for radioactive iodine, radioactive strontium, and tritium.

2.5.3.6 The Biological Monitoring and Abatement Program

Biological monitoring has been conducted for streams on the ORR for approximately 10 years. The Biological Monitoring and Abatement Programs (BMAPs) at the three facilities on the ORR were developed to meet NPDES Permit requirements and include tasks on (1) toxicity monitoring; (2) bioaccumulation in aquatic and terrestrial biota; (3) bioindicators of fish health; and (4) fish, macroinvertebrate, and periphyton community surveys. Additional BMAP tasks are required by NPDES permits on a facility-specific basis. Each of these tasks utilizes water or fauna from streams near the ETTP (Mitchell Branch, and Poplar Creek), ORNL (White Oak Creek and its tributaries), and the Y-12 Plant (Bear Creek, McCoy Branch, East Fork Poplar Creek). In addition, reference streams used for comparison with contaminated sites include Scarboro Creek, Ish Creek, Pinhook Branch, and Mill Branch (Hinzman 1995; Hinzman 1996; Loar 1994).

2.5.4 Contaminated Areas

Since 1942, the three plants on the ORR have had significantly different operations and missions, but all have generated contaminated waste that was disposed of on-site in shallow land burial trenches. Early waste disposal practices have resulted in contaminated streams, groundwater, and soil on the reservation. Spills and piping leaks have contributed to environmental contamination. Most of the contamination occurs within the developed and fenced areas of the Y-12 Plant, ETTP, and ORNL (Fig. 2.12). During the period from 1955 to 1963, ORNL was designated by the AEC as the Southern Regional Burial Ground and received a wide variety of poorly characterized waste from approximately 50 different sources. These wastes were included in the shallow land burial sites in use by ORNL.

Remediation of the contaminated areas at ORNL is conducted under CERCLA. A Federal Facilities Agreement was signed by DOE, EPA, and the State of Tennessee to coordinate environmental remediation activities on the ORR. Cleanup goals for the contaminated areas are negotiated through the CERCLA process and are documented in a Record of Decision. A variety of issues must be addressed as cleanup goals are developed: anticipated future land use, availability of water treatment and disposal facilities, policy decisions on length of institutional control and where waste is to be managed, and risk to human and ecological receptors. Although cleanup goals have not been finalized, it is anticipated that some of the contaminated areas will be remediated in place.

Stakeholder input to future uses of the contaminated lands on the ORR is being developed by the End Use Working Group, a citizens' group sponsored by the ORR EM Site-Specific Advisory Board. Technical data are provided by DOE's EM program. After review and evaluation of the data, land use recommendations ranging from restricted/government ownership to unrestricted/private owners are submitted to DOE to help guide its decisions on the levels of remediation required to meet the desired end uses for the contaminated areas on the ORR. Stakeholders are also developing overall strategies for the use of groundwater and surface water and stewardship/institutional control in relation to the recommended end uses.

2.5.5 Land Application of Biosolids

The City of Oak Ridge has been applying sanitary sewage sludge to approved sites on the ORR since 1983 under agreements with DOE and the State of Tennessee. It is the policy of the federal government that DOE consider beneficial use of municipal sewage sludge for fertilizer, soil conditioner, or other uses, when such use enhances resources on federal lands and is cost effective (EPA, *Federal Register* July 91-30448). Locations are shown in Fig. 2.7.

2.5.6 Utilities (Gas, Fiber Optics, Communication Lines, Power)

Since all major utilities cross the ORR, a number of companies have easements. Details are not provided in this plan as they are described fully in the *Oak Ridge Reservation Management Plan*, February 1997. Section 3.3 of the plan, "Access Control," identifies companies with utility easements. Part of Section 3.4, "Surveillance and Maintenance," lists

Fig. 2.12

companies and organizations with operating and maintenance responsibilities. Appendix E: "ORR Research Focus" explains in detail the activities of various governmental entities and companies, some of which involve utilities. Map data for utilities are included in Fig. 2.13.

2.5.7 Oak Ridge Wildlife Management Area

Management of wildlife on an area as large as the ORR is necessary to ensure public safety and maximize wildlife health and diversity. Most of the ORR is within the Oak Ridge Wildlife Management Area. Wildlife management is carried out by TWRA in cooperation with ORNL's Environmental Sciences Division under agreements between TWRA and DOE and between DOE and Lockheed Martin Energy Research Corporation. Management includes wildlife population control through hunting, trapping, and removal; wildlife damage control; restoration of wildlife species; preservation, management, and enhancement of wildlife habitats; coordination of wildlife studies; and law enforcement. Wildlife resources are divided into management categories, each with a specific set of objectives and procedures for achieving them. These resource management categories are (1) wildlife habitats/species-richness, to ensure that all resident wildlife species exist on the ORR in viable numbers; (2) featured species, to produce selected species in desired numbers on designated land units; (3) game species, for research, education, recreation, and public safety; (4) sensitive species needing inventory, preservation, and protection of both the species and their habitats; and (5) wildlife pest problems.

2.5.8 Public Opportunities

While the reservation is not open to the public, opportunities for use of the ORR for recreation and educational activities exist (Fig. 2.6).

2.5.8.1 Gallaher Bend Greenway

This 2-mile experimental public greenway in the Oak Ridge National Environmental Research Park was opened in December 1997. It is a cooperative effort among DOE, the City of Oak Ridge, Greenways Oak Ridge, ORNL, and LMES.

2.5.8.2 Tennessee Wildlife Resources Agency Wildlife Management Area

Wildlife on the ORR is managed by TWRA under a license agreement with the DOE Oak Ridge Operations Office (ORO). This management includes annual public managed quota deer and turkey hunts (special permits are required). Public deer hunts were initiated to reduce the rapidly growing deer population and as a safety measure to address the increasing number of deer/vehicle collisions. Each deer taken during hunts is monitored for radiation contamination. Since hunts began in 1985, 2.3% of the 6349 deer taken (through 1996) have been retained due to radiological contamination. Hunt maps are available on the World Wide Web at http://www.ornl.gov/rmal/ deermaps.htm. Additionally, TWRA has led public bird walks during the spring and coordinated bird counts for input to the Partners In Flight interagency program.

Fig. 2.13

2.5.8.3 New Bethel Church Interpretive Center

New Bethel Baptist Church is one of the few remaining original structures of pre-Manhattan Project days. This facility is open to the public, and its interpretive center contains displays and artifacts relating to the building's use before and after government occupancy.

2.5.8.4 Walks/Tours

ORNL sponsors annual activities on the ORR (e.g., bird walks, wild flower hikes, and trips to field research sites) that are open for public participation. These are advertised in local media. In addition, ORNL participates in Community Days, which offer the public an opportunity to visit Laboratory facilities.

2.5.8.5 Ecological and Physical Sciences Study Center

This educational program offers hands-on experiences in outdoor environmental and physical sciences for kindergarten through high school students, as well as programs to familiarize teachers with new concepts. The programs are primarily centered at historic Freels Cabin and require preregistration through the ORNL Office of University and Science Education.

2.5.8.6 ORNL Graphite Reactor

A registered National Historic Landmark, the Graphite Reactor's primary wartime mission was to produce the first gram quantities of plutonium for experiments at the University of Chicago. Afterwards, it was dedicated to the peace-time development of atomic energy and operated until 1963. It is open to the public daily.

2.5.8.7 Other Public Facilities and Educational Programs

Facilities on the reservation operated by others and open to the public include the Clark Center Recreation Area, George Jones Memorial Church near ETTP, the ETTP Visitors Overlook, and the Y-12 Visitors Center. More than 700 undergraduate, graduate, postdoctoral students, faculty, and other guests utilized the National Environmental Research Park user facility as an outdoor laboratory over the past 5 years. Researchers work with ORNL scientists through various DOE, ORAU, and ORNL educational programs.

2.5.9 Facilities

A number of ORNL facilities, as well as facilities managed by ETTP, Y-12, and others, are located outside the ORNL developed area. ORNL facilities are identified in the “ORNL Integrated Facilities Plan” in Section 3 of this land use plan.

2.5.10 Other

Some land uses within the National Environmental Research Park are the responsibility of others as designated by DOE-ORO. These uses are identified in the *Oak Ridge Reservation Management Plan* (1997) and the *ORR Comprehensive Integrated Plan* (May 1998).

2.5.11 Maps - Current Land Use on the Oak Ridge Reservation

Maps included in this document were prepared on MapInfo software using data from the ORNL SDI. The SDI database is updated as data are available from ORNL projects as well as other ORR projects. Table 2.2 is a list of maps pertaining to current ORNL land usage.

Table 2.2. Current land use on the ORR

Fig. no.	Maps	Main components
2.5	Research areas and forested areas	National Environmental Research Park Forested areas Field research areas
2.6	Public educational and recreational opportunities	Ecological and Physical Sciences Study Center New Bethel Church Interpretive Center ORNL Graphite Reactor Gallaher Bend Greenway TWRA Wildlife Management Area Cemeteries, historic districts, churches, and home-sites
2.7	Partnership areas	Sludge landfarming sites State Natural Areas TWRA Wildlife Management Area Oak Ridge Biosphere Reserve Gallaher Bend Greenway Wetland Mitigation Areas
2.10	Safety	Emergency planning zones Surface danger zones
2.11	Compliance and monitoring	Hay fields Air and other monitoring sites Groundwater wells Surface water monitoring BMAP sites
2.12	Contaminated areas	Contaminated areas Watershed projects
2.13	Reservation infrastructure	Facilities Main roads Utilities (gas, fiber optics, communication lines, power)

2.6 FUTURE LAND USE ON THE OAK RIDGE RESERVATION

The Secretary of Energy's Land and Facility Use Management Policy states that DOE will exercise stewardship over its assets based on ecosystem management principles. Management of the ORR as a viable and healthy ecosystem provides the foundation required for

environmental research and for pursuing future scientific initiatives. Planning for future land use requires management of the ORR as an ecosystem unit. Ecosystem management is not a land use objective in itself. It is, however, a method for achieving the land use objectives. Additionally, it provides a mechanism for preservation of the land area needed to pursue future scientific research opportunities such as neutron science. Future land uses will, in most cases, expand and build on current land uses, not replace them.

2.6.1 Ecosystem Research

Ecosystem management has been defined as the ". . . integration of ecological, economic, and social principles to manage biological and physical systems in a manner that safeguards the ecological sustainability, natural diversity, and productivity of the landscape." Ecosystem management must be based on an understanding of the factors governing the limits on ecosystem sustainability and the controls on ecosystem response to environmental change. Such an understanding requires comprehensive, multidisciplinary research on a variety of ecosystems under different levels of human influence. Research approaches that combine ecosystem monitoring and experimental studies are most valuable for developing a mechanistic understanding of ecosystem sustainability and factors controlling ecosystem change.

It is within this context of ecosystem management that the ORR provides a combination of complex geology and hydrology; ecological diversity; fundamental ecosystem process research, modelling, and long-term data records; a historical record of land use change; and dynamic pressures on its ecosystems resulting from its suburban/industrial setting. Future research will effectively capitalize on the wealth of historical and ongoing ecological research and monitoring on the ORR to address the fundamental sciences underlying the structure and function of ecosystems, response of ecosystems to stress, and sustainability of ecosystems.

The focus of future experimental research and monitoring activities is identified in greater detail in Appendix E.

2.6.2 Identified New Future Land Uses

Maps for future land use reflect identified new future needs; current land uses do not preclude different future uses. Land planning, however, will need to incorporate current land use with identified new future land uses.

New future land uses include

- research facilities
- environmental research areas
- environmental partnership areas
- waste management facilities
- future initiatives
- transportation improvements
- education and recreation
- land transfers/lease areas

2.6.2.1 Research Facilities

Proposed locations of future research facilities are shown in Fig. 2.14 and are described in the following sections.

2.6.2.1.1 Spallation Neutron Source

The Spallation Neutron Source (SNS) proposed for the ORR will require approximately 110 acres to provide for a new linear accelerator facility. Within the site, support laboratories and maintenance and operations shops, a central integrated control facility, and an administration building for operations personnel will be provided. A 350,000-gal fire water reservoir, an electric service switchyard, and a stormwater retention pond will be required on site to serve the facility. The entire complex will be protected within a "property protection" fence. Five sites on the ORR were proposed for the SNS, with the preferred site identified as Chestnut Ridge. An Environmental Impact Statement for sites proposed nationwide for the SNS is in preparation.

2.6.2.1.2 Joint Institute for Neutron Sciences

The Joint Institute for Neutron Sciences is a proposed joint venture with The University of Tennessee, the State of Tennessee, and DOE for a user facility which will serve both the existing High Flux Isotope Reactor (HFIR) and the proposed new SNS. This project is funded by the state. A facility of approximately 25,000 ft^2 is proposed to house offices and check-in (badging) facilities, short-term accommodations for visiting scientists, seminar rooms and a 200-seat auditorium for conferences, and a reception hall and catering kitchen for reception and open hours events. A small satellite facility at the HFIR (and eventually at the SNS) will provide work rooms and laboratories adjacent to the instrument areas. A location along Bethel Valley Road, on the north side just east of Chestnut Ridge Road, has been proposed for the main building.

2.6.2.1.3 Laboratory for Comparative and Functional Genomics

The Laboratory for Comparative and Functional Genomics is a proposed facility that will house about 100,000 mice in support of ORNL's expertise in mouse genetics mutagenesis. A location at the west end of the ORNL site has been identified, which will allow availability of this facility to researchers and guests without the concern of restricted access. The laboratory will be adjacent to Life Sciences Division Building 1062 and convenient to the Environmental Sciences Division for cooperative research collaborations.

2.6.2.1.4 Oak Ridge Institute for Science and Education

While existing land is adequate for the Oak Ridge Institute for Science and Education (ORISE) to support its current DOE mission, future growth or development will require additional land. ORISE identified the Solway Bend area as the only area available for their future development or growth [*ORISE Site Development Plan, ORR Comprehensive Integrated Plan* (May 1998)].

Fig. 2.14

2.6.2.1.5 Oak Ridge National Laboratory Expansion

The Bethel Valley areas east and west of the central ORNL site are identified for future research and development (R&D) use to include support and service facilities. The total proposed land use is approximately 700 acres. The proposed site would be bordered on the west by Highway 95 and on the northeast by the Walker Branch Watershed.

2.6.2.1.6 Engineering Technology Complex

The Engineering Technology Complex is a proposed grouping of five buildings located on the Ramsey Drive site (bordering Melton Hill Lake). These facilities will consolidate much of the work of the Engineering Technology Division now performed in several separate facilities on the Y-12 Site.

2.6.2.1.7 Fusion Materials Irradiation Facility

The Fusion Materials Irradiation Facility is a proposed facility which will be used to address the technological problems associated with the development of fusion reactor materials. It will house a linear accelerator, a supply system for lithium targets, and an experimental complex for irradiating and handling test specimen assemblies.

2.6.2.1.8 National Isotope Separator On-Line Facility

A facility to produce accelerated beams of radioactive isotopes was identified in the Long-Range Plan for U.S. Nuclear Science, prepared by the DOE/National Science Foundation Nuclear Science Advisory Committee, as the next major facility to be constructed for U.S. nuclear science. ORNL has unique resources for the construction and operation of a National Isotope Separator On-Line (ISOL) Facility, for which the Holifield Radioactive Ion Beam Facility can be considered a prototype. ORNL staff are working to finalize the concept of the National ISOL Facility and plan to submit a proposal for its construction to DOE in the autumn of 1998 (Fig. 3.23).

2.6.2.1.9 Research and Development Facilities

Space for future Melton Valley R&D Facilities has been identified bordering Melton Hill Lake (known as the Ramsey Drive Site). Approximately 39 acres of land adjoining the proposed Fusion Materials Irradiation Facility have been identified for future use. No specific facility designations have been identified for the site.

2.6.2.2 Environmental Field Research Areas

Large-Scale Environmental Process Research is an ORNL initiative (*ORNL Institutional Plan* 1998). This initiative will use the 22,175-acre National Environmental Research Park and build on natural ecosystem large-scale studies. Several areas, shown in Fig. 2.14, have been identified as important in pursuing new future ecosystem or environmental research in

addition to current research areas that will continue to be used. New field research areas include

Bull Bluff Watersheds: An area of small, paired watersheds which is suitable for watershed manipulation experiments where small catchments of 2.5 to 10 acres in size would be desirable.

Copper Ridge Research Area: A large block of mixed hardwood forest that has been less disturbed than most on the reservation. It includes the cesium forest, which was tagged in the 1960s and has potential value for reinvestigation of forest nutrient dynamics by allowing researchers to go into the system after 30 years of nutrient cycling.

Freels Bend Research Area: The largest pasture area available for agricultural research. Research in agriculture is actively developing in response to the Memorandum of Understanding between DOE and the USDA for cooperative agricultural research.

Raccoon Creek Research Area: Forests of hardwoods, planted pine, and open areas in various stages of succession. This could complement the adjacent Global Change Research Facility, which includes large-scale, long-term field manipulation experiments.

White Wing Research Area: This cove hardwood forest south of Oak Ridge Turnpike and east of White Wing scrapyard is one of the largest blocks of old-growth cove hardwoods on the reservation, and as such, represents a key reference point for future studies of biodiversity, global change, and fundamental ecological process research requiring old-growth eastern hardwood forest.

Pine Ridge Experimental Catchments: This area includes relatively undisturbed forested catchments drained from first-order streams, a combination of characteristics not commonly found on the ORR. They offer exceptionally good sites for future watershed research. The sites offer potential for expanding the Walker Branch Watershed research to include contrasting geology because the area is in different geological strata from the Walker Branch Watershed. Types of research planned include forest ecology, stream ecology, catchment hydrology, and biogeochemistry.

Current initiatives will continue to play a major role in the Large-Scale Environmental Process Research. These include

Bear Creek Valley Hydrology Field Site: These instrumented and characterized sites are currently and will continue to be important in the study of novel tracers and monitoring techniques in heterogeneous, fractured, porous media at depths up to several hundred feet.

Global Change Field Research Facility: Open-topped chambers at this facility allow researchers to examine the effects of elevated levels of atmospheric CO_2, temperature, and tropospheric ozone on vegetation.

Melton Branch Watershed: This watershed is an intensively instrumented and well characterized site. It is designed for conducting multiscale saturated and unsaturated tracer injection experiments in fractured heterogeneous, subsurface media. A proposed site of the DOE Natural and Accelerated Bioremediation Field Research Center is also located in Melton Valley between Waste Area Grouping 7 and the floodplain of Melton Branch.

Walker Branch Watershed: Represents one of the premier forested research sites of its kind in the world. Large-scale field manipulation experiments are underway with long-term experiments ongoing or planned on the site. This user facility is the core of ORNL ecological research.

2.6.2.3 Environmental Partnership Areas

"Environmental Partnership Areas" are sites of special environmental significance or sites with great potential for restoration and/or mitigation where state, federal, and educational agencies are working together or can work together to solve environmental problems. Some of these areas are shown in Fig. 2.7.

2.6.2.3.1 State Natural Areas

Additional areas on the reservation have the potential to qualify as State Natural Areas. Seven sites on the ORR were registered as State Natural Areas in 1986 in an agreement between DOE and the Tennessee Department of Conservation (now TDEC). Additional threatened and endangered species data have been collected since 1986 (Awl et al. 1996; The Nature Conservancy 1995).

To register a State Natural Area, the site must meet TDEC qualifying criteria as determined by a natural heritage evaluation and review by the State Natural Areas Advisory Committee. Registration of a State Natural Area is by a written, nonbinding registry agreement signed by the landowner and the Commissioner. Protection of the natural area is a voluntary, nonbinding conservation tool which relies on the landowner's sense of pride and stewardship; the designation can be removed if DOE decides on an alternative land use and the designation is no longer appropriate.

2.6.2.3.2 Wetland Mitigation Areas

Approximately 586 acres in wetlands have been identified on the ORR. Some of these wetlands, including one of the single largest wetlands areas, are in areas in which new program construction and waste management or remedial actions may occur, resulting in direct wetland impacts. Before any activities occur that will directly impact wetlands, it is necessary to obtain federal and/or state permits, or to fulfill the substantive requirements of the law in those cases where permits are waived (e.g., CERCLA actions). Individual permits issued by the federal and state governments will, in most cases, require compensatory mitigation as a permit condition.

Three potential sites for a mitigation bank on the ORR have been identified. These sites are located in and around two lake embayments at Freels Bend and Bull Bluff and a forested area and upper portion of a lake embayment in the lower Bearden Creek watershed. These sites may provide 10, 11, and 27 acres, respectively, of area suitable for wetland creation. These sites were initially selected based on their water source and potential water input, watershed size, and the presence, in two of the areas, of an existing structure that may be modified to control water levels. Whether or not any of these sites are physically suitable for wetland creation will have to be determined by basic hydrologic analyses and other site investigations.

Mitigation, in the wetland regulatory context, is a sequential process consisting of (1) avoidance of wetland impacts, (2) minimization of wetland impacts, and (3) if impacts are unavoidable, compensatory mitigation. Compensatory mitigation includes wetland restoration and wetland creation.

One approach to compensatory mitigation is mitigation banking. Mitigation banking is undertaken expressly to compensate for unavoidable wetland losses in advance of development actions [USACE et al., *Federal Register* 60(228)]. Among the advantages of mitigation banking are (1) a greater potential for a successful mitigation project that effectively replaces wetland functions; (2) a reduction in permit processing times; and (3) economies of scale relating to the planning, implementation, monitoring, and management of mitigation projects.

The U.S. Army Corps of Engineers (USACE), the EPA, the U.S. Fish and Wildlife Service (USFWS), the Natural Resources Conservation Service (NRCS), and the National Marine Fisheries Service issued final policy guidance regarding the establishment, use, and operation of mitigation banks (*Federal Register*: November 28, 1995, Vol. 60, No. 228). The establishment of a mitigation bank on the ORR would require the involvement of several federal and state agencies, including the USACE, EPA, USFWS, NRCS, as well as the TDEC, TWRA, and TVA.

2.6.2.3.3 Wildlife Habitat Restoration

The TWRA has initiated a cooperative effort with TVA and Quail Unlimited to improve the wildlife habitat under TVA electrical distribution lines on the ORR by restoring native, warm season grasses. A 100-acre demonstration plot will be established in 1998 with plans to convert additional acreage annually until all appropriate areas are restored to native grasses. Habitat improvement will enhance both resident wildlife and migratory birds, soil erosion control, and lower power line right-of-way maintenance needs. The habitat improvement will benefit quail, turkey, ground nesting birds, rabbits, songbirds, snakes, mammalian predators, and other mammals. Some neotropical migratory birds are especially in need of this native grass habitat. Additionally, TWRA has plans to continue restoration of wildlife species and habitats such as Freels Bend.

2.6.2.4 Waste Management Facilities

Reservation land also is needed for the following EM waste management facilities (Fig. 2.14), which are in various stages of planning:

- EM Waste Management Facility (with proposed sites at West Bear Creek, East Bear Creek, and White Wing) (Fig. 2.14)
- Transuranic Waste Packaging Facility

2.6.2.5 Future Initiatives

Land for future initiatives does not have specific projects associated with it. Diverse physical characteristics and the evaluation of proposed sites for past projects are factors used to identify suitability of such lands for future initiatives. Some of the general land areas identified for future needs are shown in Fig. 3.25.

2.6.2.6 Transportation Improvements

The following projects on the ORR have been identified as proposed by the Tennessee Department of Transportation:

- I-75/40 connector
- Highway 58 widening
- Bethel Valley/Illinois Avenue interchange

2.6.2.7 Education and Recreation

The North Boundary Road Greenway is an area under consideration as a public greenway. The decision will be based on the success of the recently designated Gallaher Bend Greenway.

2.6.2.8 Land Transfers/Lease Areas

Areas identified by DOE that have recently or will soon be leased or released are shown in Fig. 2.14. They include the following:

Public Areas: DOE has leased an 8.5-acre parcel of federal land near Wisconsin Avenue in Oak Ridge to the City of Oak Ridge for a park.

Industrial Development: Areas that have been leased or may be leased/transferred for industrial development have been identified. These do not include facilities within the ETTP developed area. Pending actions include

- Parcel ED-1 (leased April 1998 to the Community Reuse Organization of East Tennessee for industrial development)
- 100 acres of Parcel 8
- Tower Shielding Facility

Mobile Service Antenna Sites: Three locations were identified as appropriate for

commercial service antennas if so requested. These commercial antennas would be attached to existing structures, when possible. BellSouth has erected a tower in the ETTP area. SprintCom has requested use of the Chestnut Ridge site.

2.6.3 Maps - Future Land Use on the Oak Ridge Reservation

Maps included in this document were prepared on MapInfo software using data from the ORNL SDI. The SDI database was updated with data from ORNL, LMES, and other subcontractors, as available. Table 2.3 lists the categories contained on the future land use map.

Table 2.3. ORNL future land use map

Fig. no.	Category	Main components
2.14	Research facilities	Spallation Neutron Source (preferred site) Spallation Neutron Source (alternate sites) Joint Institute of Neutron Sciences Oak Ridge National Laboratory Expansion Engineering Technology Complex Fusion Materials Irradiation Facility Laboratory for Comparative and Functional Genomics
	New environmental research areas	Copper Ridge Research Area White Wing Research Area Raccoon Creek Research Area Bull Bluff Watersheds Freels Bend Research Area Pine Ridge Experimental Catchments
	Environmental partnership areas	Freels Bend Wetland Mitigation Area Bull Bluff Wetland Mitigation Area Bearden Creek Wetland Mitigation Area
	Waste management	EM Waste Management Facility (preferred and proposed locations) Transuranic Waste Packaging Facility
	Transportation improvements	I-75/40 connector Highway 58 widening Bethel Valley/Illinois Ave interchange
	Land transfers/lease areas	Parcel ED-1 Mobile service antenna sites Tower Shielding Facility

2.7 STAKEHOLDER INPUT

2.7.1 Stakeholder Definition

Recognizing that ORNL, ETTP, and the Y-12 Plant have differing missions and diverse stakeholders, DOE requested that each site establish and implement a tailored stakeholder involvement plan.

ORNL stakeholders include those who use the land for DOE mission activities, those who fund activities on the ORR, those with state or federal regulatory interest, neighbors who may be impacted by land use decisions, and those with a perspective on regional/national/ international impacts of ORR land use decisions.

2.7.2 Process for Input

Local stakeholder input was obtained through summarizing existing comments (e.g., the Common Ground process that solicited input from stakeholders in the surrounding communities in 1995). Additional input will be solicited from ORNL stakeholders not reached through the Common Ground process. The ORNL tailored stakeholder plan is included in Appendix C.

Stakeholder input on overall ORR planning was obtained through public review of the *ORR Comprehensive Integrated Plan* (May 1998).

2.7.3 Input Summary

2.7.3.1 Input Summary from Common Ground

The objectives of obtaining stakeholder input for the Common Ground process were different and more limited in scope than those of the ORNL land planning team; however, it provided valuable input. Objectives of stakeholder input for the Common Ground process were to (1) provide a basis for environmental remediation decision making by identifying stakeholder-preferred future land uses for the ORR; (2) foster comprehensive, integrated land-use and site-development planning, with integral public participation and involvement; and (3) provide for constructive reuse of surplus land and facilities by facilitating the transfer of assets no longer required by DOE to the private sector.

During 1994 and 1995, 359 people participated in the DOE Common Ground Process to identify stakeholder-preferred alternatives for future use of the ORR. These included internal stakeholders (people working with DOE and Lockheed Martin) and external stakeholders (people living and working in surrounding counties and people with regulatory or oversight responsibilities for the ORR).

Most participants supported DOE and, prospectively, other federal or state government missions as a major ORR land use. Preservation of the reservation's natural environment, especially its special natural habitats, was widely supported, as was selective industrial development, especially industry complementary to DOE missions. Low-impact recreational uses such as hiking and biking trails were widely supported, although more by external

participants than internal participants.

Except for staff and other elements of the City of Oak Ridge, only limited support existed for residential uses. Limited support was expressed for forestry or agricultural research, but not for general agricultural uses. There was little support for use of the land for a transportation corridor and virtually no support for major commercial development (e.g., malls).

Release of the land was an especially controversial issue among stakeholders. Some spoke against releasing more ORR land; a few said that all land not needed for federal purposes should be released; and some said that release of land might be acceptable, but only under certain conditions (DOE 1996b).

2.7.3.2 Input from Other ORNL Stakeholders

The stakeholder letter received prior to publication of this document is included in Appendix D. Recognizing that land and facilities planning is not a static process, solicitation of tailored ORNL stakeholder responses will be ongoing. Input received subsequent to publication will be incorporated in update documents.

2.7.4 Use of Input

Responses of stakeholders external to ORNL and participants in the Common Ground process, as well as public comments received informally throughout the planning, will be evaluated for compatibility with the ORNL vision for land use. Where appropriate and possible, these responses have been or will be incorporated into the plan of current land uses and planning for future land uses.

Planning land uses is an opportunistic and dynamic process. Through the ORNL Land and Facilities Use Committee, additional comments, ideas, and suggestions will be evaluated in a timely manner for implementation and reviewed through the RMO as needed.

2.8 ADDITIONAL LAND USE FACTORS

2.8.1 DOE/ORR Vision Statement (As submitted October 9, 1996)

DOE is responsible for some 35,000 acres of federal land referred to collectively as the ORR. Over the last 50 years, the reservation was used to pursue a number of federal research and industrial programs which supported a variety of national goals. The major facility developments on the reservation took place in three geographic areas known as the K-25, X-10, and Y-12 sites. These areas encompass about 12,500 acres of the reservation and

accommodate the site facilities and the necessary buffer or exclusion areas. The remaining land, some 22,500***** acres, is a DOE National Environmental Research Park.

In a memorandum dated January 12, 1994, DOE Headquarters initiated a process to identify stakeholder-preferred alternatives for the future use of land and buildings at each DOE site. This effort was driven by the need to have a land use strategy taking into account the changing mission profile of DOE and an aggressive program to remediate contaminated land that could then be made available for alternative uses. In response to this initiative, the ORO chartered the Common Ground Process Team, which prepared a summary report and seven volumes of supporting information entitled *A Report to the U.S. Department of Energy on Recommended Future Uses of the Oak Ridge Reservation, Paducah Gaseous Diffusion Plant, and the Portsmouth Gaseous Diffusion Plant* and dated December 1995. This report became the basis for the Oak Ridge section of a DOE Headquarters report entitled *Charting the Course, The Future Use Report*, published in April 1996 (DOE 1996b).

The DOE Headquarters report noted that the ORO adopted a concept for the reservation specifying that the site should serve as an integrated science, education, and technology complex operated in partnership with the private sector. Under this scenario, the reservation would be managed by the federal government as a single parcel. The report cited the Common Ground recommendation that a comprehensive planning process be put in place to support eventual land use decision. The context for that planning process is suggested by the strong support of the Common Ground Process respondents for the continuation of the reservation's current missions, especially research, with the understanding that future use would include a mixture of activities that would be compatible with and would contribute to ongoing and anticipated DOE missions. This is not to suggest that future use planning should be restricted to only DOE or even just federal uses. To the contrary, the consensus included an expectation that portions of the reservation would be used to promote the development of private sector enterprises. Beyond this, there were also expressions of support for various forms of passive recreational use that would be compatible with anticipated research, industrial, and conservation uses of the reservation. Residential use of reservation land received less support, but the City of Oak Ridge identified three parcels of interest for residential development and additionally noted its claim of first right to certain parcels designated as "self-sufficiency" parcels. The State of Tennessee saw the Common Ground Process as a starting point which would be influenced by other considerations best dealt with by a comprehensive planning process.

The effort to articulate and continuously refine a comprehensive strategy for the reservation began in the fall of 1995 with the release of the Vision Statement for the Oak Ridge Complex (DOE Vision) by the ORO. Our vision for the reservation is that it will be used to support many of the same programs it currently supports while adapting to changing national goals and interests. Our intention is to maintain a dialogue with stakeholders and use an inclusive strategic planning process to support operational decisions.

*****Since the publication of the DOE/ORR Vision Statement on October 9, 1996, the acreage of the Oak Ridge National Environmental Research Park has been recalculated at approximately 22,175 acres.

The feature of the DOE Vision that may have the most dramatic effect on the reservation is the plan to find for the private sector business opportunities on the reservation that will directly or indirectly offset the cost of cleanup of contaminated facilities and allow their timely transfer to nonfederal uses. DOE plans to complete environmental restoration of its facilities by 2006. Our intention is to be a cooperative force to turn a significant portion of those facilities to private sector uses. Another aspect of the DOE Vision that will impact the reservation is the expectation that public-private partnerships will be used to further the programmatic interests of DOE, not just those associated with environmental cleanup. This may result in land being sold or otherwise made available for private development of a capability allied to DOE-supported work. Additionally, there is the anticipation that DOE will privatize the operation of utilities that serve the reservation, removing additional land and facilities from federal roles. Other parts of the DOE Vision argue for maintaining a significant fraction of the reservation as federal lands. The Vision anticipates a robust R&D mission for ORNL and an equally robust industrial capability to support the maintenance of the enduring nuclear weapons inventory. ORNL is primarily located at the X-10 site but currently performs mission work at the Y-12 site and at various locations in the National Environmental Research Park. Defense programs work will continue to be performed at the Y-12 site, although the defense footprint will significantly shrink.

In the near term, zero to 25 years, we anticipate significant defederalization and private development at the ETTP (formerly the K-25 Site) and the east end of Y-12. However, our intention is to find creative ways to offset environmental cleanup costs and, in instances of mission-based partnering with the private sector, present opportunities anywhere on the reservation. In this time frame, the remaining areas of the reservation need to be maintained to discharge the current mission of DOE at Oak Ridge and provide the ability to pursue future initiatives, particularly the construction and operation of major scientific facilities such as the SNS. Apart from future capital development opportunities on the reservation, the National Environmental Research Park serves as a regional anchor for the Southern Appalachian Biosphere Reserve, along with its partners, the Great Smoky Mountains National Park and Coweeta Hydrologic Laboratory in North Carolina. The park contains numerous research sites for both ongoing and future environmental research initiatives and is a unique resource for securing future major initiatives (Vision Statement 1996).

3. ORNL INTEGRATED FACILITIES PLAN

3.1 PURPOSE

The Integrated Facilities Plan defines future plans for Oak Ridge National Laboratory (ORNL) facilities and site development. In addition, it serves as a reference source for a broad base of site and facilities characterization data. Future facility and land requirements are determined by the functional and physical adequacy of existing facilities and equipment and by future mission and program plans. This plan provides a summary of existing ORNL assets. The general plant projects (GPPs) and line item (LI) construction projects required to support ORNL's future mission and program plans are described, and the impacts of this construction on the site's assets are summarized. In addition, essential general plant critical equipment needs and plans are described.

Key elements of the site planning analysis include assumptions and objectives for site development at ORNL. The assumptions provide the context for planning; the objectives or goals provide a framework for evaluation of the site. The plan provides an evaluation of the site for the objectives. The format of this plan identifies an immediate planning base (current through next three years), an extended planning base (four years in the future through the succeeding six years, and long-range planning (greater than 10 years) for the site. Of course, full implementation of the site development plans will require many years, perhaps two or three decades or more.

3.2 SUPPORTING INFORMATION

This plan has been developed with the philosophy of referencing existing, relevant planning documents whenever possible and duplicating information from those documents only to the extent necessary to assure a cogent, comprehensive presentation of appropriate information within the context of this plan. Users, therefore, should access the referenced documents for detailed information. The *ORNL Land and Facilities Plan* will be updated periodically on the World Wide Web as significant changes to the information in the plan occur. Paper copies of this plan should be utilized with the understanding that they may not contain the most current information available.

Listed below are the key planning documents that support this plan. A short description of the referenced document is provided along with a World Wide Web Uniform Resource Locator (URL) address, if one is available. An organizational contact, responsible for the specific document, is also provided (Table 3.1).

3.2.1 Comprehensive Integrated Planning: A Process for the Oak Ridge Reservation, Oak Ridge, Tennessee (May 1998) (http://www.ornl.gov/~dmsi/cip/)

The *ORR Comprehensive Integrated Plan* is intended to assist U.S. Department of Energy (DOE) and contractor personnel in implementing a comprehensive/integrated planning

Table 3.1. List of organizational contacts for documents/databases

Document/Web address, if applicable	Organizational Contact	Bldg/MS	Phone	UID*
Comprehensive Integrated Planning: A Process for the Oak Ridge Reservation, Oak Ridge, Tennessee (May 1998) (http://www.ornl.gov/~dmsi/cip/)	P. D. (Pat) Parr, LMER	Bldg. 1505/MS 6038	576-8123	par
Environmental Management Baseline (http://www-internal.ornl.gov/ER/baseline_management/em_baseline.html)	D. A. (David) Starling Bechtel Jacobs Company LLC	Bldg. K-1225/MS 7293	576-6501	sa9
LMER ES&H Management Plan for ORNL	R. J. (Rick) Forbes, LMER	Bldg. 1000/MS 6302	574-0404	rfs
ORNL ESHQ&I Budget Formulation Submission (http://svr1.cmo.ornl.gov/eshwc/wc.dll?eshweb~TopPage)	P. E. (Patty) Cox, LMER	Bldg. 1000/MS 6302	576-4183	pcx
ORNL Institutional Plan (http://www.ornl.gov/inst_plan/IP_Outline.html)	M. B. (Bonnie) Nestor, LMER	Bldg. 4500N/MS 6251	574-4173	mnj
ORNL Land and Facilities Plan (http://www.ornl.gov/~dmsi/landUse/)	A. R. (Tony) Medley, LMER P. D. (Pat) Parr, LMER	Bldg. 4500N/MS 6254 Bldg. 1505/MS 6038	574-9156 576-8123	arm par
ORNL Strategic Plan (http://www.ornl.gov/inst_plan/STRATEGIC_PLAN/title98sp.html)	M. B. (Bonnie) Nestor, LMER	Bldg. 4500N/MS 6251	574-4173	mnj
Oak Ridge Reservation Annual Site Environmental Report (http://www.ornl.gov/ Env_Rpt/aser96/aser.htm)	L. V. (Laury) Hamilton, LMER	Bldg. 4500S/MS 6317	576-4526	lvm
Oak Ridge Reservation Management Plan	P. D. (Pat) Parr, LMER	Bldg. 1505/MS 6038	576-8123	par
P&E Division Maintenance Work Plan: FY 1998-FY 2003, ORNL/CF-97/37	J. C. (Jim) Nook, LMER	Bldg. 2518/MS 6328	574-4313	noo
ORNL Facility Index http:www-sap.ornl.gov/scripts/wgate/ZKWWW_FACINDEX/!?_FUNCTION=Z_K_WWW_FACINDEX_MENU	D. (Dave) Kennard, LMER	Bldg. 4500N/MS 6254	574-9282	k33

*Users external to ORNL should add the extension @ornl.gov to all UIDs (e.g., par@ornl.gov).

process consistent with DOE Order 430.1, “Life Cycle Asset Management (LCAM).” DOE contractors are charged with developing and producing the *ORR Comprehensive Integrated Plan*, which serves as a summary document, providing information from other planning efforts regarding vision statements, missions, contextual conditions, resources and facilities, decision processes, and stakeholder involvement.

The *ORR Comprehensive Integrated Plan* is a planning reference that identifies primary issues regarding major changes in land and facility use and serves all programs and functions on-site as well as the DOE Oak Ridge Operations Office (ORO) and DOE Headquarters. The plan illustrates how the ORR, as a valuable national resource, is and shall be managed based on the principles of ecosystem management and sustainable development and how mission, economic, ecological, social, and cultural factors are used to guide land and facility use decisions. The long-term goals of the comprehensive integrated planning process, in priority order, are to support DOE critical missions and stimulate the economy while maintaining a quality environment.

3.2.2 ORNL Institutional Plan (http://www.ornl.gov/inst_plan/IP_Outline.html)

ORNL produces an institutional plan each year to convey information about the Laboratory to DOE. The institutional planning process provides a means for DOE to consider the Laboratory as an institution (rather than as a collection of programs) and to review its mission, its health as an institution, and its plans for the future. DOE approval of ORNL's institutional plan indicates that the Laboratory's mission, vision, and strategic plan are aligned with Departmental needs and plans.

3.2.3 ORNL Strategic Plan (http://www.ornl.gov/inst_plan/STRATEGIC_PLAN /title98sp.html)

Since its establishment in 1943, ORNL has anticipated and supported national needs for research and development (R&D), developing broad, multidisciplinary capabilities that today are directed primarily toward support for the missions of DOE. Throughout its existence as a DOE national laboratory, ORNL has conducted strategic planning to prepare for new challenges, focus its resources on the future, and explore new technical directions. The Laboratory's current strategic planning efforts are summarized in this document. They reflect significant changes that are occurring at many levels.

3.2.4 LMER ES&H Management Plan for ORNL

The *Lockheed Martin Energy Research Corporation (LMER) Environment, Safety, and Health (ES&H) Management Plan for ORNL* was developed to describe the approach used at ORNL to ensure the health and safety of employees and the public, protect the environment, and comply with requirements set forth in the Work Smart Standards agreed upon by LMER and DOE. This plan documents the systems and processes used by ORNL to (1) establish and communicate ES&H expectations and requirements to the ORNL community, (2) identify and secure funding for ES&H activities using risk-based planning and priority setting, (3) conduct R&D activities and operations through integration of ES&H

principles in work planning and execution, and (4) assess ES&H performance and provide feedback to promote continuous improvement. The plan was prepared in accordance with guidelines in the *DOE Guidance Manual for the ES&H Planning Process for Fiscal Year (FY) 1999*, and its issuance satisfies the requirement in the DOE-LMER Management Contract, I.71 DEAR 970.5204-2 Paragraph C.

In July 1997, the *Action Plan for Improved Management of Brookhaven National Laboratory (BNL)* was issued in response to the Department's Oversight Report entitled *Integrated Safety Management Evaluation of Brookhaven National Laboratory*. The Action Plan defined six high-level actions for improving the management of BNL. In discussing Action 2.0, which was assigned to the Department's Chief Financial Officer, the Action Plan notes that the Department lacks a consistent approach to formulating budgets for ES&H and infrastructure needs. It is imperative that contractor and DOE managers be able to view and evaluate both ES&H and infrastructure needs in an integrated fashion. Funding decisions for these activities must be made considering the specific and overall risks to achieve a balance in priorities and ensure that available resources are effectively allocated to address safety, programmatic, and operational considerations.

ORNL has completed the integration of ES&H and infrastructure requirements into a single database system. The desired outcomes of this system are that it enables ORNL to

- meet major ES&H and infrastructure commitments,
- address key issues,
- manage unfunded ES&H and infrastructure risks,
- systematically reduce ES&H and infrastructure risks, and
- establish and maintain stakeholder confidence.

Future editions of the *LMER ES&H Management Plan for ORNL* will include infrastructure information as well as environmental, safety, health, and quality information.

3.2.5 ORNL ESHQ&I Budget Formulation Submission

ORNL's FY 2000 Environment, Safety, Health, Quality, and Infrastructure (ESHQ&I) Budget Formulation Plan was developed in accordance with the guidance in the DOE Guidance Document for the ESHQ&I Planning Process for FY 2000 [Office of Laboratory Operations and ES&H (ER80), Laboratory Infrastructure Division (ER82), *Environment, Safety & Health, and Infrastructure Management Plan - Guidance Manual*, dated February 27, 1998]. It identifies the ESHQ&I activities considered necessary at ORNL to ensure the health and safety of employees and the public; protection of the environment; and compliance with applicable laws, regulations, DOE policies and orders, and other ESHQ&I requirements while carrying out the site's missions and the planning for ORNL infrastructure needs which support R&D as well as the environment, safety, health, and quality (ESH&Q). This plan was developed using risk-based planning and priority-setting methodologies to (1) establish and communicate ESHQ&I expectations to all stakeholders, (2) support the development of Departmental budgets and secure funding for ESHQ&I programs and activities, (3) support the integration of ESHQ&I principles in site-wide work planning and execution, and (4)

assess ESHQ&I performance and provide feedback to promote continuous improvement.

3.2.6 Oak Ridge Reservation Annual Site Environmental Report (http://www.ornl.gov/Env_Rpt/aser96/aser.htm)

This document contains a summary of environmental monitoring activities on the ORR and its surroundings. The monitoring and documentation criteria are described within the requirements of DOE Order 5400.1, "General Environmental Protection Program." The results summarized in this annual report are based on the data collected prior to and through the reported year.

3.2.7 Oak Ridge Reservation Management Plan

The primary purpose of this management plan is to define responsibilities and authority for ORR management. The management plan treats the ORR as a single site wherever possible and addresses roles and responsibilities for managing the physical and human resources of the reservation on both a day-to-day and long-term basis. The focus of the document is to address general overall reservation policy and management, particularly as it relates to the portion of the ORR outside the immediate site boundaries.

3.2.8 ORNL Facility Index

The ORNL Facility Index (URL) is a Web-based database of ORNL facilities with related links that include ORNL site maps, the ORNL Facilities Management Database, the ORNL Area Responsibility Listing, the ORNL Condition Assessment Survey (CAS), the ORNL Space Allocation Management System (SAMS), the Property Management System (PRISM), GLI Web - General Locator Information, and Whos. Photographs of the facilities are also available at this index.

3.3 EXISTING ORNL SITE CONDITIONS

Understanding existing site conditions and functions performed at ORNL constitutes a major step in site development planning. This section discusses the ways in which ORNL uses its resources to fulfill its mission.

3.3.1 Site Physical Characteristics

The majority of ORNL facilities lie in Bethel Valley, between Chestnut and Haw Ridges, within approximately 2 miles of the Clinch River. Major facilities are also located just to the south in Melton Valley and on adjacent Copper Ridge. These locations constitute the ORNL Main Site. Other ORNL activities are located at the Y-12 Plant (in Bear Creek Valley, 5 miles to the northeast). Section 2.4.3 of this plan describes topography, geology, hydrology, vegetation, and wildlife.

3.3.1.1 ORNL Main Site

ORNL's land and facilities have two basic purposes: (1) to directly accommodate R&D activities and (2) to support these activities by operating and maintaining the ORNL physical plant. Functional use categories associated with the first purpose include Life Sciences, Physical Sciences, Social Sciences, Technology Development, and Nuclear Technology; categories associated with the second purpose include Administration, Technical Services, Environmental Operations, Support Services, and Laboratory Protection.

3.3.1.2 Bethel Valley

Land and facilities that accommodate Life Sciences include Walker Branch Watershed; the drainage of White Oak, Fifth, and First creeks and the Northwest Tributary; and a cluster of buildings at the west end of the developed area. Facilities accommodating Physical Sciences are more dispersed. The greatest concentrations lie east of the main entrance drive and south of Bethel Valley Road and in Building 4500N of the Central Research Complex (Fig. 3.1). This complex, housing about one-third of ORNL's total population, also accommodates Social Sciences and a substantial portion of Technology Development. Other facilities accommodating Technology Development lie north of Central Avenue. Nuclear Technology is accommodated in facilities located both north and south of Central Avenue.

Administration is located in 4500N. This building also houses Technical Services, as do several other facilities to the west and northwest of 4500N. Environmental Operations take place at the east and west ends of the Bethel Valley area, north of 4500N, and in numerous facilities west of the Central Research Complex. Support Services are generally concentrated at the far east end (7000 Area) of the developed area and between First and Third streets toward the west. Laboratory Protection is housed in a number of small facilities throughout the valley area.

At present, Bethel Valley supports an intermixing of clustered development, predominately in a central core area. Some of this mixing is intentional and desirable, reflecting ORNL's multiprogrammatic, multidisciplinary nature. However, much of this mixing came about because of the use of available space on an as-needed basis. The result may contribute to fragmentation of certain functions, separation of some interacting groups, difficulty in effective reprogramming of space when requirements change, and the use of facilities for purposes other than those for which they were designed.

3.3.1.3 Melton Valley

Land and facility-use patterns in Melton Valley differ markedly from those in Bethel Valley (Fig. 3.2). Melton Valley is characterized by large areas of land devoted to environmental research or waste management and widely dispersed clusters of facilities, some with significant potential hazards.

Fig. 3.1

Fig. 3.2

Land accommodating Life Sciences includes watersheds throughout Melton Valley and research areas at its far west end. Technology Development is concentrated in the eastern portion in the Robotics and Process Systems Complex (RPSC) and in several small facilities in the 7500 and 7900 areas. The 7900 Area containing the High Flux Isotope Reactor (HFIR) facilities and a laboratory at the RPSC are devoted to Nuclear Technology. Buildings 7920 and 7930 house the Radiochemcial Engineering Development Center (REDC), which is the production, storage, and distribution center for heavy-element research programs. The REDC is the main center of production for transuranium elements in the U.S.

By far, the largest amount of space in Melton Valley is used for Environmental Operations. This space includes four small facilities and two research sites toward the east end of the Valley, several sections of the 7900 Area, and the vast waste storage and disposal areas of the western part of the Valley. Only a few facilities contain Support Services.

3.3.1.4 Copper Ridge

Copper Ridge has clusters of facilities at two relatively isolated sites that accommodate Technology Development and Nuclear Technology (Fig. 3.3). The Health Physics Research Reactor (HPRR) was shut down in 1990; its site and structures constitute the Dosimetry Applications Research Facility (DOSAR). The Tower Shielding Facility (TSF) contains the Tower Shielding Reactor-II, a research reactor that has served as a reactor operations training facility and functioned as a site for transportation cask drop-testing. The TSF has been leased to an outside contractor for use as a nuclear medical research and treatment facility.

3.3.1.5 ORNL at the Y-12 Plant

ORNL facilities at the Y-12 Plant lie in the central and eastern portions of the plant, as shown in Fig. 3.4. ORNL facility uses include Life Sciences, Physical Sciences, Technology Development, Technical Services, and Support Services. Other facilities are used for multiple purposes.

ORNL's activities were placed in available Y-12 Plant facilities; consequently, activities in several functional use categories are dispersed among a number of buildings. This is most apparent for Technology Development, which is accommodated in 12 different buildings. ORNL is responsible for maintaining the buildings it uses at the Y-12 Plant, but it has only limited responsibility for providing utilities and services that support ORNL activities.

3.3.1.6 User Facilities

Guest scientists are a valuable component of ORNL's research staff. Their assignments, which range from two weeks to two years, broaden the Laboratory's base of expertise and support goals in scientific cooperation and technology transfer. In FY 1997, the Partnership Office supported 3533 assignments of scientists and engineers from universities, industries,

Fig. 3.3

Fig. 3.4

and other federal institutions. Of this number, about 25% were industrial guests. Many of these guests carry out R&D at one of ORNL's 16 designated user facilities.

- Atomic Physics EN Tandem Accelerator
- Bioprocessing Research Facility
- Buildings Technology Center
- Californium User Facility
- Centers for Manufacturing Technology (with Y-12)
- Computational Center for Industrial Innovation
- High Flux Isotope Reactor Facility
- High Temperature Materials Laboratory
- Holifield Radioactive Ion Beam Facility
- Metals Processing Laboratory User Center
- Metrology R&D Laboratories
- Mouse Genetics Research Facility
- Oak Ridge Electron Linear Accelerator
- Oak Ridge National Environmental Research Park
- Shared Research Equipment Program
- Surface Modification and Characterization Research Center

3.3.2 Buildings

The Melton Valley site, the Bethel Valley site, and Copper Ridge combined contain approximately 3.7 million gross ft of building space. In addition, more than 1.4 million gross ft of building space at the Y-12 plant is used by the Laboratory. ORNL has full responsibility for its Bethel and Melton Valley sites and surrounding areas. At the Y-12 plant, ORNL has responsibility for building maintenance and ESH&Q functions as approved by Memorandums of Understanding between ORNL and Y-12. Table 3.2 presents an ORNL building summary.

Table 3.2. ORNL building summary

Location	Buildings	Building ft^2	Trailers	Trailer ft^2	Total ft^2
ORNL main site	**428**	**3,740,818**	**91**	**80,275**	**3,821,093**
• Lockheed Martin	308	3,273,646	71	60,092	3,333,738
• Bechtel Jacobs	120	467,172	20	20,183	487,355
ORNL at Y-12	**29**	**1,379,230**	**2**	**2,436**	**1,381,666**
Leased off-site	**4**	**62,169**			**62,169**
Total	**461**	**5,182,217**	**93**	**82,711**	**5,264,928**

Continued growth in ORNL staff, visiting researchers, and guests along with the assignment of a number of DOE personnel to Laboratory offices, has resulted in overcrowding of facilities, particularly of office space in Bethel Valley. This has necessitated the use of temporary buildings and trailers, as well as the leasing of approximately 83,000 gross ft of office space off the ORR.

The majority of ORNL's buildings were constructed during and immediately after World War

II. About 77% of the building space is over 30 years old, and nearly 53% is over 40 years old (Fig. 3.5). Limited budgets have allowed the physical condition and adequacy of buildings to decline. Just 23% of ORNL's building space is deemed adequate. While 67% of the Laboratory's space requires minor rehabilitation, 7% requires major rehabilitation and 3% requires replacement (Fig. 3.6). The continued installation of sophisticated and expensive equipment into deteriorating physical facilities could eventually compromise ORNL's standing as a world-class research institution. Detailed information, including condition assessment surveys and photographs of ORNL facilities, can be accessed via the ORNL Facility Index on the World Wide Web (URL).

ORNL's diverse projects require many types of facilities ranging from ordinary offices to highly specialized and unique laboratory facilities; 25% of ORNL's space is used as offices, while 21% is used as laboratory space and 54% is used for a variety of other purposes (Fig. 3.7).

The infrastructure serving many of ORNL's buildings, particularly those designed for laboratory use, requires upgrading. Many piping, wiring, alarm, and heating, ventilation, and air conditioning (HVAC) systems installed during the late 1940s and early 1950s have not been replaced and, in many areas, are obsolete and not in conformance with current building and safety codes. Many of the roads within the early developed area of ORNL, likewise, do not meet current codes for width, easement, clearance, pavement quality, and radius of curve.

Few of ORNL's facilities were designed or built to comply cost effectively with today's stringent and continuously evolving ES&H requirements. Because available resources have been directed toward meeting these requirements in a timely manner, most major upgrades and replacements have had to be postponed. Nevertheless, a limited amount of building space has been replaced through construction projects supported by GPP funds. In addition, approval of a limited number of LI requests has permitted construction of several important new research buildings and significant restoration of utility systems. However, much more must be accomplished to ensure that ORNL's facilities remain conducive to world-class research.

3.3.3 Inactive and Surplus Assets

ORNL annually requests funding to establish a comprehensive management program for those facilities determined as Surplus to Programmatic needs of the Laboratory or are Orphaned with no identifiable program owner.

At a minimum, these surplus facilities require surveillance and maintenance to ensure the safety and health of staff and the public or to prevent environmental damage. Surplus or inactive facilities represent a drain on R&D funding, detract from the Laboratory appearance, and occupy space for potential new activities or construction projects.

The goals of the ORNL Surplus/Inactive Facilities Program are to address landlord legacies, to achieve compliance with ES&H requirements, to maintain and ensure the necessary safety envelope, and to provide additional space for current and future activities. Current or

Fig. 3.5

Fig. 3.6

Fig. 3.7

projected facilities for decontamination and/or decommissioning not previously accepted into the Environmental Management (EM) program are listed in Table 3.3 and are shown in Figs. 3.8 and 3.9.

Table 3.3. Projected ORNL surplus/inactive facility* list

Building	Facility or area name
	Currently surplus facilities
2017	East Research Satellite Shop
2061	Stack
2654	Sewage Digester Building
3121	Cell Off-Gas Filter House for 3019
3597	Hot Storage Garden
7833	Alpha Greenhouse Facility
9201-2	86-Inch Cyclotron
9201-2	Thermal Heat Transfer Facility
9201-3	Single Rod Test Facility
9201-3G	Coal Lab Hood
9201-3H	Fuel Aerosol Test
9201-3J	Small oil tanks (3), basement
9204-1K	Tank on Southeast Circle
9204-3	Plutonium Processing Facility
9204-3	Curium Glovebox Handling Facility
9220	Molecular Biology Facility
Building	**Facilities expected to be declared surplus FY 2000**
2000	Solid State Annex
2001	Information Center Annex
2087	Storage, I & E
3525	High Radiation Level Examination Laboratory
3548	Cell Vent Filters for 3517
7062	Asbestos Shop
7811	Geoscience storage building
9204-1	Contaminated Attic, East end basement
9204-1	Calthrate Test Facility
9204-1	Forced Convection Test Facility
9204-1	Homogeneous Reactor Test
9204-1	Thermal Energy Storage Test Loop
9204-1	Inactive hoods and roof stacks
9204-1	Tank, 2nd floor
9204-1	Basement tanks
9207	Biology Building, Office Annex and Office Tower
9211	Co-Carcinogensis Facility

*Facilities not presently in EM40 or EM60.

Table 3.3. Surplus/inactive facility* list (Cont'd)

Building	Facility or area name
	Facilities expected to be declared surplus FY 2005
3036	Isotope area storage and service building
3503	High Rad. Level Chem. Eng. Lab
3541	MSR Process Development Lab. Facility
3542	Storage building (for 3505 and 3517)
3550	Research lab annex
3592	Coal conversion facility
9999-1	Generator motor for 9204-3
9210	Mammalian Genetics Facility

*Facilities not presently in EM40 or EM60.

The EM40 and EM60 programs are not expected to accept any additional facilities in the near future. If no further facilities can be added to the DOE-EM programs, the burden for disposition of surplus and inactive facilities will fall on currently funded programs. This will have a negative impact, both short-term and long-term, on R&D and/or landlord programs, leading to a decline in research activities and continued infrastructure deterioration.

3.3.4 Utilities

3.3.4.1 Electricity

Electrical power needed to operate Laboratory facilities at both the X-10 and Y-12 Sites is supplied by high-voltage transmission lines from the Tennessee Valley Authority (TVA) power grid. The 161-kV primary power system serving the ORR is an integral part of the TVA power grid; therefore, system design, operation, and maintenance must be compatible with the rest of the TVA system. The Power Operations Group located in the Y-12 Facilities Maintenance Organization has responsibility for coordinating operations and activities on the distribution grid and with operating and maintaining the main substations serving each individual site. Electrical power used at ORNL is fed from the TVA network through two feeders. One feeder is approximately 8 miles long and extends from the K-27 substation at the East Tennessee Technology Park (ETTP) Site; the other is about 6 miles long and feeds from the Elza Substation located at the Y-12 Site. Each line is rated at 161 kV and is capable of supplying the Laboratory with approximately 110 MW. Transformers at the main substation at Building 0901 reduce the 161 kV to 13.8 kV. Current capacity of the feeders is sufficient to accommodate virtually any facility or program which may be located at the Laboratory, but the substation will need to be upgraded if total energy usage at the Laboratory increases significantly.

Fig. 3.8

Fig. 3.9

Eight 13.8-kV feeders distribute power to facilities throughout the Laboratory, where transformers further reduce the voltage to usable levels. Five secondary 2.4-kV substations, a 2.4-kV distribution system, switchgear, and numerous facility transformers complete the primary electrical distribution system which provides power to Laboratory facilities. Fig. 3.10 is a diagram of the primary electrical distribution system.

The system includes 32 miles of overhead distribution lines, 4 miles of underground cable, 20 medium voltage distribution switchgear assemblies and over 200 facility transformers. Transformer installations range in size from 15 to 7500 kVA and range between 1 and 55 years old. The system has a maximum capacity of 80 MW, but practical guidance limits current capabilities to approximately 40 MW. The present electrical load averages less than 15 MW for much of the year.

Many of the most critical operations and facilities are equipped with gasoline- or diesel-powered generators. These standby generators automatically start up to provide essential power to allow functions associated with ES&H to continue unaffected during power outages. They are a key component of safety systems designed to protect the public from the materials and hazards present on Laboratory grounds.

The oldest sections of the ORNL electrical system were built in the early to mid-1940s and the age of the system is rapidly becoming a major problem. A number of projects intended to upgrade the system and its components have been completed and more, including a major LI project, have been identified that will improve and upgrade the safety and reliability of the electrical system. The electrical distribution system, while aged, provides reliable service to all customers in the Laboratory. If recommended improvements are completed, the system will easily support Laboratory operations and facilities well into the next century.

3.3.4.2 Natural Gas

The East Tennessee Natural Gas Company (ETNGC) supplies natural gas to ORNL. ETNGC owns, operates, and maintains the main line and the three pressure-reducing stations that make up the supply system to the ORR. DOE has delegated managing responsibility to the Power Operations Department located at the Y-12 Plant. This responsibility includes maintaining flow conditions within the supply contract limitations. No current supply limitations impact on Laboratory operations; the system was designed with more capacity than is now demanded. However, contractual agreements limit the amount of gas ORNL will demand. Under the current contract, ORNL can demand 1000 decatherms (1000 mcf) without incurring a penalty charge.

The ORNL natural gas tap is at Metering Station "B," located north of Bethel Valley Road at the Melton Valley Access Road intersection. Natural gas from the ETNGC main is reduced to 100 pounds per square inch (psi) at the metering station and passes through an orifice flange where ORNL responsibility begins. Fig. 3.11 is a diagram of the natural gas distribution system. The 6-in. ORNL supply line runs south to a tee where a 2-in. line branches off to supply gas to the 7000 Area reducing station. Gas pressure is reduced at the station to 10 psi for distribution to user facilities in the 7000 Area. Pressures are further reduced at each individual user facility according to the needs of that facility.

Fig. 3.10

Fig. 3.11

The gas supply for the remainder of the Laboratory runs southward from the tee for approximately 1000 ft before emerging from the ground. It then turns west and runs aboveground for approximately 7500 ft along the north side of Haw Ridge until it reaches the Steam Plant.

At the Steam Plant there are seven pressure reducers at "Reducing Station 2." Five of these reduce the 100-psi natural gas to 10 psi for use in the boilers in the Steam Plant. The other two reducers drop the pressure to 5 psi to supply the distribution grid which supplies gas to facilities located in the main ORNL Bethel Valley complex. The 5-psi distribution grid consists of approximately 3500 ft of 6-in., 3-in., and 1.5-in. steel pipe. Eleven buildings are connected to the distribution grid in Bethel Valley and of these, only eight use natural gas for any purpose.

The natural gas system at ORNL was constructed in 1948 with the only significant improvement coming in 1969, when the 100-psi main line was relocated to the north side of Haw Ridge to remove it from highly populated research areas. This aboveground line is in good condition, having been sandblasted and recoated in 1987; it should be able to continue to provide safe and reliable service for the next 15 to 25 years if the protective coating system is maintained. The underground portions of the line in the main plant area are in fair condition. Cathodic protection on these lines has prevented corrosion of the pipe. Only two leaks have developed on this underground section in the last 15 years, but due to the increasing line age, more frequent leaks can be expected in the future. To ensure that future customers will have a reliable natural gas supply, major upgrades to the underground system must be initiated in the next five years. Options to consider include replacing some sections of the lines and valves and utilizing cured-in-place lining systems on other sections which are not easily or economically accessible. These actions would need to be funded through the GPP system but currently do not receive support because of the small number of users on the system.

3.3.4.3 Compressed Air

Compressed air powers all of ORNL's major pneumatically operated control systems. Loss of the air supply would disable many experimental programs and processes, as well as many building ventilation systems. Safety-related systems that are actuated or controlled using compressed air are designed to fail in the safe shutdown mode upon loss of air pressure. Safety-related systems may also have backup air compressors or large accumulators to provide a sufficient volume of compressed air to complete a safe shutdown of operations.

Clean, dry, instrument-quality, 100 pounds per square inch, gage (psig) compressed air is produced at the Steam Plant for customers in the Bethel Valley area by one or more of five air compressors. In addition, a single diesel-powered air compressor is used in emergency situations such as power outages or when maintenance or breakdowns on the other compressors require their use. Four air receiver tanks, three prefilter units, and two air dryer systems operate in conjunction with the air compressors to provide a clean, reliable supply of compressed air to the Laboratory. Compressors 1 and 2 are old electric reciprocating piston air generators acquired for use when the Laboratory was built in 1943. The No. 1 air compressor is a late 1930s model, and the No. 2 air compressor has been dated to 1917. Each

compressor can provide 900 cubic feet per minute (ft^3/min) of compressed air at the nominal delivery pressure of 100 psi. The No. 3 air compressor is an 1100-ft^3/min rotary piston unit that was installed at the plant in 1960. It has a dual-drive capability using either electricity or steam to provide power. The Nos. 5 and 6 air compressors are relatively new, oil-free, rotary screw type compressors. The No. 5 compressor is rated at 2000 ft^3/min and is the primary air supplier for the Laboratory. It was installed in 1987, totally rebuilt in 1994, and underwent a slightly less intensive overhaul in the summer of 1997. Although operating hours are approaching 100,000, the machine has been well maintained and is considered to be in good condition. The No. 6 air compressor was installed in 1991 and can produce 900 ft^3/min. It has logged in excess of 5000 operating hours and is in excellent condition. The Laboratory's compressed air load typically runs between 2400 and 2800 ft^3/min, day and night, and the various compressors are operated to suit the demand and to allow for maintenance on the equipment.

A new 1000-kW diesel generator was added in 1996 to provide emergency backup power to the Nos. 5 and 6 air compressors. The generator gives the Steam Plant the capability to supply compressed air to customers during electrical outages. A new 3000-ft^3/min air compressor has been funded, and work is currently underway to procure and install the new unit. A new 4000-ft^3/min air dryer has been identified in the infrastructure plan to replace aging units at the plant. If funded, the addition of this new equipment will further enhance and guarantee reliable production of compressed air at the Laboratory.

The compressed air produced at the plant is distributed to customers in the Bethel Valley area through an arterial looped underground and aboveground piping system (Fig. 3.11). The compressed air distribution system in the eastern area of the Bethel Valley complex was replaced in conjunction with the replacement of the steam distribution system in 1989. The steam lines and compressed air lines were placed in concrete trench ducts with easily removable concrete lid sections. The outward appearance of the new trenches is like that of sidewalks and, in fact, some of the trenches actually replaced sections of sidewalks in some areas. Replacement of the west end distribution system is almost complete, with 14 buildings tied into the new steam and compressed air piping system. Because of schedule concerns over the onset of the winter heating season, construction efforts were stopped in October 1997 and are scheduled to resume in the spring of 1998, when the remaining buildings will be tied into the system. Again, aboveground portions of the steam and air distribution systems are being placed in concrete trench ducts to enhance overall Laboratory appearance, improve system reliability, and provide for easy access should maintenance be required. Underground compressed air and steam lines in the old central section of the Bethel Valley site will not be replaced in the same manner because (1) many facilities in the area are inactive with only small portions of the buildings supporting operations, (2) plans are in place to decommission many of the facilities, and (3) much of the soil in the area is contaminated with chemical and radioactive materials which would make trenching a complicated and expensive operation. A 300-ft section of underground compressed-air piping in this old area is not currently cathodically protected. This line is part of the main arterial loop system and will remain in service even if no facilities remain operational in the area. Installation of cathodic protection on this line would be an inexpensive way to keep the piping in good condition. A study is being initiated to determine the most economical means of protecting this line. When the study is complete, the best method of accomplishment will be determined and application

made for the appropriate source of funding for the improvement.

3.3.4.4 Potable and Process Water

Water for ORNL is taken from the Clinch River south of the eastern end of the Y-12 Plant and pumped to the water treatment plant located on the ridge northeast of the Y-12 Plant. The DOE treatment facility can supply water at a potential rate of 24 million gal/day (Mgd) to two storage reservoirs with a combined capacity of 7 million gal. Water from the two reservoirs is distributed to the Y-12 Plant, ORNL, and the City of Oak Ridge.

Water to Bethel and Melton valleys and remote sites of ORNL flows by gravity through a single 24-in. main to the 3-million-gal storage reservoir on the south slope of Chestnut Ridge near the Bethel Valley site. A 20-in. main intercepts the primary main from the Y-12 Plant north of the 7000 Area and supplies two 1.5-million-gal reservoirs on Haw Ridge, which are interconnected by check and regulating valves. Water flows by gravity into the plant distribution grid. The water is used for both potable and process purposes. Water usage is approximately 2.2 Mgd on a winter day and 3.4 Mgd during the summer; on a very hot day water usage can climb to 4 Mgd. A flow of 7 Mgd can be accommodated by the ORNL supply system under current operating conditions. Loss of this single supply source could impact ORNL operations within a short period.

The 3-million-gal water storage reservoir on Chestnut Ridge is constructed of reinforced concrete, and its condition is poor. Major spalling has occurred inside the reservoir on the roof and support beams, and steel reinforcement is exposed and decaying. Minor exterior cracks have developed and have been healed by calcium deposits. The reservoir underwent a thorough internal and external inspection in 1997, and the evaluator recommended that extensive repairs be performed in the near future to ensure that the reservoir can remain functional. A project is proposed for FY 2000 to effect the required repairs. The reservoirs on Haw Ridge are constructed of steel and in 1984 were found to be heavily corroded above the normal water level. In 1986, the reservoir tanks were sand blasted and sealed, and new aluminum dome lids were installed on both tanks. These reservoirs were inspected internally and externally in 1997 and were judged to be in good shape. The only deficiency noted was a breakdown in the external coating system that will require the tanks to be recoated in the next 2 to 3 years.

A third reservoir serves facilities in a remote area of the Laboratory. A small, 30,000-gal steel storage tank provides water to facilities at what was previously known as the HPRR site. While the mission has changed in this area, the facilities continue to be occupied. This tank was inspected in 1997 and was judged to be in poor condition. Internal corrosion has occurred despite cathodic protection, and a new coating system is needed. Discussions are currently under way to determine the best method of repair and/or replacement.

The water distribution system at ORNL (Fig. 3.12) consists of approximately 100,000 ft of cast iron and steel pipe and 900 valves ranging from 2- to 24 in. in diameter, of which the

Fig. 3.12

process water segment constitutes a relatively minor part. Contamination of the potable water system is prevented by back-flow preventers at the major take-off points and near the points of use on the process system. During the 1970s, the piping in the 7000 Area was upgraded from steel to cast iron.

Considering its age, the general condition of the water system is good, but some areas need improvement. Funding needs to be obtained to replace and upgrade the four major backflow preventer stations that supply water to the process water system. These stations are over 35 years old, and repair and replacement parts are no longer available. A GPP recently installed new motorized valves in the older sections of the system, but some older motorized valves and operators still exist and will need to be replaced with operating funds. The main line running east and west through the center of the Bethel Valley site has become brittle, and a major failure occurred in 1981 that was attributed to this embrittlement. Several improvements have been identified that would provide improved reliability, especially for fire protection, and would reduce the risk of flooding due to line breaks in low-lying areas. A GPP is being developed that will address the issues surrounding potential flooding of research facilities in the 6000 Area as a result of a failure of the 16-in. line passing through the site.

Two other LI projects are planned. These two projects address legacy-type problems associated with water lines running through the older process areas within the plant. The soil there is known to be contaminated with radioactive nuclides. Leakage *from* the pipes could leach radioactive material into groundwater and surface water. Leakage *into* the pipes could contaminate the potable water supply itself. A number of studies have been performed on these projects, and risk assessments resulted in the installation of additional valves to allow quick isolation of leaks in these areas. A back-siphonage event that could result in internal contamination of the piping system was also evaluated and was determined to be highly unlikely due to the need for two or more initiating events. As stated before, two projects are being considered to address all the issues associated with water lines running through contaminated areas. These projects now propose to replace the underground water system in these areas with an above-ground water system. This is not considered to be a reasonable option for a number of reasons, and support for the projects has been difficult to obtain. Any activity in these areas is extremely expensive, and the proposed projects still cannot guarantee with a high degree of certainty that a leak will not occur. It is hoped that, with advances in trenchless technology, new methods of rehabilitating or replacing these lines will become available in the next few years, which will allow these areas to be addressed in a realistic manner.

3.3.4.5 Chilled Water

The Central Chilled Water System, centered at Building 4509, provides chilled water used in the air-conditioning systems of 13 buildings in the central portion of the Laboratory (Fig. 3.13). The two branches of the system serve (1) Building 4500N (less Wing 5), Buildings 4501 and 4505, and (2) Buildings 3500, 4500S, Wing 5 of 4500N, 4508, 4515, 5500, 5505, 5507, 5510, 5510A, and 6010. The system is comprised of 9 chiller units with an aggregate capacity of 8600 tons, 9000 ft of piping, 3 cooling towers, 324 fans, 47 chilled

Fig. 3.13

water pumps, and 10 tower water pumps. The chilled water system serves approximately 1 million ft^2 of floor area, including offices, laboratories, computers, and accelerators. Many of these applications require cooling, regardless of the weather.

Five of the nine chillers are less than 5 years old and utilize non-chlorofluorocarbon (CFC) refrigerants. They represent 5800 tons, or 66%, of the cooling capacity available. The other four units have a combined total capacity of 2800 tons and are primarily used for backup of the newer chillers. Currently, the limiting variable is the capacity of the cooling towers. The Building 4510 cooling tower was rebuilt in 1997 and has a capacity of 4800 tons. The Building 4521 cooling tower was constructed in 1989 and has a 2000-ton capacity. A third tower, Building 4511, is in extremely poor condition and cannot be used. The two operating towers have a 6800-ton maximum capacity, which is less than the total cooling capacity available with the chillers. An extended outage on the Building 4510 tower will reduce the capacity of the chilled water to cool all 13 buildings in any season other than winter. Efforts are underway to secure funding to replace or rebuild the Building 4511 tower. When this tower is replaced, tower capacity will equal chiller capacity. The 8600 tons available is sufficient to provide reliable service to facilities and users in the Laboratory at this time. Additional cooling capacity will be necessary to provide sufficient capacity and redundancy if additional demand is created.

ORNL contains 31 additional self-contained chilled water systems, which are located within individual buildings that they serve (i.e., 2026, 2033, 6000, and 7900). There are 34 self-contained chillers, totaling 3883 tons capacity, with 12 cooling towers. Fifteen of these chillers are less than 7 years old and utilize non-CFC refrigerants. Two chillers have been converted to non-CFC refrigerants, and four CFC refrigerant units remain operational. Five of the 12 cooling towers are less than 10 years old.

A CFC chiller replacement project, initiated in FY 1994, has funded the replacement of 11 CFC chillers with general-purpose equipment (GPE) funding. Funding for this program is planned through FY 2001 to replace the remaining CFC chillers and non-CFC chillers which are deteriorated, or whose leak rates frequently exceed the allowable U.S. Environmental Protection Agency (EPA) limits (i.e., 3047E, 7910, 7603). Appropriate funding is being sought to replace the remaining CFC chillers and non-CFC chillers which are deteriorated, or whose leak rates frequently exceed the allowable EPA limits (i.e., 3047E, 7910, 7603). Appropriate funding is being sought to replace or repair cooling towers at Buildings 3525 and 6001.

3.3.4.6 Steam

The steam production system consists of four dual-fuel boilers (using coal, gas, or oil) and one package-type boiler (which uses gas or oil), all of which are housed in the Steam Plant (Building 2519). The total capacity of the five boilers is 305,000 lb/h of saturated steam at 250 psig. They supply steam to the Bethel Valley facilities and the 7500 and 7900 areas in Melton Valley. The Steam Plant also houses the necessary auxiliaries, such as boiler feedwater pumps, induced- and forced-draft fans, water-softener systems, the fuel oil pumping system, the natural gas pressure-reducing station, and the coal-handling system. The

coal-handling system is composed of 3 conveyors, a drawdown vibrating hopper, a tripper unit, 8 coal bunkers, and 16 coal feeders.

The Steam Plant was constructed in 1948 and underwent conversion from coal to natural gas/fuel oil in the early 1950s and from natural gas/fuel oil back to coal in the late 1970s. The conversion to coal as a primary fuel resulted in a reduction of capacity when using gas to fuel the boilers to make room for the coal equipment. The natural gas burners were relocated from the front of the boilers to the side. The side burner arrangement is very inefficient and reduces boiler capacity by approximately 60% compared to coal.

Oil can be utilized as a fuel for boiler 5 but is used only in an emergency situation because it produces smoke and mist and is very expensive relative to coal and natural gas. In addition to the operational difficulties that burning oil causes, the on-site storage tank can provide sufficient fuel oil for only three days during heavy winter steam loads.

About 90% of the steam produced is used primarily for heating approximately 135 buildings, and the remainder is used for process steam. The process steam drives the emergency off-gas turbines in the 3039 stack areas if there are power outages. Other uses include heating water and drying clothes in the Decontamination Laundry; dish, pot, and pan washing in the cafeteria; and processes to support R&D activities throughout the Laboratory.

The steam distribution system (Fig. 3.14) is sized to handle the total capacity of the five boilers. The system includes approximately 27,000 ft of piping involving approximately 360 major valves, 50 steam-regulating stations, and 70 steam pits. Steam is produced at 240 psig and routed from the northeast and southeast corners of the Steam Plant through an 8-in. line along Central and White Oak Avenues to form a loop around the Building 4500 complex. Steam lines to the 7000 Area are connected to the loop near Building 5505. A project to replace the steam and compressed air lines in the eastern portion of the Bethel Valley complex with new lines in concrete trench ducts was completed in 1989. These trench ducts have easily removable concrete lids and, because they were set below grade in most areas, have the outward appearance of sidewalks. Work is almost complete on a similar upgrade of the western portions of the steam and air distribution system. Work was stopped in the fall of 1997 because of schedule concerns and the upcoming winter heating season. The remaining work is scheduled to be completed starting in the spring of 1998; in all, 15 buildings of a scheduled 19 have been tied into and are operating off the new system. Other projects to upgrade the remainder of the steam distribution system in older areas of the Laboratory are being discussed. To avoid disturbing contaminated soil in the old area of Bethel Valley, steam lines there will not be replaced by a trench system. An aboveground system would be the only option for replacing steam lines in the old area; however, the need for steam in the old area is expected to diminish as old facilities are closed.

No improvements are planned for the steam supply to the facilities in the Melton Valley area, including the HFIR, at this time. If future funding allows, an additional feed line will be run from the Steam Plant and tied into this steam line at a point just north of the HFIR area. The addition of this new feed will allow maintenance outages to occur on the supply lines without affecting HFIR operations.

Fig. 3.14

Condensate return lines have been installed during the upgrades to the east and west portions of the system. This condensate return system allows approximately 40% of the condensate generated to be fed back to the boiler feedwater system. The condensate is not yet being reused because of concerns over the chemicals which would have to be used and their potential effect on experiments and operations at the Laboratory. This is an ongoing issue and has not yet been resolved.

While the Steam Plant remains reliable, the major equipment systems, including the boilers, have exceeded their useful design life. A Steam Plant study has been completed that identifies replacement and upgrade projects that will be necessary if the plant is to continue to operate reliably and efficiently. It is doubtful that funding will be available in the foreseeable future to finance the construction of a new Steam Plant or to make any type of wholesale improvements to the steam generation system. Because of this, it appeared that a master plan needed to be developed to determine the least costly means to ensure continued operations. Many pieces of major equipment and a number of critical systems will need to be replaced in the next 10 years. The plan identified these needs and will allow funding to be allocated to these projects in manageable portions. The addition of a new, natural gas and fuel-oil-fired boiler, funded as a 1998 LI, heads the list of projects which have been identified thus far. Once this boiler is in place and on-line, plans are that a gradual step-by-step conversion will occur, with natural gas becoming the primary fuel once more. The adoption of this firing strategy will eliminate the need to upgrade systems such as the Coal Yard Runoff Facility, the electrostatic precipitator, coal handling systems, and ash removal and disposal systems. The result should eventually be lower operating cost and significant capital cost avoidances from not having to repair and replace these major systems.

A number of projects are also underway or will be in the upcoming years. Funding has been allocated to replace the economizers on boilers 2 and 3, and work is expected to be completed in the early fall of 1998. The economizers are a key component of the boiler feedwater system. Situated in the flue gas stream coming out of the boiler firebox, boiler feedwater passes through these heat exchangers and is preheated before entering the water side of the boiler. The existing economizers on boilers 1, 2, 3, and 4 are 20 years old and have been experiencing an increased tube failure rate. After the two are replaced this year, it is planned that additional funding can be applied to replacing the two remaining units in FY 1999.

Another issue that is critical to providing a reliable and efficient source of steam to the Laboratory is that involving a secondary fuel source. When the new boiler 6 is complete, the Steam Plant will be capable of providing all of the Laboratory's steam needs using natural gas as its primary fuel and fuel oil as its secondary, or backup, fuel source. A constraint to using fuel oil exclusively as a backup fuel currently exists and will be addressed in a GPP project in FY 2000. An additional fuel oil storage tank will be constructed at the Steam Plant to provide sufficient on-site resources to allow reliable use of fuel oil as a primary fuel during worst-case weather events that cause the primary natural gas supply to be cut back or curtailed. Initially identified as a 500,000-gal tank, the logic surrounding this decision is being examined to consider tank turnover rates. We must have sufficient "normal" use from the tank

to allow the fuel to stay fresh. If fuel oil is allowed to sit in storage tanks for long periods, condensate accumulates in the bottom of the tank, and an ideal environment for the growth of algae and some forms of bacteria is created. When fuel oil is pumped out of a tank that contains these contaminants, filters or fuel nozzles on the boilers can clog, effectively shutting off the fuel supply until they can be cleaned. Therefore, current planning may call for a tank capacity on the order of 250,000 gal.

3.3.4.7 Industrial Gases

Industrial gases used at ORNL facilities are provided in refillable containers by vendors from the local area. These gases include nitrogen, argon, helium, acetylene and other specialty or high-purity gases required for laboratory and industrial-type uses. Gas cylinders are received at Central Stores and are distributed to the various user stations as requested. Many facilities have gas manifold systems which allow distribution of the gases to many users throughout the facility, while other facilities rely on a system whereby individual users are responsible for their own gases. Liquid nitrogen is an important resource to many facilities throughout the Laboratory. Bulk liquid nitrogen is delivered to the Laboratory by a vendor and transferred to a bulk storage tank which delivers it to individual users, either into bulk storage tanks or transportable Dewars.

The Laboratory maintains a storage facility for compressed gas cylinders which is physically removed from adjacent buildings. Safety assessments have been performed on this facility which helped determine stocking levels of hazardous and flammable gases. Stocks of these types of materials are maintained in the facility at these minimum levels to help ensure minimal impact in the event of an accident.

3.3.4.8 Heating, Ventilation, and Air Conditioning

The HVAC design in each building depends on the specific features of each building (e.g., the energy produced by equipment operated within the building and the likelihood of airborne contamination being released in the building). Large computer installations and certain other instruments must be housed in an area with low temperature and relative humidity. Most buildings in Bethel Valley are heated using steam from the Steam Plant. Remote facilities in Melton Valley and Copper Ridge have electric space heaters. Away from the area served by the chilled-water system, air conditioning is provided by electric units. Larger facilities may have their own chillers to be used for space and equipment cooling. Smaller facilities utilize either residential-type central units, through-the-wall units of the type found in motels, or window units.

Ventilation exhaust systems in laboratories, hot cells, and other facilities prevent human exposure to toxic and radioactive fumes, gases, and particulates. Many of the ventilation systems that exhaust radioactive containment areas have been upgraded by replacing corroded mild steel ductwork with stainless steel ductwork. Exhaust stack linings are made from materials that are not easily susceptible to corrosion. Radioactive containment ventilation systems at ORNL may use chemical recombiners, liquid scrubbers, charcoal filters, and high-efficiency particulate air (HEPA) filters to remove radioactive contamination from the air,

which is then released to the environment through an exhaust stack. Contaminated absorbers and filters are disposed of as low-level radioactive waste. Five of the six major exhaust stacks are equipped with emergency diesel-powered or steam-driven blowers, in addition to the electric blowers, to provide for continued building ventilation in the event of an electrical power outage. All of the exhaust stacks are monitored. Personnel working in containment areas are monitored and are provided the appropriate protection in the form of personal protective equipment or administrative controls. Some of the air monitoring equipment has local alarm capability, while others are alarmed both locally and at a central location in Building 3130 or at the Shift Superintendent's Office in Building 4512. A project was completed in FY 1997 which cleaned perchloric acid residue from ventilation hoods and ductwork.

Issues involving indoor air quality and "sick building syndrome" are becoming increasingly important and will impact Laboratory operations in the future. Many of the facilities at ORNL are over 40 years old. Ventilation systems in the buildings were not designed to be easily cleaned or maintained and are now coated with dusts, molds, allergens and other contaminants. Indoor Air Quality legislation is currently being considered for inclusion in the Occupational Safety and Health Act of 1970 (OSHA) safety and health standards. Should legislation be passed, ORNL may be required to upgrade or replace many of the building ventilation systems currently in use. Ductwork will need to be replaced or cleaned, humidification and dehumidification systems installed and building air intakes will need to be relocated or otherwise modified. Even without the legislation, as a part of the Laboratory's efforts to provide a safe work environment, indoor air quality issues will continue to gain importance. It has been proven that there is a definite link between how well people feel and perform and the general overall "health" of the buildings in which they work and live. To avoid excessive liability, the Laboratory considers building health as an important component of its overall facility management strategy.

3.3.4.9 Stormwater Collection System

The stormwater collection system consists of drainage ditches, catch basins, manholes, and collection pipes which convey stormwater, condensate, and cooling water flows to the receiving streams. White Oak Creek traverses the site and ultimately receives all the discharges from the Laboratory as well as normal flows from the four tributaries which feed it. Rainfall, snow-melt and other authorized flows are directed to the gravity-drainage system which conveys the water from buildings, parking lots, streets, and roofs to specific outfalls. The collection system itself was installed in an unplanned manner over the years as the Laboratory developed and matured, which has resulted in the existence of 146 National Pollutant Discharge Elimination System (NPDES) Permitted stormwater outfalls discharging into the receiving streams. To comply with current stormwater regulations and the Laboratory's NPDES Permit, each of these outfalls must be periodically sampled and characterized to determine the makeup of the discharge stream and to ensure that it complies with permit parameters.

Significant effort must be expended to keep up with compliance-related issues associated with these outfalls and their discharges. During the last two years, two liquid-feed dechlorinators

have been installed on outfall pipes that carry large volumes of once-through cooling water. Smaller, tablet-feeder dechlorinators have also been installed on numerous outfalls that convey smaller continuous or periodic flows of cooling water. Due to the strict in-stream chlorine concentration limits imposed on the Laboratory by the NPDES Permit, it is imperative that these wastewater streams are chlorine-free prior to their discharge.

A comprehensive storm drain survey was completed at ORNL in the summer of 1997. This survey was mandated by a court order that resulted from the Friends of the Earth vs DOE lawsuit. It consisted of a comprehensive survey of all pipes, sinks, and other connections to the storm drain system. Facility managers, subject matter experts, and members of the support services staff walked-down and dye-checked all the drains in 846 facilities, buildings, and other structures located within the ORNL Complex. The results of this survey have been used to eliminate inappropriate discharges into the stormwater system and to identify sources of once-through cooling water that can be treated, rerouted, or eliminated. Dechlorinators are being used to eliminate chlorinated discharges, but because of the costs involved in the maintenance and upkeep of these units, substantial efforts are being made to eliminate the source of the discharge itself. Through these efforts it is hoped that compliance can be consistently achieved with a minimum of expense and effort.

Other efforts to improve the system are also being pursued. In many areas, pipe elevations and receiving stream flows have made it impossible to obtain representative samples of flows in the discharge pipes. Modifications are being made to many pipe systems to improve configurations and allow accurate sampling to take place. In other areas, sampling wells are being installed in the pipe itself to allow improved access to the pipe. In all areas, the Laboratory has adopted a “best management practices” approach as an economical and practical way to achieve compliance. A Stormwater Pollution Prevention Plan describing these practices has been developed and is serving as guidance to help identify potential problem areas and to recommend possible mitigating actions that can be taken to avoid permit noncompliances.

3.3.4.10 Telecommunications

Telecommunications on the ORR are provided by the Oak Ridge Federal Integrated Communications Network (ORFICN) managed by U S WEST Communication Federal Services, Inc., for DOE. A system of buried cable, repeater lines, and subscriber line carriers connects the facilities on the ORR with DOE's fiber-ring supported network and switching system. Most of the main stations and extensions on the Official Oak Ridge Telephone System can access the Oak Ridge and Knoxville calling areas, and many can access the Federal Telecommunications System (FTS). Non-FTS (commercial) long-distance traffic is provided by FTS-2000-AT&T.

In 1997, installation was completed on an AT&T 5ESS switching system at the Y-12 Plant with nodes at the Federal Building, ORNL, ETTP, and the Office of Scientific and Technical Information. The 5ESS machine was installed with initial capacity to serve 22,500 total customer lines with ORNL equipped for 7,500 lines. The switching system can be expanded to a total 37,000 lines. (Currently, 30,000 telephone numbers are available in the 241, 574, and 576 prefixes.) The system and the network will support traditional analog telephone lines,

Integrated Services Digital Network telephone lines, basic Caller ID and other calling features, and DS1 and DS0 Special Circuits. Also, the 5ESS and the fiber-ring network components conduct self-fault location and system configuration functions that will automatically identify faulty equipment, remove it from service, notify maintenance for repairs, assist in diagnosing the fault, and confirm the repairs. Additional carriers can be added to the system to accommodate customer demand.

Computer communication on the ORNL site is generally accomplished by Ethernet-based local area networks (typically serving a building or a section of a building) interconnected by a fiber-optic cable system installed in the early 1990s. Data communications to other ORR sites is accomplished via a fiber-optic cable "triangle" (ORNL, Y-12, and ETTP) that was installed by U S WEST as part of the ORFICN. External communications links to ORNL include Energy Sciences Network (ESnet), DOE Business Network (via ORO), and The University of Tennessee, Knoxville (via 155 Mbps, ATM link).

Video services are available via a coaxial cable television system installed in 1983. This system allows selected conference rooms to be both sending and receiving locations. The system is interconnected to other ORR sites via the same fiber-optic "triangle" used by data communications services. In addition to providing the capability for local programs (e.g., "live" meetings), this system is connected to a satellite dish for receiving remote broadcasts; furthermore, it has the capability to provide programming over the Internet via MBONE.

ORNL uses "supervised" leased telephone lines for the communication of security alarm signals. Voice communications are handled via radio and telephone. Radio communications are enhanced by using repeater stations located at Melton Hill, Building 3017, and Chestnut Ridge. In addition, the repeater at 3017 has a telephone interconnect that allows telephone calls to be placed from field radios. Normal communications are open; coded communications can be used in an emergency, but this capability is available only on selected radios and is subject to an "encryption delay."

3.3.5 Transportation Infrastructure

ORNL Main Site locations are accessible only by road. Although portions of the site border the Clinch River, there is no barge facility; such a facility could be developed if future operations warrant. Vehicle circulation at ORNL may be divided into two sectors: off-site and on-site circulation. Off-site circulation consists of staff movements to and from work and between the various Oak Ridge installations on work assignments and of materials delivery. Off-site roads include State Route 95 (White Wing Road), which provides access to the west end of the Bethel Valley area, and State Route 62 and Scarboro Road, which provide access to the eastern end of Bethel Valley and the ORNL facilities at the Y-12 Plant. On-site circulation consists of materials handling, movement of personnel between buildings and to and from parking lots, and contractor and vendor personnel movement.

Principal roads serving ORNL's Bethel Valley site are shown in Fig. 3.1. The main road is Bethel Valley Road. This east-west road provides access to the site and leads to all of the

parking lots. Completion of several construction and expansion projects has helped alleviate some of the chronic parking problems experienced at the Bethel Valley site. On-site transportation is provided by several main roads and access roads. The primary north and south corridors are First, Second, Third, Fourth, and Fifth streets. The major east and west corridors are White Oak and Central avenues. Materials are transported via the same route used by employees and visitors.

The main roads in Melton Valley are Melton Valley Drive, Ramsey Drive, and Melton Valley Access Road (Fig. 3.2). These roads lead to the principal experimental facilities, including the HFIR, the Consolidated Fuel Reprocessing Center, and the Robotics and Process Systems Complex. Several other access roads serve the numerous Solid Waste Storage Areas (SWSAs).

Copper Ridge has one main route, Gravel Hill Road, which connects the DOSAR Facility and the Tower Shielding Facility to State Route 95, a road located at the western end of the ORNL site. These roads are shown in Fig. 3.3.

By far, the largest portion of off-site traffic circulation generated by ORNL is personnel commuting to and from work. The average commute of an ORNL employee working in Bethel Valley is about 35 miles. Peak traffic occurs between 7 and 8 a.m. with the arrival of workers at the site and between 4 and 5 p.m. with their departure. Minimal traffic delays are experienced during these peaks since work shifts are staggered, car and van pooling are practiced, and most deliveries to and shipments from ORNL are timed to avoid the rush hour. Road maintenance and the movement of heavy equipment or escorted shipments typically occur during the work day after traffic flow has subsided.

ORNL's Life Sciences facilities at the Y-12 Plant can be reached from Bear Creek Road at the North Portal, via Guard Portal 25 (Fig. 3.4). Second Street is the primary east-west corridor that runs in the vicinity of the other ORNL facilities. Most of the buildings can be accessed via Guard Portal 32. The main roads connecting the ORNL Main Site with the Y-12 Plant are Scarboro and Bethel Valley roads.

3.3.6 Security

The objective of the ORNL Office of Laboratory Protection is to implement appropriate security measures needed to protect against events that may cause adverse impacts on national security, the environment, the health and safety of Laboratory employees and the public, while maintaining an environment conducive to research and the efficient operation of the installation.

3.3.6.1 ORNL Protection Strategy

ORNL protection strategies establish concentric layers of increasing security measures, starting at the Laboratory’s outer boundary and moving inward toward the special nuclear material storage, handling, and processing facilities. This defense-in-depth concept achieves a progressively higher probability of deterring or detecting hostile acts, as well as increasing difficulty and delay in perpetrating these acts as an adversary approaches ORNL’s interior

target areas. This concept relies on a graded approach to establish five types of security areas:

Material Access Area (MAA): Area where Category 1 and 2 quantities of special nuclear material is processed, used, or stored. MAAs are located within a Protected Area, have additional access controls, and are defined by physical barriers. Access to an MAA requires a Q clearance and special approval.

Protected Area: Area which contains Category 1 and 2 quantities of special nuclear material and is protected by physical barriers such as walls and fences. Access to a Protected Area requires a Q clearance and special approval.

Limited Security Area: Area which is approved for the storage and processing of classified matter and Category 3 quantities of special nuclear material. An L or Q clearance is required for unescorted access within these areas, which are generally located within buildings but may also be located within areas surrounded by security fencing.

Property Protection Area: Security area having boundaries identified with barriers and access controls for the protection of DOE property. Uncleared personnel with proper identification (a DOE photo-identification badge or ORNL Visitor Identification) may have unescorted access.

ORNL has only a few facilities that house special nuclear material and thus require the extra protection and more limited personnel access provided by a Limited Security Area or Protected Area. Activating the intrusion alarm systems in these areas will initiate a tactical response from the ORNL Protective Force within a predetermined period. Special nuclear material located in ORNL facilities is provided a level of security commensurate with its quantity and attractiveness level. Additional perimeters and intrusion detection systems protect these few dispersed facilities; however, these barriers do not significantly inhibit land use or disrupt circulation.

Classified matter is stored and processed in Limited Security Areas. Access to these areas is limited to L- or Q-cleared individuals or people accompanied by authorized escorts. Classified areas have been developed, when required, to support various classified projects using the "security island" concept. This concept ensures that only the physical space required for the classified work receives the necessary additional restrictions and increased level of protection.

Most of ORNL is a Property Protection Area. To enter a Property Protection Area, employees and visitors must wear identification badges, but they do not have to possess a security clearance. No classified matter may be stored in these areas, nor may classified subjects be discussed. Property Protection Areas are generally defined by perimeter chain-link fences and have access points called portals that are controlled by the ORNL Protective Force or badge-reader-operated turnstiles.

Fencing and Other Barriers. The most common perimeter security barrier currently used at ORNL is chain-link fencing. When fencing is used without intrusion-detection devices, it has limited ability to detect unauthorized entry. A more effective physical barrier can be the

walls of a building. Most wall materials are more solid and difficult to penetrate than the fence fabric; however, these materials must be carefully selected and properly designed when used as a security barrier.

Portals. Portals at ORNL are controlled by Security Police Officers, Security Officers, badge-reader-operated turnstiles, or administratively controlled by signage. Vehicular access during off hours (after 6:00 p.m.) is restricted to one portal. Vehicular access to secured areas during the off-shift can be coordinated with the ORNL Protective Force.

Lighting. Protective illumination is provided to permit detection and assessment of adversaries and to reveal unauthorized persons.

3.3.6.2 ORNL at the Y-12 Plant

The Y-12 Plant also operates under a graded response and defense-in-depth security concept. All of the ORNL facilities at the Y-12 Plant except Building 9204-3 are in the Property Protection Area. This access area comprises the eastern and the extreme western portion of the Y-12 Plant and contains security fences, gates, and portals that control access and prohibit movement of unauthorized persons into areas with higher levels of security.

Building 9204-3 is located within the Y-12 Plant Protected Area. In this area, Security Police Officers from the Y-12 Protective Force and other internal controls are used to prevent access to classified matter and special nuclear material by unauthorized persons. A Q clearance is required for unescorted access to this area.

3.3.7 Environment, Safety, and Health

ORNL is committed to excellence in all activities and to cost-effective operation in compliance with all applicable ES&H laws and regulations.

The *ES&H Management Plan* describes the approach used at ORNL to ensure the health and safety of employees and the public, protect the environment, and comply with applicable DOE policies and orders and other ES&H requirements. The plan documents the systems and processes used by ORNL to (1) establish and communicate ES&H expectations to the ORNL community, (2) identify and secure funding for ES&H activities using risk-based planning and priority setting, (3) conduct R&D activities and operations through integration of ES&H principles in work planning and execution, and (4) assess ES&H performance and provide feedback to promote continuous improvement. As noted, this plan will be upgraded to become the basis of the *Integrated Safety Management Plan* for ORNL.

A Risk Ranking Board, established in FY 1998, ensures that ES&H issues receive appropriate attention and consistent funding consideration. The board uses consistent criteria to promote the effective use of resources through risk-knowledgeable operations management. Its work replaces multiple prioritization processes that were often in conflict with established funding mechanisms. The ORNL Risk Ranking Board ranked all ES&H and quality (ESH&Q) overhead tasks for FY 1998 and FY 1999, ensuring that all needs are identified and balanced. The ORNL integrated planning process will use the board results, thereby ensuring that

ES&H considerations are a part of every ORNL project and activity and that consistently prioritized needs are integrated into all decisions.

3.3.7.1 Regulation of ORNL Operations

In accord with its operational imperatives, ORNL works with DOE to ensure that its facilities are operated in a safe and environmentally responsible manner. Work Smart Standards address the operation of most facilities at ORNL. These standards incorporate, by reference, regulations and standards established by standards committees, regulatory bodies, and agencies "external" to DOE. Standards/Requirements Identification Documents remain in effect for some facilities and activities, and Appendix E of the contract between DOE and LMER contains requirements for a few areas (e.g., security, accounting). Nuclear activities at ORNL are carried out in accordance with the requirements of the Price-Anderson Amendments Act. In addition, various aspects of ORNL's operations are carried out under the oversight of the EPA, the U.S. Department of Transportation (DOT), the Tennessee Department of Environment and Conservation (TDEC), and other external agencies. These forms of regulation assist ORNL in fulfilling its operational imperatives and conducting its mission activities in accordance with DOE policy.

DOE is exploring the desirability of moving toward external regulation of work safety and nuclear facility safety at its facilities. A pilot study of regulation of workplace safety by OSHA has been conducted at DOE's Argonne National Laboratory, and DOE is now working with OSHA on a pilot project at ORNL. A pilot program to simulate oversight of DOE nuclear facilities by the Nuclear Regulatory Commission (NRC) is under way; ORNL's REDC is one of three facilities in this program. A report on the REDC pilot program was scheduled to be completed in July 1998.

As DOE continues its exploration of external regulation of its facilities, several key issues must be resolved. In general, external regulation needs to be a substitute for, rather than an addition to, current forms of regulation. The appropriate regulatory body or bodies—NRC, OSHA, or state governments—must be identified for DOE facilities. The costs associated with transition to external regulation must be identified and a plan developed to ensure that they can be met without negative effects on DOE mission needs. A specific problem for ORNL will involve interfaces with other DOE contractors (e.g., Lockheed Martin Energy Systems, Inc., and Bechtel Jacobs Company LLC). The plan must define the specific roles of all contractors involved with facilities on the ORNL site.

3.3.7.2 Industrial Safety and Health

The purpose of site-wide programs for health physics, industrial safety, and industrial hygiene is to promote the continued safety of workers, to avoid accidents, and to prevent adverse impacts on the local and off-site environment. Safety programs are administered by capable safety and health professionals (i.e., industrial hygienists, health physicists, and nuclear safety and industrial safety personnel) for various functions at ORNL-owned facilities.

Safety at ORNL can be separated into two classifications. The first deals with standard health

and safety issues inherent in most laboratory and industrial operations. The second classification deals with the health and safety issues that are unique to ORNL facilities. Safety groups are established in decentralized locations to provide more timely and facility-specific response to individual facility needs.

3.3.7.3 Hazardous Material Transportation, Storage, and Handling

Many buildings at ORNL receive, store, or use hazardous materials or chemicals. Storage of chemicals is typically limited to amounts that can be used in short periods and involve small amounts or consumer volumes, defined as laboratory quantities, which if suddenly released, would have no measurable off-site impact. Larger volumes of hazardous materials may be stored in bulk at various locations. Only two facilities have been identified as bulk storage areas, and neither poses any off-site release impact. The refueling station is the primary location where large volumes of hazardous fuels and oils are stored. It is separated from other facilities by sufficient distance to minimize any on-site or off-site impact from an inadvertent spill, release, or fire. The Materials Receiving Area provides large capacity storage for compressed gases used throughout ORNL. Gas cylinders are properly secured to prevent inadvertent tipover accidents, and hazardous gases are segregated to prevent the formation of toxic chemical combinations. Transportation of hazardous materials and chemicals is typically performed by the ORNL shipping and receiving function according to all applicable DOT regulations. Safety analysis studies have been completed for on-site transportation and show negligible risk due to small volumes of properly packaged hazardous materials moving at or under on-site speed limits.

Chemicals and radioactive materials in transit within the ORR are packaged in accordance with DOT regulations and are not considered capable of creating an off-site release of hazardous materials. Moreover, receipt, handling, and storage of bulk chemicals is not expected to affect facility operations. Efforts have been made to minimize the probability of these types of accidents so that the potential for off-site releases from the affected facilities is minimal.

3.3.7.4 Fire Protection

ORNL maintains a fully staffed and equipped fire department to respond to fire and other general emergencies. A comprehensive looped proprietary alarm system covers the ORNL facilities. ORNL facilities at the K-25 Site and the Y-12 Plant are provided fire and emergency response by on-site fire departments. The ORNL Fire Station, located in Building 2500 near the western end of the Bethel Valley site, provides a central alarm signal response area and emergency equipment, including fire and rescue equipment and ambulances. A second response location is provided at Building 4512, the Laboratory Emergency Response Center. Most ORNL buildings are equipped with a fire protection system that includes a fire detection system, a fire alarm, an evacuation system, and sprinklers.

National and State of Tennessee codes and consensus standards require a rigorous Inspection, Testing, and Maintenance (IT&M) program of fire alarm and protective systems. The Fire Protection Systems Section performs and/or coordinates systems IT&M or repairs of all site

fire systems.

Fire Protection Engineering reviews all engineering plans to ensure that fire codes and applicable DOE orders are met. For example, buildings are required to be spaced 50 or more ft apart to prevent a fire in one building from involving its neighbor. Buildings erected with less than 50 ft of separation must share fire detection and alarm systems. In addition, buildings may not be built more than three stories high because of limitations in the fire response equipment. Codes also require that roads to buildings be constructed with the capability to support the emergency response and fire equipment.

The system that supplies water for fire protection is generally adequate. However, a small percentage of the system has deficiencies due mostly to age. System weaknesses include (1) old deteriorated water lines that are likely to cause an impairment; (2) an inadequate number of sectional valves to isolate an impairment; (3) inadequate flow capacity at hydrants because of short run lengths; (4) dead-end lines without loops; and (5) insufficient lines to adequately service developing sites.

3.3.7.5 Unique Facilities

ORNL has a number of unique experimental and production facilities that involve nuclear or other hazardous materials. Each of these facilities has engineered barriers and/or administrative safeguards that minimize the probability of an incident that could lead to a dangerous release beyond the facility walls or off-site and impact facility siting. Because many of these facilities were constructed according to standards and codes in effect many years ago, the managing contractor is performing a comprehensive safety evaluation of all facilities through the Safety Analysis Report Update Program (SARUP).

SARUP consists of several phases of upgrades to the facility safety documentation. The first phase, completed in 1989, was to evaluate the risk of acceptability of ongoing operations. SARUP then reviewed all ORNL facilities for hazard screening and categorization. The more hazardous facilities received detailed hazard evaluation and documentation. Information from this work was applied to interim upgrades of the facilities' operational controls; these were typically documented in DOE-approved, Operational Safety Requirements documents. Facilities with radioactive inventory were also categorized in accordance with DOE-STD-1027-92. This standard directs the categorizations based on radioactive material inventory and relates that inventory to the potential for significant off-site, significant on-site, or only significant localized consequences for the Category 1, 2, and 3 designations, respectively. Basis for Interim Operation (BIO) documents were created and approved by DOE for those facilities that were determined to be Category 1, 2, or 3 nuclear facilities. BIO documents establish the safety basis for current facility operations and operational controls until more detailed safety documentation that is compliant with the DOE orders for Safety Analysis Reports (SARs) and Technical Safety Requirements (TSRs) is developed and approved by DOE. These SARs and TSRs are being prepared for the ORNL nuclear facilities with the last SAR and TSR scheduled to be submitted to DOE by December 1999. As the SARs are approved and implemented, they will be maintained by annual updates and by the Unreviewed Safety Question Determination program (reference DOE Order 5480.21).
The facilities at the ORNL site that have been categorized as Category 1, 2, or 3 nuclear

facilities are identified on an ORNL Web site. This listing is maintained current as the mission and, therefore, the hazards and categorizations, change. ORNL has one Category 1 facility, which is the HFIR. Facilities other than the Category 1, 2, and 3 nuclear facilities are classified as “Other Industrial” hazard facilities (or the older terminology of “Generally Accepted” hazard facilities). DOE’s Office of EM also specifies the category of “Radiological” for facilities with significant radioactive inventory but less than the Category 3 threshold. These EM facilities at ORNL have been identified. ORNL has no facilities with chemical hazards that exceed the threshold levels to require implementation of OSHA’s Process Safety Management rule (29 CFR 1910.119) or the EPA’s Risk Management Plan rule (40 CFR 68).

3.3.8 Waste Management and Environmental Issues

In December 1997, DOE-ORO announced that Bechtel Jacobs Company LLC had been awarded the contract for management of all EM program activities. In this role, Bechtel Jacobs Company assumes responsibility for the waste management, environmental restoration, technology deployment, and enrichment facilities programs at all DOE-ORO sites (ORNL, Y-12, ETTP, Paducah, and Portsmouth). The contract is performance based with a minimum 5-year performance period and is to focus on an "exit strategy" for accelerated remediation of the hundreds of contaminated sites covered by the EPA's Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) program. The contract also stipulated that Bechtel Jacobs Company is to significantly reduce the size of the base program staff and utilize outside subcontractors to the maximum extent possible. This shift of work force from Lockheed Martin to Bechtel Jacobs Company and to outside subcontractors is to occur over a 2-year transition period. For ORNL, it is expected that this shift in funding could result in a reduction of over $100M in LMER base support during that period, with an associated staff impact of several hundred employees.

For ORNL, the biggest impacts associated with this change in EM contracting approach will be in loss of technical and overhead staff workload resulting from the shifting of work scope to subcontractors. These impacts have been minimized for the FY 1998 budget year by Bechtel Jacobs Company through continuation of essentially all current LMER-supported EM activities by LMER staff. This is particularly critical in the areas of waste management, Molten Salt Reactor Experiment (MSRE) remediation, Gunite Tanks remediation, and facilities surveillance and maintenance. However, no long-term commitments for these projects have been made by Bechtel Jacobs Company and, in fact, some efforts are already underway in outsourcing of waste management and facilities surveillance and maintenance for FY 1999. ORNL and DOE-EM management are working diligently to reach policy decisions on ORNL’s long-term responsibilities for the newly generated waste streams and to ensure a smooth transition of the ORNL work force over the next few years.

In addition to the work scope and work force transition issues, significant focus will be on ensuring protection of the ORNL mission, work force, and Laboratory environment as full-scale remediation in both Melton and Bethel valleys gets underway in accordance with the accelerated Bechtel Jacobs Company plans.
A number of periodic interface meetings have been established to promote coordination of activities on the ORNL site. Senior management from LMER, Bechtel Jacobs Company, and

the DOE program office meet weekly. Biweekly program meetings are also held with contractor and DOE program and site office participants. Weekly coordination meetings are held with Plant and Equipment (P&E) Division management and Bechtel Jacobs Company project personnel. A monthly contractors' forum is also held to review ESH&Q issues. Bechtel Jacobs Company, LMER, and LMES provide representatives on the Reservation Management Organization, an organization responsible for oversight of operational interfaces across the ORR. The EM Baseline for Management and Integration (M&I) Projects at ORNL can be accessed on the World Wide Web at URL http://www-internal. ornl.gov/ ER/baseline_management/em_baseline.html.

To facilitate the accomplishment of their contractual responsibilities, facilities that have been accepted into the EM program and those that are part of the waste management systems to be managed by the EM contractor have been transferred to Bechtel Jacobs Company. Figs. 3.9, 3.15, and 3.16 show the facilities transferred to Bechtel Jacobs Company, and Table 3.4 provides a list, which is still being reviewed and will be updated as necessary to reflect contractual responsibilities of the specific contractor.

3.3.8.1 Waste Management

The mission of the waste management program is to provide quality waste management capability and protect human health and environment in compliance with applicable regulatory requirements and improved operating procedures.

ORNL's wastes are managed in seven categories: conventional, low-level radioactive, hazardous, mixed, toxic, transuranic, and classified. This section discusses the sources of these wastes and the facilities for treatment, storage, and disposal.

A number of ORNL's operations produce low volumes of wastes; the aggregate amount for the Laboratory, however, is substantial. A large percentage of the radioactive and hazardous waste comes from remediation and demolition projects. Indeed, ORNL has 380 sites that are contaminated to the extent that they require monitoring and remediation. Previously, these sites were grouped into 20 Waste Area Groupings to organize waste management activities. Currently, environmental restoration and waste management activities are organized on a watershed basis across the ORR (Fig. 3.17). Off-site contamination as a result of ORNL operations is also a concern.

3.3.8.1.1 Conventional Waste

Conventional wastes include industrial wastes, sanitary sewage, process wastewater, and stormwater. Solid conventional wastes are regulated by the Tennessee Solid Waste Management Act. In 1991, an estimated 115,000 lb of such waste was disposed of by ORNL.

Industrial Wastes. Industrial trash consists of paper, garbage, wood, metal, glass, plastic, demolition and construction debris, sanitary and food wastes from cafeteria operations, sludge from water and air treatment, and other special wastes. The Y-12 Plant Centralized

Fig. 3.15

Fig. 3.16

Table 3.4 - Management and Integration (M&I) Contractor Facilities as of 8/31/98

Building	Program	Description
00814	EM40	Trailer in 0800 Area
00830	EM40	White Oak Creek Embayment Structure
00857	EM40	Goat Building in 0800 Area
01001	WM	SWSA 3 Burial Grounds
01554	WM	Contractor Land Fill
02026A	WM	LLLW Collection Tank at 2026
02032	WM	Manhole 240
02034	WM	Manhole 95
02099	WM	MCS for Building 2026
02101	WM	Health and Hygiene Change House
02531	WM	Radioactive Waste Evaporator
02532	WM	Waste Storage Cooling
02533	WM	Cell Vent Filter
02534	WM	Off-Gas Filter Pit
02535	WM	Cooling Tower
02537	WM	Evaporator Service Tanks
02539	WM	Cooling Tower
02568	WM	Cell Vent & Off-Gas Filter, Facilities for 2531, 2337
02600	WM	Bethel Valley Storage Tanks
02624	WM	SWSA 1 Burial Grounds
02647	WM	Triple Wide by Steam Plant
02649	WM	Transported Waste Receiving Facility
02650	WM	Evaporator Chemical Shed
02651	WM	2600 Area Emergency Generator
02657	WM	Manhole 243
02658	WM	F-4005 Monitor Station
03001	EM40	Graphite Reactor Building
03001B	WM	LLLW Collection Tank (Inactive)
03002	EM40	Filter House for Graphite Reactor (3001)
03002A	WM	Drain Tank South of 3002
03003	EM40	Fan House for Graphite Reactor (3001)
03003A	WM	Drain Tank South of 3003
03004B	WM	Inactive LLLW Collection Tank 3004B
03005	EM40	Low Intensity Test Reactor
03009	EM60	Bulk Shielding Facility (BSF) Pumphouse
03010	EM60	Bulk Shielding Facility
03013	WM	LLLW Collection Tank
03018	EM40	Stack for Graphite Reactor (3001)
03019B	EM60	High Radiation Level Analytical Facility
03023	WM	North Tank Farm
03026C	EM60	Krypton-85 Enrichment Facility
03026D	EM60	Metal Segmenting Facility
03028	EM40	Alpha Power Facility

Table 3.4 - Management and Integration (M&I) Contractor Facilities as of 8/31/98

Building	Program	Description
03029	EM40	Source Development Laboratory
03030	EM40	Radioisotope Production Laboratory
03031	EM40	Radioisotope Production Laboratory
03032	EM60	Radioisotope Production Laboratory
03033	EM40	Radioactive Gas Processing Facility
03033A	EM40	Radioactive Production Laboratory Annex
03034	EM60	Radioisotope Area Services Building
03038AHF	EM60	Alpha Handling Facility
03038E	EM60	Isotope Materials Laboratory
03038M	EM60	Radioisotope Packaging and Shipping Facility
03039	WM	Central Radioactive
03042	EM40	Oak Ridge Research Reactor (ORRR)
03077	WM	Air Cooler - Low Intensity Test Reactor
03082	WM	Data Concentrator #2
03083	EM40	ORRR Neutron Spectrometer Station
03085	EM40	ORRR Primary Pumphouse
03085A	EM40	ORRR Demineralized Water Holding Tank
03085B	EM40	ORRR Demineralized Water Holding Tank
03086	EM40	ORRR Pool Cooling Tower
03087	EM40	Heat Exchangers for ORRR (3042)
03089	EM40	ORRR A/C Cooling Tower
03092	WM	Off-Gas Scrubber
03093	EM60	Krypton Storage Cubicle
03098	EM60	BSF Filter Facility
03099	EM60	Storage Pad
03102	EM40	ORRR Heat Exchanger Pit
03103	EM40	ORRR Main Cooling Tower
03105	WM	LGWOD Health Physics Office
03106	WM	4500 Area Filters
03107	EM40	ORRR 25-Meter Target House
03109	EM40	ORRR Process Off-Gas Filter Pit
03110	WM	Cell Vent Filter for Radioisotope Area
03116	EM40	Nitrogen Storage Building North Tank Farm
03117	EM60	BSF Cooling Tower
03117A	EM60	Sulfuric Acid Tank
03118	EM60	Radioisotope Production Laboratory - H Building
03119	EM60	Heat Exchanger and Pumphouse
03125	WM	3039 Stack Area
03126	EM40	ORRR Normal Off-Gas Filter Pit
03127	WM	LGWOD Storage Building
03130	WM	Waste Operations Control Center
03133	WM	BV Valve Box 1a
03139	EM40	ORRR Cell Vent Filters
03145	WM	LLLW Storage Building

Table 3.4 - Management and Integration (M&I) Contractor Facilities as of 8/31/98

Building	Program	Description
03151	WM	Manhole 25
03154	WM	Manhole 112
03155	WM	Manhole 114
03158	WM	North Monitoring Building
03159	WM	South Monitoring Building
03502B	WM	Data Concentrator #4
03505	EM40	Metal Recovery Facility
03507	WM	South Tank Farm
03513	WM	Waste Holding Basin
03515	EM40	Fission Product Pilot Plant
03517	EM60	Fission Products Development Laboratory
03518	WM	Neutralization Plant
03518A	WM	LGWOD Spare Parts
03524	WM	Equalization Basin
03535	EM40	Filter Enclosure in South Tank Farm
03539	WM	190 Pond #1
03540	WM	190 Pond #2
03544	WM	Process Waste Treatment
03544B	WM	Process Waste Treatment
03594	WM	Waste Operations
03608	WM	Nonrad Wastewater
03613	WM	Diversion Box Monitoring Station
03614	WM	Manhole 190
03615	WM	Manhole 235
03616	WM	Manhole 149
03617	WM	Manhole 229
03618	WM	Pumping Station Tanks WC-10, 11, 12, 13, 14
04003	WM	SWSA 2 Burial Grounds
04007	WM	Waste Operation Support Facility
04507	EM40	High Level Chemical Development Lab
04556	EM40	High Level Chemical Development Lab Filter Pit
06556A		Office Trailer-Put into PRISM, Never C or M+E25
06556B		Office Trailer
06556C	WM	Contractor Trailer
06556D	WM	Contractor Trailer
06556G	WM	Contractor Trailer
06556J		Close Support Lab - Sample Preparation
06556K		Close Support Lab - Counting Facility
06556L		Close Support Lab - Special Techniques
06556M		Close Support Lab - Sample Kit Preparation
06556R		Office Trailer - 2 Person
06556S	WM	Contractor Trailer
06556ST1	WM	Contractor Trailer
06556ST2	WM	Contractor Trailer

Table 3.4 - Management and Integration (M&I) Contractor Facilities as of 8/31/98

Building	Program	Description
06556ST3	WM	Contractor Trailer
06556ST4	WM	Contractor Trailer
06556ST5	WM	Contractor Trailer
06556ST6	WM	Contractor Trailer
06556ST7	WM	Contractor Trailer
06556ST8	WM	Contractor Trailer
06556ST9	WM	Contractor Trailer
06556T	WM	Contractor Trailer
07002A	WM	Abandoned Underground Waste Oil Storage Tank
07002W	WM	Waste Oil Storage Tank
07019	WM	Thorium Storage Silos
07025	EM40	Tritium Target Preparation Facility
07075	WM	Used Oil Storage Tank
07078A		Office Trailer
07078B		Office Trailer
07078C		Office Trailer
07078D		Office Trailer
07078E		Conference Room/Kitchen
07078F		Office Trailer
07500	EM40	HRE Reactor Building
07502	EM40	Waste Evaporator
07503	EM40	MSRE Reactor Building
07503A	WM	LLLW Tank at MSRE
07507	WM	Hazardous Waste
07507W	WM	Mixed Hazardous Storage Pad
07509	EM40	MSRE Office Building
07511	EM40	MSRE Filter Pit
07512	EM40	MSRE Blowers and Stack
07513	EM40	MSRE Cooling Tower
07514	EM40	MSRE Supply Air Filter House
07516	WM	Field Service Shop
07554	EM40	HRE Cooling Tower
07555	EM40	MSRE Diesel Generator House
07556	WM	HRE Settling Pond
07557	EM40	HRE Absorber Pits
07558	EM40	Waste Evaporator Loading Pit
07559	EM40	HRE Charcoal Absorber Valve Pit
07560	WM	LLLW Collection and Storage Tank
07561	EM40	HRE Decon Pad
07562	WM	LLLW Collection and Storage Tank
07563	EM40	Circulator Pump Pit (for Building 7500)
07567	WM	Central Pumping Station
07569	WM	LLLW Collection Tank WC-20
07572	WM	CH-TRU Waste

Table 3.4 - Management and Integration (M&I) Contractor Facilities as of 8/31/98

Building	Program	Description
07574	WM	NFS Waste
07582	WM	LGWOD Spare Parts Facility
07602	EM60	Integrated Process Demonstration Facility
07651	WM	Clean Used Oil Storage Pad
07652	WM	Hazardous Waste Storage
07653	WM	Chemical Waste Storage Facility
07654	WM	Long-Term Hazardous Waste Storage Facility
07658	WM	Closed Contractor's Landfill
07659	WM	Leaking Gas Cylinder Area
07659B	WM	Reactive Chemicals Disposal Area
07659C	WM	Soil Injection of Radioactive Gas
07666A	WM	Hazardous Waste Area Support Trailer
07667	WM	Chemical Detonation Facility
07668	WM	Mixed Waste Storage Facility
07670	WM	HWOG Equip Storage Facility
07700	EM60	Tower Shielding Facility
07700A	EM60	Big Beam Shield
07700B	EM60	Outside Storage Area
07701	EM60	Tower Shielding Handling Pool
07702	EM60	Control House
07703	EM60	Hoist House
07704	EM60	Control House 2
07705	EM60	Pumphouse
07706	EM60	Cooler
07707	EM60	Battery House
07708	EM60	Butler Building
07711	WM	Process Waste Basin
07716	EM60	Tower Shielding Pool Pump and Filter House
07720	EM60	Tower Shielding Civil Defense Facility
07800	WM	SWSA 4 Burial Ground
07802	WM	SWSA 5 (South) Burial Ground
07802A	WM	Seep C Collection and Treatment System
07802B	WM	Seep D Collection and Treatment System
07802C	WM	Deep Monitoring Well #1
07802D	WM	Deep Monitoring Well #2
07802E	WM	Sludge Test Removal Tank
07802F	WM	Radiation Monitoring Equipment Storage
07802N	WM	SWSA 5 North Trench
07805	WM	Chemical Waste Pit #1
07806	WM	Chemical Waste Pit #2
07807	WM	Chemical Waste Pit #3
07808	WM	Chemical Waste Pit #4
07809	WM	Chemical Waste Trench #5
07810	WM	Chemical Waste Trench #6

Table 3.4 - Management and Integration (M&I) Contractor Facilities as of 8/31/98

Building	Program	Description
07810A	WM	Interim Non-Reg Waste Storage Facility
07811A	WM	Pilot Pits Experiment Area
07818	WM	Chemical Waste Trench #7
07819	EM40	Shielded Transfer Tank Shed
07821	WM	Emergency Waste Basin - Melton Valley
07822	WM	Solid Waste Storage
07822A	WM	SWSA 6 Retrieval Wells/WAG 6 Explosive Detonation Trench
07822B	WM	Fissile Disposal
07822C	WM	Low Range Silos
07822D	WM	High Range Silos
07822E	WM	Hill Cut Disposal
07822F	WM	Tumulus I
07822G	WM	Tumulus II
07822H	WM	Asbestos Silos
07822J	WM	Radioactive Solid Waste
07823	WM	LLW Staging/Storage Facility
07823A	WM	Underground Storage Facility Wells
07823B	WM	Temporary Waste Storage
07823C	WM	Temporary Waste Storage
07823D	WM	Temporary Waste Storage
07823E	WM	Temporary Waste Storage
07823F	WM	SWSA 5N Storage Shed
07824	WM	Waste Exam and Assay Facility
07824A	WM	WEAF Support Facility
07826	WM	TRU Drum
07827	WM	Shielded Dry Well
07829	WM	Shielded Dry Well
07830	WM	Melton Valley Storage Facility
07830A	WM	Hazardous Waste Storage
07831A	WM	SLLW Storage
07831C	WM	SLLW Storage
07831D	WM	SWSA 5 Storage Pad
07834	WM	TRU Drum Storage Facility
07835	WM	Process Waste Sludge Basin, WAG 5
07841	WM	Contaminated Equipment Storage
07841A	WM	Rad Waste Storage Area Office Support Trailer
07842	WM	CH-TRU Waste
07842A	WM	LWSP II Solid Waste Storage
07842B	WM	SWSA 6 Temp Storage
07842C	WM	SWSA 6 Temp Storage
07847	WM	Vehicle Personnel Monitoring Station
07852	EM40	Old Hydrofracture Facility
07852A	WM	Old Shale Hydrofracture Pond/Pits
07853	WM	LGWOD Storage Building

Table 3.4 - Management and Integration (M&I) Contractor Facilities as of 8/31/98

Building	Program	Description
07855	WM	RH-TRU Storage Bunk
07855A	WM	SWSA 5 Equipment Tent
07856	WM	MVST Capacity
07857	WM	IWMF Drainage and Collection
07860	WM	New Hydrofracture Facility
07863	WM	General Storage for Building 7860
07863A	WM	LGWOD General Storage Shelter
07863B	WM	LGWOD General Storage Shelter
07863C	WM	LGWOD General Storage Shelter
07872	WM	Data Concentrator #7 for WOCC DAS
07876	WM	Health Physics Office Trailer
07877	WM	LLLW Solidification Facility
07878	WM	CH-TRU Waste
07878A	WM	Temporary Storage Facility
07879	WM	TUR/LLW Staging Facility
07881	WM	Post #24
07882	WM	Emergency Generator
07883	WM	RH-TRU Bunker
07886	WM	Interim Waste Management Facility
07906	WM	Retention Pond B - HFIR
07907	WM	TRU Pond A
07908	WM	TRU Pond B
07919	WM	HFIR, TRU, TURF
07922	WM	Data Concentrator #6 for WOCC DAS
07934	WM	CH-TRU Waste Storage Facility
07935	WM	Equip Cleaning Facility
07952	WM	Melton Valley Process
07961	WM	Melton Valley Collection Tanks
07966	WM	Buildings 7920 and 7930
13822	WM	Helium Tank
BV COLLECTION	WM	Collection Header and Valve Boxes
LLW COLLECTIC	WM	Tanks WC
LW INTEM	WM	Transfer Line

Fig. 3.17

Sanitary Landfill II is used for disposal of nonhazardous materials such as construction debris. Most other sanitary wastes can be sent to this Y-12 Plant landfill also. During FY 1997, the Waste Management Operations Division (WMOD) received and disposed of 104,895 ft^3 of solid sanitary waste.

Sanitary Sewage Collection and Treatment

Sewage Collection. The sewage collection system (Fig. 3.18) consists of over 32,000 ft of clay, cast iron, and polyvinylchloride (PVC) pipe ranging in size from 4 in. to 12 in. Access to this system is obtained through 194 brick and concrete manholes. The system itself has grown as the Laboratory has grown. The early parts of the system, located roughly between First Street and Fifth Street, consist primarily of vitreous clay pipe with packed joints and manholes constructed entirely of brick. This part of the system is the oldest, with most of it being constructed in 1943 when the Laboratory was built. The rest of the collection system was constructed as the Laboratory grew and developed. The construction methods used in these areas reflect construction practices used when they were built with some collection grid lines constructed from vitreous clay, concrete, cast iron, and PVC. Manhole construction also reflects this, as some are built entirely from brick while others are part brick and part concrete, some are poured-in-place concrete, and the newer manholes reflect the current practice of using precast units.

In the early 1980s, a leak test was performed on the system which indicated areas where illegal taps had been made and where infiltration was a problem. The illegal taps were removed and restrictions placed to help prevent the recurrence of the problem. The survey also was used as the basis for the first GPPs in the mid-1980s directed at lessening infiltration into the system. During 1984 and 1985, approximately 60% of the sewage collection grid lines 6 in. and larger were rehabilitated using a then-new process called Insituform. The Insituform process installs a new, joint-free liner into the existing pipe, creating a slick, leak-free system. The success of this effort was immediate, with daily average flows falling from the 250,000 gallons per day (gpd) range to the 150,000 gpd range.

This proved not to be the ultimate solution to infiltration problems. Within a year after these lines were rehabilitated, volumes began to slowly increase. Investigation of the problem indicated that the groundwater flow which previously had been entering the pipe through open joints, cracks, and breaks was now flowing along the outside of the pipe and entering the system either through the manholes or through a section of pipe which had not been lined.

Because of this problem and other weaknesses identified in the sewage collection system, a LI project to upgrade the sanitary sewage collection system was initiated in the late 1980s and funded in 1993. Construction on this project has been completed, and the system is in operation and functioning efficiently. The project consisted of five basic parts, each designed to address a specific problem with the operation of the sewage collection and treatment system:

- Rehabilitate the remainder of the sewage collection grid. Collection lines 6 in. in diameter and larger were relined using the Insituform process. In all, an additional

Fig. 3.18

3000 ft of the collection grid was repaired using this method. Insituform also rehabilitated all the manholes in the Bethel Valley area and sealed these manholes to prevent infiltration by using a process called "Spray Wall." This polyurethane-based process constructs a new manhole on the interior skin of the existing manhole, creating a leak-proof unit. Also included in this portion of the project was the installation of plastic lids beneath the cast iron manhole covers. These lids have been effective in significantly reducing surface water infiltration into the system through leaking manhole covers. These infiltration-related initiatives have resulted in reducing infiltration into the system, and current average flows are 198,000 gpd. They have also significantly lessened the possibility that contaminated groundwater will enter the sewage collection grid.

- Rebuild the septic tank drainfield system serving the 7600 Area of the Laboratory. This area is currently the home of the Robotics and Process Systems Division. Activities in this area were continuing to grow and were seriously taxing the existing septic system in that area. The new system was constructed to accommodate normal flows for upwards to 150 people, the maximum number this area can currently house.

- Construct a new sewer force main from the HFIR area to the main Sewage Treatment Plant (STP). This line extended “normal” service to an area that was previously served by a tanker truck. By eliminating “pump and haul” and its associated problems and costs, divisions in the Melton Valley Area are better served, and the possibility of environmental insult has been reduced.

- Construct a new sewer line around 4500S. The sewer line serving the eastern portion of 4500 and the 5000, 6000, and 7000 areas of Bethel Valley ran beneath the basement of 4500S. This new line routes flows from these areas around the facility, greatly lessening the impact that building settling had on the line running beneath the basement.

- Purchase and install a sewage sludge drying system to supplement the drying beds at the STP. Because of concerns over periodic low levels of radioactivity in sewage sludge generated at the plant, the sludge must be disposed of in B-25 boxes in one of the SWSAs. This disposal method made it mandatory that the volume and moisture content of the material be reduced as much as possible. The equipment installed by this project allows ORNL operating forces to draw liquid sludge from the digester, process it through a centrifuge to reduce liquid content and to then dry the material to a 10 to 15% moisture content in an efficient and effective manner. This dried material has the consistency of a good, dry topsoil and can easily be loaded into containers for removal to the storage areas.

Efforts are currently underway that may allow us to combine sewage sludge generated at the ORNL STP with that of the City of Oak Ridge for use in their sludge land farming process. Infiltration control efforts and the elimination of the Decontamination Laundry’s wastewater from the influent stream have resulted in a reduction of radiological contamination found in the sludge. Combining our sludge with theirs will allow us to simply remove digested liquid sludge from the STP and pump it into a tanker truck, which will transport it to the city’s municipal treatment plant. There it will be combined with their sludges and processed to meet

their requirements. The sludge drying system currently in use at ORNL will remain operational to allow drying different types of sludges generated by the other treatment facilities located on-site and as a backup for occasions when the wet sludge cannot be delivered to the city. Additional efforts are being pursued to further reduce inflows and infiltration into the system. A number of once-through water-cooled air conditioning and equipment cooling units that discharge into the sanitary sewer system have been identified. These units are being replaced with direct-air units or the discharges are being rerouted from the sanitary system and into the appropriate discharge point. A smoke test survey is planned and will be performed on areas of the system to identify other potential sources of infiltration. These efforts should help further reduce treatment volumes in the system and improve the overall process.

Sewage Treatment. The ORNL STP consists of a DAVCO 300,000-gpd packaged, extended aeration plant which provides primary and secondary treatment and a sand/gravel filter and chlorine contact chamber to provide tertiary treatment. The plant was constructed in 1985 and has performed continuously since that time. Treated flows averaged 217,000 gpd during FY 1997 and have been reduced to 198,000 gal in FY 1998. A number of improvements that should help the treatment process and reduce the probability of NPDES Permit violations are either being considered or are underway at this time. These include

- Efforts at reducing the number of inappropriate inflows and infiltration will stabilize flows in the plant. By being able to treat a consistent volume and eliminating spikes, the treatment process will be improved.

- Environmental Sciences Division is performing a Toxicity Reduction Study on the effluent of the plant to determine the source of the periodic toxicity problems and suggest treatment options to eliminate this toxicity.

- Chemical Technology Division is currently looking into ammonia reduction options. To be considered is whether we can adjust the treatment process itself to provide better ammonia reduction or whether additional equipment will need to be installed to strip the ammonia from the effluent. When this study has been completed, we will take those steps necessary to ensure that we have the equipment and process necessary to comply with the ammonia limits set in the permit.

- For the last few years, a long-term study has been in place to study a “wetlands” approach to treatment of the effluent from the plant. The goal of this study is to investigate whether we could improve the effluent quality by allowing it to flow through a “wetlands” type environment prior to its discharge into the creek. In effect, we hope to use the “wetlands” as a final polishing of our plant effluent. A “test” wetland has been installed and a sidestream flow is periodically routed through the testbed. Scientists are performing periodic sampling and analysis and should be able to develop a set of recommendations in the future.

- Plans are underway to remove chlorine from the plant effluent. In-stream chlorine limits have been significantly reduced in the NPDES Permit and to consistently comply with

these limits dechlorination systems have been installed at locations throughout the plant. These systems are costly to operate and simply trade chlorine for another chemical. Ultraviolet light systems have been evaluated by plant personnel and, because of operating problems experienced by other facilities, a decision has been made not to install this type of disinfection system. An ozone system was installed at the plant on a trial basis in 1997, and the results were favorable. The new system should be up and operating in 1998.

Process Wastewater. The collection system consists of a series of underground pipes where process wastewater flows from the source facility to a pumping station for transfer to the Process Waste Treatment Complex - either Building 3544 (for radiological treatment) or Building 3608 (for nonradiological treatment). At strategic points throughout the collection system, manholes are equipped with alpha and beta-gamma radiation monitors, pH monitors, and flow monitors that are continuously monitored at the Waste Operations Control Center (WOCC) to allow personnel to detect any unusual activity within the system. Wastewater goes to either the radiological or nonradiological treatment process based on radiation limits monitored at these manholes. Wastewater going to radiological treatment is transferred to the storage tanks (two 350,000-gal and one 1,000,000-gal capacity each) at Building 2600. An underground pipe is used to transfer the wastewater to Building 3608 for water softening prior to its transfer to Building 3544 for radiological treatment.

Process Waste Treatment Complex - Building 3544. The process equipment installed for the Building 3544 operations was originally sized on a process water design flow rate of 200 gallons per minute (gpm). In early 1997, modifications were made to Building 3608 to relocate the water softening operation from Building 3544 to the spare clarifier at Building 3608. This modification allowed personnel to achieve treatment rates of 300-350 gpm at Building 3544. This modification was placed in service in the spring of 1997 after an extensive test and evaluation. The existing clarifier and filter press at Building 3544 were placed in standby for usage during maintenance of the system at Building 3608.

The process consists of three basic operations: precipitation, filtration, and ion exchange. The first two of these, together called head-end treatment, utilize conventional water-treatment equipment: a static in-line pipe mixer, a sludge-blanket type precipitator-clarifier, and pressure filters. The ion-exchange equipment is tailored to the process and based on criteria developed during the pilot plant operations.

Process Waste Treatment Complex - Building 3608. This facility was designed to treat process wastewater from the Process Waste Treatment Complex - Building 3544, 4500 Area, 2000 and 1505 areas, and the HFIR/REDC site for the removal of particulates, heavy metals, and organics, as well as to adjust the pH of the wastewater before discharge to White Oak Creek. Building 3608 was designed to segregate its incoming waste streams into two streams: one containing heavy metals and one not containing heavy metals. At the facility are two 325,000-gal surge tanks: one receives heavy metals wastewater, and the other receives the nonmetals wastewater. The facility consists of the following unit operations: precipitation, filtration, air stripping, treatment through granular-activated carbon columns, and pH adjustment.
Building 3608 has the capacity to treat up to 760 gpm (1.1 Mgd) of wastewater. This facility

is operated 24 h/day, 7 days/week. The plant is controlled using a computerized control system, which allows the operator to monitor and control the plant operations either from the Building 3608 control room or from backup control consoles at other waste management facilities which are manned 24 h/day, 7 days/week.

In late 1996, modifications were made to route process waste from the surge tanks at Building 2600 to Building 3608 for water-softening prior to treatment at Building 3544. This was done because of mechanical restrictions limiting the throughput of the existing water-softening process at Building 3544 to no more than 200 gpm. With the modifications to Building 3608, the water-softening throughput was increased to over 300 gpm; this reduced a significant throttle point in the process waste system operations. The modifications included installation of piping to allow the water from Building 2600 to bypass the metals tank at Building 3608 and go directly to the clarification process. One of the clarifiers was modified for water-softening operations. A new surge tank and feed pumps to transfer the softened water to Building 3544 for further treatment were also installed. The modifications were declared fully operational in the spring of 1997.

3.3.8.1.2 Liquid Low-Level Waste System

The liquid low-level waste (LLLW) system at ORNL collects, neutralizes, concentrates, and stores aqueous radioactive waste solutions from various sources at the Laboratory. The Waste Acceptance Criteria (WAC) administratively limits the wastes added to the LLLW system to a total radionuclide concentration of the ingestion dose equivalent of 2 Ci/gal ^{90}Sr. The sources of these waste solutions are "hot" sinks and drains in R&D laboratories, radioisotope production facilities, and the HFIR located in both Bethel and Melton valleys. Most ORNL facilities are no longer connected to the LLLW system because many tanks and lines had to be inactivated under the terms of the Federal Facilities Agreement (FFA), and even the HFIR will be removed this year once its ion exchange system is revamped. Many facilities are now served by bottling and trucking operations rather than pipelines.

The waste solutions are discharged from the source buildings to 13 collection tanks, one such tank being located convenient to each building. The waste solutions that accumulate in these collection tanks are periodically transferred to W-22, one of the five 50,000-gal stainless steel storage tanks located at the LLLW Evaporator Facility. Other generating facilities are connected directly to the collection system. Tank W-22 is connected directly to the LLLW Evaporator systems, and its contents are transferred on a batch basis to the evaporator facility for volume reduction.

At the evaporators, the aqueous waste is routinely concentrated by a factor of 20 to 35. The radioactive concentration of the condensate is less than the feed solution concentration by a factor of 10^4 to 10^5. Evaporation is achieved by the use of steam coils located in the bottom of the evaporator vessel. The evaporators are operated in a semicontinuous manner. Raw waste is transferred by steam jet to an evaporator, and boil-down proceeds at a rate of 50 lb/h/ft^2 of surface area. During this period, more raw waste is automatically sent to the evaporator at a rate controlled by the level in the evaporator vessel. Condensate from the evaporator is directed to the process waste system. When the specific gravity of the concentrated waste reaches a value between 1.2 and 1.25, the evaporator is shut down. Its

contents are cooled and then sent to one of the 50,000-gal storage tanks for interim storage.

The concentrate stored at the evaporator facility is periodically pumped to the Melton Valley Storage Tanks (MVSTs) for long-term storage. Transfer from the LLLW Evaporator Facility to the MVSTs is through approximately 6,000 ft of double-contained stainless steel pipe, which is buried in a specially prepared bed of select clay and is cathodically protected.

In September 1997, a project between Liquid and Gaseous Waste Operations Section personnel and AEA Technologies was begun to demonstrate the effectiveness of their sludge mobilization system in tank W-22 at the Evaporator Service Tanks. Tank W-22 was emptied of sludge by early CY 1998 and personnel then moved to tank W-21, whose sludge layer was also removed by early March 1998. The process consisted of using pulse jets to get the sludge layer into suspension and then transferring the suspended sludges to the MVSTs after the process reached steady state. Plans are to empty tank W-23 in mid-1998 using this same process.

From 1989 through 1995, the supernate layer in two of the MVSTs (tanks W-29 and W-30) was transferred to the LLLW Solidification Facility, where a commercial vendor solidified the waste in a concrete waste form to provide additional storage capacity for future LLLW operations. During each campaign approximately 50,000 gal of LLLW supernate was solidified. The solidified waste was sampled and characterized in anticipation of approval to begin shipments to the Nevada Test Site for final disposal. Interim storage was provided by transferring the solidified waste forms to the Solid Waste Operations Group. At DOE-ORO direction, no further solidification campaigns are planned. Instead, personnel will be conducting several out-of-tank evaporation campaigns to increase the storage capacity for LLLW concentrate.

The out-of-tank evaporation demonstration project performed in early 1996 at the LLLW Solidification Facility consisted of processing approximately 25,000 gal of LLLW supernate through a portable evaporator system inside the facility to further reduce the volume. Since the demonstration in 1996, four additional out-of-tank evaporator campaigns have been conducted in 1998. Approximately 10,000 to 12,000 gal of liquid is evaporated from the supernate and transferred to the process waste tanker for further treatment. The evaporator concentrate was returned to the MVSTs for storage. This was begun as a joint demonstration project between EM30 and EM50.

An additional demonstration project performed in 1997 at the LLLW Solidification Facility consisted of processing approximately 25,000 gal of LLLW supernate through resin columns for the removal of cesium, in an attempt to reduce the exposure personnel would get during other processing operations conducted at the facility; this was a joint demonstration project between EM30 and EM50.

3.3.8.1.3 Solid Low-Level Radioactive Waste

Solid low-level waste (SLLW) is waste that contains radioactivity but is not classified as high-level waste, transuranic (TRU) waste, spent nuclear fuel, or by-product material as defined by DOE Order 5820.2A, *Radioactive Waste Management*. SLLW does not contain hazardous

waste as regulated by the Resource Conservation and Recovery Act (RCRA) and as defined in 40 *CFR* 260-268 or polychlorinated biphenyl (PCB)-contaminated or PCB-detectable waste as regulated by the Toxic Substances Control Act (TSCA) and as defined in 40 *CFR* 761. DOE Order 5820.2A and the Atomic Energy Act of 1954, as amended, provide the primary regulatory guidance and requirements for the management of SLLW. WAC have been developed to address the storage, treatment, and disposal of SLLW, and an implementing procedure to affect the WAC is in place for SLLW.

SLLW is generated throughout ORNL and is characterized by the generator, with waste certification being a joint responsibility of the generator and the WMOD. The WMOD determines the most suitable management option for all SLLW generated by ORNL. Based on the characteristics and certification of the waste, WMOD may store the waste in one of several storage facilities dedicated to SLLW; utilize treatment options such as compaction and incineration offered by commercial treatment, storage, and disposal facilities (TSDFs) or in-house treatment options; or designate the waste as a candidate for the Interim Waste Management Facility (IWMF).

The IWMF uses tumulus disposal technology to dispose of SLLW. The waste is packaged inside a concrete or steel cask. The cask is placed inside a tumulus vault, and any void space within the vault is filled with concrete grouting. The vault lid is sealed with a steel-reinforced concrete cover and stacked on a concrete tumulus pad. After the tumulus pad is filled with vaults, it is covered with a 5-ft thick, multilayer gravel, clay, and earthen cap. The IWMF may contain up to six tumulus pads and store 190,000 ft^3 of waste. A drainage system and several monitoring stations have been installed to test any water running off or beneath the pads. The first pad was constructed to accommodate 324 vaults, and each subsequent pad can accommodate 330 vaults. As of April 1998, WMOD has three filled pads and is at approximately 38% of the capacity of the fourth pad. During FY 1997, WMOD received 81,400 ft^3, treated 25,712 ft^3, and disposed of 8,928 ft^3 of SLLW.

3.3.8.1.4 Transuranic Waste

TRU waste is waste contaminated with alpha-emitting transuranium radionuclides (atomic number greater than 92) with half-lives greater than 20 years and concentrations greater than 100 nCi/g at the time of assay. The following radioisotopes meet these criteria and are managed as TRU: Am-241, Am-242m, Am-243, Bk-247, Cf-249, Cf-251, Cm-243, Cm-245, Cm-246, Cm-247, Cm-248, Cm-250, Np-237, Pu-238, Pu-239, Pu-240, Pu-242, and Pu-244. WAC and an implementing procedure are in place for TRU wastes.

TRU waste is generated by a limited number of generators and facilities at ORNL. TRU waste is characterized by the generator, and certification is a joint effort between the generator and the WMOD. All TRU waste is currently stored in on-site storage facilities. Most of these facilities are RCRA-permitted and store some RCRA-contaminated TRU waste, as well as some RCRA-contaminated SLLW that exceeds the dose limits for WMOD's other RCRA-permitted storage facilities. A very small quantity of TRU waste is also PCB-contaminated. During FY 1997, WMOD received 952 ft^3 of TRU waste for storage.

3.3.8.1.5 Hazardous Waste

Hazardous waste is any discarded material that is not excluded by 40 *CFR* 261.4(a) and that is either listed in 40 *CFR* 261 Subpart D or that exhibits one or more characteristics identified in 40 *CFR* 261 Subpart C. RCRA, as amended by the Hazardous and Solid Waste Amendments of 1984 (HSWA), regulates the generation, storage, treatment, disposal, and transportation of hazardous wastes. RCRA also regulates the facilities that conduct these operations. The State of Tennessee, Tennessee Department of Environment and Conservation, is authorized to administer its own RCRA program in lieu of the federal program, except to the extent of newly issued HSWA provisions. The state program has authorization to regulate mixed waste as well and is authorized under the Tennessee Hazardous Waste Reduction Act of 1990.

Hazardous waste is a waste or surplus material with negligible value that may cause or significantly contribute to an increase in mortality or to an increase in serious reversible illness or pose a substantial present or potential hazard to human health or the environment when improperly stored, treated, disposed of, or transported. Hazardous wastes are defined in RCRA by specific source lists, nonspecific source lists, characteristic hazards, and discarded commercial chemical product lists. Characteristic wastes are those which exhibit the characteristics of ignitability, corrosivity, reactivity, or toxicity, as defined in 40 CFR 461.

Hazardous wastes are generated throughout ORNL and are stored in generator satellite accumulation areas or in (90-day) accumulation areas pending pickup by WMOD. The WMOD determines the most suitable management option for all hazardous waste generated by ORNL. Based on the characteristics and certification of the waste, WMOD may store the waste in one of several storage facilities dedicated to hazardous and mixed waste pending off-site disposal; utilize treatment options such as compaction and incineration offered by commercial TSDFs; detonate the waste in the on-site ORNL Detonation Facility or perform other on-site treatment, such as silver recovery from photographic wastes; or immediately transport to a commercial TSDF for treatment and/or disposal.

WAC and an implementing procedure are in place for hazardous wastes. During FY 1997, WMOD received 8,142 lb, treated 87 lb, and disposed of 70,934 lb of hazardous waste.

3.3.8.1.6 Mixed Waste

Mixed waste is waste that contains both hazardous and radioactive components and must be managed to meet the requirements applicable to both. “Hazardous” in this instance refers to both those wastes regulated by RCRA and those PCB wastes with concentrations or sources greater than or equal to 50 ppm. The WMOD determines the most suitable management option for all mixed wastes generated by ORNL. Based on the characteristics and certification of the waste, WMOD may store the waste in one of several storage facilities dedicated to hazardous and mixed waste, pending determination of suitable treatment, storage, and disposal option. Many of ORNL’s mixed wastes are treated in the TSCA Incinerator at ETTP. This incinerator burns mixed wastes from ORNL, the Y-12 Plant, ETTP, the Paducah Gaseous Diffusion Plant, the Portsmouth Gaseous Diffusion Plant, and other sites and

facilities as directed by the DOE. The resulting ash must undergo further treatment prior to disposal to meet the Land Disposal Requirements or must be delisted in accordance with the RCRA regulations. All resulting ash is currently stored at ETTP.

Few commercial TSDFs are available to process or dispose of mixed wastes. Accordingly, ORNL has been unable to eliminate its inventory of mixed waste via processing or disposal. Transfers of mixed waste inventories to ETTP were initiated in FY 1997 and will continue in FY 1998.

WAC and an implementing procedure are in place for mixed wastes. During FY 1997, WMOD received 188,095 lb and disposed of 222,931 lb of mixed waste.

3.3.8.1.7 Toxic Waste

TSCA Waste. TSCA waste is waste regulated by the Environmental Protection Division under TSCA. In accordance with 40 *CFR* 761, Subpart D, TSCA regulates wastes (1) with PCBs in concentrations equal to or exceeding 50 ppm, (2) with PCBs from sources equal to or greater than 50 ppm, and (3) with PCB surface contamination equal to or exceeding 10 ug/100 cm^2. TSCA provides some guidance with regards to proper management of PCB waste with concentrations or sources less than 50 ppm, but subpart D does not apply to such PCB-detectable wastes. PCBs with concentrations and/or sources greater than or equal to 2 ppm but less than 50 ppm are managed (stored) as PCB-detectable waste and are either petitioned for alternative disposal approval or disposed of as PCB waste.

TSCA also addresses the manufacturing, importing, and processing of asbestos and establishes requirements for asbestos abatements projects performed by government and state employees not covered by (1) the Asbestos Standard of OSHA, 29 *CFR* 1926.58, (2) an asbestos standard adopted by a state as a part of a plan approved by OSHA under Section 18 of the Occupational Safety and Health Act, or (3) a state asbestos regulation which the EPA has determined to be comparable to or more stringent than that established in 40 *CFR* 763.120. Since ORNL does not manufacture, import, or process asbestos, and since asbestos activities are covered by an approved Asbestos Standard, any waste with asbestos-containing material (ACM) is not regulated under TSCA. ACM is either managed as sanitary waste, SLLW, transuranic waste, TSCA/RCRA, or TSCA/RCRA mixed if the ACM has come into contact with such constituents. Accordingly, asbestos will be managed as a TSCA (PCB) waste only if it has come into contact with PCBs from a source or concentration greater than or equal to 50 ppm.

WAC and an implementing procedure are in place for TSCA wastes. PCB wastes received, treated, and disposed of during FY 1997 are included in the totals for hazardous and mixed wastes.

3.3.8.1.8 Classified Waste

Classified wastes are discarded materials whose analysis or review could reveal information withheld for reasons of national security. The management of such waste is governed by DOE Order 5632.1. ORNL generates a minute amount of classified waste. Disassociation from

source or use is sometimes used to declassify certain materials.

3.3.8.2 Effluent Monitoring

Liquid effluents are regulated by ORNL's NPDES Permit issued by TDEC. Receiving streams are monitored at designated locations for both radioactive and nonradioactive contaminants. Surface water samples are collected as part of the Clean Water Act (CWA) requirements and DOE Orders. In addition, monthly surface water samples are collected at two sampling locations to determine background contaminant levels before the influence of ORNL. The two locations are Melton Hill Dam above ORNL's discharge point into the Clinch River and White Oak Creek headwaters above the locations of ORNL discharges to White Oak Creek. Fig. 3.19 shows the locations of the various sampling points.

All process wastewater streams were routed to the Nonradiological Wastewater Treatment Plant (NRWTP) when it began operations in 1990. This made it possible to combine five permitted and monitored NPDES wastewater-discharge points into one monitored point.

3.3.8.3 Environmental Restoration Activities and Issues

The Oak Ridge Environmental Restoration Program has entered a new phase with the selection of Bechtel Jacobs Company as DOE's M&I contractor for environmental management activities in Oak Ridge, with responsibility for executing the plans documented in *Accelerating Cleanup: Paths to Closure*, DOE/EM-0342, February 1998. This will affect ORNL in three primary areas:

- reduction in ORNL direct scientific and support labor in project implementation;
- increased ORNL vulnerability as outside remediation firms conduct remedial actions near active research and administrative support areas; and
- regulatory decision-making on long-term land use plans for major portions of the ORNL site.

Near-term impacts on research and support divisions are already being felt as DOE steps up its strategy for outsourcing major components of the remediation program. Proactive marketing to existing EM40 sponsors, teaming with local commercial firms, and seeking new environmental business clients are all part of the emerging ORNL strategy for managing the first issue. Both the ES&H concerns related to increasing site presence of new contractors and the CERCLA decision-making process related to long-term land use designation for ORNL property need close scrutiny as Bechtel Jacobs takes ownership of these issues.

EM50 remains under pressure from Congress and internal EM program managers to justify the value of past expenditures in technology development. ORNL has been one of the

Fig. 3.19

primary contributors in technology development and deployment over the past 8 years, and any significant reduction in technology funding will seriously affect the supporting research divisions. Successful execution of DOE's plans for facilities cleanup (documented in *Accelerating Cleanup: Paths to Closure*) will be dependent on the use of new and more cost-effective technologies. ORNL requests that DOE-ER actively support the continuation of all phases of the EM technology development and demonstration being conducted through the Focus and Crosscut Areas, the EM Science Program, and the Accelerated Site Technology Deployment initiative for getting proven technologies into the field.

For the technology deployment work, Bechtel Jacobs has been given the leadership role for technologies being deployed on its sites. This change in leadership will result in more constraints on the ORNL principal investigators in proposing and implementing field activities.

3.3.8.3.1 Bethel Valley Watershed RI/FS Record of Decision

The cleanup of the Bethel Valley Watershed, which includes the main ORNL site, is being conducted under CERCLA. Four regions have been established in the Bethel Valley Watershed based on area hydrology, the level and type of environmental management activities, and the knowledge that the end use of these regions may vary. These regions are

- Raccoon Creek Region (West of State Highway 95),
- West Region (from Highway 95 to the developed area of ORNL)
- Central Region (the originally developed area of ORNL), and
- East Region (the 7000 Area of ORNL).

DOE is conducting a Remedial Investigation/Feasibility Study (RI/FS) of the Bethel Valley Watershed as part of its CERCLA decision-making process for environmental management of the site. The Bethel Valley Watershed Record of Decision (ROD) will identify the remediation goals for the Bethel Valley Watershed and all actions needed to meet these goals. The key issue to be addressed for the Bethel Valley Watershed is the environmental policy for the Central Region, encompassing the initial area of the site, which was developed beginning in 1943. This policy must address whether contaminated facilities and soils will be stabilized in place or removed to an off-site location.

3.3.8.3.2 Gunite and Associated Tanks

The Gunite and Associated Tanks (GAAT) consist of six large tanks of 170,000-gal capacity each and two smaller tanks of 42,500-gal capacity, each containing residual quantities of mixed waste (radioactive and RCRA characteristic sludges; some tanks contain transuranic mixed waste). Most of the liquid and solid waste was removed in the 1980s, but a heel of sludge and other debris remains in the tanks. Additional contamination is also present in the tank walls and floors. This waste, as well as the equipment, structures, soil, and groundwater in the tank farms, represents a potential threat to human health and the environment. The GAAT Project is an interim remedial action (IRA) being performed under an FFA among DOE, EPA, and TDEC. To resolve uncertainties regarding the best way to clean out the

GAAT, DOE performed a Treatability Study (TS) under the provisions of CERCLA. The TS spanned from the development of waste removal technologies to the successful waste removal operations from the two smaller, lower-risk tanks. Concurrently, site preparation for the IRA was underway on the six remaining larger tanks. The amount of waste removed from the tanks during the interim action will be determined based on the information gained from the TS and on the conditions experienced in each tank. Waste generated will be temporarily stored in one or more of the large gunite tanks and then transferred to the existing permitted MVSTs. A contractor selected through a separate ongoing DOE action will eventually treat the waste. Once the IRA is considered complete, a final remedy, which is currently being established in the Bethel Valley Record of Decision, will address the remaining tank shells.

3.3.8.3.3 Molten Salt Reactor Experiment

The MSRE facility operated from 1965 to 1969 to test the molten salt concept for commercial nuclear power reactors. During routine surveillance activities in 1994, it was noted that measured radiation levels in various areas throughout the facility were increasing. The source of radiation originated in the two fuel drain tanks and was being distributed throughout the off-gas system. A uranium deposit was also discovered in a charcoal bed that filtered the off-gas from the drain tanks. This condition could result in a potential criticality accident and possible radiation exposure to the on-site (MSRE) personnel.

Actions have been initiated under CERCLA to reduce and eliminate potential risks of a nuclear criticality accident or a release of reactive gases from the facility. The three activities to remediate these concerns are (1) to remove the migrating gases throughout the facilities off-gas system (begun in late 1997), (2) remove the uranium deposit, and (3) to remove the fuel salt itself. The Interim ROD for the MSRE Fuel Salt Removal has been approved by TDEC and EPA.

3.3.8.3.4 Corehole 8

The Corehole 8 (CH8) Plume is the result of LLLW pipeline leaks at an inactive Waste Tank W-1A located in the North Tank Farm at ORNL. The historic pipeline leaks, discovered in the mid-1980s, have contaminated soil and groundwater adjacent to and beneath the tank and created the source for the CH8 Plume, which has spread east and west of the tank site.

Three actions have been taken over the past several years after discovery of radiological contaminant releases into First Creek at the western end of the ORNL plant site. The primary contaminants detected in the creek were ^{90}Sr and uranium isotopes. In 1995, a CERCLA Removal Action was initiated to collect and treat contaminated groundwater. A shallow interceptor and sump collection system was installed with the water being pumped back to a manhole for treatment at the ORNL Process Waste Treatment Plant (PWTP). In early 1998, a shallow french drain collector was installed and two manholes were waterproofed to prevent infiltration into the storm drain system and ultimate release into First Creek.

Future plans by DOE are to proceed with a CERCLA Removal Action project for the contaminated soil and the inactive Tank W-1A. The CH8 Plume Source Removal Action will select a method to stop further leaching of contaminants from the plume source into

groundwater. The project will focus on remediating the contaminated soil, a tank, and pipelines at the plume source leak site. An Engineering Evaluation/Cost Analysis and Action Memorandum will be produced in 1998 to document the preferred action.

A plume investigation will perform technical evaluations of methods that can stabilize the CH8 plume and stop the spread of contamination in groundwater. The two management strategies being studied are (1) hydraulic control of the plume using pumping wells to control groundwater flow in the plume and slowly remove contaminants from the bedrock zone and (2) injection of a chemical solution containing phosphate or other compounds to cause in situ precipitation of the contaminants in a very low solubility solid form. A plume management recommendation is planned to be signed into the Bethel Valley Watershed ROD.

3.3.8.3.5 Bethel Valley Evaporator Service Tanks

The Bethel Valley Evaporator Service Tanks (BVEST) store evaporator concentrate and dilute radioactive liquid low-level waste. A total of 23,750 gal of radioactive transuranic sludge is contained in five 50,000-gal capacity tanks. The tanks have undergone modification in preparation for a demonstration in BVEST W-21. The sludge in BVEST W-21 was mobilized using AEA Technology's fluidic pulsed jet mixing process. Cleaning of Tank W-22 has been completed, and Tank W-23 is underway. Completion of this project is scheduled for February 1999.

3.3.8.3.6 Surface Impoundments Operable Unit Project

The Surface Impoundments Operable Unit (SIOU) is part of the Bethel Valley Watershed Central Region and consists of four impoundments designated A, B, C, and D. The impoundments received radioactive low-level liquid wastes generated during experiments and materials processing at ORNL. They contain radioactively contaminated sediments with the primary contaminants of concern being cesium, plutonium, cobalt, strontium, and americium. The selected remedy consists of the removal, treatment, and disposal of sediments off the project site. A contractor has been selected for C and D ponds, and work is under way. A request for proposal has been issued for A and B ponds. Contract award is projected for September 1998. Completion of this project is scheduled for January 2003.

3.3.8.3.7 Old Hydrofracture Facility Removal Project

The Old Hydrofracture Facility site was used for the disposal of radioactive waste by injecting grout into shale formations 1000 ft below ground. Operations were terminated in 1980, leaving approximately 50,000 gal of transuranic waste in five underground storage tanks at the site. This waste has been removed and transferred to the MVSTs for processing and disposal during the MVST-TRU waste treatment and disposal project. A proposal to grout the tanks and a holding pond in place has been prepared and will be submitted for regulatory approval. Completion of this project is projected for the summer of 1999.

3.3.8.3.8 Melton Valley Watershed RI/FS Record of Decision

The cleanup of the Melton Valley portion of the White Oak Creek Watershed, which includes most of the primary waste disposal units in Melton Valley, is being conducted under CERCLA. DOE has completed the RI/FS of the Melton Valley Watershed as part of its CERCLA decision-making process for environmental management of the site. Copies of these documents can be obtained from the Oak Ridge DOE Information Resource Center. The Melton Valley Watershed Proposed Plan and ROD will identify the remedial actions to be conducted in Melton Valley Watershed.

3.3.8.4 Hazardous Materials within the 500-Year Floodplain

Flooding on the ORNL site has not been a major problem. Brief summer storms have caused short-duration flooding of some parking areas and roads, but have had little impact on plant operations. The level of White Oak Creek governs flooding at ORNL. The creek's level is determined by the level of Watts Bar Lake, and the lake level can be controlled by dams operated by TVA. Thus, TVA can mitigate the consequences of heavy rainfall.

The 500-year flood, that flood expected to occur only once in 500 years or, equivalently, that flood which has a 1 in 500 chance (0.2%) per year of occurring, will have little impact on ORNL facilities. Table 3.5 lists those facilities located within the 500-year floodplain. It is important to note that none of the SWSAs lie within the 500-year floodplain. Moreover, none of the facilities designated by the SARUP as posing a moderate or high hazard, nor any of the facilities designated for decontamination and decommissioning (D&D), lie within the 500-year floodplain. The most serious impact would probably result from the flooding of the Sewage Treatment Plant.

Table 3.5. ORNL facilities located within the 500-year floodplain

Building no.	Facility name
2521	Sewage Treatment Plant
3518	Process Wastewater Treatment Plant
4500-S	Central Research and Administration
5500	High Voltage Accelerator Lab
6008	Office/Lab Facility
6011	Computer and Telecommunications

Source: Derived from information provided by the TVA Floodplain Protection section, 1992.

3.3.8.5 Surplus and Excess Facilities in the EM Program

From October 1993 to January 1994, Phase I of the DOE directed Surplus Facility Inventory and Assessment Project was conducted. A number of assets were identified at ORNL contaminated with low-level radioactive waste, transuranic waste, hazardous waste, or mixed waste.

Because of the potential release of contamination to the environment, contaminated assets must undergo D&D. An organizational division of DOE's Office of Environmental Restoration and Waste Management, EM60, controls the asset during the transition to D&D. Once an asset is accepted into the D&D program, another organizational division, EM40, assumes ownership of the asset.

Forty-nine ORNL facilities have been accepted into DOE's D&D program funded by EM40. Forty-four facilities, utilized previously for the production of isotopes, are in the Nuclear Materials and Facilities Stabilization Program funded by EM60. Facilities accepted into EM40 and EM60 programs are listed in Table 3.4. Four facilities and five associated aboveground tanks have been demolished to date.

3.3.9 Maintenance Program

The P&E Division is responsible for effective preservation of facilities, infrastructure, and associated systems at the ORNL site and portions of the Y-12 Plant that are occupied by ORNL. Modern maintenance management systems and practices are used to assure the continued service of the facilities for their intended use.

- The Facility and Maintenance Management Information System (FAMMIS) is a computerized system used for tracking maintenance job requests. The system provides information for managing the maintenance budget in accordance with LCAM. The system uses current technology to provide a graphical user interface with advanced query tools to aid in the management of maintenance activities. A Web interface was implemented in FY 1996 to allow users to input maintenance job requests and query the status of outstanding requests.

- A preventive maintenance (PM) system is used to provide semiautomated scheduling of PM activities and collection of repair history on buildings and equipment. The system is continuously improved to provide cost-effective facility and equipment maintenance. The current PM system is scheduled to be replaced with a new PM module that will be tightly integrated with FAMMIS using current client-server and Internet technology in FY 1998. The new FAMMIS PM module will include a master equipment list for items in the PM program.

- The P&E Web Server provides access to information needed by P&E personnel using Internet technology. The home page is continuously evolving and currently provides links to the FAMMIS Web Interface, Area Responsibility Listings, Planner Time Usage Application, Network Systems Information, Asbestos Management Program, Technical

Training, P&E Procedures, Performances Measures, Condition Assessment Survey, and ES&H Information. Links are also provided to commonly used ORNL and Energy Systems pages and systems to facilitate access to these areas from a common area.

- P&E has continued to expand its use of Internet technology to improve availability of information for customers by providing Web pages which describe P&E services and contacts. Organizational information such as mission, philosophy, values, organization charts, and reengineering newsletters are also now available through the Web at http://www.pe.ornl.gov/.

- A local area network (LAN) provides access to FAMMIS, many commercial software packages, and shared services and files. The network has allowed P&E to manage access to commercial software economically by maintaining fewer shared copies, which are installed and configured centrally to ease user frustration and maintenance for these packages. The LAN also provides the ability to share printers and files among work groups for more efficient management of these resources.

- The CAS program completed initial inspections of all ORNL facilities in FY 1997. Along with the inspections, facility dimensions were gathered and each facility was photographed. A facility roof database was created and is currently being populated to include photos, type of roof, and square footage. This database, when finalized, will provide complete information concerning all roofs at ORNL. The CAS program has been utilized in updating and verifying the Facility Information Management System and the P&E Space Allocation Management System databases. The need for facility information is increasing, and the program will concentrate on gathering vital information for facilities starting in FY 1998. The CAS program is planning to include infrared technology in the inspections, which will enhance the PM program, provide energy conservation data for facilities, and provide predictive maintenance (PdM) information. The CAS program will label and photograph approximately 6000 equipment items in support of the division's PM program.

An annual review of maintenance equipment, building service equipment, and automotive and heavy equipment is performed to determine capital equipment needs for future budget years. These needs are prioritized and submitted for budget approval to assure that critical needs are addressed on a priority basis and that the Laboratory is supported in a cost-effective manner.

Funds continue to be requested to implement PdM practices to move maintenance management practices toward a more efficient, proactive system of reducing corrective maintenance work. Infrared thermography, oil analysis, and vibration analysis are the primary technologies for a well-rounded PdM program. Vibration analysis is the most highly developed of the technologies and is applied by reading routes that are trended over time and by investigation of special problems that occur across the site. Should funds become available, a more compete PdM program will be developed with the aim of reducing the downtime and costs associated with corrective maintenance.
The P&E Division Maintenance Work Plan provides additional information required by DOE Order 430.1, "Life Cycle Asset Management." This fulfills a two-part requirement:

1. The Annual Maintenance Work Plan discusses maintenance requirements during the period FY 1998 - FY 2000 to correspond with current budget preparation for those years.

2. The Long-Range Maintenance Work Plan details a projection of maintenance requirements during the period FY 2001 - FY 2003.

3.4 PLANNING METHODOLOGY

Future facility and land requirements are determined both by future mission and program plans and by the functional and physical adequacy of existing facilities and equipment. Future requirements are both mission-based and asset-based.

3.4.1 Laboratory Missions

ORNL is a multiprogram science and technology laboratory managed for DOE by LMER. In support of the Department's missions, ORNL conducts basic and applied R&D to create scientific knowledge and technological solutions that strengthen the nation's leadership in key areas of science; increase the availability of clean, abundant energy; restore and protect the environment; and contribute to national security.

3.4.1.1 Mission Roles

As a multiprogram national laboratory, ORNL carries out R&D in support of all four of DOE's major missions: science and technology, energy resources, environmental quality, and national security. The Laboratory plays a principal role in fundamental science and energy resources and applies special capabilities to support DOE's needs in environmental quality and national security. Key R&D activities that support DOE's major missions are as follows:

- Science and Technology
  - Analytical and separations chemistry
  - Environmental and social sciences
  - Fusion science and technology
  - Genetics, genomics, and biotechnology
  - Materials science and engineering
  - Neutron science
  - Nuclear physics and astrophysics with radioactive ion beams

- Energy Resources
  - Biomass: renewable energy feedstock and conversion technologies
  - Energy-efficient technologies for buildings, industrial, transportation, and utility end-use
  - Fossil fuel: applied materials and turbines
  - Nuclear technology and safety
- Environmental Quality
  - Environmental restoration and waste management
  - Environmental technology development

- Health and environmental risk assessment

- National Security
  - Management and disposition of weapons-related nuclear material
  - Promoting nonproliferation and international nuclear safety
  - Strategic computing for safe stockpile management

3.4.1.2 Mission Execution

In executing its mission assignments, ORNL is governed by the following operational imperatives:

- Conduct all operations with due regard for the health and safety of all employees, guest scientists and engineers, visitors, and the general public.
- Conduct all operations in a safe and environmentally responsible manner.
- Adhere to the highest professional and ethical standards in all activities.
- Support the execution of R&D missions with efficient, cost-effective business practices and support services.
- Acquire and sustain the intellectual and physical resources needed to explore challenging scientific and technical problems and provide innovative solutions.
- Collaborate with universities, industry, other DOE laboratories, other federal agencies, and state and regional organizations to create new opportunities.
- Communicate the value of ORNL's R&D activities to a broad audience.
- Respect the value of other people's time.

ORNL carries out its mission assignments by applying distinctive capabilities developed through and directed toward support for DOE needs. These capabilities flow from pioneering work, unique facilities, and talented staff.

ORNL focuses its capabilities through several areas of R&D emphasis:

- energy production and end-use technologies;
- neutron-based science and technology;
- advanced materials synthesis, characterization, and processing;
- biological and environmental sciences and technology;
- instrumentation and measurement science and technology; and
- computational science and advanced computing.

3.4.1.3 Strategic Goals

ORNL has established the following strategic goals and objectives to move the Laboratory toward its vision of advancing the frontiers of science and technology through broad

interdisciplinary R&D programs that answer fundamental questions, solve technical problems, and address societal needs:

- Deliver new insights into the nature of materials and energy through world-class programs in neutron science and nuclear physics.
  - Secure the world's best capabilities for neutron science and technology and apply them to biotechnological, materials, and basic research problems
  - Maintain world leadership in the use of radioactive ion beams to broaden the understanding of nuclear structure, nuclear astrophysics, and nuclei subjected to extreme temperatures and pressures
  - Broaden the use of ORNL's existing neutron sources and accelerators by outside partners

- Integrate fundamental understanding of biological and environmental systems with computational and technological expertise to improve human health and sustainable development.
  - Enhance ORNL's capabilities in functional genomics and apply them to the development of practical applications in medicine, agriculture, energy production, environmental protection, and industrial processes
  - Deepen the understanding of environmental processes and systems and generate innovative technology solutions to energy-related environmental problems
  - Integrate and extend capabilities in separations science, isotope production, and biotechnology to provide new processes and techniques for nuclear medicine, waste management and environmental restoration, and national security

- Create and apply knowledge about materials through research aimed at developing and engineering materials properties.
  - Advance fundamental understanding of materials through interdisciplinary research
  - Develop advanced materials technologies that provide innovative solutions to national priorities in energy, national security, and the environment
  - Enhance partnerships in materials science R&D

- Provide scientific knowledge, advanced technologies, and assessments that support the production, delivery, and use of reliable, economical energy with minimal adverse environmental impacts.
  - Provide advanced technologies and materials for biomass, fission, fossil, and fusion energy sources
  - Develop efficiency improvements in the delivery and use of energy for buildings, manufacturing, and transportation
  - Improve analytical methods for exploring the effects of human activities on the environment

- Develop and apply state-of-the-art computational resources, tools, and techniques to meet new scientific and technical challenges.
  - Extend ORNL's high-performance computing, data storage, and networking environment, in a balanced way, to attack a new generation of problems

- Enhance ORNL's leadership in systems and strategies for high-performance distributed computing, including expanding partnerships
- Sustain ORNL's leadership in computational tools and techniques for highly parallel, and geographically distributed, environments

- Create new knowledge in measurement and analytical sciences and apply it to the design and implementation of methods for detecting, measuring, monitoring, and controlling phenomena important to basic research and technological applications.
  - Advance the state of the art in photonics, electronics, signal processing, sensor development, and simulation and integrate these capabilities to provide unique measurement and control systems
  - Advance the state of the art in analytical chemistry, analytical separations, and chemical physics as a basis to design novel prototype methods and instrumentation to achieve sensitivity, selectivity, and field practicality
  - Advance the state of the art in nuclear detection systems for dosimetry, criticality safety assessment, diagnostics, nuclear reactor and nuclear material monitoring, nuclear physics experiments, and nuclear material characterization

3.4.2 Facilities Planning Process

The ORNL facilities planning process is managed through Capital Assets Management Office. Facilities planning is required by DOE Order 430.1, “Life Cycle Asset Management.” The order specifies that ORNL shall plan, acquire, operate, maintain, and dispose of physical assets as valuable national resources. Implementation of this order is through a graded approach based upon best industry practice as agreed upon by the DOE Headquarters program office that functions as the landlord and local DOE oversight offices.

The Capital Assets Management Office has established performance measures to ensure formal comprehensive, integrated, documented planning, and control methods. These include

- A comprehensive land-use planning process with stakeholder involvement.
- The efficient and effective acquisition, management, and use of energy and utilities.
- The management of backlogs associated with maintenance, repair, and capital improvements.
- A method for the prioritization of infrastructure requirements.
- A method to declare assets surplus.

3.4.3 Site Planning Methodology

The site planning process required by DOE Order 430.1, “Life Cycle Asset Management,” is documented in this section and illustrated in Fig. 3.20. Section 3.4.4 states assumptions and objectives for site development at ORNL. The assumptions concern impacting influences and provide the context for site planning; the objectives or goals provide a framework for evaluation of the site. Section 3.4.5 provides an evaluation of the site for each objective. This evaluation is the result of a comparison between two bodies of information. The comparison indicates, for each objective, the extent to which the site's assets are deficient. Section 3.4.6

Fig. 3.20

proposes alternatives for removing the site's deficiencies and states the preferred alternative. This preferred alternative is the basis for the Master Plan. Section 3.4.7 expands upon this alternative, yielding guidelines for development of the plan. Finally, Section 3.5.8 acknowledges that influencing factors could necessitate deviations from the Master Plan and requires that an alternative course of action be updated in future updates to this plan.

3.4.4 Site Planning Assumptions and Objectives

The purpose of site development planning at ORNL is to support the mission of the Laboratory by

- ensuring aging infrastructure conditions are evaluated and improvements are made to continue safe and efficient operations;
- providing for the orderly and timely development of site resources;
- facilitating programmatic evolution via the site and facilities; and
- ensuring that the layout of the site and its facilities is flexible, so as to allow for future changes in assigned missions, programs, and workloads.

To this end, planners must specify sets of assumptions and objectives.

Assumptions. ORNL is subject to external factors that influence both present activities and the course of the Laboratory's future development. U.S. energy policy and congressional funding are just two examples. ORNL has little control over most of these factors, and their future impact may not be predictable using available information. Planners commonly handle such uncertainty by making assumptions. The seven assumptions listed below provide a context for planning.

- National priorities for R&D will reflect pressing needs in high-priority areas (e.g., environmental protection, health care, manufacturing, national security, telecommunications, and transportation).

- The debate on the proper role of government in R&D, which is fueled in part by the urgent focus on reducing the federal deficit and federal spending of all kinds, will continue.

- The DOE national laboratory system will become more efficient as a result of actions now under way:
  - improvements in oversight, leading to a decrease in support personnel responsible for meeting oversight requirements;
  - laboratory efforts to improve productivity; and
  - increased integration of complementary capabilities across the system.

- Cost-effective, efficient operation and resource management will be major factors in evaluations of national laboratory performance and in decisions about program assignments and contractor selection.

- ORNL will remain a DOE-owned, contractor-operated multiprogram national laboratory, and DOE will remain ORNL's primary sponsor. ORNL will continue to play a principal role in fundamental science and energy resources and to apply special capabilities to support the Department's needs in environmental quality and national security. Work for other sponsors, consistent with the Laboratory's missions, will provide a means of leveraging scarce resources.

- Partnerships with universities, industry, and state and regional organizations will provide an increasingly important means of making the Laboratory's capabilities available to others in the national interest.

- Effective program development, resource planning, and marketing, carried out in collaboration with a variety of partners (local, state, national, and international), will provide opportunities to pursue new technical directions.

Objectives. Within the context of the assumptions, site development at ORNL is subject to local direction and control. For example, the location and arrangement of new buildings is determined by ORNL facilities management with oversight from local DOE authorities. Thus, planners establish objectives or goals that describe a vision or desired future for the site toward which development can be directed. The five objectives listed below provide a framework for creation of a Master Plan.

1. Plan and conduct all activities on the site in full compliance with all applicable laws, codes, standards, regulations, and ES&H requirements. This includes

    - providing adequate accommodations for the additional resources and personnel required by these activities;
    - establishing any needed historic sites and any required health and safety buffer zones; and
    - minimizing the number and extent of locations where hazardous activities are conducted or hazardous materials are handled.

2. Consolidate related activities into zones so as to improve the efficiency of both research and support operations by reducing costs associated with flows of people, material, and equipment. This includes

    - eliminating remote sites to the extent practicable;
    - consolidating functions (e.g., Life Sciences) into a single area where most facilities are within walking distance);
    - centralizing certain support activities;
    - consolidating waste management operations (treatment, storage, and disposal) to the extent possible; and
    - consolidating utility infrastructure, where possible.

3. Improve working conditions. This includes

   - ensuring that facilities are in compliance with the Americans with Disabilities Act;
   - providing an adequate amount of quality office space for each office worker;
   - providing the appropriate laboratory space for accomplishing ORNL's mission; and
   - providing sufficient space for the supporting infrastructure.

4. Enhance the overall visual character of the Laboratory. This includes

   - shifting from the atmosphere of an industrial plant toward that of a university campus;

   - harmonizing the human-made and natural environments; and
   - demolishing and removing facilities and infrastructure as they are decontaminated and decommissioned.

5. Focus any needed safeguards or security measures on the activities that must be shielded or protected. This includes

   - removing all unnecessary security barriers or relocating outside of the barriers those activities that do not need to be secured; and
   - configuring any new security barriers so that they present minimum hindrance to flows of people, material, or equipment about the site.

3.4.5 Evaluation

ORNL's present assets are capable of fulfilling its present mission assignments. However, significant improvements are needed if the Laboratory is to meet the five planning objectives: compliance, consolidated activities, adequate working conditions, appropriate visual character, and focused safeguards.

Compliance. ORNL is committed to maintaining full compliance with all federal, state, local, and internal laws and regulations concerning environmental protection, safety and health of employees and the public, and safeguards and security. In addition, ORNL will probably be subject to new regulations as its mission assignments evolve. Unfortunately, ORNL's assets are not able to fully support this commitment. The majority of the Laboratory's facilities were not originally designed to comply with today's stringent and continuously evolving OSHA, life-safety, or natural phenomena requirements. Much of the Laboratory was constructed quickly for a mission different from today's more diverse mission assignments. Of ORNL's building space, 77% is over 30 years old, and 56% is over 40 years old. Some of the structures are of light construction intended for temporary use.

ORNL has been able to meet or exceed the standards set forth in ES&H and safeguards and security regulations, often being forced to do so with "quick fixes" and at increasingly higher costs. The number of compliance requirements has grown and will continue to grow. The impact of these trends is compounded by the gradual deterioration of facilities and equipment that make up the site infrastructure. Replacement and/or complete restoration of these

facilities will be time consuming and costly. Maintaining compliance indefinitely with ORNL's existing facilities presents a significant challenge.

Consolidated activities. Only 72% of ORNL's gross square footage of building space, not including trailers, is at the Main Site. Another 26% is at the Y-12 Plant, and 2% is leased in the Oak Ridge area. Moreover, the Main Site consists of three physically separated areas that are highly linear in nature. Because of this geography, many of ORNL's programs and divisions–and the functions they perform–are physically dispersed.

Such dispersion of activities has resulted in unnecessary costs associated with flows of people, materials, and equipment; with safeguards and security; and with meeting ES&H requirements. Consolidation and centralization of these activities into functional, programmatic, or divisional areas would improve the overall operating efficiency of the Laboratory.

Consolidation means that certain activities would occupy a specific area, use the facilities there, and serve customers nearby. In most cases, the present sites–a result of nearly 50 years of relatively uncoordinated development often on an as-needed rather than a master-planned basis–do not lend themselves to such consolidation. Economies of consolidation could be best captured by relocating all activities to the Main Site and dedicating portions of that site to specific functions, programs, or divisions.

Adequate infrastructure and working conditions. Continued growth in site population, particularly in the number of visiting researchers and guests, has resulted in overcrowding of facilities, especially in offices at Bethel Valley. This lack of space has necessitated use of temporary buildings, trailers, and off-site rental space.

ORNL's inventory of 429 buildings is also aging; fully 109 were constructed during and immediately after World War II. Limited budgets have allowed the quality of most of these—and of some of the younger buildings—to decline. Overall, only 23% of ORNL's building space is deemed adequate. While approximately 74% of the Laboratory's space can be rehabilitated, 3% must be replaced. In addition, much of ORNL's aging infrastructure needs upgrading.

Appropriate visual character. While a few parts of ORNL's Main Site have the character of an R&D institution, much of it resembles a World War II-era industrial site. And because a number of facilities are slated for decommissioning, decontamination, and demolition, this character is likely to persist and become more imposing. Yet the natural setting of the Main Site is beautiful; there is ample opportunity—through creative site development planning and architectural design—to harmonize the human-made and natural environments. The atmosphere of a world-class research, development, and educational institution should resemble that of a university campus.

Focused safeguards. Relatively little work remains at ORNL's Main Site that must be shielded or protected for reasons of national security. Yet security barriers are not yet strictly focused on this work. Portions of the Laboratory operate in areas with security levels beyond current needs.

It is costly to maintain activities with a level of security that is needlessly high. Not only are the security measures costly, but security barriers and clearance procedures also impede flows on the site, decreasing productivity. Technology transfer and education—site missions of growing importance—are more difficult when there are unnecessary impediments to information exchange and human interaction.

Ideally, safeguards and security measures should be focused on the activities and materials that must be shielded or protected. Security barriers should be configured so that they are a minimal hindrance to the flow of people, material, and equipment throughout the site.

3.4.6 Alternatives

When viewed in terms of objectives for a multimission twenty-first-century R&D laboratory, ORNL's assets are deficient in five areas: (1) the cost of compliance with all ES&H requirements; (2) the degree of consolidation of activities or operations; (3) working conditions on the sites; (4) the visual character of the sites; (5) the efficiency of safeguards and security measures. Four broad alternatives for removing these deficiencies were identified during the planning process:

1. Make no changes.
2. Eliminate all but the currently adequate facilities.
3. Maintain existing adequate facilities; upgrade currently inadequate facilities; and through both rehabilitation and selected replacement, provide additional facilities to meet new requirements.
4. Replace all inadequate or inappropriate existing facilities and provide new facilities to meet new requirements.

Alternative One. Alternative One maintains the status quo. This may be a viable option for facilities 10 years old or younger. The technological status, physical condition, and compatibility with the current mission are all likely to be satisfactory. Unfortunately, only 8% of the Laboratory's building space falls into this category. As a facility ages, the period of time the status quo can be maintained diminishes. After 25 years, buildings and site infrastructure begin to require rehabilitation or replacement. This is the case for 77% of ORNL's building space.

Alternative Two. Elimination of all but the currently adequate facilities is appealing because it would significantly reduce facility operating and maintenance costs as well as rehabilitation and replacement costs. Although the core of the Laboratory is adequate, a major portion of its buildings and infrastructure contain deficiencies requiring some form of action. The elimination of all deficient facilities would reduce Laboratory facilities to a level below that required to support current and future missions. This would require termination of some activities.

Alternative Three. Maintaining the currently adequate core of Laboratory facilities while aggressively seeking to upgrade or replace inadequate facilities should permit the continuation

of current and projected mission assignments. Operating and maintenance costs would climb until inadequate facilities were restored, but if the program were aggressive, this effect would be relatively short lived. The addition of new facilities to meet new requirements would reduce the need to retain inappropriate or obsolete facilities and would lower the average age of the Laboratory's facilities.

Alternative Four. Replacing all inadequate or inappropriate facilities and adding new facilities to meet new requirements would significantly reduce the average age of the Laboratory's facilities. These new facilities would have appreciably lower operating and maintenance costs. ORNL divisions currently at the Y-12 Plant would be housed in new, more appropriate facilities at the ORNL Main Site, thereby eliminating rental costs and increasing efficiency. The near-term cost impact of this alternative would, however, be the greatest of the four options. Minimizing disruption to ongoing Laboratory operations could be a significant concern during the period of replacement.

Preferred Alternative. The fourth alternative is preferred. Only this alternative can provide the necessary levels of human and environmental protection at minimum cost; a high degree of operational efficiency in research, development, and support; adequate working conditions and visual character; and appropriate safeguards and security. Moreover, the fourth alternative appears to be the most cost-effective alternative in the long run.

3.4.7 Facilities Resource Requirements

The management of facility space for the Laboratory presents a number of challenges. ORNL's physical infrastructure, including utilities, will continue to need maintenance and upgrades, both in areas of continuing operation and to maintain unusable facilities in a safe state. Shifts in personnel location and space needs are taking place because of changes in staffing levels associated with the restructuring of DOE's contractual arrangements in the Oak Ridge area and with downsizing and because of Laboratory management's decision to reduce dependence on off-site space.

Several approaches have been implemented to support the effective use of available facility assets. Approximately 22,000 sq ft of leased space in the Oak Ridge area has been vacated; the personnel and functions formerly located in this space have returned to ORNL sites. ORNL no longer occupies space at the East Tennessee Technology Park. The space chargeback system implemented in April 1998 is expected to provide clear incentives for programs and organizations housed in ORNL facilities to efficiently and effectively manage their space now and in the future.

Constraints on funding for infrastructure requirements and proposed programmatic initiatives make it difficult to address even the most crucial Laboratory needs. The overall emphasis on reducing the federal budget also constrains line-item funding (as well as operational funding) and limits ORNL flexibility in addressing infrastructure and programmatic requirements. Only the most urgent needs can be accommodated under these conditions. For the past 3 years, GPP and GPE funding has been approximately half of the FY 1995 level. Available funding has been sufficient to meet only a small portion of ORNL's most critical needs.

Requirements in these areas continue to grow, and projected funding levels remain well below the level needed to maintain the Laboratory's infrastructure in good condition. The projected budget for these activities in FY 1999 and FY 2000 is $7.7 million annually. However, the identified requirements are $13.5 million in FY 1999 and $23.9 million in FY 2000. The recent increase in the GPP level from $2.0 million to $5.0 million makes this situation worse by placing an even larger scope of work, previously funded as line item projects, within the GPP funding program. To most effectively meet the needs of ORNL programs, GPP and GPE funding needs to be consistent with levels prior to FY 1996. Line item funding requirements for infrastructure improvements is expected to continue in the $7 million to $10 million range annually.

3.4.8 Reengineering Initiatives

As a result of reengineering, steps have been taken to decrease costs, eliminate inefficiencies, increase customer control, provide flexibility, and increase performance in Engineering Design and Construction (ED&C) processes that support ORNL missions, including infrastructure management. Over the past 12 months, ORNL Engineering has assumed the construction manager role for all construction projects. LMER also received delegated procurement authority from DOE. To increase the responsiveness and flexibility in procuring design and construction services, several task order type architect-engineer support services and basic ordering agreement construction contracts have been put in place. These changes have resulted in an approximate reduction in design/construction cost of 20 to 30% and a reduced procurement time of 50%. Other changes in the ED&C process include the identification of a single organizational ES&H oversight authority and the use of pre-qualifications for awarding construction contracts. These changes are proving to maximize the use of scarce capital improvement funding.

Other reengineering initiatives in the area of ES&H have provided a set of Work Smart Standards which identifies the necessary and sufficient regulatory laws, rules, and orders required to fulfill requirements in a responsible and efficient manner similar to the commercial and private sectors.

3.4.9 Master Plan Development

The development of the ORNL Master Plan is based on the following premises or guidelines. These premises stem from the preferred alternative for removing the deficiencies of the site.

1. ORNL divisions currently at the Y-12 Plant will be relocated in new, purpose-built facilities at the Main Site.

2. All inadequate or inappropriate facilities at the Main Site will eventually be upgraded or replaced. New facilities will be added to meet new mission assignments and requirements.
3. The linear pattern of the existing Main Site layout, derived from local ridge and valley terrain, will serve as the general physical form determinant. The areas within Bethel and Melton Valleys will be divided into zones of related activities (i.e., according to function,

program, or division). Design will resemble that of a university campus.

3.5 ORNL MASTER PLAN

The ORNL Master Plan was created from the ESHQ&I Management Plan Information System database of the activities and projects currently in the planning process for Capital Assets Management. The Master Plan accommodates the Laboratory's anticipated programs by establishing the following scenarios:

- Section 3.5.1 identifies those activities and projects currently funded or planned in the current FY through the next two FYs.

- Section 3.5.2 identifies those activities and projects beginning the fourth FY following the current FY through the tenth FY.

- Section 3.5.3 identifies those activities planned in outyears or greater than ten years following the current FY and emphasizes consolidation of related activities into zones or campuses.

ORNL is committed to good stewardship of its resources, both in management of existing facilities and in planning for future needs. In the long term, the physical infrastructure at ORNL, including utilities, will continue to need expansion, maintenance, and upgrades. Shifts in programs, personnel, and needs in facilities drive planning for new or redesigned work and R&D facilities and processes. Constraints on the availability of funding for infrastructure requirements and proposed programmatic initiatives dictate a system of risk analysis and prioritization to fund the most crucial needs. As the ORNL facilities age, the requirements for infrastructure funding increase. The projected funding levels for these requirements are anticipated to be well below the level needed to maintain the Laboratory's infrastructure in a state-of-the-art condition. However, funding allocations are assumed to be placed on those activities that would impact ES&H issues.

Sections 3.5.1 and 3.5.2 list those funded or planned activities and projects by type of funding (LIs, GPPs, GPEs) and designated as either landlord or program-specific programmatic. Specific GPE projects are not listed beyond the initial 3-year period.

The 10-year planning horizon involves three project areas as described below. Each type of project with a basis for inclusion in the master plan is described.

- **R&D Related Infrastructure Projects**. These projects are programmatic R&D and Landlord R&D related infrastructure activities which support the ongoing mission of the Laboratory. Funding of these projects is dependent on LI funding allocations and on Landlord allocation of GPP funds. Prioritization is generally supported by the current R&D mission, which impacts specific facility and program activities.
- **General Facility Infrastructure Projects**. These projects are typically the ongoing utilities and operations and maintenance activities and planning, oversight, and management activities funded through the Energy Research Office of Basic Energy

Sciences Landlord funds. The projects support the several major projects identified as top programmatic and infrastructure construction initiatives. These projects were risk ranked by the ORNL Risk Ranking Board and prioritized by ORNL senior management prior to being submitted to DOE for final approval of funding allocations.

- **M&I Contractor Projects**. These projects are the responsibility of the Oak Ridge M&I Organization for identification, risk ranking, prioritization, and funding/project management. ORNL-specific projects that impact the continuing mission of the Laboratory are identified and briefly described. For detailed information on projects managed by the M&I contractor, the EM Baseline for M&I projects at ORNL can be accessed on the World Wide Web at URL http://www-internal.ornl.gov/ER/baseline_management/em_baseline.html.

3.5.1 Current to Three Years

Figs. 3.21 and 3.22 show the GPP and LI projects scheduled during FY 1998, FY 1999, and FY 2000. Table 3.6 identifies projects scheduled for initiation and/or completion during the near-term funding cycle (current to 3 years). These projects are described in Sections 3.5.1.1 and 3.5.1.2. Funding of near-term projects is dependent on the type of project, the funding source, and the priority based on infrastructure conditions or the R&D mission of the Laboratory.

The near-term strategy is to ensure the successful accomplishment of the R&D mission of the Laboratory by providing facilities and systems and the continuation of activities supporting ongoing operations of the physical plant and infrastructure. Project activity is in support of utilities, operations, maintenance, related administrative and technical support, ESH&Q, and general space management. Roles/objectives of the near-term projects are

- **Spallation Neutron Source**. In response to the national need for the production of neutrons for use in scientific research, DOE-ER provided funds to initiate the R&D for such a source and completed a conceptual design report (CDR) for the SNS. The Laboratory organized a collaborative design effort involving several of the national laboratories. This CDR review was an essential and important step to providing the information needed by DOE to continue the SNS to completion.

- **Neutron Sciences Support**. Neutrons play an essential role in many areas of science and technology to study the structure and dynamics of condensed matter. In support of this role, a continuing need for supporting facilities for neutron studies and housing for scientific personnel is critical.

Fig. 3.21

Fig. 3.22

Table 3.6. ORNL current line item and general plant projects

Type project	Line items	General plant projects
R&D-related infrastructure projects	-Spallation Neutron Source -Joint Institute for Neutron Sciences (state funded) -HFIR Accelerator/Reactor Improvement Modifications -HFIR Remote Handling Facility -HFIR Thermal Neutron Guide Hall	-Neutron Sciences Support Building -Environmental and Life Sciences Laboratory -HFIR Users Facility -Addition to Building 6012 -Metrology Laboratory -Five Teraops Computer Facility
General facility infrastructure projects	-Steam Plant Upgrade -Roofing Replacement -Electrical Systems Upgrade	-West End Steam Upgrade Completion -Building 2519 - 3000 Scfm Air Compressor Replacement -Condensate Return System Upgrade -Repair No. 1 Water Reservoir -250,000-Gal Steel Fuel Oil Storage Tank Construction -Building 4509 Maintenance Shop Addition -Fire Protection Systems Upgrade -Upgrade Electrical Systems (Areas 3000, 6000, and 7000) -Water System Upgrade, 6000 Area -Security Perimeter Configuration -Road and Parking Lot Paving -Mailroom Facility -Child Care and Fitness Center
M&I contractor projects *	-Melton Valley Storage Tank Capacity Increase -Bethel Valley LLLW-CAT System Upgrades -Bethel Valley FFA Upgrade -Transuranic Waste Packaging Facility	

*The Environmental Management Baseline for M&I projects at ORNL can be accessed on the World Wide Web at URL http://www-internal.ornl.gov/ER/baseline_management/ em_baseline.html.

- **High Flux Isotope Reactor Upgrades**. The HFIR is one of the world's most important research reactor facilities. To continue the critical mission of the HFIR, upgrades are needed to modernize some of its instruments and components, to add new capabilities, to increase its power level, and to maintain or improve the availability of neutrons to researchers. With these improvements, the HFIR can continue to operate and provide a unique resource for neutron-based science.

- **Functional Genomics**. ORNL is positioning itself for the formation of a core functional genomics effort dedicated to the large-scale generation, phenotypic characterization, molecular analysis, and distribution of new mutations in the mouse. Reaching this objective will require laboratory space for housing the mice and ancillary laboratories for experimental breeding and necropsy activities.

- **General Infrastructure Projects**. ORNL programs require a variety of buildings and equipment, including specialized experimental laboratories, a large complement of office space, and major utility and waste disposal facilities. Continuing efforts are required to enable extensive renovations and rehabilitation of general-purpose buildings and utility systems that have deteriorated due to insufficient capital improvement funding for modernization and adaptation to changing program needs. Utilities upgrades for primary electrical systems, steam distribution systems, fire protection systems, and general continuing maintenance projects are essential for near-term completion of successful Laboratory mission objectives.

- **M&I Contractor Projects**. The Oak Ridge M&I contractor is responsible for the funding of waste management and environmental remediation activities at the ORNL site. These projects are essential to the ongoing operation of facilities and systems as well as research needs of the Laboratory. The WMOD is responsible for the interface with the M&I contractor to assure that projects are identified and funded to meet Laboratory mission objectives.

3.5.1.1 Line Item Projects

Spallation Neutron Source (ADS S97D0046, FY 1999 LI)

The SNS is a new experimental facility planned to meet the national need for neutron scattering and related research. The facility will be available to scientists from universities, from industry, and from other federal laboratories. The SNS will be equipped with an initial complement of advanced instruments for neutron beam research.

The facility will be built around a spallation neutron source. Combining the higher source power with improved experimental facilities will create a useful neutron flux significantly higher than is now available at any facility in the world. There will be beam lines for neutron scattering instruments or other neutron research equipment in experimental halls. The potential also exists for the development of entirely new lines of scientific research based on the enhanced capabilities that will be available in the SNS facilities.

The primary objectives in the design of the site and buildings for the SNS are to provide the

optimal facilities for utilization of neutron beams and to address the mix of needs associated with the user community, the operations staff, security, contamination control, noise, etc.

The objectives stated above are being met with a group of major structures which include ion sources, linac and klystron accelerators, synchrontron or compression ring facilities, beam transport, and experimental halls which include detectors and instrumentation, and capabilities for remote servicing of the spallation targets. Also included on the site are facilities to support the needs of operations staff, technical support staff, and users.

Major computer items in the construction project include the instrumentation and control systems, business computing systems, and the Experiment Systems Computer and Data Handling System.

In a related project, ORNL, UT, and the State of Tennessee have initiated plans for a **Joint Institute for Neutron Sciences** (JINS). This facility will enhance the utility of the SNS and the HFIR by providing meeting facilities, offices, laboratories, a communication center, and housing for scientists and engineers from universities, industries, and the international research community. It will also be a focus for expanding neutron science R&D with UT, other regional universities, and industrial collaborators and will serve as an interface and economic development gateway for outside access to ORNL's neutron science facilities. Funds included in the State of Tennessee's FY 1996 budget were used to begin the conceptual design for the JINS in preparation for a construction request in coming years.

HFIR Accelerator/Reactor Improvement Modifications (ADS A98D0005 – Funded, FY 1998 LI and P98D0032 – Unfunded, Proposed FY 1999 LI)

This project describes the HFIR's continuing need for Accelerator and Reactor Improvement and Modifications (ARIMs) funds to replace outdated reactor systems and equipment to help ensure continued safe and reliable operation. This will be the continuation of a series of safety improvement projects started in FY 1990. To be most effective, this funding is needed on a continuing basis to replace 30-year old systems and equipment, which have exceeded design and useful life. Many of these systems and much of the equipment are safety-related, and spare parts are no longer available.

The success of the HFIR mission is dependent upon adequate system and equipment replacement. Reactor availability and productivity for neutron scattering research, isotope production, neutron activation analysis, and materials irradiation are dependent upon continued HFIR operation at the highest efficiency.

HFIR operation ARIMs requirements have been prioritized for FY 1999 and FY 2000. Should the funding levels not meet projected requirements, then projects not funded will be considered in subsequent fiscal years.

HFIR Remote Handling Facility (ADS S97D0053, FY 1999 LI)

This project will provide remote handling capability at the HFIR in the form of a new hot cell and telemanipulators over or near the reactor pool. Availability of hot cells in ORNL to new scientific endeavors has become increasingly small since existing hot cell facilities are either oversubscribed by existing programs or are in line to be phased out as part of the D&D program.

HFIR Thermal Neutron Guide Hall (ADS S97D0044, FY 2000 LI)

This project will provide a facility with as many as five shielded neutron guides and an initial complement of neutron scattering instruments. The Guide Hall will include a structure approximately 23 m by 46 m (75 ft by 150 ft) consisting of a Guide Hall on the ground floor coincident with the ground floor of the HFIR building and a second floor that includes office space, conference facilities, and computer terminals for staff and users. The Guide Hall is attached to the HFIR building by interconnecting doors and vestibules to maintain confinement; neutron beams pass from the HB-2 position in the HFIR biological shield through shielded guides to the Guide Hall and thence to the neutron instruments.

Steam Plant Upgrade (Boiler Addition) (ADS Number S97D0017, FY 1998 LI)

This LI project will construct an additional 100,000-lb boiler for increased capacity at the ORNL Steam Plant. The new boiler will be capable of burning either natural gas or fuel oil using modern boiler technology. Included in the project will be those boiler auxiliaries (e.g., pumps, fans, tanks, etc.) necessary to support plant operations. Four existing coal-fired boilers are approaching 50 years of age and the end of their dependable life. Boiler and economizer tube failures, coal-handling problems, and the general age-related degradation of the boilers and their support systems make it necessary to pursue options designed to extend the dependable operational life of the Steam Plant. The project will augment the plant's steam generation capability while further extending the remaining life of the equipment and facility by adding a new reliable, efficient boiler. The addition of this boiler will allow time for the evaluation of options available for the total replacement or rehabilitation of the existing Steam Plant in an economical, planned manner.

Roofing Replacement (ADS Number S97D0029, FY 1994 LI)

This LI project provides funding for the replacement of deteriorated roofs on buildings and facilities throughout the main ORNL site complex. Most of the roofs at the complex have been in service for over 30 years. Deteriorated conditions have caused significant leaks. In many instances, these leaks have adversely affected equipment, records, and research. Potential personnel safety and health are caused by deteriorated roofing conditions associated with leaks and structure damage. The scope of this project includes the replacement of built-up roofing, including removal and disposal of existing membrane and insulation, inspection and repair of damaged decking, and installation of new insulation and membrane with associated flashing and trim.

Electrical Systems Upgrade (ADS C97D0106, FY 2000 LI)

The ORNL electrical distribution system requires significant restoration and expansion to assure the continued operation in support of the research and operation missions of the Laboratory. Electrical components throughout the Laboratory are obsolete and increasingly dangerous to operate. Specific funded activities associated with this LI include

- *Overhead Feeders 244 and 264 Upgrade*. The 13.8-kV overhead feeders run from the ORNL Primary Substation to the 7600 Area Robotics and Process Systems Division facilities. The feeders serve the 6010 Oak Ridge Electron Linear Accelerator (ORELA), the 6011 Computing and Telecommunications Facility, the 6012 Computer Science Research Facility, and the 5510 Analytical Mass Spectrometer Laboratory; they serve as a dual-feed to the 4509 and 2632 major 2.4-kV secondary substations within the Laboratory. The feeders will be completely rebuilt to ensure reliable continuation of service.

- *Electrical Metering System*. A computerized electrical metering system will be installed in the ORNL electrical distribution system. Electrical meters will be installed on major distribution feeders and on significant facilities throughout he Laboratory.

- *Building Electrical Service Entrance Upgrades*. Obsolete and inadequate switchgear, transformers, and conductors will be replaced at the main service entrances of Buildings 2519, 4501, 4500S, and 5500. New switchgear and cabling will be added to the bus ties in Buildings 4500N and 4500S.

- *Substation 4509 Improvements*. Secondary Substation 4509 will be upgraded by installing two new 13.8/2.4-kV, 7500-kV transformers, and new 2.4-kV switchgear to form a 13.8-kV primary selective arrangement and a 2.4-kV transformer and switchgear double-ended arrangement. Existing 13.8-kV switchgear "A" will be reinsulated and refurbished. A 13.8-kV primary selective system arrangement will be provided for two internal Building 4509 service transformers.

Melton Valley Storage Tank Capacity Increase

The increase in storage capacity for LLLW and sludges capable of being pumped is in response to the FFA requirement to transfer waste from leaking, inactive, and substandard LLLW tanks to storage facilities that incorporate double containment, leak detection, and cathodic protection. This project will provide an additional 450,000-gal storage capacity to the existing MVST Facility plus a reserve capacity of 90,000 gal, equal to the useable capacity of the largest tank in the system. The storage project includes (1) lined tank vaults containing six 100,000-gal (90,000 gal useable) capacity tanks; (2) a lined vault for associated process pumps and valves; (3) a filtered ventilation system that maintains the tanks and vaults under negative pressure and prevents buildup of combustible gases; (4) a buried and lined valve pit that connects the new tanks to the existing tanks and to the LLLW evaporator in Bethel Valley; (5) a truck unloading facility consisting of a diked and covered concrete pad and piping connections that allow receiving chemicals from trucks and pumping liquid process waste into a waste tank truck; and (6) a control and equipment room which houses support equipment.

Bethel Valley LLLW-CAT System Upgrades

This project will upgrade a portion of the Bethel Valley LLLW collection and transfer (CAT) system using the best available technology. The project includes (1) approximately 1 mile of 2-in. and 3-in. doubly contained stainless steel pipeline with active leak detection and cathodic protection to prevent corrosion; (2) approximately two 1900-gal stainless steel tanks in doubly contained concrete vaults lined with stainless steel and supplied with flow control, pH monitoring, and an automatic caustic addition system for neutralization; (3) local monitoring and control stations integrated with the existing Waste Operations Control Center; and (4) a new Transported Waste Receiving Facility for receiving LLLW transported by tanker truck or small bottles. The latter facility will include one LLLW tank and one process tank for monitoring and control.

Bethel Valley FFA Upgrade

This project consists of two main sections. The hot off-gas (HOG) portion rerouted condensate from the underground HOG ventilation system ductwork to the process waste system. This condensate is classified as process waste but had previously drained to LLLW Tank WC-9, which is scheduled for removal. This work, which was completed in FY 1997, consisted of a new underground tank, a steam station, and associated pipes for transferring tank contents to the process waste system.

The second portion is associated with the LLLW Evaporator Facility. It provides a new above ground filter systems facility (Building 2568) for the cell vent and off-gas streams replacing two underground filter pits. Instrumentation, controls, and steam stations for the existing Evaporator Service Tanks (Building 2537) will also be upgraded.

Transuranic Waste Packaging Facility

This project will provide a facility in the Melton Valley area of ORNL for the processing, packaging, and shipment of transuranic wastes collected in the Melton Valley Storage Tanks for off-site disposal.

3.5.1.2 Landlord GPPs and Programmatic GPPs

Neutron Sciences Support Building (ADS S97D0001, Funded FY 1997 Landlord GPP)

This project will provide a support facility of approximately 5000 ft^2 constructed adjacent to the existing beam room at the HFIR. The facility will facilitate the separation of user activities from reactor operations at the HFIR for Basic Energy Science, Health and Environmental Research, and Energy Efficiency and Renewable Energy programs. The facility will provide critically needed space for equipment storage during routine beryllium reflector changeouts and other reactor maintenance.
This project will substantially reduce the risk of Health Physics and Safeguards and Security noncompliances and will allow ORNL to project a more “user friendly” image while improving overall security at HFIR. HFIR has the highest thermal neutron flux in the world,

and the multiprogram demand for HFIR research (materials, energy efficiency, structural biology) is growing. Approximately $2,000K/year is possible in new research funding and an additional $10M in equipment is contingent on completion of this project.

Environmental and Life Sciences Laboratory (ADS C98D0120, Funded FY 1998 Landlord GPP)

This project will construct a 64-ft-wide by 100-ft-long two-story laboratory building located in close proximity to two generic office buildings immediately west of Building 1000.

The new research laboratory facility will consist of eight large laboratories of approximately 1,250 ft^2 each. The laboratories will have HEPA ventilated hoods, sinks, and topical counters. General laboratory equipment will be moved from Y-12 and other ORNL sites.

This project will assist in providing a means for achieving future research goals by relocation of development organizations at Y-12 to the ORNL research complex. Improved research capabilities and increased interaction with other strong R&D programs at ORNL are the primary objectives. Constructing the facility at ORNL is vital to a plan to relocate ORNL personnel so that they will be ideally situated for effective collaboration with scientists in other ORNL divisions instead of being adjacent to a high-security weapons production facility.

HFIR Users Facility (ADS P98D0253, Funded FY 1998 Landlord GPP)

This project will provide needed office space for a broad spectrum of HFIR users and HFIR Subgrade Project personnel. HFIR users have nearly doubled in the past three years, and no space is available to accommodate this increase. The HFIR Upgrade Project has been funded, and it is essential that the project team be located in close proximity to HFIR. This project will provide 21 offices to alleviate overcrowding in Building 7962, provide space for the HFIR Upgrade project team, provide space for instrument scientists for the SNS project, and provide space to accommodate the increased numbers of users at HFIR.

HFIR is ORNL's premiere facility, serving a broad spectrum of programs and more than 350 outside users per year. The continued operation of HFIR is contingent on the successful completion of the HFIR Upgrade Project and on the existence of a growing and satisfied scientific user community.

Addition to Building 6012 (ADS S97D0002, Proposed FY 1999 Programmatic GPP)

The addition to Building 6012, the Mathematical Sciences Research Facility (MSRF), will provide (1) space for additional computational science research staff members and (2) a ground-level laboratory that will provide direct access and adequate overhead clearance for several robot systems studied at the Center for Engineering Systems Advanced Research (CESAR). The total area of 6500 ft^2 will be divided into laboratory, office, and control room spaces.
The most rapidly growing R&D activities in Computing Sciences and Mathematics Division are informatics, networking, visualization, and cooperative intelligent systems. The growth and impact of these R&D efforts in recent years have created a critical space shortage that

will halt future growth and threaten our ability to retain existing programs.

Metrology Laboratory (ADS S97D0009, Proposed FY 2000 Programmatic GPP)

An upgrade to Building 3500, A27 high-bay area, is proposed. Consisting of the creation of a second floor in the high-bay and high-quality laboratory modules on both the first and second floors, this facility upgrade will result in the addition of 3040 ft^2 of needed laboratory space. These laboratories include

- a state-of-the-art environmental control module for nanometer accuracy metrology,
- a pair of class 100 clean rooms for advanced electronics integration, packaging and micro-electro-mechanical systems (MES) prototyping and development,
- a class 4 laser laboratory for infrared and visible light spectroscopies, and
- a myriad of other sensor, instrument, and network system testing and development facilities.

The high-bay area was originally designed to cost effectively accommodate such an upgrade, and the present structure already has sufficient beam support for installing the upper floor.

Five Teraops Computer Facility (ADS A98D0019, Proposed FY 1999 Landlord GPP)

This project will provide space, utilities, and power for the installation of a five teraops (TO) computer system in Building 4500N to support the Strategic Simulation Initiative.

West End Steam Upgrade Completion (ADS S97D0032, Funded FY 1997 Landlord GPP)

This project will provide funding to install concrete trench duct, installation of steam piping, compressed air piping, condensate return piping, insulation of this piping, and final tie-ins to existing buildings in the west end of the main ORNL site. Design work has been completed and materials have been procured for completion of these tasks.

Current steam system configuration in the west end of the Laboratory requires isolation of key research facilities to perform maintenance on the steam system. Completion of the new system across First Street will provide a loop that will provide the operational flexibility to perform maintenance without affecting ongoing research activities.

Building 2519 – 3000 Scfm Air Compressor Replacement (ADS S97D0010, Funded FY Landlord 1998 GPP)

This project will purchase and install a new 3000-scfm, rotary screw turbine type, oil-less air compressor to replace aging units at the plant. The new unit will provide the Steam Plant with the capability to produce sufficient quantities of oil-free compressed air to satisfy the current 2200 plus scfm site-wide demand. Clean, oil-free compressed air is used throughout the Laboratory to control equipment, systems, and processes and is a critical utility in the operation and maintenance of the Laboratory.

The new compressor will allow plant production of compressed air by one air compressor and will allow the removal of the No. 1 and No. 2 compressor units from service. The No. 1 compressor is a late 1930s reciprocating model, and the No. 2 compressor is a 1917 model Pennsylvania reciprocating unit. Both of these units were obtained from area industries for the Laboratory during 1943 and were originally installed in the first ORNL Steam Plant. They were moved to the existing plant when it was constructed in 1947 and are used in a backup role and operate only when maintenance requires taking one of the main compressors off-line. Repair parts are unavailable for both the compressors and the synchronous drive units.

Condensate Return System Upgrade (ADS C98D0177, Funded FY 1998 Landlord GPP)

This project would provide an evaluation of the existing system to determine whether to repair or replace the various components of the system, purchase and install components needing replacement, and repair the repairable ones. Initial projections include 30 collection stations with 60 pumps which need to be reworked.

Repair of the No. 1 Water Reservoir (ADS S97D0021, Proposed FY 1999 Landlord GPP)

This project will repair deficiencies of the 3-million-gal No. 1 water reservoir. The concrete reservoir serves the Bethel Valley portion of the Laboratory and provides water storage capacity for both operational needs and fire protection purposes. Internal inspections are performed every five years to monitor and assess reservoir condition. Inspections indicate spalled concrete, corroding structural reinforcement, and cracks. The reservoir will be drained and cleaned, structural repairs will be performed, and a new corrosion-resistant liner will be installed. Additional work will be performed on the exterior surfaces of the structure to help counter the effects of weather and age.

This reservoir was constructed in 1948 and has been in continuous use. Maintenance activities have been performed only on the outside surfaces of the structure and have been largely cosmetic in nature. The repairs and improvements are necessary to ensure that the structural integrity of this critical facility is maintained.

250,000-Gallon Steel Fuel Oil Storage Tank Construction (ADS S97D0055, Proposed FY 2000 Landlord GPP)

This project will construct a 250,000-gal prefabricated steel storage tank and secondary containment structure adjacent to the ORNL Steam Plant. This tank will be used to store fuel oil, which is used as an emergency fuel source for the generation of steam at the facility. Associated fuel oil transfer lines and pumps used to move the fuel from the tank into the Steam Plant will be included in the project as well as a fire suppression system for the tank and its equipment.

The construction of this tank is one of the initial steps needed to convert the Steam Plant from coal to natural gas. As the plant continues to age, increased maintenance and equipment replacement will make burning coal as a primary fuel uneconomical. Major capital investments will need to be made in the boilers, precipitators, coal handling systems, ash systems, and the

coal yard runoff over the next 10 to 15 years if the plant is to continue to use coal as a primary fuel.

Building 4509 Maintenance Shop Addition (ADS C97D0089, Proposed FY 2000 Landlord GPP)

This project will construct an addition of approximately 2500 ft^2 to Building 4509, which houses the Air Conditioning Compressor maintenance activities for the Laboratory. The addition will allow space for maintenance personnel to work on major air conditioning units and support equipment. The addition will improve safe operations for maintenance personnel who work with gasses having potential significant hazards.

Fire Protection Systems Upgrade (ADS C97D0071, Proposed FY 2000 Landlord GPP)

Fire protection systems at facilities within ORNL are increasingly demonstrating lack of reliability and degradation of system components relative to age and exposure to corrosive conditions. This project will provide the following improvements:

- Upgrade of fire sprinklers in the Central Research and Administration Building (4500S). This upgrade will include the extension of fire sprinklers into some areas not currently protected and interface modification between the sprinkler systems and the fire alarm systems.

- Replacement of identified aged and failure-prone automatic preaction sprinkler system deluge valves with highly reliable automatic wet-pipe sprinkler system alarm valves in the High Voltage Accelerator Laboratory (5500), the High-Level Radiochemical Laboratory Building (4501), and the Experimental Engineering Building (4505).

- Replacement of identified aged and maintenance-intensive automatic dry-pipe sprinkler systems with reliable and effective automatic wet-pipe sprinkler systems in the General Stores, Shipping, and Receiving Complex.

- Upgrades in the HFIR Building of identified antiquated fire alarm systems.

- Correction of fire protection engineering assessment deficiencies in Building 7035B.

- Installation of code-approved fire barriers and upgrade electrical wiring and fixtures in the paint storage and mixing areas of 7035.

Although the systems are aging and becoming failure prone, they are on a rigid inspection, testing, and maintenance schedule. Failure rates and types are recorded and accumulated. Should failure rates reach a “critical” level where negative impacts on people and property appear imminent, this project will be reassessed for timing and funding allocations.

Upgrade Electrical Systems (Buildings in the 3000, 6000, and 7000 Areas) (ADS C97D0069 and ADS C97D0070, Proposed FY 2000 Landlord GPPs)

This project will replace obsolete and inadequate switchgear and transformers at the main electrical service entrances of buildings in the 3000, 6000, and 7000 areas. These electrical

devices are the control points for the main electrical systems in these facilities. Much of this equipment has been in service for 50 years and must be replaced to ensure reliable electrical service to the customers and provide a safe environment for building occupants, system operations, and maintenance personnel.

Water System Upgrade, 6000 Area (ADS C97D0097, Proposed FY 2000 Landlord GPP)

This project will provide a needed infrastructure upgrade for the potable water system in the 6000 Area of Bethel Valley. New lines will be installed to replace major feed lines installed during the early 1940s that have undergone structural degradation with age. Included in the project will be improved fire protection capabilities and reliable potable water supply to the 6000 Area. The upgrade will consist of the installation of approximately 7200 ft of new 16-in./12-in. water mains, isolations valves and motor controllers, and pressure-reducing valves and valve pits.

Security Perimeter Reconfiguration (ADS S97D0059, Proposed FY 2000 Landlord GPP)

This project will reconfigure the existing security perimeter configuration to be more adaptable to the current and future scientific mission of the Laboratory and improve the operational efficiency. The project will install guard booths at the main ingress/egress locations and establish the proper barriers to maintain the Property Protection Areas. This configuration would improve the competitive nature of the Laboratory to make the reservation more comparable to other premiere DOE laboratory facilities.

Road and Parking Lot Paving (ADS C97D0104, Proposed FY 2000 Landlord GPP Contingency Project)

This project will provide for paving of gravel parking lots which have been constructed in recent years. These lots include the HFIR area lot, the 2000 and 2001 lot, and other smaller areas which meet capitalization criteria for new paving.

Mailroom Facility (ADS A98D0086, Proposed FY 1999 Landlord GPP)

This project will construct an approximately 3000-square-foot steel frame/brick addition adjacent to 4500S for mailroom operations. The addition will provide space for efficient mail handling and sorting as well as room for bulk mail carts, ten of which are now stored in the 4500S corridor adjacent to the existing mailroom.

Child Care and Fitness Center (ADS C98D0123, Landlord GPP)

This project will provide a Child Care and Fitness Center. Approximately 100 children could be accommodated in the facility, which will be located adjacent to Bethel Valley Road in the 6000 Area of ORNL and will encompass a fenced area of 675 ft by 130 ft. Traffic controls will be provided as required for access to the center. The building will have approximately 13,000 ft^2 of space. The addition of this facility will be a significant asset in attracting and maintaining talented R&D personnel and users of the various Laboratory facilities.

3.5.1.3 General-Purpose Equipment

GPE Summary (ERKC)

FY 1998 Detailed List of GPE Acquisitions

ADS No.	ADS Title	FY 1998 Budget
C98D0004	Computing Systems & Supporting Modules for SAP	$ 641K
C97D0005	Dechlorination System	25K
C98D0003	Aerial Work Platform	52K
C98D0010	Electric Personnel Lift	30K
C98D0185	Boot Shop Spray Booth Automation	120K
P98D0248	Uninterruptible Power System (UPS) for LERC	56K
C98D0020	Replacement Valve Test Stand	123K
C98D0099	Bucket Truck	160K
C98D0006	Thermography Technology	68K
C97D0125	CFC Phaseout - Clean Air Act Compliance (KC)	1,900K
C98D0179	Replace Steam Plant Economizers	550K
C98D0009	LERC Data Acquisition System Upgrade, Bldg. 4512	40K
C98D0021	Particulate Counter for Filter Testing	49K
C97D0083	HVAC Upgrades - GPE - Target	229K
P98D0250	Replace Emergency Response Vehicle	115K
C98D0121	Replace Fleet Vehicles - GPE	330K
C98D0182	Laboratory Director's Research and Development - GPE	260K
C98D0012	480/240 Volt Standby Generator, Trailer Mounted	65K
C98D0001	Trash Truck Compactor, Front Loading	170K
C98D0005	Distilled Water Makers, 4500N and 4500S	85K
C98D0007	CNC Engraver	37K
C98D0014	Upgrades for Mass Spectrometers	75K
C98D0035	Crane Replacement	125K
C98D0015	Network Appliance F230	125K
C98D0011	Microwave Network Analyzer	70K
C98D0034	Forklift Replacement	83K
C98D0068	Replace Drill Press in Ironworker Shop	47K
C98D0017	Ultraspec Model 890940 Diagnostic System	38K
C98D0018	Wet Magnetic Particle Inspection System	68K
C98D0026	Remote Visual Inspection System	88K
C98C0183	Replace Transformers, Building 7901 (HFIR)	116K
C98D0019	Sullair 1600Q Portable Rotary	100K
C98D0013	Dosimetry System Upgrade	170K
C98D0008	Falcon 400 CNC Lathe	200K
P98D0252	Pipe, Angle, Channel Bending Machine	72K
	TOTAL FY 1998	$6,482K

FY 1999 Proposed GPE Acquisitions

ADS No.	ADS Title	FY 1999 Budget

C98D0004	Computing Systems & Supporting Modules for SAP	$800K
C98D0053	Automatic Film Processor	45K
C98D0063	Electronic Heat Sealer	33K
C98D0044	Oil/Grease Separator	113K
C98D0094	Road Grader	130K
C97D0125	CFC Phaseout - Clean Air Act Compliance (KC)	1,000K
C98D0179	Replace Steam Plant Economizers	550K
C98D0060	Alpha 2100 Computer System	60K
C98D0078	Manlift, Hydraulic Operated	27K
C97D0083	HVAC Upgrades - GPE - Target	411K
C98D0121	Replace Fleet Vehicles - GPE	300K
C98D0182	Laboratory Director's Research and Development - GPE	260K
	TOTAL FY 1999	$3,729K

FY 2000 Proposed GPE Acquisitions

ADS No.	ADS Title	FY 2000 Budget
C97D0125	CFC Phaseout - Clean Air Act Compliance (KC)	$1,000K
C97D0083	HVAC Upgrades - GPE - Target	460K
C98D0121	Replace Fleet Vehicles - GPE	300K
C98D0182	Laboratory Director's Research and Development - GPE	260K
C98D0109	Radioactive Materials Shipping Cask	750K
S97D0018	Replacement of Air Compressors - Bldg. 7603	275K
C98D0045	Colmac High-Production Shirt Press	63K
C97D0082	Elevator Upgrades	500K
C98D0025	Advanced Network Communications Analyzer	45K
C98D0079	Pants Press, Colmac High-Production Automated Unit	70K
	TOTAL FY 2000	$3,723K

3.5.2 Four to Ten Years

Figs. 3.23 and 3.24 show the GPP and LI projects scheduled for FY 2001 through FY 2007. Table 3.7 identifies projects scheduled for initiation and/or completion during the mid-term planning cycle (4 to 10 years). These projects are described in Sections 3.5.2.1 and 3.5.2.2.

Fig. 3.23

Fig. 3.24

Table 3.7. ORNL projects – 4 to 10 years

	Line items	General plant projects
R&D-related infrastructure projects	-National Isotope Separator On-Line (ISOL) Facility -Advanced Materials Characterization Laboratory -Computational Sciences Building -ORNL Center for Biological Sciences -Laboratory for Comparative and Functional Genomics	-HFIR Entrance Addition and Expansion -Building 3144 Addition -Building 7920 Facility Expansion -Building 7930 Upgrades -Construct Office Building for Chemical Technology Division Relocation -40 Teraops Computer Facility -Demolish and Replace Building 6003
General facility infrastructure projects	-Fire Protection Systems Upgrade -Laboratory Facilities HVAC Upgrade -Laboratory Facilities Ventilation Systems Upgrade -Process Waste Treatment Plant Relocation -Potable Water System Upgrade I -Potable Water System Upgrade II	-Automotive Wash Facility -Auxiliary Systems Upgrades -Building 7030 Addition -GPP HVAC Upgrades -Install Water Meters -ORNL at Y-12 Elevator Upgrades -ORNL Steam Plant No. 5 Boiler Upgrade -ORNL Visitor Center -Replacement of the B 2519 East End Water Softeners -Restoration of the Natural Gas Distribution System -Transportation and Packaging Management Facility -Ventilation Systems, Ductwork, and Fume Hood Upgrade -Building 7002 Changehouse Upgrade -Water System Upgrade, 1000 Area -Extend the 7000 Area Water Main -Water System Upgrade, 7600 Area -Melton Valley Road Replacement -ORNL Technical Support Building -Upgrade the ORNL Steam Distribution Condensate Removal System -Replace Cooling Tower 4511 -ORNL Facilities Water System Upgrade

The mid-term planning strategy is to continue with those projects initiated in the near-term planning until completion and to assure sufficient planning and implementation of mid-term projects. Mid-term projects include those activities that are currently being planned which are essential to the continued operability of the Laboratory infrastructure and utility systems and the provision of facilities required to support the Laboratory's mid-term R&D initiatives and objectives.

- **Neutron-Based Science and Technology**. Support for neutron-based science and technology activities is planned, including completion and startup of the SNS. R&D

activities provide neutron-based science and technology which include the design and operation of neutron sources (reactors and accelerators) and the use of neutrons in science and technology. Capabilities in this area support fundamental nuclear physics research, studies of material properties, nuclear materials management, development of materials for nuclear fusion and fission, isotope production for industrial and medical applications, and environmental protection.

- **Materials Research**. Materials research is a primary core function of the Laboratory. Efforts in materials research are performed to some extent by all of the R&D divisions. The goal is to create and apply knowledge about materials through research aimed at developing and engineering materials properties. Specific objectives include the advance of fundamental understanding of materials through interdisciplinary research, development of advanced materials technologies that provide innovative solutions to national priorities in energy, national security, and the environment, and the enhancement in materials science R&D.

- **Computational Sciences**. Development and application of state-of-the-art computational resources, tools, and techniques to meet existing and new scientific and technical challenges is a core goal of the Laboratory. Specific objectives include extending ORNL's high-performance computing, data storage, and networking environment, enhancing ORNL's leadership in systems and strategies for high-performance distributed computing to include expanded partnerships and sustaining ORNL's leadership in computational tools and techniques for highly parallel, and geographically distributed, environments.

- **General Infrastructure Projects**. ORNL uses a prioritization system based on ESH&Q, mission, and cost-effective risk-based factors for identifying those project activities which are funded by current allocations and anticipated future allocations. For mid-term GPP infrastructure, projects are identified as funded based on prioritization assigned by risk until anticipated funding is allocated. The remaining project activities identified are, however, listed as unfunded. Reallocation of funding is made based on prioritization and needs. Plant utilities systems (electrical, water, steam, fire, etc.) continue to be high-priority activities during the mid-term planning period. Mission activities for reservation access and parking facilities also receive significant recognition and planning for infrastructure improvements.

- **M&I Contractor Projects**. The WMOD continues to interface with the M&I contractor to assure that projects impacting the continued success of the Laboratory's mission are planned, initiated, and successfully completed. Several mid-term projects are in the initiation stages with near-term projects being completed. The M&I contractor's current contract projects a completion date of 2003 with the potential for a 5-year extension, if needed.

3.5.2.1 Line Item Projects

National Isotope Separator On-Line ISOL) Facility (FY 2001 Programmatic LI)

A facility to produce accelerated beams of radioactive isotopes was identified in the Long-Range Plan for U.S. Nuclear Science, prepared by the DOE/National Science Foundation Nuclear Science Advisory Committee, as the next major facility to be constructed for U.S. nuclear science. ORNL has unique resources for the construction and operation of a National ISOL Facility, for which the Holifield Radioactive Ion Beam Facility (HRIBF) can be considered a prototype.

ORNL staff are working to finalize the concept of the National ISOL Facility and plan to submit a proposal for its construction to DOE in the autumn of 1998. This "second-generation" ISOL facility will be capable of providing a broad range of intense proton- and neutron-rich beams of radioactive ions to a large scientific user community. The facility will produce intense beams of most neutron-rich fission fragments with half-lives greater than about a second and are sufficiently volatile to defuse from a hot target. Intense beams of these isotopes are not available from first-generation ISOL facilities such as the HRIBF. The advanced facility will also provide a larger variety of proton-rich radioactive ion beams (RIBs) than the HRIBF can supply. Both proton- and neutron-rich RIBs will be accelerated from tens of kiloelectron volts for materials science studies and radioactive target preparation to above the Coulomb barrier, thereby allowing nuclei to fuse for nuclear structure studies.

Advanced Materials Characterization Laboratory (ADS S97D0047, FY 2002 Programmatic LI)

The Advanced Materials Characterization Laboratory, a new 32,000 ft^2 structure that will provide the high-quality environment required to optimize performance of sophisticated characterization equipment essential for the next generation of advanced materials R&D, will provide for the centralization of advanced materials structural characterization equipment. Electron microscopes, atom probe microscopes, and nanoindenter mechanical properties equipment are now housed in buildings that barely meet the manufacturers' requirements for optimum operation of this equipment. It is clear that the current buildings will not allow ORNL to maintain state-of-the-art instrumentation for the next generation of this equipment.

Computational Sciences Building (ADS S97D0045, FY 2002 Programmatic LI)

This project will construct a new multistory computer laboratory and office building of approximately 20,000 ft^2. It will be located north of the Central Research complex and will house the Center for Computational Science (CCS) research and support staff along with their collaborators.

The building will include individual offices and computer laboratories for about 50 occupants. It will also include conference, computer training, and storage rooms as well as a reception area. The building structure will be steel with brick veneer and/or other low-maintenance exterior skin. A central HVAC system will provide cost-effective, energy-conserving space conditioning. Land improvements will include service drive, walkways, drainage, and landscaping. Utilities will be extended from the existing distribution systems adjacent to the

site and upgraded as required. Design/build concepts will be used for construction to the extent feasible. Furniture and equipment for the conference rooms, training room, and modular offices will also be provided.

For the CCS, the Computational Sciences Building (CSB) will provide vital work and research space to accommodate approximately 50 research personnel. Construction of the CSB will enhance the ORNL position as a world leader in the computational field. To ensure the opportunity for ORNL to have an essential dominant role in the key technologies of the future (computing and networking), this project is a wise and necessary investment. CCS effectiveness will be substantially enhanced through consolidating the staff and collaborators in a single building with associated laboratories for visualization, networking, electronics, and the Computational Center for Industrial Innovation (CCII). The extensive CCS educational program necessitates an 18-position (workstation plus workspace) educational room. The building also needs conference rooms, some equipped with video- conference facilities, and offices for visitors. Networking capabilities must be state-of-the-art. Offices should be of a size to accommodate the workstations and associated gear that are the norm for modern offices for persons whose primary activities are computationally related.

The CCS currently includes computer room space holding five large computers with a peak computing capability of about 200 gigaFLOPS, a multiterabyte data storage capability, and associated networking gear. The CCS staff, including those working on CCS-related projects such as the High Performance Storage System (HPSS), the CCII staff, and the Intel support staff, totals about 30 scattered in Buildings 4500N, 4500S, and downtown Oak Ridge.

ORNL Center for Biological Sciences (ADS A98D0087, FY 2003 Programmatic LI)

The ORNL Center for Biological Sciences (CBS) is planned as a modular complex of buildings, equipment, and infrastructure that will house current and future research programs in the areas of functional genomics, structural biology, proteomics, and systems biology.

The CBS will also encompass the proposed Center for Structural Molecular Biology, a user facility that will integrate special present and future neutron sources—High Flux Isotope Reactor and Spallation Neutron Source, respectively—with strong programs in mass spectrometry and computational biology at the Laboratory.

Laboratory for Comparative and Functional Genomics (ADS S97D0043, FY 2001 LI)

This project will construct the Laboratory for Comparative and Functional Genomics housing about 100,000 mice. The laboratory employs expertise in mouse genetics mutagenesis to generate and analyze mutations that add functional information to specific human DNA sequences. These mutant stocks are a matchless resource for advancing understanding of the complex mechanisms underlying the development and functioning of biological systems. In addition to space for 100,000 mice, the facility will provide ancillary laboratories for experimental breeding and necropsy activities, a specific pathogen-free design, 100% fresh air facility with 12 to 15 air changes per hour, temperature and humidity control, variable intensity lighting, an emergency power supply, a loading dock, “silent” low-frequency fire

alarms, and vermin-proofed caulking and sealing.

The facility will be located on the ORNL reservation at the west end of the site, which will be convenient to researchers and guests without the concern over restricted access. The laboratory will be adjacent to Life Sciences Division Building 1062 and convenient to the Environmental Sciences Division for cooperative research collaborations.

Fire Protection Systems Upgrade (ADS C97D0147, FY 2001 Landlord LI)

The following projects/tasks of the proposed upgrades are in support of the ORNL fire protection systems:

- Extend automatic wet-pipe sprinklers throughout offices, corridors, and under the attic floor slabs in Wings 1-4 of the Central Research and Administration Building (4500N). These specific areas are not protected with a fire suppression system.

- Upgrade automatic fire sprinkler systems and water spray systems in the hot cells and cubicles containing combustible solids and liquids in the Radiochemical Engineering Development Center (Building 7920). Existing fire suppression systems protecting these areas cannot be fully tested/maintained and are showing signs of water spray nozzles plugged with pipe scale/rust.

- Replace numerous fire alarm control panels with modern fire alarm equipment and modify alarm device/evacuation horn circuits to utilize the full capability of the new control panels. Many fire alarm control panels and annunciators at ORNL are 30 to 40 years old and operate via antiquated technology (springs and shunts) which does not permit interface with modern fire detection and fire alarm initiation devices. These older panels also do not perform self monitoring of fire alarm and evacuation horn circuits as required by mandated National Fire Codes, and replacement parts are not available to facilitate timely maintenance/repairs.

- Install early warning smoke detectors to provide area protection in this laboratory and give early indication of an incipient fire to fire response forces. High-value robotics research is conducted at the CESAR Laboratory in Building 6010. High-value, one-of-a-kind robotics equipment and work stations in this densely populated laboratory create the potential for a fire loss exceeding $1 million.

- Upgrade the Central Fire Alarm Receiving Station at the ORNL Fire Department Headquarters to replace antiquated equipment currently performing this vital function. This 20-year-old equipment monitors the condition of fire alarm systems and provides notification of fire alarm system activation for more than 200 buildings at the X-10 site. It is imperative that this equipment remain highly reliable and that replacement parts be readily available. As the equipment ages, replacement parts are more difficult to procure and maintenance costs increase, resulting in questionable reliability.

- Upgrade the engine driver and water pump in Pumphouse 7953. The manually operated gasoline engine driver and water pump in Pumphouse Number 7953 were installed in the

early 1960s. This pump supplies fire protection and potable water to the DOSAR Site, which includes the Radiation Calibration Laboratory (7735), laboratories handling radioactive material in Building 7710, and Building 7709, the HPRR building currently being utilized for storage of unique one-of-a-kind replacement parts for the HFIR. Recent tests of the aged pump and pump driver resulted in a failure to operate. This project will replace the manually operated pumping system with an automatic starting pump along with updating the aged maintenance-intensive equipment with modern equipment.

- Upgrade fire barriers in ORNL facilities. National Fire Codes and regional/DOE adopted building codes contain requirements to limit the spread of fire to a certain square foot area. The Life Safety Code requires physical separation in protected means of egress. Both code requirements must be met by installed fire barriers, which are rated by Underwriters' Laboratories, Inc. (UL) to withstand a fire for a time period (e.g., one-hour rated, two-hour rated, etc.). These two old, very large administrative and research facilities do not currently have required fire barriers in place.

- Install sprinklers in Room C110 and fire detection equipment in Rooms C109 and C111 of Building 6000. [Recommendation from Fire Protection Engineering Assessment Building 6000 and Tiger Team Assessment ORNL-6657/VI/R3 of 10/90 (FP.4-1)].

- Upgrade fire alarm and sprinkler system for Building 4505. The fire alarm upgrade includes the following: replace the shunt-trip type fire alarm annunciator panel; eliminate heat-actuated devices throughout the facility and replace with water flow switches for zone annunciation; add above/below sprinkler lines and heads as deemed necessary; and replace the horn panel in the east stairwell controlling all evacuation horns in the building.

- Upgrade fire alarm and sprinkler system for Building 4501. The fire alarm and sprinkler upgrade includes the following: eliminate one of two master fire alarm boxes (MFAB) which serve 4501; replace two shunt-trip type fire alarm annunciator panels adjacent to the two existing MFABs and an auxiliary annunciator panel near the sprinkler system risers in the basement; eliminate heat-actuated devices throughout the facility and replace with water flow switches for zone annunciation; add above and below ceiling sprinkler lines and heads as necessary; and replace the horn panel in the east stairwell controlling all evacuation horns within the building.

- National Fire Codes and regional/DOE adopted building codes contain requirements to limit the spread of fire to a certain square foot area. The Life Safety Code requires physical separation in protected means of egress. Both code requirements must be met by installed fire barriers which are rated by UL to withstand a fire for a time period (e.g., one-hour rated, two-hour rated, etc.). 4500N does not currently have required fire barriers in place.

- Install fire alarm system in Building 7604, which is used for storage of experimental and test equipment such as development hardware, computers, and instrumentation. A portion of the building is used periodically as a control room for experiments conducted in adjacent areas outside the building. No personnel are housed full time in this building, but

some personnel enter the building on a regular basis as part of their responsibilities, particularly when there is experimental activity in the control room area. The building has no fire protection system other than portable fire extinguishers. This activity adds a fire protection alarm system to Building 7604. Fire and smoke detectors will be installed in Building 7604 and will be connected to an existing fire alarm system in adjacent Building 7601.

Laboratory Facilities HVAC Upgrade (ADS A98D0006, FY 2004 Landlord LI)

This project will upgrade HVAC systems that serve most of ORNL's major multiprogram research and related support facilities that have been in service for over 30 years and are in need of renovation, upgrade, or replacement due to age. This deteriorated condition is resulting in a growing number of repeated operational interruptions, prolonged equipment downtime, and increasing maintenance cost. Repair is often complicated by difficulty in finding replacement parts for units that are now obsolete. The interruptions are affecting experimental quality assurance for a significant number of the laboratories and are causing problems for supporting computer systems and service shops.

Laboratory Facilities Ventilation Systems Upgrade (ADS A98D0007, FY 2002 Landlord LI)

This project will upgrade ventilation and exhaust systems in many ORNL facilities which are in serious need of repair and cleaning to continue service at any level. Systems currently in operation meet regulatory requirements, but some laboratory areas are not used for research because of a lack of proper ventilation. Postponed items of normal maintenance for operating systems have compounded into a myriad of deficiencies needing correction. Some are simple in nature, but some are far-reaching, such as replacing corroded/contaminated exhaust HEPA filter housings and ductwork. Very few upgrading efforts have ever been performed on these systems. Therefore, the systems feature 35-year-old equipment applied in a 35-year-old design concept that is attempting to perform to 1990s expectations. Some fume hoods need to have HEPA filtration installed locally, as mandated, to prevent serious duct contamination past building boundaries. Additional hoods are needed in some areas. In many systems, the exhaust ducting and filter housings are seriously corroded and can be expected to provide only a marginal future life expectancy. New exhaust fans, ducts, hoods, and an EPA-compliant stack are needed for compliance to regulations. The majority of these duct/housing units are contamination zones that will require closely controlled work conditions to alter. Duct material is basically galvanized steel with duct joints having a slip/crimped fit (riveted). This makes repair impracticable. Of further concern are the existing filter housings that apply HEPA filters with prefilter space, a violation of a specific "shall be" in DOE 6430.1A (1550-2.5.5) that would require justification to omit.

Process Waste Treatment Plant Relocation (ADS C97D0152, FY 2001 Programmatic LI)

This activity supports relocation of radioactive wastewater treatment operations from the PWTP, Building 3544, to the NRWTP, Building 3608. It includes an evaluation of current

unit operations at Building 3544 with the goal of identifying more effective and efficient technology. Currently, process wastewater contaminated with radioactive and/or hazardous contaminants is processed at Building 3544 using conventional ion exchange resins and mixed-media filters. This activity will identify and implement new treatment operations that will decouple the process waste system from the LLLW system, thereby eliminating the largest input to the LLLW system. It will also locate those treatment operations at 3608, allowing operations at Building 3544 to be discontinued.

This activity was identified by the Waste Management Reengineering effort as having the potential to save between $0.9 million and $1.2 million annually by eliminating operation and maintenance of Building 3544 and by eliminating the generation of LLLW. Failure to implement this activity does retain a high likelihood that infrastructure damage at 3544 will require a one-time expenditure of < $25M to keep the facility operating. Also, current operations at 3544 are not effective in removing radioactive cesium from process wastewater. One of the goals of the new treatment technology will be to provide effective removal of the cesium. There is a medium probability that a cesium release will occur that will cause minor damage to the environment.

Potable Water System Upgrade I (ADS C97D0061, FY 2003 Landlord LI)

This project will replace potable water lines serving facilities located in the center of ORNL. This will include potable water lines running along Central Avenue and along the north side of Buildings 3508 and 3517. These underground services will be replaced with aboveground lines to minimize the amount of excavation and the potential for spreading ground-based contamination.

The existing water lines are located where significant quantities of radioactive and chemical contaminants are in the surrounding soil. This contamination is the result of past operations, leaking tanks, spills, etc. Water lines running through these same areas are over 50 years old. Should one break at the most severely contaminated location, the release of contamination could be significant and widespread.

Potable Water System Upgrade II (ADS C97D0062, FY 2005 Landlord LI)

This project will replace potable water lines serving facilities located north of Central Avenue in the central area of ORNL. This will include water lines running from Central Avenue northward through the Isotopes area, those running north of Building 3047, and those serving the cooling tower area northeast of the ORR Pumphouse, Building 3085. These underground services will be replaced with aboveground lines to minimize the amount of excavation and the potential for spreading ground-based contamination.

The water lines to be replaced in this project run directly through or adjacent to areas of known radiological contamination. A leak or back-siphonage incident in these areas could result in either spread of contamination into the environment or the contamination of a significant portion of the ORNL sanitary water supply system. By replacing existing lines with

a system not susceptible to such incidents, failures which could result in the spread of contaminants will be avoided.

3.5.2.2 Landlord GPPs and Programmatic GPPs

HFIR Entrance Addition and Expansion (ADS S97D0052, Landlord GPP)

This project would improve the entry into the HFIR building to allow improved operational efficiencies. Two existing personnel entrances will be enhanced with addition of an entrance to the east side of the building adjacent to the truck air lock. The project will add a lobby with access controls and a parking area with a bus pull-out for improved services for visitors and guests.

Building 3144 Addition (ADS S97D0057, Programmatic GPP)

This project will increase floor space in the Building Technology Center (BTC) by 30% to accommodate two new program areas and improve productivity of the existing building equipment and envelope test facilities. The BTC is the premier national user facility devoted to the development of technologies that improve the energy efficiency and environmental compatibility of residential and commercial buildings. The center is housed in six buildings totaling 20,000 ft^2. Selection of ORNL as the site for new programs in fuel cell and desiccant air conditioning equipment testing requires additional laboratory space, while the increasing number of users of the existing testing capabilities require additional space to improve throughput. This proposal will add 7,000 ft^2 of space on the north and west faces of Building 3144. To accommodate the expansion, the Roof Thermal Research Apparatus, Structure 3138, will be removed.

The additional space will provide room for a fuel cell test stand, a desiccant air handler loop, and reestablishment of the domestic refrigeration test lab. It will also improve the throughput of the existing building envelope and equipment climate chambers and test stands by providing assembly space where researchers can prepare instrument experiments while the chambers are occupied with other work. The proposed expansion will also provide space for acquainting BTC users and visitors with the capabilities and accomplishments of the center in the form of permanent installations of outreach materials and exhibits, classroom space, and a library.

Building 7920 Facility Expansion (ADS S97D0007, Programmatic GPP)

The work, equipment, and insulation activities will include major structural additions with footings and foundations, concrete block walls, new energy-efficient fluorescent lighting, fire protection piping, concrete floors, internal structures for holding master-slave manipulators, double doors on the south side, and a south side dock to match the existing dock.
The manipulator storage addition to Building 7920 will be located on the west side of the building just north of the existing external crane and double doors on the first floor, which are currently used for receipt and acceptance of manipulators in Building 7920 when ordered by the operator, and the double doors at the second level, which are used for receipt and

acceptance of drums and materials for the chemical makeup room for hot cell work. An existing elevated dock provides access to the first-level double doors. The addition to Building 7920 will be a two-story facility 24 ft high, 19.5 ft in the north-south direction, and 24 ft east-west near the wall of the existing roll-up door. The construction will be concrete block and will be painted inside and out, with the outside paint to match that of the existing building. The new construction will be two story with no access between the two stories. However, the upper room will be accessed from the landing and the stairwell. The new roof will be flat with standard built-up roofing. No cooling system will be required for the normal function of the facility. If a fire protection system must be installed to meet the requirements of the National Fire Protection Association (NFPA) codes, a heating system of some sort will also have to be provided. Diking must be provided for the lower floor only. The engineering details of this dike or sump will be worked out in the design. Support utilities should be minimized (i.e., lighting will be provided as is necessary for ES&H and electrical receptacles as required by code).

Building 7930 Upgrades (ADS A98D0020, Programmatic GPP)

The project will provide upgrades to material processing facilities in REDC, Building 7930, to support production of ^{238}Pu for radioisotope power systems supplied to the National Aeronautics and Space Administration. ORNL will fabricate ^{237}NP targets for both the Advanced Test Reactor at Idaho National Engineering and Environmental Laboratory and the HFIR irradiations and would provide chemical processing of the targets for material recovery at REDC.

Construct Office Building for Chemical Technology Division Relocation (ADS S97D0008, Programmatic GPP)

This project would provide a two-story building of approximately 7000 ft^2 to house about 40 permanent staff and support members of the Engineering Coordination and Analysis Section of the Chemical Technology Division. The "generic office building," 11 of which are being constructed at ORNL, has a nominal space of 6900 ft^2. It will comfortably house 36 people if all of the space on both floors (except for bathrooms, elevators, and stairwells) is utilized for office space (that is, the two conference rooms on the first floor would have to be converted to office space). In any event, this facility would have elevators, stairwells, rest rooms, and appropriate support utility spaces and would be compliant with the provisions of the Americans with Disabilities Act. Telecommunications would include voice and data transmission capabilities. An expanded facility would require new designs for both the facility and utility services.

40-Teraops Computer Facility (ADS A98D0011, FY 2001 Programmatic GPP)

A 25,000 ft^2 computer facility and required utility system will be constructed to house components of a 40-TO parallel computer in conjunction with Sandia National Laboratories. The facility will be located in the Central Research Complex and adjacent to the planned Center for Computational Sciences site.

Demolish and Replace Building 6003 (ADS C98D0110, Landlord GPP)

This project will provide for the construction of a 9700 ft^2 office building for the Physics Division. The new building will replace Building 6003, which will be demolished as part of this project. Building 6003 now provides 20 offices. The Physics Division programs have grown with a greater demand for office space for employees and guests. The current Building 6003 is substandard in both safety and environmental conditions.

Automotive Wash Facility (ADS S97D0011, Landlord GPP)

This facility construction will have capacity to automatically wash vehicles from sedans to city-type buses and provide an area to clean compactors (garbage trucks) and dumpster pans. The facility will include wastewater treatment equipment to permit full compliance with environmental regulations for effluent discharge.

Currently there is not a facility available to wash vehicles and mobile equipment at ORNL. The ORNL fleet is experiencing paint damage and rusting, and equipment is deteriorating at an increased rate. This washing facility would be a drive-through operation with recycling and treatment capabilities. Equipment such as dumpster pans and compactor trucks could also be cleaned, with the water being recycled rather than being collected in 55-gal drums. With the ability to wash vehicles on a frequent basis, deterioration will decrease and service life will be extended. As a result, annual vehicle and equipment acquisition costs will be less.

Auxiliary Systems Upgrades (ADS S97D0040, Landlord GPP)

This activity will upgrade auxiliary systems for replacement or refurbishment of vertical turbines for circulation of cooling tower water and general facility vacuum pumps, condensate pumps, and sump pumps.

Building 7030 Addition (ADS S97D0015, Landlord GPP)

The project will provide a 100 ft x 50 ft addition to Building 7030. The covered shed will provide equipment storage and a heavy equipment staging area. This extension to an existing storage shed would protect equipment (manlifts, cranes, forklifts, etc.) and would reduce maintenance costs and increase equipment reliability. It will also provide a place for maintenance work to be performed during inclement weather.

GPP HVAC Upgrades (ADS S97D0051, Landlord GPP)

This project provides the installation of new HVAC systems and replacements of deteriorated air conditioning components which provide environmental control for Laboratory facilities. A prioritized listing of activities included in this project is maintained by the P&E Division. All equipment on this list has exceeded its life expectancy. Replacing these deteriorated components will improve air conditioning reliability and reduce operating and maintenance cost.

Install Water Meters (ADS S97D0024, Landlord GPP)

This activity will install water meters on service lines to major user facilities at the Laboratory. It is projected that approximately 75 meters will need to be procured and installed either at existing building service entrances or in meter pits located outside the facilities.

Accurate metering and billing for water use are necessary for efficient operations. Users of water are currently billed based on estimates developed for this purpose. By metering actual use and billing customers based on consumption, usage rates are expected to decline and operating efficiencies will be achieved.

ORNL at Y-12 Elevator Upgrades (ADS C97D0078, Landlord GPP)

This project will refurbish deteriorated elevators in the identified ORNL at Y-12 Facilities. The elevators are not reliable and have become continuously more expensive to maintain. Replacement of all the required mechanical elements on the elevators is needed: cab, rollers, platform sling, etc.

The impact of not accomplishing these elevator upgrades will be continued deterioration of elevators and thus the buildings/structures. This could lead to personnel injuries because of hazardous conditions for the general plant population and ORNL at Y-12 divisions' personnel. Elevators could become even more unreliable and continue to be expensive to maintain. Lack of maintenance funding could lead to violation of DOE Order 430.1 and other DOE orders, adverse impact on research activities because of inadequate elevators to move research equipment and personnel, and adverse public perception.

ORNL Steam Plant No. 5 Boiler Upgrade (ADS S97D0056, Landlord GPP)

This project will upgrade the natural gas/fuel oil burners, combustion system auxiliaries, and boiler controls on the No. 5 boiler in the Steam Plant.

The No. 5 boiler was constructed and put into service in the early 1960s and has been in operation since that time. Burner and control technologies have advanced significantly, and an upgrade of the internal components in this boiler will increase its life expectancy and efficiency. As the ORNL Steam Plant makes a gradual shift from coal as a primary fuel to gas as a primary fuel over the next few years, an upgrade of this burner will be one of the necessary components to ensure a reliable steam supply for the Laboratory.

ORNL Visitor Center (ADS S97D0060, Landlord GPP)

This project will construct a new visitor center for ORNL, including necessary access road changes. This modern, easily accessible center will meet current and long-term needs to provide access to ORNL facilities in support of national and international research endeavors.
Replacement of the B 2519 East End Water Softeners (ADS C98D0145, Landlord GPP)

This project will consist of removal and disposal of the current water softener system and de-aerator tank, procurement and installation of a new water softener and tank, and procurement and installation of state-of-the-art control systems.

The East End Water Softener System consists of sodium and acid storage tanks, mixing tanks, and pumps. The system was installed in the early 1960s with a design life of 25 years. The system controls are obsolete, and the capacity is not sufficient for the capacity of the Steam Plant. The project will include replacement of the deaerator as well as the softeners and be of sufficient capacity to match the Steam Plant capacity.

Restoration of the Natural Gas Distribution System (ADS S97D0020, Landlord GPP)

This project will restore the existing natural gas distribution grid located in the Bethel Valley area of the Laboratory. Restoration activities will include replacement of line segments, valves, and pressure regulators where warranted and will use trenchless technology techniques to rehabilitate pipe where these methods can be proven cost effective. All cathodic protection systems currently in use to prevent corrosion of the system will also be upgraded.

The natural gas piping system is a steel piping grid that provides gas to research facilities throughout the center portions of the Bethel Valley complex. It was constructed in 1948 and has been in continuous use since that time. While it has been largely trouble-free, design life has been exceeded, and it is expected to develop problems over the next few years. Given the serious nature of accidents caused by natural gas leaks, it is imperative that measures be taken to restore this system to "as-new" condition before degradation of piping and valves can cause a leak.

Transportation and Packaging Management Facility (ADS S97D0058, Landlord GPP)

This project will provide a one-story building 85 ft x 130 ft with 3400 ft^2 of space. The building will provide three managers' offices, 16 employee offices, a shipping area 30 ft x 20 ft, a loading dock, and a hazardous/nonhazardous and radioactive packaging area. The facility will provide space for packaging, quality assurance checks, and shipment which will comply with regulatory requirements.

The current operation for the transportation and packaging of facility materials occurs in three different locations. These facilities have levels of fixed contamination which will reduce potential exposure to personnel with the construction of the new facility.

Ventilation Systems, Ductwork, and Fume Hood Upgrade (ADS C97D0054, Landlord GPP)

Facility work will include activities to upgrade ventilation systems, filtration systems, inter-connecting ducting, and equipment for fume hood and exhaust systems located in facilities at ORNL.
Deteriorated fume hoods and associated exhaust ductwork will be selectively repaired or replaced from hood to filter housing. Repairs will replace all corroded ductwork (with stainless steel or equivalent) and provide leakproof construction with gasketted flanged joints as required for installation/removal. Duct size will be standardized as 12-in. diameter for hood service. Existing exhaust ductwork from fume hoods will be considered a contaminated material in all cases and will require strict conformance to local work procedures in its repair and/or replacement.

Fume hoods not previously replaced by interim improvements will be replaced with new fume hoods that conform with the new system concept. The intricate requirements for building airflow balance will be carefully considered in deciding the type of fume hoods and exhaust system arrangement to be employed. Variable-volume fume hoods (airflow regulated by sash position) provide a more appropriate application for these buildings than do auxiliary air hoods (as related to DOE 6430.1A, 1161-4, and 1161-5). Variable-volume fume hoods allow much less complication of controls and should require less total air volume to be heated and filtered (as supply and as exhaust) through the system's life.

Deteriorated HEPA filter housings will be replaced with new single-filter housings with prefilter space (thus allowing prefilter use to be optional). To achieve full airflow for an 8-ft Class II fume hood (1300 ft^3/min), two single-filter housings are required, using manifolding with interconnection to a single exhaust fan (or header connection). Specifically, these housings and fans will require stacking similar to that now practiced to conserve space. Unit modules will be standardized to use 24 x 24 in. prefilter elements and 24 x 24 x 11.5 in. HEPA filters. All new ductwork and filter housing will be made to conform with current regulations to allow its continued use in the future.

Building 7002 Changehouse Upgrade (ADS S97D0012, Landlord GPP)

This project will renovate Building 7002 Changehouse and bathroom area. The renovation will provide additional shower facilities, locker space, and improvements to hygiene conditions.

The changehouse and bathroom area of this building is approaching 50 years of age. Floors, walls, and facility components are deteriorated and pose potential safety and hygiene problems. Approximately 100 employees use this facility daily. Improvements will result in a sanitary and less crowded facility. The facility will also provide facilities for women which currently do not exist.

Water System Upgrades, 1000 Area (ADS A98D0009, Landlord GPP)

This project will provide a needed infrastructure upgrade for the potable water system in the west end of the ORNL complex. This area is now supplied by a single feed of 6- and 8-in. water mains. This system will be inadequate for planned future development in this area and provides only marginal fire water supply to the area. This project will install approximately 3000 ft of 16-in. main to the west end of the ORNL complex, along with the associated pressure-reducing valves, isolation valves, fittings, hydrants, and valve pits.

Extend the 7000 Area Water Main (ADS S97D0023, Landlord GPP)

This project will extend the existing water distribution grid into the area east of the Laboratory's 7000 Area. This area currently houses numerous material storage buildings as well as two research/materials processing facilities. Water service in the area is currently limited and is being provided by a single 8-in. steel line. The project will construct an 8-in. looped system in the area and will provide hydrants, as well as fire protection and potable and

process service water, to customers in the area.

This area was known as the "Jones Camp" during construction of the Laboratory. Water service was provided to construction-related facilities in the area via an 8-in. temporary steel water line. This line is still in use and is the only source of water to the facilities currently located in this area. Corrosion inside this line has restricted its water-carrying capacity, and its ability to provide an adequate fire protection water supply is in question. Addition of a ductile iron looped main to replace this deteriorated system will allow continued operation of facilities in this area and will enhance fire protection capability.

Water System Upgrades, 7600 Area (ADS A98D0010, Landlord GPP)

This project will provide a needed infrastructure upgrade for the potable water system in the east end of the ORNL complex. Presently, there is only a single feed to the 7600 Area of ORNL where there is major potential for a fire loss. Relocation of the Fusion and Engineering Technology facilities from Y-12 to this area is also planned for the future. This project will install approximately 9000 ft of 16-in. main to the 7600 Area at the far east end of the ORNL complex along with the associated isolation valves, fittings, hydrants, and valve pits.

Melton Valley Road Replacement (ADS S97D0019, Landlord GPP)

This project will remove the existing asphalt surface with alignment of the road both vertically and horizontally. This may entail modifying/extending existing drainage structures as well as installation of new drainage structures. This project would greatly reduce the maintenance required on this road and improve the safety of employees and visitors using it. It would also enhance development of the area.

ORNL Technical Support Building (ADS C97D0105, Landlord GPP)

This project will provide a new facility to house and protect the Technical Support Center (TSC), from which crisis management and support teams carry out coordinated emergency response activities. This item will provide funding to add a second floor on Building 4512 which will accommodate adequately sized quarters for the TSC, permit upgrading and automation of TSC equipment, and provide office space for the Emergency Preparedness Department. Completion of this project will assist ORNL in complying with DOE Order 151.1 plus the DOE Task Force Report on Compatibility of Emergency Operations Center Communications and Information Processing Systems.

Upgrade the ORNL Steam Distribution Condensate Removal System (ADS C97D0057, Landlord GPP)

This project will install approximately 44 new steam condensate removal points and 36 new bypass valves on the existing steam distribution system. These improvement will enhance operability and operator safety while upgrading the steam system to current standards.

Replace Cooling Tower 4511 (ADS A98D0016, Landlord GPP)

The 4511 cooling tower wooden structure is deteriorating at a rapid rate under dry conditions and becomes increasingly hazardous to maintain. This project will replace the cooling tower superstructure.

ORNL Facilities Water System Upgrade (ADS C97D0081, Landlord GPP)

This project will upgrade Buildings 4500N, 4501, and 4505 identified water supply systems for the following:

- Installation of safety showers and eye wash stations with potable water supply.
- Replacement of existing water stills that supply distilled water
- Replacement of piping and associated components used to supply and remove process water.
- Replacement of piping and associated components used for heating

The upgrades will meet OSHA standards. Potable water headers will be installed to supply the water for the safety shower and eyewash stations.

3.5.3 Greater Than 10 Years (Outyears)

To facilitate long-range planning, ORNL has determined the need to consolidate all activities onto the main ORNL site and into zones or campuses which will improve efficiency of R&D, ES&H, and operations support while reducing cost. The campus approach would lend itself to an academia arrangement which would result in an efficient R&D environment, improve overall working conditions, and enhance the appearance of the Laboratory. A key objective is the relocation of ORNL facilities currently at the Y-12 Plant to the ORNL main complex. Configuring security barriers to reduce hindrance to flows of people, materials, and equipment would also strengthen the mission of the Laboratory. The future locations of individual campuses are shown in Fig. 3.25.

3.5.3.1 Bethel Valley

Five complexes or centers of functional activity are planned for the Bethel Valley area. Efforts will be made to provide a central architectural theme for these complexes to enhance the overall visual and campus-like character of the area. Associated infrastructure improvements will be made as needed, with the major program being the widening and relocation of Bethel Valley Road. First to be developed will be the Life Sciences Complex,

Fig. 3.25

the Environmental and Health Protection Facilities, and the Materials Science and Engineering (MS&E) Complex.

Life Sciences Complex and Environmental and Health Protection Facilities. This complex, proposed to be located in the west end of Bethel Valley, will provide new laboratories for expanding R&D needs of the Life Sciences, Environmental Sciences, and Energy divisions. Modern facilities will replace old buildings that are often crowded, inefficient, and in need of repair. Construction will consist of GPP upgrades and two new LI projects:

- Biological Imaging and Photonics Laboratory
- Earth Systems Facility.

Particular emphasis will be placed on creating work space that supports the interdisciplinary and collaborative nature of the research being performed in each area.

Biological Imaging and Photonics Laboratory. This laboratory will serve as a focal point for integrating currently diverse activities in biological imaging and advanced photonic devices such as lasers, fiber optics, spectrometers, and detectors. It is designed to support the ORNL Genome Program. Biological Imaging using advanced electron scanning tunneling, photon scanning tunneling, and atomic force microscopes will help develop future hybrid instruments for chemical mapping and biological sampling techniques. The building will contain offices and laboratories comprising a total floor area of about 12,000 ft^2.

Earth Systems Facility. Establishment of this facility will allow ORNL to play a pivotal role in the advancement of understanding earth systems. The 50,000 ft^2 laboratory facility will contain specialized computer capabilities, wet laboratories, staging areas, and related support space specifically designed to support global-change, subsurface science and ecological research program activities.

Other proposed buildings in this area include

- Conference Center and Guest Users Support Facility,
- Open Air Study Retreat,
- Environmental Sciences Division Support Shop,
- West End Cafeteria,
- International Center for Energy and Environmental Analysis,
- Environmental Sciences Facility,
- Environmental Engineering Facility,
- Health Effects Information Building,
- Environmental Biotechnology Facility,
- Environmental Sampling and Training Center,
- Radiation Protection Facility,
- Environmental Protection Facility,
- Measurement and Assessment Facility, and
- Industrial Hygiene Facility.

Improvements will be made on the Interim Use and Overflow Office Space and on Building 1503.

Materials Science and Engineering Complex. The MS&E Complex will consolidate a number of existing ORNL programs. It will incorporate new buildings and facilities that will be less expensive to construct than the cost of bringing the existing facilities up to modern code standards. The complex will be constructed in the undeveloped area immediately to the east of the present central research facilities. The MS&E Complex will include four new LI projects:

- Center for Study of Advanced Materials;
- Composite Materials Laboratory;
- Solid State Research and Processing Science Center; and
- Center for Advanced Microstructural Analysis.

This complex will enhance the already-strong ORNL programs in high-temperature metals and alloys, ceramics, composites, and superconductors.

Center for Study of Advanced Materials. This Center is an initiative of the university community of the Southeastern Universities Research Association and will encourage joint materials research activities with ORNL by establishing a university/industry presence at the MS&E Complex.

Composite Materials Laboratory. Proposed at 50,000 ft^2, this laboratory will house an interdisciplinary team of more than 100 ORNL and university scientists, engineers, students, and supporting staff. Research will continue on polymer, carbon-carbon, and metal and ceramic matrix composites.

Solid-State Research and Processing Science Center. This science center will allow the research activities that are now located in 15 separate buildings to be consolidated into a central facility. The 80,000 ft^2 facility will contain approximately 100 offices and 40 laboratories for state-of-the-art materials R&D.

Center for Advanced Microstructural Analysis. This center is a response to the need for buildings capable of housing the broad range of microanalytical instrumentation available at ORNL, including analytical and high-resolution electron microscopes, atom probes and field ion microscopes, surface analysis instrumentation, X-ray diffraction facilities, and mechanical property microprobes. The added space, 52,000 ft^2, will alleviate severely overcrowded conditions in the Metals and Ceramics Division and will address the ability to isolate the most sensitive instrumentation.

Other proposed facilities in the MS&E include an Office of Guest and User Interactions and an Optics Science Center.

Partnerships and Technology Transfer Campus. This area will provide a center for cooperative study and transfer of the technology developed at and in cooperation with ORNL through cooperative R&D agreements. The proposed complex will provide the facilities and

a centralized location to accomplish this mission as well as that of advancing technical and scientific education. The campus will be located at the east entrance of the Bethel Valley area and will be comprised of the following buildings:

- Central Cafeteria;
- Intelligent Machine Research Facility;
- Information Resource Center for Energy and the Environment;
- Center for Educational Programs and Technology Transfer;
- Oak Ridge Detector Center;
- DOE On-Site Administrative Facility;
- University Research Consortium (Phase-I);
- High Energy Physics Institute (Alliance of Universities and DOE);
- University Research Consortium (Phase-II);
- Offices and Housing Facility for Visiting Scientists and Official Guests;
- Corporate Retreat;
- Technology Advancement Complex;
- Energy Systems Research Facility; and a
- Science and Mathematics Education Center.

Central Research and Technical Support Facilities. These facilities will provide a location from which supercomputing capabilities can be shared with the entire Laboratory and with commercial and educational communities throughout the world. The Center for Computational Science will anchor this complex. This center will bring together the resources of a number of national laboratories and educational institutions to support mathematical and computer sciences research and a program for high-performance computing access for high school students. Computers and equipment will likely be procured through a lease agreement providing the flexibility to maintain the latest in high-power computation capabilities. Other proposed facilities in the complex include

- Central Research and Support Building,
- Environmental Safety and Health Compliance and Training Building, and
- Restore Building 4500N, Central Research Complex.

Multidivisional Offices and Technical Services Complex. This complex will consolidate and centralize many of the current support services while providing cost-effective replacement of many obsolete buildings and facilities. Proposed facilities include

- Central Maintenance Support and Qualification Test Facility,
- Future Waste Operations Support Building,
- Measurements and Controls Support Facility,
- Multidivisional Offices and Technical Services Center,
- Instrument and Controls Maintenance Building,
- Low-Level Waste Monitoring Control Station,
- Waste Management Operations Health and Hygiene Support Facility,
- Records Storage Facility,
- Metrology Laboratory,
- Operations Compliance Training Facility,

- Waste Remediation Office Facility,
- Liquid Waste Transfer Station,
- Liquid and Gaseous Wastes Support Facility,
- Contaminated Equipment Storage Facility,
- Process Waste Treatment Facility,
- Transported Waste Receiving Facility,
- Waste Operations Control Center Expansion, and
- Safeguards and Security Building.

3.5.3.2 Melton Valley

Facilities proposed for the development sites in Melton Valley are described below.

Engineering Technology Complex. Five buildings are proposed for the Ramsey Drive site. These facilities will consolidate in one location much of the work of the Engineering Technology Division that is now carried out in several separate facilities.

Radiochemical Engineering Center. The center will provide new chemical processing facilities, isotope production and separation, and hot cell examination facilities to support ongoing and future programs. Proposed Radiochemical Engineering Center buildings will include

- Technology Transfer Building;
- New Hot Cells;
- Office & Training Facility;
- New Isotope Enrichment Facility;
- Storage Building;
- New High-Radiation Analytical Laboratory; and
- Future Maintenance Facility.

Fusion Materials Irradiation Facility. This facility will be used to address the technological problems associated with development of fusion reactor materials. It will house a linear accelerator, a supply system for lithium targets, and an experimental complex for irradiating and handling test specimen assemblies.

3.5.4 Future Utilities Planning

Major utilities that are required at ORNL and are provided by outside entities include electricity, natural gas, water, and telecommunications. In addition to these, the Laboratory produces its own steam and compressed air and operates and maintains systems for the collection and treatment of sanitary, process, and industrial-type wastes. Detailed descriptions for the current utility systems are presented in Section 3.3.4. Sources of supply are not expected to change in the near term, but deregulation of the electrical and natural gas industries may offer the Laboratory opportunities for savings in the future. It is anticipated that the infrastructure needed to support the Master Plan will include much of that currently in use; however, refurbishment and upgrades to the existing systems will be necessary to

support both continuing operations as well as planned facilities. Upgrades to the electrical, potable water, process waste, telecommunications, and fire alarm systems are scheduled over the next several years. The most pressing need is to provide utility systems with redundant capability. This will require additional electrical switchgear as well additional water lines and water valves. The main thrust of this upgrade program is to ensure that a single point failure in a utility supply system at one Laboratory location will have a minimal impact on the other locations and facilities served by that utility. Utilities that serve potentially hazardous facilities should be provided with the redundancy necessary to ensure operation or the capability of performing a safe shutdown of its operations. This strategy coincides with DOE's desire to ensure that all facilities have the same level of reliability and protection as those which fall into the "best protected class" in general industry.

3.5.4.1 Electricity

Plans for the ORNL Electrical Distribution System include the addition of alternate feeds, replacement of switchgear and transformers, rebuilding overhead feeders and a general upgrading of many building service entrances in older facilities throughout the site. The SNS will require the addition of another 161-kV Substation to provide reliable power to those facilities. As currently identified, this substation would be located along TVA's existing 161-kV corridor adjacent to the proposed SNS site. Other proposed projects currently in the funding pipeline will require only minor additions and/or alterations to the electrical distribution grid and new substations to provide a safe and dependable power supply to the new facilities or operations.

3.5.4.2 Natural Gas

The long-range plan developed by the ORNL Steam Plant proposes to move away from using coal as the primary fuel over the next 5 to 7 years. The plan describes a natural gas plant which will use fuel oil as a secondary fuel source. In the Business Risk Assessment performed on the plan, it was determined that with the addition of a new, efficient natural gas/fuel oil-fired boiler will provide the most economical source of steam while avoiding a number of future costs associated with upgrading the existing coal firing, handling and waste treatment systems. No additional users are expected to be added to the natural gas system in the near term, and plans are to evaluate the condition of the existing 50-year-old distribution system to determine the most practical and efficient means of providing the gas option to research customers within the Laboratory.

3.5.4.3 Water

Water usage is expected to remain relatively constant until the SNS comes on-line. Current daily usage ranges from approximately 2 Mgd in winter months upwards to almost 4 Mgd during the hottest periods of the summer. A number of expansions and improvements to the water system are in the planning stage. A proposed FY 2000 LI entitled " Water System Upgrade" will add redundant capability to outlying facilities and address some risk factors associated with an aging water line which runs adjacent to the Holifield Radioactive Ion Beam

Facility. A GPP currently being considered for the FY 1999 or 2000 time frame will renovate the 50-year-old concrete water reservoir located on Chestnut Ridge. A recent inspection of the facility identified a number of areas where improvements are required to ensure its reliable operation in the future. Two other LI projects are on the planning horizon that will address the potential for cross contamination in the potable water system that may be caused when water lines run through areas of known subsurface contamination. A number of different options have been considered to address this potential, and trenchless technology is being closely monitored to identify a simple and cost-effective means of addressing this potential problem.

The SNS currently proposes to tap into the main 24-in. water line upstream of the Laboratory's reservoir system and add a reservoir on the site to provide the level of redundancy required. A modification to this concept has been proposed that would loop the new SNS water system with the existing ORNL water distribution grid. This improvement in the basic utility design of the SNS would provide an increased level of redundancy for both the SNS and the remainder of the Laboratory.

3.5.4.4 Telecommunications

Telephone systems will continue to be upgraded as technology and demand change. Computer networking improvements will include the gradual upgrading of office wiring to include "Category 5" grade copper cable and/or fiber to the desktop and the migration of the existing network topology from shared-media to switched-media using a combination of layer-2 and layer-3 switches. The ORNL network backbone will remain fiber-optic based but will evolve from its current Fiber Distributed Data Interface (FDDI) technology base to a set of parallel FDDI, Gigabit Ethernet, and ATM networks that provide the flexibility to accommodate almost any network-intensive computing project while holding the line on costs for less demanding applications.

3.5.4.5 Sanitary Sewage

Construction of the SNS and the Laboratory for Comparative and Functional Genomics will require an addition to the ORNL STP. A proposed construction force of over 2000 people coupled with an increased wastewater load from the mouse facilities in the Genomic Laboratory will introduce new flows in excess of what the current plant is designed to treat. The addition of an additional aeration basin at the STP or the construction of a new oxidation ditch to replace the existing package plant would ensure adequate treatment capacity for the new facilities. Preliminary discussions are beginning to determine the best possible avenue for the Laboratory to pursue to adequately treat the sanitary wastes generated.

3.5.4.6 Fire Protection

ORNL facilities are protected from fire by remotely monitored fire alarm and sensing systems coupled with automatic sprinkler devices. A LI project has been proposed that will upgrade many of the old, outdated fire alarm systems in laboratory facilities and add new systems to facilities currently not covered. These improvements will enhance fire protection capability for the Laboratory and ensure compliance with the requirements in the fire protection standards.

3.5.5 Future Transportation Infrastructure Planning

Area travelers, while benefiting from new construction, will continue to use existing roadways, which will be maintained and improved as needed. Some major public road improvements outside of the ORNL boundaries are presently under way. Completion of the Pellissippi Parkway extension from I-40/I-75 to Alcoa, Tennessee, provides a direct route for travel between Oak Ridge, West Knoxville, and the McGhee-Tyson Airport.

Future State of Tennessee plans would realign State Highway 95 from I-40 to State Highway 58, widen that segment to four lanes, and construct an interchange at State Highway 95 and Bethel Valley Road. Long-range plans would provide for State Highway 58 expansion to five lanes from I-40 to State Highway 95. Bethel Valley Road extends from State Highway 95 through ORR to State Highway 62 and provides access to ORNL. The portion passing directly north of the Laboratory will be realigned and widened to five lanes. Additional plans call for widening of State Highway 62 and for adding an interchange at Bethel Valley Road.

Inside ORNL boundaries, roads providing access to new facilities will be constructed and others realigned to improve traffic flow. Bethel Valley road will be widened and relocated to provide space for and access to the proposed new complexes. Melton Valley Drive will be realigned and upgraded; paved two-lane roads will provide access from Melton Valley Drive to the new Radiochemical Engineering Center and SWSA 7. Lagoon Road from Highway 95 to Melton Valley Drive will be realigned and upgraded. The HPRR access road will be upgraded. A new access road to Burial Ground No. 6, a new Melton Branch Patrol Road, and a new access road to the Waste Handling and Packaging Plant will be constructed. Ramsey Drive to Walker Branch Road will be improved, and a new road from Ramsey Drive will provide access to the Engineering Technology Complex and Fusion Materials Irradiation Facility areas. A potential haul road for the soil borrow site on Copper Ridge is planned.

New walkways will surround all new facilities and connect individual buildings with others in the same area and with parking areas. A bicycle and jogging trail will connect ORNL with the City of Oak Ridge.

3.5.6 Future Security Planning

Future security planning by the Office of Laboratory Protection will continue to place an emphasis on appropriate security measures that protect ORNL against events that may cause adverse impacts on national security, the environment, and the health and safety of employees

and the public, while continuing to maintain an environment conductive to ORNL's research mission.

Reconfiguration of ORNL's security perimeter is planned to be completed by FY 2000. The objective of this reconfiguration is to ease access by creating a more open, less restrictive atmosphere for employees and visitors, without degrading overall site security. This will be accomplished by realigning the current site perimeter by constructing new portals along ORNL's outer perimeter along Bethel Valley Road and Highway 95. This will allow employees and visitors access to the entire site by passing through only one staffed portal located on ORNL's perimeter.

As new facilities are constructed, ORNL will continue to utilize the defense-in-depth strategy to put higher levels of security in place at those facilities which require them while still maintaining levels of security appropriate for the remainder of ORNL.

3.5.7 Changes in Direction

Site development planning is a real-time activity, evolving as necessary to meet changing needs. The planning process recognizes that external factors may not permit implementation of the Master Plan, and changes in direction may be necessary.

Section 3.4.4 lists seven assumptions about external factors that provide a context for development of the Master Plan. It is assumed that there will be a consensus in the U.S. regarding the critical importance of the nation's energy supply, its environment, and its economic competitiveness. As a result, it is assumed that adequate resources will be available to the Laboratory, allowing it to implement the Master Plan. Any number of developments could invalidate this assumption, such as economic depression or stagnation or lack of political leadership or consensus. The result would be inadequate resources for ORNL to implement Alternative Four (the preferred alternative), or even Alternative Three. This would represent a major change in planning direction for the Laboratory.

Should ORNL be unable to pursue Alternative Four or Alternative Three, the Laboratory would choose Alternative One–make no change. This would preserve the status quo without reducing facilities to a level below that required to support mission assignments. This alternative would also "buy time" in hope of a change in the national economic or political climate. After a few years, however, the cost of operating and maintaining decaying facilities and infrastructure in compliance with ES&H requirements would become prohibitive, perhaps leading to a troubling decline in the ability of the Laboratory to complete its mission assignments or to accept new ones.

3.6 CONCLUSIONS

To effectively respond to national challenges in the areas of energy, environment, economic competitiveness, and education, the Laboratory and DOE management must concentrate on three issues. First, the infrastructure of the Laboratory must be rebuilt and expanded. Then, ORNL must achieve excellence in ES&H protection while at the same time maintaining a suitable environment for superior R&D. Additionally, the Laboratory must continue to expand its interactions and collaborations with outside organizations, especially with universities and U.S. industries.

Rebuilding and expanding the infrastructure of ORNL requires management attention to decommissioning several World War II-era facilities, upgrading most existing facilities to meet current ES&H standards, replacing some existing buildings, and acquiring new research facilities that can also serve as national user installations. The most important of these are the SNS, the Life Sciences Complex, and the Materials Science and Engineering Complex. Infrastructure can be improved further by consolidation of appropriate activities to the ORNL Main Site for more economical and efficient operation. Budget constraints must be acknowledged and alternatives found to support infrastructure improvements.

Although the Laboratory has made significant progress in meeting ES&H needs and requirements, much remains to be done. The challenge is complex, especially in view of the age of the facilities, of increasingly rigorous DOE and other agency regulations, and of limited financial resources. To address the most critical ES&H needs first within available resources, ORNL and DOE must continue to work together to establish priorities. All of this must be accomplished without jeopardizing the Laboratory's current and future stature in R&D.

Continued expansion of the Laboratory's interactions and collaborations with outside organizations will require considerable effort to make ORNL more "user friendly" and visually attractive. Both DOE and ORNL management must pay more attention to simplifying access to the Laboratory and to providing facilities and services for guest researchers, persons involved in technology transfer, and students.

Finally and fundamentally, the nation must realize that challenges to its energy supply, environment, and economic competitiveness affect its very way of life. A consensus must be reached to meet these challenges by allocating adequate resources and by ensuring, through DOE and ORNL management, that resources are effectively spent.

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APPENDIX A

DOE/LMER Contract
(Section on Land-Use Planning and Management)

(ii) Land-use planning and land management services for the DOE Oak Ridge Reservation (ORR). The ORR consists of 34,545 acres of Federally-owned land. This contract addresses land for which Lockheed Martin is assigned management responsibility which includes the entire ORR, with the exception of TVA areas and those assigned to other contractors as identified in the Facility Information Management System (FIMS, formerly RIPS) database and shown in Figure 2 of the draft ORR Management Plan dated June 9, 1995 (ES/EN/SFP-37). Specifically, the Contractor will be responsible for:

(A) Land and facility planning for the ORNL Site.

(B) Management of the National Environmental Research Park and the Reservation, exclusive of the K-25 and Y-12 sites, including:

The safe and environmentally acceptable execution of assigned programmatic activities conducted on the Reservation.

Forestry management and wildlife management, including the maintenance of effective relationships with the Tennessee Wildlife Resources Agency.

Assuring the safe, secure, and environmentally acceptable execution of activities which provide the public controlled access to the Reservation (e.g., hunting programs).

Assuring the safe and environmentally acceptable infrastructure of the Reservation in roads, road maintenance, hazard identification, integration of day-to-day activities, etc.

(C) Supporting the Reservation Management process in a joint Lockheed Martin Land Use Committee which will serve as the integrating body for Reservation planning, practices and budgets in support of DOE land management activities. The charter and membership of this committee will be approved by DOE.

(iii) Facility transition involving the preparation of ORNL facilities for safe shutdown and transfer to the Surplus Facilities Program.

(iv) Other services performed in Oak Ridge and elsewhere as agreed to in writing by DOE and the Contractor, as described in (c)(2), Related Services.

Part III – Services:

(i) ORNL is responsible for providing services as needed to support the functions described above in Parts I and II. This includes the development and implementation of related policies and procedures, as appropriate. These services may be provided by ORNL, purchased or provided by other elements of the Lockheed Martin Corporation, or outsourced, on the basis of make/buy analyses. These determinations will be made in the best interest of the Government and will provide reasonable transition periods, as appropriate.

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APPENDIX B

DOE Requirements for Plan
Life-Cycle Asset Management (LCAM) Order

U.S. Department of Energy

Washington, D.C.

ORDER

DOE O 430.1

Approved: 08-24-95
Review Date: 08-24-97

SUBJECT: LIFE CYCLE ASSET MANAGEMENT

Chg 1: 10-26-95

1. OBJECTIVES . The Department of Energy (DOE), in partnership with its contractors, shall plan, acquire, operate, maintain, and dispose of physical assets as valuable national resources. Stewardship of these physical assets shall be accomplished in a cost-effective manner to meet the DOE mission. This shall incorporate industry standards, a graded approach, and performance objective.

2. IMPLEMENTATION. This Order shall be implemented on a site-by-site basis through the establishment, by contract or financial assistance agreements, of site-specific performance criteria and a performance measurement system. The existing Orders listed below and already implemented in current contracts remain in effect until such incorporation takes place. Additionally, for specific facilities under the purview of the Defense Nuclear Facilities Safety Board, DOE 4330.46, MAINTENANCE MANAGEMENT PROGRAM, and DOE 6430.1A, GENERAL DESIGN CRITERIA, remain in effect until 10 CFR 830.340, MAINTENANCE MANAGEMENT, and D0E O 420, FACILITY SAFETY, for defense nuclear facilities are issued as finals by the Assistant Secretary for Environment, Safety, and Health. For sites not managed by a contractor, implementation shall occur when the responsible DOE organization has completed the development of appropriate performance measures.

3. CANCELLATION. The following directives are deleted or consolidated into this Order and shall be phased out as noted in paragraph 2:

DOE 1332.1A	UNIFORM REPORTING SYSTEM
DOE 401O.1A	VALUE ENGINEERING
DOE 4300.1C	REAL PROPERTY MANAGEMENT
DOE 4320.16	SITE DEVELOPMENT PLANNING
DOE 4320.2A	CAPITAL ASSET MANAGEMENT PROCESS
DOE 4330.4B	MAINTENANCE MANAGEMENT PROGRAM
DOE 4330.5	SURPLUS FACILITY TRANSFER
DOE 4540.1C	UTILITY ACQUISITION AND MANAGEMENT
DOE 4700.1	PROJECT MANAGEMENT SYSTEM
DOE 4700.3	GENERAL PLANT PROJECTS
DOE 4700.4	PROJECT MANAGER CERTIFICATION
DOE 5700.2D	COST ESTIMATING , ANALYSIS, AND STANDARDIZATION
DOE 6430.1A	GENERAL DESIGN CRITERIA

Vertical line denotes change.

DISTRIBUTION,
All Departmental Elements

INITIATED BY:
Office of Field Management.

4. APPLICABILITY. This Order applies to all DOE elements except the Naval Reactors/Naval Nuclear Propulsion Program. This Order does not preclude issuance of program directions unrelated to asset management systems. While this Order applies to al 1 the physical assets in DOE, there are additional requirements for special and nuclear facilities that are the responsibility of the Assistant Secretary for Environment, Safety, and Health to develop and maintain.

5. DEFINITIONS. See Attachment 1.

6. REQUIREMENTS .

a. DOE elements shall use a value-added, quality driven, graded approach to life-cycle asset management.

b. Every site shall be supported by a Headquarters program office that functions as the landlord. Landlords shall coordinate their facilities management activities to provide a consistent corporate approach to facilities management, especially at multi-program sites. At single program sites, the responsible program office shall perform the landlord responsibilities.

c. Assets management performance measures shall be based upon best industry practice and shall be commensurate with the value and importance of the asset using a graded approach.

d. Asset management performance measures shall ensure formal, comprehensive, integrated, documented planning, and control methods for the acquisition, use, maintenance, and disposal of physical assets, including real estate and energy and utilities. This shall address, but shall not be limited to, the following:

(1) A comprehensive land-use planning process with stakeholder involvement.

(2) The efficient and effective acquisition, management, and use of energy and utilities.

(3) The management of backlogs associated with maintenance, repair, and capital improvements.

(4) A method for the prioritization of infrastructure requirements.

(5) A method to declare assets surplus

e. The process for physical asset acquisition shall be an integrated, systematic approach that shall ensure, but shall not be limited to, the following:

(1) Use of a comprehensive land-use process with stakeholder involvement.

(2) Use of a process tool, such as value engineering, to improve efficiency and cost-effectiveness when analyzing physical asset acquisition.

(3) Specification of the appropriate state, regional, or national building codes to which physical assets shall be designed and constructed.

(4) Consideration of maintainability, operability, life-cycle costs, and configuration integrity in designs and acquisitions.

(5) Consideration of current mission needs and an appropriate scope.

(6) Use of a DOE-certified real estate specialist for the execution of real estate acquisitions.

(7) A project management system based on effective management practices that is sufficiently flexible to allow for the size and complexity of the project. For line item projects, the following requirements are considered minimal:

(a) Prior to the commencement of conceptual design, include the following in project planning for approval:

1 mission need,
2 minimum technical functional requirements,
3 proposed cost and schedule ranges,
4 preliminary environmental strategy,
5 identification of project technical and organizational interfaces, and 6 integration with other projects and activities.

(b) Prior to the commencement of execution, include the following in project planning for approval:
1 project objectives,
2 scope, schedule, and cost baselines, including contingencies,
3 life-cycle cost analysis,
4 preliminary safety assessment,
5 project controls, including baseline change control, change control thresholds, and statusing,
6 completion of National Environmental Protection Act documentation prior to final commitment to an alternative,

7 verification of performance criteria through test and evaluation, and
8 design alternatives.

(c) Prior to operation, a plan for turnover of a facility shall be prepared; verification of performance criteria through test and evaluation shall be accomplished; and operational readiness shall be verified.

f. The process for the operation and maintenance of physical assets shall ensure, as a minimum, the following:

(1) The identification, inventory, and periodic assessment of the condition of physical assets in the maintenance program.

(2) The establishment of requirements, budgets, and a work management system to maintain physical assets in a condition suitable for their intended use.

(3) The preventive, predictive, and corrective maintenance to ensure physical asset availability for planned use and/or proper disposition.

(4) A configuration management process to ensure the integrity of physical assets and system.

(5) The efficient and effective management and use of energy and utilities.

(6) A method for the prioritization of infrastructure requirements.

(7) The management of backlogs associated with maintenance, repair, and capital improvements.

g. The process for the disposition of physical assets shall ensure, as a minimum, the following:

(1) The use of a signed agreement to document items and conditions when transferring assets between DOE program offices.

(2) The use of a DOE-certified real estate specialist to execute the disposal of real estate, including the disposal of DOE improvements without the underlying land.

(3) A method of timely identification and reporting of surplus assets.

(4) In addition, for nuclear facilities, as a minimum the following apply:

(a) The development of a decommissioning turnover plan.

(b) The development of a decontamination plan if appropriate for the facility.

(c) The completion of a deactivation readiness review.

h. Utility services shall be acquired and disposed of through a DOE prime contract.

i. The DOE corporate physical assets database shall be maintained as a complete, current inventory of the DOE physical assets. The

corporate database is Facilities Information Management System (FIMS).

j. In the acquisition, operation, maintenance, and disposition of physical assets, DOE elements shall ensure that all applicable Federal, state, and local laws and regulations are followed.

7. RESPONSIBILITIES.

a. Secretary.

(1) Authorizes actions to acquire title to or interest in real property by condemnation.

(2) Accepts donations of physical assets from outside DOE.

(3) Approves critical decisions on strategic systems.

b. Associate Deputy Secretary of Field Management.

(1) With General Counsel and participation of field elements, jointly represents DOE consumer interests by intervening, or otherwise participating in, hearings or proceedings before utility regulating bodies, when these proceedings affect DOE operations.

(2) With General Counsel and the Office of Clearance and Support, jointly reviews and approves documents for the acquisition and sale of utility services.

(3) With DOE elements, coordinates the possible reuse of facilities that field elements report as excess.

(4) In coordination with program offices and program offices with landlord responsibilities, takes the lead in verifying that field elements have the asset management performance criteria and measures in place to effectively oversee the contractors.

(5) Provides technical assistance to the program offices, landlords, and field elements.

(6) Coordinates among program offices and field elements to support an efficient, economic approach to physical asset management.

(7) Manages the certification program for DOE real estate specialists.

(8) Supports the planning and budgeting process for physical assets.

(9) Sponsors and coordinates the Life-Cycle Asset Management Planning and Analysis Group.

(10) Acts as the DOE point-of-contact for external activities and issues relating to life-cycle asset management.

(11) Supports the Secretary in the strategic systems critical decision process.

(12) Supports the development of Departmental performance

objectives.

(13) Facilitates the assignment of the landlord program office responsibility.

(14) Conducts independent cost assessments on strategic systems (or on other projects, as requested) to verify a sound basis for critical decision making that commits large expenditures of DOE resources.

c. Program Office.

(1) Leads in defining, planning, and budgeting for program needs, including operations, facilities, and projects.

(2) Leads in verifying that program objectives are met and is accountable to the Secretary for program direction and execution through the field element.

(3) Notifies field elements of plans to close program facilities.

(4) Coordinates with the Office of Field Management and field elements to support an efficient, economic approach to physical asset management.

(5) Develops, documents, and maintains a system to prioritize the acquisition of programmatic physical assets, including upgrades.

(6) Participates in the Life-Cycle Asset Management Planning and Analysis Group.

(7) Supports or, if delegated, leads the critical decision process for strategic systems funded by the program.

(8) Conducts reviews of field element performance, including design, scope, and cost peer reviews for program elements under their programmatic authority.

(9) Issues policy relative to its programmatic planning, budgeting, and execution activities.

(10) Leads in establishing and clearly stating expected program performance objectives and program performance criteria and supports the contracting officer in implementation of performance criteria for stated objectives.

(11) Supports the Office of Field Management to verify that field elements have the asset management performance criteria and measures in place to effectively oversee programmatic facilities.

(12) Supports, including funding, the field elements in the management of inactive and surplus program facilities that have not been transferred to the Office of Environmental Management.

(13) For single program sites, performs responsibilities of the landlord.

(14) For multi-program sites, provides support, including resources,

to the program performing the responsibilities of the landlord.

(15) Leads oversight of field elements to ensure that performance criteria and measures are in place to effectively achieve program and project objectives related to the program office's programmatic authority.

(16) Assumes the responsibilities of the field element for project management and physical asset management not delegated to the field element.

d. Program Office Designated as Landlord.

(1) Supports DOE field element's management of site infrastructure by prioritizing and budgeting for real property needs in a manner consistent with current and planned site mission activities. For multi-program sites these responsibilities include coordination of funding requirements with other program offices.

(2) Issues policy relative to its infrastructure planning and budgeting activities.

(3) Leads in establishing infrastructure performance objectives and supports the contracting officer in developing performance criteria for the site.

(4) Supports the Office of Field Management in verifying that field elements have asset management performance criteria and measures in place to effectively oversee nonprogrammatic facilities.

(5) Leads reviews of field elements infrastructure activities, in coordination with the program offices and the Office of Field Management.

(6) Develops, documents, and maintains a system to prioritize the acquisition of nonprogrammatic physical assets.

(7) Supports, including funding, field elements in the management of inactive and surplus landlord facilities that have not been transferred to the Office of Environmental Management.

(8) Supports or, if delegated, leads the critical decision process for strategic systems funded by the landlord.

(9) Leads issue resolution between program offices regarding possible conflicts in planned infrastructure uses at multi-program sites.

(10) Supports field elements in site-wide and external facilities management and infrastructure issues requiring Headquarters involvement.

(11) Coordinates landlord facilities management activities with other DOE landlord programs to provide a consistent approach to landlord facilities management.

e. Field Elements.

(1) Serve as contracting officers for site contracts and all other contracts and financial assistance agreements executed by field elements.

(2) Prepare initial budget requests and planning for physical assets.

(3) Obtain necessary approvals for projects from the sponsoring program offices including mission need and project baselines, as appropriate.

(4) Oversee projects delegated to them and oversee those projects executed by contractors to verify requirements are met.

(5) Notify the Office of Field Management of excess real property that has a significant remaining useful life.

(6) Verify adequate management of inactive and surplus facilities until a reuse is found or the real property is disposed of.

(7) Lead the verification of an efficient, economic approach to physical asset management in coordination with program offices and the Office of Field Management.

(8) Participate in the DOE certification program for real estate specialists.

(9) Participate in the Life-Cycle Asset Management Planning and Analysis Group.

(10) Support the strategic systems critical decision process.

(11) Support the program offices in development of performance criteria for program performance objectives and lead in implementing program criteria.

(12) Lead in negotiating the performance criteria and measures with the contractor to meet the defined performance objectives.

(13) Lead in evaluating the performance of the contractor against the performance measures in the contract.

(14) Are accountable to the program offices and the landlord program office for contractor performance.

(15) Coordinate all review and external oversight activities of the contractors.

(16) With General Counsel and the Office of Field Management, participate in the DOE's utility intervention process.

(17) When project size and complexity warrants, conduct independent design, scope, and cost reviews.

8. ASSISTANCE. For answers to questions, contact the Office of Field Management at (202) 586-2850.

DEFINITIONS

1. Assets. See Physical Assets.

2. Asset Management Systems. Processes and/or procedures that are employed for non-programmatic management of a facility or physical asset.

3. Baseline. A quantitative expression of projected costs, schedule, and technical requirements; the established plan against which the status of resources and the progress of a project can be measured.

4. Certified Realty Specialist. A DOE employee that is certified in one or more of the four specialty realty areas: acquisition, non-GSA leasing, GSA leasing, and land management and disposal. Employees so certified may authorize or contract for real estate actions within certified specialty area(s).

5. Commencement of Execution. The beginning of the project phase that accomplishes development and remedial action/construction. This project phase advances the project from conceptual design to turnover to operations, through the execution of the design, construction/building-/remediation and acceptance of the project. During this project phase, preliminary design, detailed design and construction/remedial design and remedial actions take place.

6. Conceptual Design. The activities required to evaluate project design alternatives and to develop sufficient detail to baseline the scope, cost and schedule for project authorization.

7. Corporate Facilities. See DOE Facilities.

8. Corrective Maintenance. See Repair.

9. Critical Decision. A formal determination at a specific point in a project that allows the project to proceed. Critical decisions occur in the course of a project, for example: prior to commencement of conceptual design, commencement of execution and prior to turnover.

10. Disposal. Permanent or temporary transfer of DOE control and custody of real property to a third party who thereby acquires rights to control, use, or relinquish the property.

11. Disposition. Those activities that follow completion of program mission, including, but not limited to, stabilization, deactivation, decontamination, decommissioning, dismantlement, and/or reuse of physical assets.

12. DOE Elements. First tier organizations at Headquarters and in the field. Field elements include all operations offices, field offices, energy technology centers, and power marketing administrations.

13. DOE Facilities. Any of the DOE-owned, -leased, or -controlled facilities.

14. Excess. Physical assets that are not required for DOE needs and the discharge of its responsibilities.

15. Facilities. Land, buildings, and other structures, their functional

systems and equipment, and other fixed systems and equipment installed therein, including site development features outside the plant, such as landscaping, roads, walks, and parking areas; outside lighting and communication systems; central utility plants; utilities supply and distribution systems; and other physical plant features.

16. Facilities Management. A documented process by which facilities are operated and maintained.

17. Facility. The buildings, utilities, structures, and other land improvements associated with an operation or service and dedicated to a common function.

18. Graded Approach. The depth of detail required and the magnitude of resources expended for a particular management element to be tailored to be commensurate with the element's relative importance to safety, environmental compliance, safeguards and security, programmatic importance, magnitude of the hazard, financial impact, and/or other facility-specific requirements.

19. Infrastructure. All real property and installed equipment and personal property that is not solely supporting a single program mission.

20. Landlord Program Office. (Landlord) The Headquarters program office responsible for the support, planning, acquisition, operation, maintenance, and disposition of physical assets related to infrastructure.

21. Life-Cycle. The life of an asset from planning through acquisition, maintenance, operation, and disposition.

22. Line Item Project. Those separately identified project activities that are submitted for funding and are specifically reviewed and approved by Congress.

23. Maintenance. Day-to-day work, including preventive and predictive maintenance, that is required to maintain and preserve plant and capital equipment in a condition suitable for it to be used for its designated purpose.

24. Maintenance Backlog. The amount of maintenance and repair work not accomplished at the end of the fiscal year that is needed or planned to sustain the assigned mission.

25. Partnership. A process in which individual stakeholders create a team approach to achieve mutual goals and objectives or to resolve problems.

26. Performance Criteria. A condition or set of conditions that, when satisfied, indicate successful completion of the performance objective.

27. Performance Measures. Any evaluation, comparison, or judgement toward meeting the performance objective.

28. Performance Objective. A statement of wants, needs, and expectations of customers that sets the direction for all contract effort.

29. Personal Property. See Physical Assets.

30. Physical Assets. All DOE-owned or DOE-used and -controlled land, land

improvements, structures, utilities, motor vehicles, equipment, and components are included.

a. Real Property or Real Estate. Real property includes land, improvements on the land, or both, including interests therein. All equipment or fixtures (such as plumbing, electrical, heating, built-in cabinets, and elevators) that are installed in a building in a more or less permanent manner or that are essential to its primary purpose are usually held to be part of real property.

b. Related Personal Property. Related personal property means any personal property that, once installed, becomes an integral part of the real property in which it is installed or is related to, designed for, or specially adapted to the functional or productive capacity of the real property. The removal of related personal property will significantly diminish the economic value of the real property or the related personal property. Examples of related personal property are communications and telephone systems.

c. Personal Property. Generally, capitalizable property that can be moved, or that is not permanently affixed to and part of real estate. Generally, items remain personal property if they can be removed without seriously damaging or diminishing the functional value of either the capitalizable property or the real estate. Examples of personal property are shop equipment and automated data processing and peripheral equipment.

31. Programmatic Management. Functions that include planning and developing the overall program; establishing broad priorities; providing program technical direction; preparing and defending the program budget; controlling milestones; integrating all components of the program; providing public and private sector policy liaison; expediting interface activities and follow-up actions; and retaining overall accountability for program success.

32. Project. In general, a unique effort that supports a program mission with defined start and end points, undertaken to create a product, facility, or system with interdependent activities planned to meet a common objective/mission. Projects include planning and execution of construction/renovation/modification/environmental restoration or decontamination and decommissioning efforts, and large capital equipment or technology development activities. Tasks that do not include the above elements, such as basic research, grants, and operations and maintenance of facilities, are not considered projects.

33. Property. See Physical Assets.

34. Related Personal Property. See Physical Assets.

35. Repair. The restoration of failed or malfunctioning equipment, system, or facility to its intended function or design condition. Repair does not result in a significant extension of the expected useful life.

36. Site. A geographic entity comprising leased or owned land, buildings, and other structures required to perform program activities.

37. Strategic System. (formerly Major Systems Acquisition) A special type of line item project(s) that is a single, stand-alone effort within a program mission area that is a primary means to advance the Department's

strategic goals. Designation of a strategic system is determined by the Secretary based on cost, risk factors, international implications, stakeholder interest, and/or national security.

38. Strategic System Critical Decision Process. See Critical Decision.

39. Surplus. Any facility that the responsible program office declares available for other use.

40. Utility. A system, or any of its components, that generates and/or distributes (via pipelines, wires, buses, or electromagnetic waves) a commodity or service to itself and/or to other facilities.

41. Utility Service. A service, such as the furnishing of electricity, natural gas, steam, water, and sewer service and the furnishing of appurtenant facilities and systems. Telecommunication services or the removal and disposal of garbage, rubbish, and trash are not included.

42. Value-added. A decision-making process that leads to an improvement in an operation or process, based on effectiveness, efficiency, cost-effectiveness, safety, etc.

43. Value Engineering. An organized effort, directed by a person trained in value engineering (VE) techniques, to analyze the functions of systems, equipment, facilities, services, and supplies to achieve the essential functions at the lowest life-cycle cost that is consistent with required performance, reliability, availability, quality, and safety. (Terms such as value analysis, value control, value improvement, value management, and functional analysis are synonymous).

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APPENDIX C

ORNL Tailored Stakeholder Plan

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ORNL Tailored Stakeholder Plan

Many individuals, communities, industries, agencies, and institutions are interested in the successful planning and growth of ORNL. While some of the stakeholders for ORNL are the same as those for ETTP and Y-12, many groups are specific to ORNL because of differing mission objectives. Recognizing these unique site needs, DOE has requested that each site establish and implement a "tailored" stakeholder plan. Through the tailored stakeholder plan, input specific to a particular site and its mission is targeted. This tailored stakeholder plan identifies the process used for ORNL. Local stakeholder input obtained in 1995 through the DOE Future Use Initiative for the entire ORR has been incorporated into the ORNL plan as appropriate. General land use plans for the entire ORR are identified in a comprehensive integrated planning document published in May 1998, which included a public comment period. Continuing updates to this *ORR Comprehensive Integrated Plan* will have public review for comments and will incorporate tailored stakeholder input obtained through the site planning documents.

Requesting Input

Electronic communication is the preferred method of stakeholder review and input. Stakeholder review will be requested by E-mail, when possible, or by letter with reference to the document location on the World Wide Web. Reviewers unable to access the electronic version can request a hard copy of the document sections of interest. A comment box at the end of the Web document will facilitate reviewer input on individual document sections. Comments will be returned to Pat Parr, ORNL Land Area Manager, and Tony Medley, ORNL Capital Assets Manager. The number of hits and the location of the hits on the document will be recorded. A copy of the letter transmitted to ORNL tailored stakeholders is included.

Incorporation of Stakeholder Comments

Tailored stakeholder comments, as well as others received throughout the process, will be evaluated for compatibility with the ORNL Vision for Land Use. Where appropriate and possible, these responses have been or will be incorporated into the Plan of Current Land Uses and Planning for Future Land Uses. Planning land uses is an opportunistic and dynamic process. Through the ORNL Land and Facility Use Committee, additional comments, ideas, and suggestions will be evaluated in a timely manner for implementation and reviewed through the Reservation Management Organization, as needed.

Responding to Stakeholder's Input

Receipt of stakeholder comments will be acknowledged. For the most part, however, a response to each stakeholder comment will not be provided to the stakeholder. Updated versions of the document will be brought to the attention of the participating stakeholders. Opportunities to comment on additional drafts of the document as well as document updates will be provided.

Identification of ORNL Tailored Stakeholders

A diverse group of agencies, institutions, and organizations will be contacted for stakeholder input and includes

A. DOE Oak Ridge Operations and Headquarters Sponsors/Programs - such as *ORNL Institutional Plan* reviewers, DOE Energy Research, DOE ORNL Site Office, National Environmental Research Parks.

B. Other agencies that support research - including Lockheed Martin Energy Research, Electric Power Research Institute, the National Aeronautics and Space Administration, Department of Defense, Southern Appalachian Man and the Biosphere, National Park Service, Tennessee Valley Authority.

C. Educational users - The University of Tennessee, Oak Ridge Associated Universities, Tennessee Technological University, University of Tennessee Forestry Experiment Station.

D. Natural Resource Trustees or Agencies - DOE's List of Natural Resource Trustees, Tennessee Wildlife Resources Agency, Tennessee Department of Environment and Conservation Natural Heritage Program, Tennessee Department of Environment and Conservation Oversight Office, U.S. Fish and Wildlife Service.

E. Professional Organizations with Large-Scale Perspective on Ecosystem Management - Ecological Society of America, American Institute of Biological Sciences, Association of Southeastern Biologists, International Society for Ecological Monitoring, Tennessee Nature Conservancy, Partners in Flight.

F. Other organizations - Friends of Oak Ridge National Laboratory, Tennessee Citizens for Wilderness Planning, World Engineering Partnership for Sustainable Development.

APPENDIX D

ORNL Stakeholder Response Letter

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APPENDIX E

Oak Ridge Reservation Research Focus

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Oak Ridge Reservation Research Focus

The location of the ORR in a suburban/industrial setting in the Southeastern United States makes it a particularly valuable site for addressing several important issues dealing with future ecosystem management. The Southeastern United States is experiencing higher rates of population and industrial growth than most areas of the nation. Such growth will place increased stresses on the diverse ecosystems of the region, particularly the abundant forests and freshwaters. Forest productivity and vitality are important to the large forest products industry in the region, and water quality is critical for domestic, industrial, and recreational interests. The Southeastern United States is also thought to be among the most vulnerable regions to global climate change (Neilson and Marks 1994). Future management of terrestrial and aquatic ecosystems in the region will require a much better understanding of the interactions between these expected anthropogenic stresses and climate changes. Many species and communities in the Southeast are at the southern limits of their distributions, and warming may result in elimination. The humid climate and high rates of evapotranspiration (ET) in the Southeast increase the vulnerability to drought resulting from warming effects on ET or possible reductions in rainfall. Plant distributions and productivity, aquatic productivity and biodiversity, and water quality in the Southeast are likely to be strongly impacted by climate change.

One of the most important issues concerning the well-being and security of the nation is how to accommodate future economic development and maintain the ecosystem integrity and sustainability on which human systems ultimately depend. Management approaches to development and land use are frequently driven by emphasis on short-term productivity or economic gain, rather than the long-term sustainability of ecosystems. The ability to make rational decisions about land management and to be adaptable to changing needs and priorities while, at the same time, preserving long-term options requires a combination of long-term monitoring and research based on a fundamental understanding of the ecological processes and relationships necessary for long-term sustainability of ecosystem structure and function. The Ecological Society of America recently identified several barriers to long-term sustainability: (1) inadequate information on the biological diversity of environments, (2) widespread ignorance of the function and dynamics of ecosystems, (3) the openness and interconnectedness of ecosystems on scales that transcend management boundaries, and (4) a prevailing public perception that the immediate economic and social value of exploiting supposedly renewable resources outweighs the risk of future ecosystem damage or the benefits of alternative management approaches.

The ORR will be used for experimental research and monitoring activities addressing the following areas for the eastern deciduous forest type:

- Vegetation response to atmospheric stresses (ozone, high nitrogen deposition) under variations in climate (productivity, water use, natural pathogens);
- Changes in plant community dynamics in response to land use, atmospheric stresses, and climate variation (rare species, shifts in dominant vegetation types);
- Biogeochemical cycling and output of nitrogen with changes in nitrogen deposition and forest succession and growth;

- Interactions among different vegetation and animal communities at the landscape scale;
- Terrestrial-aquatic interactions under climate variations and terrestrial community succession or change; and
- Recovery of stream communities from past disturbances.

Expected outcomes:

- A viable, working framework and model for sustainable development of the Oak Ridge subregion.

- Establishment of the ORR as a national showcase for the environmental and social sciences missions of DOE.

- Creation of the long-term context within which the infrastructure assets of the ORR are preserved and enhanced for new initiative development.
  - -Bioremediation Demonstration Center
  - -Global Change Ecosystem Research
  - -Biofuels Feedstock Demonstrations
  - -Plant Genome Introductions
  - -Environmental Technology Demonstrations

Research on the ORR will continue to address major national issues and contribute to national and international collaborative research initiatives and issues such as:

Global Climate Change

- Manipulative experiments to evaluate impacts of future climate change
  -U.S. Global Change Research Program
  - -Water balance manipulation
  - -Elevated CO_2
  - -Temperature manipulations

- Biodiversity
  -Southern Appalachian Man and the Biosphere Program
  - -Biosphere Reserve Unit
  - -DOE National Environmental Research Park
  - -Threatened and endangered species
  - -Neotropical migratory birds
  - -Wildlife management

- Tropospheric Air Quality
  -National Acid Precipitation Assessment Program
  -North American Research Strategy for Tropospheric Ozone Program
  -Ozone secondary air quality standard research

- Sustainable Development
  -Council on Environmental Quality/PCSD Initiative
    -Indices of sustainability
  -DOE Science of Sustainability

- Endocrine Disrupters
  -EPA/Interagency Endocrine Disrupter Initiative

- Multiple Stress Interactions
  -Climate Change X Ozone X Nitrogen

There are a number of important issues where future research will draw upon the land resources of the ORR to meet future mission needs:

- Monitoring and Scaling Issues
  -National Environmental Monitoring and Research Program
  -National Index Site
  -National Environmental Report Card
  -National Aeronautics and Space Administration Ground-Truthing of Ecological Processes, Scaling
  -EPA Environmental Monitoring Technologies Test Bed

- Ecological Recovery
  -Natural and Accelerated Bioremediation Research Demonstration Site
  -Test Bed for Environmental Restoration Technologies
  -Demonstration of Ecological Recovery

- Basic Forest Biology Research
  -Genotypic and phenotypic mapping of significant forest species, either for global change research or for forest industry research
  -Forest biotechnology demonstrations
    -Short rotation woody crops
    -Herbaceous crops

- Other interagency research missions for which the ORR serves as a resource:
  -Wetlands research, wetlands banking
  -Wildlife research
    -Game species (e.g., deer and turkey)
    -Beaver

- Landscape Dynamics/Land Use/Urban Ecosystems
  -Patch dynamics
  -Ecologically significant corridors
  -Minimum size of patch

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APPENDIX F

Self-Sufficiency Parcels for the City of Oak Ridge

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Self-Sufficiency Parcels for the City of Oak Ridge

In 1979, the Secretary of Energy approved a program to permit DOE to make financial assistance payments to the City of Oak Ridge for a 5-year period under the authority of the Atomic Energy Community Act of 1955. The city submitted a self-sufficiency plan which proposed that DOE sell land to the city for industrial and commercial development. ORO determined that the land could be transferred directly at fair market value to the city in support of the self-sufficiency program rather than being reported excess to the General Services Administration for screening and subsequent disposal. When the self-sufficiency program ended, certain remaining designated parcels that had been in review at the time were "grandfathered," thus permitting DOE to consider those transfers should the land become excess to the needs of DOE. These parcels are shown in Fig. F.1.

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