ORNL/M-6714

OAK RIDGE NATIONAL LABORATORY

LAND AND FACILITIES PLAN

ORNL/M-6714

OAK RIDGE NATIONAL LABORATORY LAND AND FACILITIES PLAN

August 1999

Prepared by
LOCKHEED MARTIN ENERGY RESEARCH CORPORATION
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

Reservation and Capital Assets Management
Oak Ridge National Laboratory
P.O. Box 2008
Oak Ridge, TN 37831-6302
Telephone: (423) 576-4183

Comments on the 1998 *Oak Ridge National Laboratory Land and Facilities Plan* have been addressed and resolved as appropriate in this update. Recognizing that land and facilities planning is not a static process, this document will continue to address comments with additional 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 and Brett Hopwood, ORNL Computing, Information, and Networking Division.

CONTENTS

LIST OF FIGURES ix

LIST OF TABLES xi

ACRONYMS AND ABBREVIATIONS xiii

ACKNOWLEDGMENTS xvii

1. INTRODUCTION 1-1
1.1 LAND USE HISTORY OF THE OAK RIDGE RESERVATION 1-1
1.2 A SHIFT TO PUBLIC OWNERSHIP 1-5

2. ORNL LAND USE PLAN 2-1
2.1 DOE VISION FOR LAND USE 2-1
2.2 DEVELOPMENT OF THE LAND AND FACILITIES PLAN 2-1
2.3 LAND USE DECISION MAKING AND PLANNING 2-2
2.3.1 Guidelines for Land Use Planning 2-2
2.3.2 Land Use Priorities 2-2
2.3.3 Review by Subject Matter Experts 2-3
2.3.4 ORNL Land and Facilities Use Committee 2-3
2.3.5 Review Process 2-4
2.3.6 Overlapping Land Use/Management Responsibilities 2-4
2.4 DESCRIPTION OF THE OAK RIDGE RESERVATION 2-4
2.4.1 Location 2-4
2.4.2 DOE Facilities 2-6
2.4.3 Physical Characteristics 2-6
2.4.3.1 Topography, Geology, and Hydrology 2-6
2.4.3.2 Vegetation and Wildlife 2-11
2.4.3.3 Caves, Open Sinkholes, and Quarries 2-13
2.4.4 Cultural Resources 2-13
2.4.5 Environmental Designations 2-13
2.4.5.1 State Natural Areas 2-15
2.4.5.2 Oak Ridge Wildlife Management Area 2-15
2.4.5.3 Wetlands 2-17
2.4.5.4 Nature Conservancy Biodiversity Ranked Areas 2-17
2.4.5.5 Nature Conservancy Landscape Complexes 2-17
2.4.5.6 Research Park Endangered Species Habitats (Natural Areas) 2-19
2.4.5.7 Research Park Endangered Species Potential Habitats (Reference Areas) 2-19
2.4.5.8 Biosphere Reserve 2-19
2.4.6 Maps - Physical Characteristics and Natural Resources of the Oak Ridge Reservation 2-19
2.5 CURRENT LAND USE ON THE OAK RIDGE RESERVATION 2-21

2.5.1 National Environmental Research Park 2-21
2.5.2 Safety 2-23
2.5.2.1 Training Facilities with Surface Danger Zones 2-24
2.5.2.2 Emergency Planning Zones 2-24
2.5.3 Compliance and Monitoring 2-24
2.5.3.1 Environmental Monitoring 2-26
2.5.3.2 Air Monitoring 2-26
2.5.3.3 Surface Water Monitoring 2-28
2.5.3.4 Groundwater Monitoring 2-28
2.5.3.5 Terrestrial Vegetation Monitoring 2-29
2.5.3.6 The Biological Monitoring and Abatement Program . 2-30
2.5.4 Contaminated Areas 2-30
2.5.5 Land Application of Biosolids 2-32
2.5.6 Utilities (Gas, Communication Lines, Power) 2-32
2.5.7 Oak Ridge Wildlife Management Area 2-32
2.5.8 Public Opportunities 2-34
2.5.8.1 Public Greenways 2-34
2.5.8.2 Tennessee Wildlife Resources Agency Wildlife Management Area 2-34
2.5.8.3 New Bethel Church Interpretive Center 2-34
2.5.8.4 Walks/Tours 2-35
2.5.8.5 Ecological and Physical Sciences Study Center 2-35
2.5.8.6 ORNL Graphite Reactor 2-35
2.5.8.7 Other Public Facilities and Educational Programs . . . 2-35
2.5.9 Facilities 2-35
2.5.10 Other 2-35
2.5.11 Maps - Current Land Use on the Oak Ridge Reservation 2-35
2.6 FUTURE LAND USE ON THE OAK RIDGE RESERVATION 2-37
2.6.1 Ecosystem Research 2-37
2.6.2 Identified New Future Land Uses 2-37
2.6.2.1 Research Facilities 2-38
2.6.2.1.1 Spallation Neutron Source 2-38
2.6.2.1.2 Joint Institute for Neutron Sciences 2-38
2.6.2.1.3 Laboratory for Comparative and Functional Genomics 2-38
2.6.2.1.4 Oak Ridge Institute for Science and Education 2-39
2.6.2.1.5 Oak Ridge National Laboratory Expansion . 2-39
2.6.2.1.6 Engineering Technology Complex 2-39
2.6.2.1.7 Fusion Materials Irradiation Facility 2-39
2.6.2.1.8 Isotope Separator On-Line Facility 2-39
2.6.2.1.9 Research and Development Facilities 2-42
2.6.2.2 Environmental Field Research Areas 2-42
2.6.2.3 Environmental Partnership Areas 2-43
2.6.2.3.1 State Natural Areas 2-43
2.6.2.3.2 Wetland Mitigation Areas 2-44

2.6.2.3.3 Wildlife Habitat Restoration 2-45
2.6.2.4 Waste Management Facilities 2-45
2.6.2.5 Future Initiatives 2-45
2.6.2.6 Transportation Improvements 2-45
2.6.2.7 Education and Recreation 2-46
2.6.2.8 Land Transfers/Lease Areas 2-46
2.6.3 Maps - Future Land Use on the Oak Ridge Reservation 2-46
2.7 STAKEHOLDER INPUT 2-47
2.7.1 Stakeholder Definition 2-47
2.7.2 Process for Input 2-48
2.7.3 Input Summary 2-48
2.7.3.1 Input Summary from Common Ground 2-48
2.7.3.2 Input from Other ORNL Stakeholders 2-49
2.7.4 Use of Input 2-49

3. ORNL INTEGRATED FACILITIES PLAN 3-1
3.1 PURPOSE 3-1
3.2 SUPPORTING INFORMATION 3-1
3.2.1 Comprehensive Integrated Planning: A Process for the Oak Ridge Reservation, Oak Ridge, Tennessee 3-3
3.2.2 ESHQ&I Management Plan Information System 3-3
3.2.3 Environmental Management Program Baselines 3-3
3.2.4 LMER ESHQ&I Budget Formulation Submission for ORNL . . . 3-3
3.2.5 LMER ESHQ&I Management Plan for ORNL 3-4
3.2.6 ORNL Facility Index 3-4
3.2.7 ORNL Institutional Plan 3-5
3.2.8 ORNL Strategic Plan 3-5
3.2.9 Oak Ridge Reservation Annual Site Environmental Report 3-5
3.2.10 Oak Ridge Reservation Management Plan 3-5
3.2.11 P&E Division Maintenance Work Plan 3-5
3.3 EXISTING ORNL SITE CONDITIONS 3-6
3.3.1 Site Physical Characteristics 3-6
3.3.1.1 ORNL Main Site 3-6
3.3.1.2 Bethel Valley 3-6
3.3.1.3 Melton Valley 3-8
3.3.1.4 Copper Ridge 3-8
3.3.1.5 ORNL at the Y-12 Plant 3-11
3.3.1.6 User Facilities 3-11
3.3.2 Buildings 3-13
3.3.3 Inactive and Surplus Assets 3-16
3.3.4 Utilities 3-20
3.3.4.1 Electricity 3-20
3.3.4.2 Natural Gas 3-22
3.3.4.3 Compressed Air 3-24
3.3.4.4 Potable and Process Water 3-25
3.3.4.5 Chilled Water 3-29

3.3.4.6 Steam 3-31
3.3.4.7 Industrial Gases 3-35
3.3.4.8 Heating, Ventilation, and Air Conditioning 3-35
3.3.4.9 Stormwater Collection System 3-36
3.3.4.10 Telecommunications 3-37
3.3.5 Transportation Infrastructure 3-38
3.3.6 Security 3-40
3.3.6.1 ORNL Protection Strategy 3-40
3.3.6.2 ORNL at the Y-12 Plant 3-42
3.3.7 Environment, Safety, Quality, and Health 3-42
3.3.7.1 Regulation of ORNL Operations 3-43
3.3.7.2 Industrial Safety and Health 3-44
3.3.7.3 Hazardous Material Transportation, Storage, and Handling 3-44
3.3.7.4 Fire Protection 3-44
3.3.7.5 Unique Facilities 3-45
3.3.8 Waste Management and Environmental Issues 3-47
3.3.8.1 Waste Management 3-48
3.3.8.1.1 Conventional Waste 3-62
3.3.8.1.2 Liquid Low-Level Waste System 3-66
3.3.8.1.3 Solid Low-Level Radioactive Waste 3-71
3.3.8.1.4 Transuranic Waste 3-71
3.3.8.1.5 Hazardous Waste 3-72
3.3.8.1.6 Mixed Waste 3-73
3.3.8.1.7 Toxic Waste 3-73
3.3.8.1.8 Classified Waste 3-74
3.3.8.2 Effluent Monitoring 3-74
3.3.8.3 Environmental Restoration Activities and Issues 3-76
3.3.8.3.1 Bethel Valley Watershed RI/FS Record of Decision 3-76
3.3.8.3.2 Gunite and Associated Tanks 3-77
3.3.8.3.3 Molten Salt Reactor Experiment 3-77
3.3.8.3.4 Corehole 8 3-78
3.3.8.3.5 Bethel Valley Evaporator Service Tanks . . . 3-78
3.3.8.3.6 Surface Impoundments Operable Unit Project 3-78
3.3.8.3.7 Old Hydrofracture Facility Removal Project 3-79
3.3.8.3.8 Melton Valley Watershed RI/FS Record of Decision 3-79
3.3.8.3.9 Transuranic Waste Packaging Facility 3-79
3.3.8.4 Hazardous Materials Within the 500-Year Floodplain 3-79
3.3.8.5 Surplus and Excess Facilities in the EM Program 3-80
3.3.9 Maintenance Program 3-80
3.4 PLANNING METHODOLOGY 3-82

3.4.1 Laboratory Missions 3-82
3.4.2 Site Planning Issues 3-83
3.4.3 Facilities Planning Process 3-83
3.4.4 Site Planning Methodology 3-84
3.4.5 Site Planning Assumptions and Objectives 3-84
3.4.6 Evaluation 3-87
3.4.7 Alternatives 3-89
3.4.8 Facilities Resource Requirements 3-90
3.4.9 Reengineering Initiatives 3-91
3.4.10 Master Plan Development 3-92
3.5 ORNL MASTER PLAN 3-92
3.5.1 Current to Three Years 3-93
3.5.1.1 Line Item Projects 3-97
3.5.1.2 Landlord GPPs and Programmatic GPPs 3-102
3.5.1.3 General-Purpose Equipment 3-109
3.5.2 Four to Ten Years 3-110
3.5.2.1 Line Item Projects 3-114
3.5.2.2 Landlord GPPs and Programmatic GPPs 3-117
3.5.3 Greater Than Ten Years (Outyears) 3-125
3.5.3.1 Bethel Valley 3-126
3.5.3.2 Melton Valley 3-132
3.5.4 Future Utilities Planning 3-132
3.5.4.1 Electricity 3-133
3.5.4.2 Natural Gas 3-133
3.5.4.3 Water 3-134
3.5.4.4 Telecommunications 3-134
3.5.4.5 Sanitary Sewage 3-135
3.5.4.6 Fire Protection 3-135
3.5.5 Future Transportation Infrastructure Planning 3-135
3.5.6 Future Security Planning 3-136
3.5.7 Changes in Direction 3-136
3.6 CONCLUSIONS 3-137

4. REFERENCES 4-1

Appendix A. DOE/LMER Contract A-1
Appendix B. ORNL Tailored Stakeholder Plan B-1
Appendix C. ORNL Stakeholder Responses C-1
Appendix D. ORR Research Focus D-1
Appendix E. Self-Sufficiency Parcels for the City of Oak Ridge E-1

LIST OF FIGURES

1.1 Geographic areas of responsibility 1-2
1.2 Current and potential future ORR land uses 1-4
1.3 Original DOE land purchase and current reservation boundaries 1-6
2.1 Location of the ORR and surrounding region 2-5
2.2 Topography with slope 2-7
2.3 Geology with karst features 2-9
2.4 Water, wetlands, floodplains, and watersheds 2-10
2.5 Research areas and forested areas 2-12
2.6 Public, educational, and recreational opportunities 2-14
2.7 Partnership areas 2-16
2.8 The Nature Conservancy biodiversity rankings and landscape complexes 2-18
2.9 Research park confirmed and potential habitats for rare species 2-20
2.10 Safety 2-25
2.11 Compliance and monitoring 2-27
2.12 Watershed areas with potential release sites 2-31
2.13 ORR utilities 2-33
2.14 New future uses 2-40
3.1 ORNL Bethel Valley area facility uses 3-7
3.2 ORNL Melton Valley area facility uses 3-9
3.3 ORNL Copper Ridge area facility uses 3-10
3.4 ORNL at Y-12 facility uses 3-12
3.5 Age of ORNL buildings 3-14
3.6 ORNL facilities modification/repair cost as a percentage of replacement value . 3-15
3.7 Use and condition of ORNL space 3-17
3.8 Primary electrical distribution system 3-21
3.9 Natural gas and compressed air distribution systems 3-23
3.10 Water distribution system. 3-28
3.11 Chilled water system 3-30
3.12 Steam distribution system 3-32
3.13 Environmental Management facilities at the ORNL main site, Bethel Valley . . . 3-49
3.14 Environmental Management facilities at the ORNL main site, Melton Valley . . . 3-50
3.15 Locations of Environmental Management watershed areas. 3-61
3.16 Sanitary and process sewage system 3-63
3.17 Environmental sampling locations. 3-75
3.18 ORNL site planning methodology. 3-85
3.19 ORNL planned development FY 1999 - 2001, Bethel Valley area 3-94
3.20 ORNL planned development FY 1999 - 2001, Melton Valley area 3-95
3.21 ORNL planned development FY 2002 - 2008, Bethel Valley area 3-111
3.22 ORNL planned development FY 2002 - 2008, Melton Valley area 3-112
3.23 ORNL planned development FY 2009 and beyond 3-127
E.1 Oak Ridge Reservation self-sufficiency parcels E-5

LIST OF TABLES

2.1 Physical characteristics and natural resources of the ORR 2-21
2.2 Current land use on the ORR 2-36
2.3 ORNL future land use map 2-47
3.1 List of organizational contacts for documents/databases 3-2
3.2 ORNL building summary 3-13
3.3 ORNL current surplus/inactive facility list 3-18
3.4 ORNL facilities expected to be declared surplus FY 2000 3-19
3.5 ORNL facilities expected to be declared surplus FY 2005 3-19
3.6 Management and Integration (M&I) contractor facilities 3-51
3.7 ORNL facilities located within the 500-year floodplain 3-80
3.8 ORNL current line item and general plant projects 3-96
3.9 ORNL projects - 4 to 10 years 3-110

ACRONYMS AND ABBREVIATIONS

ACM	asbestos-containing material
ADS	Activity Data Sheet
AEC	U.S. Atomic Energy Commission
ARIMs	Accelerator and Reactor Improvement and Modifications
ATDD-NOAA	Atmospheric Turbulence Diffusion Division of the National Oceanic and Atmospheric Administration
BIO	Basis for Interim Operation
BMAP	Biological Monitoring and Abatement Program
BSR	biological significance ranking
BTC	Building Technology Center
BVEST	Bethel Valley Evaporator Service Tank
CAS	Condition Assessment Survey
CBS	Center for Biological Sciences
CCII	Computational Center for Industrial Innovation
CCS	Center for Computational Science
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
CROET	Community Reuse Organization of East Tennessee
CSB	Computational Sciences Building
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
ESHQ&I	environment, safety, health, quality, and infrastructure
ET	evapotranspiration
ETMC	East Tennessee Mechanical Contractors
ETNGC	East Tennessee Natural Gas Company
ETTP	East Tennessee Technology Park

FAB	Facility Authorization Basis
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 Tank
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
HPRR	Health Physics Research Reactor
HRIBF	Holifield Radioactive Ion Beam Facility
HSWA	Hazardous and Solid Waste Amendments of 1984
HVAC	heating, ventilation, and air conditioning systems
I&C	Instrumentation and Controls
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
kVA	kilovolt-ampere
LAN	local area network
LGWOP	Liquid and Gaseous Waste Operations Project
LI	line item
LLLW	liquid low-level (radioactive) waste
LMER	Lockheed Martin Energy Research Corporation
LMES	Lockheed Martin Energy Systems, Inc.
LWS	Laboratory Waste Services
M&I	management and integration
MAA	Material Access Area
MAB	Man and the Biosphere
MFAB	master fire alarm box
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
NABIR	Natural and Accelerated Bioremediation Research

NESHAP	National Emission Standards for Hazardous Air Pollutants
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
NRCS	Natural Resources Conservation Service
NRWTP	Nonradiological Wastewater Treatment Plant
NSAC	Nuclear Science Advisory Committee
ORAU	Oak Ridge Associated Universities
ORFICN	Oak Ridge Federal Integrated Communications Network
ORIC	Oak Ridge Isochronous Cyclotron
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
OSR	Operational Safety Requirement
OSTI	Office of Scientific and Technical Information
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
PWTC	Process Waste Treatment Complex
PWTP	Process Waste Treatment Plant
R&D	research and development
RCRA	Resource Conservation and Recovery Act
REDC	Radiochemical Engineering Development Center
RIB	radioactive ion beam
RI/FS	Remedial Investigation/Feasibility Study
RMO	Reservation Management Organization
ROD	Record of Decision
RPSC	Robotics and Process Systems Complex
S&M	surveillance and maintenance
SAMS	Space Allocation Management System
SANS	Small Angle Neutron Scattering
SAR	Safety Analysis Report
SARUP	Safety Analysis Report Update Program
SC	Office of Science
SDI	Shared Data Initiative
SLLW	solid low-level (radioactive) waste
SNS	Spallation Neutron Source
SWSA	Solid Waste Storage Area
TDEC	Tennessee Department of Environment and Conservation
TRU	transuranic

TS	Treatability Study
TSC	Technical Support Center
TSCA	Toxic Substances Control Act
TSD	Transportation Safeguards Division (DOE Albuquerque Operations Office)
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
UEFPC	Upper East Fork Poplar Creek
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
USQD	Unreviewed Safety Question Determination
UT	University of Tennessee
VOC	volatile organic compound
WAC	Waste Acceptance Criteria
WM	Waste Management
WOCC	Waste Operations Control Center
WSSs	Work Smart Standards

ACKNOWLEDGMENTS

Development of this 1999 update of the *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:

Willie Allen
Susan Anderson
Loretta Asplund
Bob Atchley
Barry Berven
Buddy Bland
Susan Bly
Phyllis Cotten
Sherri Cotter
Patty Cox
Nancy Dailey
Danny Davis
Karen Downer
Lou Dunlap
Tom Etheridge
Norman Farrow
Rick Forbes
Dave Fowler
Stan Frey
Tommy Gibson
Dave Hall
Tana Helms
Brenda Hembree
Greg Herdes
Steve Hildebrand
Nancy Holcombe
Brett Hopwood
Joan Hughes
Greg Irby
Gary Jacobs
Phil Jardine
Dave Kennard
Dick Ketelle
Mark Kohring
Frank Kornegay
Ed Krieg
Lynn Kszos
Mack Lakumb
Regis Loffman
Gay Marie Logsdon
Jim Mathys
Dave McGinty
Tony Medley
Lance Mezga
Tim Myrick
Bonnie Nestor
Pat Parr
Cecil Peters
Wayne Pope
Judy Rosenberg
Barbara Rosensteel
Tom Scanlan
Crystal Schrof
Chris Scott
Ann Shirley
David Skipper
Dennis Smith
Don Stallions
Mike Turpin
Charlie Valentine
Randy Walker
Mike White
and numerous reviewers

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 Science (SC) research programs depend not only on the national laboratory facilities, but also 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 18,000 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.

Updated information on ORNL land and facilities use and planning is contained in this 1999 revision of the 1998 *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).

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 E.

2. ORNL LAND USE PLAN

The Department of Energy (DOE) has made the commitment that as it conducts its energy mission on behalf of the nation on the Oak Ridge Reservation (ORR), DOE will do so in a manner that is respectful of the land and local environment.

2.1 DOE VISION FOR LAND USE

The ORR is a unique and irreplaceable resource for DOE to use for its national science and technology missions. The DOE ORR vision, as stated in the *ORR Comprehensive Integrated Plan* (May 1998), emphasizes that the ORR serves as an integrated science, education, industrial, and technology complex managed by DOE in partnership with the private sector—supporting a dynamic regional and national economy. The intent of the federal government is to manage the reservation as a single parcel. DOE will retain sole responsibility and will continue to manage it in support of DOE missions. Future use is to include a mixture of activities that are compatible with and contribute to ongoing and anticipated DOE missions. According to current plans, the reservation will be used to support many of the same programs it currently supports while adapting to changing national goals and interests and to reduced federal budgets. 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 ORNL Land and Facilities Use Committee, chartered August 1998, now has the responsibility of updating the plan. In addition, input to the plan was solicited from external stakeholders. This revision updates the 1998 *ORNL Land and Facilities Plan* (ORNL 1998).

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.

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 vision for land use. Recommendations on land use are made through the process described in Section 2.3.5 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 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,
ensure consistency with Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) remediation agreements, and
consider stakeholder input.

2.3.2 Land Use Priorities

For any parcel of land that will be used to support DOE's ORNL mission, 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 and not preclude future options. 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,
remediation and cleanup activities, 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 revised *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 1999. 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.

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°) 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.

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 that 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.

Problems in recent years 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). 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).

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 in 1994 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).

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 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.

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 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)
Three Bend Scenic and Wildlife Refuge
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 and communities 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).

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)].

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 1988, the Oak Ridge National Environmental Research Park Biosphere Reserve (Fig. 2.7) was designated. Biosphere reserves are areas of terrestrial and coastal ecosystems that 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 encouraged to fulfill three functions as appropriate within their management framework: 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). The Oak Ridge Biosphere Reserve is managed by ORNL for DOE.

In addition, the Oak Ridge National Environmental Research Park Biosphere Reserve is a unit of the Southern Appalachian Man and the Biosphere Cooperative, 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.

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, source water protection area, and quarries
2.4		Hydrologic features including water, wetlands, floodplains, and watersheds
	Environmenta	
2.5	l	Research areas and forested areas
2.8		The Nature Conservancy Biodiversity Rankings and Landscape Complexes
2.9		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 Science 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 20,000 acres, the Research Park serves as an outdoor laboratory for studying the nature of present and future environmental consequences from energy-related issues such as global and regional change, environmental stresses, and resource use (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 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 Environmental Management (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 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.

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-level manipulation 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.

Three field facilities located at Source Area A in Waste Area Group 5 (WAG 5), West Bear Creek Valley, and Melton Branch Subwatershed are extensively instrumented to monitor storm driven unsaturated flow and saturated groundwater flow. The hydrologic and geochemical processes have been well characterized at each site, and instrumentation is available for performing sustained tracer injection studies. Investigations at the various sites have focused on quantifying the mechanisms of preferential flow and matrix diffusion in fractured saprolites and shale bedrock. Research findings have significantly improved our decision making strategies with regard to contaminant remediation in complex heterogeneous subsurface media.

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 that 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 facility is providing an opportunity for researchers from all over the U.S. to increase collaborative research on the effects that changes in precipitation or CO_2 may have on the long-term development of these forest communities.

Portions of Bear Creek Valley have been offered to the Office of Science to serve as the field research center for the Natural and Accelerated Bioremediation Research (NABIR) Program. This field research center would provide a field facility for NABIR investigators to obtain subsurface samples and perform manipulative experiments on the use of in situ bioremediation to help immobilize radionuclides and hazardous metals.

Additionally, the ORR will play a role in studies on soil carbon storage as part of the DOE Center for Research on Enhancing Carbon Sequestration in Terrestrial Ecosystems.

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

More detailed 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) and on the Environmental Sciences Division World Wide Web site at http://www.esd.ornl.gov/.

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 Lockheed Martin Energy Systems, Inc. (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 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. The emergency planning zone around each ORO site (ETTP, ORNL, and Y-12) extends out 5 miles and is subdivided into emergency planning sectors that are defined by easily recognizable terrain features (*Oak Ridge Reservation Emergency Plan* 1998). Hazard assessments support 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.

As regulatory agencies transition to watershed-based load-allocation permitting for wastewater discharges, the presence of additional new facilities on the ORR that need to discharge wastewaters to ORR streams under the National Pollutant Discharge Elimination System (NPDES) could cause DOE to reduce constituent concentrations in DOE-facility wastewater effluents in order to control watershed loading to an acceptable standard. 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/aser97/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 from areas that have the potential to be affected by activities on the ORR. Data from the 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 primary statute governing the monitoring of effluent discharges to surface waters on the ORR is the CWA, which requires the issuance of 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, CERCLA, TDEC Solid Waste Management regulations, 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.

Source Water Protection Area. The First Creek headwaters have been identified as a sensitive water source for the Aquatics Research Laboratory, Building 1504. Figure 2.3 shows the First Creek Source Water Protection Area. The area is based on a combination of surface topography and geology. The southern boundary of the area was confirmed in June 1999 by groundwater tracing from disappearing streams to springs in the First Creek headwater. Extensive terrain modification or contamination of groundwater or surface water within this area will have adverse impacts on the water quality of First Creek and consequently impact the Aquatics Research Laboratory.

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. Five 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, and 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 (FFA) 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, Communication Lines, Power)

Since all major utilities cross the ORR, a number of companies have easements. ORR utilities are shown in Fig. 2.13. Details are not provided in this plan as they are described fully in the *Oak Ridge Reservation Management Plan*, February 1999. Section 3.3 of the plan, "Access Control," identifies companies with utility easements. Part of Section 3.4, "Surveillance and Maintenance," lists companies and organizations with operating and maintenance responsibilities. Appendix E: "ORR Roles and Responsibilities" explains in detail the activities of various governmental entities and companies, some of which involve utilities.

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 categorized in 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 maintain 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.

Fig. 2.13

Three Bend Scenic and Wildlife Refuge Area. Secretary of Energy Bill Richardson set aside 3000 acres of the DOE ORR as a conservation and wildlife management area on June 23, 1999, in an agreement between the Energy Department and TWRA. The proclamation, signed by Secretary Richardson and George Akans, Jr., of the Tennessee Wildlife Commission, calls for the land to be cooperatively managed for preservation purposes under a use permit.

The Three Bend Scenic and Wildlife Management Refuge Area consists of 3000 acres located in the ORR buffer zone on Freels, Gallaher, and Solway bends on the north shore of Melton Hill Lake in Anderson County.

TWRA, in consultation with DOE and the Oak Ridge community, will prepare a cooperative agreement to serve as a natural resources management plan for the Three Bend Area. The plan will establish guidelines for managing the area to preserve and enhance its natural attributes.

2.5.8 Public Opportunities

While the reservation is not freely accessible to the public, parts are open at various times for recreation and educational activities (Fig. 2.6).

2.5.8.1 Public Greenways

Gallaher Bend Greenway, an experimental public greenway in the Oak Ridge National Environmental Research Park, was opened in December 1997. North Boundary Road Greenway, which follows East Ridge Road and Poplar Creek Road, was approved in 1999. They are cooperative initiatives 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 an 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 animal taken during deer and turkey hunts is monitored for radiation contamination. Since hunts began in 1985, 2.3% of the 7123 deer taken (through 1998) have been retained due to radiological contamination. Deer and turkey hunt maps are available on the World Wide Web at http://www.ornl.gov/rmal/ huntinfo.htm. Additionally, TWRA has led public bird walks during the spring and coordinated bird counts for input to the Partners In Flight interagency program.

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 Day, which offers 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.

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.

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* (1999) 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 Clark Center Recreation Area North Boundary Road Greenway
2.7	Partnership areas	Sludge landfarming sites State Natural Areas TWRA Wildlife Management Area Oak Ridge Biosphere Reserve Gallaher Bend Greenway Wetland Mitigation Areas North Boundary Road Greenway
2.10	Safety	Emergency planning zones Surface danger zones
2.11	Compliance and monitoring	Hay fields Air monitoring sites Groundwater wells Surface water monitoring BMAP sites Meteorological towers Fish sampling locations
2.12	Contamination areas	Potential release sites EM watershed project boundaries
2.13	ORR utilities	Electrical lines Water lines Communications lines Natural gas lines Sanitary sewer lines Water treatment plants Water reservoirs Electrical substations Natural gas stations Main roads

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.

Within this context of ecosystem management, 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 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 D.

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) will serve as a world-class facility for neutron research. The SNS will require approximately 110 acres to provide for a new linear accelerator facility. Within the site, support laboratories and shops, a central office building, user facilities, and a central utility building 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. After reviewing the analysis presented in the "Final Environmental Impact Statement for the Construction and Operation of the Spallation Neutron Source" (SNS FEIS, DOE/EIS-0247, April 23, 1999), DOE issued a Record of Decision for the Construction and Operation of the Spallation Neutron Source on June 18, 1999, whereby the ORR (Chestnut Ridge) was selected as the site for the SNS.

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 provide short-term accommodations for visiting scientists and serve other user needs. A potential site, integrated into the SNS campus, has been identified.

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 50,000 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

The Oak Ridge Institute for Science and Education (ORISE) Scarboro Operations Site on the ORR is located on approximately 247 acres of the ORR. Existing land is adequate for ORISE

to support its current DOE missions; however, future development or growth will require additional land. With pending/proposed transfers of land to the Tennessee Department of Transportation and to the City of Oak Ridge at the east end of the Scarboro facility, the only developable land will remain on the west side of Scarboro Creek. Because no ORISE town sites have land for development, the remaining land at the Scarboro Operations Site is ORISE's only available land for future growth.

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 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 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 an 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 ISOL Facility (Fig. 3.21).

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 strategic direction (*ORNL Institutional Plan* 1999). This initiative will use the 20,000-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 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 requiring small catchments of 2.5 to 10 acres.

Copper Ridge Research Area: A large stand 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 investigate the system after 30 years of nutrient cycling.

Freels Bend Research Area: The largest pasture area available for agricultural research. ORNL is pursuing research in agriculture 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 area 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 stands of old-growth cove hardwoods on the reservation and represents an important reference area 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. Because the area is in different geological strata from the Walker Branch Watershed, it offers exceptionally good sites for expanding the Walker Branch Watershed research to include contrasting geology. Research in forest ecology, stream ecology, catchment hydrology, and biogeochemistry is planned.

NABIR Field Research Center: This DOE Field Research Center, proposed in Bear Creek Valley, includes a 404-acre central area and a 243-acre field site within the Y-12 Area of Responsibility. The Field Research Center utilizes a relatively stable contaminated groundwater plume and a comparable uncontaminated control area to conduct research on natural and accelerated bioremediation.

Unexploded Ordnance Research and Demonstration Area: Sites on the ORR are being evaluated for use in testing and validating methodology of locating unexploded ordnance (ordnance would be loaded with inert nonhazardous materials) of varying sizes in a variety of terrains. This would be a cooperative Department of Defense and DOE project.

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 NABIR Field Research Center is also located in Melton Valley between Waste Area Grouping 7 and the floodplain of Melton Branch.

Walker Branch Watershed: This site represents one of the premier forested research watersheds 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. An approximately 70-acre demonstration plot was treated in 1998 with plans to convert additional acreage annually. Habitat improvement will enhance conditions for both resident wildlife and migratory birds, provide 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 (at East Bear Creek) (Fig. 2.14)
Transuranic Waste Packaging Facility and connecting road from Highway 95

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. 3.23.

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

A portion of East Fork Road (Parcel ED-1) is under consideration as a public greenway, expanding the North Boundary Road 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. Actions include

Parcel ED-1 [leased April 1998 to the Community Reuse Organization of East Tennessee (CROET) for industrial development]
100 acres of Parcel 8 (pending)
Tower Shielding Facility (26 acres leased 1998 to BioNeutrics, Inc.)
Parcel ED-2 (15 acres leased to CROET)
Parcel ED-3 (450 acres currently under review for leasing to CROET)

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 erected a tower on 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	New research facilities	Spallation Neutron Source Joint Institute for Neutron Sciences ORNL Expansion Laboratory for Comparative and Functional Genomics Radiochemical Engineering Center Engineering Technology Complex Fusion Materials Irradiation Facility Future Research and Development Facilities
	New research areas	Bull Bluff Watersheds Copper Ridge Research Area Freels Bend Research Area Raccoon Creek Research Area White Wing Research Area Large-Scale Environmental Studies Area Pine Ridge Experimental Catchments NABIR Field Research Center Control Area NABIR Field Research Center Experimental Area
	Environmental partnership areas	Bearden Creek Wetland Banking Wildlife Refuge
	Waste management areas	Environmental Management Waste Management Facility Transuranic Waste Packaging Facility
	Transportation improvements	Interstate Connector (proposed) Highway 58 Widening Bethel Valley/Illinois Avenue Interchange
	Land transfers/lease areas	Mobile Service Antenna Sites BioNeutrics, Inc. Parcel ED-1 Parcel ED-2

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

Stakeholder letters received regarding the 1998 *ORNL Land and Facilities Plan* are 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.

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 3 years), an extended planning base (4 years in the future through the succeeding 6 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).

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
ESHQ&I Management Plan Information System (http://svr1.cmo.ornl.gov/eshwc/wc.dll?eshweb~TopPage)	P. E. (Patty) Cox, LMER	Bldg. 1000/MS 6302	576-4183	pcx
Environmental Management Program Baselines (http://www.bechteljacobs.org/busmgt/baseline/Baselines.html)	D. A. (David) Starling Bechtel Jacobs Company LLC	Bldg. K-1225/MS 7293	576-6501	sa9
LMER ESHQ&I Budget Formulation Submission for ORNL (http://oecdwsrv.oecd.ornl.gov/camplrpt/bgtfrm/fy2001/index.htm)	P. E. (Patty) Cox, LMER	Bldg. 1000/MS 6302	576-4183	pcx
LMER ESHQ&I Management Plan for ORNL (http://oecdwsrv.oecd.ornl.gov/camplrpt/ESHPlan/Plan99/Index.htm)	R. J. (Rick) Forbes, LMER	Bldg. 1000/MS 6302	574-0404	rfs
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
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/aser97/aser.htm)	L. V. (Laury) Hamilton, LMER	Bldg. 4500S/MS 6317	576-4526	lvm
Oak Ridge Reservation Management Plan (http://www-internal.ornl.gov/orrmp/)	P. D. (Pat) Parr, LMER	Bldg. 1505/MS 6038	576-8123	par
P&E Division Maintenance Work Plan: FY 1999-FY 2004, ORNL/CF-98/37 (not yet available on World Wide Web)	W. D. (Danny) Davis, LMER	Bldg. 2518/MS 6328	574-7921	wiv

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

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 process consistent with DOE Order 430.1A, "Life Cycle Asset Management." 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 ESHQ&I Management Plan Information System (http://svr1.cmo.ornl.gov/eshwc/wc.dll?eshweb~Toppage)

The ESHQ&I Management Plan Information System was developed to serve as a management decision-making support tool. It accepts and stores data associated with ESHQ&I Activity Data Sheets (ADSs) either from the ORNL Program Management Tracking System or as direct input information into an ADS. The system accepts the risk matrix scores assigned to each ADS by the ORNL Risk Ranking Board and screens for entry of all pertinent data associated with an ADS, and support data validation where possible and appropriate. The system provides flexibility in viewing and editing data with powerful features for querying, indexing, and reporting data.

3.2.3 Environmental Management Program Baselines (http://www.bechteljacobs.org/busmgt/baseline/Baselines.html)

The Environmental Management Baseline is a fiscal year baseline used by the Bechtel Jacobs Company LLC to plan for completing the cleanup of EM work in the scope of the program. The objective of baseline is to contract for safely accelerating cleanup and maximizing cost effectiveness through the use of competitive subcontracting.

3.2.4 LMER ESHQ&I Budget Formulation Submission for ORNL (http://oecdwsrv.oecd.ornl.gov/ camplrpt/bgtfrm/fy2001/index.htm)

ORNL's FY 2001 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 2001. ESHQ&I activities are identified 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.

3.2.5 LMER ESHQ&I Management Plan for ORNL (http://oecdwsrv.oecd.ornl.gov/camplrpt/ESHPlan/Plan99/Index.htm)

The *Lockheed Martin Energy Research Corporation (LMER) Environment, Safety, Health, Quality, and Infrastructure (ESHQ&I) 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, comply with contractual requirements set forth in the Work Smart Standards (WSSs) agreed upon by LMER and DOE, and manage physical assets and infrastructure from acquisition through operations and disposition. This plan documents the systems and processes used by ORNL to (1) establish and communicate ESHQ&I expectations and requirements to the ORNL community, (2) identify and secure funding for ESHQ&I activities using risk-based planning and priority setting, (3) conduct R&D activities and operations through integration of ESHQ&I principles in work planning and execution, and (4) assess ESHQ&I 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) 2001*, and its issuance satisfies the requirement in the DOE-LMER Management Contract, I.71 DEAR 970.5204-2 Paragraph C.

ORNL has an integrated ESHQ&I database system that enables ORNL to

meet major ESHQ&I commitments,
address key issues,
manage unfunded ESHQ&I risks,
systematically provide information for the reduction of ESHQ&I risks, and
establish and maintain stakeholder confidence.

3.2.6 ORNL Facility Index

The ORNL Facility Index is an internally available 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.

3.2.7 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.

3.2.8 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.

3.2.9 Oak Ridge Reservation Annual Site Environmental Report (http://www.ornl.gov/Env_Rpt/aser97/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.

3.2.10 Oak Ridge Reservation Management Plan (http://www-internal.ornl.gov/orrmp/)

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.

3.2.11 P&E Division Maintenance Work Plan

The *Plant and Equipment (P&E) Division Maintenance Work Plan: FY 1999 FY 2004*, ORNL/CF-98/37, supports the P&E Division’s Long-Range Strategic Plan that, in turn, supports the *ORNL Institutional Plan* and the *ORNL ESHQ&I Management Plan*. The Maintenance Work Plan provides additional information required by DOE Order 430.1,

"Life Cycle Asset Management." This fulfills a two-part requirement to discuss maintenance requirements during the period FY 1998 - FY 2000 to correspond with current budget preparations or those years and to detail a projection of maintenance requirements during the period FY 2001 - FY 2003.

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 reflects an intermixing of clustered development, predominately in a central core area. Some of this mixing is intentional and desirable, reflecting ORNL's multi-programmatic, 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 potential ESHQ&I issues.

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 High Flux Isotope Reactor (HFIR) facilities and a laboratory at the RPSC, are devoted to Nuclear Technology. Buildings 7920 and 7930 house the Radiochemical 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 by CROET 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 2 weeks to 2 years, broaden the Laboratory's base of expertise and support goals in scientific cooperation and technology transfer. In FY 1998, the Partnership Office supported 3100 assignments of scientists and engineers from universities, industries, 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 17 designated user facilities.

Advanced Propulsion Technology Center
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
Physical Properties Research Facility (proposed)
Shared Research Equipment Program
Surface Modification and Characterization Research Center

Fig. 3.4

3.3.2 Buildings

The Melton Valley site, the Bethel Valley site, and Copper Ridge combined contain approximately 3.4 million gross ft^2 of building space. In addition, approximately 1.4 million gross ft^2 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 Memoranda 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**	**3,352,082**	**89**	**76,842**	**3,428,924**
Lockheed Martin	307	2,927,240	56	49,924	2,977,164
Bechtel Jacobs	121	424,842	33	26,918	451,760
ORNL at Y-12	**29**	**1,379,230**	**2**	**2,436**	**1,381,666**
Leased off-site	**3**	**62,169**			**62,169**
Total	**460**	**4,793,481**	**91**	**79,278**	**4,872,759**

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 62,000 gross ft^2 of office space off the ORR.

The majority of ORNL's buildings were constructed during and immediately after World War II. About 79% of the building space is over 30 years old, and nearly 54% 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 ESHQ&I 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 that are determined to be 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 (S&M) 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 ORNL's 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 ESHQ&I requirements, to maintain and ensure the necessary safety envelope, and to provide additional space for current and future activities. Current or projected facilities for decontamination and/or decommissioning not previously accepted into the Environmental Management (EM) program are listed in Tables 3.3, 3.4, and 3.5 and are shown in Figs. 3.1, 3.2, and 3.4.

Table 3.3. ORNL current surplus/inactive facility* list

Building	Facility or area name	Contami-nated
2017	East Research Satellite Shop	C
2061	Stack	
2654	Sewage Digester Building	
3121	Cell Off-Gas Filter House for 3019	C
3140	Cell Ventilation Filters for 3026	C
3547	Cell Vent Roughing Filter for 3517	C
3548	Cell Vent Filters for 3517	C
3597	Hot Storage Garden	C
7811	Geoscience Storage Building	
7833	Alpha Greenhouse Facility	
9201-2	86-Inch Cyclotron	C
9201-2	Thermal Heat Transfer Facility	
9201-3	MSRE Fuel Preparation Facility - 2nd Floor, SE	
9201-3	Tritium Test Loop - 2nd Floor, E High Bay Area	C
9201-3	Tank - 1st Floor, NE Corner Above Room 130	
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	C
9204-3	Curium Glovebox Handling Facility	C
9207	Biology Building (Including Annex and Tower)	
9211	Co-Carcinogeous Building	
9220	Molecular Biology Facility	
9734	Spectrochemistry Lab	
9735	Research Services Building	C

*Facilities not presently in EM40 or EM60.
C - Contaminated facility

Table 3.4. ORNL facilities expected to be declared surplus FY 2000

Building	Facility or area name	Contaminated
2000	Solid State Annex	C
2001	Information Center Annex	
2087	Storage, I & E	
3541	Engineering Development Lab	C
3592	Coal Conversion Facility	C
7062	Asbestos Shop	
9100-10	Solway Barn	
9100-23	Freels Barn	
9100-24	Freels White Barn	
9100-25	White Barn Silo	
9100-27	Sheep Barn	
9100-XX	Freels Dose Irradiation Facility	C
9204-1	Contaminated Attic, East End Basement	C
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	

C - Contaminated facility

Table 3.5. ORNL facilities expected to be declared surplus FY 2005

Building	Facility or area name	Contami-nated
3036	Isotope Area Storage and Service Building	C
3503	High Radiation Level Chemical Engineering Lab	C
3525	High Radiation Level Exam Lab (HREL)	C
3542	Storage Building (for 3505 and 3517)	C
3550	Research Lab Annex	C
7902	Cooling Tower for 7900 (HFIR)	C
7903	Cooling Tower Equipment Building for 7900 (HFIR)	C
9204-3	Isotope Separations	C
9210	Mammalian Genetics Facility	
9999-1	Generator Motor for 9204-3	

C - Contaminated facility

The EM40 and EM60 programs are not expected to accept any additional facilities until FY 2002. Twenty-four of the facilities are contaminated and would appear to meet criteria for transfer to the EM program.

Noncontaminated facilities are not eligible for transfer to the EM program. The burden for disposition of these 32 surplus and inactive facilities will fall on Laboratory overhead and/or 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 ORNL 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 for 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 ORNL 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 ORNL, but the substation will need to be upgraded if total energy usage at the Laboratory increases significantly.

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 ORNL facilities. Fig. 3.8 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 10 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 20 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 ESHQ&I 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 ORNL 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 have been completed that have greatly improved the safety and operability of the electrical distribution system. Two LI projects have been proposed to improve and modernize additional segments of the electrical system. One is directed at correcting identified deficiencies and problems on a long overhead feeder, installing redundancy at the 4509 Substation, reworking bus-ties in the research complex, and installing additional meters to allow for improved efficiency. The second, as it is being developed, will upgrade the existing 2400-V distribution grid to 13,800 V, resulting in a safer, more reliable system.

GPP and GPE needs have also been identified and are in the planning base. The projects involve replacing oil-filled circuit breakers in the main substation with new SF6 units obtained from reindustrialization efforts at ETTP, replacing and rebuilding facility service entrances, changing out old unsafe switchgear, and replacing transformers at substations throughout ORNL. The electrical distribution system, while beginning to show signs of age, continues to provide reliable service to all customers in the Laboratory. If recommended improvements are completed, the system will easily support ORNL operations and facilities safely and reliably 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 ORNL operations as the system is designed with more capacity than what is now demanded. However, contractual agreements do limit the amount of gas ORNL can demand. Under the current contract, ORNL can demand 1000 decatherms (1000 mcf) without incurring a penalty charge. Efforts to modify this demand charge are being pursued as the new ORNL Steam Plant gas-burning Boiler 6 project is being constructed.

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. 3.9 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.

The gas supply for the remainder of ORNL 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 currently 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 should be initiated in the next 5 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. An alternative that will be investigated is the use of bottled systems at the individual user facilities. Usage patterns will need to be examined to determine the feasibility of this alternative as some facilities and users may be unable to adapt their operations to efficiently use bottled systems.

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 ORNL. 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 ORNL. 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. ORNL'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. Work is currently underway on a new 3000 scfm air compressor. The job is progressing smoothly and should be completed in FY 1999. 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 ORNL.

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. 3.9). 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 was completed in 1998. Again, aboveground portions of the steam and air distribution systems were 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.

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.

The DOE water treatment facility will be transferred to the City of Oak Ridge in April 2000. Uncertainties associated with this transition include the future operating philosophy of the City of Oak Ridge, priorities for and availability of water, and the potential impact of future

city ordinances governing the water treatment facility system and customer-owned systems connected to the city system.

Water to ORNL is provided via a single 24-in. line extending from the water plant and running approximately 7.5 miles across Chestnut Ridge into the ORNL plant site. This 24-in. line feeds the ORNL reservoir system, which consists of one 3-million-gal capacity concrete reservoir on the south slope of Chestnut Ridge and two 1.5-million-gal steel reservoir tanks on Haw Ridge. These reservoirs provide the reserve capacity necessary to support ongoing day-to-day activities in ORNL facilities located in the Bethel and Melton valley areas. From these reservoirs, water flows by gravity into the plant distribution grid. The water is used for domestic, sanitary, fire protection, and process purposes. Water usage is approximately 2.5 Mgd on a winter day and 4 Mgd during the summer, though on a very hot day, water usage can approach 5 Mgd. A flow of 7 Mgd can be accommodated by the ORNL supply system under current operating conditions. Loss of the single supply line from the water plant, or any activity that would cause loss of the reserve capacity of one of the reservoirs, could impact ORNL operations within a short period.

The 3-million-gal water storage reservoir on Chestnut Ridge is constructed of reinforced concrete and is in poor condition. 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 to ensure that the reservoir can remain functional. A proposed project to rehabilitate this reservoir has been replaced with a project that will construct an additional reservoir next to the concrete reservoir. Any major repair work performed on the existing reservoir would have required taking it out of service and draining it for an extended period. This situation would have forced ORNL to rely entirely on the two remaining reservoirs and the single supply line from the water plant and would have exposed it to the unacceptable risk of a water outage with the potential to shut down operations. The replacement project will construct an additional reservoir adjacent to the concrete reservoir and will allow operations personnel the flexibility to remove a reservoir from service for maintenance without impacting ORNL operations.

The steel reservoir tanks on Haw Ridge were constructed in 1963 and are configured to normally provide reserve water capacity for ORNL operations located in Melton Valley (e.g., HFIR). Corrosion within the tanks necessitated replacing the steel roofs with aluminum dome-type structures in 1986. At that time, the tanks were also thoroughly sandblasted and corrosion-resistant coatings were applied to both the interior and exterior surfaces. These reservoirs were inspected internally and externally in 1997 and were judged to be in good condition. The only deficiency noted was a breakdown in the external coating system that will require the tanks to be recoated in the next few years. Maintenance personnel have spot repaired the worst areas on the external surfaces and will continue to do so to prevent a further decline in the structures' condition.

A third reservoir serves facilities in a remote area of ORNL. A small 30,000-gal steel storage tank provides water to facilities at what was previously known as the Health Physics Research Reactor 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 with fire protection and operations personnel indicate that this reservoir capacity may not be necessary any longer because the reactor has been shut down and moved. If capital funding can be obtained to replace a 1960s vintage fire pump serving the area, this reservoir may be removed from service and replaced with a smaller 2000-gal/day tank.

The water distribution system at ORNL (Fig. 3.10) 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 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 for the backflow preventer valves. 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 LI project 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 in the outyear planning base. 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. These two projects remain in the planning because of the necessity to consider plausible scenarios in order to ensure a safe water supply to employees at ORNL. These projects propose to replace the underground water system in contaminated areas with an aboveground water system. This is not considered to be a reasonable option for a number of reasons, including the fact that it would be unsightly, difficult to operate, and would not address all the issues surrounding the problem. Any construction activity in these contaminated 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 with a reasonable, cost-effective approach.

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 ORNL (Fig. 3.11). 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 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 (non-CFC) refrigerants. They represent 5800 tons, or 67%, 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, was built in 1959, 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 at ORNL at this time. Additional cooling capacity will be necessary to provide sufficient capacity and redundancy if additional demand is created.

ORNL contains 33 additional self-contained chilled water systems, which are located within individual buildings that they serve (i.e., 2026, 2033, 6000, and 7900). There are 35 self-contained chillers, totaling 3868 tons capacity, with 13 cooling towers. Twenty-six of ORNL's 44 chillers are less than 15 years old and utilize non-CFC refrigerants. Three CFC chillers have been converted to non-CFC refrigerants using operating funds, one has been abandoned, and five CFC refrigerant chillers remain operational.

A CFC chiller replacement project, initiated in FY 1994, has funded the replacement of 14 large CFC chillers with general-purpose equipment (GPE) funding. Funding for this program is planned through FY 2003 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). Five of the 13 self-contained cooling towers are less than 15 years old. Appropriate funding is being sought to replace or repair cooling towers at Building 6001. Additionally, a LI project proposed to upgrade ORNL HVAC systems will include a project to provide a primary/secondary pumping system in the central chilled water system and extend a new chilled water header to Building 4501.

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 3 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 ORNL.

The steam distribution system (Fig. 3.12) 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 was essentially completed in 1998 on a similar upgrade of the western portions of the steam and air distribution system. New lines were installed in the below-grade pipe trenches, and 18 buildings were tied into the new looped system. Some additional minor demolition work on the old system remains to be done and will likely be performed using operating funds when resources allow. Other projects to upgrade the remainder of the steam distribution system in older areas of ORNL are being considered. 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 and decontamination and demolition activities accelerate within the area.

No improvements are currently planned for the steam supply to facilities in the Melton Valley area, including the HFIR. If future funding allows, and programmatic requirements dictate, an additional feed line will be run from the steam plant and tied into the existing Melton Valley 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 or other facility operations.

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, but a current project is installing the equipment necessary to do so and should be completed this year. The condensate will then be reused as boiler feedwater, thus improving the overall efficiency of the steam generation process.

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. This boiler should come on-line in early fall of 1999, and its availability will allow a gradual step-by-step conversion to occur, with natural gas once again becoming the primary fuel. 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.

In order to take full advantage of the capability that the new boiler will provide and to completely avoid future costs associated with coal handling and ash processing, a switch to fuel oil as a secondary fuel source is necessary. A 250,000-gal fuel oil tank project is currently underway to provide the capability to burn fuel oil to make steam should the primary supply of natural gas be curtailed or reduced. This 250,000-gal reserve, along with the existing 70,000 gal will provide sufficient fuel oil supplies to produce steam for about 3 weeks under the worst possible weather conditions. Design work is being completed, and this project should be in the construction phase by September 1999 and completed around the end of the calendar year.

A number of other projects are also underway or will be in the upcoming years. Funding will be allocated in FY 2000 and FY 2001 to replace the economizers on Boilers 1 and 4, after completion of a successful project which replaced the same components on Boilers 2 and 3 during the summer of 1998.

Projects aimed at upgrading Boiler 5 are being developed. This 100,000 lb/h package boiler is approaching 40 years of age and is in need of some improvements to ensure its reliability in the future. Proposed projects include replacing the economizer heat exchanger, replacing the burners, changing the setup from steam atomization to air atomization, upgrading and relocating boiler controls, and installing telemetry. These improvements, coupled with general maintenance-type activities, will return the boiler to first-class operating condition.

The East End Water Softener System softens boiler feedwater and serves as a backup to the primary West End Softener System. This old system was installed in 1963 and desperately needs upgrading. Currently designed to treat boiler feedwater to produce up to 100,000 lb/h of steam, its performance has degraded steadily over its years of use. The system needs to be replaced with a new unit designed to accommodate the normal maximum winter steam output in order to be an effective backup system.

The Boiler No. 6 project, projected to be completed in September 1999, will give the steam plant the capability to produce year-round steam loads without using coal. This will allow the rehabilitation of the old coal boilers, one at a time, and their conversion to natural gas and fuel oil firing. The rehabilitation effort will include new steam tubes and drums, replacing all refractory brick and insulation, and removal of all coal-handling equipment and replacement with a new fuel manifold system to allow maximum output from gas or fuel oil. Projects have been proposed to perform this upgrade over a span of years to ensure the steam plant remains viable well into the future.

While most of the projects proposed at the steam plant deal with maintaining the plant's ability to produce steam and compressed air, there are a number of other proposals directed at both the plant's and the Laboratory's long-term environmental compliance goals. Once the steam plant has a total natural gas/fuel oil capability, coal contracts can be terminated and coal inventories burned off. Projects to demolish and remove those physical systems that exist solely to handle coal, coal ash, and its other byproducts will become increasingly important. Once the coal is removed from the coal yard, steps will be taken to stabilize that area and return it to its original "green" state. When coal is no longer burned, precipitators used to remove coal particulates from the flue gas and the whole ash conveying and disposal system will no longer be needed and should be disconnected and removed. Coal-handling equipment in the steam plant itself will need to be removed to prevent future problems. The Coal Yard Runoff Treatment Plant, designed to process highly acidic wastewater from the coal yard, will no longer be needed once the coal yard has been shut down. The demolition and decommissioning of the coal-related systems will be costly but should have a reasonable payback when the benefits of improved efficiency of natural gas vs coal burning are considered along with decreased maintenance and wear and tear on the systems within the plant. The greatest benefit will likely be the greatly diminished potential for environmental incidents. Coal is a dirty fuel, requiring many systems and subsystems to operate cleanly and efficiently. As these coal-handling systems approach their 23rd year of operation and require increasing maintenance

expenditures to continue to operate, many major capital expenditures can be avoided if these plans are followed.

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 ORNL. 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.

ORNL 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 of the older research buildings which contain exhaust hoods were designed for 100% outside air and operate very inefficiently. Most buildings in Bethel Valley are heated using steam from the steam plant. Remote facilities in Melton Valley and Copper Ridge have electric heat. Away from the area served by the chilled water system, air conditioning is provided by direct expansion 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 ORNL 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 relocated or otherwise modified. Even without the legislation, as a part of ORNL'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, ORNL 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 ORNL 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 ORNL 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 ORNL'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 few 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 ORNL 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 continue to be 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, ORNL has adopted a “best management practices” approach as an economical and practical way to achieve compliance. A Stormwater Pollution Prevention Plan describing these practices is in place and serves as a guidance document 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. Remote areas of the site border the Clinch River, but no barge facility has been developed. Such a facility could be developed if future needs arise that will require moving large, heavy objects. ORNL has access and has used two different barge facilities in the past; one at the East Tennessee Technology Park (ETTP) and the other at the Tennessee Valley Authority's Bull Run Steam Plant. Rail access is limited as well, as no tracks run to the ORNL Site. Access to rail service can be made either at the ETTP or at the Y-12 Plant, both of which are served by a rail spur.

Motorized vehicle circulation at ORNL may be divided into two sectors: off-site and on-site. Off-site circulation consists of staff movements to and from work and between the various other Oak Ridge installations and offices on work assignments and for material pick-up and delivery. Off-site roads include State Route 95 (White Wing Road), located approximately 1 mile to the west of the Laboratory's main complex, and State Route 62 and Scarboro Road, which provide access to the Laboratory and ORNL facilities at Y-12 from the east. Bethel Valley Road extends between Hwy's 95 and 62 by running approximately 8 miles through the center of the Oak Ridge Reservation and is the main artery serving the Laboratory. Though Hwy's 95 and 62 run through the Oak Ridge Reservation, maintenance and emergency services on these roads is provided by the State of Tennessee and the City of Oak Ridge. Bethel Valley Road, on the other hand, is owned by the DOE and maintenance services are subcontracted to East Tennessee Mechanical Contractors, who also has responsibility for many of the remote sections of the ORR. Security and emergency services are provided along Bethel Valley Road by the ORNL Plant site, DOE contract security, the

City of Oak Ridge, or, as is often the case, a combination of these three entities. The State

of Tennessee is considering routing a west interstate bypass around the Knoxville metropolitan area. A number of alternative routes are being considered, including one route across the ORR (Fig. 2.14).

On-site motor vehicle circulation consists of employee movement between and among work sites within ORNL and the delivery and pick-up of materials, tools, and equipment used to support routine operations. In addition to walking, employees use cars and trucks, golf carts and bicycles to move among the widely dispersed facilities at the Laboratory. A paved bicycle trail extends from the west end of the plant to provide a safe and efficient way for cyclists to move about Laboratory facilities.

Principal roads serving ORNL's Bethel Valley Site are shown in Fig. 3.1. The main road is Bethel Valley Road, an east-west thoroughfare that provides access to the site and leads to all of the main parking lots. The road surface is poor and currently needs resurfacing from a point just west of the ORNL 7600 Area access road to just beyond the westernmost entrance to the Laboratory. The existing asphaltic surface is deteriorated and patches have failed. Potholes and "pulls," areas where the asphalt has lost adhesion with base surfaces, are common making for an uneven driving surface.

Completion of several construction and expansion projects has alleviated chronic parking problems experienced at the Bethel Valley facilities in the past. Parking lot conditions, in general, are good. Most asphalt lots are holding up well but could stand a general re-stripping to delineate parking spaces. Gravel lots typically serve to provide parking under overflow conditions, such as during the heavy guest and visitor months in the summer. These lots are well constructed and provide safe parking for employees but should be paved to meet the intent of ORNL's Stormwater Pollution Prevention Plan. Rains cause erosion and rutting in the gravel lots and the sediment picked up during rains is carried into the areas receiving streams. On-site transportation is provided by an arterial grid system of streets running through ORNL. North-south access is provided by numbered streets, starting with First Street at the west end of the plant and ending with Eighth Street in the east. The main east-west

corridors are Central Avenue and White Oak Avenue. Most main routes have sidewalks running parallel to them to ease employee accessibility and improve safety. Sidewalk conditions throughout ORNL are considered good with only small sections needing repair or replacement each year. Vehicles used for casual transport, as well as those used to haul materials and make deliveries, utilize the same traffic grid, though traffic volumes are such that it is rare to have any problems.

The main roads in Melton Valley are Melton Valley Drive, Ramsey Drive, Melton Valley Access Road, Lagoon Road, and HPRR Access Road (Fig 3.2). These roads lead to the principal experimental facilities including the HFIR, Robotics and Process Systems Complex and the REDC, as well as to the numerous Solid Waste Storage Areas (SWSAs) and waste processing sites in the valley. Road conditions need to be improved on both Melton Valley Drive and Lagoon Road. Both roads predate ORNL and were designed to only provide access
to the farm community that was in the area prior to 1943. Melton Valley Drive east of the

HFIR entrance has not been paved or upgraded since the 1960s and has deteriorated significantly. The old asphalt surface has many cracks and irregularities, and subsurface drainage systems show sign of failing, causing areas of undermining of the base material. Traffic volumes, both vehicular and pedestrian, dictate that the road be realigned and leveled to provide a safe driving surface for employees and guests who must use it. Lagoon Road is similarly affected. Age and use, coupled with a poor initial design, make this road dangerous, particularly in wet weather. The road has many hills and curves and needs to be straightened and leveled to improve safety.

Copper Ridge has one main route, Gravel Hill Road, which connects the old DOSAR Facility and the Tower Shielding Facility to State Route 95. The road is a single-lane, unimproved gravel access road running along a power line right-of-way. Since the Tower Shielding Facility has been turned over to CROET for reindustrialization, access into the area by anyone other than a small group of utility service providers is being discouraged. The road will continue to be adequate for these users if properly maintained.

By far, the largest portion of off-site traffic circulation is generated by ORNL 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, and 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 four types of security areas:

Material Access Area (MAA): Area where Category I and II 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. Unescorted access to an MAA requires a Q clearance and special approval.

Protected Area: Area which contains Category I and II quantities of special nuclear material and is protected by physical barriers such as walls and fences. Unescorted 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 III 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 to the main Laboratory area 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, Quality, 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 *ESHQ&I 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 ESHQ&I requirements. The plan documents the systems and processes used by ORNL to (1) establish and communicate ESHQ&I expectations to the ORNL community, (2) identify and secure funding for ESHQ&I activities using risk-based planning and priority setting, (3) conduct R&D activities and operations through integration of ESHQ&I principles in work planning and execution, and (4) assess ESHQ&I performance and provide feedback to promote continuous improvement.

An ORNL Risk Ranking Board ensures that ESHQ&I 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. The ORNL

Risk Ranking Board ranks all ESHQ&I direct funded and overhead tasks, ensuring that all needs are identified and balanced. The ORNL integrated planning process uses the board results, thereby ensuring that ESHQ&I 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 accordance with its operational imperatives, ORNL works with DOE to ensure that its facilities are operated in a safe and environmentally responsible manner. WSSs address the ES&H operation of all facilities at ORNL. These standards incorporate, by reference, regulations and standards established by federal and state regulatory bodies, standards committees, and agencies "external" to DOE, as well as applicable DOE orders. Standards/Requirements Identification Documents remain in effect for Emergency Management and Occurrence Reporting, and Appendix E of the contract between DOE and LMER contains requirements for other areas (e.g., security, accounting). Nuclear and radiological activities at ORNL are subject to 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 establish a legal framework for ORNL in fulfilling its operational imperatives and conducting its mission activities in accordance with DOE policy.

DOE recently completed a pilot program at ORNL to explore the desirability of moving toward external regulation of work safety and nuclear facility safety at its facilities. A pilot program sponsored by the Nuclear Regulatory Commission (NRC) and DOE to simulate oversight of a DOE nuclear facility was completed for the REDC at ORNL. The report on this REDC pilot program was sent to Congress on July 2, 1999, by the Secretary of Energy, Bill Richardson. The report concluded that while agreement was reached between DOE and

NRC review teams about the general applicability of the NRC nuclear safety regulations, the agencies did not reach agreement on the value of transitioning the Departments's nuclear facilities to external regulation. In fact, DOE concluded that a number of issues must be fully addressed before any regulatory transition is considered for nondefense nuclear facilities.

A similar pilot was conducted jointly by OSHA and DOE to assist OSHA in formulating the resources needed to effectively provide oversight of DOE facilities and to provide DOE and the contractor the opportunity to determine those issues which must be addressed prior to external regulation. DOE reached similar conclusions as a result of the OSHA pilot— that a number of issues must be fully understood and addressed before external regulation can occur. Recently, DOE concluded that external regulation by OSHA is not feasible at this time.

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, medical, rescue, and other general emergencies. A comprehensive looped proprietary alarm system

serves 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 houses emergency equipment, including fire and rescue equipment and

ambulances. A second alarm receiving location is provided at Building 4512, the Laboratory Emergency Response Center. Most ORNL buildings are equipped with fire protection systems that include 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. These facilities utilize design features for safety and implement administrative controls to minimize the probability and consequences of an accidental release of hazardous material to on-site and off-site receptors. The Safety Analysis Report Update Program (SARUP) is the mechanism used to identify nuclear facilities at ORNL. The SARUP process involves a series of evaluations and analyses to ensure that the operations within each identified nuclear facility are and can be maintained in accordance with DOE Orders 5480.23 and 5480.22.

SARUP has used a graded approach to categorize facilities and upgrade facility safety documentation. Initial SARUP efforts were developed in accordance with DOE Order 5481.1B, which has subsequently been canceled and superseded by DOE Orders 5480.23 and 5480.22. The first phase, completed in 1989, conducted hazard screening evaluations of all hazards present in all ORNL facilities. Facilities containing inventories of materials that exceeded the hazard screening threshold values required additional evaluation in accordance with 5481.1B. The hazard screening process resulted in the "classification" of facilities according to the potential consequences of their hazards. Initially, there were four facility hazard classifications: "generally accepted" (no hazard or standard industrial hazards), low, moderate, or high. Nuclear Category 1, 2, and 3 and the "radiological" classification for facilities were eventually added. Information from these evaluations resulted in the need for

facilities to upgrade current safety documentation, primarily existing Operational Safety Requirement (OSR) documents, and generate interim safety documentation for facility operations.

DOE Orders 5480.23 and 5480.22, issued in 1992, required the development and implementation of Safety Analysis Reports (SARs) and Technical Safety Requirements (TSRs) for all facilities classified as nuclear. DOE-STD-1027-92 was issued to provide guidance to categorize a facility as nuclear based primarily on that facility's nuclear material inventory. The results of the 1027-92 evaluations determined the initial nuclear facility hazard category for all identified facilities. SARUP efforts focused on developing Basis of Interim Operations (BIOs) documents as the safety basis for the continued operations at designated nuclear facilities in the interim until final SARs could be developed. Existing OSRs were upgraded and were often included as part of the BIO. Each BIO and updated OSR has been submitted to DOE and has received approval. These documents are designated as Facility Authorization Basis (FAB) documents and will serve as the safety basis until DOE approves the final hazard classification presented in the detailed final SARs and TSRs. BIOs and OSRs are reviewed annually and updated as necessary.

SARs and TSRs are being prepared for the ten nuclear facilities for which ORNL has responsibility. Of these ten facilities, two have approved SARs and TSRs/Technical Specifications. All SARs and TSRs will have been submitted to DOE for approval by December 1999. ORNL has one Category 1 nuclear facility (i.e., HFIR), five Category 2 facilities, and four Category 3 facilities.

Changes and modifications to a nuclear facility or to the existing FAB documentation will be evaluated to determine if DOE approval is required using the Unreviewed Safety Question Determination (USQD) process as required by DOE Order 5480.21. All FAB changes evaluated by USQDs become part of the FAB documentation and are incorporated into the FAB during the annual review and update.

The ORNL Office of Nuclear Safety maintains a Web site at URL http://x10capserv.ornl.gov/htmldocs/x-10/ons/onshome.htm, which contains lists of nuclear facilities on the ORNL site, their facility hazard classification, and facility safety documentation (e.g., FAB documents).

Hazard categorization did not identify any ORNL facilities with chemical hazards which exceed threshold levels that would require implementation of the OSHA Process Safety Management Rule (29 *CFR* 1910.119) or the EPA 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 had been awarded the contract for management of all EM program activities. In this role, Bechtel Jacobs Company assumed 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 stipulates 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 will result in a reduction of over $100 million in LMER base support during this 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 1999 budget year by Bechtel Jacobs Company through continuation of most of the current LMER-supported EM activities by LMER staff. This is particularly critical in the areas of 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, efforts are already underway in outsourcing of the facilities S&M work for FY 2000. For waste management activities, the transition of waste facilities and staff to Bechtel Jacobs Company was completed in FY 1999. Over 140 facilities and 150 staff are now the full responsibility of Bechtel Jacobs Company, and they will be accessed by LMER for all treatment, storage, and disposal needs. 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 scope back to the Office of Science 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 progresses 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 ORNL Land and Facilities Use Committee and 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 http://www.bechteljacobs.org/busmgt/baseline/Baselines.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. 3.1, 3.2, 3.13, and 3.14 show the facilities transferred to Bechtel Jacobs Company, and Table 3.6 provides a list, which will be updated as necessary to reflect contractual responsibilities of the specific contractor. Facilities are classified as CROET leased (CR), watershed projects (MV and BV), legacy waste (LW), and Waste Operations (WO).

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 344 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. 3.15).

3.3.8.1 Waste Management

On February 1, 1999, Bechtel Jacobs Company assumed responsibilities for waste storage, transport, and disposal at ORNL. Most of the functions previously performed by the ORNL Waste Management Operations Division transitioned to Bechtel Jacobs Company.

To ensure that ORNL waste is properly characterized and certified to meet all requirements and to assist ORNL in getting its waste ready for receipt by Bechtel Jacobs Company, ORNL established an organization called Laboratory Waste Services (LWS), which has two major groups: (1) Planning and Administration and (2) Waste Characterization and Handling.

The Planning and Administration Group focuses on day-to-day operations; strategic planning, including up-front waste management planning with new generators, such as the Spallation Neutron Source Division; the interface with Bechtel Jacobs Company and its subcontractors; and waste management performance measurement. The pollution prevention and recycle position integrates and coordinates these functions for ORNL.

The Waste Characterization and Handling Group focuses on assuring that waste is adequately characterized, packaged, and certified for transfer to Bechtel Jacobs Company or its subcontractors for treatment, storage, or disposal. In addition, they operate a consolidated 90-day area and schedule all waste transfer to Bechtel Jacobs Company.

Another organizational element, the Waste Certification Office, is part of the Office of Environmental Management Programs.

Table 3.6 Management and Integration (M&I) contractor facilities as of August 23, 1999

Building	Program	Description
01001	BV	SWSA 3 Burial Grounds
01554	BV	Contractor Land Fill
01562	BV	Scrap Metal Area
02624	BV	SWSA 1 Burial Grounds
03001	BV	Graphite Reactor Building (Including Storage Canal)
03001B	BV	LLLW Collection Tank (Inactive)
03002	BV	Filter House for Graphite Reactor (3001)
03003A	BV	Drain Tank South of 3003
03004B	BV	Inactive LLLW Collection Tank 3004B
03005	BV	Low Intensity Test Reactor
03009	BV	Bulk Shielding Reactor Facility (Pumphouse)
03010	BV	Bulk Shielding Reactor Facility (South)
03018	BV	Stack for Graphite Reactor (3001)
03019B	BV	High Radiation Level Analytical Facility
03023	BV	North Tank Farm
03026C	BV	Krypton-85 Enrichment Facility
03026D	BV	Metal Segmenting Facility
03028	BV	Alpha Powder Facility
03029	BV	Source Development Laboratory
03030	BV	Radioisotope Production Laboratory C
03031	BV	Radioisotope Production Laboratory D
03032	BV	Radioisotope Production Laboratory E
03033	BV	Radioactive Gas Processing Facility
03033A	BV	Radioactive Production Laboratory Annex
03038	BV	Radioisotope Laboratory
03038AHF	BV	Alpha Handling Facility
03038E	BV	Isotope Materials Laboratory
03038M	BV	Radioisotope Packaging and Shipping Facility
03042	BV	Oak Ridge Research Reactor (ORRR)
03075	BV	Decommissioned LITR Ponds
03083	BV	ORRR Neutron Spectrometer Station
03085	BV	ORRR Primary Pumphouse
03085A	BV	ORRR Demineralized Water Holding Tank
03085B	BV	ORRR Demineralized Water Holding Tank
03086	BV	ORRR Pool Cooling Tower
03087	BV	Heat Exchangers for ORRR (3042)
03089	BV	ORRR A/C Cooling Tower
03093	BV	Krypton Storage Cubicle
03098	BV	BSR Filter Facility
03099	BV	Storage Pad
03102	BV	ORRR Heat Exchanger Pit
03103	BV	ORRR Main Cooling Tower
03107	BV	ORRR 25-Meter Target House
03109	BV	ORRR Process Off-Gas Filter Pit
03110	BV	Cell Vent Filter for Radioisotope Area
03116	BV	Nitrogen Storage Building North Tank Farm
03117	BV	BSF Cooling Tower
03117A	BV	Sulfuric Acid Tank
03118	BV	Radioisotope Production Laboratory - H Building
03119	BV	Heat Exchanger and Pumphouse
03126	BV	ORRR Normal Off-Gas Filter Pit
03139	BV	ORRR Cell Vent Filters

Table 3.6 Management and Integration (M&I) contractor facilities as of August 23, 1999

Building	Program	Description
03505	BV	Metal Recovery Facility-Transfer Canal and Dissolver Pit
03507	BV	South Tank Farm
03512	BV	Decommissioned Waste Holding Basin
03513	BV	Waste Holding Basin
03515	BV	Fission Product Pilot Plant
03517	BV	Fission Products Development Laboratory
03524	BV	Equalization Basin
03535	BV	Filter Enclosure in South Tank Farm
03539	BV	190 Pond #1 Remediated Site
03540	BV	190 Pond #2 Remediated Site
04003	BV	SWSA 2 Burial Grounds
04507	BV	High Level Chemical Development Lab
04556	BV	High Level Chemical Development Lab Filter Pit
06556A	BV	Office Trailer-Put into PRISM, Never C or M+E25
06556B	BV	Office Trailer
06556C	BV	Contractor Trailer
06556D	BV	Contractor Trailer
06556G	BV	Contractor Trailer
06556J	BV	Close Support Lab - Sample Preparation
06556K	BV	Close Support Lab - Counting Facility
06556L	BV	Close Support Lab - Special Techniques
06556M	BV	Close Support Lab - Sample Kit Preparation
06556R	BV	Office Trailer - 2 Person
06556ST1	BV	Contractor Trailer
06556ST3	BV	Contractor Trailer
06556ST4	BV	Contractor Trailer
06556ST5	BV	Contractor Trailer
06556ST6	BV	Contractor Trailer
06556ST7	BV	Contractor Trailer
06556ST8	BV	Contractor Trailer
06556ST9	BV	Contractor Trailer
06556T	BV	Contractor Trailer
07025	BV	Tritium Target Preparation Facility
07078A	BV	Office Trailer
07078B	BV	Office Trailer
07078C	BV	Office Trailer
07078D	BV	Office Trailer
07078E	BV	Conference Room/Kitchen
07078F	BV	Office Trailer
13822	BV	Helium Tank
	BV	Contaminated Soil, 7002A
	BV	Fan House Graphite Reactor (3001) (Fan Rm only 3003)
	BV	Inactive LLLW Collection/Storage Tank WC-1, 3037
	BV	Thorium Storage Silos area soil, 7019
07700	CR	Tower Shielding Facility
07701	CR	Tower Shielding Handling Pool
07702	CR	Control House
07703	CR	Hoist House
07704	CR	Control House 2
07705	CR	Pumphouse
07706	CR	Cooler
07707	CR	Battery House
07708	CR	Butler Building

Table 3.6 Management and Integration (M&I) contractor facilities as of August 23, 1999

Building	Program	Description
7716	CR	Tower Shielding Pool Pump & Filter House
04007	LW	Waste Operation Support Facility
07507	LW	Hazardous Waste Storage Facility
07507W	LW	Mixed Hazardous Storage Pad
07572	LW	CH-TRU Waste Storage Facility
07574	LW	NFS Waste Storage Facility
07651	LW	Clean Used Oil Storage Pad
07652	LW	Hazardous Waste Storage Facility
07653	LW	Chemical Waste Storage Facility
07654	LW	Long-Term Hazardous Waste Storage Facility
07659	LW	Leaking Gas Cylinder Area
07661	LW	7661 Electrical Distribution Building
07662	LW	7662 Emergency Generator
07666A	LW	Hazardous Waste Area Support Trailer
07667	LW	Chemical Detonation Facility
07668	LW	Mixed Waste Storage Facility
07670	LW	HWOG Equip Storage Facility
07802N	LW	SWSA 5 North Trench Retrievable TRU Storage
07810A	LW	Interim Non-Reg Waste Storage Facility
07822A	LW	SWSA 6 High Range Disposal Wells
07822J	LW	Radioactive Solid Waste Staging and Storage Pad
07823	LW	LLW Staging/Storage Facility
07823A	LW	Underground Storage Facility Wells, TT1-TT8
07823B	LW	Temporary Waste Storage
07823C	LW	Temporary Waste Storage
07823D	LW	Temporary Waste Storage
07823E	LW	Temporary Waste Storage
07823F	LW	SWSA 5N Storage Shed
07824	LW	Waste Exam and Assay Facility
07824A	LW	WEAF Support Facility
07826	LW	TRU Drum Storage Facility
07827	LW	Shielded Dry Well Facility
07829	LW	Shielded Dry Well Facility
07830A	LW	Hazardous Waste Storage Tank
07831	LW	Field Office and Compactor Facility
07831A	LW	SLLW Storage Building
07831C	LW	SLLW Storage Shed
07834	LW	TRU Drum Storage Facility
07841	LW	Contaminated Equipment Storage Yard
07842	LW	Temporary LLW Storage Facility
07842A	LW	LWSP II Solid Waste Storage Pad
07842B	LW	SWSA 6 Temp Storage Facility
07842C	LW	SWSA 6 Temp Storage Facility
07847	LW	Vehicle/Personnel Monitoring Station
07855	LW	Concrete Cask Storage Facility
07855A	LW	SWSA 5 Equipment Tent
07876	LW	Health Physics Office Trailer
07878	LW	CH-TRU Waste Storage Facility
07878A	LW	Temporary Storage Facility
07878B	LW	Equipment Storage Facility
07879	LW	TRU/LLW Staging Facility
07883	LW	RH-TRU Bunker
07934	LW	CH-TRU Waste Storage Facility

Table 3.6 Management and Integration (M&I) contractor facilities as of August 23, 1999

Building	Program	Description
00807	MV	CS-137 Tagged Area for Rad. Runoff Studies
00814	MV	Trailer in 0800 Area
00816	MV	Cesium Plots Study Area
00830	MV	White Oak Creek Embayment Structure
00853	MV	White Oak Creek Below Dam
00857	MV	Goat Building in 0800 Area
07500	MV	HRE Reactor Building
07502	MV	Waste Evaporator
07503	MV	MSRE Reactor Building
07503A	MV	LLLW Tank at MSRE
07509	MV	MSRE Office Building
07511	MV	MSRE Filter Pit
07512	MV	MSRE Blowers and Stack
07513	MV	MSRE Cooling Tower
07514	MV	MSRE Supply Air Filter House
07554	MV	HRE Cooling Tower
07555	MV	MSRE Diesel Generator House
07556	MV	HRE Settling Pond
07557	MV	HRE Absorber Pits
07558	MV	Waste Evaporator Loading Pit
07559	MV	HRE Charcoal Absorber Valve Pit
07560	MV	LLLW Collection and Storage Tank
07561	MV	HRE Decon Pad
07562	MV	LLLW Collection and Storage Tank
07563	MV	Circulator Pump Pit (for Building 7500)
07602	MV	Integrated Process Demonstration Facility
07658	MV	Closed Contractor's Landfill
07659B	MV	Reactive Chemicals Disposal Area
07659C	MV	Soil Injection of Radioactive Gas
07700A	MV	Big Beam Shield
07700B	MV	Outside Storage Area
07711	MV	Process Waste Basin
07720	MV	Tower Shielding Civil Defense Facility
07759	MV	Cesium 137 Forest Research Area
07800	MV	SWSA 4 Burial Ground
07802	MV	SWSA 5 (South) Burial Ground
07802A	MV	Seep C Collection and Treatment System
07802B	MV	Seep D Collection and Treatment System
07802C	MV	Deep Monitoring Well #1
07802D	MV	Deep Monitoring Well #2
07802F	MV	Radiation Monitoring Equipment Storage
07805	MV	Chemical Waste Pit #1
07806	MV	Chemical Waste Pit #2
07807	MV	Chemical Waste Pit #3
07808	MV	Chemical Waste Pit #4
07809	MV	Chemical Waste Trench #5
07810	MV	Chemical Waste Trench #6
07811A	MV	Pilot Pits Experiment Area
07813	MV	White Oak Creek Dam
07818	MV	Chemical Waste Trench #7
07819	MV	Decontamination Bldg. And Shielded Transfer Tank Shed
07821	MV	Emergency Waste Basin - Melton Valley
07822	MV	Solid Waste Storage Area 6

Table 3.6 Management and Integration (M&I) contractor facilities as of August 23, 1999

Building	Program	Description
07822A	MV	WAG 6 Explosive Detonation Trench
07822B	MV	Fissile Disposal Wells
07822C	MV	Low Range Silos (Inactive)
07822D	MV	High Range Silos (Inactive)
07822E	MV	Hill Cut Disposal (inactive) Test Facility
07822F	MV	Tumulus I (Inactive)
07822G	MV	Tumulus II (Inactive)
07822H	MV	Asbestos Silos (Inactive)
07831D	MV	SWSA 5 Storage Pad
07835	MV	Process Waste Sludge Basin, WAG 5
07846	MV	White Oak Lake
07852	MV	Old Hydrofracture Facility
07852A	MV	Old Shale Hydrofracture Pond/Pits
07881	MV	Post #24
07906	MV	Retention Pond B - HFIR
07907	MV	TRU Pond A
07908	MV	TRU Pond B
02026A	WO	LLLW Collection Tank at 2026 (Inactive)
02032	WO	Manhole 240 Monitoring Station
02034	WO	Manhole 95 Monitoring Station
02099	WO	MCS for Building 2026
02101	WO	Health and Hygiene Change House
02531	WO	Radioactive Waste Evaporator
02532	WO	Waste Storage Cooling Pumphouse (inactive)
02533	WO	Cell Vent Filter Pit (inactive)
02534	WO	Off-Gas Filter Pit (Inactive)
02535	WO	Cooling Tower
02537	WO	Evaporator Service Tanks and Control Room
02539	WO	Cooling Tower
02568	WO	Cell Vent & Off-Gas Filter, Facilities for 2531, 2337
02600	WO	Bethel Valley Storage Tanks
02649	WO	Transported Waste Receiving Facility
02650	WO	Evaporator Chemical Shed
02651	WO	2600 Area Emergency Generator
02657	WO	Manhole 243 Monitoring Station
02658	WO	F-4005 Monitor Station
03002A	WO	Drain Tank South of 3003 (Inactive)
03039	WO	Central Radioactive Gas Disposal Facility
03082	WO	Data Concentrator #2
03092	WO	Off-Gas Scrubber
03105	WO	LGWOD Health Physics Office
03106	WO	4500 Area Filters
03125	WO	3039 Stack Area Emergency Generator
03127	WO	LGWOD Storage Building
03130	WO	Waste Operations Control Center
03133	WO	BV Valve Box 1a
03145	WO	LLLW Storage Building
03151	WO	Manhole 25 (inactive) Monitoring Station
03154	WO	Manhole 112, Monitoring Station
03155	WO	Manhole 114 & 234 Monitoring Station
03158	WO	North Monitoring Building (Inactive)
03159	WO	South Monitoring Building
03502B	WO	Data Concentrator #4

Table 3.6 Management and Integration (M&I) contractor facilities as of August 23, 1999

Building	Program	Description
03518	WO	Neutralization Plant
03518A	WO	LGWOD Spare Parts Trailer
03544	WO	Process Waste Treatment Complex
03544B	WO	Filter Press Building for PWTC
03594	WO	Waste Operations Storage Building
03608	WO	Process Waste Treatment Complex
03613	WO	Diversion Box Monitoring Station
03614	WO	Manhole 190 Monitoring Station
03615	WO	Manhole 235 Monitoring Station
03616	WO	Manhole 149 Monitoring Station
03617	WO	Manhole 229 Monitoring Station
03618	WO	Pumping Station Tanks WC-10, 11, 12, 13, 14 (Inactive)
03620	WO	Hot Off Gas Collection Tank F2175
07505	WO	CPAF Contractors Headquarters
07506	WO	Contractor Shop
07567	WO	Central Pumping Station Tanks T1 and T2
07569	WO	LLLW Collection Tank WC-20 (Inactive)
07582	WO	LGWOD Spare Parts Facility
07802E	WO	Sludge Test Removal Tank (Inactive)
07830	WO	Melton Valley Storage Facility
07853	WO	LGWOD Storage Building
07856	WO	MVST Capacity Increase Project
07857	WO	IWMF Drainage & Collection System and Biol. Freezers
07860	WO	New Hydrofracture Facility, Including T-14 (Inactive)
07863	WO	General Storage for Building 7860
07863A	WO	LGWOD General Storage Shelter
07863B	WO	LGWOD General Storage Shelter
07863C	WO	LGWOD General Storage Shelter
07877	WO	LLLW Solidification Facility
07882	WO	Emergency Generator for 7877
07887	WO	Solid Liquid Separations Unit
07919	WO	HFIR, TRU, and Turf Manhole Monitoring Station
07922	WO	Data Concentrator #6 for WOCC DAS
07935	WO	Equip Cleaning Facility
07952	WO	Melton Valley Process Waste Pumping Station
07961	WO	Melton Valley Collection Tanks
07966	WO	LLW Collection Tanks, 7920 and 7930
2508	WO	INST Trailer for Sludge Mobilization
7886	WO	Interim Waste Management Facility
BV COLLECTION	WO	Collection Header and Valve Boxes
LLW COLLECTION	WO	LLLW Collection/Transfer System
LW INTEM	WO	Intervalley Transfer Line
	WO	WC-19
	WO	WC-12 Tank Area
	WO	HFIR Tank
	WO	W-16, 17, 18 Tank Area
	WO	Building 3019 to C-2 Valve Pit
	WO	Valve Box 1
	WO	Process Waste Junction Box (N of 3513)
	WO	Valve Box 2
	WO	Process Waste Pumping Station (4001)
	WO	Valve Box 2A

Table 3.6 Management and Integration (M&I) contractor facilities as of August 23, 1999

Building	Program	Description
	WO	Pumping Station 1
	WO	WC-3 Tank Area
	WO	OHF VB
	WO	WC-2 Pump Pit and Collection Tank
	WO	MH-208 Diversion Box
	WO	Numerous Manholes in Process Waste System (no Bldgs)
	WO	Cell Vent Header Sump (4th and Central)
	WO	Cell Vent Header Sump (5th Street)
	WO	South Parking Lot Valve Box (LLLW)
	WO	South Parking Lot Valve Box (PW)
	WO	W-6 Valve Box
	WO	MH-208
	WO	F-2110 Pump Station
	WO	HFIR, TRU, TURF, MH Monitoring Station, 7919 (no Buildings)
		Graphite Reactor Storage Canal
		Contaminated Soil (3001, 3019)
		Soil Contamination HF S1A
		Tc-95m and I-131 Contaminated Pasture
		LLLW Line Leak Site, Gauging Station SWMU, 200' West of WOC Gauging Station
		LLLW Line Leak Site, Trench 6 SE of SWMU, 150' of Trench 6 (Between Pit 3 and Trench 6)
		WAG 4 Sr-90 Seeps
		Decontamination Area (near WAG 5)
		FPPP Contaminated Soil
		ORR 10,000 Gallon Decay Tank
		Bldg. 3503 Mercury Contaminated Soil
		Bldg. 3592 Mercury Contaminated Soil
		4501 Mercury Contaminated Soil
		4508 Mercury Contaminated Soil
		OGR Fan House, Fan Room only 3003
		Underground Exhaust Ducts Soil Contamination 3001-3003
		FPDL LLLW Transfer Line 3507 area
		FPDL Inactive Cells & Service Tunnel 3517 area
		Inactive LLLW Collection Tank T-30, 4507 area
		Interim Decontamination Bldg. Tanks (ST1, ST2, ST3, ST4, St5) 7819 area
		Hydrofracture Experimental Site #1, HFS1
		Hydrofracture Experimental Site #2, HFS2
		Hydrofracture Experimental Site #2, Soil Contamination HFS2A
		BV Collection Header & Valve Boxes
		Municipal Sewage Sludge Application Site XF1226
		Waste Storage Tank, TH-4
		Contaminated Surfaces & Soil from 1959 Explosion, 3019
		Contamination at Base of 3019 Stack
		LLLW Lines & Leak Sites-Between W5 and WC-19
		LLLW Lines & Leak Sites-Between WC-1 and W-5
		LLLW Lines & Leak Sites - Bldg. 3028
		LLLW Lines & Leak Sites - Abandoned Line Central Ave. area
		Filter Pit (Fission Product Development Lab) Soil Contam.
		LLLW Lines & Leak Sites -E. of 3020
		LLLW Lines & Leak Sites N. of 3019
		LLLW Lines & Leak Sites General Isotopes area

Table 3.6 Management and Integration (M&I) contractor facilities as of August 23, 1999

Building	Program	Description
		LLLW Lines & Leak Sites - E. of 2531
		LLLW Lines & Leak Sites - Bldg. 3525 to a Sump
		LLLW Lines & Leak Sites - Bldg. 4508
		LLLW Lines & Leak Sites - 3518 West
		LLLW Lines & Leak Sites - 3503, Ground Contamination
		LLLW Lines & Leak Sites NW of SWSA 1
		LLLW Lines & Leak Sites - W. of 3082
		LLLW Lines & Leak Sites - SW Corner of 3019
		LLLW Lines & Leak Sites - Underneath 3047
		LLLW Lines & Leak Sites - Underneath 3026
		LLLW Lines & Leak Sites - Underneath 3515
		LLLW Lines & Leak Sites - Bldg. 3092 Area
		LLLW Lines & Leak Sites - Underneath 3550
		LLLW Lines & Leak Sites - Sewer Near 3500
		LLLW Lines & Leak Sites - ORR Water Line
		WOC Floodplain Soils & Sediments
		LLLW Lines & Leak Sites - S. of 3020
		Oak Ridge Research Reactor Decay Tank Rupture Site
		Transfer Canal & Dissolver Pit, contaminated soil near 3505
		Corehole 8
		Inactive LLLW Collection/Storage Tanks, TH-1
		Inactive LLLW Collection/Storage Tanks, TH-2
		Inactive LLLW Collection/Storage Tanks, TH-3
		Inactive LLLW Collection/Storage Tank, W-19
		Inactive LLLW Collection/Storage Tank, W-20
		Inactive LLLW Collection/Storage Tanks, WC-15
		Inactive LLLW Collection/Storage Tanks, WC-17
		LLLW Lines and Leak Site -OHF, Release of Grout
		LLLW Line North of Lagoon Road
		LLLW Lines and Leak Site - OHF Contam. Soil (Bldg. 7852 Hydrofracture Injection)
		LLLW Line from Valve Box to OHF
		LLLW Line Leak Site, Trench 7 Access Road, 200' N. of Trench 7
		Leak in Transfer Line from Decon Fac. And Pit 1
		HFIR Cooling Tower Surface Impoundment
		Leak in Line Between Pit 3 and Trench 6
		Aircraft Reactor Experiment Surface Impoundment
		LLLW Lines & Leak Sites - Melton Valley Drive & SWSA 5 Access
		Contractor Spoils Area - Melton Valley, W-SW of 7900
		LLLW Lines & Leak Sites - Lagoon Rd. & Melton Valley Dr.
		LLLW Lines & Leak Sites - 7500 Area
		LLLW Lines & Leak Sites - Melton Valley Transfer Line
		LLLW Lines & Leak Sites - West of Melton Valley Pumping Station
		LLLW Lines & Leak Sites - 7920 Ditch Line
		Abandoned Sanitary Waste Pipeline and Septic Tank North of Bldg. 7910
		ARE Contaminated Tool Storage
		Inactive OHF Waste Storage Tank T1
		Old Landfill (NE edge of SWSA5
		Drainage 1, 2 in WAG 5
		Trash Area East of HRE Parking Lot
		MSRE Storage Well
		Inactive OHF Waste Storage Tank T2
		Inactive OHF Waste Storage Tank T3

Table 3.6 Management and Integration (M&I) contractor facilities as of August 23, 1999

Building	Program	Description
		Inactive OHF Waste Storage Tank T4
		Inactive OHF Waste Storage Tank T9
		PWSB Pipeline from PWSB to Process Waste Treatment Plant
		Homogeneous Reactor Experiment Fuel Wells
		OHF Grout Sheets
		Old Hydrofracture Injection Well
		NHF Grout Sheets
		SWSA 6 TVA Easement
		Former Waste Pile Area (S. of NRWTP)
		Drainage 3 next to WAG 5
		Waste Valve Pit (HRE)
		Tc-99 & Np-237 Contaminated Soil Lysimeters, Plutonium
		Soil at HRE Decontamination Pad/She
		Buried Scrap Metal Area
		Abandoned Burn Pit
		Zn-65 Tagged Red Oak Seedlings
		Tc-95m Contaminated Soil and Plants
		Tc-95 Uptake Studies
		C-14 Efflux in Yellow Poplar Stand
		Ca-45 Tagged Trees
		Ca-45 Tagged Soil and Vegetation
		Ca-45 Tagged Forest
		C-14 Maintenance-Respiration Study
		C-14 Sucrose Inoculation of Oak and Pine Trees
		C-14 Allocation in White Oak Trees
		C-14 Allocation in White Oak Pine Trees
		C-14 Allocation in Woody Biomass Plantation Species
		Cs-134 Contemned Grasses
		Cs-134 Contaminated Lichens and Mosses
		Cs-134 Contaminated Oak Trees
		Cr-51 Contaminated Grass Plots
		Cs-134 Contaminated Persimmon Tree
		Co-60 and Mn-54 Animal Study
		Cs-137 Contaminated Meadow
		Cs-134 Contaminated Soybean and Sorghum
		Cs-137, Co-60 Contaminated Forest Area includes (Chestnut Ridge) (Eastern & Western Areas)
		Cs-137 Contaminated Forest Floor
		Cs-137 Contaminated Forest Understory
		Bethel Valley Active and Inactive Wells
		Melton Valley Active and Inactive Wells
		LLLW Collection Tanks, W-11
		LLLW Collection Tanks, W-12
		LLLW Collection Tanks, WC-4
		LLLW Collection Tanks, WC-5
		LLLW Collection Tanks, WC-6
		LLLW Collection Tanks, WC-7
		LLLW Collection Tanks, WC-8
		LLLW Collection Tanks, WC-9
		LLLW Collection Tanks, T13, 7860
		LLLW Collection Tanks, H-209
		LLLW Collection Tanks, 4501-P
		Leak in Valve Pit North of Trench 7

Table 3.6 Management and Integration (M&I) contractor facilities as of August 23, 1999

Building	Program	Description
		LLLW Lines and Leak Sites, Bldg. 7920 and MV Pumping Station Area
		Well Drillers Steam Cleaning Area
		West End Dump Site
		Monitoring Stations 1 and 3 (SWSA 6)
		First Creek Planting and Riparian Corridor
		Building 7819 Septic Tank
		Cs-134 Tagged Trees
		Cs-137 Bagged Leaves Study
		Cs-137, Fe-59 Contaminated Animal Trees
		H3 Contaminated Trees
		Hg-197 Tagged Stream
		Hg-203 Tagged Stream
		Na-22 Contaminated Soil
		Rb-86 Contaminated Plants
		Filter House/Isotope Area, Ductwork (3110 area)
		Cs-134 Contaminated Pine and Oak Seedlings
		LLLW Collection Tank, Building 3013

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

3.3.8.1.1 Conventional Waste

Conventional wastes include sanitary/industrial wastes, sanitary sewage, process wastewater, and stormwater. Solid conventional wastes are regulated by the Tennessee Solid Waste Management Act.

Sanitary/Industrial Wastes. Sanitary/industrial waste 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 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 1998, ORNL generated and disposed of 244,377 ft^3 of sanitary/industrial waste.

Sanitary Sewage Collection and Treatment

Sewage Collection. The sewage collection system (Fig. 3.16) 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 ORNL 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 ORNL 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 inside 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:

Rehabilitation of the remainder of the sewage collection grid. Collection lines 6 in. in diameter and larger had a new cured-in-place liner installed and manholes where sealed by a process which used a high-solids polyurethane material to build a new manhole inside the existing structures.

A new septic tank and drainfield were constructed serving facilities located in the 7600 Area.

A new sewer force main was installed to serve facilities located in Melton Valley.

A new line was installed to bypass a segment of trunk main located beneath a building.

A new sewage sludge drying system was installed at the Sewage Treatment Plant.

Sewage Treatment. The ORNL Sewage Treatment Plant consists of a DAVCO 300,000-gpd packaged, extended aeration plant which provides primary and secondary treatment and a sand/gravel filter and disinfection 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 fell to 181,000 gpd in FY 1998, in part due to a drier than normal year. First quarter 1999 flows indicate a move upward to the 195,000 gpd range and, if rainfall amounts return to normal, average daily flows are expected to remain in this range.

Efforts aimed at improving overall operations at the Sewage Treatment Plant continue with some notable successes. The agreement which allows delivery of sewage sludge to the City of Oak Ridge has been signed. Digested sludge from the ORNL Sewage Treatment Plant is taken to the West End Treatment Plant in Oak Ridge where it is combined with sludge generated at the facility. The combined product is then disposed of through the sludge land farming contract the City of Oak Ridge has with DOE. The volume of sludge disposed of by this method is restricted due to limits on the amounts of specific contaminants, but the process is viewed as a significant step towards resolving disposal issues. Future efforts will concentrate on locating and eliminating sources of the contaminants in question, many of which may still be entering the system through sections of building service feeder lines that were unable to be sealed with the lining process used during previous projects. Sections of these lines may need to be excavated and rebuilt to prevent the infiltration from occurring.

The ozonator system has been installed at the Sewage Treatment Plant and is undergoing test and checkout. This system was identified as a means to eliminate the use of chlorine as a disinfection agent on the effluent stream leaving the plant. When properly installed, maintained, and operated, ozone systems are an effective disinfection system and are gaining favor at plants throughout the country. The use of this system will reduce the amount of chlorine in the receiving stream and will help ORNL meet its NPDES Permit compliance goals. A new sewage analysis laboratory has been set up in a building adjacent to the Sewage Treatment Plant, and operations personnel have been trained in the basic analytical techniques used to monitor and control the sewage treatment process. By performing on-site analysis of the treatment process, operating parameter tolerances have been tightened, resulting in a higher quality effluent. This year's NPDES Permit audit applauded these improvements in the plant's operations and praised plant management for its proactive approach.

Ongoing activities at the Sewage Treatment Plant include continuing to find sources of infiltration and working with the various planning groups involved with the SNS and the Life Sciences Complex. These facilities and their associated processes will generate new flows into the Sewage Treatment Plant, and planning is in process to ensure that their needs will be accommodated in both the construction and operational phases of these projects.

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/facilities are located throughout ORNL–the LLLW storage tanks are located near the LLLW source buildings; the LLLW Evaporator Facility is located near Third Street, between Central and White Oak Avenue; and the Melton Valley Storage Tanks (MVSTs) and LLLW Solidification Facility are located in Melton Valley.

LLLW Collection Tanks

Bethel Valley. The ten collection tanks currently in service in Bethel Valley are fabricated of stainless steel and were all installed in the early 1950s. These tanks vary in capacity from 1000 to 4600 gallons. Most tanks are buried underground on a concrete saucer provided with a sump at its low point. A well extends to the surface of the ground in order to permit

sampling and monitoring for the detection of leakage from the tank. Crushed stone is packed

around the tank above the concrete saucer to the tank top. At least 5 ft of earth provides shielding above the tank top. A replacement tank for 2026A was placed in service in April 1996. This tank (F-1401) is double-contained in a stainless-steel-lined concrete vault with leak detection and meets all requirements of the Federal Facility Agreement (FFA) for the LLLW system.

Melton Valley. There are five underground collection tanks in Melton Valley that were designed and installed, somewhat later, similar to those in Bethel Valley. All are horizontal tanks and have capacities ranging from 10,000 to 15,000 gal. Tanks WC-20 and F-1800 are located in a stainless-steel-lined concrete vault. Only Tank F-1800 receives programmatic-generated waste; the other four tanks have been removed from service by the FFA for the LLLW system.

The HFIR LLLW tank, is a 13,000-gal LLLW collection tank that was installed in 1961. This tank, which is installed below grade, is fabricated from 772-R-2 high-chromium steel and is encased in concrete. This tank was removed from service on November 30, 1997, when the Melton Valley LLLW CAT Line Item completed modifications to Building 7900 that allowed personnel to discontinue generation of LLLW.

The two 15,000-gal collection tanks, T-1 and T-2 at Building 7567, were installed in 1962. They are all-welded vessels fabricated of type 304L stainless steel. Both of these tanks, which provide an intermediate hold-up point for liquids from the HFIR LLLW tank until they can be transferred to the LLLW Evaporator Facility in Bethel Valley, are buried directly in the ground on concrete saucers and are provided with dry wells for sampling and monitoring. Building 7567 also includes the transfer pumps used to transfer Tanks T-1, T-2, and WC-20 to the LLLW Evaporator Facility. These tanks no longer receive any programmatic-generated waste as of November 30, 1997.

In 1981, WC-20, a 10,000-gal collection tank (located at Building 7569), was installed in Melton Valley to serve Buildings 7920 and 7930 (the REDC). This tank is fabricated of 304L stainless steel and is installed in a reinforced underground concrete vault which is lined with stainless steel to provide secondary containment. Before this tank was installed, the REDC was serviced by T-1 and T-2. This tank was replaced by F-1800 on September 30, 1997, and is no longer in active service.

Tank F-1800 (located at Building 7966) is a 10,000-gal collection tank located in Melton Valley to serve Buildings 7920 and 7930 (the REDC). This tank is fabricated of 304L stainless steel and is installed in a reinforced underground concrete vault which is lined with stainless steel to provide secondary containment. This facility also contains transfer pumps and associated valving so that the tank's contents can be transferred to the LLLW Evaporator Facility in Bethel Valley through a double-contained pipeline (also placed in service in September 1997). This facility meets all requirements of the FFA for the LLLW system.

Engineered Safeguards

The LLLW collection tanks are provided with liquid level measuring devices. Alarms indicating over-filling are telemetered to the WOCC, which is manned around the clock. Also, Tanks WC-20, F-1401, and F-1800 are provided with combustible gas analyzers.
With the exception of Tanks WC-20, F-1401, and F-1800, shielding and leak detection are provided by the earth fill and the presence of the concrete saucers and dry wells to collect any leakage. Tanks WC-20, F-1401, and F-1800 are doubly contained, and both the tank and secondary containment vault are provided with liquid level alarms.

In all cases, the tanks are vented, either via off-gas systems or directly to the atmosphere, through HEPA filters.

LLLW Bottling and On-Site Transportation

As an alternative to the LLLW collection system utilizing a network of underground piping and tanks, LLLW is also transported by surface vehicles to the LLLW collection system for treatment. Bulk liquid wastes that are not transferred by pipeline are transported from the generating facility by tank motor vehicle to the collection header in the South Tank Farm for further transport by pipeline to the storage tanks and Building 2531 for treatment. Smaller quantities of liquid waste, such as those produced in some of the research laboratories, are bottled and transferred from the generating facility by motor vehicle directly to Building 2531 for treatment.

Vehicular Tanks. Two tanks are presently in use. The first is a 1,000-gal flatbed-mounted tank operated by Waste Management personnel to transport up to 800 gal of LLLW to the LLLW collection system, where it is gravity drained to the hard-piped system. The second tank is the Building 3074 dumpster tank which is owned by P&E division. Waste Management empties this tank as requested by P&E division personnel.

Bottled Waste. Small quantities of LLLW are routinely transferred from the generators' facilities to the LLLW evaporator facility in a DOT Specification 7A Type A Bottle Package System which consists of a 2.5-gal thick-walled reusable polyethylene bottle with a 20-gal drum overpack.

LLLW Evaporator System

Two 600-gal/h evaporator systems, housed in Building 2531, are used to concentrate the LLLW. The first of these was put into operation in 1965 and the second in 1979 (the vessel was replaced in 1994 due to deterioration of the internal steam coils). The original evaporator is served by a 4400-gal feed tank (A-1). The newer evaporator is fed directly from one of the evaporator service tanks (normally W-21 or W-22). Both evaporator installations consist of an evaporator vessel, a vapor filter, a water-cooled condenser, and a condensate catch tank. With the exception of the feed and the condensers, the equipment in both systems is identical. The overheads from the evaporator vessels are condensed and receive treatment at the Process Waste Treatment Complex - Building 3544 for the removal of radiochemicals from the evaporation process. Four 50,000-gal each storage tanks are used to store the LLLW concentrate until it can be transferred to the MVSTs.

Melton Valley Storage Tanks

Storage capacity for the concentrated LLLW has been provided by eight 50,000-gal storage tanks installed in two underground vaults located adjacent to the LLLW Solidification Facility in Melton Valley (Building 7830, also called the Melton Valley Storage Tanks). The tanks are contained in two concrete vaults with stainless steel liners and leak detection instrumentation.

Construction of additional storage capacity for the concentrated LLLW has recently been completed with the turnover on November 13, 1998, of Building 7856 (Melton Valley Storage Tanks Annex) to Liquid and Gaseous Waste Operations Project (LGWOP) personnel. This facility, which was placed in service on December 3, 1998, after undergoing a DOE-ORO Readiness Assessment, provided an additional six 100,000-gal storage tanks installed in individual vaults located southeast of the existing MVSTs (Building 7830). The tanks are contained in individual concrete vaults with stainless steel liners and leak detection instrumentation, which were constructed by the Melton Valley Storage Tanks - Capacity Increase Project.

Principal Process

The 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, radiochemical pilot plants, and nuclear reactors located in both Bethel and Melton valleys. With the exception of some facilities that do not contain radioactive operations, virtually all of the buildings at ORNL are serviced by this system.

The waste solutions are discharged from the source buildings to ten collection tanks, one such tank being located convenient to each building. The waste solutions, which accumulate in these collection tanks, are periodically transferred to either Tank W-21 or W-22, two 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. Tanks W-21 and W-22 are connected directly to the LLLW Evaporator systems, and their 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 10E4 to 10E5. 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 boildown 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 1.20 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 MVSTs (or MVST Annex, when placed in service) for long-term storage. Transfer from the LLLW Evaporator Facility to the MVSTs is through approximately 6000 ft of double-contained stainless steel pipe. This pipe is buried in a specially prepared bed of select clay and is cathodically protected.

In September 1997, a project between LGWOP 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 calendar year 1998, and personnel then moved to Tank W-21, whose sludge layer was also removed by early March 1998. In mid-April, personnel mobilized to begin the sludge removal from Tank W-23. Due to a higher than expected suspended solids concentration, personnel were able to empty Tank W-23 in three transfers of sludge (this allowed personnel to complete the operation 2 weeks earlier than scheduled). The last transfer was completed during the first week of May 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.

In 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 were conducted in 1998. Approximately 10,000 to 12,000 gal of liquid were 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 receive 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. Waste Acceptance Criteria have been developed to address the storage, treatment, and disposal of SLLW, and an implementing procedure to effect the WAC is in place for SLLW.

SLLW is generated throughout ORNL and is characterized by the generator, with waste certification being accomplished through the combined efforts of the generator, LWS, and the Laboratory Waste Certification Official. SLLW is staged at the generating location until the waste is certified by ORNL and accepted by Bechtel Jacobs Company. Bechtel Jacobs Company determines the most suitable management option for all SLLW generated by ORNL. Based on the characteristics and certification of the waste, Bechtel Jacobs Company may (1) store the waste in one of several storage facilities dedicated to SLLW; (2) utilize treatment options such as compaction and incineration offered by commercial treatment, storage, and disposal facilities (TSDFs) or in-house treatment options; or (3) designate the waste as a candidate for the Interim Waste Management Facility (IWMF).

Use of the IWMF for on-site disposal of ORNL newly generated SLLW was discontinued in 1998. The IWMF used tumulus disposal technology to dispose of SLLW. The waste was packaged inside a concrete or steel cask, which was placed inside a tumulus vault, and any void space within the vault was filled with concrete grouting. The vault lid was sealed with a steel-reinforced concrete cover and stacked on a concrete tumulus pad. After the tumulus pad was filled with vaults, it was covered with a 5-ft-thick, multilayer gravel, clay, and earthen cap. The IWMF contains six tumulus pads, four of which are loaded. A drainage system and several monitoring stations were 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 1999, four pads at IWMF were filled. Current plans call for loading the remaining two pads with legacy waste once closure issues have been resolved with the Low-Level Waste Disposal Facilities Federal Review Group. During FY 1998, ORNL generated approximately 6900 m^3 of SLLW. Approximately 1068 m^3 of SLLW were disposed of in FY 1998, while an additional 1100 m^3 of SLLW were repackaged or shipped off-site for treatment or disposal.

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. Waste Acceptance Criteria 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, with certification being accomplished through the combined efforts of the generator, LWS, and the Laboratory Waste Certification Official. All TRU waste is currently stored in on-site storage facilities operated by Bechtel Jacobs Company. 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 Bechtel Jacobs Company's other RCRA-permitted storage facilities. A very small quantity of TRU waste is also PCB-contaminated. During FY 1998, ORNL generated approximately 24 m^3 of TRU waste, which was placed in on-site 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* 261.

Hazardous wastes are generated throughout ORNL and are stored in generator satellite accumulation areas or in (90-day) accumulation areas operated by the generator or LWS pending pickup by Bechtel Jacobs Company. Bechtel Jacobs Company determines the most suitable management option for all hazardous waste generated by ORNL. Based on the characteristics and certification of the waste, Bechtel Jacobs Company may (1) store the waste in one of several storage facilities dedicated to hazardous and mixed waste pending off-site treatment or disposal, (2) detonate the waste in the on-site Chemical Detonation Facility, or (3) utilize other on-site treatment (e.g., silver recovery from photographic wastes). Hazardous wastes may also be immediately transported to an off-site commercial TSDF for treatment and/or disposal.
Waste Acceptance Criteria and an implementing procedure are in place for hazardous wastes. During FY 1998, ORNL generated approximately 200 m^3 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. Like hazardous wastes, mixed wastes are generated throughout ORNL and are stored in accumulation areas operated by the generator or LWS pending pickup by Bechtel Jacobs Company. Bechtel Jacobs Company determines the most suitable management option for all mixed wastes generated by ORNL. Based on the characteristics of the waste, Bechtel Jacobs Company 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 DOE. The resulting ash is treated, as required, and disposed of at Environcare of Utah.

Few commercial TSDFs are available to process or dispose of mixed wastes. Accordingly, ORNL was unable to eliminate its inventory of mixed waste via processing or disposal prior to the transfer of waste management operations responsibilities to Bechtel Jacobs Company. Transfers of mixed waste inventories to ETTP were initiated by ORNL in FY 1997 and continued under Bechtel Jacobs Company in FY 1999.

Waste Acceptance Criteria and an implementing procedure are in place for mixed wastes. During FY 1998, ORNL generated approximately 64,500 m^3 of mixed waste. Approximately 59,000 m^3 of that total were treated and disposed of at on-site DOE and off-site commercial facilities.

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.

Waste Acceptance Criteria and an implementing procedure are in place for TSCA wastes. TSCA wastes are initially stored by generators until pickup by Bechtel Jacobs Company for either on-site storage or off-site storage or disposal. 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 to determine background contaminant levels before the influence of ORNL. These samples are collected at White Oak Creek headwaters above the locations of ORNL discharges to White Oak Creek. Fig. 3.17 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. The NRWTP operated in total compliance with the ORNL NPDES Permit from 1990 to 1998. In 1997–1998, the NRWTP and the Process Waste Treatment Plant (PWTP) were reconfigured and combined to provide the Process Waste Treatment Complex (PWTC), which resulted in more effective, efficient treatment of ORNL process wastewaters. The PWTC has continued to operate in total NPDES Permit compliance.

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. Both the ESHQ&I 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 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. The ROD for Bethel Valley should be submitted to the regulators for approval by the end of 1999.

3.3.8.3.2 Gunite and Associated Tanks

The Gunite and Associated Tanks (GAATs) 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 to (1) remove the migrating gases throughout the facilities off-gas system (begun in late 1997), (2) remove the uranium deposit, and (3) 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 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 was approved in 1999 for the preferred action. Field activities are scheduled to start in September 1999.

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 (BVESTs) store evaporator concentrate and dilute radioactive liquid low-level waste. 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 Tanks C-1, C-2, W-22, and W-23 has been completed.

3.3.8.3.6 Surface Impoundments Operable Unit Project

The Surface Impoundments Operable Unit 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. Impoundments C and D were successfully remediated in 1998. A contract was awarded for A and B ponds in 1999. Field mobilization should begin in late 1999. 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. The sludge has been removed and approval has been received for grouting the tanks and holding pond in place. This work will be accomplished in FY 2000.

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. The ROD should be submitted to the regulators for approval by the end of 1999.

3.3.8.3.9 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.

3.3.8.4 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 3.7 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 3.7. 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 as being 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 3.6. 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 Oak Ridge 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 P&E Division has adopted the Integrated Safety Management System as the overarching philosophy and approach to integrate safety into its management tools and work practices so that its mission is successfully accomplished while protecting the public, the workers, and the environment. A program description has been published, and the division is actively pursuing its full implementation. Success of this endeavor will provide acceptance of ESH&Q ownership by line management and workers and involvement of workers in the ESH&Q aspects of the planning and evaluation of work, as well as its execution. The division's strategy is to build on existing systems and promote new initiatives to create a truly integrated

and effective program. The division strives to continually improve ESH&Q performance toward the ultimate goal of minimization of all hazards and elimination of all work-related injuries, adverse health effects, and environmental insults.

The Facility and Maintenance Management Information System, Version 2, (FAMMIS - II) is P&E's integrated business management system. It allows near real-time tracking of customer and maintenance job costs, status, and history. It has been fully integrated with the division's preventive maintenance (PM) program. The system provides the capability for tracking and trending of maintenance history, job delays, customer load, backlog, productivity, and other information needed to manage P&E's business. ESH&Q issues are addressed in the job planning process and supported by the system's capability to document hazards, required training, permits, support services, protective equipment, and other requirements. The system also provides information for managing the maintenance budget. 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 allows users to input maintenance job requests, query the status of outstanding requests, appraise closed job requests, and review equipment history.

The P&E Web server provides access to information needed by P&E personnel using intranet technology. The home page is continuously evolving and currently provides links to many applications and Web pages commonly used by P&E personnel and their customers. Some of these are the FAMMIS Web Interface, Area Responsibility Listings, P&E Absence Control Tracking System, Planner Time Usage Application, Network Systems Information, Asbestos Management Program, Technical Training, P&E Procedures, Performance

Measures, Condition Assessment Survey, and ESHQ&I information, procedures, and guidelines. Organizational information such as mission, philosophy, values, organization charts, and reengineering newsletters are available through the Web.

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 provides the ability to share printers and files among work groups for more efficient management of these resources.

The CAS program completed inspections of all ORNL facilities in FY 1998. Along with the planned inspections, the CAS program had a request to assess the condition of all fences and roads at ORNL. The CAS program inspected more than 48 miles of fences and photographed the deficiencies. The road inspections are ongoing because of the various levels of roads and lack of maps and road signs. A facility roof database was created and was populated to include photos, types of roof, and square footage. This database provides complete information concerning every roof at ORNL. The roof database and CAS personnel are instrumental in identifying and prioritizing ORNL roofing needs for Line Items, GPPs, and GPEs. The CAS inspectors label and photograph equipment items for the PM program. The steam pit and road and fence databases have been developed and the data fields are being

populated as information is gathered.

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 the critical needs are addressed on a priority basis and that the Laboratory is supported in a cost-effective manner.

The P&E Division has procured predictive maintenance (PdM) tools, and now has the opportunity to develop a reliability-centered maintenance program. Initially the new technologies have been utilized for trouble-shooting, sporadic special projects, and routine data collection. Future efforts will be focused on gradual evolution from traditional, scheduled PM practices toward a more efficient, proactive system utilizing predictive technologies to provide maintenance when needed. Infrared thermography, oil analysis, and vibration analysis are the primary technologies for a well-rounded PdM program. The vibration analysis is being applied by reading routes that are trended over time or for investigation of special problems that occur across the site. The PdM program is expected to allow a more efficient means of performing PdM, while reducing the downtime and costs associated with corrective maintenance.

The P&E Division Maintenance Work Plan provides additional information required by DOE Order 430.1A, “Life Cycle Asset Management.” This work plan discusses maintenance requirements that correspond to the current budget preparation.

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, technology, and energy laboratory established in 1942 as an element of the Manhattan Project. Capabilities developed in fulfilling its wartime mission have evolved into distinctive strengths in materials science and engineering, neutron science and technology, energy production and end-use technologies, mammalian genetics, and ecological research. In support of DOE'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.

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. As described in the *Strategic Laboratory Missions Plan—Phase I* (Laboratory Operations Board, U.S. Department of Energy, July 1996), the Laboratory plays a principal role in fundamental science and energy resources and has a specialized participating role in environmental quality

and national security. ORNL's R&D activities are described in detail in its annual institutional plans (e.g., *Oak Ridge National Laboratory Institutional Plan for FY 1999-2003*, ORNL/PPA-98/2, December 1998, available on the World Wide Web at URL http://www.ornl.gov/inst_plan/IP_Outline.html).

The institutional plan is the mechanism through which ORNL, as a multiprogram national laboratory under the direction of DOE's Office of Science, submits its missions and plans to the Department. Approval of the plan by the director of the Office of Science is an endorsement of the Laboratory's mission, vision, and strategic plan.

ORNL uses strategic planning to identify areas on which it will focus attention to ensure that it continues to deliver cost-effective scientific and technological performance to DOE and the nation. The Laboratory strategic plan, which is included in the annual institutional plan, is updated and revised as necessary to ensure its alignment with ORNL and DOE missions.

3.4.2 Site Planning Issues

A number of high-level issues that impact site planning have been identified. They are as follows:

1. Availability of uninterrupted programmatic funding for major science and technology initiatives (e.g., the SNS and the Laboratory for Comparative and Functional Genomics) to foster long-term viability of ORNL programs.

2. Availability of adequate landlord capital funding, including GPP, GPE, and line item funding, to ensure long-term viability of the ORNL physical plant.

3. Availability of sufficient operating funding for landlord activities such as waste management; excess/surplus facility S&M, deactivation and demolition, and transfer to EM program; and landlord ES&H requirements (e.g., asbestos removal, OSHA safety and health improvements, and electrical upgrades) to ensure safe and compliant operation of the Laboratory.

4. Relocation of ORNL organizations at the Y-12 site to the ORNL site.

5. Orderly transition of operations and infrastructure activities to the next ORNL management and operating contractor.

3.4.3 Facilities Planning Process

The ORNL facilities planning process is managed through the Capital Assets Management Office. Facilities planning is required by DOE Order 430.1A, "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.

3.4.4 Site Planning Methodology

The site planning process required by DOE Order 430.1A, "Life Cycle Asset Management," is documented in this section and illustrated in Fig. 3.18. Section 3.4.5 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 3.4.6 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 3.4.7 proposes alternatives for removing the site's deficiencies and states the preferred alternative. This preferred alternative is the basis for the Master Plan. Section 3.4.8 expands upon this alternative, yielding guidelines for development of the plan. Finally, Section 3.5.7 acknowledges that influencing factors could necessitate deviations from the Master Plan and requires that alternative courses of action be updated as this plan is revised in the future.

3.4.5 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 through 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.

1. 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).

2. 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.

3. 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.

4. 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.

5. 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.
6. 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.

7. 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 ESHQ&I 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 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 (including facilities at the Y-12 Plant);
   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.

3.4.6 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 ESHQ&I and safeguards and security regulations, often being forced to do so with "quick fixes" and at increasingly higher costs. These costs are predominantly funded through Laboratory or divisional overhead. 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.

Surplus/excess facilities surveillance and maintenance (S&M) and transfer costs, in general, are currently funded through Laboratory or divisional overhead. These costs will exceed $1 million in FY 1999. These costs will continue to grow in the future and will become an increasingly significant burden on overhead if landlord funding is not provided. Additionally, provisions in DOE Order 430.1A, “Life Cycle Asset Management,” for transfer of S&M funding to EM with the transferred facilities is not feasible from Laboratory overhead.

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 428 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.

3.4.7 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. Realistically, given the current federal budget constraints, the most likely achievable alternative is probably Alternative Three.

3.4.8 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 (1) changes in staffing levels associated with the restructuring of DOE’s contractual arrangements in the Oak

Ridge area, (2) downsizing, and (3) 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 ft^2 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 2000 and FY 2001 is $7.7 million annually; however, the identified requirements are $13.5 million in FY 2000 and $23.9 million in FY 2001. 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.

3.4.9 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 18 to 20% and a reduced procurement time of 50%. Other changes in the ED&C process include the

identification of a single organizational ESHQ&I 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 ESHQ&I have provided a set of WSSs 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.

3.4.10 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 10 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 ESHQ&I 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 2-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 Office of Science 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 in Figs. 3.13 and 3.14 and Section 3.3.8.3. 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.bechteljacobs.org/busmgt/ baseline/Baselines.html.

3.5.1 Current to Three Years

Figs. 3.19 and 3.20 show the GPP and LI projects scheduled during FY 1999, FY 2000, and FY 2001. Table 3.8 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.

Table 3.8. 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 -Radioactive Ion Beam Upgrade, ORIC -Laboratory for Comparative and Functional Genomics -HFIR Cold Source	-Neutron Sciences Support Building -Environmental and Life Sciences Laboratory -HFIR Cooling Tower Replacement -7602 High Bay Upgrade -Lab Expansion for Nanoscience Metrology and Instrumentation -Addition to Building 6012 -HFIR HB-4 Beam Line -Neutron Science Support Building Extension
General facility infrastructure projects	-Steam Plant Upgrade -Roofing Replacement -Electrical Systems Upgrade -Fire Protection Systems Upgrade -Laboratory Facilities HVAC Upgrade	-Computer Facility Upgrades -Building 2519 - 3000 Scfm Air Compressor Replacement -Condensate Return System Upgrade -1.5-Million-Gal Water Reservoir -250,000-Gal Steel Fuel Oil Storage Tank Construction -Eyewash, Safety Shower, and Water System Upgrades -Fire Protection Systems Upgrade -Lambert Quarry Signage and Fencing -Sanitary Waste Transfer Station -Security Perimeter Reconfiguration -Road and Parking Lot Paving -Seismic Upgrades, 1506 -Child Care and Fitness Center

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 to authorize SNS as an FY 1999 Line Item Project.

- **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.

- **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 Laboratory Waste Services Organization 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 world-class experimental facility designed 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 operating facility and the user community.

The objectives stated above are being met with a group of major structures which include an ion source, a linear accelerator, a klystron building, an accumulator ring, beam transport, and an experimental hall that includes 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 and the Experiment Systems Computer and Data Handling System.

In a related project, ORNL, The University of Tennessee (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 – FY 2000 and FY 2001)

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 2000 and FY 2001. Should the funding levels not meet projected requirements, then projects not funded will be considered in subsequent fiscal years.

Radioactive Ion Beam Upgrade, ORIC (ADS A99D0043, FY 1999 AIP)

This project will provide for improvement of the Oak Ridge Isochronous Cyclotron (ORIC). The proposed project will be located in the Holifield Radioactive Ion Beam Facility (HRIBF), Building 6000, at the Oak Ridge National Laboratory.

ORIC has a crucial role in the Holifield Radioactive Ion Beam Facility. ORIC's light-ion primary beams will be used to produce radioactive atoms from fusion reactions in thick targets on a Radioactive Ion Beam (RIB) injector. The ions from the RIB injector will be mass analyzed, accelerated with the 25-MV tandem, and used for the RIB experimental program. The RIB intensity will be proportional to the ORIC light-ion beam intensity and the number of hours of beam-on-target per year will be impacted by accelerator reliability and component activation.

Major ORIC improvements are needed to reduce activation and radiation exposure to operations personnel and to assure reliable, high-intensity operation. Expected benefits include increased upper limits on ORIC beam intensity, reduced ORIC activation, improved ability to handle activated components consistent with ALARA principles, improved operation efficiency, reduced down time, and reduced operating costs.

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

This project will construct the Laboratory for Comparative and Functional Genomics housing about 50,000 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 50,000 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.

HFIR Cold Source (ADS S97D0061, FY 1997 LI)

This project will provide a liquid hydrogen cold neutron source in HB-4. HFIR is the only high-power research reactor in the world whose capabilities do not include a source of cold (that is, very low energy, long wavelength) neutron beams: such beams are now used for much of the most important neutron scattering research and basic nuclear physics experiments at reactors. The liquid hydrogen cold source to be installed in HB-4 will provide gain factors of 5 to 30, depending on the wavelength, in the low energy neutron flux available at HFIR. The intensity of the new beams will be as high or higher than those available anywhere in the

world, although geometrical and space limitations will only allow three or four beams, at most, to be extracted with at least eight at the Institut Laue Langevin in Grenoble.

Steam Plant Upgrade (Boiler Addition) (ADS 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, 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 the 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.

Fire Protection Systems Upgrade (ADS A99D0018, 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.

- 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.

- 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 fire alarm 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; and replace the horn panel in the east stairwell controlling all evacuation horns in the building.
- Upgrade fire alarm system for Building 4501. The fire alarm 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; and replace the horn panel in the east stairwell controlling all evacuation horns within the building.

- Replace the 55-year-old 16-in. underground water main in the 6000 Area of ORNL with approximately 7000 ft of new lines. Associated isolation valves, pressure reducing valves, hydrants, and valve pits will be installed with the new water main.

Laboratory Facilities HVAC Upgrade (ADS A99D0017, FY 2001 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.

The scope of work will include (1) installation of primary/secondary central chilled water plant pumping system, 4509; (2) installation of 4501/4505 chilled water tie-in; (3) installation of chilled water coil inside 3500E air handler; (4) replacement of 4500N and 4501 air handlers; and (5) replacement of 4500S reheat system.

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 million/year is possible in new research funding and an additional $10 million 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 Cooling Tower Replacement (ADS A99D0048, Proposed Landlord GPP)

The HFIR Secondary Coolant System is composed of the secondary coolant piping, pumps, valves, cooling tower, and its control system. The components of the secondary coolant system are over 33 years old and are approaching their end of life. The piping has experienced leaks in both the aboveground and underground sections, in the tower risers, and in the pump bowl of one of the main secondary pumps. Recent inspection of the wooden cooling tower internal structural components shows extensive degradation. Additionally, recent ORNL fire protection inspections of the cooling tower fire protections system found leaks in this system and strongly argue for its complete replacement. The remaining life for the HFIR cooling tower is estimated at 3 to 5 years. This project will replace the HFIR secondary cooling system, including the piping from the reactor building, the cooling tower structure, the pumping station, and the flow control system.

Installation could be accomplished by construction of a new cooling tower adjacent to the HFIR Facility, while HFIR continues to operate. Then, during a reactor outage, tie-ins could be completed among the new tower, new pumping station, and the existing secondary coolant piping. In a later reactor outage, the piping between the reactor building and the new cooling tower could be installed.

7602 High Bay Upgrade (ADS A99D0098, Proposed FY 2000 Programmatic GPP)

This project will provide a needed upgrade to the high bay of Building 7602 to return a portion of an unused facility under EM40 into a vital ORNL work and research space. The project will involve covering the pit area with the fabrication and installation of pit cover blocks, removing and dispositioning of contaminated equipment, decontaminating floors and walls, and painting of surfaces.

Laboratory Expansion for Nanoscience Metrology and Instrumentation (ADS

A99D0020, Proposed FY 2001 Landlord GPP)

An upgrade to laboratory space in Building 3500 is proposed. The modifications to the A27 high bay area are to add an exit stair and second-floor structural system to the upper high bay to create approximately 3000 ft^2 of additional usable modular clean room laboratory space and reconfigurable office space for the proposed Laboratory Expansion for Nanoscience Metrology and Instrumentation. Approximately 1000 ft^2 of the first-floor high bay will be reconfigured for additional laboratory space and clean room. In addition to the high bay modifications, Room B-19 in Building 3500 will be converted from laboratory space to an electron microscope facility. The conversion will require modifications to the room HVAC system and possible foundation modifications for vibration isolation.

The purpose of the Laboratory Expansion for Nanoscience Metrology and Instrumentation is to provide critical enabling facilities and infrastructure that will permit a broad range of ORNL's research programs to carry out forefront scientific and engineering research on nanomaterials, nanostructures, and their applications.

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

The addition to Building 6012, the Mathematical Sciences Research Facility, 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.

HFIR HB-4 Beam Line (ADS A99D0146, Funded FY 1999 Programmatic GPP)

This proposed project will design, fabricate, and install neutron guides, mirrors, and shielding for four new beam lines at the HFIR facility. The new beam lines will be installed following the beryllium reflector changeout planned to begin in FY 2000.

The beam lines will be optimized for use with the new HB-4 beam tube and cold neutron source currently under design and construction. The resulting brighter beams will make it possible to provide a higher flux of neutrons on the experimental samples that are placed in the beams for study.

HFIR is operated as both an isotope production facility and as a user facility supporting a strong national research program using neutron scattering. To maintain competitive, forefront research capabilities, these user facilities must be improved to accommodate the changing experimental needs of the research community. The purpose of the new HB-4 beam line is to increase the available flux of cold neutrons delivered to the instruments and to increase the number of instruments that can be accommodated. Locations will be provided for at least two added facilities, a high resolution triple axis machine and a cold neutron test facility. The other

instruments are already available but are installed at existing locations in the HFIR where the useful neutron flux on the experiments are very much lower (by a factor of up to 100) than will be provided by the beam lines to be installed in this project.

Neutron Science Support Building Extension (ADS A99D0147, Proposed FY 2000 Programmatic GPP)

The Neutron Science Support Building Extension will be an 80-ft extension to the south end of the Neutron Science Support Building. This project will provide space for use by the neutron sciences researchers at the HFIR facility. A Basic Energy Sciences Advisory Committee Review Committee has recommended that the cold neutron Small Angle Neutron Scattering (SANS) capabilities at the HFIR be expanded to accommodate an additional beam and another instrument and that both of these SANS machines be placed in a low background region more distant from the reactor than possible with the current facility. This building extension will provide the space needed to meet that recommendation, providing greatly enhanced capabilities for all programs that rely on small angle scattering experiments. Multiprogram demand for research at the HFIR is growing, and there is currently insufficient space to support all of these activities.

Computer Facility Upgrades (ADS A99D0054, Proposed FY 2000 Landlord GPP)

This project will provide space, utilities, and power for the installation of a one-teraflop computer system at ORNL.

Building 2519 - 3000 Scfm Air Compressor Replacement (ADS S97D0010, Proposed FY1998 Landlord 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 sitewide 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.

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.

1.5-Million-Gal Water Reservoir (ADS S97D0021, Proposed FY 2000 Landlord GPP)

This project will provide a new 1.5-million-gal steal water reservoir adjacent to the existing 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 5 years to monitor and assess

reservoir condition. Inspections indicate spalled concrete, corroding structural reinforcement, and cracks. The No. 1 reservoir must be drained and cleaned, structural repairs performed, and a new corrosion-resistant liner installed. Additional work must be performed on the exterior surfaces of the structure to help counter the effects of weather and age. The new 1.5-million-gal steal reservoir will provide water to ORNL during the repair of the No. 1 reservoir and will provide additional capacity for Laboratory requirements.

250,000-Gal Steel Fuel Oil Storage Tank Construction (ADS S97D0055, Funded FY 1999 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.

Eyewash, Safety Shower, and Water System Upgrades (ADS C97D0081, FY 2000 Landlord GPP)

The scope of this activity includes the (1) upgrade of water supply systems, (2) installation of safety showers and eyewashes with potable water supply, (3) replacement of piping and associated components used to supply and remove process water, and (4) replacement of piping and associated components used for heating.

Fire Protection Systems Upgrade (ADS C97D0071, Funded FY 1999 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.

- Upgrade 4500N Wing 5 alarm system and connect it to the 4500N alarm system.
- Upgrade antiquated fire alarm systems in the HFIR Building.
- Upgrade antiquated fire alarm panels in various ORNL buildings.
- Replace fire doors in 4500N between the wings and main corridors.
- 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 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.
- 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.
- 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.

Lambert Quarry Signage and Fencing (ADS A99D0042, FY 2000 Landlord GPP)

Lambert Quarry is an ORNL responsibility located on the eastern border of Parcel ED-1. With increased usage of the areas surrounding the quarry (e.g., ED-1 development, DOE greenway), the ORNL Land and Facilities Use Committee recommended that the entire quarry area be signed and fenced, including gates at the two main access roads.

Sanitary Waste Transfer Station (ADS C98D0105, FY 2000 Landlord GPP)

This new facility will replace an existing facility, eliminating the need for a compaction trailer that is obsolete, deteriorating, and expensive to maintain. The new station will consist of a stationary compactor and roll-off type pans, which will be picked up, delivered to the landfill, and returned to ORNL.

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)

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.

Seismic Upgrades, Building 1506 (A99D0055, Proposed Landlord GPP)

In response to a seismic evaluation driven by Executive Order 12941, Building 1506 was found to be in the "Definitely Needing Repair" category. A possible failure scenario has been postulated because of a lack of roof diaphragm action due to the absence of a topping slab. A study is currently underway to recommend necessary modifications to improve the building's resistance to seismic failure modes.

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 on the ORNL site 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 1999 Detailed List of GPE Acquisitions

ADS No.	ADS Title	FY 1999 Budget
C98D0004	Computing Systems & Supporting Modules for SAP	$817K
A98D0105	Secure Network Remote Access/Firewall	100K
A99D0059	Shared Systems Computing Equipment for Separation	146K
A98D0106	Enterprise Gigabit Ethernet Backbone Switches	55K
A98D0108	Network Video/Audio Broadcast System	55K
A99D0061	HVAC Upgrades, 9204-1 35-Ton Unit	50K
C98D0063	Electronic Heat Sealer	
41K		
C97D0125	CFC Phaseout - Clean Air Act Compliance (KC)	1,200K
C98D0121	Replace Fleet Vehicles - GPE	300K
A99D0050	Wrecker Truck	10K
C98D0182	Laboratory Director's Research and Development - GPE	350K
A98D0014	Mailmobile Replacement 4500N, Second Floor	42K
A99D0019	Building 4515 HVAC System Controllers	111K
C98D0020	Replacement Valve Test Stand	20K
C98D0179	Replace Steam Plant Economizers	10K
	TOTAL FY 1999	$3,307K

FY 2000 Proposed GPE Acquisitions

ADS No.	ADS Title	FY 2000 Budget
A99D0128	Logic Analyzer, High-Speed, Deep Memory	$99K
A99D0130	Development System for ORNL's Supercomputing Resource	56K
A98D0015	Engineering Equipment Replacement	300K
A99D0059	Shared Systems Computing Equipment for Separation	188K
A98D0106	Enterprise Gigabit Ethernet Backbone Switches	55K
A99D0097	Spincoater, Developer and Inspection Station	98K
A99D0099	Photomask Aligner and Exposure System Upgrade	65K
A99D0100	Tube Furnaces and Process Gas Handling Station	97K
A99D0101	Wet Chemical Etching Station	65K
A99D0091	EMAIL.CIND System Upgrade	53K
A99D0095	WWW.ORNL.GOV Web Server Upgrade	31K
A99D0021	Field Emission Scanning Electron Microscope	770K
A99D0028	Whole Body Counting Lab Liquid Nitrogen Tank	83K
A99D0033	Primary Substation SF6 Breakers	490K
C98D0179	Replace Steam Plant Economizers	340K
C98D0121	Replace Fleet Vehicles - GPE	300K
C98D0182	Laboratory Director's Research and Development - GPE	260K
A99D0053	Mailmobile Replacement - 4500N, First Floor	43K
C97D0125	CFC Phaseout	500K
	TOTAL FY 2000	$3,893K

3.5.2 Four to Ten Years

Figs. 3.21 and 3.22 show the GPP and LI projects scheduled for FY 2002 through FY 2008. Table 3.9 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.

Table 3.9. ORNL projects 4 to 10 years

	Line items	General plant projects
R&D-related infrastructure projects	-Isotope Separator On-Line (ISOL) Facility -Advanced Materials Characterization Laboratory -Computational Sciences Facility -ORNL Center for Biological Sciences -40-Teraflops Computer Facility -HFIR Remote Handling Facility	-HFIR Entrance Addition and Expansion -Building 3144 Addition -Building 7920 Facility Expansion -Building 7930 Upgrades -Demolish and Replace Building 6003
General facility infrastructure projects	-Laboratory Facilities Ventilation Systems Upgrade -Potable Water System Upgrade I -Potable Water System Upgrade II -Central Services and Conference Center Facility -Support Services Facility	-Auxiliary Systems Upgrades -GPP HVAC Upgrades -Install Water Meters -ORNL at Y-12 Elevator Upgrades -ORNL Steam Plant No. 5 Boiler Upgrade -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 -Water System Upgrade, 1000 Area -Extend the 7000 Area Water Main -Water System Upgrade, 7600 Area -Melton Valley Road Upgrade -ORNL Technical Support Building Addition, 4512 -Upgrade the ORNL Steam Distribution Condensate Removal System -Replace Cooling Tower 4511 -Eyewash, Safety Shower, and Water Systems Upgrade -Building 4509 Maintenance Shop Addition -West End Steam Upgrade Completion -Upgrade Electrical System (Areas 3000, 6000, and 7000) -Mailroom Facility -Environmental Controls, I&C Calibration Facility -Flow Monitoring Stations for Low-Flow Verification -Coal Storage Area Reclamation -Heavy Equipment Shed -Renovation of 1506 Greenhouses

Fig. 3.21

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 as 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, thereby 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.

3.5.2.1 Line Item Projects

Isotope Separator On-Line (ISOL) Facility (FY 2002 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 an ISOL Facility, for which the HRIBF can be considered a prototype.

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 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.

ORNL Physics Division staff members have previously explored the possibility of locating an advanced ISOL facility at the Laboratory. The *ORNL Institutional Plan for FY 1998–FY 2002* (ORNL/PPA-97/2, January 1998) presented a possible layout for such a facility at the HRIBF site. The *ORNL Institutional Plan for FY 1999–FY 2003* (ORNL/PPA-98/2, January 1999) described how an extremely cost-effective RIB facility could be constructed by taking advantage of the very high intensity beam of high-energy protons to be produced in the linear accelerator of the SNS. Both of these options remain open to consideration if funding is not available to construct the facility proposed by the ISOL Task Force.

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 Facility (ADS S97D0045, FY 2002 Landlord 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, 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 the HFIR and the SNS, respectively with strong programs in mass spectrometry and computational biology at the Laboratory.

40-Teraflops Computer Facility (ADS A98D0011, FY 2002 Landlord LI)

A 25,000 ft^2 computer facility and required utility system will be constructed to house components of a 40-teraflops 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.

HFIR Remote Handling Facility (ADS S97D0053, FY 2003 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.

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.

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.

Central Services and Conference Center Facility (ADS A99D0056, FY 2002 Landlord LI)

The Central Services and Conference Center Facility, a multistory 28,000 ft^2 building to be constructed north of Building 4500N, will provide essential cafeteria, conference center, library, and visitor control facilities. This building is required to provide modern, efficient facilities to promote effective collaboration and support R&D activities at ORNL. Current facilities are widely dispersed, deteriorating due to age, and are located in buildings where research space is at a premium. Adequate conference facilities do not exist. The bulk of the Laboratory population resides in the 4500 Area, and the new facility will provide a more central location. This building is to be configured so that visitors and guests can attend meetings and conferences without entering the secure area of the Laboratory. Vacated facilities will be modified for other needed purposes.

Support Services Facility (ADS A99D0148, FY 2002 Landlord LI)

This project will involve the demolition of Quonset hut type structures built in the 1940s that house respirator test facilities, cylinder and valve test facilities, radiography and non-destructive examination services, the HEPA filter test facility, ORNL assessment and audit functions, and maintenance support services. This project will construct a new multipurpose facility containing test equipment areas, service and repair shops, maintenance areas, and office areas for the associated personnel. This new facility will improve efficiency and safety of the previously stated service support functions, reduce and eliminate ES&H exposure hazards, and reduce the maintenance costs associated with the continued occupancy of the existing obsolete and deteriorated facilities.

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 A98D0013, 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 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.

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.

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.

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 430.1A 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.

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.

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 Upgrade (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 Addition, 4512 (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.

Eyewash, Safety Shower, and Water System Upgrades (ADS C97D0081, FY 2000 Landlord GPP)

The scope of this activity includes the (1) upgrade of water supply systems, (2) installation of safety showers and eyewashes with potable water supply, (3) replacement of piping and associated components used to supply and remove process water, and (4) replacement of piping and associated components used for heating.

Building 4509 Maintenance Shop Addition (ADS C97D0089, Proposed 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.

West End Steam Upgrade Completion (ADS S97D0032, Proposed Landlord GPP)

This project will perform those activities necessary to complete the West End Steam System Upgrade. Included in the work will be insulation of the pits and demolition of old pits, pipe, and pipe supports.

Upgrade Electrical Systems (Buildings in the 3000, 6000, and 7000 Areas) (ADS C97D0069 and ADS C97D0070, Proposed 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.

Mailroom Facility (ADS A98D0086, Proposed 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.

Environmental Controls – Instrumentation and Controls (I&C) Calibration Facility (ADS A99D0063, Proposed Landlord GPP)

A crucial need is a substantial improvement in the current calibration facility's environmental controls. As the precision and accuracy of measurements increases, so does the uncertainty due to fluctuations in the environmental conditions in which the measurements are made. Establishing and maintaining a constant environment is essential to achieving the measurement accuracy currently required at any national laboratory for standard comparisons and calibrations. The need for such accuracy levels can also be expected to increase significantly with the demands that will be placed on the facility by new, highly instrument dependent programs such as the SNS. With the exception of two "window type" air conditioners set into the east wall, our current facility, unlike almost every other calibration facility in existence, has no special environmental (temperature, humidity, dust, etc.) controls.

Flow Monitoring Stations for Low-Flow Verification (ADS A99D0027, Proposed Landlord GPP)

This project provides for the installation of permanent flow monitoring equipment at upper First and Fifth creeks in the ORNL main plant area. The equipment will be designed such that ORNL can collect continuous flow data at a point above ORNL wastewater discharges. The ORNL NPDES Permit currently includes stringent effluent limits for several outfalls on First and Fifth creeks with which compliance is difficult. These limits are based on conservative

regulatory assumptions about baseline flow rates in these two ORNL receiving streams and have been appealed by DOE. A long-term flow record is expected to allow ORNL to verify or disprove flow rate assumptions on which NPDES Permit requirements are based. This will position DOE to propose and negotiate more realistic and achievable NPDES Permit requirements for discharges to these streams.

Coal Storage Area Reclamation (ADS A99D0114, Proposed Landlord GPP)

This project will involve the removal/disposal of any remaining coal, demolition of two coal conveyors, and revegetation of the coal storage area. Completion of this project will eliminate the source of possible NPDES violations.

Heavy Equipment Shed (ADS A99D0088, Proposed Landlord GPP)

This project will construct a new 40 X 60 X 12 ft sidewall storage shelter to protect heavy equipment such as backhoes, tractors, and lawn mowers from the elements. These equipment items are currently stored outside or in the existing high-sidewall storage shelter. The high sidewalls offer minimal protection from blowing rain or snow. The new shelter would have a lower profile and would protect these pieces of equipment from rain, snow, and sun.

Renovation of 1506 Greenhouses (ADS S97D0005, Proposed Landlord GPP)

This project will replace the existing four greenhouses adjacent to Building 1506 with a new Environmental Sciences Division Plant Research Facility designed with experimental functionality in mind. Replacement, as opposed to renovation, is the most desirable option due to the deterioration of the greenhouses and the inadequate design of the existing units to control environmental conditions for research purposes. The replacement facility will consist of three interconnected structures: (1) a research greenhouse (approximately 24 by 48 ft) having four distinct experimental bays, (2) a production greenhouse (approximately 48 by 50 ft) used primarily to grow seedlings and plants for use in research work, and (3) a headhouse (a pre-engineered steel structure 20 by 40 ft) to support greenhouse operations (sample preparation, storage, etc.). Prior to construction, the existing four greenhouse units will be razed, the floor drain system will be modified, and a new concrete foundation and floor system will be installed.

3.5.3 Greater Than Ten 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. 3.23.

3.5.3.1 Bethel Valley

Seven 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, 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,
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:

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
Restored 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.

Spallation Neutron Source Complex. The SNS is a new world-class experimental facility designed 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 operating facility and the user community.
The objectives stated above are being met with a group of major structures which include an ion source, a linear accelerator, a klystron building, an accumulator ring, a beam transport, and an experimental hall that includes 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 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.

Nuclear Physics Complex. The Nuclear Physics Complex is located in the 6000 Area of ORNL. The HRIBF at ORNL, an ISOL facility for the production of accelerated beams of radioactive isotopes, is the first U.S. RIB facility devoted to low-energy nuclear structure and nuclear astrophysics research. Radioactive ions are produced when intense beams accelerated by the ORIC are directed onto thick, refractory targets. The radioactive elements diffuse out of the target, are ionized, and are mass selected for injection into the 25-MV tandem accelerator, producing beams of 0.1–10 MeV per nucleon for light nuclei and up to 5 MeV per nucleon for mass 80. These beams are ideal for research in nuclear astrophysics and nuclear structure.

An advanced ISOL facility for the production of accelerated beams of radioactive isotopes was identified in the 1996 Long-Range Plan for U.S. Nuclear Science, prepared by the DOE/National Science Foundation Nuclear Science Advisory Committee (NSAC), as the next major facility to be constructed for U.S. nuclear science. This facility would provide the larger variety of more intense RIBs needed to take full advantage of the opportunities in this new interdisciplinary research field.

In October 1998, the DOE Nuclear Physics Program established an ISOL Task Force to evaluate technical options for a new RIB facility in the United States. The task force provided an interim report to NSAC in April 1999 and is expected to issue a final report in October 1999. The interim report recommended construction of an ISOL facility based on a high-energy, heavy ion accelerator to produce radioactive ions. The estimated cost of this projectile fragmentation–based ISOL facility is $400 million to $500 million, and it would not be operational until about FY 2010.

At the request of the DOE Nuclear Physics Program, ORNL has examined ways of upgrading the HRIBF that would enhance the competitive position of RIB research in the United States during the 10-year period before the new facility can be completed. A number of upgrades, with costs ranging from $1 million to $30 million, have been identified. ORNL will work with the Nuclear Physics Program to determine appropriate options for expanding the use of RIBs.

ORNL Physics Division staff members have previously explored the possibility of locating an advanced ISOL facility at the Laboratory. The *ORNL Institutional Plan for FY1998–*

FY 2002 (ORNL/PPA-97/2, January 1998) presented a possible layout for such a facility at the HRIBF site. The *ORNL Institutional Plan for FY 1999–FY 2003* (ORNL/PPA-98/2), December 1998) described how an extremely cost-effective RIB facility could be constructed by taking advantage of the very high intensity beam of high-energy protons to be produced in the linear accelerator of the Spallation Neutron Source. Both of these options remain open to consideration if funding is not available to construct the facility proposed by the ISOL Task Force.

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. 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 as 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.

DOE has expressed the desire to turn the 161 kV supply lines serving the individual Oak Ridge plant sites over to TVA. The eventual impact on power supplies and operations is impossible to determine at this point, but it is expected that change will essentially be in ownership only.

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 1 to 4 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 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 GPP currently being considered for the FY 2000 time frame would add a new 1.5-million-gal reservoir on Chestnut Ridge adjacent to the

existing 3-million-gal concrete reservoir. The addition of this reservoir would allow renovation of the old reservoir without impacting overall Laboratory operations or users. The 3-million-gal concrete reservoir is in poor condition and needs repairs to stop concrete spalling and fix leak areas. Without another reservoir, it would be almost impossible to remove the reservoir from service without potentially impacting Laboratory programs. The addition of another tank would allow repairs to proceed on the old reservoir in a logical and timely manner and should extend its overall life expectancy well into 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.

Of concern to the Laboratory is the upcoming (April 2000) transition of the Oak Ridge water treatment plant from DOE ownership and operation to the City of Oak Ridge. Discussions have been underway for over a year regarding the issues surrounding this transition, and ORNL has been involved since the plan was initiated. Of most concern to Laboratory representatives is (1) the loss of “buffer” reservoir capacity at the water plant that has, in the past, insulated the Laboratory from both Y-12 maintenance and water plant operations and (2) potential changes in the water treatment process that could impact water usage in heat exchangers and cooling towers throughout the Laboratory. These issues are being discussed, and resolution or consensus is expected well in advance of the transition date.

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 but may be rejected because of concerns over cost containment for the new facility.

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 Sewage Treatment Plant. 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 Sewage Treatment Plant 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 and a GPP have 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. The State of Tennessee has also considered routing a new interstate bypass west of Knoxville across the ORR as well as east and west of the ORR. No specific route has yet been selected.

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. 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 2001. 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 3.4.5 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 the 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 ESHQ&I 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 consolidating appropriate activities in 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 ESHQ&I 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 ESHQ&I 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.

4. REFERENCES

Awl, D. J., L. R. Pounds, B. A. Rosensteel, A. L. King, and P. A. Hamlett. 1996. *Survey of Protected Vascular Plants on the Oak Ridge Reservation*. June.

Comprehensive Integrated Planning: A Process for the Oak Ridge Reservation. 1998. Oak Ridge, Tennessee. ES/EN/SFP-49, ORNL/M-6545. May.

Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. *Classification of Wetlands and Deepwater Habitats of the United States*. FWS/OBS-79/31. U.S. Fish and Wildlife Service, Washington, D.C.

DOE (U.S. Department of Energy) 1989. *Oak Ridge Reservation Site Development and Facilities Utilization Plan*. DOE/OR-885. Oak Ridge, Tennessee. June.

DOE 1995. *Environmental Monitoring Plan for the Oak Ridge Reservation*. DOE/OR-1066R1. United States Department of Energy Oak Ridge Field Office, Oak Ridge, Tennessee. May.

DOE 1996a. *Comprehensive Land-Use Planning Process Guide*. Office of Field Management. March.

DOE 1996b. *Charting the Course, The Future Use Report*. DOE/EM-0283. Office of Environmental Management, Office of Field Management. April.

DOE 1997. *DOE Emergency Management Guide, Hazards Surveys and Hazards Assessments*. DOE G 151.1-1. August.

DOE 1998. *DOE Oak Ridge Reservation Emergency Plan*. EMPO-500. April.

Environmental Sciences Division. 1998. *Environmental Sciences: Research, Assessment, and Technology to Understand and Meet the Challenges of the Future*. ORNL/M-5911C. Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Hamilton, L. V., D. C. West, L. W. McMahon, L. G. Shipe, J. G. Rogers, and W. S. Koncinski. 1996. *ORR Annual Environmental Monitoring Report for 1995*. ES/ESH-69. September.

Hinzman, R. L. (ed). 1995. *Third Report on the Oak Ridge K-25 Site Biological Monitoring and Abatement Program for Mitchell Branch*. ORNL/TM-12790. Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Hinzman, R. L. (ed). 1996. *Report on the Biological Monitoring Program for Bear Creek at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee (1989-1994)*. ORNL/TM-12884. Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Loar, J. M. (ed). 1994. *Fourth Report on the Oak Ridge National Laboratory Biological Monitoring and Abatement Program for White Oak Creek Watershed and the River*. ORNL/ TM-11544. Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Mann, L. K., P. D. Parr, L. R. Pounds, and R. L. Graham. 1996. *Protection of Biota on Nonpark Public Lands: Examples from the U.S. Department of Energy Oak Ridge Reservation*. Environmental Management. 20: 207-218.

Mitchell, J. M., E. R. Vail, J. W. Webb, A. L. King, and P. A. Hamlett. 1996. *Survey of Protected Terrestrial Vertebrates on the Oak Ridge Reservation*. ES/ER/TM-188. May.

The Nature Conservancy. 1995. *Oak Ridge Reservation, Biodiversity, and the Common Ground Process, Preliminary Report on the Oak Ridge Reservation*.

Neilson, R. P. and D. Marks. 1994. "A Global Perspective of Regional Vegetation and Hydrologic Sensitivities from Climate Change." *Journal of Vegetation Science*. 5:715-730.

Oak Ridge National Laboratory Institutional Plan, FY 1999–FY 2003.1998. ORNL/ PPA-98/2.

Oak Ridge National Laboratory Land and Facilities Plan. 1998. ORNL/M-6557. August.

Oak Ridge Reservation Management Plan. 1999. ORNL/M-6614. February.

Phase I Environmental Report for the Advanced Neutron Source at Oak Ridge National Laboratory. 1992. ORNL/TM-12069. Oak Ridge National Laboratory, Oak Ridge, Tennessee. February.

Pounds, L. R., P. D. Parr, and M. G. Ryon. 1993. *Resource Management Plan for the Oak Ridge Reservation. Volume 30: Oak Ridge National Environmental Research Park Natural Areas and Reference Areas—Oak Ridge Reservation Environmentally Sensitive Sites Containing Special Plants, Animals, and Communities*. ORNL/NERP-8. Oak Ridge, Tennessee. 20 pp.

Souza, P. A., G. D. DuVall, and N. Tinker. 1997. *DOE Oak Ridge Operations Office Cultural Resource Management Plan, Anderson and Roane Counties, Tennessee*. ORNL/ M-5080. Oak Ridge National Laboratory, Oak Ridge, Tennessee. September.

Washington-Allen, R. A., T. L. Ashwood, S. W. Christensen, H. Offerman, and P. Scarbrough-Luther. 1995. *Terrestrial Mapping of the Oak Ridge Reservation: Phase I*. ES/ER/TM-152. Oak Ridge National Laboratory, Oak Ridge, Tennessee.

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

APPENDIX B

ORNL Tailored Stakeholder Plan

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 Office of Science, 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.

OAK RIDGE NATIONAL LABORATORY
MANAGED BY LOCKHEED MARTIN ENERGY RESEARCH CORPORATION
FOR THE U.S. DEPARTMENT OF ENERGY

POST OFFICE BOX 2008
OAK RIDGE, TN 37831-6038

PHONE: (423) 576-8123
FAX: (423) 576-8646

INTERNET: parr@ornl.gov

Date: July 30, 1999

To: ORNL "Tailored" Stakeholders

From: Patricia D. Parr, 1505, MS-6038, (423) 576-8123 PDParr
Anthony R. Medley, 1000, MS-6302, (423) 574-9156 ARMedley

Subject: 1999 Draft "Land and Facilities Plan"

Oak Ridge National Laboratory is requesting comments on the 1999 draft "Land and Facilities Plan." The Plan's scope includes the Department of Energy's Oak Ridge National Laboratory and the Oak Ridge National Environmental Research Park. It does not include the other two major DOE facilities on the reservation (East Tennessee Technology Park and the Y-12 Plant).

Changing federal missions have resulted in diverse recommendations from within and outside of the Department of Energy (DOE), regarding the future use of the Oak Ridge Reservation. There is continuing strong interest by Oak Ridge community leaders for release of land for residential and industrial development. And there are current and planned multiple uses of the land and facilities for DOE mission activities ranging from ecosystem research to reindustrialization to major new initiatives such as the Spallation Neutron Source. The "ORNL Land and Facilities Plan" provides detailed information on current and future land and facility uses.

ORNL's vision for reservation land use is "The DOE Oak Ridge Reservation is a unique and irreplaceable resource for DOE to address its national science and technology missions. Land use planning will identify and prioritize needs for preservation of reservation land to meet the requirements of existing and future scientific facilities, environmental research, education, and other compatible uses."

Approximately 25,000 acres, serving originally as facility buffer, have been fairly undisturbed since acquisition by the federal government in 1942. As a result, the Oak Ridge Reservation now includes large blocks of contiguous native forest with plant and wildlife species and communities now uncommon or absent in surrounding areas. This large, diverse forested area provides a foundation for ecological research, monitoring, demonstration, and educational activities at Oak Ridge National Laboratory.

Since the sites/facilities within the Oak Ridge Reservation have differing missions and a diverse set of stakeholders, DOE has requested that each site establish and implement a "tailored" stakeholder plan. ORNL "tailored" stakeholders include Research and Development sponsors (DOE and other agencies), natural resource trustees/agencies, educational users, and stakeholders with regional and national perspectives for land uses of the Oak Ridge Reservation.

Your comments, as an ORNL "tailored" stakeholder, on this draft ORNL plan and the vision will provide valuable input for planning as well as documentation to DOE.

Local stakeholder input obtained in 1995 through the DOE Future Use Initiative for the entire reservation and from the 1998 "ORNL Land and Facilities Plan" has been incorporated into the this 1999 draft ORNL plan as appropriate. General land use designations for the entire reservation are identified in a comprehensive, integrated planning document published in May 1998 which included a public comment period.

The draft "ORNL Land and Facilities Plan" is available for your review on the World Wide Web at http://www.ornl.gov/~dmsi/landUse/. (Note- the "U" in landUse must be capitalized).

Please email your comments to Pat Parr <par@ornl.gov> or Tony Medley <arm@ornl.gov> or respond using the comment box at the end of the web document. Your comments are important. Input received after the mid-August publication of this draft plan will be included in the update document.

APPENDIX C

ORNL Stakeholder Responses

------ Forwarded Message
DateMon, 21 Sep 1998 140105 -0500
Fromegf@ornl.gov (Jim Evans)
SubjectReComments on the ORNL Facilities and Land Use Plan
ToPat Parr <parrpd@ornl.gov>

The following are comments submitted from JIM EVANS/TWRA WILDLIFE MANAGER/ORWMA

This message is related the Land and Facilities Plan on the web at http//www.ornl.gov/~dmsi/landUse/

Comments
Pat Parr, I would like to take this opportunity to offer my support and endorsement of the ORNL "tailored" Land and Facilities Plan. I would also like to add a few additional thoughts and comments. First, the tailored plan captures most closely the TWRA's opinion of the relative value of the ORR and the direction we would like to see taken with this special area. Additionally, the ORNL plan closely supports the TWRA's mission and legislative mandate of wildlife management, preservation and land stewardship. This is in contrast to other plans in which the ORR's ecological importance is downplayed. I think much of the value of the Reservation is lost to most people within and outside the DOE and Oak Ridge community because they have never seen the area other than perhaps driving to and from work. Second, the fact that the ORR is one of the largest, if not the largest, contiguous tracts of relatively undeveloped land remaining in ridge and valley area should not be overlooked. This large land base is enhanced by the close proximity to the TVA'S 1500-acre former CRBR site, the UTK Arboretum property (2260 acres), and the City's Haw Ridge park (~1000 acres). Another side issue that needs to be addressed, but perhaps at a different level or forum, is touched upon indirectly when the tailored plans mentions the past need for a security and safety buffer. Perhaps there is a current need for an "ecological buffer" around the area to keep contaminated wildlife on the governments property. In other words, if the surrounding lands are in private hands how is the issue of contaminated wildlife (i.e. deer, geese, turkey) straying on to those private lands going to be addressed. In addition, I think the tailored plan needs to be expanded to include comments about the ORR's huge potential for a wide variety of wildlife related programs. Such as education, wildlife viewing, additional hunting opportunities, etc. Also, if the land is going to be considered surplus the TWRA would be very much interested in acquiring some of the non-contaminated tracts. Jim Evans

Jim Evans
Wildlife Manager II
Oak Ridge Wildlife Management Area
Oak Ridge National Laboratory
Bldg. 0907 Ms. 6490
Oak Ridge, Tn. 37831
(423) 574-8204

Tennessee Valley Authority, 17 Ridgeway Road, Box 920, Norris, Tennessee 37828-0920

August 20, 1999

Ms. Pat Parr
Oak Ridge National Laboratory
P.O. Box 2008
Oak Ridge, Tennessee 37831-6038

Dear Pat:

In response to your request dated July 30, 1999, Judith Bartlow of the TVA Regional Natural Heritage Project, reviewed the 1999 Draft "Land and Facilities Plan".

Her only comments were:

> Grassy Creek is 103-acre mesic wooded ridge, designated as a TVA Natural Area for the protection of a rare plant. Bugbane (*Cimicifuga rubifolia*) is listed as Threatened in Tennessee. This mesic, forested ridge appears to be adjacent to a DOE weapons range on Bear Creek Road and is separated from the range by a chain link fence. The weapons range boundary is well marked. Threats to this rare plant community include invasive exotic species that would alter the character of the habitat. Clearing and the resulting increased sunlight would allow certain invasive plant species, such as Japanese honeysuckle and privet, to penetrate the natural area. If the forested ridge south of the rifle range is under consideration or review for changing use, we would recommend that 45 m (150 ft.) buffer be maintained in a forested condition. For additional information, please contact Wesley James, TVA, Melton Hill Watershed Team, 988-2440, or Judith Bartlow, TVA, Natural Heritage, 632-1592.

Thank you for providing us the opportunity to review this plan. If we can be of any additional service, please feel free to call on us.

Sincerely yours,

Dennis Curtin
Program Administrator
Regional Natural Heritage Project

APPENDIX D
Oak Ridge Reservation Research Focus

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

APPENDIX E

Self-Sufficiency Parcels for the City of Oak Ridge

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. E.1.

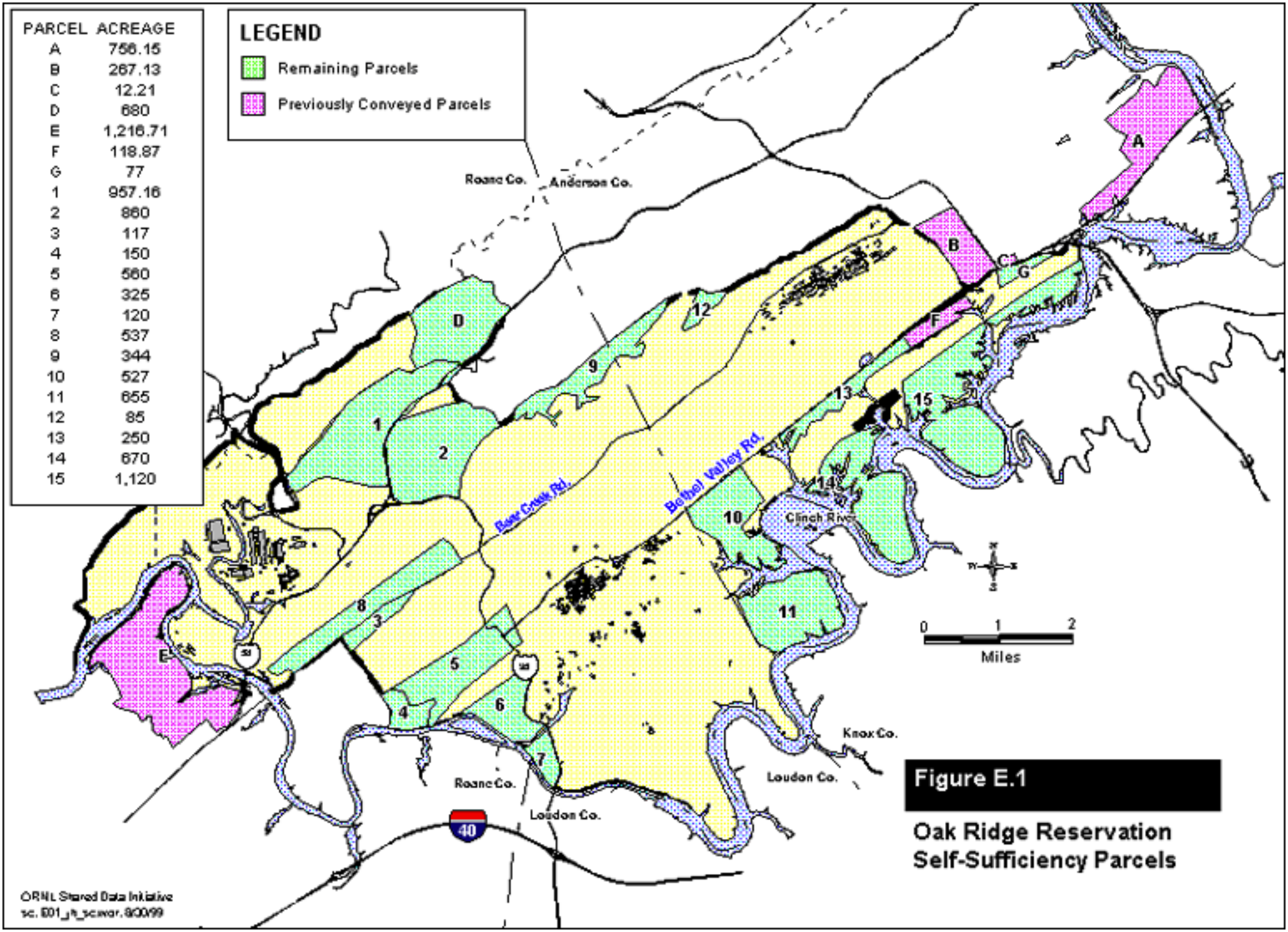

Figure E.1

Oak Ridge Reservation Self-Sufficiency Parcels