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Oak Ridge Reservation Site Management Plan for the Environmental Restoration Program

Environmental Restoration Division
P.O. Box 2003
Oak Ridge, Tennessee 37831-7298

Date Issued—June 1994

Prepared for
U.S. Department of Energy
Office of Environmental Restoration and Waste Management
under budget and reporting code EW 20

MARTIN MARIETTA ENERGY SYSTEMS, INC.
managing the

Environmental Restoration and Waste Management Programs at
Oak Ridge K-25 Site
Oak Ridge Y-12 Plant
Oak Ridge National Laboratory
under contract DE-AC05-84OR21400

Paducah Gaseous Diffusion Plant
Portsmouth Gaseous Diffusion Plant
under contract DE-AC05-76OR00001

for the
U.S. DEPARTMENT OF ENERGY

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ACRONYMS

ARAR	applicable or relevant and appropriate requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CX	Categorical Exclusion
D&D	decontamination and decommissioning
DOE	U.S. Department of Energy
DQO	data quality objective
Ebasco	Ebasco Services, Inc.
EE/CA	engineering evaluation/cost analysis
EPA	Environmental Protection Agency
ER	Environmental Restoration
FFA	Federal Facilities Agreement
FS	feasibility study
GIS	geographic information system
GWPO	Groundwater Program Office
GWPPM	Groundwater Protection Program Manager
HRE	Homogeneous Reactor Experiment
HSWA	Hazardous and Solid Waste Amendments
IDW	investigation-derived waste
IP	integration point
LLLW	liquid low-level (radioactive) waste
MLE	most likely exposure
NCP	National Contingency Plan
NEPA	National Environmental Policy Act
NRDA	Natural Resource Damage Assessment
OREIS	Oak Ridge Environmental Information System
ORHSP	Oak Ridge Hydrologic Support Program
ORNL	Oak Ridge National Laboratory
ORO	DOE Oak Ridge Operations
ORR	Oak Ridge Reservation
ORRHAGS	ORR hydrologic and geologic studies
OSHA	Occupational Safety and Health Act
OU	operable unit
P&A	plugging and abandonment
PCB	polychlorinated biphenyl
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
ROD	Record of Decision
S&M	surveillance and maintenance
SWSA	solid waste storage area
TDEC	Tennessee Department of Environment and Conservation
TSD	treatment, storage, and disposal
VOC	volatile organic compound
WAG	waste area grouping
WM	Waste Management

1. INTRODUCTION

This site management plan for the Oak Ridge Reservation (ORR) describes the overall approach for addressing environmental contamination problems at the ORR Superfund site located in eastern Tennessee. The ORR consists of three major U.S. Department of Energy (DOE) installations constructed in the early to mid 1940s as research, development, and process facilities in support of the Manhattan Project. In addition to the three installations—Oak Ridge National Laboratory (ORNL), the Oak Ridge Y-12 Plant, and the Oak Ridge K-25 Site (formerly the Oak Ridge Gaseous Diffusion Plant)—the ORR Superfund Site also includes areas outside the installations, land used by the Oak Ridge Associated Universities and waterways that have been contaminated by releases from the DOE installations.

To date, ~400 areas (Appendix A) requiring evaluation have been identified. Cleanup of the ORR is expected to take two to three decades and cost several billion dollars. This site management plan provides a blueprint to guide this complex effort to ensure that the investigation and cleanup activities are carried out in an efficient and cost-effective manner.

This site management plan supplements the ORR Federal Facility Agreement (FFA), also known as an Interagency Agreement, hereafter referred to as "the Agreement." DOE, the U.S. Environmental Protection Agency (EPA), and the Tennessee Department of Environment and Conservation (TDEC), hereafter known as "the Parties," entered into this Agreement to comply with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and coordinate remediation activities undertaken on the ORR pursuant to CERCLA, the Resource Conservation and Recovery Act (RCRA), and the National Environmental Policy Act (NEPA).

1.1 FEDERAL FACILITIES AGREEMENT/ THE AGREEMENT GOAL

The Parties have a common goal to ensure that releases of hazardous substances to the environment associated with past waste management (WM) and operational activities at the ORR are adequately investigated and that appropriate remedial action is taken to protect human health and the environment.

The following are the general purposes of the Agreement:

- Establish a procedural framework and schedule for developing, implementing, and monitoring appropriate response actions at the ORR in accordance with CERCLA, RCRA, NEPA, appropriate DOE and EPA guidance and policy, and Tennessee state law.
- Coordinate response actions under CERCLA with closure, postclosure care, and corrective measures under way or planned under RCRA and applicable state laws, in such a manner as to maximize flexibility and preclude redundant activity.

- Minimize the duplication of investigative and analytical work and documentation and ensure the quality of data management.
- Expedite response actions with a minimum of delay.

1.2 SITE MANAGEMENT PLAN GOAL

To address contamination of the ORR as a whole, the Parties have partitioned the ORR into waste area groupings (WAGs)/operable units (OUs), that can be prioritized to achieve the most effective and rapid investigation and cleanup possible. The goal of this plan is to describe the rational basis for addressing these OUs, which includes defining the OUs and their interrelationships based on existing information. OUs may be redefined and work schedules adjusted as investigations progress and new data become available.

The following guidelines are basic to Environmental Restoration (ER) Program planning and implementation:

- Emphasis is placed on integrating ongoing activities into the overall effort and making maximal use of historical information in scoping and focusing site characterization and cleanup activities.
- Considerable attention and importance has been paid to coordinating and integrating the activities of other major programs with the ER Program to ensure that adequate resources are available, data are provided in a consistent format to satisfy multiprogram needs, and technical issues and remediation technologies are communicated throughout the ER Program so that consistent approaches are applied.
- Remedial action schedules for the OUs are dynamic and can be revised per mutual agreement of the Parties and appropriate public involvement.
- OUs may be redefined or reprioritized as the investigation progresses per mutual agreement of the Parties and appropriate public involvement.
- Work at the OUs will be managed to minimize waste and to prevent the recontamination of OUs previously remediated.

Information contained in this plan comes from detailed technical documents prepared to guide scientific studies, community participation efforts, and cleanup activities. These documents are available for public review at the Information Resource Center, 105 Broadway, Oak Ridge, Tennessee.

1.3 REMEDIATION PHILOSOPHY/STRATEGY

A fundamental goal of cooperative efforts by the Parties in implementing the Agreement is that remedial action be emphasized. This goal recognizes that no reasonable amount of investigation can resolve all uncertainty and that once remedial actions are initiated they must be able to accommodate divergence from original hypotheses. This approach promotes earlier remedy selection, flexibility for remedial action, and contingencies to react to new information discovered during investigations.

The Parties support this goal and will proceed with the ORR ER Program based on the following premises.

1. OUs consisting of remediation unit groupings have been initially identified for the ORR. These OUs will proceed through the formal CERCLA process encompassing investigation field activities, the selection of the appropriate remedial actions, design and construction, and unit-monitoring activities. During the performance of the remedial investigation (RI) phase, the initial OUs or WAGs may be further subdivided into additional OUs or combined to best expedite the identification and implementation of the remediation alternatives.

2. Early response actions (removal actions, interim remedial actions, and some routine maintenance actions) within defined OUs may also be taken to stabilize a site, prevent further degradation, or achieve significant risk reduction quickly. Emergency removal actions and time critical removal actions will be undertaken to protect human health and the environment from an imminent threat in the short term (i.e., the planning period prior to initiation of action is less than 6 months).

3. Unit characterization will be planned on the basis of optimizing field sampling and maximizing use of available data. For cases in which sufficient historical data exist to support or eliminate potential remedies, these data on the OUs will be used to converge early on remedial actions based on probable unit conditions. Measures will be implemented to effectively manage the uncertainties if the unit has not been fully characterized.

4. A pre-RI will be performed on units newly discovered or not already included in one of the existing OUs. Following the pre-RI, these units will be classified as requiring no further investigation, requiring immediate action to stabilize the area and provide controlled access, or requiring further investigation. Units requiring further investigation may be added to an existing OU or combined with other units to create a new OU.

5. Remediation of many ORR waste areas poses challenges unlike those encountered in cleanup of non-DOE Superfund sites. For example, many of the sites have hazardous as well as radioactive contamination, which limit the commercially available treatment methods used at other Superfund sites. Excavating and treating some radioactive wastes may pose unacceptable risk, leading therefore to the frequent use of consolidation and containment remedies. Thus, final remediation schedules will most likely be longer than those encountered at non-DOE Superfund sites and involve interim actions to reduce the risk to human health and the environment until the final remediation.

1.4 CONSOLIDATION OF REGULATORY INTERACTION

1.4.1 RCRA Integration into CERCLA

The Agreement will establish a procedural framework and schedule for developing and implementing response actions under CERCLA at the ORR. The Parties to the Agreement recognize that current and future hazardous waste management activities may be subject to RCRA permit requirements under federal and state laws. The Parties to the Agreement recognize that on-site CERCLA response actions are not subject to federal or state permits per CERCLA 121(e)(1). However, RCRA shall be considered an applicable or relevant and appropriate requirement (ARAR) per CERCLA 121(d). Hence, current and future response actions at the ORR will achieve comprehensive remediation of releases or threatened releases of hazardous substances, pollutants, and contaminants. RCRA/Hazardous and Solid Waste Amendments (HSWA) administrative requirements and permitting activities will be integrated as necessary into the CERCLA process.

In 1984, DOE determined it would close rather than seek operating permits for 13 interim status hazardous waste management units.

S-3 Ponds	Oil Landfarm
Chestnut Ridge Sediment Disposal Basin	Chestnut Ridge Security Pits
New Hope Pond	Kerr Hollow Quarry
Bear Creek Burial Ground	9409-5 Tank Storage Facility
ORNL SWSA 6	Interim Drum Yard
K-1407-B Pond	K-1407-C Pond
Garage Underground Tanks	

The RCRA closure schedules for these units have not in all cases accommodated the CERCLA investigations and decision-making process for releases associated with these and other nearby sites. As much as possible, these interim unit closures will try to accommodate the intentions of CERCLA and RCRA monitoring and will be incorporated into the appropriate OU Records of Decision (ROD) addressing these units.

EPA, DOE, and TDEC have negotiated the Agreement to ensure that the environmental impacts associated with past and present activities at the ORR are thoroughly investigated and that appropriate remedial actions or corrective measures are taken as necessary to protect human health and the environment. This Agreement will establish a procedural framework and schedule for developing, implementing, and monitoring response actions at the ORR in accordance with CERCLA. The three parties to the Agreement intend to coordinate the DOE CERCLA response obligations with the corrective measures required under the HSWA permit as these units are designated inactive. Response actions under the Agreement will achieve comprehensive remediation of releases or threatened releases of hazardous substances, hazardous wastes (including hazardous constituents), pollutants, or contaminants at or from the ORR. For this reason, the Agreement supplements corrective actions under the HSWA permit with response actions under CERCLA for releases not presently addressed in the HSWA permit. The Parties to the Agreement, therefore, intend that activities covered by the Agreement will achieve compliance with CERCLA and all other environmental regulations.

The Agreement expands the RCRA facility assessments and investigations presently under way at the ORR with requirements to investigate (1) releases at or from units not included in the RCRA permit and (2) releases of hazardous or radioactive substances not regulated by DOE's RCRA HSWA permit. The Parties to the Agreement intend to coordinate and consolidate these assessments, investigations, and other response actions, as well as the administrative records developed for activities under the RCRA HSWA permit and the public participation requirements of CERCLA. The Parties to the Agreement intend to modify the RCRA HSWA permit, as appropriate, to provide that remedial actions selected under the agreement for inactive units will qualify as corrective measures to satisfy Sects. 3004(u) and (v) of RCRA. With respect to releases of hazardous constituents from facilities that are or were authorized to operate under Sect. 3005(e) of RCRA, RCRA shall also be considered an ARAR under Sect. 121 of CERCLA.

1.4.2 National Environmental Policy Act Integration with the CERCLA Process

DOE Order 5400.4 further states that where DOE remedial actions under CERCLA trigger the procedures set forth in NEPA, it is the policy of DOE to integrate the procedural and documentational requirements of CERCLA and NEPA, wherever practical. The primary instrument for this integration will be the RI/feasibility study (FS) process, which is to be supplemented as needed to meet the procedural and documentational requirements of NEPA. In addition, the public review processes of CERCLA and NEPA will be combined for RI/FS-NEPA documents, where appropriate. The key element for the integration process is determining the level of NEPA documentation required for a remedial action project prior to entering the RI/FS scoping process or as soon thereafter as is possible so that appropriate RI/FS-NEPA planning is achieved early in the process. DOE Order 5440.1C provides policy guidance for planning and executing NEPA on DOE projects.

1.4.3 Natural Resource Damage Assessment Implementation during the CERCLA Process

DOE Order 5400.4 states that where DOE determines that natural resources for which DOE has been granted trusteeship may have been potentially injured by a release, DOE will implement the Natural Resource Damage Assessment (NRDA) process consistent with the requirements of the NRDA regulations found at Title 43 Code of Federal Regulations (CFR) Part 11 (43 CFR 11).

DOE serves a dual role when addressing releases occurring on the ORR. DOE acts in the capacity of lead agency in investigating the extent of contamination, the nature of the hazard to human health and the environment, and in managing the remedial action process. DOE also acts in the capacity of trustee to determine the residual injury to natural resources which may remain after remedial action is completed.

These roles are not incompatible but are complicated because (1) DOE shares trusteeship with other federal or state agencies that are not regulatory agencies for CERCLA actions and thus coordinates NRDA activities with parties that are not a party to the existing FFA and (2) the informational requirements of CERCLA and NRDA are similar but not the same in all instances. Additional guidance has been provided by DOE Headquarters addressing these situations so that both the CERCLA process and the NRDA process can proceed simultaneously and at minimal costs to the public. DOE guidance is to develop agreements with cotrustees to coordinate trustees' activities, share information, and whenever practical use the information developed in the CERCLA remedial action process to achieve NRDA objectives.

DOE has taken a proactive role in NRDA activities on the ORR and is working with cotrustees to develop an agreement in principal—strategies and procedures for conducting NRDA activities on the ORR. DOE is providing cotrustees information on schedule and scope of planned CERCLA activities and the results of characterization and ecological studies so that cotrustees may have an opportunity to use the CERCLA process to obtain information required for NRDA evaluations.

1.4.4 Incorporation of Other State and Federal Laws into the CERCLA Process

Incorporation of other state and federal laws (e.g., those relating to water, air, safety, transportation, etc.) into the CERCLA process is accomplished through the identification of ARARs during the remedial action process as required under the NCP (40 CFR 300).

A review of all laws that might potentially be ARARs to remedial action activities on the ORR is conducted on an annual basis. Additionally, through each phase of the remedial action process, a review of chemical-, location-, or action-specific requirements is conducted on a project-by-project basis. For example, a remedial action project located in a wetland or floodplain would be required to comply with laws governing the protection of that area in addition to all requirements of CERCLA; those additional requirements would be location-specific ARARs. Chemical-specific ARARS set numerical limits for acceptable levels of contaminants in environmental media; in the event that both a state and federal standard exist for an identical situation, the more stringent requirement takes precedence. Should a project require movement of contaminated materials across public roads, the Department of Transportation regulations would be action-specific ARARs to CERCLA requirements or RCRA requirements for handling those materials. Waivers for compliance with ARARs may be provided by regulatory agencies when full compliance with an ARAR would adversely impact CERCLA activities or is impracticable under the circumstances.

In addition to the requirement in the NCP to identify ARARs, the NCP specifically requires compliance with worker safety and health regulations found at 29 CFR 1910.120 [integrating the Occupational Safety and Health Act (OSHA)] during CERCLA activities. Because the ORR remedial action activities often involve radioactive contaminants, other worker protection laws specific to nuclear facilities and the handling of nuclear materials may apply. These laws are implemented through DOE Orders and would be action-specific ARARs or to-be-considered guidance on CERCLA projects.

2. OAK RIDGE RESERVATION REMEDIATION STRATEGY

2.1 MISSION

The ORR spans ~37,000 acres of federally owned land in Oak Ridge, Tennessee, and is bounded on the north and east by the city of Oak Ridge (population 27,500) and on the south and west by the Clinch River (a map of the Reservation can be found in Appendix B). The area surrounding the ORR is predominately rural, used largely for residences, small farms, and pasture land. Fishing, boating, water skiing, and swimming are favorite recreational activities in the area.

ORNL, the K-25 Site, and the Y-12 Plant have generated a variety of hazardous substances, including radioactive, nonradioactive, and mixed wastes, some of which have been released into the environment at the ORR. The environmental setting of the Reservation is complex hydrologically and geologically. Within this complex environmental setting, the contaminated areas are quite diverse in both the nature and extent of contamination.

The mission of the ORR ER Program is to conduct investigations and to take actions to reduce risk to human health and the environment resulting from past operations and waste disposal practices. The Reservation's location influences cleanup limits and response-time requirements. The magnitude of financial, qualified man power, and special equipment resources needed for remediation, and the lack of available technology for handling and disposing of wastes and contaminated soils and groundwater, dictate a long-term effort. Some early response actions will be required to protect human health and the environment prior to the selection and implementation of final remediation actions.

2.2 STRATEGY

The remediation process for the ORR is being led by the DOE Oak Ridge Operations (DOE-ORO) office in conjunction with EPA Region IV and TDEC. This process includes the public as an important participant in all decisions concerning the remediation of the Reservation. Task teams, made up of representatives of the Parties, have been empowered to address the removal actions and pre-RIs at the Reservation to ensure immediate attention is paid to areas in which risk to the public/workers and the environment is of greatest concern.

The remediation process has the flexibility to support the use of early response activities (Sect. 3.2.2): removal actions, routine maintenance actions, and interim remedial actions. This allows the program to reduce the environmental risk by addressing key parts of contaminated areas and selected releases of contaminants to the environment as steps toward final remediation of the Reservation. Management of the integration of early response actions results into the final remediation activities requires a comprehensive and coordinated strategy.

2.2.1 Objective

The ORR ER Program challenge and strategy is to conduct cost-effective and technically sound remediation actions to mitigate contaminant releases, reduce risk, and comply with environmental regulations to provide rapid reductions in contaminant releases and to implement and verify final remedies for contaminated areas. Through strategic planning and utilization of the technical resources in Oak Ridge, rapid and innovative actions will be implemented that address the major contaminant releases and their sources in a prioritized and hierarchical fashion. This will be done in such a manner that all efforts support the selection and implementation of final remedies. All actions will be undertaken with the full participation of the public.

2.2.2 Approach

2.2.2.1 Operable units

An OU is defined as a portion of a WAG for which an RI/FS will be performed, including any early response actions. On the ORR, many of the remediation areas (Appendix A) were grouped according not only to their proximity but also by common physical and hydrogeological parameters. However, OU designations did not allow for the recognition that sources contributing to groundwater contamination that is part of one OU often also contribute to the groundwater contamination that is part of another OU. To remedy this, the current OU strategy addresses the integration or mingling of releases from adjacent contaminant sources by establishing groundwater operable units. Essentially all contaminants transported out of the integrator OUs are the result of a coupled shallow groundwater and surface water system. Identification of groundwater OUs with multiple sources of contaminants will facilitate comprehensive monitoring of the water pathways and prioritization of contaminant source areas. This approach will also preclude redundant groundwater investigations. All contaminants transported out of the groundwater OUs are the result of a coupled shallow groundwater and surface water system. Small watersheds with multiple sources of contaminants were identified at the OUs to facilitate monitoring and prioritization of contaminant source areas.

Figure 2.1 illustrates groundwater discharge and surface water receptors. Surface water drainage systems are integrators of contaminant transport from a variety of sources of contamination located both on and off of the ORR. This approach recognizes that the Clinch River/Watts Bar Reservoir is ultimately the integrator of all groundwater/surface water contamination from the ORR.

To effectively evaluate the cumulative impact of releases from multiple sources of contamination, the Parties have agreed to a structured approach for the ORR based on studies of the groundwater and surface water, which in some instances will be addressed separately from studies of the sources of contamination. Based on the realization of the complexity of the hydrogeologic regime of the ORR, together with the fact that there are numerous sources contributing to groundwater contamination within a geographical area, it was agreed that more timely investigations, at lower cost, can be achieved at some OUs by addressing the sources of contamination separately. The result will be more immediate attention to controlling the sources of contamination [resulting in RODs for interim actions] while continuing to investigate longer term remediation for both the sources of contamination and/or hydrogeologic regimes (resulting in RODs for final action).

Upon completion of remedial actions performed at OUs to control the source of the contamination, sufficient monitoring data from the groundwater/surface water OUs will be available to determine if the remedial actions taken to control/remove the sources of the contamination have been effective, and, if not, further remediation would be undertaken in the appropriate OUs identified for final remedial action. OU maps and descriptions are provided in Appendix B for ORNL, the Oak Ridge K-25 Site, the Oak Ridge Y-12 Plant, areas outside the installations—land used by Oak Ridge Associated Universities—and waterways.

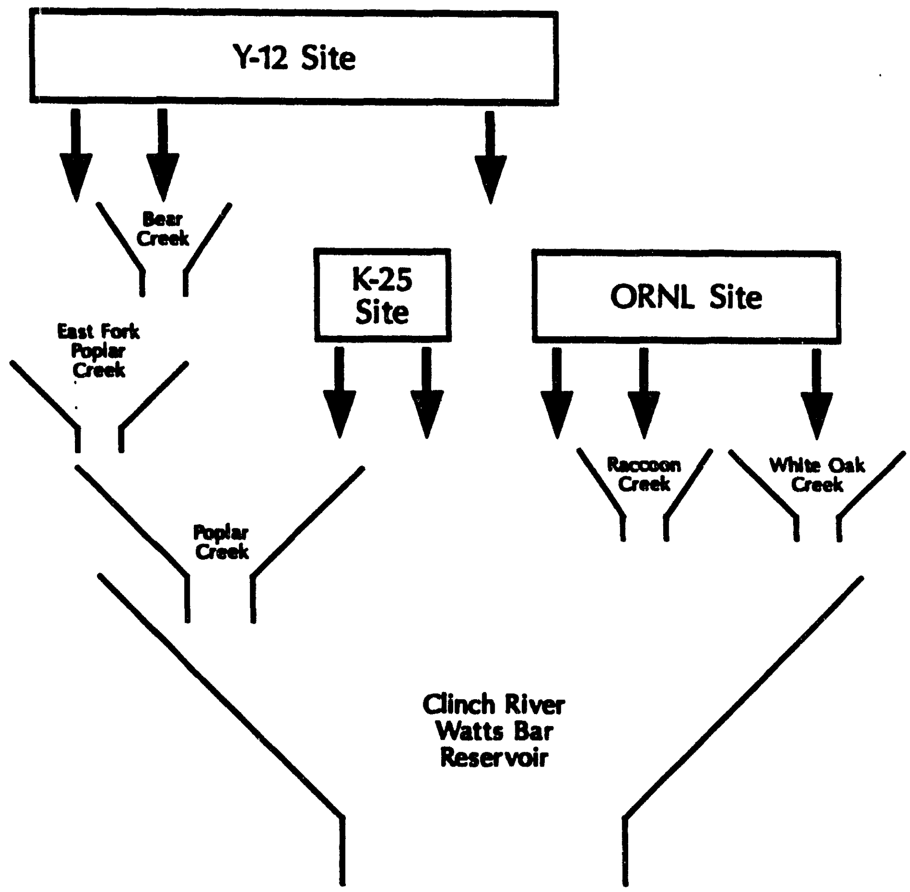


Fig. 2.1. Groundwater discharge and surface water receptors.

2.2.2.2 Study areas

The existing information on the other remediation areas have a small probability of contributing to environmental contamination, or the information on these areas was insufficient to determine the environmental damage. These areas (included in Appendix A) will be further assessed under the pre-RI phase and designated for potential inclusion into new or existing OUs. The Parties will use data from pre-RIs to determine the status (no further investigation, removal action, or operable unit) and the prioritization for those sites that require further action.

2.2.3 Phases of the Remedial Action Strategy

The following are the remedial action phases that help plan and manage the activities executed to achieve final cleanup actions. These activities support the comprehensive and coordinated OU strategy that guides the implementation of remedial actions at the ORR.

Step 1: Conduct scoping workshops for each potential remediation project. The purposes of the scoping workshops are to (1) review available historical information and existing data on the OU; (2) identify the potential contamination problems, associated potential risks to human health and the environment; (3) identify the likely remediation alternatives; and (4) reach agreement on the need for additional data and the data quality objectives (DQOs) for decisions on remedial action.

Step 2: Identify and conduct early response actions focused on key areas to minimize additional environmental contamination and contaminant release/transport to surface water and local groundwater. Early response actions can be taken under the CERCLA process as removal actions, routine maintenance actions, and interim remedial actions, which may then be linked with additional actions for a contaminated study area or OU.

- Conduct monitoring at key locations to quantify and track contaminant releases from the Reservation and identify the major source areas contributing to contaminant transport. Monitoring also supports the investigations of the key pathways and processes for contaminant release.
- Perform risk screening analyses to prioritize specific areas for early response actions.

Step 3: Conduct RIs for OUs (in parallel with Step 2) to provide the information needed to formulate and implement approaches resulting in RODs for either interim or final remedial solutions for those OUs.

- Work with public participation to establish land use objectives for each contaminated area to be consistent with current and future uses for adjacent and downgradient areas and to allow cost-effective remedial actions.
- Conduct technology development and demonstration efforts as required, based on anticipated remedial decisions, to provide effective tools for remediation.

Step 4: Conduct an FS, and with public involvement, select among the technological alternatives for achieving final remedies. Examples of the selection criteria are ease of implementation, worker risk, cost, public health risk, and environmental risk in the context of future land use.

Step 5: Conduct remediation to achieve the risk reduction commensurate with planned or potential future land use in compliance with environmental regulations.

Step 6: Conduct monitoring at key locations to track the effectiveness of interim and final remedial actions, evaluate the need for contingent actions, and identify remaining or new areas of concern. Conduct additional actions, as needed, prior to final remediation or as contingencies following final actions.

Step 7: Prepare documentation necessary to remove the Reservation from the National Priorities List following the completion of all remediation response activities.

2.3 STRATEGIC CHALLENGES

To implement the strategy discussed in the previous section for conducting ER on the Reservation, several strategic challenges must be considered. Because these challenges—lack of consensus on future land use, lack of remediation technologies, inadequate waste management facilities, communication impeded by complex and separate facilities, and lack of comprehensive prioritization guidelines—will impede if not prevent the completion of interim and final remedial actions, solutions need to be found. The following sections will describe the strategic challenges and how they impact the ER Program on the ORR.

2.3.1 Communications

To make wise remedial action decisions, communication among the public participants is essential. It is necessary for all public participants to understand the following:

- the risk associated with the areas on the ORR, how risk is used in decision-making and prioritization, and the relative risk of the areas on the Reservation to other natural and manmade risks;
- the strategy of the ORR ER Program and the strategic challenges that it faces;
- the method of accomplishment as mandated by environmental regulations, the NCP, and the FFA; and
- the current schedules so that documents can be adequately reviewed.

The need for communication of these various topics to a large and diverse group of public participants is a challenge for the ER Program. Communication is being achieved in public meetings, advisory groups, and regulatory working groups, but additional efforts are still needed to meet this challenge.

2.3.2 Future Land Use

The mission of the ORR ER Program is inadequate for planning and implementing remedial actions. Quantifiable cleanup objectives are necessary for contaminated media remediation. Before cleanup criteria can be established, it is necessary to know the future use of the land (e.g., restricted, industrial, agricultural, recreational, national environmental research park, or residential). The future land use will dictate to what extent the site must be remediated.

2.3.3 Remediation Technologies

Technology development is driven by the need to reduce risk from contamination and to reduce the cost of remediation. Until land use and subsequent cleanup criteria are known, it is not possible to realistically assess what, if any, technologies are needed. If the future land use is restricted and the contaminants will be left in place, then technologies for hydrologic isolation would be emphasized. If the future land use is unrestricted, then exhumation technologies would be emphasized.

To develop technologies that reduce risk more effectively or reduce the cost of remediation, it is necessary to know the end points of remediation so that the correct risk and cost drivers are understood. Otherwise, inappropriate technologies may be developed.

A technology development program has been initiated to identify, develop, and demonstrate technologies focused on the highest priority remediation needs for the ORR. An advisory committee composed of appropriate public participants will be involved in all phases of the program. The following are objectives of the technology development program:

- Identify, develop, and demonstrate technologies to address the highest priority needs on the ORR. This effort will include technologies for characterization, source control, retrieval, and treatment.
- Prioritize on the basis of providing cost-efficient risk reduction.
- Coordinate efforts with the Martin Marietta Energy Systems, Inc., Center for Environmental Technology, the DOE Office of Technology Development, other DOE ER programs, and other entities performing such efforts to leverage resources and ensure the highest technical quality.
- Coordinate with ongoing site remediation efforts to ensure continued harmony with strategic planning and to accelerate selection and implementation of remedial actions.
- Communicate and transfer technologies to operational status on the ORR and elsewhere.

2.3.4 Waste Management Facilities

During remediation activities, wastes are generated that must be managed. Depending on the nature and quantity of the waste, it may be handled on site, on the Reservation, or at another site. In any case, appropriate facilities must be available when needed or the remediation activities will be delayed. The nature and quantity of waste to be generated and the subsequent type of waste management facilities needed depend on the objective or the remedial action, which is dependent on the future use of the land. Whether contaminants will be left in place, treated in place, exhumed and stored, or exhumed and disposed of makes a tremendous difference in the type and size of waste management facilities needed. Long-range planning for waste management facilities makes assumptions concerning the objectives of remediation so that facilities will be available, but until the land use is defined, the possibility of too few or too many facilities exists.

2.3.5 Prioritization

Because of the large number of remediation areas on the ORR and the finite resources available to address these areas, a method of prioritizing the areas and the actions based on risk has been developed. The ER Program is faced with the challenge to use this risk-based prioritization system to make decisions about early actions, interim actions, final actions, characterization and monitoring, surveillance and maintenance (S&M), and technology development consistently across the entire Reservation. Only by consistently applying the prioritization can defensible decisions be made for allocating resources.

The three parameters currently used to evaluate activities are human-health risk, environmental and ecological risk impacts, and regulatory obligations. OUs are classified in this process as having high, intermediate, or low cleanup priority. The priorities are evaluated by scoring each parameter. Additional risk assessment activities are under way to better prioritize the OUs while supporting the strategic process. These risk assessment activities are explained in detail in Chap. 3.

Table 2.1 reflects the current ORR OU ER Program priorities. It is separated into columns representing DOEs budgeting of the three installations and Oak Ridge Associated Universities/Clinch River areas. Each OU was evaluated based on the three weighted parameters. The OUs within each installation/area are ***listed in order of highest priority*** based on these categories, and detailed descriptions of the OUs are provided in Appendix B.

Table 2.1. Oak Ridge Reservation operable unit prioritization table

Other[a]	K-25 Site	ORNL	Y-12 Plant
Clinch River	K-1070	WAG[b] 5	Upper EFPC[c] OU 1
Lower EFPC	K-901	WAG 10 OU 3	Bear Creek OU 4
Lower Watts Bar Reservoir	K-770	WAG 1 OU 1	Chestnut Ridge OU 1
South Campus	K-1420	WAG 1 OU 3	Bear Creek OU 1
	K-1407	WAG 1 OU 4	Chestnut Ridge OU 4
	K-1401	WAG 4	Chestnut Ridge OU 2
	K-1004	WAG 1 OU 2	Bear Creek OU 2
	K-1007	WAG 2 OU 1	Upper EFPC OU 3
	K-1064	WAG 1 OU 5	Upper EFPC OU 2
	K-1410	WAG 2 OU 2	Chestnut Ridge OU 3[d]
	K-25 Groundwater	WAG 10 OU 2	
	K-33	WAG 7 OU 1	Y-12 Plant Plating Shop[d]
	K-29	WAG 3	
	K-1413	WAG 9	
		WAG 6	
		WAG 8	
		WAG 1 OU 10	
		WAG 1 OU 9	
		WAG 7 OU 2	
		WAG 11	
		WAG 13	
		WAG 1 OU 6	
		WAG 1 OU 7	
		WAG 1 OU 8	
		WAG 10 OU 1	

[a]Includes Clinch River, Oak Ridge Associated Universities, and Lower EFPC OUs.
[b]WAG = waste area grouping.
[c]EFPC = East Fork Poplar Creek.
[d]Remedial actions complete.

3. THE RESERVATION REMEDIATION PROCESS

Implementation of the remediation process on the ORR is a complex and painstaking process. Therefore, it is necessary that a strategy be formulated and agreed on by the Parties. The strategy will serve as the basis for its implementation.

The process, as described below, is the result of regulatory requirements, meetings that have been held with the Parties, and lessons that have been learned from past activities. The strategy encourages communication among the Parties and provides the necessary flexibility to reach early remedial action decisions when sufficient information is available. The flexibility provided within the strategy is supported by empowered task teams, distinct paths, decision points, and scoping workshops.

3.1 RISK ASSESSMENT STRATEGY

Risk assessment is a process in which the probability or likelihood of adverse human health or ecological effects resulting from exposure to hazardous/radioactive contaminants is evaluated. The remediation process emphasizes the use of risk assessment to justify the need to take action at a site, to establish preliminary and final remediation goals/criteria, and as a baseline against which alternatives can be compared. In addition, risk assessment can be used to evaluate the net performance of a selected remediation alternative by comparing the risk reduction achieved with the risk associated with generated wastes and worker risks associated with implementation.

The primary components of the risk assessment strategy are the qualitative risk/cost-based prioritization, the most likely exposure (MLE) and integration point (IP) assessments, and the baseline risk assessment. The strategy focuses primarily on the RI phase of a project by evaluating the need to take action, prioritizing the actions that must be taken, and selecting the appropriate action to take whether it be an interim or a final action. Each of the types of assessments/activities to be performed, when they are to be performed, and the end use of their results are outlined in Fig. 3.1 and discussed in the following sections of this document.

3.1.1 Qualitative Risk/Cost-Based Prioritization

As appropriate, a formalized, qualitative risk- and cost-based prioritization will be conducted for ER areas. The objectives of this qualitative prioritization are to (1) provide a qualitative assessment of the potential risks posed to the environment, public, and site personnel by ER activities; (2) ensure that prioritization efforts are consistent across the program; and (3) facilitate the allocation of resources in a defensible, cost-effective manner. The qualitative prioritization effort is independent of the other risk assessment activities to be performed for the ORR. This effort will be revisited, as necessary, to ensure that as more data become available and additional area of concern are identified the prioritization will reflect the relative risk/cost-based prioritization of the study areas and OUs as accurately as possible.

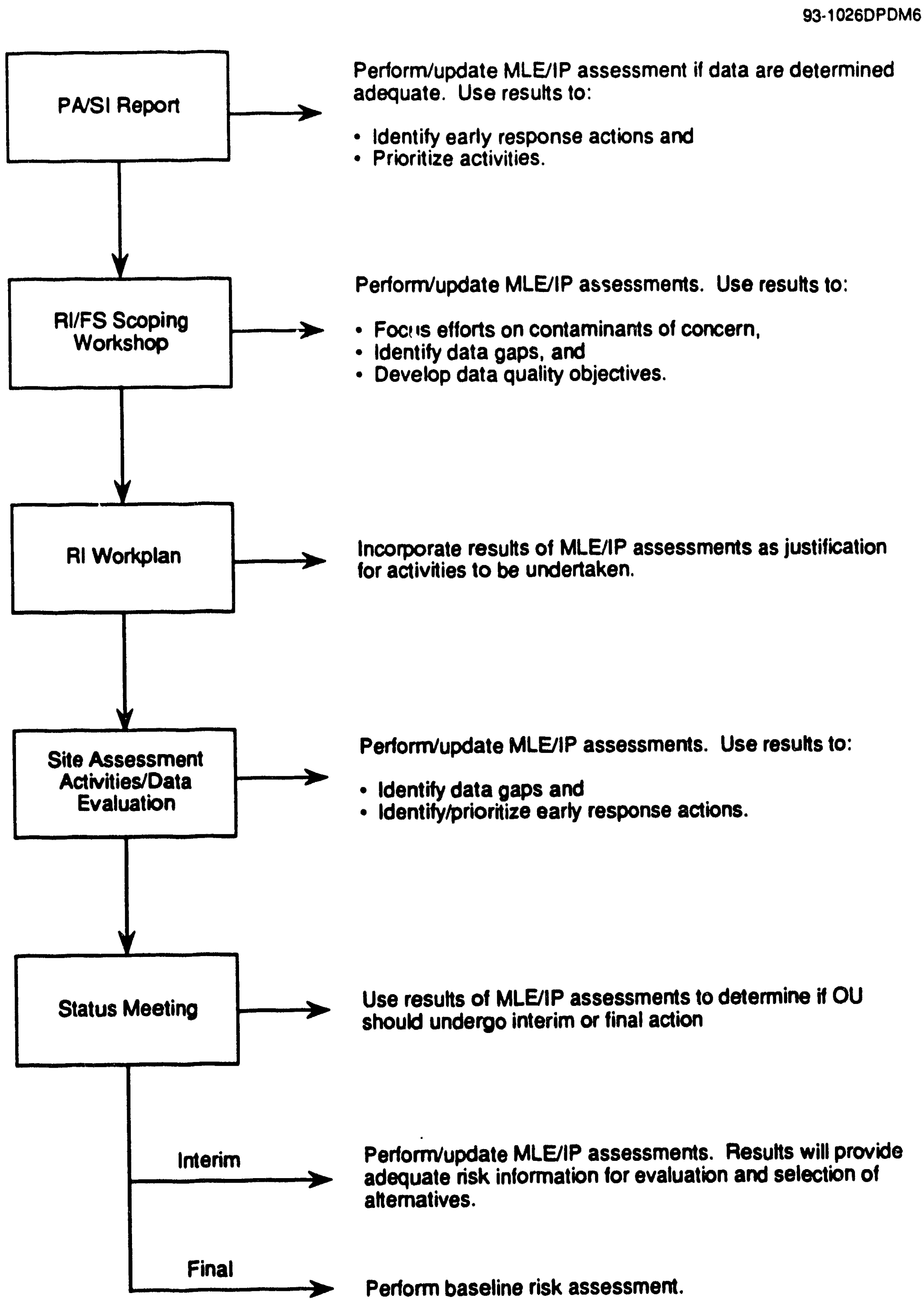


Fig. 3.1. Integrating risk assessment in the Reservation remediation process.

Risk scores will be derived for activities by multiplying a numerical weight representing the severity of an impact by the likelihood of occurrence of that impact. The impacts evaluated will fall into seven categories: public health and safety, environmental protection, site worker safety, regulatory compliance, mission and operational performance, and business efficiency.

This activity will be conducted for all ER activities regardless of their current status (study area or OU). The information generated will be used in conjunction with the results of MLE and IP assessments to ensure that the prioritization of ER activities is both defensible and cost effective.

3.1.2 Integration Point and Most Likely Exposure Assessments

The risk assessment strategy is a two-phased approach. The first phase is comprised of two components—the MLE assessment and the IP assessment—and is described in detail below. The second phase is a baseline risk assessment performed as part of the RI activities; this second phase will be discussed in Sect. 3.1.3.

The MLE and IP assessments are tailored for identifying sites for which early response actions are warranted, prioritizing those early response actions, justifying no further investigation determination, and the prioritizing final response actions. The MLE assessment was developed for use in conjunction with the results of the IP assessment to identify those sites of highest priority relative to both on-site and off-site risk, respectively. The MLE and IP assessments, as proposed, utilize existing (monitoring, compliance, preliminary assessment/site inspection, etc.) data and can be performed as part of the pre-RI activities or during/subsequent to the generation of the RI work plan to identify, prioritize, and/or support early response actions. Once performed, the MLE and IP assessments can be easily updated with new data as it becomes available.

3.1.2.1 Most likely exposure assessment

The MLE assessment, generally, is performed using the methodology outlined in the *Risk Assessment Guidance for Superfund: Volume I, Human Health Evaluation Manual* (Part A) EPA/540/1-89/002. However, the MLE assessment is limited to the evaluation of four primary exposure pathways: (1) external exposure to radiation in soil/sediment, (2) ingestion of soil/sediment, (3) inhalation of volatile compounds and wind-generated dust, and (4) dermal contact with soil/sediment. In addition, the intake and exposure duration parameters have been modified to reflect the "most likely exposure" that would occur on site. Thus, the MLE assessment provides the risk manager with information concerning the relative on-site risk to workers.

3.1.2.2 Integration point assessment

For ORR sites, the majority of any contaminant exposure to the public results from contact with or ingestion of surface water, the major transport media of contaminant concentrations to off-site receptors. Other potential transport mechanisms such as the food chain, the air pathway, and groundwater transport, are not currently primary sources of off-site exposures. The IP assessment is designed to actively use monitoring, surveillance, compliance, and RI data (if available) to evaluate the off-site risk from a variety of sources that input into the various surface water OUs. The following are the purpose of these data:

- Establish a baseline for evaluating the risk at different points within the surface water OUs.
- Identify and prioritize areas that are serving as sources of contamination to the surface water OUs.
- Establish the degree of risk reduction an action at an OU can potentially achieve with respect to the associated surface water OU.

3.1.3 Baseline Risk Assessment

A baseline risk assessment is performed for all sites undergoing final remedial action. The objectives of the baseline risk assessment process are to provide the following:

- an analysis of the risks that might exist if no remediation or institutional controls were applied to a site, which would help determine the need for action at sites;
- a basis for determining levels of chemicals that can remain on site and still be adequately protective of public health;
- a basis for comparing potential health impacts of various remedial alternatives; and
- a consistent process for evaluating and documenting public health threats at sites.

The number and concentration of contaminants detected, the exposure scenarios (i.e., residential, industrial, agricultural, etc.) evaluated, and the available toxicity information for the contaminants of concern determine the degree of rigor/complexity associated with a baseline risk assessment. In other words, exposure scenarios evaluated for one OU may not be appropriate/realistic for a different OU based on the current and/or potential future land use designation of the area, as determined during the RI scoping workshop (Sect. 3.2.1).

3.2 CERCLA PROCESS IMPLEMENTATION

The implementation of the remediation process on the ORR will generally follow the process described in *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA 1988). The ORR remediation process (Fig. 3.2) contains all of the elements required by the EPA guidance plus additional pre-RI activities and interaction (i.e., scoping workshop and status meetings) between the Parties. The strategy emphasizes using early response actions (e.g., removal actions, some routine maintenance actions, and interim remedial actions) to address contaminated areas or selected releases of contaminants to the environment to ensure that immediate attention is given to areas where risk to the public, workers, and/or the environment is unacceptable. The strategy also emphasizes using risk assessment for identifying sites for which early response actions are warranted, prioritizing early and final response actions, and providing a baseline against which alternatives can be compared, cleanup criteria can be established, and alternative performance can be assessed. Note in Fig. 3.2 that there are two exit paths from the ER Program:

- An ROD for final action on a remediation area has been signed by the Parties, the remediation activities have been performed, and postconstruction monitoring per CERCLA requirements have been satisfactorily performed.

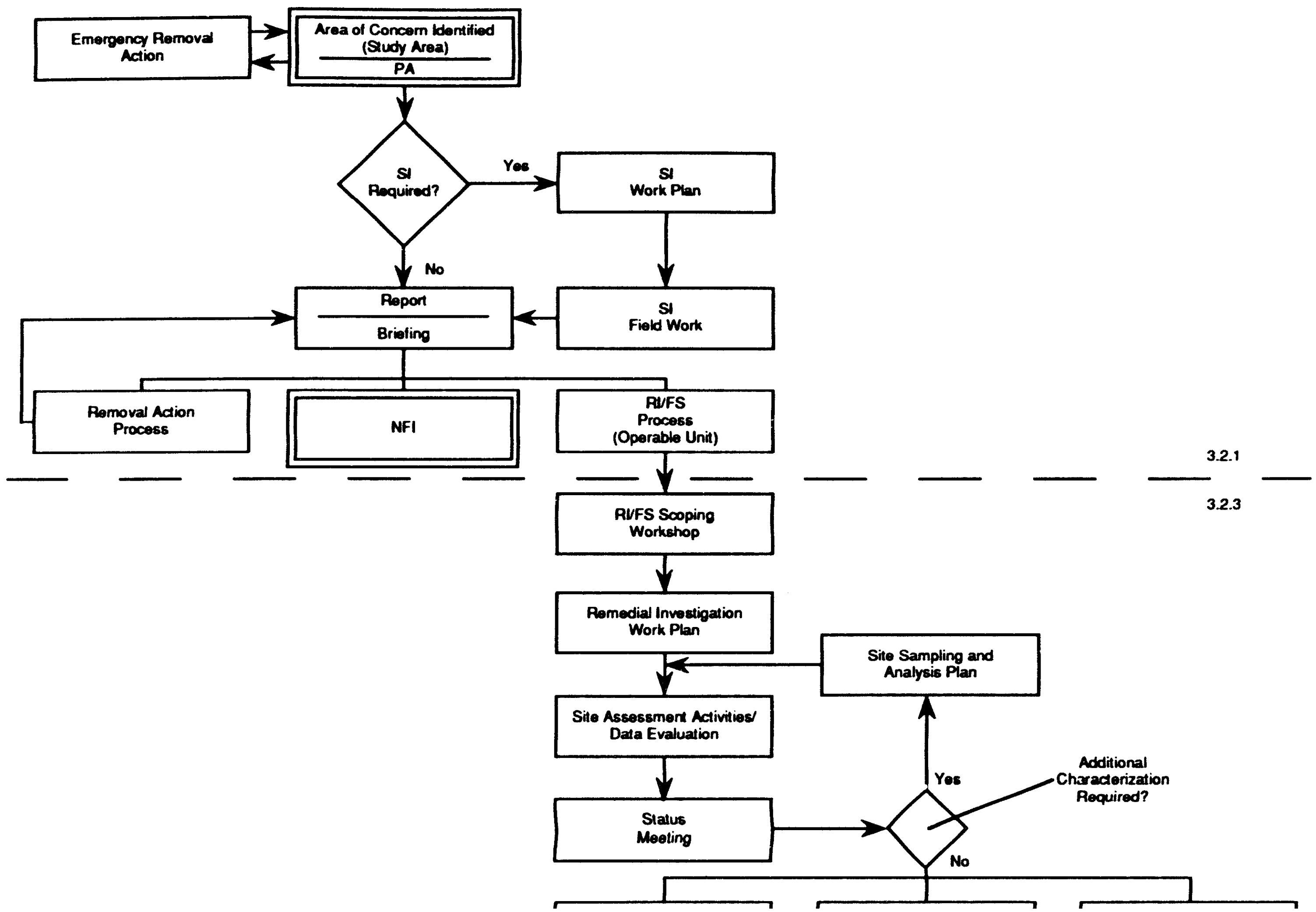
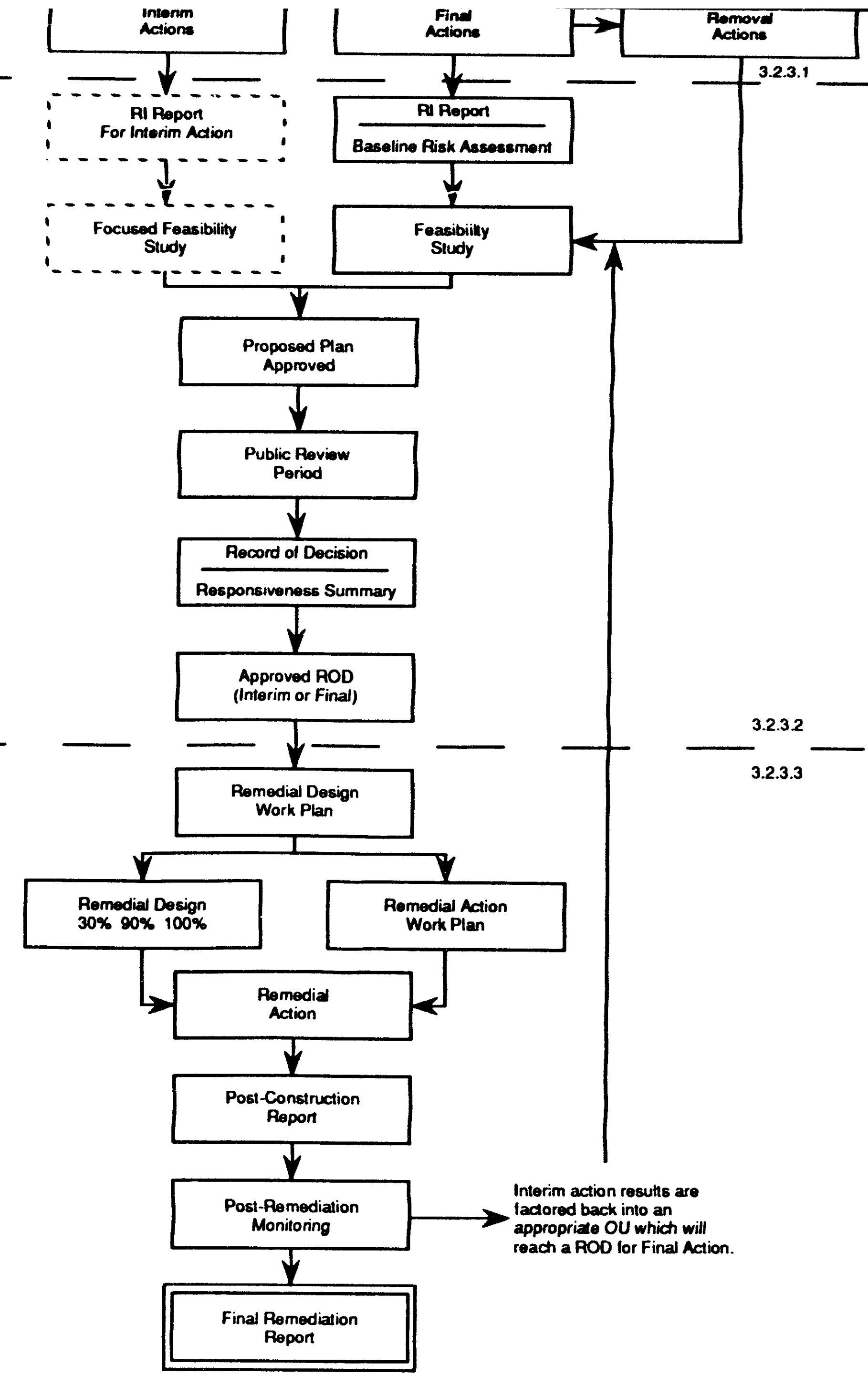


Fig. 3.2. Oak Ridge Rese

vation remediation process.



- The Parties determine that no further investigation is required based on the results of the pre-RI work for a remediation area within a study area group.

Areas of concern (see Appendix A) at the ORR are grouped as either (1) study areas subject to pre-RI or (2) OUs for remedial action. As additional areas are identified, they will be reviewed for removal action classification (Sect. 3.2.1) or placed in a study area group for pre-RI. If a removal action is determined appropriate, an empowered removal action task team will meet to determine the appropriate approach for the area, the prioritization, and the resources and schedule necessary to support those activities.

Areas of concern that have already undergone pre-RI have been grouped into OUs or WAGs. These OUs/WAGs will undergo the remediation process as outlined in Fig. 3.2, with risk assessments being performed during the RI investigation to determine the need for early response actions. Subsequent to the RI field work, but prior to the preparation of the RI report/baseline risk assessment, a status meeting will be held with the Parties to decide whether an early response action, final action, or a combination of both is feasible and/or appropriate.

Figure 3.3 illustrates the variations of the remediation process under which an OU/WAG can proceed to final action. Again, not all remedial activities continue at an OU until an ROD for final action has been signed by the Parties and the remediation activities have been performed. Monitoring information collected for OUs for which an interim action ROD is developed will be incorporated into the appropriate OU, which will reach a final action decision.

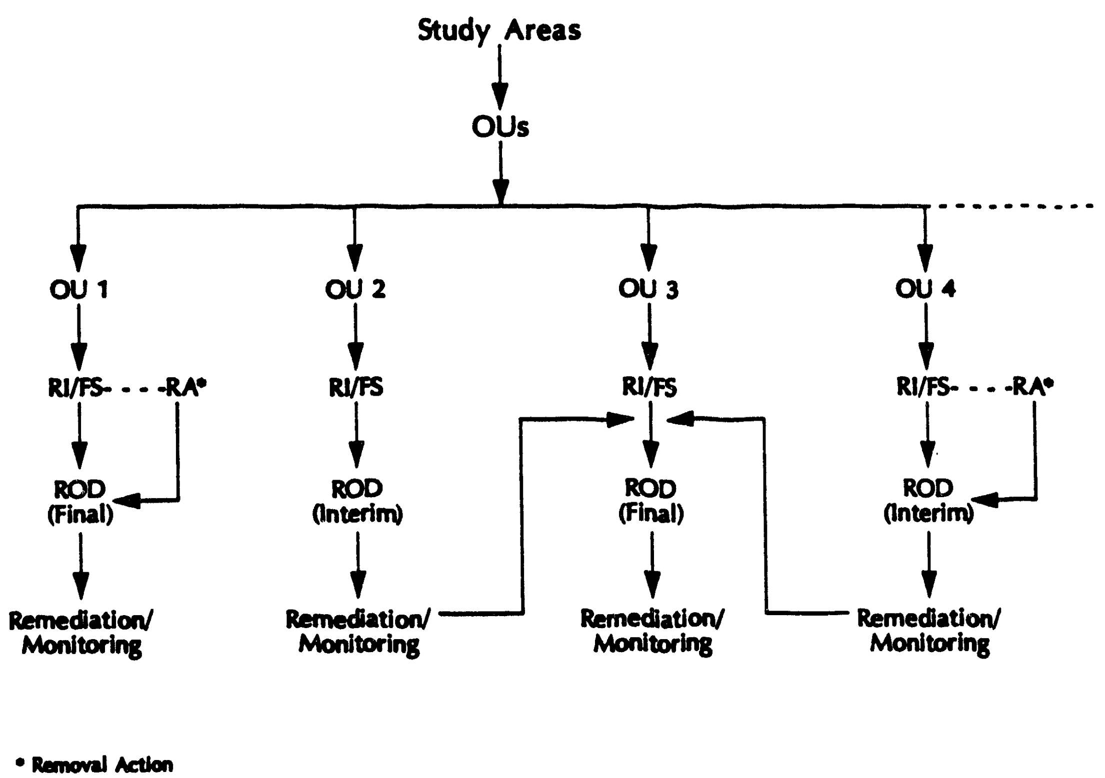


Fig. 3.3. Operable unit to final Record of Decision.

3.2.1 Study Areas: Preremedial Investigation Activities

Placement of the ORR on the CERCLA National Priorities List, required an RI and FS to be initiated within 6 months. Several potential areas of concern have been discovered since the pre-RI was used to place the ORR on the National Priorities List, and because of the Reservation size and complexity additional discoveries are likely. Several solid waste management units identified and documented per the Hazardous and Solid Waste Amendments permit and other areas of concern have not yet undergone pre-RI. In addition, several land units closed pursuant to RCRA requirement are to be evaluated pursuant to CERCLA.

Preliminary assessments, per NCP requirements, will be conducted on areas of concern. The preliminary assessment is the first phase in the process of determining whether a unit in the study area is releasing or has the potential to release hazardous substances, pollutants, or contaminants to the environment and whether it requires early response action that is authorized by CERCLA. During the preliminary assessment, the investigator compiles and evaluates available information about a unit and its surrounding environment, including information on potential waste sources, migration pathways, and receptors. The preliminary assessment incorporates the findings of the site inspection when there is sufficient cause to warrant the performance of limited sampling and analysis activities. The goal of such sampling is to determine if a release has occurred that requires further characterization and risk assessment through the RI process. The preliminary assessment culminates in a brief report with formal recommendations based on the Remediation Mechanism Selection Criteria (Table 3.1) approved at the January 1993 meeting.

Table 3.1 Remediation mechanism selection criteria

	Emergency removal	Time critical removal	Nontime critical removal	Remedial action (interim or final)
Existing knowledge of site	NR[a]	Sufficient or adequate	Sufficient or adequate	Insufficient or final
Site complexity	NR	Limited	Limited	NR
Risk	High to extreme	High	Moderate to high	Low to high
Release or potential release	Yes	Yes	Yes	Yes
Further action required	Possibly	Possibly	Possibly	Interim—yes Final—no
Time to plan action	Immediately	$<$ 6 months	$\geq$ 6 months	NR
Time to implement action	Immediately	$<$ 6 months	$>$ 6 months (NR)	NR

[a]Not required

The pre-RI (performed on study areas) has three specific goals exemplified in Fig. 3.4:

- Eliminate areas that pose no threat to human health or the environment or that warrant no further investigation under the remedial program. The Parties must concur on this determination.
- Identify areas that qualify for removal actions.
- Identify the appropriate OU(s) to designate the areas for which the RI/FS will be conducted.

A meeting should be held with the Parties to discuss the scope and data needs required prior to starting the site inspection activities. A scoping workshop will be held to determine the direction to be taken at the unit following pre-RI activities. If it is determined that no further investigation is warranted based on the information available to the Parties, this decision is documented with the form that appears in Appendix C. Copies of this information and the form are then placed in the Information Resource Center, and the site is removed from the FFA Appendix C list.

Prior to initiation of the RI process, several activities will occur, which will help to identify and prioritize sites that warrant early response actions, identify areas for which no further investigation is warranted, and prioritize OUs for final response actions. These activities may include the qualitative risk/cost-based prioritization, an MLE and IP assessment, and/or the traditional preliminary assessment/site inspection activities associated with a CERCLA site.

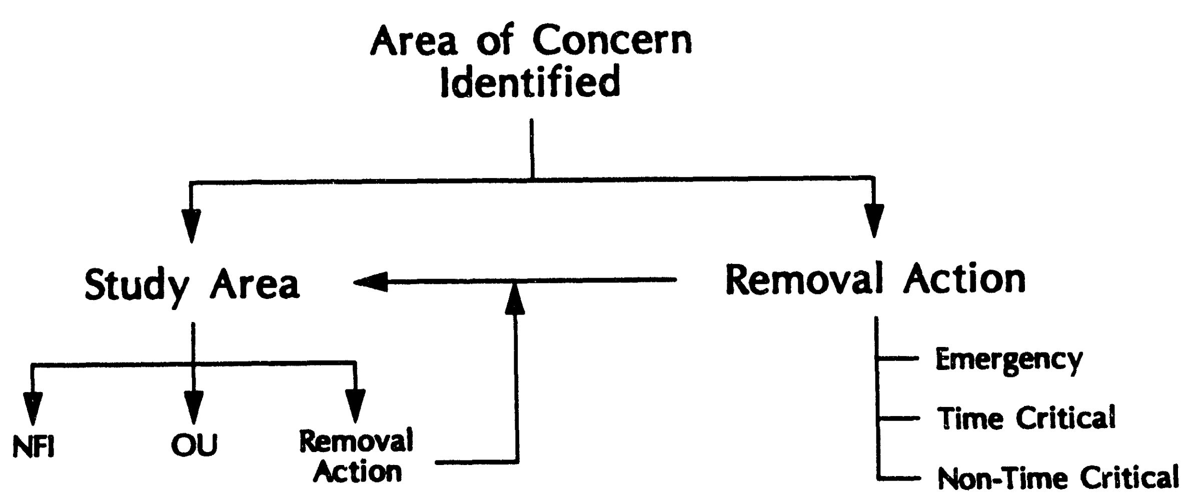


Fig. 3.4. New areas of concern.

3.2.2 Early Response Actions

The Parties may determine, based on available information, that an early action is appropriate to eliminate, reduce, or control hazards posed by a site or to expedite the completion of total site cleanup. Routine maintenance activities (removal of contaminated bushes and trees and cleanup of localized spots of contaminated soil and/or vegetation) will be undertaken at times to address environmental concerns to the work force.

Early response action may be addressed pursuant to Sect. 300.415 or Sect. 300.430 of the NCP. Section 300.415 sets out removal actions, which are intended to alleviate an immediate threat to human health or the environment. Section 300.430 sets out remedial actions, which are interim measures taken to remediate sites in phases using OUs to address hazards as early as possible. A remedial action may be taken prior to or concurrent with the development of an RI/FS as information becomes available that is sufficient to support a remedy selection. The results of the MLE and IP assessments will serve as sufficient risk information to support an early response action.

3.2.2.1 Removal actions

A removal action (Fig. 3.5) may be interim or final and is used to respond to emergency and time-critical situations in which long deliberation prior to implementing a remedy is not feasible. The process by which the decision is made to pursue a removal action depends on readily available information pertaining to a release or threat of release of hazardous substances, pollutants, or contaminants. The goal of a removal action is to prevent, minimize, or mitigate a near-term threat to human health and the environment. Removal actions are expected to meet regulatory standards and attain ARARs to the extent practicable considering the urgency of the situation and the scope of the removal action. Whenever a planning period of at least 6 months exists (Table 3.1) before on-site activities must be initiated and a removal action is deemed appropriate, an engineering evaluation/cost analysis (EE/CA) is conducted [NCP §300.415(b)(4)(i)]. The EE/CA is an analysis of removal alternatives for a site. Public participation is ensured for all nontime critical removal actions through a public comment period prior to the beginning of on-site removal activity. The results of all removal actions will be either factored into the RI/FS process as activities are scheduled for the appropriate OU, or a "no further investigation" determination (Appendix C) document will be signed by the Parties and stored with the Administrative Record Files at the Information Resource Center.

After the removal action is completed, the area is placed in a study area grouping. Additional removal actions can and will be implemented during the RI process if determined necessary. Ultimately, the area will be prioritized and assigned to an appropriate OU for remedial action or classified as requiring no further investigation.

3.2.2.2 Interim remedial actions

Limited quantitative risk information (e.g., results of the MLE and IP assessments), as well as qualitative risk information, may support a determination that an interim remedial action is necessary to stabilize the site, prevent further degradation, or quickly achieve significant risk reduction (55 Federal Register 8704, March 8, 1990). A limited number of remedial alternatives are evaluated for appropriateness as the interim remedial action. Only those ARARs associated with the limited scope of the action are considered applicable.

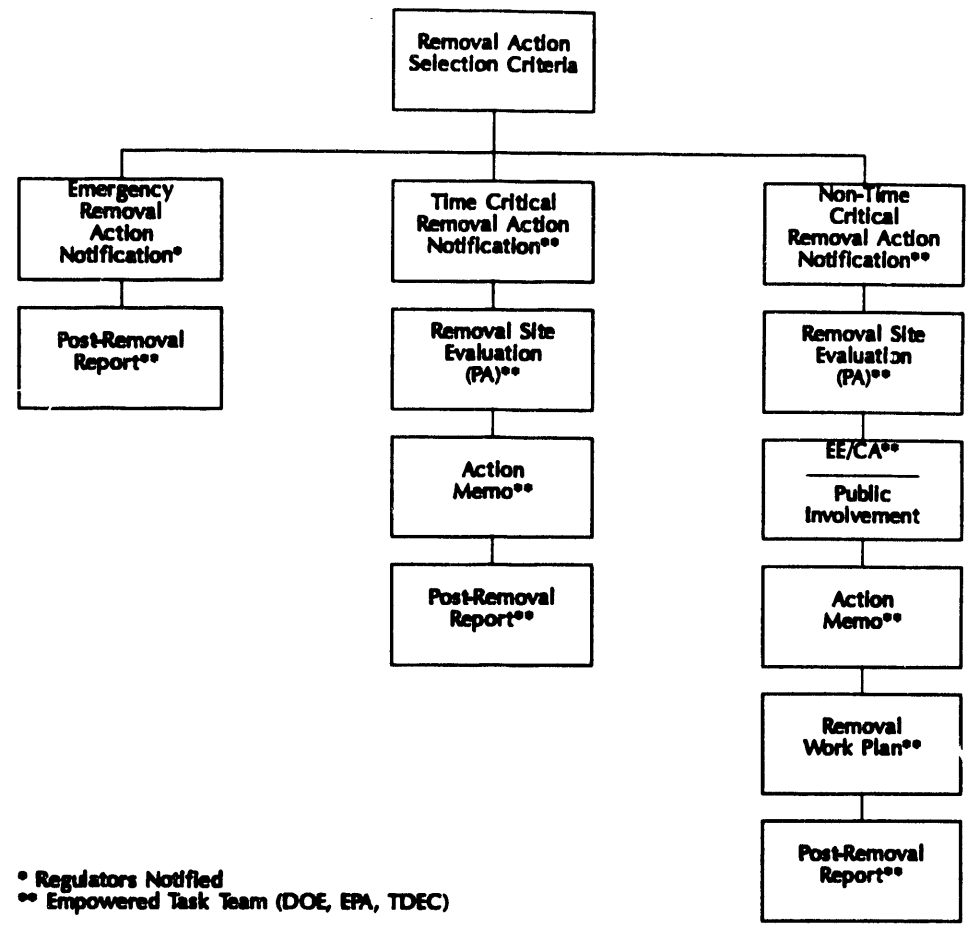


Fig. 3.5. Removal action process.

Although preparation of an RI/FS report is not required for an interim remedial action, there must be documentation that supports the interim remedial action rationale (March 1991, Office of Solid Waste Emergency Response Directive 9355.3-02FS-3). Supporting data, including MLE and IP assessment information and the alternatives analysis, are documented in the RI report and in the FS, respectively, which will be focused on the scope of the interim remedial action. The requirement for and the technical scope of the limited RI and FS reports will be negotiated by the Parties during the RI/FS scoping sessions. For appropriate areas, the material in these two documents may be submitted as a single document.

Community participation is an important part of the interim remedial action process. The technical information is presented to the public in the proposed plan. Following review of the public comments, an interim remedial action alternative is selected and documented in the ROD for interim action. The interim remedial actions performed may result in a no action determination for that site.

3.2.3 Operable Units: Remedial Investigation Scoping Workshop

OU RI activities are initiated with a scoping workshop to (1) establish the quality and quantity of data required for clearly linking the data collection efforts with decisions required for problem resolution early in the RI work plan development phase and (2) provide a framework for managing uncertainty and facilitating decision making throughout the ER process. The RI/FS scoping process is the basic planning process for establishing the DQOs for the OU RI/FS phase described in CERCLA. The 2- to 5-day RI/FS scoping workshop held by the Parties include the following:

- assessment of existing data to develop a conceptual site model;
- identification of preliminary remedial action objectives and likely response actions;
- preliminarily identifying ARARs;
- determining the type of decisions to be made and the type, quantity, and quality of data needed to support those decisions (defining DQO);
- identifying the need and schedule of treatability studies;
- designing the data collection program (sampling approaches and analytical methods); and
- defining the RI and FS tasks.

In addition, the scoping workshop will be used as the forum for establishing the current and potential future land use designation for the OU under consideration. This determination must be made because the exposure scenarios that will be evaluated in the baseline risk assessment will influence the quality and quantity of samples to be gathered as part of the RI.

Some OUs contain solid waste management units for which RCRA facility investigation plans have been prepared pursuant to the 1986 Hazardous and Solid Waste Amendments permit. Depending on the quality of the RCRA facility investigation plan(s) and how closely the scope of the RCRA facility investigation(s) corresponds to the scope of the OU RI, a new comprehensive OU RI work plan may be prepared or the OU RI work plan may take the form of an addendum (e.g., a revised sampling and analysis plan) to the RCRA facility investigation plan(s). Interim status units are still being addressed with RCRA closures and will require additional work to satisfy CERCLA.

The sampling and analysis plan incorporated in the RI work plan will provide the scope of the characterization work to be performed at the OU. OU field work will be initiated once approval of the RI work plan document has been received from the regulators and DOE.

3.2.3.1 Remedial investigation/feasibility study process

RI activities for an OU will be carried out and documented according to the protocols outlined in the approved RI work plan. After completion of the field sampling, the analytical work, and the baseline risk assessment and prior to completion of the RI report for the OU, another meeting will be conducted with the regulators. The purposes of the OU status meeting will be to determine if any modifications to the OU are needed and if unit characterization has been completed. At this point in the process, it may be determined that some or all of the OU requires (1) further characterization, (2) interim remedial action, (3) removal action, or (4) final remedial action activities. This determination has the potential for creating additional OUs from the initial OU and/or adding areas from other OUs.

At the ORR, every effort will be made to streamline the RI/FS process. To the extent possible, available historical data will be used to limit additional field work. Potential remedies that are clearly impractical for the OU will be eliminated during scoping workshops to produce a more focused and efficient RI/FS. Sampling and analysis plans will be written to allow field team leaders to expand or reduce the scope of sample collection efforts based on observations and measurements made in the field. Use of field analyses and mobile laboratories will be maximized to reduce the number of samples sent to fixed laboratories and the associated delays in obtaining results.

If the OU proceeds to the interim remedial action or final action, the performed field work activities and the resulting data will be presented in the RI report. This report will not only contain a summary of the activities that were undertaken, but will describe in detail the current environmental conditions, the contaminants detected, the fate and transport potential of those contaminants, a comparison of the activities accomplished and the data generated with the project DQO, and any data gaps that were identified. Finally, OUs will be characterized only to the extent necessary to support selection of an alternative that would be protective of both human health and the environment. The FS report documents the alternatives that were considered in selecting either the interim action or the final action.

3.2.3.2 Public review and remedy selection process

The remedy selection process is initiated when there is adequate information provided to select an interim or final remedy for an OU. The remedy selection is initiated when DOE submits the proposed plan identifying the best alternatives for regulatory review. Once the proposed plan has been approved by the regulators, the formal public review period is announced in the local newspapers. All public review and comment periods and other mechanics of the remedy selection process follow guidance from NCP, EPA, and the ORR Community Relations Plan (PEER 1991). The alternative(s) selected for the remediation of the OU and the responsiveness summary, the significant comments generated by members of the public, and the responses to those concerns are documented in the ROD, which is also submitted to the regulators for review as a primary document. Remedy selection is complete when the ROD is signed and the regulators concur in writing. The "resolution of dispute" process also can be used if there is disagreement with the alternative to be selected for the OU.

3.2.3.3 Post-Record of Decision remediation activities

Post-ROD activities include the design, construction, and monitoring phases (Fig. 3.2) required when the ROD requires further action at the OU. The design work will be streamlined to the extent possible to meet the CERCLA requirement to commence substantial continuous physical remedial action within 15 months of issuance of an approved ROD. The regulators will be closely involved in the design work to ensure timely approval of the remedial action work plan. Following final selection of the remedial actions, the remedial design and remedial action work plans for the selected remedial actions, including appropriate timetables and deadlines, will be submitted to the regulators for review.

Remedial design process. When the ROD stipulates remedial action, the remedial design phase will be initiated with the development of the remedial design work plan. Given the critical nature of the remedial design, it will be necessary to provide regulatory agencies with early design documents to ensure that consensus is maintained. This will be accomplished in working sessions with the regulators and submittal of preliminary design documents, usually at 30% completion, for their review. When the plans and specifications reach 90% completion, this document will be submitted as the primary remedial design document. At this time, all aspects of the design will be essentially complete; the final 10% of the design will include resolving the comments from the regulators on the remedial design document. This will, in effect, accelerate the design review and approval processes. The remedial action work plan will be submitted with the 90% remedial design document.

Remedial action process. Once approval for the remedial action work plan has been obtained, substantial and continuous remedial action construction activities will begin. The Parties will make a concerted effort to ensure that this happens within 15 months of issuance of an approved ROD as directed by CERCLA. The primary remedial action postconstruction report will be prepared at the completion of the remedial action phase and will include the following:

- brief description of outstanding items from the pre-final inspection conducted by the project managers and their resolution,
- synopsis of work defined in the remedial action work plan and certification that this work was performed,
- explanation of any modifications to the remedial action work plan,
- certification that the remedy is operational and functional, and
- monitoring information prior, during, and after the remediation process, if available.

Postremediation monitoring. At the completion of the construction phase, a proposal for the monitoring plan and schedule will be submitted if the remediation selected for the OU warrants continued oversight. CERCLA requires periodic reviews—at least every 5 years—at units where remedial action leaves hazardous substances, pollutants, or contaminants. This means that whenever a remedy is selected that assumes limited land use or relies on institutional controls to ensure attainment of protective exposure levels, a review will be conducted. In addition to the 5-year reviews required by statute, the ROD may specify more frequent reviews or specific reviews of the remedy selected, such as assessments of remedial technologies that might not have been available at the time the decision was made.

3.3 SCHEDULING AND REPORTING OF REMEDIATION ACTIVITIES

3.3.1 The Reservation Schedules

Figure 3.6 shows the interrelationship and the generic schedule of activities to be performed during this process. The time frames represented by this generic schedule do not reflect actual times necessary for the activities. Each OU is different, and schedules for OU deliverables are negotiated and approved each year for inclusion in FFA Appendix E. Additional negotiations are held each year to identify the prioritized work activities for the two subsequent fiscal years.

The regulators may at any time request additional work, including field modifications, remedial investigatory work, or engineering evaluations, which they determine necessary to accomplish the purposes of the Agreement. Should DOE require and agree to additional work, deadlines and schedules for the submission of primary documents (or modifications of

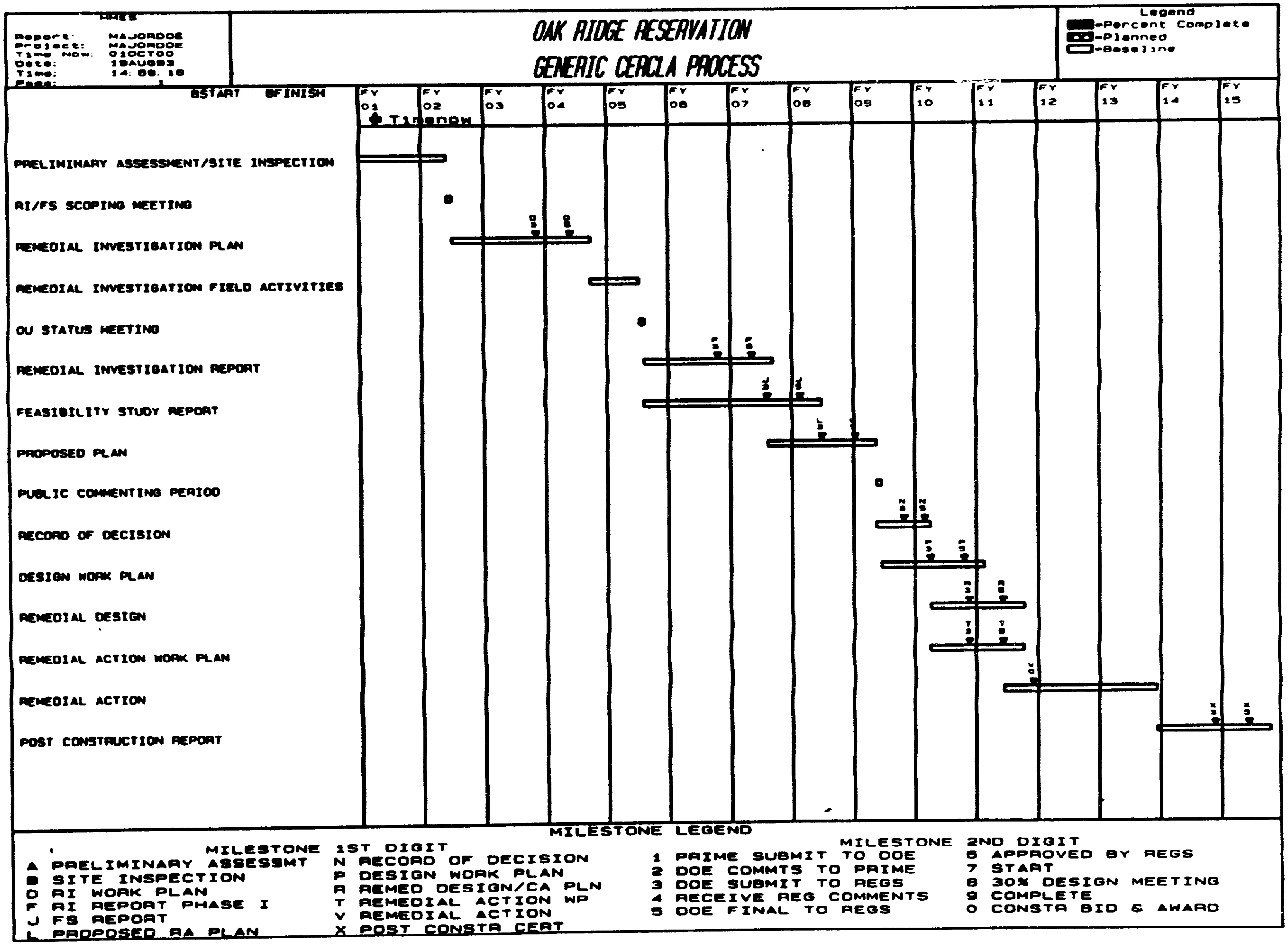


Fig. 3.6. Schedule of the generic remediation process for the Reservation.

primary documents relating to that work) and the target dates for secondary documents, as well as schedules for implementation of any remedial activity, will be proposed by DOE and reviewed for approval by the regulators.

3.3.2 The Reservation Documents

FFA primary documents identified for each OU must be approved by EPA and TDEC. If the Parties cannot reach an agreement on the technical information presented in the primary documents, the disagreement can be resolved in the "resolution of dispute" process documented in Sect. XXVI of the Agreement. Secondary documents support the information found in subsequent primary documents and are transmitted to EPA and TDEC for their review. The document matrix (Table 3.2) represents the primary and secondary documents that may be produced in the execution of the remedial activities at the ORR. The table of removal action and remediation activities documents was agreed to by the Parties at an ORR strategy meeting held in January 1993. Each of the generated documents is made available for the public at the Information Resource Center at the time it is transmitted to the regulators for review.

The results of investigations/activities (i.e., pre-RI activities, removal actions and/or interim remedial actions, etc.) conducted prior to the selection of a final action and issuance of an ROD will be integrated into the final action documentation (RI/FS report). Monitoring data taken during the post-ROD remedial actions (Sect. 5.1.3) to treat the contaminant sources that have not reached final action will be re-evaluated during the alternative selection phase of an appropriate OU that will reach final action. By integrating this information into the investigation of the groundwater/surface water OU, which addresses the off-site releases of contamination, the effectiveness of the remedial actions performed on contaminant sources can be determined, and the need for further monitoring or remediation can be identified.

Annotated outlines for the majority of the documents required by the FFA are contained in *Annotated Outlines for Documents Required by FFA and CERCLA for Oak Ridge Reservation Sites*, DOE/OR/01-1077. These outlines were developed to ensure that the document formats are consistent across the ORR. The outlines comply with CERCLA but also integrate NEPA, RCRA, and NRDA requirements. Additional annotated outlines for documents required by the FFA (i.e., remedial design work plans, remedial design reports, remedial action work plans, and postconstruction reports) will be issued as they are developed.

Table 3.2 Comprehensive Environmental Response, Compensation, and Liability Act remediation documentation

	Emergency removal action	Time critical removal action	Non-time critical removal action	Remedial action (interim)	Remedial action (final)
Discovery/notification	Yes	Yes	Yes	Yes	Yes
Preliminary assessment	No	Yes	Yes	Yes	Yes
No further investigation determination	No	Yes	Yes	Yes	Yes
Site inspection work plan	No	Maybe	Maybe	Maybe	Maybe
Site inspection/site removal evaluation	No	Removal site evaluation	Removal site evaluation	Maybe	Maybe
Remedial investigation work plan	No	No	No	Maybe	Yes
Remedial investigation report	No	No	No	Maybe[a]	Yes[b]
Focused feasibility studies (FS)/FS/engineering evaluation/cost (EE/CA) analysis	No	No	EE/CA	Focused FS[c]	FS
Proposed plan	No	No	No	Yes	Yes
Action memo/Record of Decision (ROD)	No	Action memo	Action memo	ROD	ROD
Remedial design work plan	No	No	No	Maybe	Maybe
Remedial design report	No	No	No	Maybe	Maybe
Removal work plan/remedial action work plan	No	No	Removal work plan	remedial action work plan	remedial action work plan
Postremoval report/postconstruction report	Postremoval report	Postremoval report	Postremoval report	Postconstruction report	Postconstruction report
National Environmental Policy Act	Categorical Exclusion (CX)	CX	CX	CX or environmental assessment (EA)	EA or environmental impact statement

[a]Includes screening risk assessment.
[b]Includes baseline risk assessment.
[c]Includes risk assessment (screening-level maximum) if no remedial investigation.

4. PROGRAM MANAGEMENT

4.1 ROLES AND RESPONSIBILITIES

The ORR remediation program will be conducted using a "lead agency" strategy to minimize duplication of effort and maximize oversight productivity. The lead agency is designated as the responsible agency for overseeing and coordinating the activities in accordance with the Agreement. The regulators will provide support within their oversight role to the lead agency.

4.1.1 Lead Agency

The lead agency for the ORR, DOE-ORO, provides the on-scene coordination to plan and implement remedial actions under the NCP. Lead agency duties include the following:

- Oversee and manage ORR remedial activities pursuant to the Agreement and the site management plan.
- Serve as primary contact and coordinator with the regulators for the purposes of implementing the Agreement and the site management plan.
- Ensure availability of resources required to implement the site management plan.

4.1.2 Regulators

EPA and TDEC are participating in the Agreement as both working partners in initiating the remedial action work at Oak Ridge and in a regulatory oversight role. In this capacity, they will provide regulatory opinions and counsel to the lead agency. The regulators will assist the lead agency by attending working meetings, providing timely response to action items, and providing timely review and concurrence, where applicable, of ORR remedial documentation and/or activities. EPA, DOE, and TDEC will each designate project managers to coordinate the implementation of the Agreement and the ongoing regulatory oversight duties and shall notify each other in writing of the designation.

4.2 WORKING SESSIONS AND INFORMATION MEETINGS

4.2.1 Working Sessions

Several times during the RI, decision, and restoration activities at an OU, working meetings will be held with EPA, TDEC, DOE staff, OU project managers, and OU project teams. At these meetings, all agreements and assigned action items will be documented and signed before concluding the meeting. These signed documents will be taken to the main offices of the Parties for review and concurrence by the FFA project managers. If there is any disagreement with any of the agreements and/or action items that cannot be quickly resolved by the program managers, these issues will be discussed at the next FFA project managers meeting. The agreements and action items that affect the scope of the OU work will not be acted on until the documents have been approved by FFA project managers.

4.2.2 FFA Project Managers Meetings

FFA project managers meetings are held at least once each quarter to exchange information on the state of the program (i.e., action-item status and FFA document review status) and to exchange information on issues that transcend the work at the Reservation (i.e., groundwater program, risk assessment, consolidated environmental data base, etc.). Modifications to the ORR-FFA text and appendixes are negotiated, including revisions to the commitment work schedules.

4.3 CONTRACTORS

4.3.1 Integrating Contractor

The Energy Systems ER Division has been designated as integrating contractor for the DOE ER Program. The primary purpose of the integrating contractor role is to ensure that all participants in the Oak Ridge ER Program approach and conduct their tasks in a technically consistent and operationally similar manner to ensure a common focus for technical and administrative management. The primary contractors to DOE as of the date of this document are Energy Systems; Jacobs Engineering; Ebasco; and MK-Ferguson in Oak Ridge.

In fulfilling its role as integrating contractor, Energy Systems will be the focal point each year for coordinating the preparation of the activity data sheets; contributions to the 5-year planning effort; and preparation of installation-specific plans, budget, schedules, and budget packages for the prioritization process. In its integrating contractor role, the Energy Systems ER Division will conduct meetings, collect information, and assemble total packages related to these activities for use by DOE-ORO. The ER Division will ensure that technical consistency is achieved among the participants in areas such as risk assessment, NEPA compliance, and WM for ER activities, among others. The Energy Systems ER Division will have primary responsibility for reporting total ER Program cost and schedule status each month. The Energy Systems ER Division will obtain budget, cost, schedule, and progress information from the technical support contractor (Jacobs Engineering), the remedial design contractor (Ebasco), the construction manager, and DOE-ORO each month and consolidate this information in the monthly status report to be submitted to the director of the DOE-ORO ER Division.

The Energy Systems ER Division also has the following responsibilities as integrating contractor:

- Evaluate other DOE prime contractor, subcontractor, and prospective subcontractor ER programs, procedures, systems, processes, and policies regarding health and safety, housekeeping, environmental requirements, radiation protection, security, quality assurance, and related operations.
- Provide coordination with plant operations with respect to any field work, including RIs and remedial actions.
- Evaluate design, strategies, and sequencing of work in accordance with existing project management procedures established by the assistant manager for construction and engineering, with respect to the remedial design architect-engineer.

- Participate in and chair the Level IV Change/Configuration Control Board. The Energy Systems ER Division will process and maintain all change requests and approvals for DOE-ORO ER Program projects.
- Prepare ER Program technical and administrative policy and procedures for use by ER Program participants.
- Coordinate technical reviews of all products, plans, schedules, and documents prepared by all ER Program participants in fulfillment of regulatory deliverables to ensure consistency of technical approach, adequacy, and completeness of the assessments and to ensure that regulatory requirements are being met.
- Provide WM treatment, storage, and disposal (TSD) services for management of ER-originated wastes in a manner consistent with regulatory guidance.
- Conduct a rigorous self-assessment program to evaluate regulatory compliance and procedure adherence during the conduct of ER activities.
- Develop and operate OREIS, a system used to manage all environmental data products on the ORR.
- Coordinate and evaluate priorities for DOE-ORO ER Program ongoing and proposed activities to ensure that the highest priority remediation projects are funded and pursued commensurate with DOE funding availability balanced against public/community concerns, regulatory requirements, human health and environmental risk assessments, and institutional considerations.

4.3.2 Technical Support Contractor

Jacobs Engineering now serves as the technical support contractor for the ORR. Generally, this organization provides technical support for the RIs; prepares the FS reports; prepares the integrated decision documents (such as environmental assessments and impact statements); and conducts ORR-level planning, regulator compliance, waste management, quality assurance/quality control, and work plan development. The technical support contractor may also be requested to perform special studies as necessary during the remedial design or remedial action phases.

4.3.3 Environmental Restoration and Waste Management Design Contractor

Ebasco serves as the ER and Waste Management Design Contractor. Ebasco will be requested to prepare the design for the selected alternative in both the draft remedial work plans and the draft D&D work plans, review the designs as needed to incorporate public comments and those of the regulators, and then complete the engineering documents so that they can be used to obtain the services of a construction subcontractor. Ebasco will also provide this support services required by the technical support contractor to compete the FSs and will conduct independent verification on construction activities, as required. During construction, Ebasco will provide Title III engineering services, as required.

4.3.4 Construction Management Contractor

MK-Ferguson Company serves as the construction management contractor for all construction at ORR. Following the long-standing DOE philosophy, every effort will be made to accomplish the construction through the award of fixed-price lump sum or fixed-unit price subcontracts. This will encompass all remedial actions and D&D subprojects. The construction manager's activities will be directed by the Office of the Assistant Manager for Construction and Engineering and will include responsibilities regarding safety and health, security, and quality assurance in addition to providing technical support during the FS.

5. ER TECHNICAL SUPPORT PROGRAMS

5.1 RESERVATION GROUNDWATER PROGRAM

5.1.1 General Description of the Groundwater Program

The Martin Marietta Energy Systems, Inc. (Energy Systems) Groundwater Program Office (GWPO) was established in May 1991 as a means of providing a consistent approach for all groundwater programs at the five plants managed by Energy Systems for DOE. The following are overall goals of the GWPO:

- Fully comply with all DOE orders and federal and state statutes pertaining to groundwater.
- Develop a groundwater program that is technically sound, consistent among the Energy Systems facilities, and responsive to the needs of DOE and the regulators.
- Establish a mechanism for technical support to the ORR facilities which addresses fundamental principles of groundwater flow, contaminant migration, and integration of this information at the installation level to the various monitoring programs.

The GWPO interfaces with each of the ORR installation Groundwater Protection Program Managers (GWPPMs). The GWPPM is the single point of contact at each facility for all activities related to groundwater. The GWPO has established a matrix organization that includes those functions associated with groundwater (ER, compliance, WM, engineering, quality assurance, field sampling, and laboratory analysis). Any activity related to monitoring well installation (location, depth, or purpose); groundwater sampling; analyses; data interpretation; or reporting is within the purview of the GWPPM. Programmatically, the GWPPM reports through the GWPO.

An essential component of the Energy Systems groundwater program is the support the Oak Ridge Hydrologic Support Program (ORHSP) provides to the GWPPMs. ORHSP is made up of three components: technical support, environmental surveillance, and the ORR hydrologic and geologic studies (ORRHAGS). For the technical support function, ORHSP has assigned a technically qualified hydrogeologist to work with each GWPPM. The hydrogeologists are to assist the GWPPM with all technical questions related to groundwater and serve as a conduit for communicating technical guidance related to groundwater monitoring programs.

The environmental surveillance component of ORHSP is established to ensure consistency and technical sufficiency in the environmental surveillance activities mandated by DOE Order 5400.1. Environmental surveillance refers to monitoring activities related to perimeter- and exit-pathway monitoring, which are designed to ensure that contaminants associated with groundwater are not crossing ORR boundaries and that the location and extent of potential contaminant migration pathways are well defined. Environmental surveillance for the ORR also includes privately owned wells located beyond the boundaries of DOE-owned land which are used for drinking water. ORNL is responsible for implementing the environmental surveillance program for the ORR. Oversight and technical guidance is provided by ORHSP.

ORRHAGS is a component of ORHSP that is responsible for developing a fundamental understanding of the underlying principles that control groundwater flow and contaminant migration on the ORR. ORRHAGS include a revision of the geologic map for the ORR, evaluation of background hydrochemical properties of groundwater, and exploration of the interaction of the hydrogeologic regime on contaminant migration. Technical support personnel of ORHSP are important in communicating to ORRHAGS the technical problems at each installation that need to be addressed and in working with the GWPPMs to understand and implement the results of ORRHAGS technical studies into installation groundwater programs.

5.1.2 Activities To Be Performed

The GWPO has several key activities that are being pursued:

- Establishment of a consistent set of plans, procedures, and specifications that will implement the groundwater programs at each facility. The plans and procedures for each facility will be identical where possible and different where appropriate based on unique features of the particular facility. However, all plans and procedures will utilize a consistent strategy.
- Oversight of the establishment of a consolidated data base for groundwater data (well construction information, geologic data, hydrochemical results, hydraulic testing results, etc.) and development of consistent data verification and validation protocols. In the interim, it is essential for the GWPPMs to develop a facility-specific, well inventory system as a management tool. These data will reside in the Oak Ridge Environmental Information System (OREIS).
- Development of a consistent strategy for groundwater monitoring activities (e.g., environmental surveillance and a comprehensive groundwater monitoring plan for each plant).

5.1.3 Monitoring Data Being Collected

Groundwater monitoring activities for the ORR fall into two categories: effluent monitoring and surveillance monitoring. Effluent monitoring includes those activities that take place at specific waste disposal areas and contaminant source areas. Groundwater samples that are collected for effluent monitoring are analyzed for a variety of water-quality and facility-specific contaminant parameters. The following are included in effluent monitoring for groundwater:

- RCRA interim status or RCRA-permitted facilities,
- 3004(u) units,
- CERCLA units,
- active WM facilities,
- underground storage tanks,

As noted, surveillance monitoring for the ORR is directed towards monitoring groundwater along plant-facility boundaries (perimeter monitoring), especially in those regions where groundwater flow pathways have the potential to result in contaminant migration across the boundaries (exit pathways). In addition, selected, privately owned wells are monitored and constitute a culinary drinking water program. In general, the list of analytes included in surveillance monitoring is restricted to a relatively small number of indicator parameters that are customized to the specific region being monitored. Surveillance monitoring also includes activities that each plant believes are necessary to supplement its overall monitoring program but are not specifically required by DOE Order 5400.1 or regulations governing effluent monitoring areas. These additional monitoring activities constitute a "best management practice."

5.1.4 Future Activities

Some activities will be addressed by the GWPO in the future:

- refinement of the conceptual model for groundwater flow and contaminant migration for the ORR,
- completion of the consolidated data base,
- evaluation and preparation of plans and procedures required to implement the groundwater monitoring program.

One of the major ongoing activities of the GWPO is to oversee development of a defensible conceptual model for groundwater flow and contaminant migration for the ORR. Basic investigations sponsored by the GWPO are designed to promote understanding of the geologic and hydrologic properties of the ORR that are common to all three facilities and affect flow and transport characteristics. Significant progress has been made in developing a conceptual model based on the results of investigations conducted during the past 10 years. However, there are gaps in our understanding, and future studies are directed toward refinement of the model by incorporating results from more focused investigations designed to fill these gaps. The following investigative themes provide summaries of the basic studies to be continued or implemented during FY 1994:

- Deep groundwater flow system: Identify the base of the active flow zone and quantify the potential for deep flow beyond the ORR.
- Karst system: Determine if the karst system allows contaminant transport beyond ORR boundaries.
- Model development: Develop a three dimensional flow and transport groundwater model that accurately represents processes for the ORR and supports risk assessment and evaluation of remedial measures.
- Systems parameterization: Identify and measure the range of values for key hydraulic, geologic, and geochemical parameters needed to characterize the ORR.

The activities and completion schedule for the consolidated data base are presented in Sect. 5.6.

A comprehensive review of the applicable plans and procedures for implementing a consistent groundwater program is in progress. It is anticipated that this review will be completed during FY 1994.

5.2 WELL PLUGGING AND ABANDONMENT PROGRAM

The objective of the well and borehole plugging and abandonment (P&A) program is to ensure that all wells and boreholes no longer in use are sealed to eliminate conduits that could allow (1) contamination from the ground surface to reach the water table or (2) movement of contaminants between aquifers. In addition, P&A tasks will also remove casings that could provide an obstacle to construction or installation of impermeable caps on areas to be remediated.

On the ORR, there are over 2300 known wells and boreholes that must be evaluated for possible P&A. At ORNL, the P&A program has been divided among the following areas: WAG 5, WAG 6, WAG 10 (hydrofracture related wells), and all other WAGs. The WAG 5 and 6 P&A will support and are integrated with remedial activities at those facilities. WAG 10 P&A will be initiated with high-priority wells that will be examined and stabilized as needed in the near term. A site-wide Well Evaluation Program, initiated in July of 1992, will provide information on the remaining ORNL wells to determine appropriate methods and procedures for well P&A. The wells that remain active or are retained for later use will be incorporated into an ongoing inspection and maintenance program with limited P&A actions as needed.

At ORNL, all monitoring wells and peizometers are being evaluated to determine whether they will be retained or scheduled for P&A according to established procedures. ORNL has a legacy of numerous old monitoring wells. Many of these wells were originally constructed with methods and materials that are no longer accepted as appropriate for monitoring wells. Plans have been developed to guide the well P&A process, which emphasize methods that minimize the generation of waste during the process.

At the Y-12 Plant, monitor wells and piezometers have been and will be plugged and abandoned in accordance with established procedures. The general situation is ongoing, routine maintenance of a monitoring network. A planning document has been prepared, which maintains the schedule to identify wells that need to undergo P&A at the Y-12 Plant.

At the K-25 Site, wells or boreholes that are damaged, unusable, or no longer needed are identified by the GWPPM, in concert with requests from managers of other site programs involving construction or remediation activities. Presently, there are no wells at the K-25 Site scheduled to undergo P&A, which also is true for the Y-12 Plant. The K-25 Site program is primarily one of ongoing maintenance of the wells network and does not include a significant legacy from past operations.

In general, P&A projects are coordinated with RI/FS tasks and unit remediation. The RI/FS provides field verification of well inventory data and supports the decisions for wells or boreholes that will be abandoned. In preparation for construction or capping as a part of unit remediation, wells are evaluated for P&A action, and the P&A process is conducted as a step in implementing overall unit closure or restoration. When needed, wells that are abandoned are replaced to ensure postclosure monitoring system integrity.

5.3 RISK ASSESSMENT

The purpose of a risk assessment is to provide interested parties (managers, regulators, workers, and the general public) with an evaluation of the human and environmental health threats posed by hazardous waste areas. Risk assessment is a four-stage process that transposes/converts specific contaminant data (collected from sampling efforts) into a single number that can be compared directly to risk-based standards. Data collection/evaluation is the first stage of this process. During this stage, analytical and other specific data are used to characterize the nature and extent of contamination. The second stage is the exposure assessment which involves the calculation of exposures based on the contaminant concentrations estimated from the analytical data, fate and transport models, and information collected on the demography and behavior of receptor populations. The third stage is the toxicity assessment which involves the collection of information concerning the toxic characteristics of each contaminant. The results of the toxicity assessment are combined with the exposure estimates to quantitatively or qualitatively evaluate the potential risks to human and environmental health posed by each contaminant of concern at a unit in the fourth stage—risk characterization.

To derive a reliable estimate of exposure for use in the risk characterization stage, it is essential to accurately determine representative constituent concentrations in the respective contaminated media at the unit. For example, consider estimating exposure from the ingestion of chemicals in drinking water. Exposure would be calculated using the following equation:

$$Exposure = \frac{RC \times IR \times EF \times ED}{BW \times AT}$$

where exposure is in milligrams per kilograms per day and

RC = representative concentration in water (mg/L),
IR = ingestion rate (L/d),
EF = exposure frequency (d/year),
ED = exposure duration (years),
BW = body weight (lbs),
AT = averaging time (period, in days, over which dose is averaged).

With the exception of the representative concentration, all of the variables in the above equation tend to be estimated by generic values recommended by EPA. Toxicity values for a given chemical are also constant across hazardous waste areas. The representative concentration is entirely area specific and is useful in determining the threat to human and environmental health posed by individual hazardous waste areas. A representative concentration cannot be derived without reliable analytical data.

To ensure that risk assessment DQOs (Appendix D) are established and incorporated into the investigation process, the Risk Analysis section of the Energy Systems Health and Safety Research Division will serve in the capacity outlined in the April 4, 1991, letter from Robert C. Sleeman, Director of the DOE-ORO ER Division, to Lanny D. Bates, Director of the Energy Systems ER Division (Sleeman 1991). Attached to this letter was the approved interim policy guidance for "Environmental Restoration Risk Assessment Initiation, Implementation, and Interaction," which defined the roles and responsibilities for all organizations and individuals involved in the DOE-ORO ER risk assessment activities. As stated in this policy guidance, the purpose was

> . . . to define the role of risk assessment in the ORO Environmental Restoration Program . . . and identify responsibilities for developing and implementing this role, and define the line and matrix interactions needed for implementation of consistent risk assessment policy and approach in the ER Division.

This policy established the position of the Risk Assessment Coordinator and called for the organization of the Central Risk Assessment Council to "provide technical expertise and support to the Risk Assessment Coordinator." The Central Risk Assessment Council is composed of a multidisciplinary team of personnel associated with the ER Program (designated Risk Assessment Team Leaders) and Energy Systems personnel not specifically associated with the ER Program but who have expertise in the following areas: human health risk, ecological risk, toxicological information and data bases, risk model validation, sensitivity/uncertainty analyses, and risk assessment project implementation. Activities of the council include the following:

- Provide advice and guidance on appropriate risk assessment methodology and procedures.
- Develop appropriate methods, procedures, models, and/or data needed to fulfill risk assessment needs.
- Provide appropriate review of ER Program risk assessment implementation.
- Support risk assessment needs by researching and developing critical data gaps.

Prior to the initiation of the characterization phase at a unit, the Risk Assessment Team Leader for that facility should be contacted to ensure that risk assessment data needs are included in the initial characterization phase. The risk assessment data needs will be succinctly stated within the sampling and analysis plans as DQOs. Risk Assessment Team Leaders are available to provide support to each of the facilities and are required to be functioning members of subcontractor teams that are performing risk assessments on the ORR.

5.4 SCREENING RISK ASSESSMENT APPROACH FOR THE RESERVATION

As part of the effort to streamline the RI/FS process, screening risk assessments will be generated as secondary documents for all OUs. Although the general form of the screening risk assessments will be consistent across all OUs, the purpose of the assessment will depend on whether the particular OU is a source-control OU or an integrator OU. Integrator OUs will have baseline risk assessments produced prior to the public comment period for the proposed plan. Source-control OUs are the on-site waste areas that are not accessible to the public and are potential sources of contaminants that may be released into specific groundwater/surface water regimes. Integrator OUs are the off-site and on-site watersheds that may receive contaminants from any number of on-site source-control OUs by way of groundwater and surface water pathways. For source-control OUs, the prime purpose of the screening risk assessment is to identify areas that do and do not represent a threat to human health and the environment and to support Interim Records of Decision and any immediate remedial actions that are required. The screening risk assessments for source-control OUs also identify areas that are potential sources of contaminants to be evaluated in the integrator OUs. Screening risk assessments for integrator OUs use existing data to identify and prioritize potential contaminants of concern for further evaluation and investigation so that sampling efforts can be focused on areas and contaminants that are prime drivers of total potential risks.

Two approaches will be used in all Screening risk assessments—upper bound risk estimation and lower bound risk estimation. The upper bound screening approach is highly unlikely to underestimate potential maximum exposures of individuals who might use the particular environment, but it may substantially overestimate the majority of the actual exposures to individuals. The lower bound screening approach provides a more realistic estimate of exposure and should not substantially overestimate the maximum exposures to individuals in the area. Under some circumstances, however, lower bound screening could underestimate maximum exposures. Actual risks are believed to lie somewhere between the risk estimates provided by the lower bound and upper bound screening approaches. The upper bound approach will be used to identify areas or contaminants that definitely do not pose a threat to human health or the environment because the conservative risk estimates are sufficiently small. The lower bound approach will be used to identify areas or contaminants that definitely or potentially pose a threat because the risk estimates are sufficiently high. Such areas may require interim or emergency response remedial actions.

Exposure concentrations used to generate screening risk estimates will be based on the available on-site sampling or inventory data. No fate and transport modeling is necessary for Screening Risk Assessments. Screening Risk Assessments will consider those exposure pathways that past experience has shown to be the prime drivers of potential risk at the ORR. These include (1) external exposure to radiation in soil/sediment, (2) ingestion of soil/sediment, (3) inhalation of wind-generated dust, (4) ingestion of deer meat, and, at certain areas, (5) ingestion of surface water and/or groundwater and ingestion of fish. Exposure parameter values for the upper bound approach are the default values provided as EPA guidance. Intake values for the lower bound approach are generally an order of magnitude less conservative than those used in the upper bound approach.

5.5 DATA MANAGEMENT PROGRAM

The primary goal of data management for the ER Program is to establish an integrated approach that will provide consolidated, consistent, and well documented data and data products to support ER activities on the Reservation. This approach includes the policies, procedures, and standards developed and implemented by the ER Data Management Program. The data management program is complemented with the development and implementation of the OREIS that includes a consolidated data base integrated with comprehensive data analysis tools. The data management program and OREIS will replace a complex of independent procedures, data bases, and systems that are currently used for data management in the ER Program.

5.5.1 ER Data Management Program

The ER Data Management Program will provide a single, effective approach for establishing, documenting, and maintaining the quality of environmental measurement data generated by ER projects. This approach will include specific requirements for data management plans and procedures for all ER projects. The plans and procedures will be adapted for each project from common guidelines provided by the ER Data Management Program. The program will also establish common data models and codes that can be accommodated by all ER projects. The ER site program's use of data bases for project review and planning will also be integrated into the approach developed by the ER Data Management Program.

The following are the primary tasks for the ER Data Management Program for FY 1994:

- Develop and implement a data management plan to include a generic data model, data dictionary, and data development process that will be used in ER projects.
- Develop and implement data management procedures that can be adjusted for use in ER projects.
- Develop and implement training and surveillance programs that will ensure compliance with guidance from the data management program.

5.5.2 Environmental Information System Program

Early in FY 1994, the OREIS Program will release version 2.0 as the first production version of OREIS during FY 1994. This version of OREIS includes a data model that can accommodate the consolidation of most types of environmental measurements from the ER studies. Data from ER reports during FY 1992 and FY 1993 will be available from the production version. Procedures, internal instructions, and records necessary to operate the OREIS data base have been developed. OREIS also includes the integration of data analysis tools with the data base. Applications software integrated into OREIS include Oracle (data storage, retrieval, and query), SAS [(tabular reports, graphs, statistics], and ARC/INFO [geographic information system (GIS), spatial analysis, map generation].

The following are the primary tasks for the OREIS program for FY 1994:

- Develop and execute training for OREIS users.
- Provide support for OREIS users (on-line and off-line usage).
- Maintain the OREIS data base (e.g., incorporate data from new ER reports, associated data base records, and administer the system).
- Evaluate the OREIS effectiveness for meeting user requirements.
- Enhance the data model and software integration as needed to provide improved system effectiveness.
- Work with the ER Data Management Program to integrate consistent data management practices and information systems throughout the ER Program.

5.5.3 ER Geographic Information System and Spatial Technologies Program

The GIS and Spatial Technologies Program will support GIS-related activities within ER in a variety of areas involving spatial data management and applications. The program will coordinated the maintenance, documentation, application, and development of geographic and remotely sensed data are and spatial technologies to ensure that consistent, defensible geographic data are used for the numerous multidisciplinary environmental applications associated with ER.

The GIS and Spatial Technologies Program will support the development of plans, standards, procedures, and training involving geographic data quality, data generation, documentation, and exchange. The program will participate in spatial data activities and coordination with other Energy Systems organizations and agencies at the federal, state, and private level.

The GIS and Spatial Technologies Program will oversee the development, enhancement, and integration of GIS and other spatial technologies for the ER Program. This includes testing and expanding new approaches and tools, data intensive products, and advanced spatial analyses, linking with environmental and remediation modeling, visualization, and imaging techniques that are applicable to ER efforts.

The program will oversee GIS activities for OREIS and its spatial data repository and distribution center to provide data and products that will ensure data consistency among all users of the information and service.

5.6 FUTURE LAND USE CONDITIONS

CERCLA requires that the baseline risk assessment address the potential land use associated with the highest level of exposure and risk [NCP §300.430 (d)]. Even though institutional controls are currently in place at the ORR, the possibility that certain areas of the Reservation may become residential in the future still exists. The NCP concedes that the assumption of future residential land use may not be justifiable if there is only a small probability that the site will support such use. Where the future land use is unclear, risks associated with residential land use should be compared with risks associated with other land uses such as industrial, recreational, or agricultural. Land use assumptions determine the individual human receptor used to define the reasonable maximum exposure scenario. If the baseline risk assessment considers a residential future land use scenario, then the reasonable maximum exposure would be defined by a family setting up residence on the hazardous waste site, conceivably while growing crops and raising livestock. The ultimate magnitude of the resulting hypothetical risk estimate is in many cases likely to be alarmingly high.

Land use and institutional control assumptions also have an impact on the remedy-selection process. The NCP states that institutional controls may be used ***as a supplement*** to engineered controls but may ***not*** substitute for them unless (1) engineered controls are not practicable as determined by remedy selection criteria or (2) institutional controls are the only means available to provide protection of human health [NCP §300.430(a)1(iii)(d) and §300.430(e)3(ii)]. The current institutional control measures at the ORR may be more effective in terms of overall protection of human health and the environment than are present-day engineering technologies.

To recognize the impact of land use assumptions in the cleanup process, screening risk assessments and baseline risk assessments will examine risks under various land use scenarios such as residential, agricultural, industrial, and recreational. Based on this information, the Site Development Office, and County and Municipal Development entities, a future land use plan will be developed for the ORR. Once the future land use plan is developed, it will be used in all risk assessments and evaluations of cleanup alternatives. For example, if it is determined that an OU is within an area considered safe only for government land use, then the risk assessment would not include an evaluation of residential exposure scenarios. Maintenance of institutional controls would be included as one of the remedial alternatives.

5.7 REMOTE SENSING AND SPECIAL SURVEYS PROGRAM

The Remote Sensing and Special Surveys Program was established to provide environmental site characterization data, change data, and trend data to ER and Waste Management Programs at the DOE facilities located in Oak Ridge, Tennessee. Data obtained from remote sensing surveys can (1) obtain screening level data for locating potential contamination sources, (2) aid in site characterization efforts, (3) establish baselines for comparison with future conditions, (4) provide a data base of information for detailed analyses, comparisons, and integration with field measurements and map data, (5) assist in RI planning, and (6) aid in long-term monitoring and environmental improvements for restoration activities. Special surveys include such activities as the threatened and endangered plant and animal species surveys being conducted for the entire ORR; remote sensing technology tests and demonstrations; and the development of new processing tools, characterization tools, and remote sensing platforms.

The Remote Sensing and Special Surveys Program is dedicated to providing an experienced team of individuals to DOE and other federal agencies to demonstrate and test emerging remote sensing characterization technologies. The program is also dedicated to demonstrate and test technologies being transferred from other industries that may prove to be useful tools in ER and waste management characterization activities.

The following are the primary tasks for the Remote Sensing and Special Surveys Program in FY 1994.

1. Conduct the third phase of a helicopter geophysical survey of the ORR.
2. Perform data analyses, processing, and interpretation of the entire geophysical data set of the ORR.
3. Perform data analyses, processing, and interpretation and management of Multispectral Scanning Imagery collected in FY 1992.
4. Evaluate results from the Portsmouth Gaseous Diffusion Plant High-Resolution Radiological Survey conducted in August 1993.
5. Schedule and hold routine briefings with ER representatives to present available site data and discuss current and future surveillance projects.
6. Initiate threatened and endangered plant species surveys of the ORR.

6. ER-RELATED PROGRAMS

6.1 NON-FFA SITES REMEDIAL ACTION

DOE ER activities at non-FFA sites in the vicinity of the ORR include restoration required under two Tennessee consent orders signed in December 1992 and restoration driven by DOE orders as authorized by the Atomic Energy Act. Work required by the consent orders includes restoration at the David Witherspoon Inc., site in Knoxville, Tennessee, and the Atomic City Auto Parts site in Oak Ridge. These two sites were once licensed by the Atomic Energy Commission and later Tennessee to possess and handle radioactive material. Residual radioactivity at the two sites has resulted from the handling, processing, and resale of salvage material obtained from facilities owned by DOE. An additional remediation site in Oak Ridge includes two sections of CSX Railroad Transportation's rail line spur that became contaminated with ^{137}Cs as a result of liquid leakage from cargo being shipped to Oak Ridge. The cleanup is a DOE voluntary action that is not subject to requirements of a Tennessee consent order. Restoration of this site is being accomplished in accordance with requirements of DOE orders.

Access to each of the sites in this portion of the DOE ER Program is not under the control of DOE or any of its contractors. For this reason, it is difficult to ensure that potential human health risks associated with source-control measures could be maintained as low as reasonably achievable. Therefore, the strategy for remediation of the non-FFA sites is excavation of radioactive, hazardous, toxic, or mixed waste and transfer of this material to a site on the ORR for treatment and/or long-term management.

6.2 WASTE MANAGEMENT PROGRAM

6.2.1 Overview

The ERWM Division provides centralized management, planning, procedure development, and guidance to ensure ongoing support in a consistent manner for the ORR waste management activities. There are specific DOE WM and DOE ER waste management objectives needed to ensure effective implementation of the policy on ORR waste management activities:

- Coordinate and integrate TSD planning and execution between the DOE WM Division and DOE ER Division in accordance with the EM-30/EM-40 Memorandum of Understanding dated September 15, 1992.
- Provide timely and cost-effective regulatory compliant TSD capabilities for remedial action and decontamination and decommissioning (D&D) activities, primarily through use of existing DOE WM Division facilities management by Energy Systems as the facilities manager contractor, and Oak Ridge Associated Universities.
- Ensure timely support of regulatory schedules through preplanning of project waste management needs and tracking of key waste management activities.

- Adequately characterize waste streams at the point of generation to ensure compliance with waste certification requirements, waste TSD facility acceptance criteria, and transportation requirements as part of a formal waste certification effort.
- Minimize the volumes of waste generated by ORR activities through conducting up-front project planning, establishing minimization goals, training, and using innovative technologies and techniques.
- Establish and maintain an ORR waste generation forecast and maintain comprehensive records of wastes from generation to disposal.
- Make optimal use of private sector and university capabilities in waste management activities, including research and development.
- Conduct waste management activities in accordance with documented quality assurance, environmental compliance, and health and safety requirements.

The overall waste management strategy, objectives, requirements, roles and responsibilities, and work plan (including TSD facility planning and operation) associated with ORR-generated waste are described in the OR-1 Project Waste Management Plan, DOE/OR-1183.

6.2.2 Information Management

As described in the OR-1 Project Waste Management Plan, participants are responsible for maintaining cradle-to-grave waste information data bases by site. These data bases shall contain cradle-to-grave waste-tracking information, including quantity, type, and characterization of waste.

The integrating contractor, Energy Systems, is responsible for developing and maintaining a central information management system with the capabilities for compiling the waste information from the data bases, as well as documenting, disseminating, and reporting other waste information and requirements. The integrating contractor is also responsible for integrating the data bases into the central information management system.

6.2.3 Waste Management Funding and Responsibilities

The ORR is a generator of wastes the same as other DOE projects or programs and, therefore, is responsible for the management and disposition of the wastes that it generates. Options include treatment, storage, or disposal using dedicated facilities or coordinating with EM-30, WM, to utilize existing TSD resources. Waste management funding requirements will be documented in the appropriate activity data sheet and in some cases, will be determined by the DOE Headquarters Facility Planning Board.

6.2.4 Treatment, Storage, and Disposal Capacity and Future Impacts

RI, remedial actions, and D&D activities are now under way at a significant pace across the ORR. Stemming from the rapid increase in waste generation volumes from associated waste management activities and the relatively small amount of excess capacity existing in individual plant TSD units, there are increasing shortfalls in TSD capacity. These situations are symptomatic of the much larger concerns that exist over the planned major RI, remedial action, and D&D activities that are expected to produce waste in the coming years. Presently, resolution of these capacity shortfalls has had to be handled on a case-by-case basis because of a lack of coordinated waste generation estimating, TSD capacity planning, and project-specific WM planning.

Actions are under way to provide the needed up-front project planning and overall waste estimating needed to avoid the TSD capacity shortfalls. Remediation participants are required to develop WM project plans that outline the expected waste quantities and waste types requiring TSD. These plans are to be reviewed and approved by the respective WM organizations and ER Division prior to approval of waste generation.

To get some overall estimate of the magnitude of the WM needs for ORR generated wastes, a waste generation forecast data base is being constructed and maintained. Waste generation forecasts will be developed and updated by participants as waste data is revised and will cover the entire time frame of waste generating activities. Forecasts will be made for the three remedial action phases (preliminary assessment/site inspection, RI/FS, and remedial design/remedial action) and for D&D activities including S&M. Wastes will be identified by the following:

- media (solid, liquid);
- category (low-level, mixed RCRA, Toxic Substances Control Act, transuranic, sanitary, and free mercury);
- material type (soil, debris, sludge, sediment, personal protective equipment/trash, asbestos, metal, decontamination water, well development/purge water, groundwater, other aqueous liquids, and solvents/oils);
- chemical or radionuclide contaminant.

The ER Division will be responsible for coordinating the forecasts and establishing and maintaining a data base documenting and archiving DOE-ORO level forecasts.

6.2.5 Management of Investigation-Derived Wastes

Past management of investigation-derived wastes (IDW) has been tailored after production waste management because of the relatively small volumes. However, increased IDW generation, coupled with the off-site shipment moratorium, shrinking TSD capacity, and limited analytical capacity required a change in IDW management. The revised IDW management entails maximizing treatment and disposal of IDW within the area of contamination consistent with EPA guidance. Successful IDW management minimizes costs while not increasing any personal or environmental risks at the waste area. Specific IDW management plans will be outlined in the RCRA facility investigation/site inspection plans submitted to regulators.

6.2.6 Transfer of Facilities to the ERWM Program

The FFA for the Reservation establishes new requirements for tanks and associated systems. It requires major upgrades to active systems and will drive the closure schedule for many active and inactive tanks. The methods proposed to implement the plans for upgrades are addressed on expense-funded projects, general plant projects, and line item projects. Facilities and systems (e.g., tanks, piping, filter pits) being replaced with improved processing systems must meet applicable regulatory requirements. Remediation of these inactive tanks and systems will require turnover to the ERWM Program.

The policy for acceptance of DOE facilities into the WM Program requires a 3-year transition period for turnover of the facility from the original program office to the WM Program. During this period, the program office is responsible for placing the facility in a safe, secure condition; removing any special nuclear materials, nuclear fuel, high-level radioactive waste, liquid wastes, and stored hazardous materials; and providing WM with an assessment of the facility's compliance with applicable environmental and safety requirements. In addition, during the transition period, DOE-ORO establishes future funding needs for S&M activities and for D&D of the facility.

6.3 ANALYTICAL LABORATORIES PROGRAM

ORR analytical chemistry requirements are ensured by a number of different sources of analytical support. These include internal laboratories, subcontracts for specific analytical services, and general-order subcontractors who are assigned specific tasks.

Each of the three ORR installations house analytical laboratory facilities for the Central Analytical Services Organization. These laboratories are responsible for the analytical needs of the facility programs. The services they offer are appropriate not only for the products produced by their plant but also for other facility requirements such as environmental, WM, industrial hygiene, health physics, maintenance, utilities, and others. When the facility laboratory does not offer a service, is not certified in an area where certification is required (such as a drinking water analysis), or does not have the internal capacity, the samples are sent by them through the Analytical Project Office to the other facility laboratories or to outside subcontractor laboratories.

The Analytical Project Office was formed in the spring of 1991. It is chartered to coordinate the overall analytical work load for the programs that are not facility specific. These programs included ER and the associated D&D programs and WM. The Analytical Project Office serves the various facility laboratories by helping to level their analytical work load overflows through the placement of analytical work with the facility laboratories and at outside commercial laboratories. The office is responsible for the analytical subcontracts needed to accomplish that work and to ensure that the appropriate quality assurance activities are carried out concerning the laboratories it uses. The office will coordinate the establishment and maintenance of standards that lead to transparency of analytical data and consistency of analytical procedures in programs. Functionally, the Analytical Project Office contains components of the following:

- program management;
- contracting and contract management;
- scheduling and cost analysis;
- quality assurance/quality control coordination;
- analytical chemistry, including organic, inorganic, and radiological;

- data management; and
- prioritization.

It also coordinates the Environmental Surveillance Procedures Quality Control Program.

The Analytical Project Office reviews project plans, sampling and analysis plans, and task orders that contain analytical support requirements. Its staff or designated alternates serve as members of the project teams during the planning of projects and assist in the formulation and definition of project requirements using the DQO process. The Analytical Project Office staff coordinates analytical activities between ER projects to ensure a consistent approach.

6.4 THE RESERVATION D&D PROGRAM

The D&D Program activities on the ORR consist of five individual programs that are coordinated/integrated (along with the Paducah and Portsmouth D&D programs) through the DOE-ORO ER Division, with the Energy Systems ER Program office as integrating contractor. The five programs are the K-25 Site D&D, the K-25 Site Gas Centrifuge Enrichment Facilities, and select facilities from ORNL, the Y-12 Plant, and Oak Ridge Associated Universities. D&D, including S&M, provides for the safe caretaking and disposition of retired, DOE-owned nuclear facilities.

The D&D Program on the ORR consists of 82 facilities at the K-25 Site (including 13 gas centrifuge enrichment structures), 16 shutdown projects at ORNL, Buildings 9201-4 and 9213 at the Y-12 Plant. The facilities currently included in the D&D Program are varied, including mercury-contaminated equipment and structures, hot cells, experimental reactors, and uranium enrichment equipment and structures. The various facilities have a wide variety of contaminants, such as polychlorinated biphenyls (PCBs), friable and nonfriable asbestos, chlorofluorocarbons, chromates, lubrication oils, miscellaneous RCRA materials, uranium, and other radionuclides.

Although some of the contaminants cause the program to be driven by specific regulations under RCRA, Toxic Substances Control Act, a related Federal Facilities Compliance Agreement or FFA/interagency agreement compliance, the program is primarily driven by DOE orders. Funding for the ORR D&D Program in FY 1993 is ~$105 million. Approximately 50% of the funding is used for the S&M necessary to preserve an acceptable level of health and safety conditions for the employees and the general public and also to acceptably protect the environment. Primarily because of their age, many of the facilities are in significant disrepair and/or need attention regarding health and safety acceptability. For example, the process buildings at the K-25 Site have been in existence 45 to 50 years and in a shutdown status since about 1985. Maintenance of ~160 acres of roofing to prevent damaging leaks that further exacerbate health (e.g., aggravated asbestos deterioration) and safety (e.g., an unsafe radiation criticality configuration or spread of radioactive contamination if water is introduced) conditions is an intense and ongoing requirement. Bringing these aged facilities into compliance and maintaining compliance status requires significant attention. With the increasing demands imposed by current and evolving health, safety, and environmental requirements, considerable program support is being required. This required support typically includes technical services, nondestructive assay measurement support, nuclear material control and accountability, special services (Health Physics, Criticality Alarms, Industrial Hygiene), support projects (self-assessment, security, safety analysis reports and emergency upgrades), environmental management, decontamination support, fire protection, electrical power, and other necessary support from Utilities. The discovery of breached UF_6 cylinders at the K-25 Site has resulted in the need for increased cylinder and cylinder yard investigation, inspections, and maintenance. In addition, UF_6 feed cylinders (normal assay) are being shipped to operating gaseous diffusion plants.

The remaining funding is used for actual removal actions for asbestos, PCBs, and other hazardous materials; for selective decontaminations; and for developing plans and strategies for long-term decommissioning actions. In an effort to better understand cost and schedule drivers for facilities with the magnitude of the K-25 Site process buildings, a pilot project to decontaminate and decommission a representative cross-section of the K-27 facility has been initiated. The characterization of the cross-section is currently under way. This project will refine and validate a "should-cost" estimate for the large-scale D&D of the gaseous diffusion plants.

Budget levels are projected to decrease from $105 million in FY 1993 to $96 million in FY 1994, then increase in FY 1995 to $109 million. Ultimately, the decommissioning of the ORR will cost billions of dollars.

The ER organization addresses the importance of close coordination and prioritization of activities relative to remedial action and D&D programs to ensure continuity and close interaction of activities. Although managed independently, the D&D Program and Remedial Action Program activities are structured within the ER organization, thereby integrating the budgeting and strategic planning into the overall ER Program. For example, some D&D facilities were the sources that contaminated some of the remedial action units. A specific example of this is the mercury contamination at the Y-12 Plant and in the city of Oak Ridge. Building 9201-4 is part of the D&D Program. In other cases the level of contamination of soil beneath a D&D facility may be unknown; when the building is demolished by the D&D Program, a remaining contaminated area may have to be added to the Remedial Action Program. Typically, D&D and Remedial Action Program schedules will be coordinated to avoid the problems of incomplete remedial action or recontamination of a remediated area that could arise if the D&D site is located within the boundaries of an ER Program OU.

The potential regulatory concerns of shutting down facilities and leaving process equipment, chemicals, piping, and building in place have presented problems for a number of years. Such facilities have been managed under a system of S&M under the D&D Program. This system, while including activities for effective management and control of hazardous and radioactive materials, needs a clearer basis under regulation.

The ORR was placed on the National Priorities List of CERCLA in 1989 and many of the facilities in the D&D Program as well as many other inactive structures may be considered potential sources of releases as defined by CERCLA. Allowing the inactive structures to be managed under the CERCLA process would provide a regulatory basis to systematically manage the closeout of these facilities under a risk-based approach. This could be accomplished by including the facilities under the present FFA or through some other formal agreement with EPA and TDEC.

6.5 K-25 SITE LANDLORD PROGRAM

6.5.1 General Scope

The Energy Systems ERWM Program's headquarters and many of its operational activities are located at the K-25 Site. These activities, properly focused on accomplishing their specific tasks of D&D; hazardous materials abatement, storage, and destruction; or other aspects of ER, require personnel and mission-specific facilities to ensure their success. Support of the facility aspects of these personnel and equipment requirements, as well as certain requirements of mission-specific facilities, is the ultimate mission of the K-25 Site Landlord Program.

The K-25 Site occupies more than 1500 acres and has 92 major buildings. Of these 92 buildings, 53 are available for assignment to the continuing or new needs and missions of the ERWM, DOE, and the ER Program. The buildings range from very large two-story cascade buildings to much smaller process support and administrative buildings of various heights and sizes (Fig 6.1).

6.5.2 Objectives

Detailed planning for facilities at the K-25 Site is documented in the annual update of the "*Site Development Plan, The Oak Ridge K-25 Site*" (K/EN/SFP-4/R1). Those facilities that are general purpose are also included in the K-25 Landlord Program plan. The objectives for the K-25 Site Landlord Program support include the following:

- Maintain all active general purpose infrastructure to appropriate standards.
- Provide for the replacement of general purpose facilities as they exceed their useful life.
- Provide for growth and change in the site's mission.
- Remove unneeded, inactive facilities that are not included in the D&D Program.
- Restructure existing utility systems to meet current and projected requirements.
- Optimize the operating characteristics of the existing utility systems.
- Provide the appropriate computing capabilities in support of multiple program users.
- Meet on-site and off-site transportation requirements of the K-25 Site staff.
- Upgrade the overall equipment inventory by eliminating marginal equipment and replacement with additional equipment.
- Provide for the orderly replacement of existing equipment as it becomes obsolete or unreliable.
- Fund environmental studies and characterizations of various portions of the K-25 Site as directed by OSHA, NEPA, DOE, the state of Tennessee, and other appropriate regulatory agencies and ensure that they are consistent with the ERWM mission.

6.5.3 K-25 Site Landlord Activity

The current near-term and long-term activities that, in addition to a continuation of current program planning and management activities, consist of some D&D activities and remediation tasks, including projects such as asbestos and OSHA electrical noncompliance abatements. The short-range planning activities span the next 5 years and address site and facilities planning issues as they are currently represented. The long-range planning activities include a 20-year-plus period and discuss issues that are anticipated and/or desired to occur in the future.

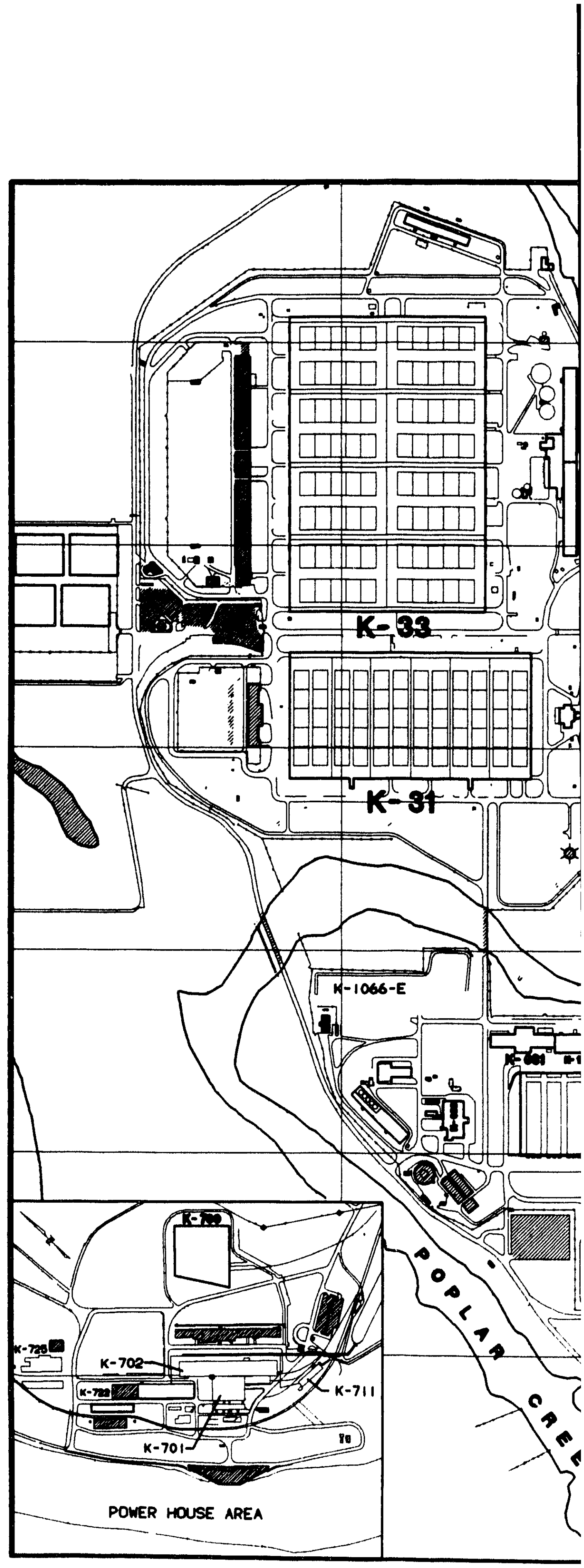
Included in the current year's effort is the design and construction of a replacement Radiologic Laundry Facility, the acquisition of a Freon Recycle/Recovery System, initiation of asbestos abatement projects in K-1004A and K-1002, and upgrades to the electrical systems in several facilities consistent with DOE-approved Risk Assessment Code Matrix for OSHA nonconformances. Also, the recently completed renovation of the on-site rail system and acquisition of a more capable locomotive, all through K-25 Site Landlord Program support, has permitted more economic and efficient movement of large volumes of hazardous wastes both on and off the site.

Current and near-term (short-range) activities for the site will maintain a mix of objectives, and they are as follows:

- The mission of the site throughout the planning period will focus on these activities:
  - ER,
  - WM,
  - ER & WM technology development,
  - D&D of appropriate shutdown Oak Ridge Gaseous Diffusion Plant facilities, and
  - support to various organizations located on the K-25 Site.

Long-range planning activities, in addition to a continuation of current activities, will include the following objectives:

- The K-25 Site will continue to acquire new programs associated with the ERWM mission which will draw on the capabilities of the K-25 Site and its multitalented work force.
- Programs and other organizations located in off-site leased facilities will be consolidated at the K-25 Site when economically and operationally feasible.
- The K-25 Site will remain a viable candidate site for new program initiatives consistent with the overall ERWM mission.



K-33
K-31
K-1066-E
K-709
K-725
K-702
K-722
K-711
K-701
POWER HOUSE AREA
POPLAR CREE

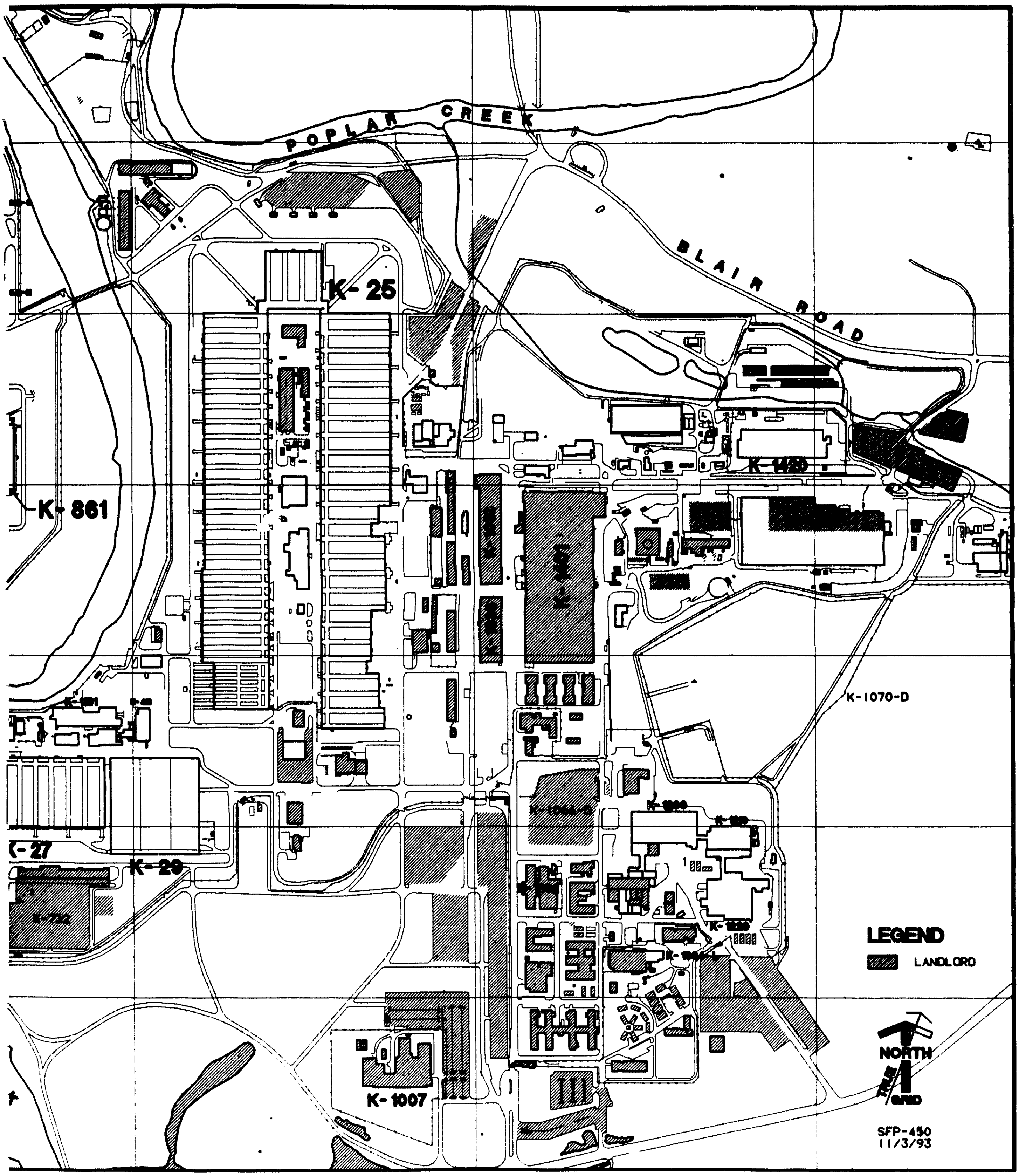


Fig. 6.1. K-25 Site Landlord Program management map.

7. REFERENCES

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Oak Ridge Reservation Operable Units

REMEDIATION

Installation/ Operable Unit	OU Status	Area Description	Area Number
K-25			
K-1070	RI/FS		
	RD/RA *	SW31 Spring	C098
		K-1070-C/D Classified Burial Ground	R005
		K-1070-D1, D2, And D3 Storage Dikes	R026
K-901	RI/FS		
		K-895 Cylinder Destruct Facility	C087
		K-1070-A Landfarm	C104
		K-1070-A Old Contaminated Burial Ground	R001
		K-901-A Holding Pond	R006
		K-901 South Disposal Area	R077
		K-901-A North Disposal Area	R081
K-770	RI/FS		
		K-725 Beryllium Building	C004
		K-770 Contaminated Debris	C009
		Building 526 Heavy Equipment Shop	C077
		Building F-29 Gasoline Station	C088
		K-770 Scrap Metal Yard	R008
		K-1085 Old Firehouse Burn Area	R043
		K-720 Fly Ash Pile	R045
		K-709 Switchyard	R075a
		K-710 Sludge Beds And Imhoff Tanks	R076
K-1420	RI/FS		
		K-1420 Contaminated Drum Storage	C067
		K-1420 Oil Storage	R010
		K-1420 Process Lines	R016
K-1407	RI/FS		
		K-1700 Stream	C002
		K-1070-B Old Classified Burial Ground	R002
	RD/RA *	K-1407-B Holding Pond	R004
		K-1407-C Soil	R023
		K-1419 Sludge Fixation Plant	R032
	RD/RA *	K-1417 Drum Storage Yard	R033
	RD/RA *	K-1407-C Retention Basin	R039
		K-1070-G Burial Ground	R054
K-1401	RI/FS		
		K-1401 Degreasers	C005
		K-1035 Gasoline Station	C092
		K-1401 Door 2W Gasoline Tank	C094
		K-1401 Acid Line	R013

* Individual Area Status/FYR Date

Installation/ Operable Unit	OU Status	Area Description	Area Number
K-25			
K-1004	RI/FS		
		K-1004-L Recirculating Cooling Water Lines	C003c
		K-1210 Recirculating Cooling Water Lines	C003f
		K-1004-J Underground Tank	R074
K-1064	RI/FS		
		K-1064 Drum Storage And Burn Area	R007
		K-1064-G Drum Deheading Facility	R020
K-1007	RI/FS		
		K-1048 Tire And Battery Shop	C079
		K-1050 Wash, Grease, And Paint Shop	C080
		K-1047 Motor Pool Repair Shop	C081
		K-1007-P1 Holding Pond	R044
		K-1007 Gas Tank	U007
K-1410	RI/FS		
		K-1410 Neutralization Pit	R011
K- 25 Groundwater	RI/FS		
		K-25 Site Groundwater	C099
K- 33	RI/FS		
		K-31 Recirculating Cooling Water Lines	C003j
		K-33 Recirculating Cooling Water Lines	C003k
		K-861 Cooling Tower Basin	C003l
		K-892-G Cooling Tower Basin	C003m
		K-892-H Cooling Tower Basin	C003n
		K-892-J Cooling Tower Basin	C003o
		K-792 Switchyard	R075b
		K-762 Switchyard	R075d
K- 29	RI/FS		
		K-27/29 Recirculating Cooling Water Lines	C003h
		K-832-H Cooling Tower Basin	C003i
K-1413	RI/FS		
		K-1413 Treatment Tanks	R015
		K-1413 Process Lines	R059
ORNL			
WAG 5	RI/FS		
		LLLW Lines And Leak Sites-OHF, Release Of Grout	05.01A
		LLLW Lines And Leak Sites-OHF Contaminated Soil	05.01B

* Individual Area Status/FYR Date

Installation/ Operable Unit	OU Status	Area Description	Area Number
ORNL			
WAG 5	**RI/FS**		
		OHF Pond/Pits	05.02
		Inactive OHF Waste Storage Tank T1	05.05A
		Inactive OHF Waste Storage Tank T2	05.05B
		Inactive OHF Waste Storage Tank T3	05.05C
		Inactive OHF Waste Storage Tank T4	05.05D
		Inactive OHF Waste Storage Tank T9	05.05E
		LLLW Line From Valve Box To OHF	05.05F
		Process Waste Sludge Basin (7835)	05.06
		SWSA 5 South (Trenches, Undefined Area, Dump, Auger Holes)	05.07
		PWSB Pipeline From PWSB To Process Waste Treatment Plant	05.07A
		Drainage 1,2 In WAG 5	05.07B
		Old Landfill (NE Edge Of SWSA 5 South)	05.14
		Inactive LLLW Tank T-14	05.16
WAG 10 OU 3	**RI/FS**		
Hydrofracture Wells		Old Hydrofracture Injection Well (7852)	10.03
WAG 1 OU 1	**RI/FS**		
Gunite & Associated Tanks		Inactive LLLW Collection/Storage Tank W-1	01.23A
		Inactive LLLW Collection/Storage Tank W-2	01.23B
		Inactive LLLW Collection/Storage Tank W-3	01.24A
		Inactive LLLW Collection/Storage Tank W-4	01.24B
		Inactive LLLW Collection/Storage Tank W-13	01.25A
		Inactive LLLW Collection/Storage Tank W-14	01.25B
		Inactive LLLW Collection/Storage Tank W-15	01.25C
		Inactive LLLW Collection/Storage Tank W-5	01.26A
		Inactive LLLW Collection/Storage Tank W-6	01.26B
		Inactive LLLW Collection/Storage Tank W-7	01.26C
		Inactive LLLW Collection/Storage Tank W-8	01.26D
		Inactive LLLW Collection/Storage Tank W-9	01.26E
		Inactive LLLW Collection/Storage Tank W-10	01.26F
		Inactive LLLW Collection/Storage Tank W-11	01.27
		Inactive LLLW Collection/Storage Tank W-1a	01.28
		Inactive LLLW Collection/Storage Tank TH-4	01.32
		Inactive LLLW Collection Tank W-17	01.42B
		Inactive LLLW Collection Tank W-18	01.42C
		Waste Evaporator Facility (3506)	01.62
		Fission Products Pilot Plant (3515)	01A.06
WAG 1 OU 3	**RI/FS**		
Underground Piping & Storm Drains		FPDL LLLW Tranfer Line	01.21

* Individual Area Status/FYR Date

Installation/ Operable Unit	OU Status	Area Description	Area Number
ORNL			
WAG 1 OU 4	RI/FS		
Groundwater		WAG 1 Groundwater	00.50
WAG 4	RI/FS		
		LLW Line North Of Lagoon Road (7800)	04.01
		SWSA 4 (7800)	04.03
WAG 1 OU 2	RI/FS		
Surface Impoundments		Waste Holding Basin (3513)	01.12
		Equalization Basin (3524)	01.13
		Process Waste Pond (3539)	01.14
		Process Waste Pond (3540)	01.15
WAG 1 OU 5	RI/FS		
WOC Floodplain Soils & Sediments		WAG 1 WOC Floodplain Soils & Sediments	00.51
WAG 2 OU 1	RI/FS		
WOL Embayment/Trib./Soil		White Oak Lake And Embayment (7846)	02.01
		White Oak Creek And Tributaries (0853)	02.02
WAG 2 OU 2	RI/FS		
Groundwater		WAG 2 Groundwater	00.53
WAG 10 OU 2	RI/FS		
Groundwater		WAG 10 Groundwater	00.52
WAG 7 OU 1	RI/FS		
Subsurface Disposal		Homogeneous Reactor Experiment (HRE) Fuel Wells (7809)	07.02
		Pit 1 (7805)	07.05
		Pit 2 (7806)	07.06A
		Pit 3 (7807)	07.06B
		Pit 4 (7808)	07.06C
		Trench 5 (7809)	07.07
		Trench 6 (7810)	07.08
		Trench 7 (7818)	07.09
		Septic Tank (7819)	07.11
WAG 3	RI/FS		
		SWSA 3 (1001)	03.01
		Scrap Metal Area (1562)	03.02
		Contractors' Landfill (1554)	03.03

* Individual Area Status/FYR Date

Installation/ Operable Unit	OU Status	Area Description	Area Number
ORNL			
WAG 9	RI/FS		
		Homogeneous Reactor Experiment (HRE) Pond (7556)	09.01
		LLLW Collection And Storage Tank 7560	09.02A
		LLLW Collection & Storage Tank 7562	09.02B
		Trash Area East Of HRE Parking Lot	09.04
WAG 6	RI/FS		
		SWSA 6 (7822)	06.01
		Emergency Waste Basin (7821)	06.02
		SWSA 6 - Explosive Detonation Trench (7822A)	06.03
WAG 8	RI/FS		
		HFIR/TRU Waste Collection Basin (7905)	08.01A
		HFIR/TRU Waste Collection Basin (7906)	08.01B
		HFIR/TRU Waste Collection Basin (7907)	08.01C
		HFIR/TRU Waste Collection Basin (7908)	08.01D
		Hydrofracture Experiment Site 2 (HF-S2A)	08.02
		LLLW Lines & Leak Sites - Lagoon Road & Melton Valley Dr	08.03A
		LLLW Lines & Leak Sites - Melton Valley Dr & SWSA 5 Access	08.03B
		LLLW Lines & Leak Sites - 7500 Area	08.03C
		LLLW Lines & Leak Sites - West Of Melton Valley Pumping	08.03D
		LLLW Lines & Leak Sites - bldg 7920 & MV Pumping Stat Area	08.03E
		LLLW Lines & Leak Sites - 7920 Ditch Line	08.03F
		LLLW Lines & Leak Sites - Melton Valley Transfer Line	08.03G
		Contractors Spoils Area-Melton Valley, W-SW Of 7900	08.13
		HFIR Cooling Tower Surface Impoundment	08.14
		Aircraft Reactor Experiment Surface Impoundment	08.15
		MSRE Storage Well	08.16
		Abandoned Sanitary Waste Pipeline & Septic Tank N Of 7917	08.17
		Inactive LLLW Collection Tank 7503A	08.20
		ARE Contaminated Tool Storage	08A.01G
WAG 1 OU 10	RI/FS		
Steel Tank Systems		Inactive LLLW Collection/Storage Tank WC-1	01.29
		Inactive LLLW Collection/Storage Tank WC-15	01.30A
		Inactive LLLW Collection/Storage Tank WC-17	01.30B
		Inactive LLLW Collection/Storage Tank TH-1	01.31A
		Inactive LLLW Collection/Storage Tank TH-2	01.31B
		Inactive LLLW Collection/Storage Tank TH-3	01.31C
		Inactive LLLW Collection Tank WC-4	01.36
		Inactive LLLW Collection Tank WC-5	01.37A
		Inactive LLLW Collection Tank WC-6	01.37B
		Inactive LLLW Collection Tank WC-8	01.37C
		Inactive LLLW Collection Tank WC-11	01.39B
		Inactive LLLW Collection Tank WC-12	01.39C

* Individual Area Status/FYR Date

Installation/ Operable Unit	OU Status	Area Description	Area Number
ORNL			
WAG 1 OU 10	RI/FS		
Steel Tank Systems		Inactive LLLW Collection Tank WC-13	01.39D
		Inactive LLLW Collection Tank WC-14	01.39E
		Inactive LLLW Collection Tank W-19	01.56A
		Inactive LLLW Collection Tank W-20	01.56B
		Inactive LLLW Collection Tank S-424	01.64C
		Inactive LLLW Collection Tank W-11	01.66
		Inactive LLLW Collection Tank 4501-C	01.67A
		Inactive LLLW Collection Tank 4501-D	01.67B
		Inactive LLLW Collection Tank 4501-P	01.67C
		Inactive Filter House Seal Tank 3002-A	01.68
		Inactive LLLW Collection Tank H-209	01.71
		Inactive LLLW Collection Tank 3001-B	01.73
		Inactive LLLW Collection Tank 3003-A	01.74
		Inactive LLLW Collection Tank 3004-B	01.75
		Inactive LLLW Collection Tank 3013	01.76
		Inactive LLLW Collection Tank T-30	01.78
		3001 Storage Canal	01.79
WAG 1 OU 9	RI/FS		
Contaminated Soils		FPPP Contaminated Soil	00.33
		Mercury Contaminated Soil (3503)	01.01
		Mercury Contaminated Soil (3592)	01.02
		Mercury Contaminated Soil (4501)	01.03
		Mercury Contaminated Soil (4508)	01.04
		LLLW Lines & Leak Sites - South Of Building 3020	01.05A
		LLLW Lines & Leak Sites - East Of Building 3020	01.05B
		LLLW Lines & Leak Sites - West Of Building 3082	01.05C
		LLLW Lines & Leak Sites - North Of Building 3019	01.05D
		LLLW Lines & Leak Sites - SW Corner Of Building 3019	01.05E
		LLLW Lines & Leak Sites - Between W-5 & WC-19	01.05F
		LLLW Lines & Leak Sites - Underneath Building 3047	01.05G
		LLLW Lines & Leak Sites, gen Isotopes Area (3037,3038,3034)	01.05H
		LLLW Lines & Leak Sites - Building 3092 Area	01.05I
		LLLW Lines & Leak Sites - Underneath Building 3026	01.05J
		LLLW Lines & Leak Sites - Between WC-1 & W-5	01.05K
		LLLW Lines & Leak Sites - ORR Water Line (Building 3085)	01.05L
		LLLW Lines & Leak Sites - Building 3028	01.05M
		LLLW Lines & Leak Sites - East Of Building 2531	01.05N
		LLLW Lines & Leak Sites - Underneath Building 3515	01.05O
		LLLW Lines & Leak Sites - Building 3525 To A Sump	01.05P
		LLLW Lines & Leak Sites - Underneath Building 3550	01.05Q
		LLLW Lines & Leak Sites - Sewer Near Building 3500	01.05R
		LLLW Lines & leak Sites - Abandoned Line Central Ave Area	01.05S
		LLLW Lines & Leak Sites - Building 4508, North	01.05T

* Individual Area Status/FYR Date

Installation/ Operable Unit	OU Status	Area Description	Area Number
ORNL			
WAG 1 OU 9	RI/FS		
Contaminated Soils		LLLW Lines & Leak Sites - Building 3518, West	01.05U
		LLLW Lines & Leak Sites - Northwest Of SWSA-1	01.05V
		LLLW Lines & Leak Sites - Bldg 3503, Ground Contamination	01.05W
		Contaminated Surfaces & Soil From 1959 Explosion, bldg 3019 Cell	01.06
		Contamination At Base Of 3019 Stack	01.07
		Graphite Reactor Storage Canal Contaminated Soil (3001/3019)	01.08
		Oak Ridge Research Reactor Decay Tank Rupture Site(3087)	01.09
		Decomissioned Waste Holding Basin (3512)	01.11
		Low Intensity Test Reactor (LITR) Ponds (3085W)	01.19
		3517 Filter Pit (Fission Product Development Lab)	01.20
		Transfer Canal And Disolver Pit (3505)	01.63
		Underground Exhaust Ducts Soil Contam. 3001-3003	01A.01E
WAG 7 OU 2	RI/FS		
Pipeline & Leak Site		Hydrofracture Exper Site 1, Soil Contamination(HF-S1A)	07.03
		Gauging Station NW Of Bldg 7852	07.04A
		Pit 6 SE (Leak Site 1)	07.04B
		End Of Trench 7 Access Road (leak Site 2)	07.04C
		Leak In Transfer Line From Decon Fac (7819) - pit 1 (7805)	07.04D
		Leak In Line Between Pit 3 (7807) And Trench 6 (7810)	07.04E
		Leak At Valve Pit North Of Trench-7 (7818)	07.04F
		Equipment Storage Area (7841)	07.12
WAG 11	RI/FS		
	RD/RA *	White Wing Scrap Yard (XDO751)	11.01
WAG 13	RI/FS		
	RD/RA *	Cesium-137 Contaminated Field (0800)	13.01
		Cesium-137 Erosion/Runoff Study Area (0807)	13.02
WAG 1 OU 6	RI/FS		
SWSA 1		SWSA-1 (2624)	01.46
WAG 1 OU 7	RI/FS		
SWSA 2		SWSA-2 (4003)	01.47
WAG 1 OU 8	RI/FS		
Waste Pile		Former Waste Pile Area (South Of NRWTP)	01.58
WAG 10 OU 1	RI/FS		
Grout Sheets		Hydrofracture Experimental Site 1	10.01
		Hydrofracture Experimental Site 2	10.02

* Individual Area Status/FYR Date

Installation/ Operable Unit	OU Status	Area Description	Area Number
ORNL			
WAG 10 OU 1	RI/FS		
Grout Sheets		New Hydrofracture Injection Well	10.04
		Grout Sheets	10.04A
ORR			
Clinch River	RI/FS		
		Clinch River	C001
Lower EFPC	RI/FS		
		Lower East Fork Poplar Creek	YS-603
LWBR	RI/FS		
		Lower Watts Bar Reservoir	C001a
South Campus	RI/FS		
		Radioisotope Laboratory	U002a
		Autopsy Laboratory	U002b
		Large Animal Containment Facility (LACF)	U002c
		LACF Accumulation Tank	U002d
		Medium Animal Containment Facility (MACF) Accumulation Tank	U002e
		Wastewater Treatment Facility (WWTF)	U002f
		Septic Tanks	U002g
		Swine Waste Lagoons	U002h
		Nutrition Barn Floor Slab	U002i
		Former Dip Tank Area	U002j
		Mechanical Shop UST Removal Site	U002k
Y-12			
Upper EFPC OU 1	RI/FS		
GW and Surface Water		Mercury-contaminated Areas	YS-127
	12/20/98*	Tank 2100-U	YS-209
	12/20/98*	Tank 2101-U	YS-210
	12/20/98*	Tank 2104-U	YS-212
		Upper East Fork Poplar Creek	YS-602
Bear Creek OU 4	RI/FS		
GW and Surface Water		Bear Creek Grndwater,Surface Water,Creek Sedmnt&Flood Plain	YS-600
Chestnut Ridge OU 1	RI/FS		
		Chestnut Ridge Security Pit	YD-023
Bear Creek OU 1	RI/FS		
		Bear Creek Burial Grounds	YD-024
		Hazardous Chemical Disposal Area-boneyard-burnyard	YD-024-HC
		Sanitary Landfill I	YD-101

* Individual Area Status/FYR Date

Installation/ Operable Unit	OU Status	Area Description	Area Number
Y-12			
Bear Creek OU 1	RI/FS		
		S-3 Ponds	YT-004
		Oil Retention Pond No. 1	YT-008
		Oil Retention Pond No. 2	YT-009
		Oil Landfarm	YT-014
Chestnut Ridge OU 4	RI/FS		
		Rogers Quarry/Lower McCoy Branch	YD-108
Chestnut Ridge OU 2	RI/FS		
		Filled Coal Ash Pond/McCoy Branch	YD-112
Bear Creek OU 2	RI/FS		
		Rust Spoil Area	YD-106
		Spoil Area I	YD-107
		SY-200 Yard	YS-125
Upper EFPC OU 3	RI/FS		
		S-2 Site	YD-103
		Salvage Yard Oil Storage	YS-018
		Salvage Yard Oil/Solvent Drum Storage Area	YS-020
		Salvage Yard Scrap Metal Storage Area	YS-111
		Building 81-10 Area	YS-117
		Tank 2063-U	YS-204
		Salvage Yard Drum Deheader	YT-109
Upper EFPC OU 2	RI/FS		
		Nitric Acid Pipeline	YS-601
Chestnut Ridge OU 3	FYR		
		United Nuclear Landfill	YD-026
Y-12 Plating Shop Container Areas	NFA [9/30/97]		
		Building 9401-2 Polytank Station	YS-334
		Building 9401-2 East Yard	YS-351

* Individual Area Status/FYR Date

PREREMEDIATION

Installation/ Study Area	Area Description	Area Number
K-25		
Study Areas		
	K-822A Cooling Tower Basin	C003a
	K-1037 Recirculation Cooling Water Lines	C003b
	K-1131 Neutralization Pile	C074
	Building 569 Heavy Equipment Shop	C078
	K-1044 Heavy Equipment Repair Shop	C082
	K-1236 Paint Shop	C084
	T-17 Light Equipment Garage	C085
	K-1027 Service Station	C086
	K-1055 Gasoline/Diesel Station	C089
	S-21 Happy Valley Service Station	C090
	K-802 Gasoline Storage Tank	C091
	Building 664 Heavy Equipment Shop	C095
	K-1232 Chemical Recovery Facility Lagoon	C101
	Flannagan's Loop Road	C102
	Duct Island Road	C103
	K-1070-F Construction Spoil Area	R018
	K-1099 Blair Quarry	R019
	K-1515-F Land Treatment	R021
	K-1031 Waste Paint Accumulation Area	R055
	K-1035 Acid Pits	R083
	K-1654-A Waste Accumulation Tank	R087
ORNL		
Study Areas		
	ER Program Office Trailer Site	00.11
	Soil At HRE Decontamination Pad/shed (7500)	00.44
	SWSA 6 TVA Easement	00.54
	Abandoned, Underground Waste Oil Storage Tank 7002A	00.55
	Drainage 3 Next To WAG 5	05.07C
	Waste Valve Pit 7561	09A.01F
	Closed Contractors' Landfill (7658)	12.01
	Former Transformers Storage Yards (9201-2,9204-1,9204-3,SY-200)	15.02
	Cesium-137 'Forest' Research Area (7759)	16.01
	Buried Scrap Metal Area	16.03
	Waste Oil Storage Tank (7002W)	17.02A
	Paint Solvents Storage Tank (7615)	18.02
	Waste Retention Basin	18.05
	Reactive Chemicals Disposal Area (7659B)	19.06
	Soil Injection Of Radioactive Gas	19.07
	Explosion & Shock Sensitivity Waste Detonation Facility (7667)	19.08
	Municipal Sewage Sludge Application Site (XF1226)	20.01
	Abandoned Burn Pit	99.01
	Cs-137, Co-60 Contaminated Forest Area	99.03

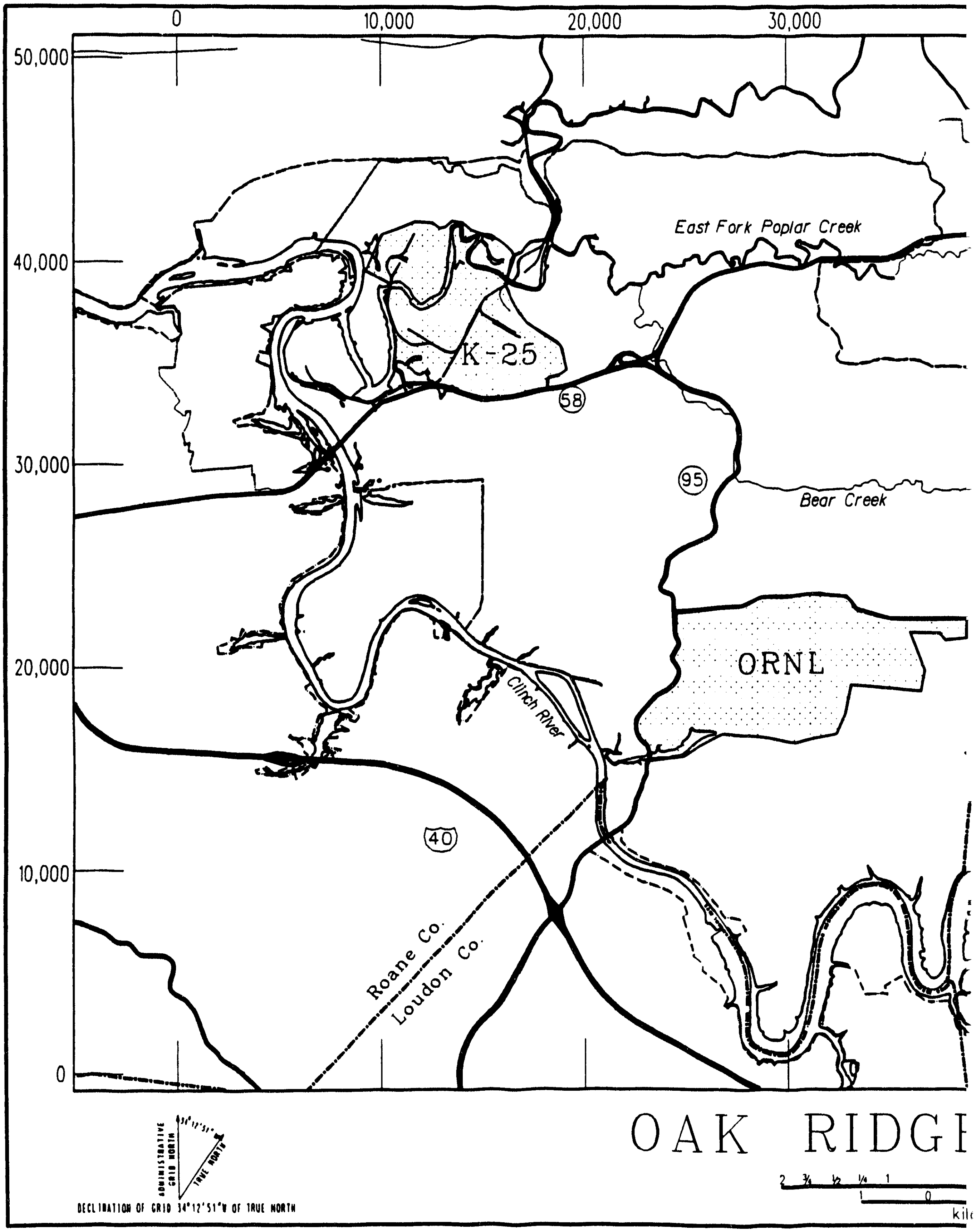
Installation/ Study Area	Area Description	Area Number
ORNL		
Study Areas		
	Cs-137 Contaminated Forest Floor	99.04
	Cs-137 Contaminated Forest Understory	99.05
	Cs-137 Contaminated Meadow	99.06
	Ca-45 Tagged Trees	ER.01
	Ca-45 Tagged Soil And Vegetation	ER.02
	Na-22 Contaminated Soil	ER.03
	Cs-137 Bagged Leaves Study	ER.04
	Hg-197 Tagged Stream	ER.05
	Cs-134 Tagged Tree	ER.06
	Ca-45 Tagged Forest	ER.07
	Cs-137, Fe-59 Contaminated Animal Pens (McNew Hollow)	ER.08
	Hg-203 Tagged Stream	ER.09
	H-3 Contaminated Trees	ER.10
	Cs-134 Contaminated Oak Trees	ER.12
	Zn-65 Tagged Red Oak Seedlings	ER.13
	Cs-134 Contaminated Pine And Oak Seedlings	ER.14
	Rb-86 Contaminated Plants	ER.15
	Cs-134 Contaminated Soybean And Sorghum	ER.16
	Cs-134 Contaminated Grasses	ER.17
	Cs-134 Contamined Lichens And Mosses	ER.18
	Tc-95m Contaminated Soil And Plants	ER.19
	Tc-95 Update Studies	ER.20
	Tc-95m And I-131 Contaminated Pasture	ER.21
	Cr-51 Contaminated Grass Plots	ER.22
	Tc-99 & Np-237 Contaminated Soil Lysimeters-Plutonium Floodplain	ER.23
	Cs-134 Contaminated Persimmon Tree	ER.27
	Co-60 And Mn-54 Animal Study	ER.28
	C-14 Maintenance-Respiration Study	ER.29
	C-14 Sucrose Inoculation Of Oak & Pine Trees	ER.30
	C-14 Allocation In White Oak Trees	ER.31
	C-14 Allocation In White Pine Trees	ER.32
	C-14 Efflux In Yellow Poplar Stand	ER.33
	C-14 Allocation In Woody Biomass Plantation Species	ER.34
Building Study Areas		
	Storage Pad Between Bldgs. 3503 & 3504	01.10
	Isotopes Ductwork/3110 Filter House	01.22
	Cobalt-60 Storage Garden (3029)	01A.04
	Pilot Pits 1, 2 (7811)	04.02
	New Hydrofracture Site Surface Facility (7860)	05.04
	Cyclotron Pit 9201-2	15.03
	ORNL @ Y-12 Contaminated Attic Area 9204-1	15A.02

Installation/ Study Area	Area Description	Area Number
ORNL		
Building Study Areas		
	ORNL @ Y-12 Contaminated East End Basement 9204-1	15A.03
	ORNL @ Y-12 Radioisotope Processing Facility 9204-3 Beta Cubicle	15A.05
	ORNL @ Y-12 Radioisotope Processing Facility 9204-3 Curium G Box	15A.06
	86-Inch Cyclotron 9201-2	15A.07
	ORNL @ Y-12 Plutonium Processing Faciltiy 9204-3	15A.09
	Mixed Waste Storage Facility (7651)	19.04
	Tritium Target Fabrication Facility (7025)	99.07
	Thorium Handling Facility (7019)	99.09
	Thorium Storage Wells	99.10
ORR		
Freels Bend		
	Animal Burial Site I	U003a
	Animal Burial Site II	U003b
	Animal Burial Site III	U003c
	Variable Dose Rate Irradiation Facility (VDRIF)	U003d
	Low Dose Rate Irradiation Facility	U003e
Y-12		
Subbasin I		
	Beta-4 Security Pits	YD-100
	ACN Drum Yard	YS-015
	Interim Drum Yard	YS-030
	Roofing Waste Pile	YS-122
	Chestnut Ridge Mercury Contaminated Gully Soil Pile	YS-131
	Tank 2116-U	YS-214
	Building 9720-13 West Yard	YS-341
	Prenco Incinerator	YT-001
Subbasin J		
	Rust Construction Garage Area	YS-400
Subbasin F		
	Building 9206 Underground Tank	YS-245
Subbasin B		
	Laundry Sump	YS-242

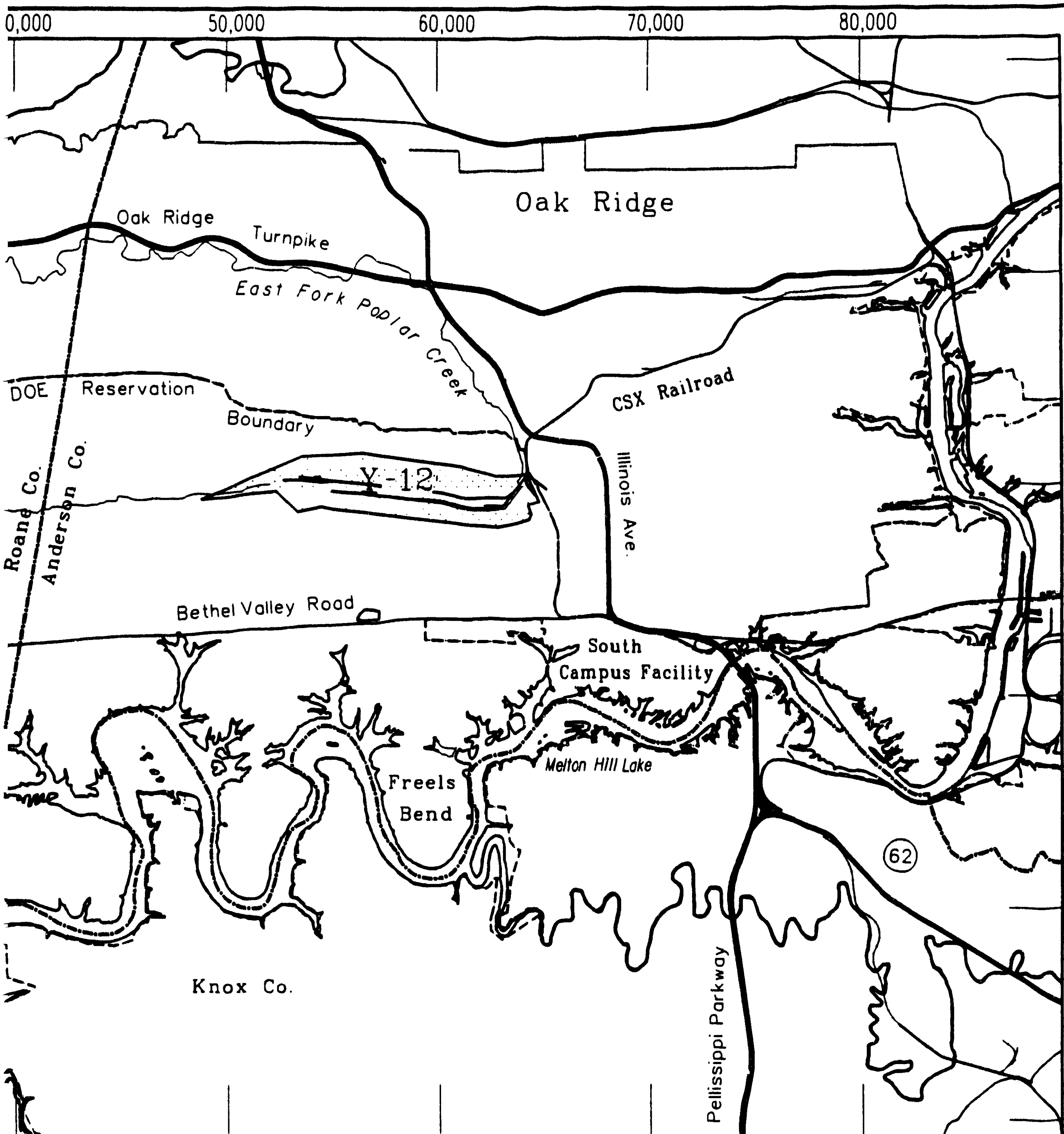
Installation/ Study Area	Area Description	Area Number
Y-12		
Subbasin D		
	Building 9766 Tank 2064-U	YS-205
	Tank 2077-U	YS-510
	Tank 2090-U	YS-516
	Tank 2091-U	YS-517
	Tank 2092-U	YS-518
Subbasin E		
	Coal Pile Trench	YD-104
	Building 9201-5E Northeast Yard	YS-322
	Building 9401-3 East Yard	YS-335
Subbasin G		
	Building 9204-2 West Yard	YS-329
	Building 9215 West Pad	YS-333
	Building 9404-11 West Yard	YS-336
	Building 9720-3 North Yard	YS-339
Subbasin C		
	Building 9418-3 Uranium Vault	YD-115
	Temporary Storage Area	YS-126
	Tank 2089-U	YS-515
	Tank 2284-U	YS-520
	Development Incinerator	YT-119
Subbasin A		
	Building 9409-5 Storage Facility	YS-017
	East Chestnut Ridge Waste Pile	YS-043
	Third Street Soil Pile	YS-116
	Cooling Tower Basin 9409-3	YS-124
	Tank 2105-U	YS-213
	Building 9202 East Pad	YS-326
	Building 9620-2 West Yard	YS-337
	Building 9720-6 North Polytank Station	YS-340
	Storm Sewer Sediment Drying Facility	YT-118
Subbasin H		
	Building 9204-4 Tank	YS-241
	Waste Machine Coolant Biodegration Facility	YT-003

Installation/ Study Area	Area Description	Area Number
Y-12		
Subbasin K		
	Ravine Disposal Site	YD-105
	Garage Underground Storage Tanks	YS-019
	Building 9712 Northeast Yard	YS-338
	New Hope Pond	YT-010
Misc. UEFPC		
	Tank	YS-239
Chestnut Ridge		
	Chestnut Ridge Sediment Disposal Basin	YD-025
	Chestnut Ridge Borrow Area Waste Pile	YS-042
	Kerr Hollow Quarry	YT-012
Bear Creek		
	Contaminated Construction Spoil Pile	YS-027
	S-3 Treatment Facility	YT-044
Building Study Areas		
	Building 9401-1 Old Steam Plant	YP-501
	Building 9766 Beryllium Contaminated Ducts	YP-502
	Old Steam Plant Storage Area, Building 9401-1	YS-029
	Bldg 9201-2 Transformer & Capacitor Storage Area	YS-128
	Building 9201-5 Tank 0074-U	YS-200
	Building 9204-4 Tank And Transfer Station	YS-233
	Building 9744 North Dock	YS-342
	Building 9206 SID 30/31 Polytank Station	YS-343

Operable Unit Descriptions and Maps



Map of the Oak



Oak Ridge Administrative Grid Coordinate System
Source:
Base map data provided by TVA.
Prepared by OREIS
Environmental Restoration Division
Martin Marietta Energy Systems, Inc.
Version 3.0 November 12, 1993

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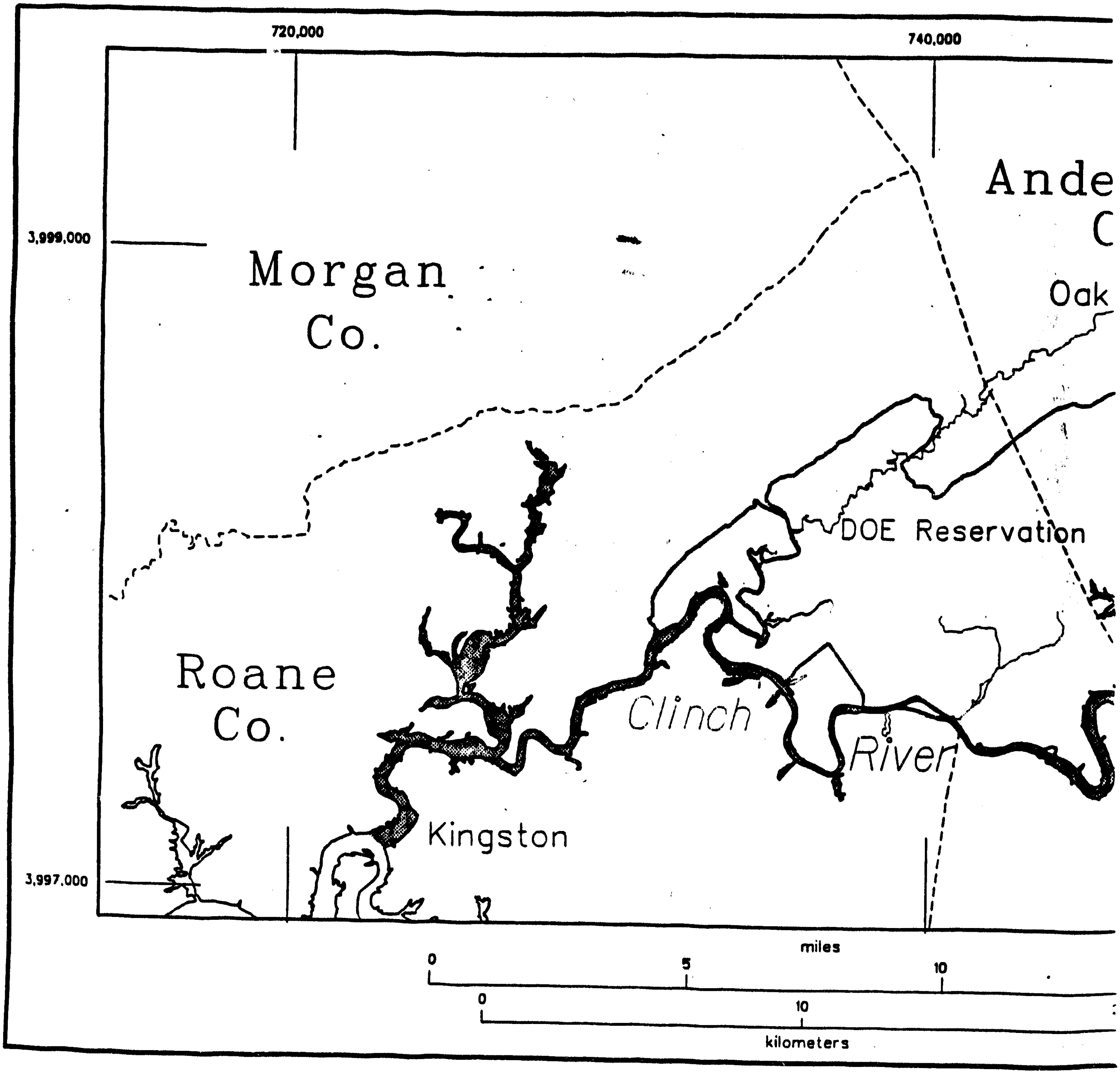
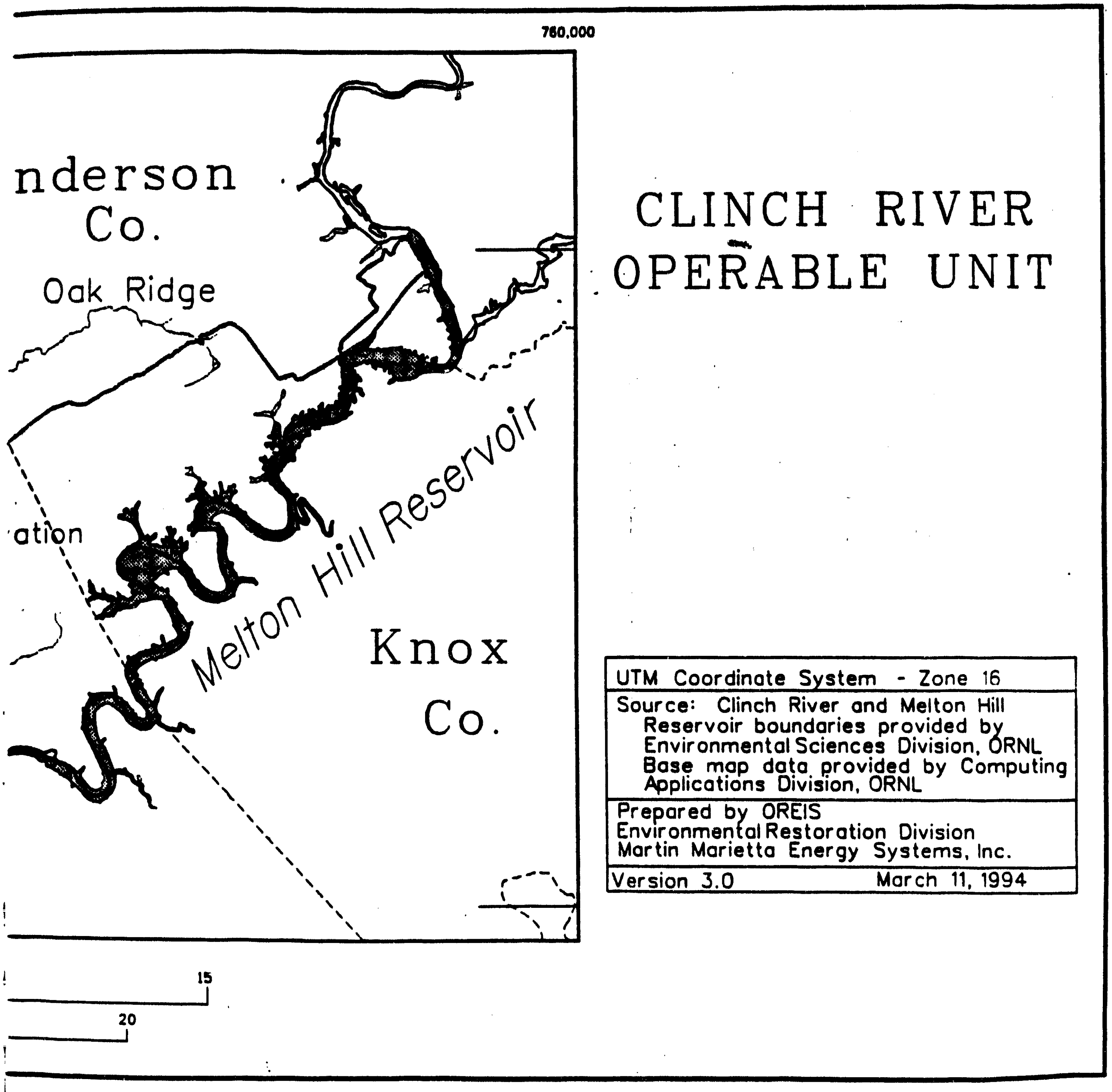


Map showing Clinch River oper



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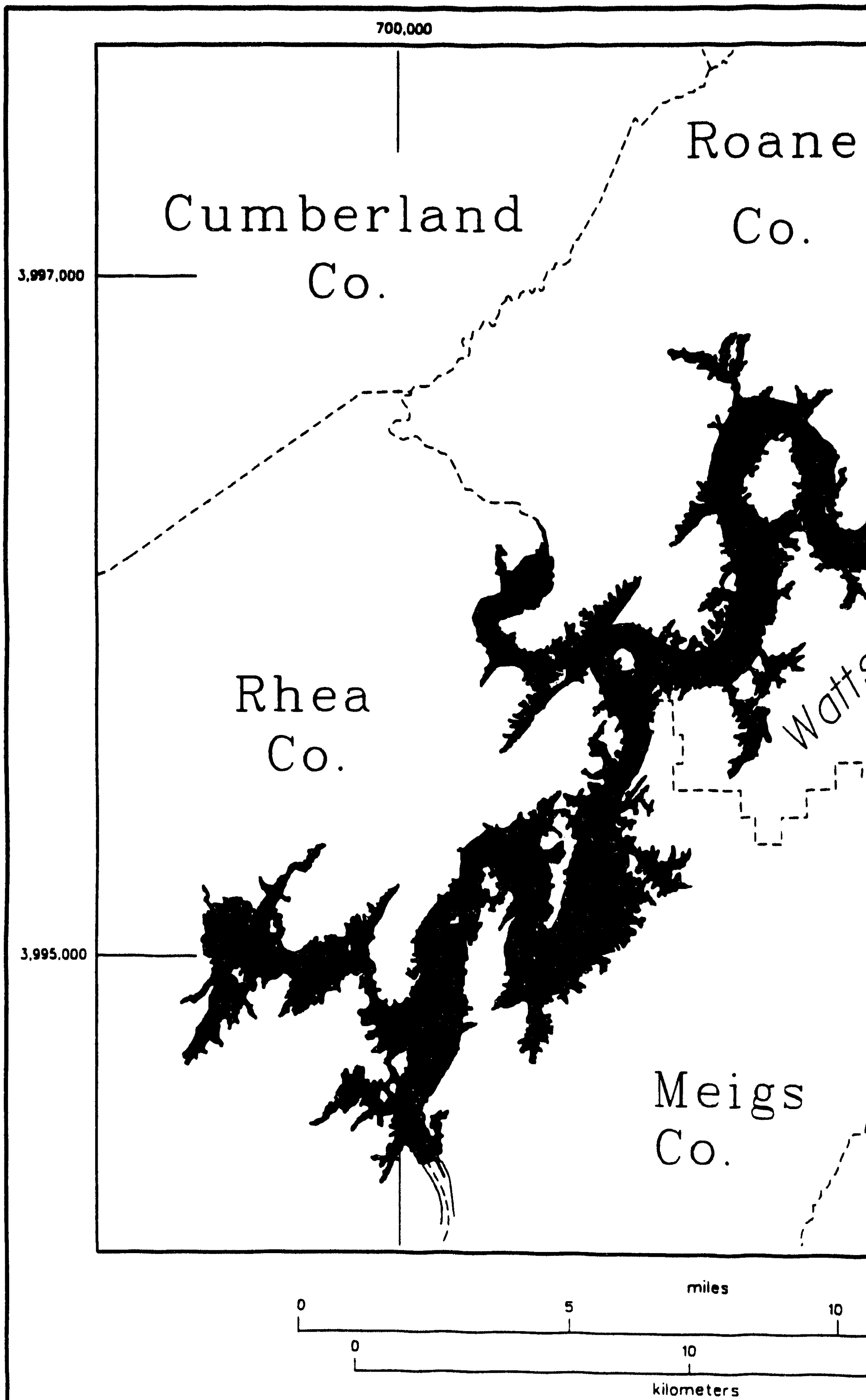
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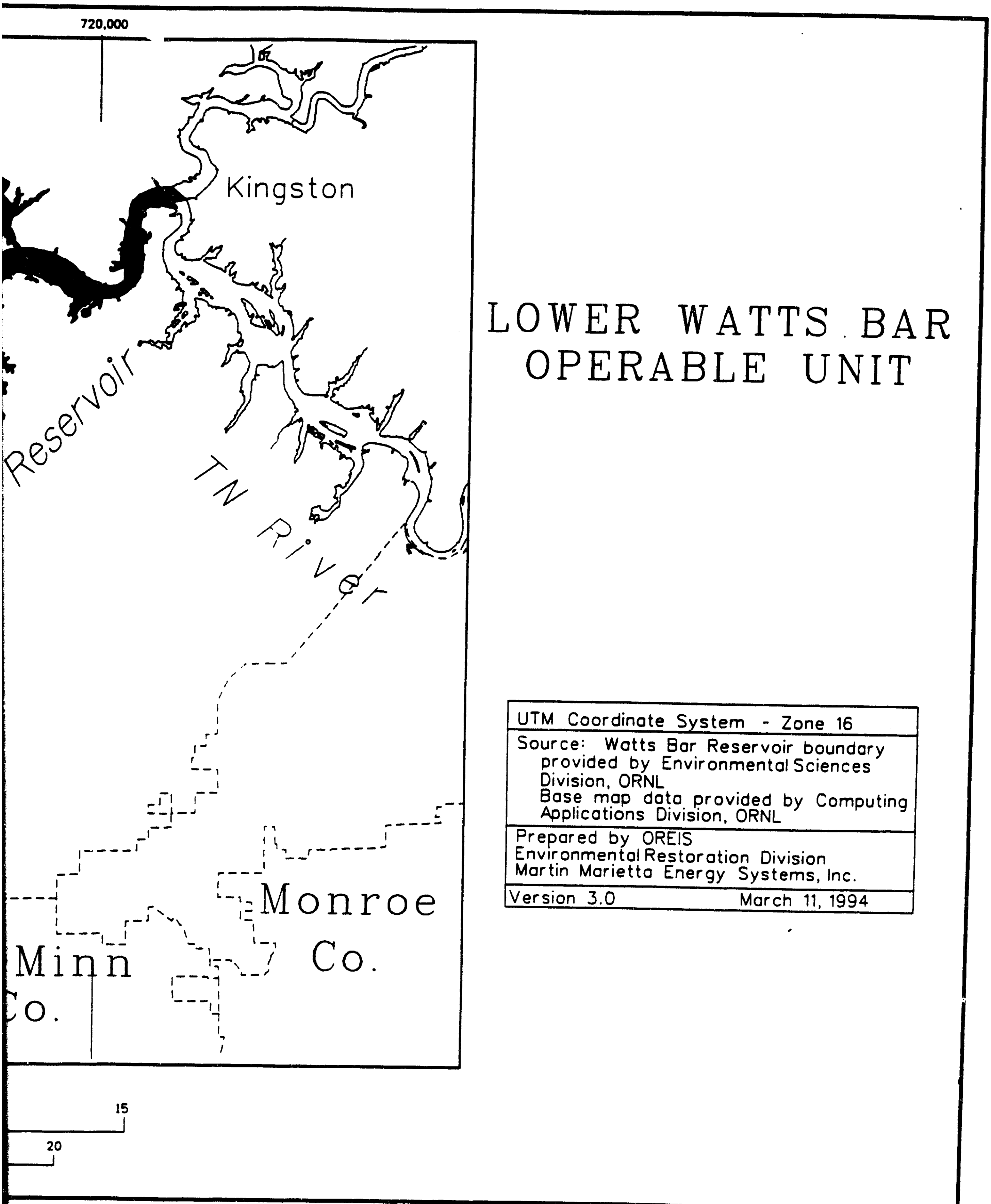
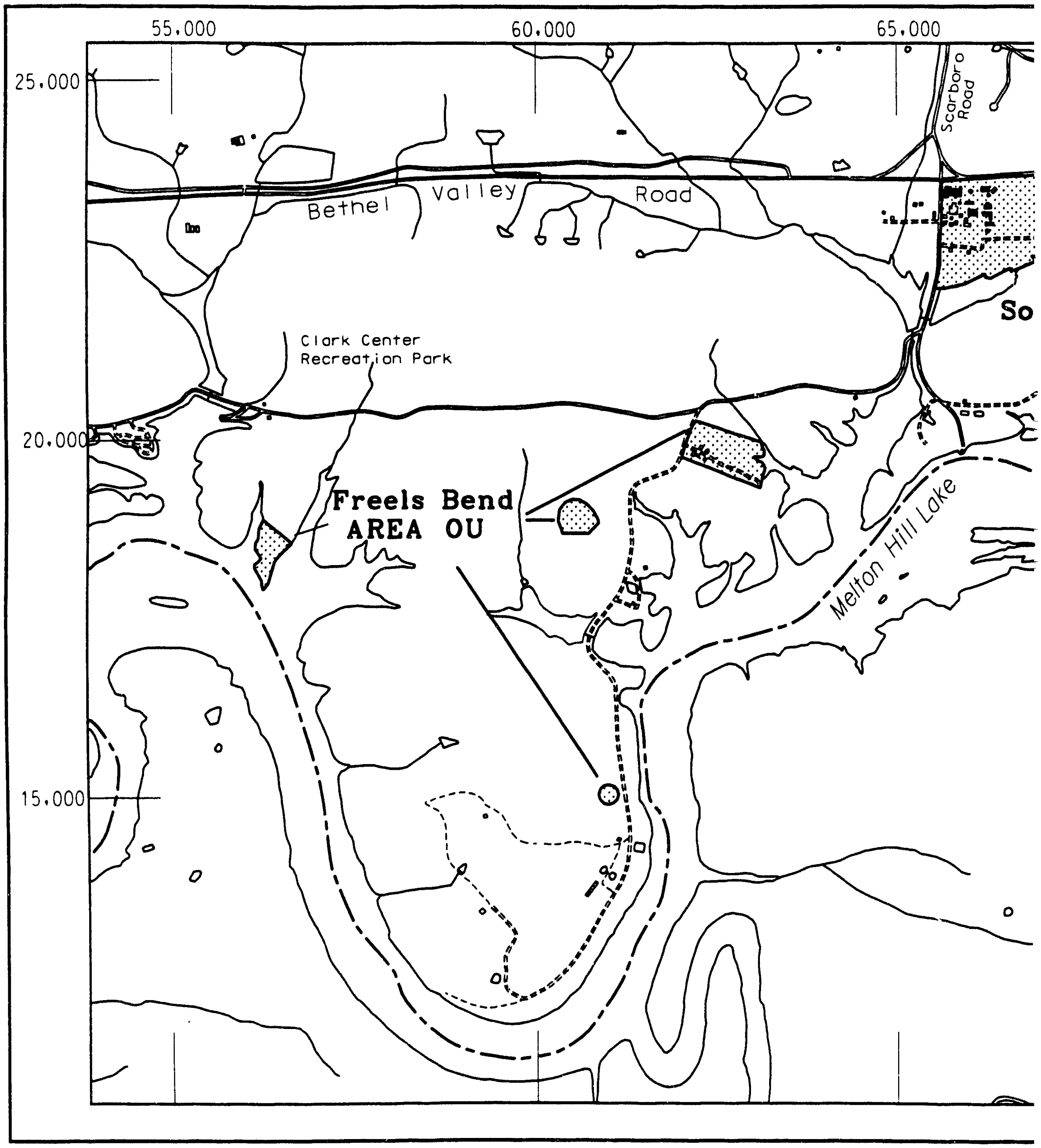
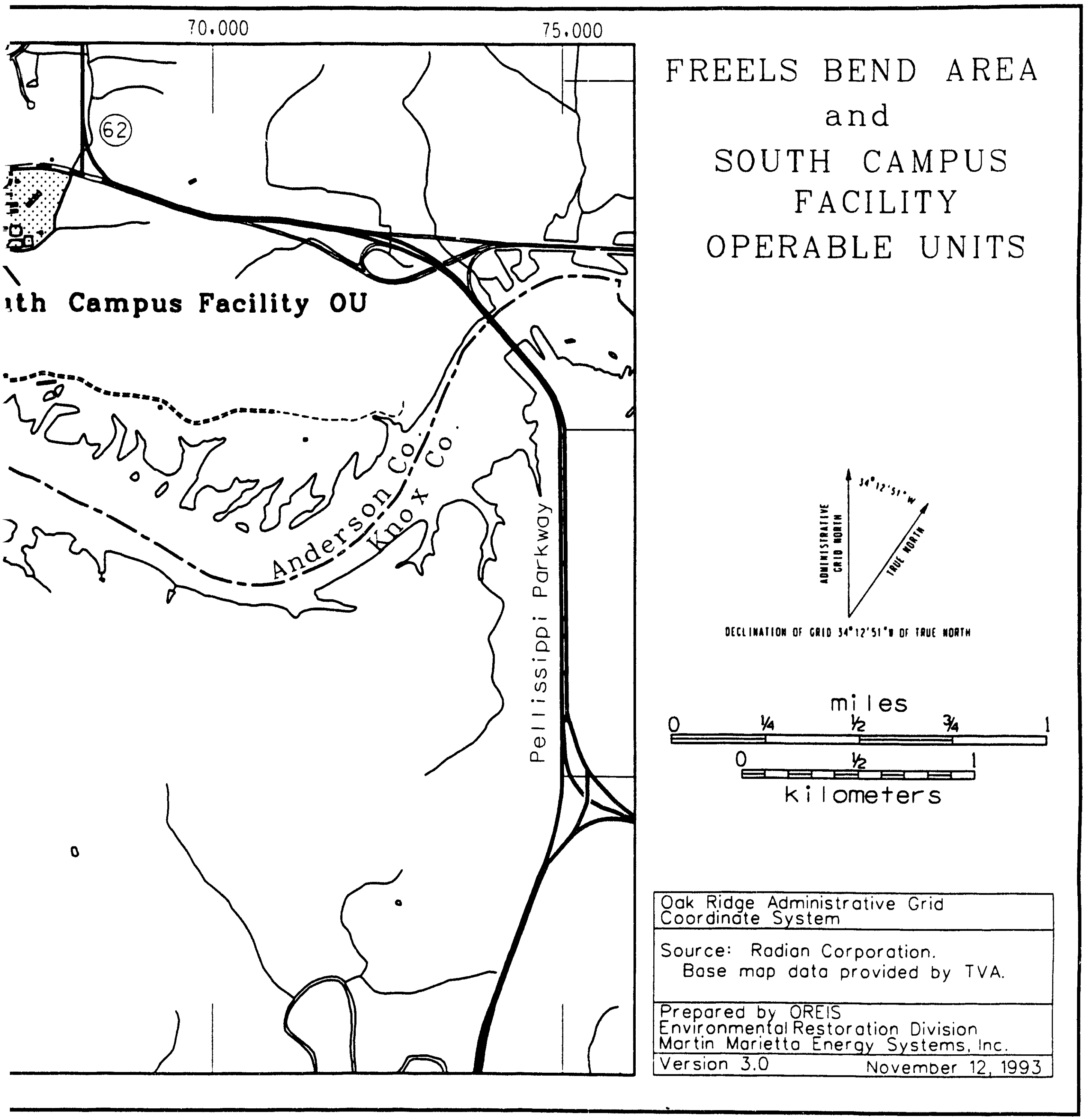


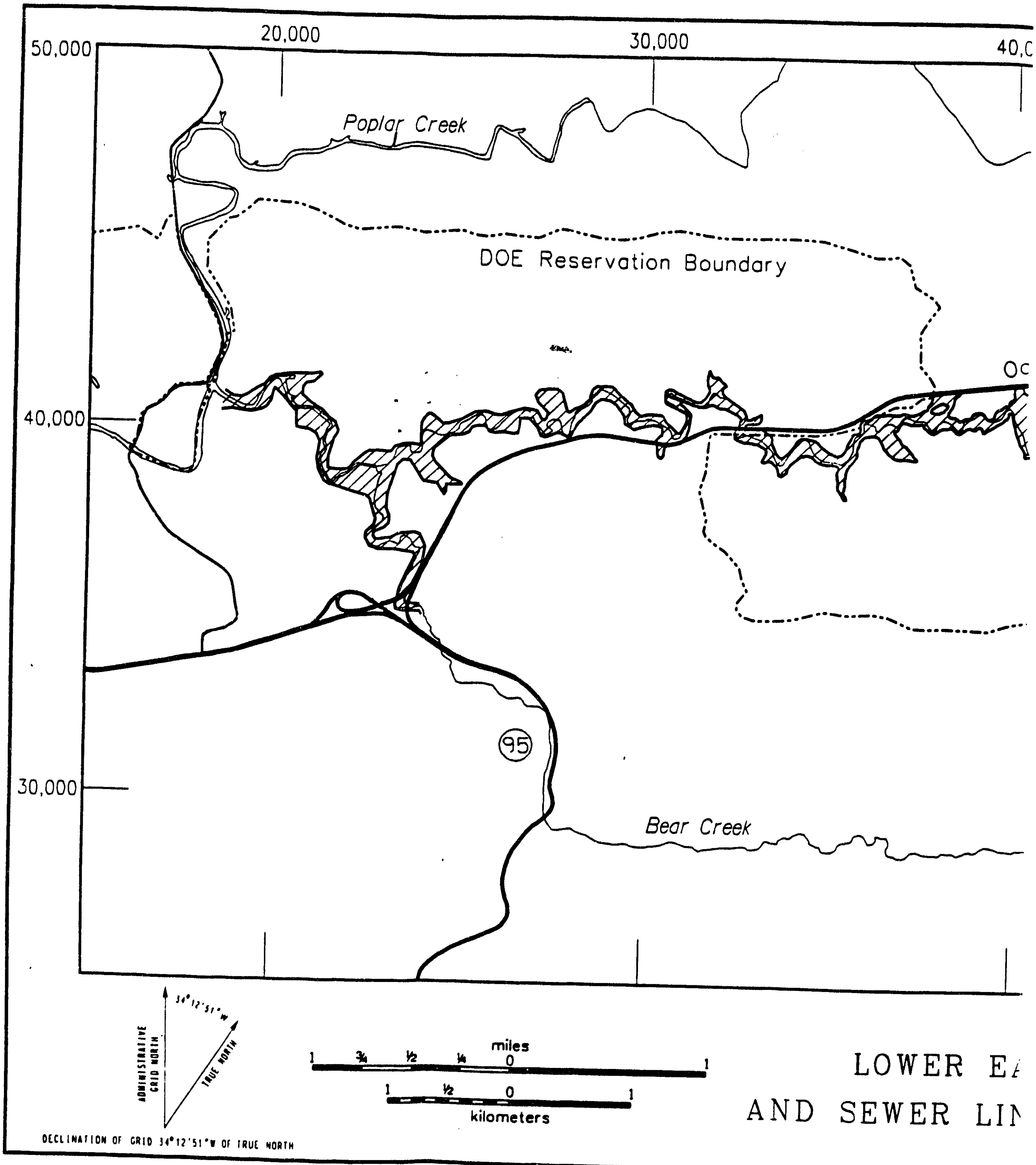
Lower Watts Bar opcable unit.



Map showing Freels Bend area and S



ıth Campus Facility operable units.



Map showing Lower East Fo
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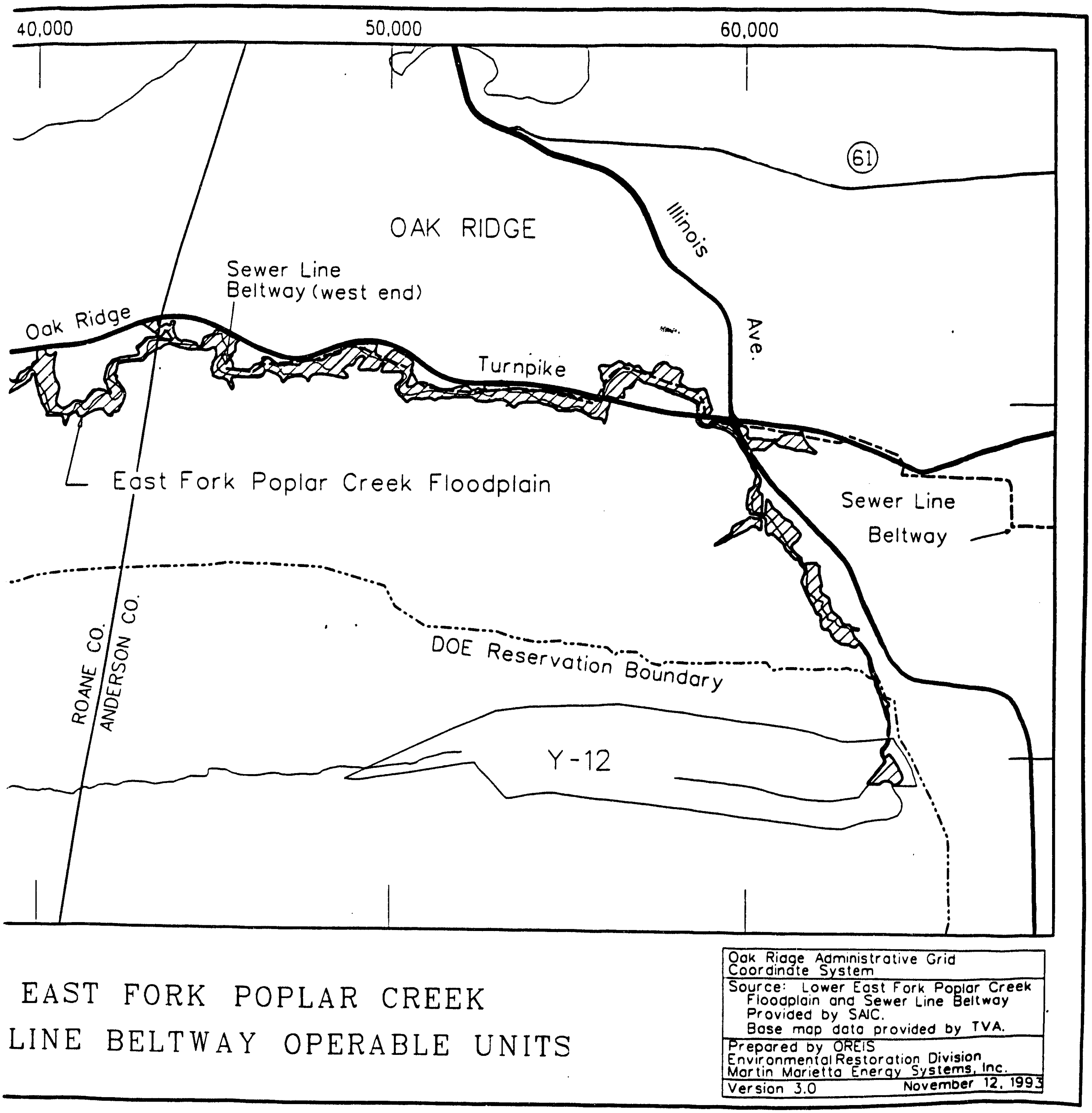


'ast Fork Poplar Creek and Sewer Line Beltway operable units.

CLINCH RIVER, OAK RIDGE ASSOCIATED UNIVERSITIES, AND LOWER EAST FORK POPLAR CREEK OUs

Clinch River OU

The Clinch River operable unit (OU) focuses on the portion of the Clinch River that may have been adversely affected by contaminants released from the mid 1940s to the present from the U.S. Department of Energy (DOE) Oak Ridge Reservation (ORR). The Melton Hill Reservoir and the Clinch River, downstream from Melton Hill Dam, form the southeastern and eastern boundaries of the ORR. The Clinch River enters the Tennessee River system of multipurpose impoundments near Kingston, Tennessee, 34 km downstream from the Oak Ridge complex. This waste area grouping (WAG)/OU/study area includes Melton Hill Reservoir and the Clinch River from Melton Hill Dam to Kingston.

The contaminants released from the ORR originate from research, industrial, and waste disposal activities conducted at Oak Ridge National Laboratory (ORNL), the Y-12 Plant, and the K-25 Site. The contaminants released from these facilities include a variety of radionuclides, metals, and organic compounds. Some liquid wastes are discharged to streams on the ORR, which drain into the Clinch River; however, much of the waterborne contamination is derived from seepage into the shallow groundwater from old waste-storage pits and trenches. The contaminants of concern in the river were determined by preliminary human health risk screening using a variety of exposure pathways and nonconservative screening. Polychlorinated biphenyls (PCBs) were identified as contaminants of concern through fish ingestion. The Tennessee Department of Environment and Conservation (TDEC) has a fish consumption advisory in effect for Melton Hill Reservoir and the Clinch River arm of Watts Bar Reservoir. Arsenic, chromium, mercury, selenium, zinc, ^{137}CS, and ^{60}Co constitute a risk only if channel sediments are dredged and dredged spoils are placed on land.

Lower Watts Bar Reservoir OU

Watts Bar Reservoir is the first Tennessee River impoundment located downstream of the ORR. Tennessee Valley Authority's Watts Bar Dam, completed in 1942, is situated at Tennessee River kilometer 853.6 (river mile 530.5). The reservoir receives inflow from both the Tennessee and the Clinch rivers. This WAG/OU/study consists of that portion of the reservoir that extends from TRK 913.1 (river mile 567.5; mouth of the Clinch River at Kingston) to Watts Bar Dam.

The source of ORR contaminants in this OU is the Clinch River. Because the dam was completed prior to the start of operations at ORR, and also because the reservoir acts as an efficient trap for sediments and any associated particle-reactive contaminants, much of these contaminants have accumulated in the bottom of Watts Bar Reservoir over the years. The contaminants of concern and exposure pathways are the same as for the Clinch River OU, with PCBs in fish posing the greatest risk. The TDEC has issued a fish consumption advisory for Watts Bar Reservoir. A fish consumption advisory is also in effect for Fort Loudon and Tellico reservoirs, located upstream of Watts Barr Reservoir and the ORR. Sediment contaminant concentrations, because of dilution by the

Tennessee River and the greater spatial extent of the reservoir as compared to the Clinch River, are generally lower in Watts Bar Reservoir than in the Clinch River. Screening-level human-health-risk analyses indicate that contaminants in sediment pose a risk only if deep channel sediments are dredged and the dredged spoil is placed on land.

Oak Ridge Associated Universities OUs

Freels Bend Area

The Freels Bend Area was used to support research conducted at the Oak Ridge Associated Universities South Campus Facility. This area is located southwest of the South Campus Facility and is bounded on three sides by the Clinch River. Control herds of some animals were maintained on pasture land here with ancillary barns and outbuildings. The research facilities included the Low Dose Rate Irradiation Facility and the Variable Dose Rate Irradiation Facility. Each of these facilities was used to expose and irradiate test animals that were subsequently observed over a period of time for exposure effects. The sources were removed from the Low Dose Rate Irradiation Facility; however, six sealed ^{60}Co sources still remain stored at the Variable Dose Rate Irradiation Facility.

There are three reported disposal areas for animal carcasses and miscellaneous wastes in the Freels Bend Area. These areas have been termed Animal Burial Sites I, II, and III. Access to the 70 acres of the Freels Bend Area is restricted and not open to the general public, although the area is not fenced. The entrance to the access road is blocked with a locked bar gate.

Freels Bend Area regions to be investigated include those associated with the irradiation facilities, animal burial locations, and three small impoundments used in the care of control herds maintained at Freels Bend Area. Contaminants of concern include radionuclides, organics, and metals.

South Campus Facility OU

The South Campus Facility OU is located within the city limits of Oak Ridge, Tennessee. It is bounded by Bethel Valley Road to the north, State Highway 62 to the east, Haw Ridge and the Clinch River to the south, and the western section of Bethel Valley to the west.

A research facility currently operated by Oak Ridge Associated Universities, South Campus Facility was originally established in 1945 to study the accidental irradiation of cattle, which occurred during the testing of the first atomic bomb near Alamogordo, New Mexico. The scope of research soon included studies on the introduction and migration of radioisotopes in the food chain as well as various other agricultural problems.

The boundaries of the South Campus Facility encompass ~25 buildings and 130 acres of pasture land, but there is no enclosing fence. Access to the South Campus Facility property is generally unrestricted. Although several signs are posted to limit access, no fences or barriers exist to preclude access.

No documented evidence is available as to waste composition or quantity that may have been released to the environment at this location. Limited data exist, however, that identify potential hazardous waste sources and pathways. In addition, previous analytical data and the results of a site inspection at this site indicate the presence of target compound list organics in the groundwater.

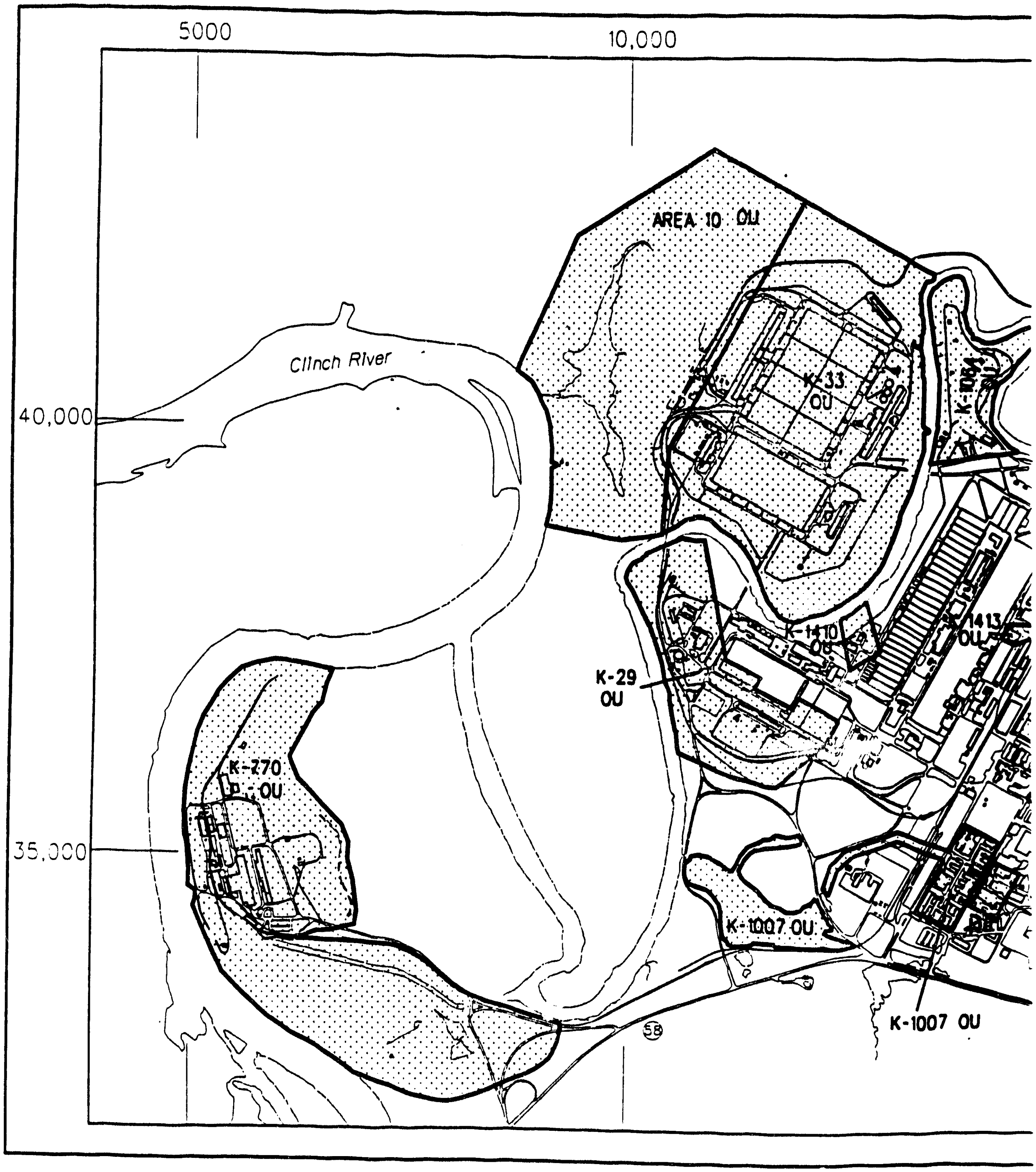
A remedial investigation (RI) at the South Campus Facility was initiated in FY 1993. South Campus Facility areas included in the RI are the wastewater treatment plant, ponds, various laboratories, and animal containment facilities. Contaminants of concern include radionuclides, volatile organics, and pentachlorophenols.

Lower East Fork Poplar Creek OU

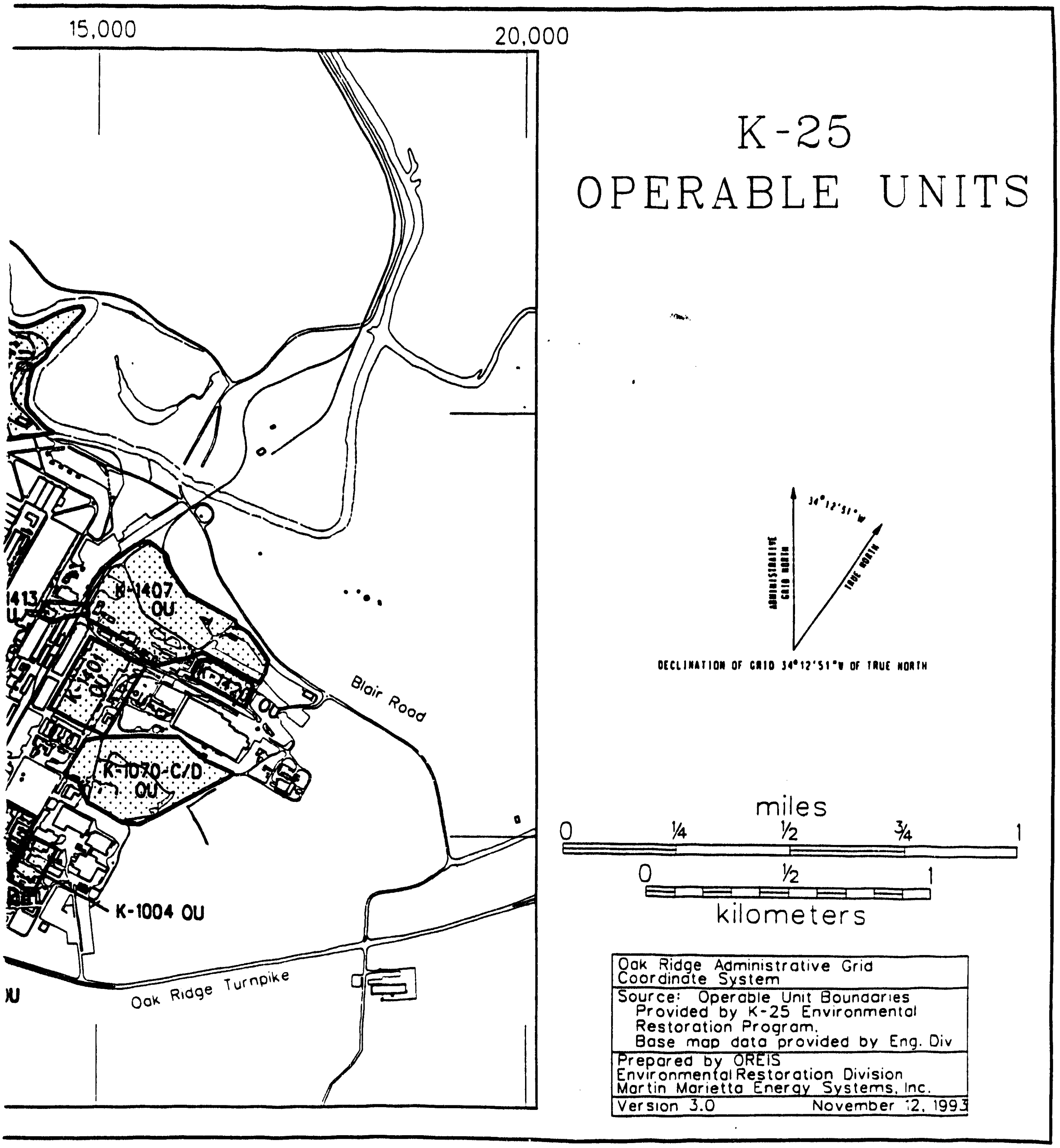
The Lower East Fork Poplar Creek OU extends from the outfall at Lake Reality at the Y-12 Plant boundary downstream to the stream's confluence with Poplar Creek. Upper East Fork Poplar Creek originates within the Y-12 Plant and extends to the Lake Reality outfall. The Lower East Fork Poplar Creek site consists of the 14-mile stream and 680-acre floodplain.

As a result of the loss to the environment of contaminants associated with lithium processing operations at the Y-12 Plant near Oak Ridge, Tennessee, East Fork Poplar Creek became contaminated with mercury and trace levels of other metals, organics, and radionuclides. Since 1953, as much as 2.4 million pounds of mercury are thought to have been released. Approximately 75 metric tons of this material may still be in the floodplain soils.

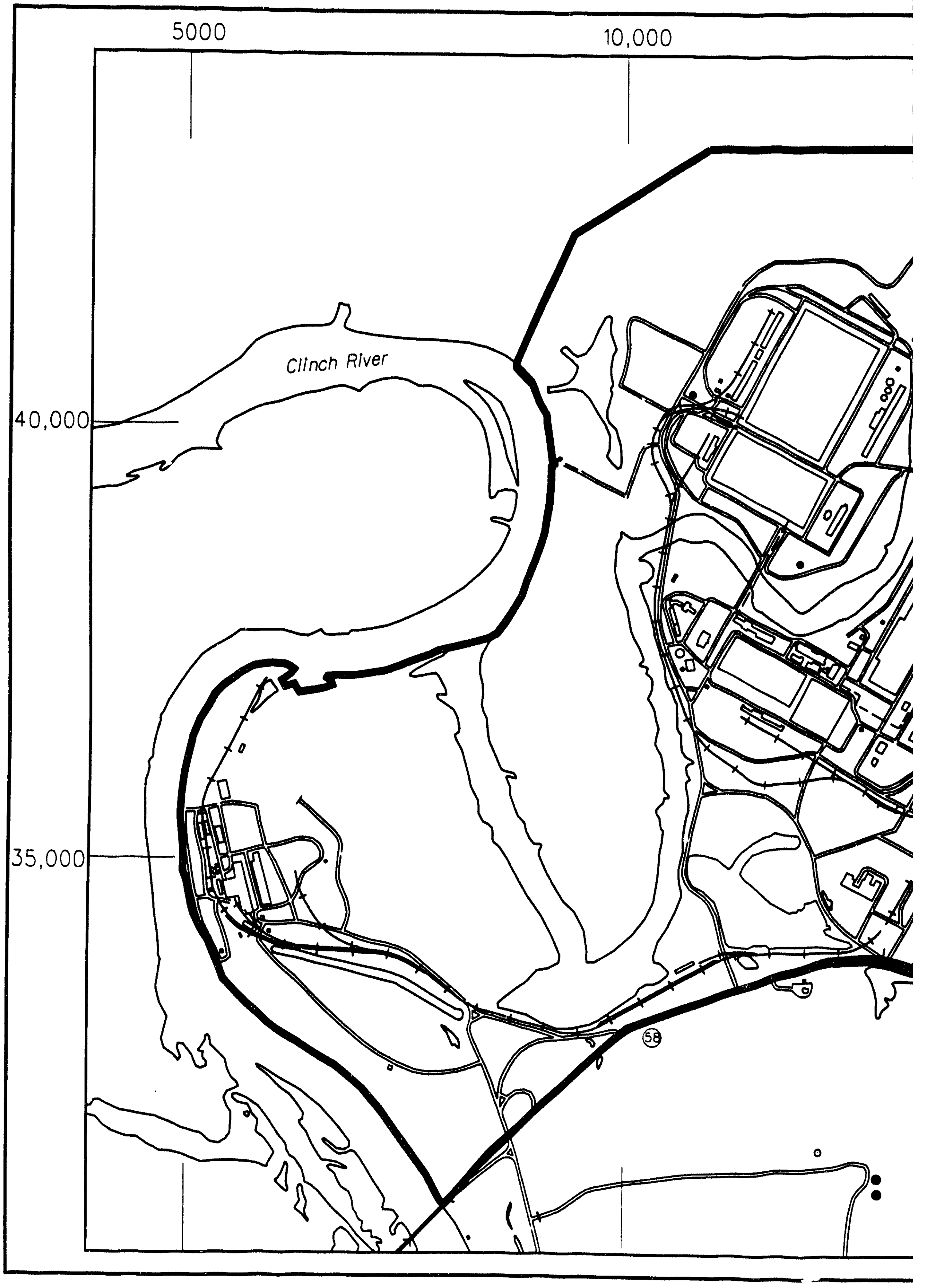
The Sewer Line Beltway was constructed by the city of Oak Ridge in 1982–83 and contains over 10 miles of sanitary interceptor sewers and force mains. In certain instances, East Fork Poplar Creek floodplain soils were used to provide topsoil. No records were kept to document the backfill procedures and locations.



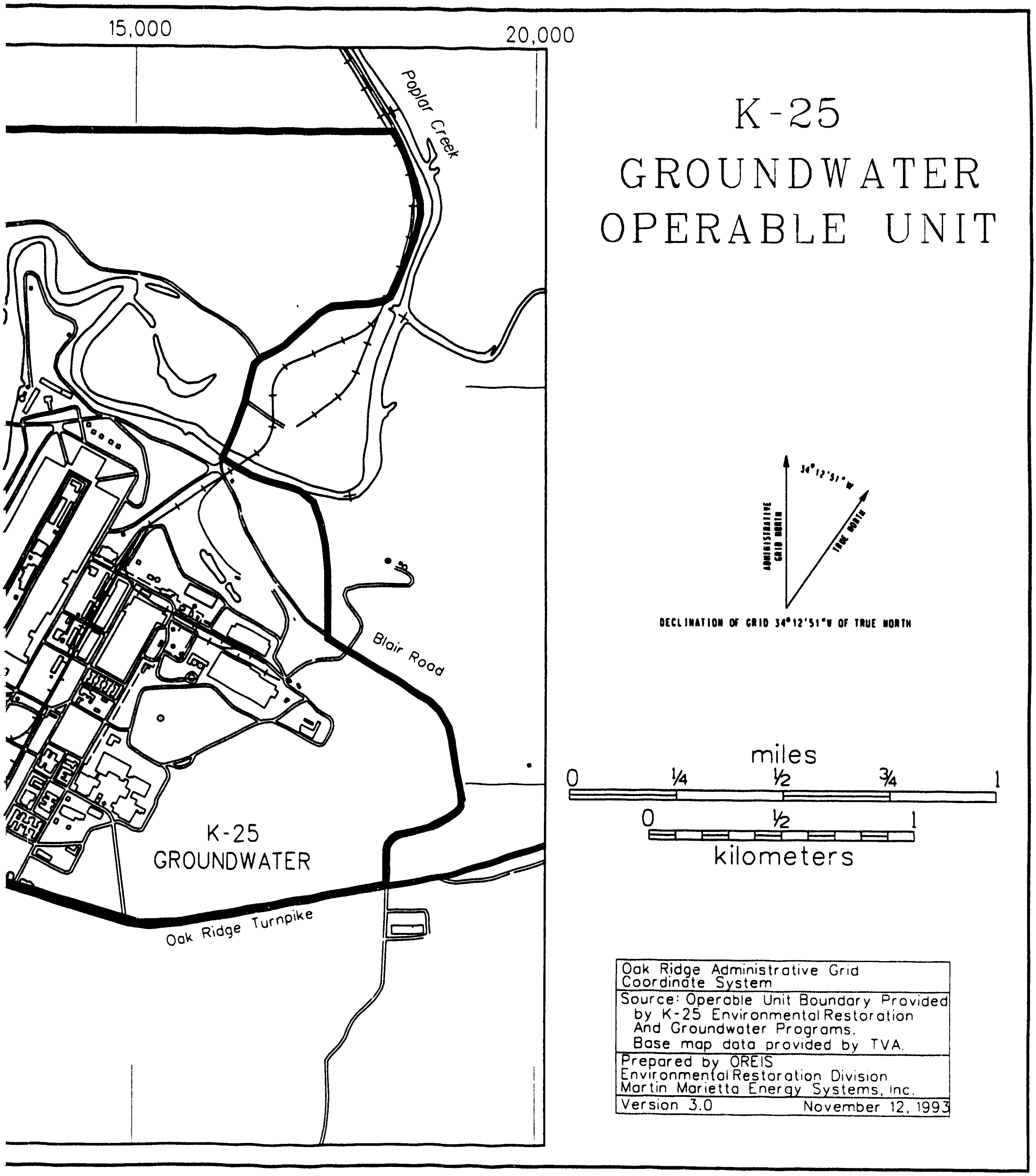
Map showing K-25 Site



:-25 Site operable units.



Map showing K-25 C



roundwater operable unit.

K-25 SITE OPERABLE UNITS

The Oak Ridge K-25 Site was built as part of the Manhattan Project during World War II to supply enriched uranium for nuclear weapons production. Construction of the K-25 Site started in 1943, and Building K-25, the first diffusion facility for large-scale separation of ^{235}U, was fully operable by August 1945. Additional buildings involved in the enrichment process were operable by 1956. In response to the national postwar nuclear emphasis, plant operations were modified to include the production of uranium compatible with reactors used to generate electric power. Because of the declining demand for enriched uranium, the enrichment process was placed on standby in 1985 and shut down in 1987. The K-25 Site now has a multipurpose mission that includes being the location of many contractor central staff functions, operating waste treatment facilities, serving as a center for applied technology, and supporting the development of the Advanced Vapor Laser Isotope Separation uranium enrichment technology.

Fourteen OUs have been identified at the K-25 installation, and one study area has been designated for the preremediation phase for future consideration (see Appendix A). The study areas will require additional examination to determine whether an RI/feasibility study is necessary. The location, operational history, and potential contaminants of concern for each OU are given in the following sections.

K-1070 OU

The K-1070 OU is located on the eastern central edge of the K-25 Site between the K-1220 and K-1037 buildings. Practical components are a 22-acre burial ground, three storage dikes, the SW-31 Spring, and the K-1414 Garage.

K-1070-C/D Classified Burial Ground. The burial ground is composed of two contiguous burial grounds, the "C" and "D" areas. The "C" area has been converted into a storage yard for general plant maintenance equipment. The "D" area comprises the remainder of the burial ground and includes several distinct disposal areas. Those areas are the trenches, pits, landfarm, dikes, and a concrete pad. Low-level radioactive and nonradioactive, nonhazardous waste materials and equipment were buried in large trenches at the K-1070-C/D Classified Burial Ground from 1972 to 1989. Wastes include hazardous chemicals and solvents, including a variety of organics. Heavy metals, including uranium and lead, were also buried at the site. The following materials were stored in the K-1070-D1, D2, and D3 Storage Dikes: trichloroethane, PCBs, paint waste, ethylene glycol, trichloroethylene, varsol, gasoline, methyl chloride, isopropyl alcohol, uranium-contaminated Freon, Vartex, methyl ethyl ketone, Dearborn 537, perchloroethylene, oil filters, Sorb-all and oil, Cimcool, sludge from garage wash racks, acetone, xylene, classified liquid, Rust Ban, tolyl triazole, scintillation waste, refrigerant oil, tributyl/phosphate, dioctyl phthalate, classified oil, Freon trichloroethane, methylene chloride, sulfonic acid, Mictobiotreatment, ethyl alcohol, classified materials (laboratory packs), paint thinner, hexane, penta-ether, Nutek, non-PCB solvents and cleaners, degreaser residue, absorbents, and sweeping compound.

SW-31 Spring and K-1414 Garage. SW-31 is a perennial-flow spring located at the bottom of the hill on which the K-1070-C/D Classified Burial Ground is located. The spring is contaminated by organic chemicals thought to have come from burial ground pits into which organic wastes were poured in the 1970s and 1980s. The K-1414 is located at the bottom of the K-1070-C/D Classified Burial Ground hill on the south side. In 1987, diesel fuel was found to be leaking from an underground storage tank at the K-1414 garage. Approximately 300 gal of fuel was recovered from the spill, but an estimated 300–600 gal remained in the subsurface environment.

K-901 OU

K-901 OU consists of a contaminated burial ground, landfarm, holding pond, two construction waste disposal areas, and the K-895 Cylinder Destruct Facility. The OU is located northwest of the main plant.

K-1070-A Old Contaminated Burial Ground. K-1070-A Old Contaminated Burial Ground, northwest of Building K-33, was used for the disposal of several types of material from the 1940s to 1976. The burial ground contains about 35,575 ft^3 of uranium-contaminated material and 2430 ft^3 of thorium-contaminated material. Other material includes UF_6 cylinders, beryllium chips, boron, radioactive NaF, oil, rags, etc.

K-1070-A Landfarm. The K-1070-A landfarm received ~5000 ft^3 of fuller's earth between 1979 and 1985. The fuller's earth was laden with concentrated acids, sludges, and other degradation products from uranium enrichment cascade oil.

K-901-A Holding Pond. K-901-A Holding Pond received chromated, cooling-tower water blowdown, and a variety of other wastes from barrels drained into the pond in the late 1950s.

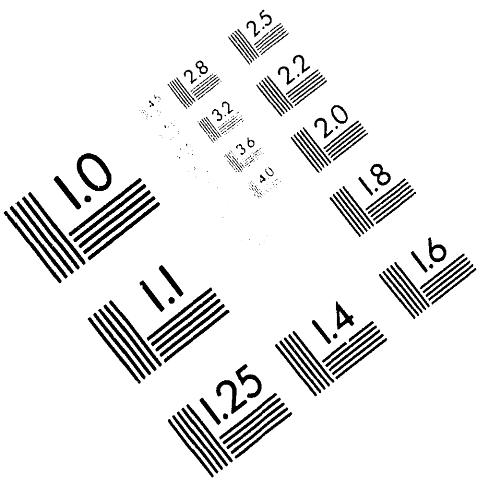
K-901 North and South Disposal Areas. The K-901 North and South Disposal areas were formerly known as the K-901 Sanitary and Waste Disposal areas, respectively. The names were changed to provide an easier way to distinguish them and because the North area is no longer considered "sanitary" since radioactive contamination was found. Each disposal area received construction wastes beginning in the 1940s. Small pockets of radioactive contamination have been found at the K-901 North Disposal Area.

K-770 OU

The K-770 OU includes a contaminated scrap metal yard and contaminated debris, two buildings used as part of a thermal diffusion plant in the 1940s, and a sewage treatment plant. The unit is located southwest of the main site area on the banks of the Clinch River. Beginning operation times for the various subunits range from 1943 to the early 1960s. The scrap metal yard and sewage treatment plant are still in operation.

K-770 Scrap Metal Yard. The K-770 Scrap Metal Yard contains ~20,000 ft^3 of asbestos-containing metal along with waste materials contaminated with uranium, transuranics, mercury, and asbestos. Within the K-770 Scrap Metal Yard is Building K-726, which was used for storing PCBs.

Buildings K-722 and K-725. Suspected contaminants of concern in Buildings K-722 and K-725 are beryllium, mercury, asbestos, and uranium.



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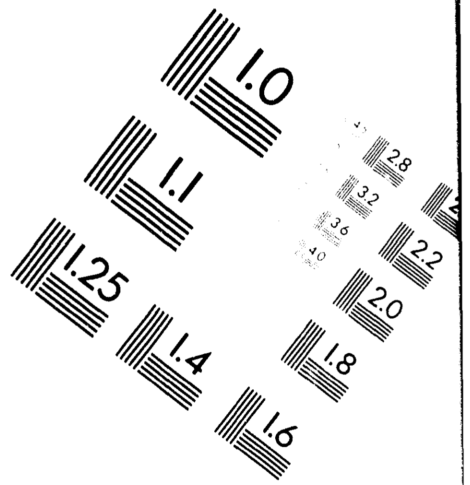

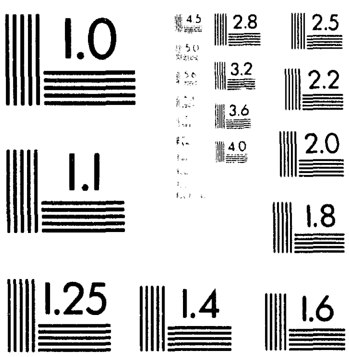

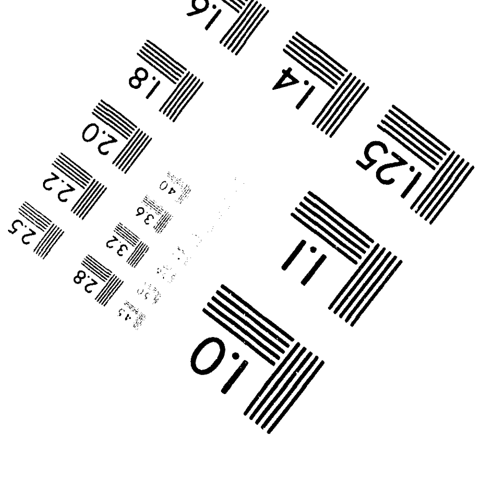

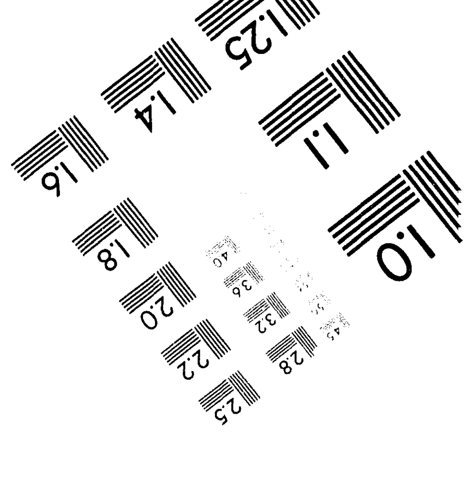

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K-709 Switchyard. Suspected contaminants of concern at K-709 Switchyard are PCBs present from routine operations.

K-1420 OU

The K-1420 OU is located within the K-25 Site between the K-1037 Building and the K-1700 Stream. The OU consists of four practical components: wastewater process lines, an oil-storage yard, an incinerator, and a mercury recovery room.

During its history of operations, the K-1420 facility has performed uranium recovery, oil recovery, mercury recovery, cylinder cleaning, plating, decontamination of uranium enrichment process equipment, converter conditioning and recovery, feed-plant equipment cleaning and decontamination, and alumina leaching. Therefore, the K-1420 facility processed a wide spectrum of chemicals and uranium compounds, including transuranics. The K-1421 incinerator burned uranium-contaminated gloves, shoes, and oil sludges during its life cycle. The K-1420 Oil Storage Station handled contaminated oils.

K-1407 OU

The K-1407 OU contains a neutralization pit, holding pond, retention basin, natural stream, two hazardous waste storage tanks, a burial ground, and soil excavated from a building project. The OU is roughly bounded by Blair Road, Poplar Creek Road, 15th Street, and Avenue C.

K-1407-A Neutralization Pit. K-1407-A Neutralization Pit consists of a 33,000-gal reaction pit where sulfuric acid and calcium hydroxide are added to neutralize corrosive waste streams. The neutralization pit processed various cleaning solutions and received heavy metals. Contents of the pit were discharged to the K-1407-B Holding Pond, a 1.3-acre impoundment with a capacity of 2.5 million gal.

K-1070-B Classified Burial Ground. K-1070-B Classified Burial Ground, located north of the K-1401 Building and west of the K-1407-B Pond, was operated from the early 1950s to 1976. Materials buried there include uranium-contaminated scrap metal, uranium, uranium fluorides, oxy fluorides, tetrafluorides, lead, and monel. Organics or oils disposed of at the unit are thought to be minimal.

K-1407 Soil. K-1407 soil upgradient of K-1407-C is contaminated with uranium and covers ~2 acres.

K-1202 Hazardous Waste Storage Tanks. The K-1202 Hazardous Waste Storage Tanks are two tanks used since 1944 to store mineral oils used for lubricating the cascade or centrifuge. Since 1989, the north tank has contained mixed wastes.

K-1700 (Mitchell Branch). K-1700 is a natural stream (Mitchell Branch) that receives treated wastewaters from the Central Neutralization Facility, a Resource Conservation and Recovery Act (RCRA)-permitted facility. Samples collected in June 1986 indicate the presence of chromium, lead, nickel, arsenic, and uranium in stream-bed sediments. The stream has a National Pollutant Discharge Elimination System permit at a point near its confluence with Poplar Creek. Since 1974 there have been occurrences in which permitted parameters exceeded the discharge limits.

K-1407-B Holding Pond. The K-1407-B Holding Pond is located west of Building K-1420 and south of the K-1407-C Retention Basin. The pond consists of a 1.3-acre impoundment with a storage volume of ~1.5 million gal. K-1407-B was placed in operation in 1943 as a settling basin for neutralized cleaning solutions generated from the cleaning of nickel-plated steel pipes. This impoundment was used primarily for settling the metal hydroxide precipitates generated during the neutralization and precipitation of metal-laden solutions treated in the K-1407-A neutralization unit. Contaminants include cadmium, chromium, lead, calcium, magnesium, various acids, nickel chloride, and ferrous chloride. The holding pond also received wastes, including uranium, mercury, transuranics, Miller's Fluorinated Lubricating oil, organic cleaners, Freon, and PCB oils from nearby operations. In 1973, sludge was removed from the K-1407-B pond to the K-1407-C Retention Basin, a surface impoundment with a capacity of about 2.5 million gal.

K-1407-C Retention Basin. The K-1407-C Retention Basin is a surface impoundment located north of the K-1407-B pond and northwest of the K-1420 Decontamination Building. The impoundment was used primarily for the storage of potassium hydroxide scrubber sludge generated at the K-25 Site. In addition, metal hydroxide sludges removed from the K-1407-B pond were discharged to this impoundment. The sludge is considered radioactive only and not hazardous.

The K-1407-C Retention Basin and K-1407-B Holding Pond are RCRA Interim Status units. In 1988, operation of both units ceased. RCRA closure plans were prepared and submitted to EPA and TDEC in 1988. The original closure plans specified that the sludges would be removed from the basin and pond, after which the remaining native soil would be sampled and analyzed for RCRA hazardous metals to verify that the sludge had been successfully removed. These actions were taken, and no RCRA hazardous constituents were present in the verification samples. However, radiological analyses indicated that radionuclides were present in the samples. CERCLA sampling of C Retention Basin revealed that the bottom of the basin has metal contamination that may be considered hazardous in addition to the radioactive contamination.

The groundwater in both the K-1407-C Retention Basin and the K-1407-B Holding Pond area shows a statistically significant difference in the upgradient and downgradient conductivity. However, studies have indicated that the differences are a result of nonhazardous constituents. The groundwater also indicates organic contamination (total organic halides) at the K-1407-B unit, but studies have shown that these constituents are from sources other than the basin.

Both of the original closure plans will be amended to reflect sludge removal and verification sampling results as well as the results of subsequent CERCLA sampling events. The closure activities will include the removal of the water that has collected in the K-1407-B and C Ponds, filling in the depression of the pond with native soils, and providing a layer of topsoil and vegetation to minimize erosion.

For each unit, an RI/feasibility study (FS) report, a proposed plan, and a Record of Decision (ROD) will be prepared. The constituents not addressed in the formal RCRA process will be addressed in the CERCLA process. This will meet the need to address the radionuclide contamination. The above actions will achieve complete remediation of the K-1407-B and K-1407-C units as CERCLA source OUs and as RCRA Interim Status Units. Because CERCLA actions at both the K-1407-B and K-1407-C units will be the same, one set of CERCLA documents will be produced which will address both units. In 1985, six monitoring wells were installed in the K-1407-C area. Well UNW-6 serves as the upgradient well providing background data for the K-1407-C Retention Basin, and the other five wells function as the point of compliance. After collection of five quarters of base-year background samples, a statistical analysis of the groundwater data was performed. Conductivity measurements were significantly elevated; some samples showed arsenic, barium, chromium, lead, and mercury levels sporadically above drinking water standards. Lead was elevated in the upgradient well with respect to the concentrations in the downgradient wells. Contamination in the upgradient well indicated that there are potential contaminant sources upgradient of K-1407-C. The contaminants detected in the wells are not believed to be attributable to K-1407-C.

K-1417 Drum Storage Yard. The K-1417 Drum Storage Yard is a RCRA-permitted waste storage area. There are ~78,000 drums stored at K-1417 containing sludge from the K-1407-B Holding Pond and the K-1407-C Retention Basin. The sludge contains inorganic, organic, and radioactive contamination and was removed from the ponds during RCRA closure activities in 1988. Prior to storage at K-1417, the sludge was either drummed or stabilized in a concrete grout mixture at the K-1419 Sludge Fixation Facility. The grout/sludge mixture was not adequate for stabilization of the radioactively-contaminated sludge, consequently, the drums began to leak and dispersal of radioactive contaminants was feared. To avert this, a program of emptying the drum into bulk storage units and moving them to Building K-31 for storage was initiated.

K-1401 OU

The K-1401 OU is located at Building K-1401 between 10th and 14th streets, west of Avenue D. Practical components are an acid line and degreasing operation.

K-1401 Acid Line. Since the 1940s, the K-1401 Acid Line has received wastes from a variety of nearby operations. Cleaning operations have included the use of degreasers, caustics, and acids. Degreasers were carbon tetrachloride, trichloroethylene, and trichloroethane. Process equipment exposed to UF_6 and cleaned in K-1401 would release uranium-contaminated cleaning solutions to the acid line. Instruments and containers from the K-1420 Mercury Recovery Room were processed through the K-1401 cleaning area, resulting in the possibility of small amounts of mercury being discharged to the acid line. Cleaners used were caustics, detergents, trioxide, and soap-oakite. Acids included hydrochloric, sulfuric, chromic, and sulfamic. Organics were methyl ethyl ketone, aromatic hydrocarbons, acetone, and Freons. The acid line was also used to dispose of paints, epoxies, and cutting oils. The K-1401 acid line has been tested for leaks on two occasions and was found to be leaking after both tests.

K-1401 Degreasers. The K-1401 Degreasers, in operation since the 1940s, have used 1,1,1-trichloroethane as a vapor degreaser to clean process equipment.

K-1004 OU

K-1004 OU. The K-1004 OU is located in the area northeast of the intersection of Avenue D and Fifth Street in the immediate vicinity of K-1004-J. Practical components include underground radioactive waste vaults and tanks underneath the K-1004 Building, and two sets of recirculating cooling water lines. Investigation and/or remediation of the contamination that may be resulting from these sources is impractical without first dismantling the structure over them; therefore, the decontamination and decommissioning (D&D) of the structure and the investigation and remediation of these sources should be carried out simultaneously.

K-1004-J Vaults and K-1004-L Underground Storage Tanks. The K-1004-J vaults and K-1004-L underground storage tanks consist of six storage vaults and 5500- and 750-gal storage tanks. Beginning in the 1940s, radioactive materials, including uranium, plutonium, neptunium, californium, technetium, and cesium were stored in the vaults and tanks.

Recirculating Cooling Water Lines. The K-1004-L recirculating cooling water system served the K-1004-L Cascade Pilot Plant from the mid 1950s to 1984. The system used a chromate/zinc/phosphate corrosion inhibitor until 1977 when it was replaced by a phosphate treatment. The K-1210 recirculating cooling water system provided secondary cooling to K-1200, K-1210, and K-1225 from 1975 to 1985. The system used sanitary water treated with Dearborn 321 biocide, Dearborn 4622, and Zimmite Chemtrol 19. Both systems are now unused.

K-1064 OU

The K-1064 OU is located northwest of Building K-25 on a peninsula formed by a bend in Poplar Creek. Practical units include two cooling tower basins and a drum storage and burn area.

K-801-G and K-802-H Cooling Towers. The K-801-G and K-802-H cooling towers were built in the mid 1940s and used a zinc/chromate/phosphate treatment system from the 1950s to 1977. Both towers were demolished in the late 1970s, but a portion of K-801-H was rebuilt and is in use. The K-802-H basin is in use for firewater makeup.

K-1064 Drum Storage and Burn Area. The K-1064 Drum Storage and Burn Area was used to store and burn waste solvents in the 1950s. From 1960 to 1983, paint wastes, organic wastes, and radioactively contaminated waste oil, including PCBs, were stored at this location. Suspected chemicals used are primarily organics, radioisotopes, and metals.

K-1007 OU

The K-1007 OU is located in the southeast section of the plant. The OU consists of an area laboratory drain, the holding pond to which it flows, and a gasoline tank.

K-1004 Area Lab Drain and K-1007-P1 Holding Pond. Wastes discharged into the K-1004 Area Lab Drain beginning in the 1940s are suspected to have included acetone, acetic acid, acetonitrile benzene, bromoform, cadmium, carbon tetrachloride, dichloropropane, ethanol, ammonium hydroxide, chloroform, chloric acid, chromates, diethylene glycol, dibutyl ether, ethylene glycol, Freons (all varieties), hexane, hydrochloric acid, hydrofluoric acid, hypophosphorous acid, isopropyl alcohol, mercury, methyl alcohol, methyl ethyl ketone, methylene chloride, nickel compounds, nitric and phosphoric acids, PCBs, photographic solutions, potassium dichromate, potassium and sodium hydroxides, pyridine, rhenium, sulfuric acid, technetium, tetrachloroethylene, toluene, trichloroethylene, tungsten, and uranium. The laboratory area facilities continue to operate, but hazardous chemicals are no longer disposed of through the drains. Beginning in the 1950s, the K-1007-P1 Holding Pond received wastes from the area lab drain, along with storm-water runoff.

K-1007 Gas Tank. K-1007 Gas Tank, with a capacity of 200 gal, was used from 1950 to 1986, when it was discovered to be leaking. The tank was removed following clean up of the spill. Soil samples were collected around the spill area to determine the need for additional remedial actions. Data indicated that none was required.

K-1410 OU

The K-1410 OU is located near the southwest corner of Building K-25 on the banks of Poplar Creek. Practical components of the OU include a neutralization pit, waste paint accumulation area, and a building formerly used for uranium decontamination, process equipment recycling, and nickel plating. To effectively investigate and remediate any contamination that may be resulting from this OU, the RI/remedial action activities will need to be conducted in conjunction with the D&D activities that may be required for this site.

Building K-1410. Building K-1410 was used for receiving and emptying cascade traps and for uranium decontamination in the 1940s, 1950s, and 1960s. From 1963 to 1979, the building was used as a nickel plating facility. Wastes generated from uranium decontamination and recovery operations included nitric acid; organic degreasers, including carbon tetrachloride, trichloroethylene, and perchloroethylene; Miller's Fluorinated Lubrication oil; and uranium compounds and transuranic. Cleaning solutions were routinely discharged into the building process drains. Degreasers were occasionally discharged down the drains. Wastes generated from the plating process and discharged into the K-1410 Neutralization Pit include alkaline cleaners, acids, nickel sulfate, and fluoride.

Building K-1031. Building K-1031, located west of the K-306-5 and K-306-6 process buildings and north of Building K-1410, has been in operation since the mid 1940s. The building was originally used to clean spent traps from the diffusion cascade process buildings. In the early 1960s, Building K-1031 was converted to a storage facility for paint and painting equipment. Beginning in 1980, the building was also used for paint mixing. Activity was discontinued in 1986. Oil-based paints, latex paints, zinc-based paints, lead oxide, chlorinated rubber-based paints, bitumastic-asphaltic tar, varnishes, shellacs, polyurethane, epoxies, enamels, glyptal, thinners, cleaning solvents, and uranium are the suspected contaminants.

K-33 OU

The K-33 OU is located around Buildings K-33 and K-31 at the northwestern portion of the plant. Practical components include four cooling tower basins, their recirculating cooling water lines, and two switchyards. The K-33 Process Building is currently included in the D&D Program. In order to investigate and/or remediate any contamination that may be emanating from these sources, the D&D activities will need to be addressed in conjunction with the remedial action activities.

K-33 OU cooling water systems and switchyards were in use from the 1950s until enrichment operations stopped in 1985. Cooling water system corrosion inhibitors included zinc, phosphate, and chromium. In addition, a biocide treatment used on the cooling towers likely produced a variety of zinc and copper salts. French drains were placed under the switchyards at construction, and skimmer pits to collect yard drainage were installed in 1980-81. PCB-contaminated oils are the only suspected contaminants for the switchyards.

K-29 OU

The K-29 OU is located at the southeast corner of the plant near Buildings K-27 and K-29. Practical components include the K-27 and K-29 recirculating cooling water system and switchyard and a sewage treatment plant. Buildings K-27 and K-29 are included in the D&D Program, therefore the underground components should be investigated and remediated in conjunction with the buildings.

K-27 and K-29 Recirculating Cooling Water Lines and K-832-H Cooling Tower Basin. K-27 and K-29 Recirculating Cooling Water Lines and K-832-H Cooling Tower Basin were in use from 1945 until uranium enrichment activities were stopped in 1985. A zinc/phosphate/chromate system was used as a corrosion inhibitor.

K-732 Switchyard. PCB-contaminated oil is the only suspected contaminant at the K-732 Switchyard, which has been in operation since 1945.

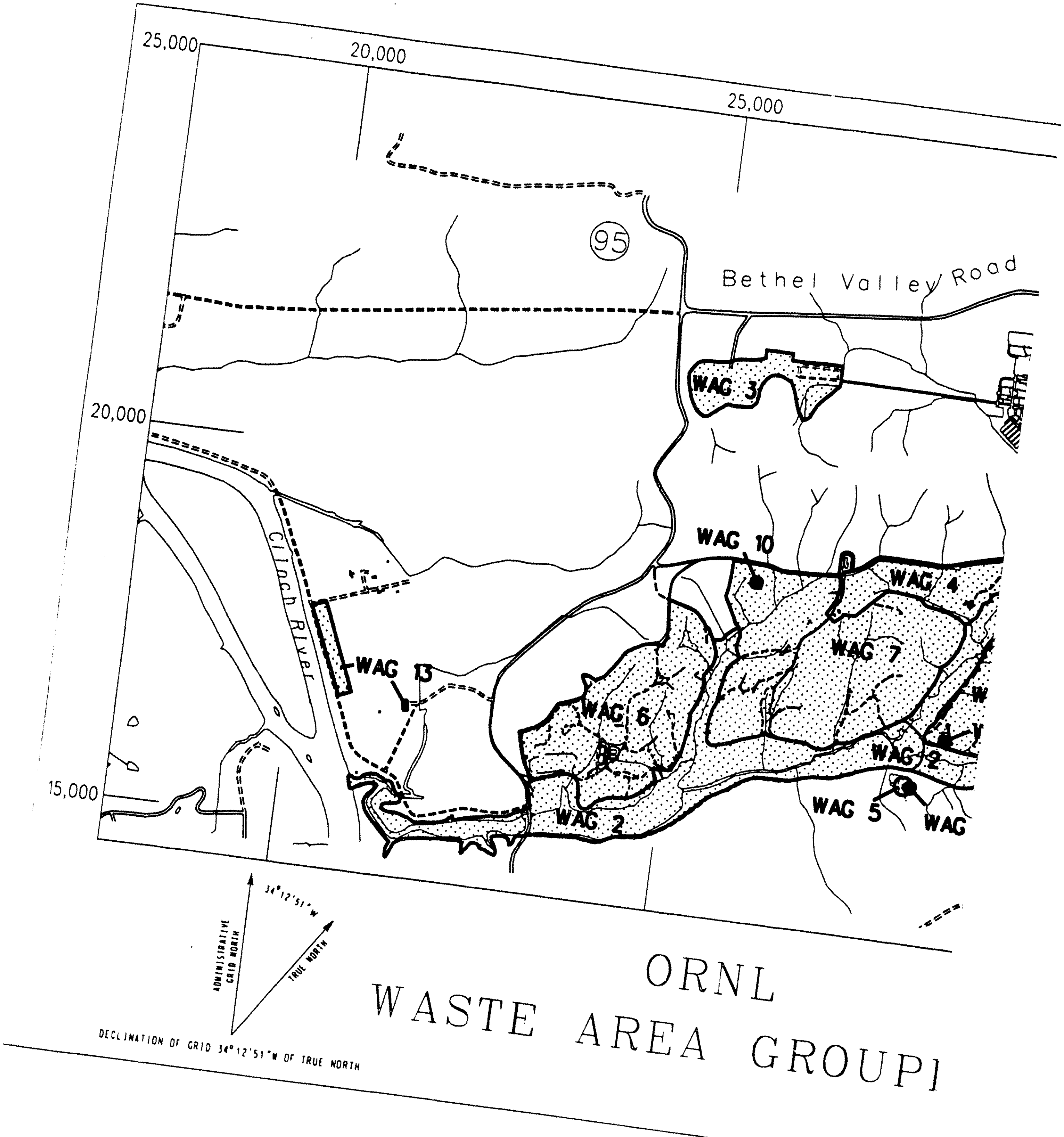
K-1203 Sewage Treatment Plant. The K-1203 Sewage Treatment Plant, located west of the K-27 process buildings, has been in operation since 1943. The Environmental Monitoring Station equipment at K-1203-B monitors compliance with the effluent limitations and monitoring requirement as set forth in the National Pollutant Discharge Elimination System permit (TN 0002950). The effluent samples for dissolved oxygen, suspended solids, and pH are taken at the discharge end of the chlorine contact tank. Analytical data indicate that the concentrations of several metals detected in sampled sludge are above guideline values.

K-1413 OU

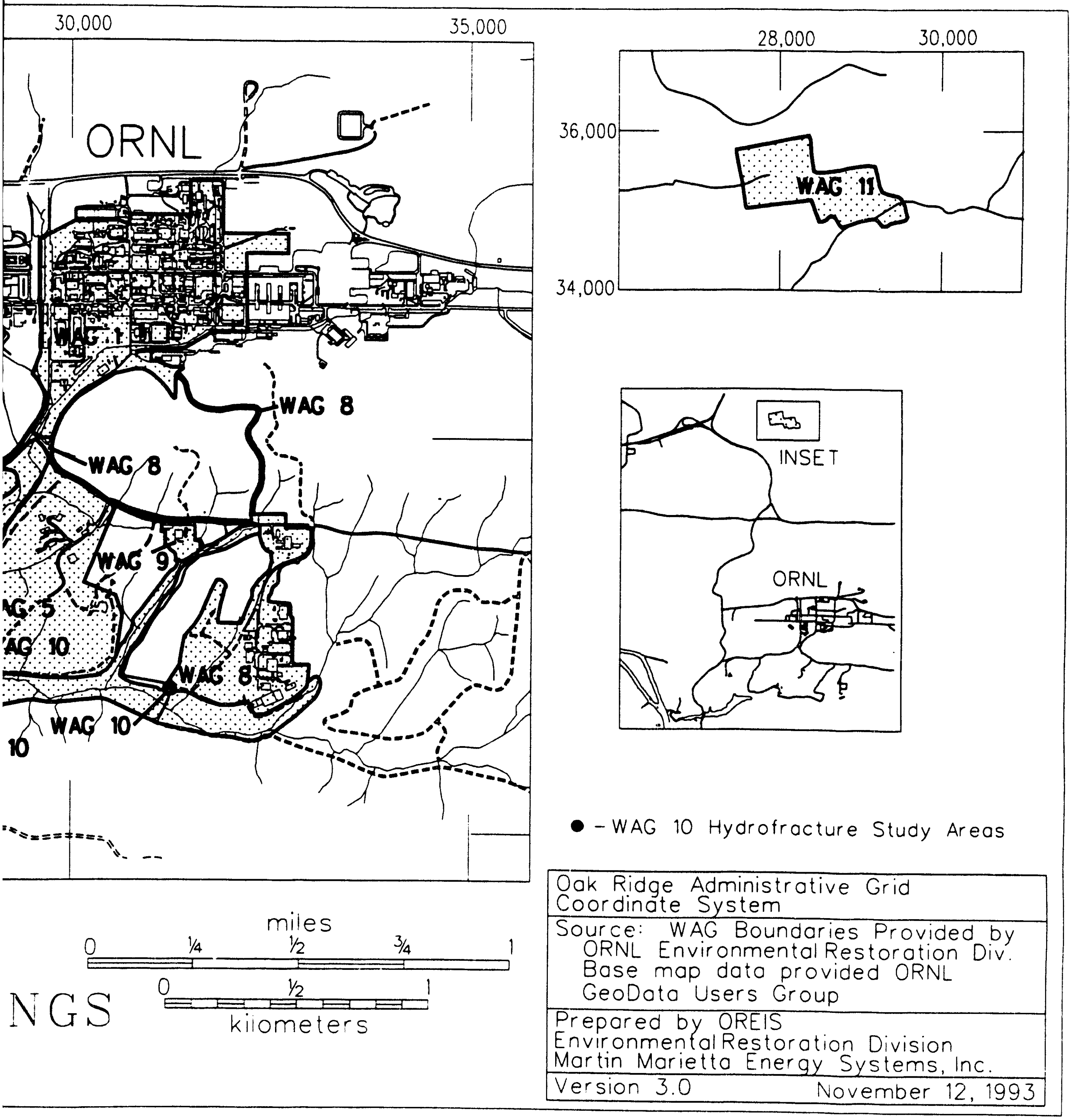
The K-1413 Treatment Tank OU is located in the main plant area directly across from Building K-25 at the intersection of 16th Street and Avenue J. Practical components include a research and development building, a neutralization pit, two process drain pits, process drain lines from the pits to the K-1401 acid line, and storm drain lines that once received the facility's process discharges. The K-1413 research and development facility operated from the 1950s to the early 1980s. As this OU consists of the underground portions of a structure that is no longer active and is a part of the D&D Program, the investigation and remediation of contamination should be conducted in conjunction with the D&D of the structure. Wastes include sodium and potassium hydroxides, uranium compounds, and acids such as sulfuric, hydrofluoric, nitric, and hydrochloric. Organic acids, diethylene glycol, dibutyl ether, and metal fluorides of sodium, chromium, nickel, uranium, and copper can be found in the discharges. Samples from the neutralization pit revealed traces of mercury.

K-25 Groundwater OU

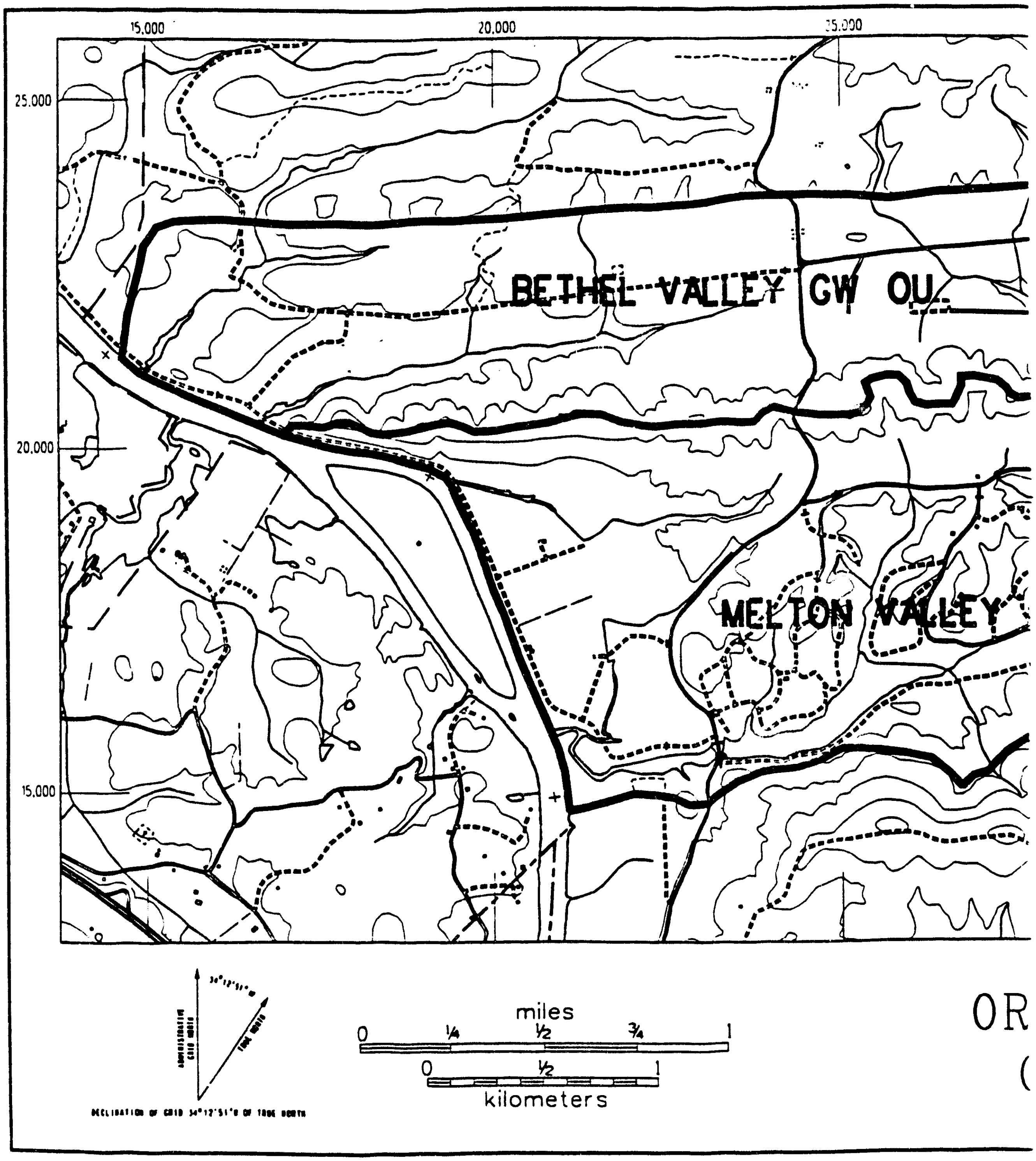
The K-25 Groundwater OU at the K-25 Site includes all groundwater underlying the plant area even though discharge is to both Clinch River and Poplar Creek. The extent of groundwater contamination is unknown at this time. Contaminants are primarily organics, including PCBs, but radioactive contaminants and some metals have also been detected.



Map showing Oak Ridge Nationa



Laboratory waste area groupings.



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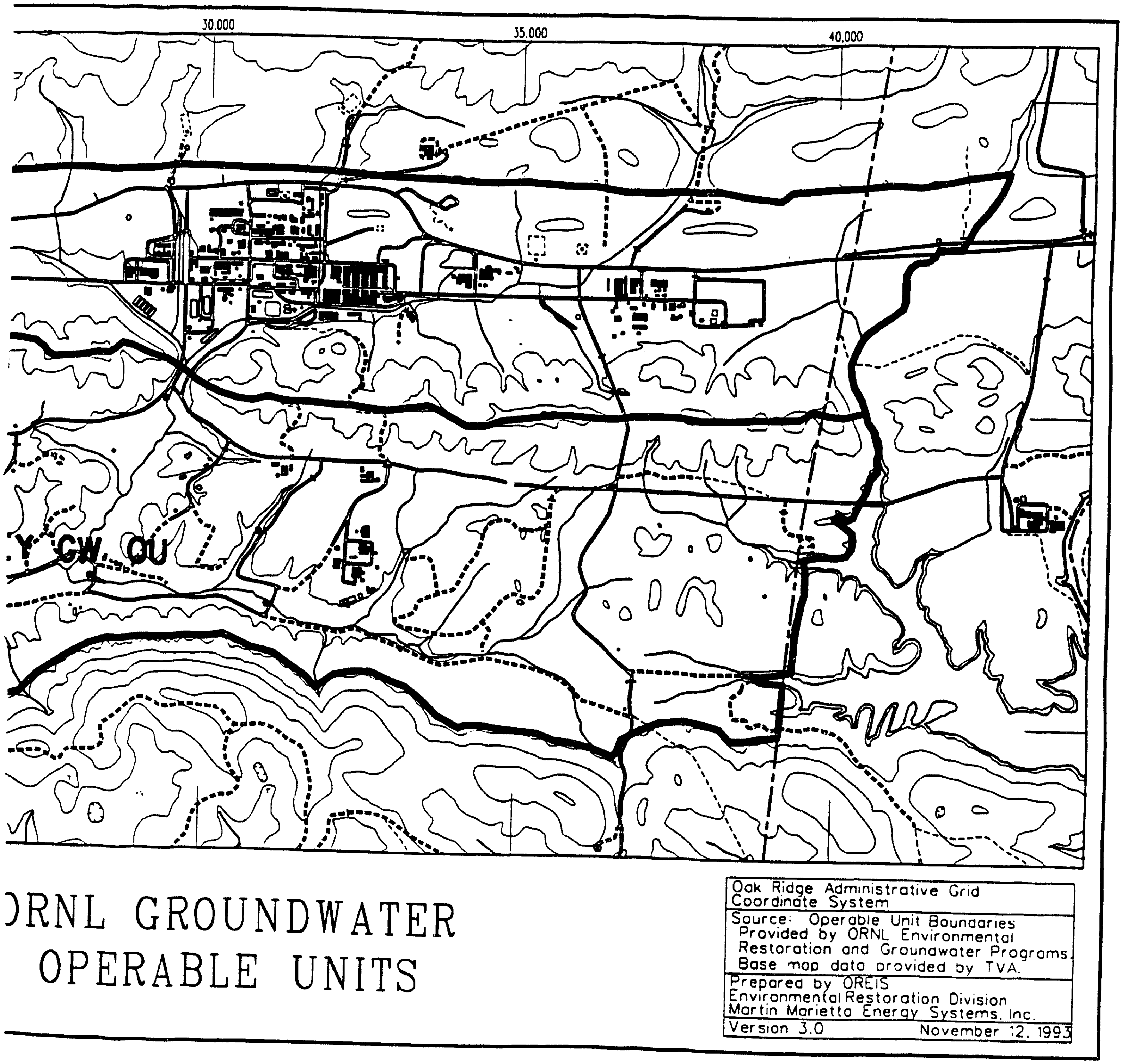


ak Ridge National Laboratory Groundwater
operable units.

OAK RIDGE NATIONAL LABORATORY WAGs/ OPERABLE UNITS

The Oak Ridge National Laboratory (ORNL) occupies several areas and covers ~3560 acres in Melton Valley and Bethel Valley, 10 miles southwest of downtown Oak Ridge, Tennessee. The mission of ORNL is to (1) conduct applied research and engineering development in support of DOE programs in nuclear fusion and fission, energy conservation, fossil fuels, and other energy technologies and (2) perform basic scientific research in selected areas of the physical, life, and environmental sciences. The laboratory was built in 1943 as part of the World War II Manhattan Project. Its original mission was to produce and chemically separate the first gram quantities of plutonium as part of the national effort to produce the atomic bomb. Presently, the groupings of remediation units at ORNL are so numerous that it is certain that these groups will be broken into additional operable units (OUs). Therefore, ORNL has retained the term "WAG" to facilitate the imminent reorganization into OUs. The WAGs are organized based on drainage area and similar waste characteristics.

Oak Ridge National Laboratory WAG 1

ORNL WAG 1 consists of 96 individual contaminated areas requiring, or potentially requiring, remediation. The unit consists of low-level liquid waste collection and storage tanks; leak and spill areas and contaminated soils; ponds and impoundments; waste treatment facilities; shallow land burial and other solid waste storage areas (SWSAs); and other miscellaneous chemical and sanitary waste facilities. These areas are located in the main plant area. A variety of contaminants of concern, including radionuclides, heavy metals, and organics, are present within this WAG.

WAG 1 has been broken into ten OUs to address the concerns within the ORNL operations area.

WAG 1 Gunite and Associated Tanks OU 1

OU 1 consists of the underground steel and gunite tanks associated with the tank farms located in the center of the ORNL main plant area. The Gunite and Associated Tanks OU includes the tanks located in the North and South Tank Farms as well as Tanks TH-4 and W-11. The solid waste management units within this OU are primarily the large gunite tanks installed to store liquid wastes in 1943 and subsequently used as the main holding tanks for the low-level liquid radioactive waste system at ORNL. A number of steel tanks associated with the North Tank Farm are also included in this OU. The strategy of this grouping is to allow those tanks that are geographically similar to be remediated as a group. Some tanks contain sludge and require isolation to mitigate further releases, while other tanks do not contain sludge and require remedial action because of groundwater infiltration from inleakage through the tank domes.

The Gunite and Associated Tanks OU is commonly referenced as three separate tank groups as described below:

- South Tank Farm Waste Tanks W-5, W-6, W-7, W-8, W-9, and W-10;

- North Tank Farm Waste Tanks W-1, W-2, W-3, W-4, W-13, W-14, W-15, and W-1A; and
- Building 3550 Laboratory Waste Tanks TH-4 and W-11.

WAG 1 Surface Impoundment OU 2

The following is a brief description of each of the four surface impoundments included in OU 2:

Basin 3513. This unlined impoundment was constructed in 1944 to serve as a settling basin for untreated waste waters prior to their discharge irto adjacent White Oak Creek. The impoundment basically was constructed by excavating into the clay soil overlying the limestone bedrock at the site, and no lining was added.

Basin 3524. Basin 3524 is one of four holding basins located in the south central portion of the Bethel Valley ORNL facilities complex. Basin 3524, frequently referred to as the equalization basin, was an intermediate storage, collection, and mixing basin for the process waste treatment system located in Building 3544. Now it is only used for surge capacity for storm events.

Basin 3539 and 3540. ORNL Basins 3539 and 3540 constructed in 1964, and frequently referred to as the 190 ponds, were formerly used as surge ponds to receive process waste streams primarily from the Building 4500 complex. The waste streams are split into identical, parallel basins and monitored primarily for radionuclides before discharge to the process waste treatment system via Basin 3524 or to White Oak Creek. Currently, the ponds are only used as surge capacities for collection of storm water during peak storm events.

WAG 1 Underground Piping and Storm Drains OU 3

An extensive network of underground utilities and storm drains exists throughout WAG 1. The pipeline trenches and storm drain trenches underlying WAG 1 and the liquid low-level waste (LLLW) transfer line in the vicinity of the South Tank Farm are included in this OU. While many pipelines are abandoned, there are near numerous others in the same trench that are still in use. Existing RI data indicates that contaminants migrate to surface waters (e.g., White Oak Creek, First Creek, and Fifth Creek) through abandoned leaking pipelines, pipeline trench backfill soils or bedding materials, and leaking storm sewers. Currently, outfalls 341 and 342 are known to release measurable concentrations of radionuclides to surface water. This OU addresses the release of contaminants across the WAG boundary through this network.

WAG 1 Groundwater OU 4

The Groundwater OU included the shallow groundwater beneath the WAG which discharges to surface streams within WAG 1. The potential exists for contaminant migration from various sources within WAG 1 through both shallow and deeper groundwater movement to off-WAG receptors. Deeper groundwater movement through bedrock underneath WAG 1 is discussed in the Bethel Valley Groundwater OU.

WAG 1—White Oak Creek Floodplain Soils and Sediments OU 5

This OU consists of soils and sediments within the floodplain of White Oak Creek, primarily in the southwestern portion of WAG 1. This area has become contaminated from discharges into White Oak Creek and from off-site WAG migration of contaminants originating almost anywhere on the WAG (e.g., the soils OU). Some of the soil and sediment contamination eventually migrate further downstream to WAG 2.

Remediation of the White Oak Creek flood plain soils and sediments is an OU because of the geographically distinct location of the soils and sediments (1) along the water course of White Oak Creek at the southwest boundary of the WAG and (2) along the water course extending up First Creek on the west boundary of the WAG.

WAG 1—Solid Waste Storage Area 1 OU 6

SWSA 1 is located southwest of the fence surrounding the main plant area at ORNL with its closest edge ~25 ft south of White Oak Creek. The site is triangular in shape and encompasses ~1 acre. The burial ground lies in the path of surface water drainage from Haw Ridge to White Oak Creek, causing marshes to develop in the topographically low portions of the area following periods of heavy rains and wet seasons.

The site probably was selected on the basis of its proximity to ORNL with no consideration given to the possibility that contaminants might leak into the nearby water system. The site was commissioned in 1943 and closed in 1944. The earliest record of burials dates from April 1944 when cans with red tops were placed in the 706-A Building for the collection of waste materials that could not be disposed of through the drains.

WAG 1—Solid Waste Storage Area 2 OU 7

SWSA 2, in the northeast corner of WAG 1, was used for the disposal of solid waste containing beta- or gamma-emitting isotopes, liquid waste contaminated with plutonium in stainless steel drums, and alpha-contaminated material from off-site locations. The site was closed in 1946, and reportedly all of the buried wastes and contaminated soils were later excavated and transported to SWSA 3. An analysis of soil and groundwater samples indicates that the soil does not contain concentrations of radionuclides constituents significantly higher than background. However, anomalies were found during geophysical investigations. A limited Phase II RI will be conducted to determine if a no further action classification is appropriate.

WAG 1—Waste Pile OU 8

The Waste Pile Area, OU 8, is located directly south of the Nonradiological Waste Treatment Plant across White Oak Lake. The exact extent of the area is unknown, but on the basis of old ORNL photographs, it appears to occupy 15 to 20 acres. Interviews with ORNL staff indicate that the site was used as both a soil borrow area and a disposal area for noncontaminated construction debris. Identification of particular wastes has not been undertaken, but an excavation for installation of a transfer pipeline uncovered numerous metal and glass containers, transite, and miscellaneous metal piping and scrap. Contamination is not expected at this OU, therefore, it is another candidate for no further action. Remediation of the waste pile is considered a separate OU because of the potential for no further action, although additional work may be required to document this decision.

WAG 1—Contaminated Soils OU 9

This OU contains all of the soils underlying WAG 1 and is subdivided into four areas: (1) soils in the 3000 watershed, (2) soils in the Isotope Circle, (3) mercury-contaminated soils, and (4) miscellaneous-contaminated soils.

3000 Watershed Soils. The 3000 Watershed Soils consists of the soils in the central portion of the WAG from the northern edge of the WAG to White Oak Creek to the southern edge. The soils are contaminated with various radionuclides from spills and/or leaks, as indicated by radiological survey data, and the area is believed to be the main drainage for the entire WAG; therefore, it receives contaminated runoff from various locations. These areas are bounded by Third Street to the west, and the eastern boundary is approximately one block to the east. Also included in this OU are any additional soils contaminated by releases from any of the 19 buildings within the area boundaries, as well as any additional miscellaneous pipelines, trench soils, bedding materials, and backfill soils.

Isotope Circle Soils. The Isotope Circle Soils, consisting of contaminated soils within a two-block area east of the North Tank Farm, is currently occupied by a number of buildings and several underground steel tanks. The soils are believed contaminated primarily with ^{90}Sr, ^{137}Cs, and uranium isotopes from various isotope research programs within the surrounding buildings. Also included is this OU are any additional soils contaminated by releases from any of the buildings within the area boundaries, as well as any additional miscellaneous pipelines, trench soils, bedding materials, and backfill soils.

Mercury Spill Soils. The Mercury Spill Soils currently consist of four distinct locations in the southeastern corner of the WAG where spills of mercury have occurred. Soils, pipelines, and trenching materials in these areas are included in the area. Subsequent soils sampling of these areas has indicated mercury contamination. Two of the spill areas are beneath occupied buildings with soil borings installed through the bottom floor. The additional mercury spill areas are isolated from the above areas. One area is along the south side of Building 3592, and the other is beneath the roadway just south of Building 3503. During the Phase I RI, soils analyses indicated a wider distribution of mercury in soil than originally suspected. Further assessments of this information may suggest that the new mercury-contaminated waste units be added.

Miscellaneous Contaminated Soils. Miscellaneous contaminated soils exist as a "catch-all" for the remaining contaminated soils units. These soils are located in the northeast corner of the WAG, scattered along the northwestern border and western half of the WAG (west of Third Street), and in the south central area, east of the surface impoundments.

WAG 1—Steel Tank Systems OU 10

The Steel Tank Systems OU consists of the following 16 tanks constructed of stainless steel: W-19, W-20, WC-1, WC-15, WC-17, T-30, TH-1, TH-2, TH-3, H-209, 3001B, 3001S, 3002A, 3003A, 3004-B, and 3013. Although attempts have been made to empty these tanks, sludge may still be present containing ^{137}Cs, ^{90}Sr, transuranic elements, and other radionuclides. The interior of these tanks and associated piping systems are contaminated, and some leakage has occurred. Steel tanks are in various locations throughout the WAG, but their remediation is designated a separate OU because the tanks may all be addressed with a similar remedial technology.

Oak Ridge National Laboratory WAG 2

ORNL WAG 2 contains two OUs. The first (OU 1) consists of the area encompassed by the stream channels of White Oak Creek and Melton Branch, White Oak Lake, White Oak Dam, and the White Oak Creek Embayment prior to confluence with the Clinch River. White Oak Creek/White Oak Lake and the tributaries represent the major drainage system for ORNL and the surrounding facilities. The second (OU 2) consists of the WAG 2 groundwater zone and is a thin active flow layer extending from the base of the streams laterally to the adjacent WAG and OU boundaries. The ORNL Groundwater OU underlies all of WAG 2 and adjacent contaminant source WAGs and OUs.

WAG 2—White Oak Creek Embayment/Tributaries/Soil OU 1

White Oak Creek and its tributaries are located in Melton and Bethel Valleys. White Oak Creek flows into the Clinch River about 1.5 miles north of the junction of Interstate 40 and State Highway 95. White Oak Lake is located upstream of White Oak Lake Dam, south of the ORNL main complex. The dam was built 0.6 mile upstream from where White Oak Creek empties into the Clinch River (mile 20.8, CRK 33.5). White Oak Creek Embayment encompasses the area downstream of White Oak Dam to the confluence of White Oak Creek with the Clinch River. White Oak Lake is a surface impoundment for radioactive and other hazardous wastes that drain from ORNL via the White Oak Creek watershed. It serves as a final settling basin for waste released from ORNL operations and waste storage areas. The White Oak Creek drainage system has been contaminated since activities at the ORNL site began in 1943. Main contaminants identified to date are ^{90}Sr, ^{137}Cs, ^{60}Co, ^{3}H, and metals (mercury, zinc, arsenic, and chromium). Hazardous organic chemicals, including PCBs, may also be present in the stream and lake sediments.

WAG 2—Groundwater OU 2

White Oak Creek in Melton Valley, Melton Branch, and their main tributaries lie in valley floors with some alluvial soils that cover the eroded bedrock surface. Groundwater occurs as a water table aquifer in the base of these alluvial soils and extends down into fractures and weathered zoned in the bedrock beneath the valley floors. The WAG 2 groundwater zone is a thin active flow layer extending from the base of the streams laterally to the adjacent WAG boundaries. The ORNL Groundwater OU underlies all of WAG 2 and adjacent contaminant source WAGs. Water enters the WAG 2 groundwater system by direct infiltration of precipitation, lateral inflow of shallow stormflow from adjacent hill slope areas, and groundwater inflows from the groundwater system underlying adjacent source WAGs and to a lesser extent from rising deeper flow system discharges from the Groundwater OU. In some areas the local streams may provide recharge into groundwater in the alluvium. Groundwater flow directions in

WAG 2 are generally from the valley margins toward the streams and along the valley axes in the base of the alluvial soils Contaminants identified in groundwater in WAG 2 are dominated by the radionuclides ^{3}H and ^{90}Sr though ^{137}Cs and ^{60}Co and are detected in some areas; transuranic isotopes are known to move from SWSA-5 North to a seep in White Oak Creek via a groundwater flow path. Volatile organic compounds and metals may occur in WAG 2 groundwater adjacent to contaminant source WAGs containing these contaminants.

Oak Ridge National Laboratory WAG 3

ORNL WAG 3 is composed of three areas: SWSA 3, the Closed Scrap Metal Area, and the Contractors' Landfill.

SWSA 3. SWSA 3 is located in Bethel Valley in an area at the foot of Haw Ridge about 0.6 mile west of the ORNL complex. The 7-acre area was commissioned in 1946 and used as a landfill for the storage of low-level solid radioactive waste and scrap metal. It was taken out of service in 1951. Contaminants of concern identified to date include small amounts of transuranic, ^{90}Sr, ^{132}Cs, and ^{3}H.

Scrap Metal Area. The Scrap Metal Area is a 4-acre triangular shaped section located in the south portion of the fenced area of SWSA 3. It was used to store contaminated metal between 1951 and 1976. Most of the scrap has now been buried in other SWSAs; however, some contaminated tanks and equipment are still stored above ground. The primary contaminant of concern identified to date is ^{137}Cs.

Contractors' Landfill. The Contractors' Landfill is located west of SWSA 3. The purpose of this landfill was disposal of debris from construction areas and noncontaminated demolition activities. This 7-acre area is also used as a disposal area for fly ash from the ORNL steam plant. No contaminants of concern are believed to be present at the Contractors' Landfill, but there is no conclusive documentation in support of this assumption.

Oak Ridge National Laboratory WAG 4

ORNL WAG 4 is composed of three units: a shallow-land burial ground containing radioactive and hazardous wastes (SWSA 4); two pilot-scale, LLLW seepage pits; and an inactive LLLW line north of Lagoon Road.

SWSA 4. SWSA 4 is located in Melton Valley about 0.5 mile southwest of the main ORNL complex. The unit is bounded on the northern side by Lagoon Road. SWSA 4 covers an area of ~23 acres and was used from 1951 to 1959 for the storage of radioactive solid waste. For a period of time, the landfill was designated as the Southern Regional Burial Ground by the Atomic Energy Commission and received wastes from nuclear installations in the eastern United States. Contaminants of concern identified to date include ^{3}H, ^{90}Sr, ^{60}Co, ^{125}Sb, and ^{137}Cs.

Pilot Pits. The two pilot pits are located south of SWSA 4 on the road leading to the waste pits and trenches. The unit was originally constructed to perform pilot-scale experiments related to fixation of high-level radioactive wastes (1955–1959) but is now used for storage of equipment and leaching tests on coal and municipal solid wastes.

Radionuclides are the only contaminants stored here, and no releases have been reported.

LLLW Line. The LLLW line, located on the north side of Lagoon Road, was used to transfer LLLW to the pits and trenches in WAG 7. The first 1.5-mile section of the waste transfer line was installed in June 1954 to transfer LLLW from the Bethel Valley waste storage tanks to Waste Pit 2. Carbon steel extensions to Trench 5 (1960), Trench 6 (1961), and finally to Trench 7 (1962) completed the transfer line to the waste pit area. In 1966, a cast-iron line was installed from Trench 7 to the Old Hydrofracture Facility (1.5 miles). Wastes handled in the transfer system were routinely generated laboratory LLLW.

Oak Ridge National Laboratory WAG 5

ORNL WAG 5 is composed of 16 contaminated areas, including LLLW transfer lines and leak sites, hydrofracture surface facilities, waste storage tanks, a sludge basin and a holding pond, a shallow land burial ground containing radioactive and hazardous wastes (SWSA 5 South), and a transuranic waste storage area. (SWSA 5 North that has not been transferred into the ER Program at this time.)

These areas are located east of White Oak Creek, northwest of Melton Branch. SWSA 5 South and North is an area of about 80 acres and was used for disposing of routine buried waste (south side) and transuranic contaminated waste (north side). The major contaminants detected in groundwater seepage are ^{90}Sr and ^{3}H.

Oak Ridge National Laboratory WAG 6

ORNL WAG 6 consists of SWSA 6, the Emergency Waste Basin, and the Explosives Detonation Trench.

SWSA 6. SWSA 6 is located northwest of White Oak Creek near White Oak Dam and State Highway 95. This 68-acre site is still in operation as a waste burial ground for solid low-level radioactive waste. Contaminants of concern include various radionuclides and hazardous chemicals.

Emergency Waste Basin. The Emergency Waste Basin is located north of SWSA 6. It is a 2-acre basin constructed as an LLLW or process-waste holding basin for use when ORNL might be unable to release wastes to White Oak Creek. The basin has never been used, and no releases have been detected in the stream leaving the basin; however, surface contamination has been found in the basin.

Explosives Detonation Trench. The Explosives Detonation Trench is located in the northern part of SWSA 6. It was used to detonate explosives and shock-sensitive chemicals requiring disposal. Waste was laid in the bottom of the trench and detonated with a small plastic explosive charge. No releases are believed to have occurred.

Oak Ridge National Laboratory WAG 7

WAG 7—Subsurface Disposal OU 1

The subsurface disposals consist of 7 LLLW seepage pits and trenches, the Homogeneous Reactor Experiment (HRE) fuel wells, the experimental hydrofracture injection areas and contaminated soil surfaces, and a decontamination facility.

WAG 7—Pipeline & Leak Site OU 2

The pipelines and associated leak sites run throughout the WAG and carry the liquid waste to each of the seven seepage pits; several known leak sites are associated with the subsurface pipelines. These units are located to the west and southwest of SWSA 4 in Melton Valley about 0.5 miles southwest of the main ORNL complex and are bounded on the south side by White Oak Creek. Several radioactive contaminants have been identified with major activities of ^{90}Sr, ^{137}Cs, ^{60}Co, and transuranic isotopes.

Oak Ridge National Laboratory WAG 8

ORNL WAG 8 is made up of 27 units that include waste collection basins, LLLW lines and leak locations, and an experimental hydrofracture injection area with associated soil contamination, LLLW collection/storage tanks, a hazardous waste storage facility, a mixed waste storage pad, a sewage treatment plant, and a silver recovery plant.

These units are located in the vicinity of the High Flux Isotope Reactor, the Melton Valley Pumping Station, the Thorium-Uranium Recycle Facility, the Molten Salt Reactor Experiment Building, and the Transuranium Processing Plant. Various radioactive contaminants have been used at these units, but very few releases have been reported or identified as being above background levels.

Oak Ridge National Laboratory WAG 9

ORNL WAG 9 is made up of six units: the HRE Pond, two inactive LLLW collection and storage tanks, a trash area, the Waste Evaporator, and the Waste Evaporator Loading Pit.

Homogeneous Reactor Experiment Pond. The HRE Pond is located in Melton Valley, 0.5 mile southeast of the ORNL complex. It is situated south of Building 7500, above Melton Branch. The pond received contaminated condensate from the reactor evaporator from 1958 to 1961. Contamination is mainly from ^{137}Cs and ^{90}Sr, with trace amounts of ^{238}Pu, ^{239}Pu, ^{241}Am, and ^{244}Cm.

Storage Tanks 7560 and 7562. The LLLW collection and storage tanks (7560 and 7562) are located south of the Waste Evaporator and north of the Waste Holding Pond, respectively. The 7560 tank (1957-1961) held condensed clean vapor from the evaporator cell until the liquid could be sampled. The 7562 tank was designed to hold high-level waste from 1957 to 1986. Major radionuclides of concern in LLLW storage tanks are considered to be ^{90}Sr, ^{137}Cs, ^{60}Co, and transuranic for both tanks.

Trash Area. The trash area east of the HRE parking lot is north of Melton Valley Drive and across from Building 7500. The unit formerly contained an old farm house that was used by HRE-1 and HRE-2 for storage. During the early to middle 1960s, all stored material, some contaminated with radioactivity, was removed for disposal. Construction debris, perhaps containing some waste contaminated with radionuclides, is visible at the east end of the area.

Waste Evaporator. The Waste Evaporator is located in Building 7502 on Melton Valley Road, 0.6 mile southeast of the main ORNL complex. The unit contains the reactor (Building 7500), the waste evaporator (Building 7502), a hot storage and decontamination pad, and a filled-in waste holding pond. The facility was intended for three phases of experimentation during the 1950s. Because of accelerated corrosion during the first experiment, the second and third experiments were never begun. A small probability exists for significant exposure from highly radioactive insoluble corrosion and fission products that remain in the process piping.

Waste Evaporator Loading Pit. The Waste Evaporator Loading Pit is located outside and adjacent to the east wall of the Waste Evaporator. The pit was used to load carriers with LLLW from the Waste Evaporator during the 1950s. The pit is contaminated, and major radionuclides are ^{90}Sr, ^{137}Cs, and ^{60}Co.

Oak Ridge National Laboratory WAG 10

ORNL WAG 10 is defined as the underground components (i.e., wells, injected grout sheets, and contaminated media) of four different areas located in Melton Valley that were used in the development and full scale application of hydrofracture operations. The four areas are Hydrofracture Experiment Site 1 (HF-1), Hydrofracture Experiment Site 2 (HF-2), Old Hydrofracture Facility (also known as HF-3), and New Hydrofracture Facility (HF-4). Surface facilities associated with the hydrofracture operations are not included in WAG 10. (The surface facilities are considered to be components of ORNL WAGs 5, 7, and 8.)

The following are three WAG 10 OUs that have been identified and are described below:

WAG 10—Grout Sheets OU 1

This OU is comprised of the thin layers of solidified, cement-based low-level waste slurry that was injected into fractures in the underground geologic structure. OU 1 also includes any contaminated rock layered between or surrounding the grout sheets.

WAG 10—Deep Groundwater OU 2

This OU includes the deep saline Melton Valley groundwater as well as free liquids resulting from hydrofracture injections and contaminated groundwater that may be interacting with fresh water systems within Melton Valley.

WAG 10—Hydrofracture Wells Plugging & Abandonment OU 3

The objective of this OU is to plug and abandon WAG 10 injection wells, deep observation and monitoring wells, and deep boreholes that are not suitable for recompletion and use as piezometers or water quality sampling wells.

Oak Ridge National Laboratory WAG 11

ORNL WAG 11 is the White Wing Scrap Yard located at the west end of East Fork R. ge between State Highway 95 (White Wing Road) and the Oak Ridge Turnpike. The unit, which covers about 30 acres, was used to store contaminated materials from the three Oak Ridge plants. Wastes (equipment, tanks, and trucks) were thought to have been stored above ground, but additional investigations may prove otherwise. Much of the stored materials and contaminated soil was removed in 1966–1971; however, some scrap metal, concrete, and other waste remains. Contaminants of concern identified to date are gamma radiation, ^{137}Cs, ^{234}Th, ^{235}U, and PCBs.

Oak Ridge National Laboratory WAG 13

ORNL WAG 13 consists of the Cesium-137 Contaminated Field and the Cesium-137 Erosion/Runoff Study Area.

Cesium-137 Contaminated Field. The contaminated field is located about 330 ft north of the Clinch River at Clinch River Mile 20.5. The 50-acre area was set aside to study the ecological effect of simulated fallout of ^{137}Cs, which would occur in the event of a nuclear war. The contaminant consisted of ^{137}Cs fused at high temperature to silica particles. After ~20 years (since contamination), about 5.2 Ci of activity should remain.

Erosion/Runoff Study Area. The Erosion/Runoff Study Area is located due north of the confluence of the White Oak Creek and the Clinch River. The purpose of this study area was to use the field contamination to study runoff, erosion, and infiltration of ^{137}Cs on a silt-loam soil.

Oak Ridge National Laboratory Groundwater OU

Surface drainage from the ORNL Groundwater OU is mostly into White Oak Creek or its one named tributary, Melton Branch. Areas that do not discharge to White Oak Creek include small watersheds that drain to Raccoon Creek west of WAG 3, unnamed streams that drain directly to the Clinch River via short surface streams, and areas east of the White Oak Creek watershed boundary that drain to Bearden Creek.

Bethel Valley Groundwater. The Bethel Valley portion of the ORNL Groundwater OU is underlain by bedrock of the Chickamauga Group, an interbedded limestone and shale geologic group. Contaminated areas within Bethel Valley include WAG 1, the ORNL main plant area; WAG 3, which includes SWSA 3 and a contractor's landfill; and WAG 17, the ORNL services area.

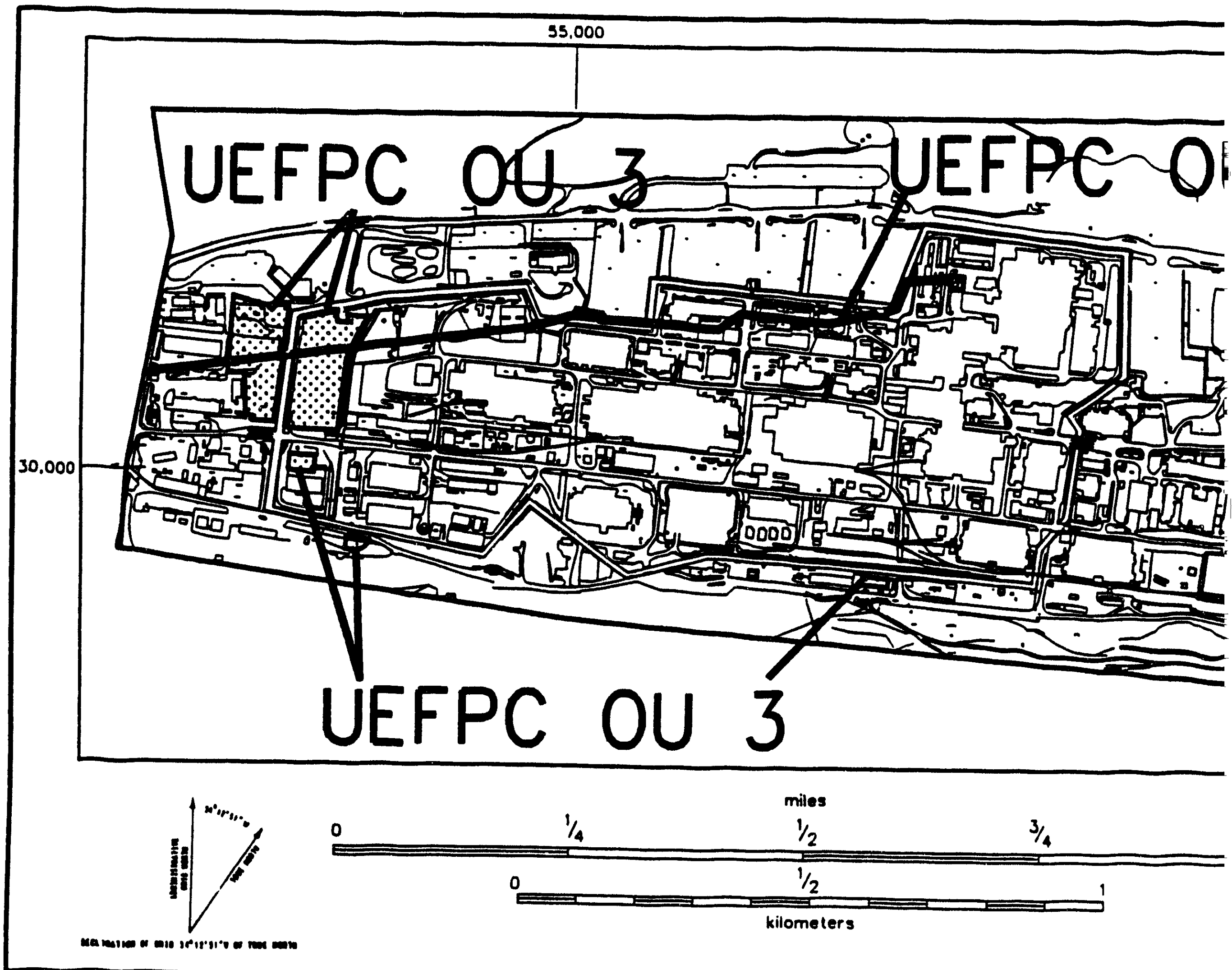
Groundwater movement in the regolith zone occurs as shallow stormflow in undisturbed areas and as channelized flow in utility trench backfill in industrialized areas such as WAG 1. Groundwater movement in bedrock is controlled by the presence of conductive fractures that are susceptible to dissolutional enlargement in carbonate bedrock. Bedrock weathering has created local cavity systems that are capable of transmitting groundwater rapidly to the surface water streams within Bethel Valley.

Contaminate sources in Bethel Valley are predominantly shallow subsurface materials including buried solid waste, contaminated soils associated with leaks and spills in the main plant isotopes production area, and sediment and liquids in active and inactive impoundments. Contaminants of concern in Bethel Valley include strontium, tritium, and organic compounds.

Melton Valley Groundwater. The Melton Valley portion of the ORNL Groundwater OU is underlain by bedrock of the Conasauga Group, heterogeneous geologic group comprised of mixed shales, siltstones, and limestones. Within the OU portion of Melton Valley, limestones tend to be thin and quite silty. Consequently dissolution of the carbonate leaves a silty residuum that does not develop karst characteristics.

Melton Valley contains WAGs 2, 4 through 10, and 13. Surface drainage is to White Oak Creek and White Oak Lake via Melton Branch and unnamed tributaries of White Oak Creek. Groundwater movement occurs via stormflow to local streams in undisturbed areas. In disturbed areas recharge reaches the shallow groundwater system and flows to local streams through fractures in the saprolite and bedrock. Groundwater flow diminishes rapidly with depth because the number of water conducting fractures decreases with depth and measured permeabilities less than 1E-7 cm/s are common at depths greater than 100 ft in Melton Valley.

With the exception of WAG 10, contaminant sources in the Melton Valley OU portion of the OU are predominantly buried wastes including solid wastes, residues from seepage ponds, residues from pipeline leaks and spills, sediment and liquid in inactive impoundments, and sediments in White Oak Lake and in the White Oak Creek floodplain. WAG 10 consists of hydrofracture waste injection zones and associated wells ranging in depth from about 200 to 1100 ft below ground surface. Contaminants of concern in Melton Valley include strontium, cesium, tritium, and organic compounds.



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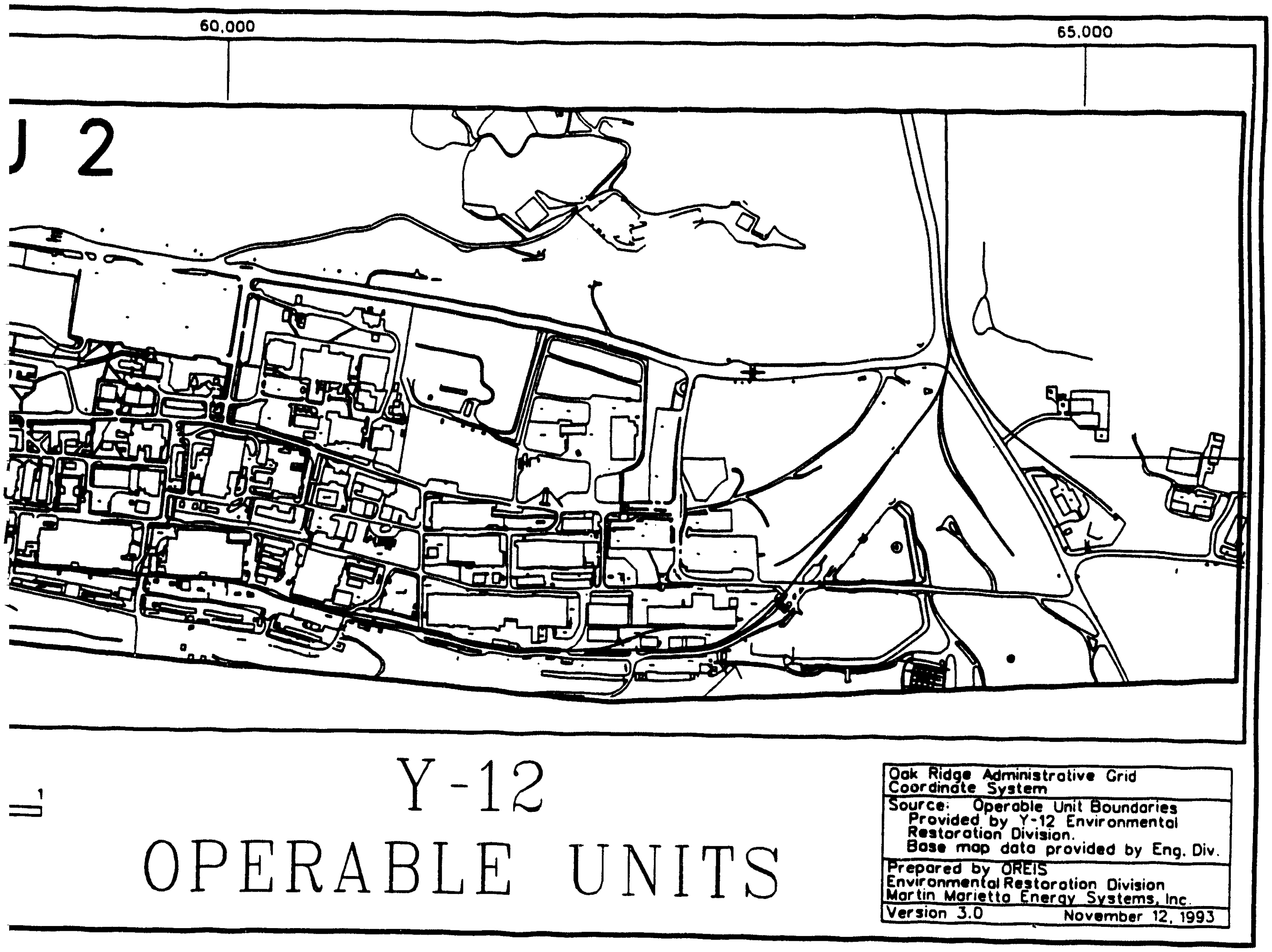

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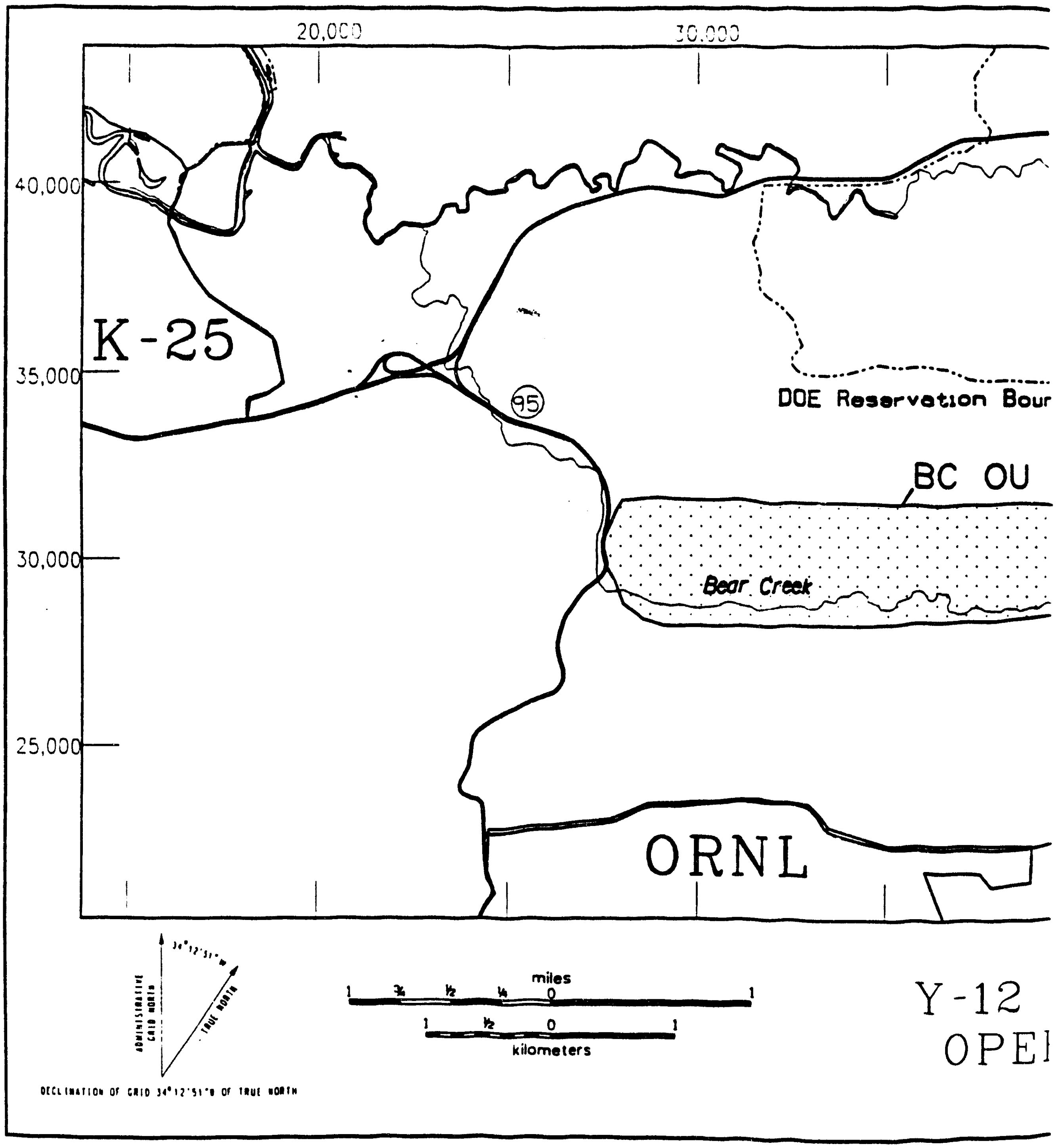

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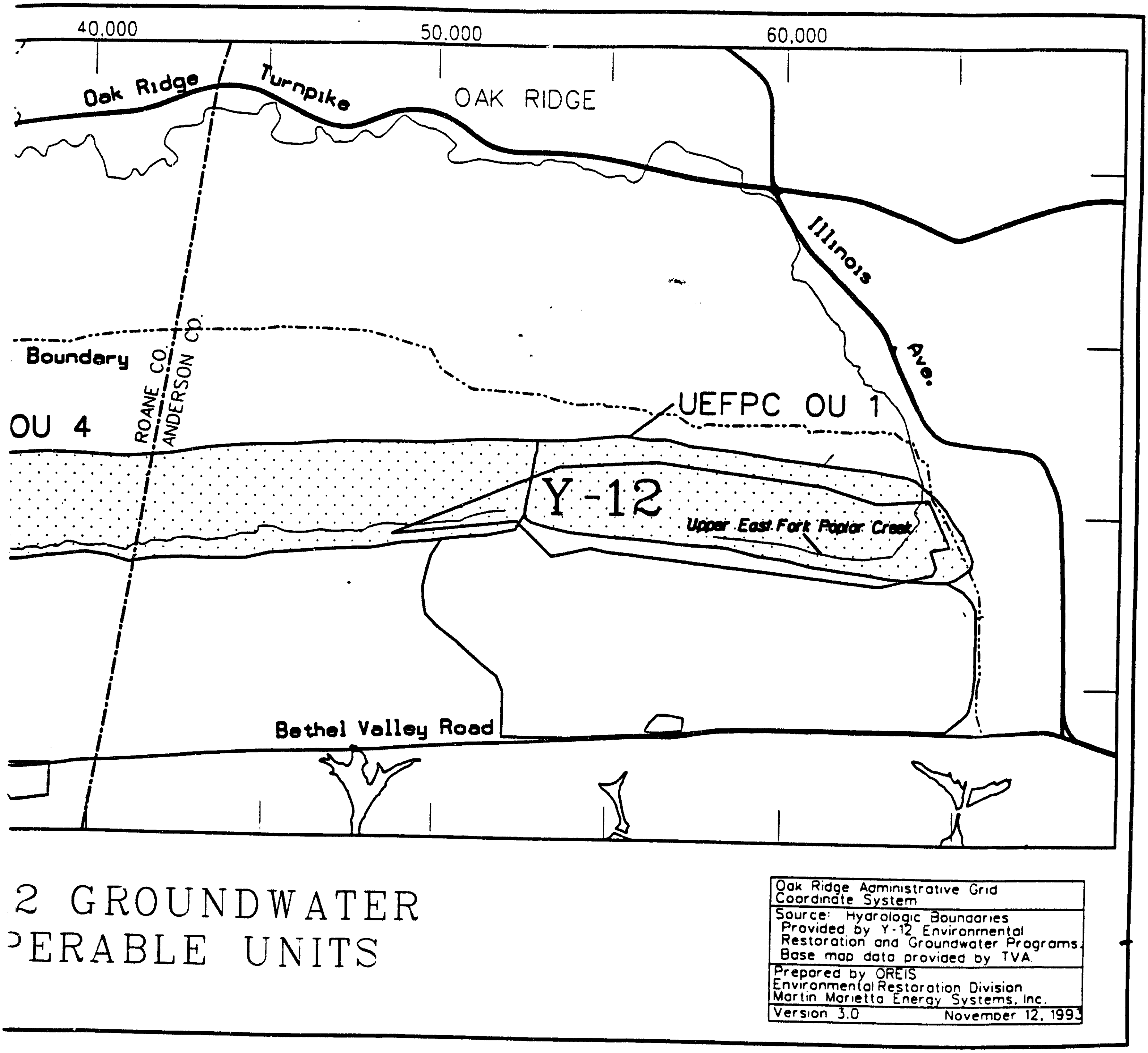

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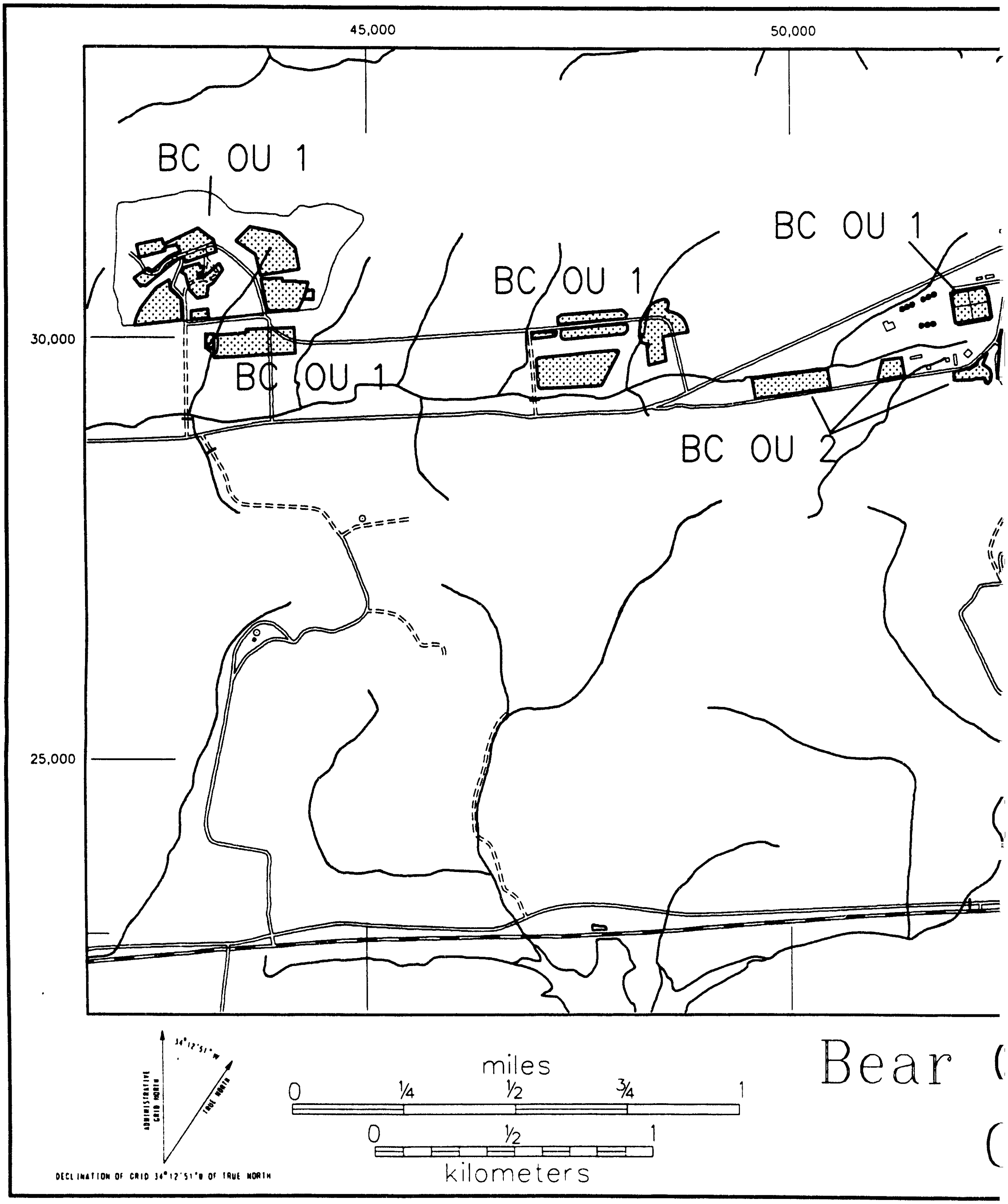

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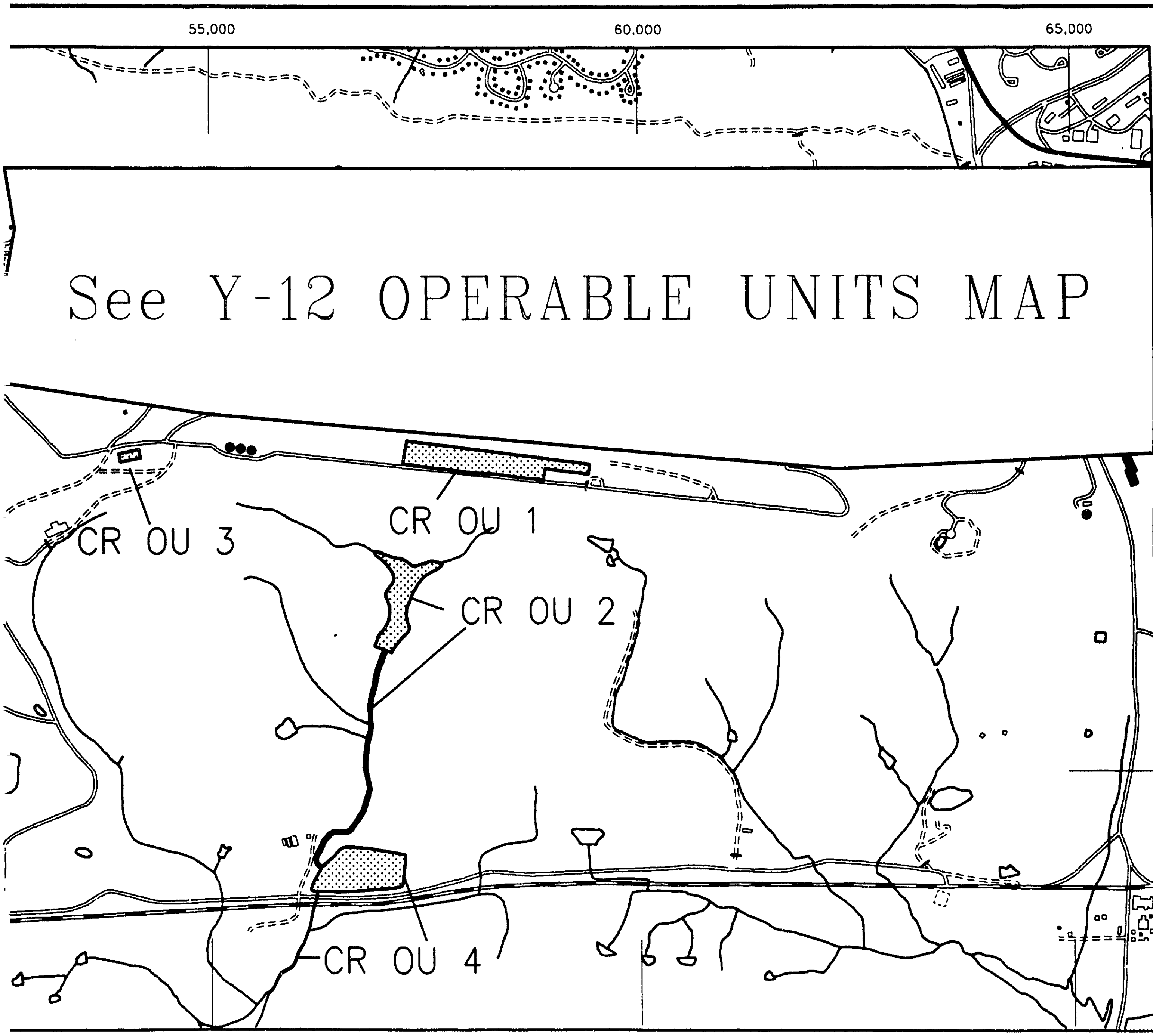

ʼreek & Chesnut Ridge
)PERABLE UNITS

Oak Ridge Administrative Grid Coordinate System
Source: Operable Units Boundaries Provided by Y-12 Environmental Restoration Division. Base map data provided by TVA.
Prepared by OREIS Environmental Restoration Division Martin Marietta Energy Systems, Inc.
Version 3.0 November 12, 1993

ɪr Creek and Chestnut Ridge
perable units.

Y-12 PLANT OPERABLE UNITS

The Oak Ridge Y-12 Plant was built by the U.S. Army Corps of Engineers in 1943 as part of the Manhattan Project. The original mission of the Y-12 Plant was to separate the fissionable isotope of uranium (^{235}U) by the electromagnetic process. After World War II, the electromagnetic separation process was discontinued in favor of the more economical gaseous diffusion process.

Since the early years of the Y-12 Plant operations, the facility has developed into a highly sophisticated manufacturing and developmental engineering facility. It occupies ~800 acres and is located immediately adjacent to the city of Oak Ridge. The total work force consists of ~8000 persons, including employees of ORNL.

The Oak Ridge Y-12 Plant is located on the DOE ORR immediately adjacent to the city of Oak Ridge, Tennessee.. Until 1993, the primary mission of the Y-12 Plant was the production and fabrication of nuclear weapon components. Activities associated with these functions included the production of lithium compounds, recovery of enriched uranium from scrap material, and fabrication of uranium and other materials into finished parts. Fabrication operations included vacuum casting, arc melting, powder compaction, rolling, forming, heat treating, machining, inspection, and testing.

Currently, personnel are refocusing the technical capabilities and expertise at the Y-12 Plant to serve the DOE and other DOE-approved customers. The Y-12 Plant is a key manufacturing technology center for the development and demonstration of unique materials, components, and services of importance to DOE and the nation. Specific focus areas for the Y-12 Plant in coming years include: (1) weapons dismantlement and storage; (2) enriched uranium material warehousing and management; (3) nuclear weapons process technology and development support; (4) Y-12 Plant management/landlord activities, including renovating stand-by or shut-down facilities by D&D; (6) providing unique capabilities and technologies not found in the private sector on DOE-approved tasks; (7) transferring technology developed at DOE facilities to enhance our industrial competitive edge in world-wide markets; and (8) maintaining and supporting the National Security Program Office for DOE.

An additional responsibility of the Y-12 Plant is to provide support and assistance to other government agencies whenever time or technology considerations warrant interagency agreements with DOE.

A number of areas of concern have been identified at the Y-12 Plant site resulting from past waste management practices. Many of these areas have been grouped into OUs based on priority and common assessment and remediation requirements. Numbers of areas have been grouped into prioritized study areas for additional assessment within the plant boundaries and surrounding environs.

Two OUs have been defined for groundwater and surface water contained within the Bear Creek and Upper East Fork Poplar Creek hydrologic regimes. Groundwater will be investigated separately because of the overlapping nature of source plumes and the observation that most plumes share a common hydrologic unit for off-site transport. Also, many releases to groundwater are historical, and the resulting plumes are no longer likely to be associated with the original source. As the groundwater plumes are defined, they will be associated with sources to the extent practical. Groundwater contamination in the Chestnut Ridge hydrologic regime is associated with each source OU.

Upper East Fork Poplar Creek OU 1

Upper East Fork Poplar Creek OU 1 consists of both surface water and groundwater components of the hydrogeologic system within the Upper East Fork Poplar Creek hydrologic regime. This coupled groundwater and surface water regime is bounded by the crests of Chestnut and Pine ridges and extends east from a topographic high near the west end of the Y-12 Plant to the point where Lake Reality discharges to Lower East Fork Poplar Creek. This OU is concerned with the surface water, including minor amounts of sediment in the Upper East Fork Poplar Creek channel, and groundwater pathways that have the potential to transport contaminants to off-site receptors.

Surface Water and Groundwater. Numerous sources of contamination to both the surface water and groundwater flow systems exist within the plant area. Infiltration from the S-3 Ponds Waste Management Area dominates groundwater contamination in the western portion of the hydrologic regime. In addition to potential surface water and groundwater contamination sources identified in Upper East Fork Poplar Creek OUs 1 and 3, the majority of the potentially contaminated units making up the Y-12 Study Area are within the Upper East Fork Poplar Creek hydrologic regime. Potential surface water contamination associated with the Storm Sewer System and Mercury Use Areas is of primary interest and will be addressed in this OU.

Storm Sewer System. The Storm Sewer System consists of an extensive array of storm drains that gather runoff from the main plant area in catch basins located across the plant. In addition, this drainage system, which was once connected to process equipment, discharged untreated waste streams. No untreated waste streams are currently discharged into the storm sewer system. The storm sewer network contains several miles of drainage pipes and culverts that range up to 108 in. in diameter. Upper East Fork Poplar Creek begins near the middle of the Y-12 Plant and is fed entirely from Storm Sewer System discharges. Surface-water runoff from the Y-12 Plant production areas and groundwater seepage are additional sources of Upper East Fork Poplar Creek flow.

Mercury Use Areas. From 1955 through 1963, a column-exchange process involving large quantities of mercury was employed to separate lithium isotopes. The Mercury Use Areas include buildings and other facilities that have been designated as possible sources of mercury contamination because of known, suspected, or presumed releases. The area of investigation includes drainages associated with the following buildings and adjoining areas: 9201-2, 9201-5, 9204-4, 9202, 9733-1, 9733-2, and mercury flask storage areas and deflasking facilities.

Surface water and groundwater within the Upper East Fork Poplar Creek hydrologic regime will be characterized and treated as an integrator OU distinct from source term OUs contributing contamination. This approach is warranted because (1) efforts to establish the horizontal and vertical extent of groundwater contaminant plumes from individual areas indicate that the plumes are significantly intermingled, making assessment and potential remedial actions of individual plumes impractical, and (2) the units share a common exit pathway from the hydrologic system, which is best addressed by a comprehensive approach. Where site-specific groundwater or surface water data are needed to better identify the source or to support a screening-level risk assessment, groundwater or surface water assessment activities (e.g., piezometers or well points) may be conducted during the RI/FS process for the source-control OUs.

Upper East Fork Poplar Creek OU 2

Upper East Fork Poplar Creek OU 2 is the Abandoned Nitric Acid Pipeline, which was used between 1951 and 1983 to transport a waste stream made up of nitric acid and depleted uranium from Building 9215 to the S-3 Ponds for disposal. The S-3 Ponds consisted of four unlined surface impoundments that underwent RCRA closure in 1988. The pipeline was constructed of 1.5- to 3.0-in.-diam stainless steel pipe and was buried at an average of 5 ft below the ground surface. Numerous leaks have been determined, with the earliest in 1951 at a weld about 350 ft east of the discharge point.

The primary exposure pathways evaluated with the Nitric Acid Pipeline were related to potential soil contamination resulting from adsorption from leaked solutions, groundwater contamination resulting from waste solutions infiltrating to the groundwater table, and surface water contamination resulting from groundwater seeps. Nitrate and uranium were the primary contaminants of concern. However, biased soil sampling data collected in early spring 1993 do not indicate detectable concentrations of these contaminants, and this OU will be proposed as a no further action ROD. A comprehensive evaluation of the extent of groundwater and surface water contamination within the watershed will be conducted as part of Upper East Fork Poplar Creek OU 1.

Upper East Fork Poplar Creek OU 3

Upper East Fork Poplar Creek OU 3 is a source term OU composed of seven areas in the western portion of the Y-12 Plant. For the most part, the Upper East Fork Poplar Creek OU 3 areas served unrelated purposes and are geographically removed from one another. The seven areas include Building 81-10, S-2 Site, Salvage Yard Oil Storage Tanks, Salvage Yard Oil/Solvent Drum Storage Area, Tank Site 2063-U, Salvage Yard Drum Deheader, and the Salvage Yard Scrap Metal Storage Area. Three other areas (Waste Coolant Processing Facility, Machine Coolant Storage Tanks, and the Coal Pile Trench) were originally placed in the Upper East Fork Poplar Creek OU 3 but have been transferred from the OU to the Upper East Fork Poplar Creek study areas. The Coal Pile Trench was removed from the OU because it is located beneath an active Coal Pile; the other areas were removed because they are currently active facilities.

S-2 Site. The S-2 Site is in the southwestern portion of the main Y-12 Plant area, south of Building 9720-32 and on the southern side of Third Street at the base of Chestnut Ridge. The unit was an unlined earthen reservoir that was operated from approximately 1943 to 1951 to dispose of corrosive and toxic liquid wastes generated by the Y-12 Plant. The unit originally consisted of a 45- by 128-ft reservoir that was ~ 20 ft deep. The reservoir was back-filled, leveled, and stabilized when disposal operations ended during the 1950s. Heavy metals (including mercury in soil), volatile organic compounds, and radioactive chemicals are contaminants of concern.

Building 81-10. The Building 81-10 site is within the Y-12 Plant at the northwest corner of the intersection of "G" Road and Third Street, south of Upper East Fork Poplar

Creek. Included as part of the site are two sumps. One sump (Building 9822) is on the east side of "G" Road, and the other sump is 25 ft east of the northeast corner of Building 81-10. Building 81-10 was built in 1943 as a tin shop. In 1957, Building 81-10 was converted for mercury recovery operations by physical separation or distillation by furnace. The furnace was in operation for approximately 5 years, closing in 1962. Mercury releases associated with handling during physical separation and from furnace operations have been documented. In 1984, the site was used as a storage area to stockpile mercury-contaminated soil. Use of the site to stockpile soil was discontinued and the soil was removed; however, the date of soil removal is unknown. Initial assessments of the site indicate mercury contamination of soil surrounding the building and storage pad.

Salvage Yard Area. The Salvage Yard Area is in the northwestern area of the plant, south of Bear Creek Road and North of Second Street. The Salvage Yard Area is about 11 acres and contains five separate OU 3 areas. The following areas are contained within the Salvage Yard Area.

- Salvage Yard Oil Storage Tanks
- Salvage Yard Oil/Solvent Drum Storage Area
- Salvage Yard Drum Deheader
- Salvage Yard Scrap Metal Storage Area
- Tank 2063-U Site

Salvage Yard Oil Storage Tanks. The Salvage Yard Oil Storage Tanks consist of two tanks surrounded by a rip-rap earthen dike in the northwest corner of the Salvage Yard Area. Waste oils stored in the Salvage Yard Oil Storage Tanks were generated by various operations within the Y-12 Plant. The southern tank with a capacity of 6000 gals was put into service in 1978 and stored automotive crankcase oils, vacuum pump oils, hydraulic systems, and machining oils. The northern tank with a capacity of 5000 gal was put into service in 1980 and contained mineral oils generated from transformer oil changeout. In 1986 use of the tanks were discontinued, and their contents were emptied. The tanks are still at the site and contain bottom sludges contaminated with PCBs and chlorinated solvents.

Salvage Yard Oil/Solvent Drum Storage Area. The Salvage Yard Oil/Solvent Drum Storage Area is in the northwest portion of the Salvage Yard and operated from 1976 to 1989. It has since been closed under RCRA. Originally, the drum storage area consisted of 2 compacted gravel areas on top of soil. Each area had a dike constructed of clay and gravel on the downgraident side. The combined storage are had a capacity of up to 175,000 gal of drummed waste oils and solvents. These drums rested on pallets and contained waste oils contaminated with chlorinate organics, uranium, and/or beryllium; chlorinated organic solvents; and nonchlorinated flammable solvents. In 1986 the western dike portion was closed and approved by the Tennessee Department of Health and Environment (now TDEC). No soil removal was required to satisfy closure criteria. Closure of the eastern portion began in 1988, when soil was removed to a depth of 1 to 2 ft and replaced with clean clay backfill and covered with a polyethylene membrane. The closure was approved by Tennessee Department of Health and Environment after soil and groundwater analysis data showed arsenic below ORR background levels and PCBs below the health based criteria values. The are is included in OU 3 until completeness of closure can be determined and, if appropriate, no further action can be pursued.

Salvage Yard Drum Deheader and Tank 2063-U Site. The Salvage Yard Drum Deheader is in the northwest portion of the Salvage Yard and operated from 1959 until 1989. It was used to cut the tops off empty drums that had contained oils and solvents. Operations of the drum deheader ceased in March 1989, and all drums have since been removed. The drum deheader and crusher were removed from the site in 1991. Residual materials present in the drums at the time of crushing was transferred to the Tank 2063-U site. This site was used to store the liquid waste until it could be removed and treated elsewhere at the Y-12 Plant. Tank 2063-U consisted of 3 concrete and cinder block tanks and were separated by a rubber baffle for water separation. In March 1989, the tanks failed a hydrostatic hold test and were excavated under federal underground storage tank regulations in July 1989. The excavated soil was returned to the pit after a plastic geomembrane liner was installed. Possible contaminants at the drum deheader include volatiles, PCBs, and heavy metals.

Salvage Yard Scrap Metal Storage Area. The Salvage Yard Scrap Metal Storage Area has been operating in the northwestern portion of the Y-12 Plant since 1950, when it was used solely for storage of uranium-contaminated and noncontaminated scrap metal. Visual evidence of surface soil contamination has been observed on aerial photographs taken over the past few years. Soil Contamination resulting from uranium-contaminated salvage materials is of primary concern at this site.

Bear Creek OU 1

Bear Creek OU 1 comprises the following units: S-3 Ponds, Oil Landfarm Waste Management Area, and Burial Grounds Waste Management Area. The Oil Landfarm Waste Management Area consists of the Oil Landfarm Hazardous Waste Disposal Unit, Sanitary Landfill I, the Boneyard/Burnyard, and the Chemical Storage Area. The Burial Grounds Waste Management Area consists of Burial Grounds A, B, C, D, E, and J and Oil Retention Ponds 1 and 2. These units were used until the 1980s as the primary area for the disposal of various types of hazardous and nonhazardous wastes generated at the Y-12 Plant.

S-3 Ponds. The S-3 Ponds are part of the S-3 Waste Management Area. They were constructed in 1951 and consisted of four unlined surface impoundments covering an area of roughly 400 ft on each side with a total storage capacity of about 10 million gal. During its operation, up to 5500 gal/d of effluent was pumped to the pond. Primary contaminants were nitrates and uranium, with lesser concentrations of heavy metals and organic solvents. In 1988, the S-3 Ponds were closed as a RCRA Landfill. An asphalt parking lot was constructed over the cap to compete site closure.

Oil Landfarm Hazardous Waste Disposal Unit. The Oil Landfarm Hazardous Waste Disposal Unit was used for the land application of waste oils and coolants that contained beryllium compounds, depleted uranium, PCBs, and chlorinated organic compounds. Disposal operations were discontinued in 1982. In 1990, the site was closed as a landfill with a multilayered engineered cap.

Sanitary Landfill I. Sanitary Landfill I received various types of nonhazardous waste from the Y-12 Plant. Waste disposal at Sanitary Landfill I was terminated in 1982, and the site was graded, capped, and closed in 1983 in accordance with TDEC regulations for sanitary landfills.

Boneyard/Burnyard. The Boneyard/Burnyard consists of ~8 acres used from 1943 to 1970 as a disposal site for waste from the Y-12 Plant. Burning and disposal of debris and sanitary, metallic, chemical, and radioactive wastes are known to have occurred. The site has been abandoned and is predominately covered with grassy vegetation.

Chemical Storage Area. The Chemical Storage Area overlays the southeastern portion of the Burnyard/Boneyard. The Chemical Storage Area was ~2 acres in size and was used to burn or neutralize liquid and gaseous wastes from 1975 until 1981. The Chemical Storage Area is presently covered with a RCRA-type cap.

Burial Grounds. Burial Grounds A, B, C, D, E, and J, located on the southern slope of Pine Ridge ~2 miles west of the Y-12 Plant covers an area of about 5000 by 3000 ft. Each disposal unit consists of a series of trenches excavated to depths of 14 to 25 ft below grade. The trenches received a variety of hazardous and nonhazardous solid and liquid wastes. All hazardous waste disposal operations were discontinued in 1981. All trenches known to have received RCRA hazardous material have been capped as part of a RCRA closure.

Oil Retention Ponds. Oil Retention Ponds 1 and 2 were constructed to intercept seepage from burial trenches. Both ponds were RCRA-closed in 1990. A wide range of contaminants may have been disposed of in the Bear Creek Burial Grounds. Volatile organic compounds in soil resulting from groundwater transport are of primary concern.

The nature and extent of soil contamination within each of the listed units in Bear Creek OU 1 and the nature and extent of sediment and surface water contamination within each associated tributary to Bear Creek will be determined during the CERCLA investigation.

Bear Creek OU 2

Bear Creek OU 2 consists of the Rust Spoil Area, Spoil Area 1, and the SY-200 Yard.

Rust Spoil Area. The Rust Spoil Area is located in Bear Creek Valley less than 0.5 mile west of the Y-12 Plant on Old Bear Creek Road. The Rust Spoil Area was used from 1975 to 1983 for disposal of spoil material generated during various renovation, maintenance, and construction operations at the Y-12 Plant. Disposed material was periodically graded, resulting in changes in topography and in filling of part of the Bear Creek channel. Approximately 100,000 yd^3 of nonuranium-contaminated construction spoils were disposed of at the site. Small quantities of solvent-contaminated material and material containing asbestos, mercury, and uranium may have been disposed of in this area. Soil contamination is of primary concern.

Spoil Area 1. Spoil Area 1 is located near the southwest end of the Y-12 Plant, bounded by Old Bear Creek Road and West Patrol Road. Spoil Area 1 was used for the disposal of ~100,000 yd^3 of nonhazardous, nonradiologically contaminated construction debris.

Although plant controls eliminated the disposal of hazardous and radioactive wastes, past plant practices indicate that some of the construction material may have been contaminated with trace amounts of asbestos, mercury, beryllium, thorium, and uranium.

SY-200 Yard. The SY-200 Yard is a 200- by 300-ft aboveground storage area located adjacent to Old Bear Creek Road. Materials from several Y-12 and ORNL divisions included PCB transformers, lead shielding plates, and radioactively contaminated materials. Soil contamination is of primary concern.

Bear Creek OU 4

The hydrologic system at the Y-12 Plant has been subdivided into distinct hydrologic regimes based on floodplain sediments, topography, surface-water drainage, and groundwater flow. Bear Creek OU 4 addresses contamination within the coupled groundwater/surface water system and downstream transport of Bear Creek channel deposits. Bear Creek has received contaminated surface water and groundwater discharges from past waste management practices in the Bear Creek and S-3 Waste Management Areas. Since these operations ceased in the mid 1980s and many of the disposal units closed, contamination of Bear Creek has been drastically reduced. Principal contaminants remaining in floodplain soils and sediments are PCBs, uranium, and cadmium. The area of interest within Bear Creek Valley extends west from a topographic high near the west end of the Y-12 Plant (S-3 Waste Management Area) to the point where Bear Creek exits the valley near State Highway 95. Potential sources of groundwater, surface water, and sediment contamination are being addressed in Bear Creek OUs 1 and 2.

Groundwater and surface water within the Bear Creek hydrologic regime will be characterized and remediated as an integrator OU distinct from the contaminated units. This approach is warranted because (1) efforts to establish the horizontal and vertical extent of groundwater contaminant plumes from individual areas indicate that the plumes are significantly intermingled, making assessment and remediation of individual plumes impractical, and (2) the areas share a common exit pathway from the hydrologic system which is best addressed by a comprehensive approach. Where site-specific groundwater or surface water data are needed to better identify the source or to support a screening-level risk assessment, groundwater or surface water assessment activities (e.g., piezometers or well points) may be conducted during the RI/FS process for the source-control OUs. The primary groundwater contaminants in the Bear Creek hydrologic regime are nitrates, volatile organic compounds, radionuclides, and to a lesser extent, trace metals. Dense, nonaqueous-phase liquids have been discovered at a depth of 270 ft below the Bear Creek Burial Grounds. The dense, nonaqueous-phase liquids consist primarily of perchloroethylene, trichloroethylene, 1,1,1-trichloracetic acid, and high concentrations of PCBs.

Chestnut Ridge OU 1

Chestnut Ridge OU 1 is the Chestnut Ridge Security Pits Hazardous Waste Disposal Unit located on the crest of Chestnut Ridge, southeast of the central portion of the Y-12 Plant. Operated since 1973, the unit consists of a series of trenches that were used for the disposal of classified hazardous and nonhazardous wastes until December 1984 and November 1988, respectively. Ten major categories of unclassified wastes have been identified: acids, fiberglass, beryllium, biological material, debris, heavy metals, inorganics, organics, thorium, and uranium. Other classified waste forms are present. The unit was closed in 1988 in accordance with a TDEC-approved closure plan consisting of a low-permeability, low-maintenance cover over the trenches. Groundwater impacts from the disposal operations are the primary focus of this OU.

Chestnut Ridge OU 2

Chestnut Ridge OU 2 consists of the Filled Coal Ash Pond and Upper McCoy Branch. The Filled Coal Ash Pond is situated within the McCoy Branch watershed about 0.5 miles south of the Y-12 Plant. The pond was constructed in 1955 to serve as a settling basin for coal ash from the Y-12 steam plant. By 1967, the pond filled, spilling sediments directly into McCoy Branch. From 1967 to 1989, ash was carried within McCoy Branch to Rogers Quarry, about 0.5 mile downstream of the Coal Ash Pond.

Impacts to surface water, stream sediments, and groundwater from metals, including uranium and major ions, are of concern. Biomonitoring of aquatic organisms in McCoy Branch and Roger's Quarry has shown a biological impact potentially from the ash pond operations.

Chestnut Ridge OU 3

Chestnut Ridge OU 3 is the United Nuclear Corporation Disposal Site located near the crest of Chestnut Ridge, in the southern portion of the Y-12 Plant. Between June 1982 and November 1984, the United Nuclear Corporation Disposal Site received 11,000 55-gal drums of sludge fixed in cement, 18,000 drums of contaminated soil, and 288 wooden boxes of contaminated building and demolition materials. The disposal site consists of a 1.3-acre excavation cut into the side of Chestnut Ridge and ranges in depth from 5 to 30 ft. The drums are stacked no greater than ten high following the contour of the excavation. Both the drums and wooden boxes are covered in polyvinyl chloride sheeting. Many of the drums and boxes have deteriorated, exposing their contents to the environment.

Groundwater transport modeling and risk assessment have indicated that nitrates and ^{90}Sr leached from the United Nuclear Corporation Disposal Site present a long-term risk to exposure from groundwater. A feasibility study has been completed and identified a multilayer/multimedia, modified RCRA cap for long-term minimization of infiltration. This alternative was documented in the ROD and signed by the Parties. Prior to cap construction, contaminated soils from the off-site Elza Gate site cleanup were placed as fill into the United Nuclear Corporation disposal site. This construction is now complete.

Chestnut Ridge OU 4

Chestnut Ridge OU 4 consists of Rogers Quarry and Lower McCoy Branch. Rogers Quarry is situated within the McCoy Branch watershed about 1 mile south of the Y-12 Plant. The quarry, which is ~1150 × 250 × 275 ft, was the source of construction materials in the 1940s and 1950s. The quarry filled with water and was abandoned with quarrying equipment in place in the early 1960s. Disposal of fly ash and bottom ash from the Y-12 steam plant into the quarry began in the 1960s, and bottom ash continues to be disposed of in the quarry via a sluice pipe across Chestnut Ridge. The quarry was also used for disposal of other plant process materials.

Lower McCoy Branch begins at the surface water discharge point of Rogers Quarry and ends at the McCoy Branch Embayment in the Clinch River/Melton Hill Lake.

Impacts to surface water, stream sediments, and groundwater from metals, including uranium and major ions, are of concern. Biomonitoring of aquatic organisms in Rogers Quarry has shown a biological impact potentially from ash disposal operations.

No Further Investigation Determination

No Further Investigation Determination

The U.S. Department of Energy, the U.S. Environmental Protection Agency-Region IV, and the state of Tennessee have completed a review of the referenced information for ___ ________________________________, as it pertains to the Oak Ridge Reservation Federal Facility Agreement. Based on this review, the Parties have determined that no further investigation or study is justified. This decision is subject to review at the time of issuance of the Record of Decision.

Brief summary of the basis for no further investigation:

References:

____ ________________

FFA Project Manager — Date
Environmental Restoration Division
DOE Oak Ridge Operations Office

____ ________________

FFA Project Manager — Date
DOE Oversight Division
Tennessee Department of Environment and Conservation

____ ________________

FFA Project Manager — Date
Federal Facility Branch
U. S. Environmental Protection Agency

Data Quality Objectives

DATA QUALITY OBJECTIVES

The DQOs are both the qualitative and quantitative statements that specify the uncertainty that the data users are willing to accept in making a decision. The DQOs are derived from a logical planning process based on the Scientific Method, Total Quality Management, decision analysis, experimental design, and operations research. The DQO process is iterative, allowing input and change as data are gathered. The EPA Quality Assurance management staff developed the process.

The DQO process brings together the data users and the data suppliers, allowing them to focus on the problems, solutions, associated decisions, and acceptable levels of decisional errors that are the basis for establishing the quantity and quality of data needed. Data users include but are not limited to the regulators, DOE, Energy Systems line managers, and project managers. Data suppliers include those generating data and geologists, sample collection staff, chemists, statisticians, risk assessors, data reviewers, and others.

The benefits of using the DQO process include the following:

- clarification of objectives and limiting the number of decisions;
- efficient use of resources, potentially saving time and money;
- effective method of communication between data suppliers and data users; and
- efficient use of data across multiple environmental programs.

The DQO process is completed prior to the collection of data. If multiple data collection phases are planned, DQOs should be developed for each phase. The result of the DQO process is the development of an optimal sampling and analysis design for each data collection effort.

DQO Process Steps

The DQO process is used to plan the data collection effort. Following data collection, data evaluation is performed. The decision rule and the limits of error provide evaluation criteria that allow development of a plan for evaluation of the data.

Each step in the process is briefly discussed in the following subsections. The relationship between risk assessment and land use in the DQO process is also discussed within steps three and four in which the information is needed for planning.

State and prioritize the problem(s)

During this step all previous information is assembled, the team of data users and data suppliers is identified, and the team begins to identify the various concerns of each member. These concerns are then prioritized. If data that can be used across multiple environmental programs can be generated, team members from each program should be included with their respective concerns. For example, when groundwater data will be used for RCRA permit monitoring and CERCLA/Superfund Amendments and Reauthorization Act remediation efforts. This step produces a final list of problems that need to be addressed. One example is a site that has previous process data indicating multiple contaminants. The risk assessment staff selects the most toxic contaminants, and the focus of the study is narrowed to one class of contaminant such as PCBs.

Identify the possible solution(s)

There must be at lease one solution for each problem, and decisions have to be made to resolve the problems. Therefore, potential solutions are prioritized to address the problems. An example of a potential solution for the above scenario is to determine which if any surface soils are contaminated with PCBs at concentrations that pose an unacceptable risk to the environment and the human population.

Identify necessary information

Data are needed to provide solutions. All the data requirements are listed. In addition to technical data, resource information, such as budget and time constraints, must be provided. It is counterproductive to establish DQOs that cannot meet the required resource constraints. The following are some examples of technical data requirements:

- What are the regulatory action limits associated with the problem?
- What are the hydrogeological considerations?
- What are the ecological populations at risk?
- What exposure time and concentration levels are potentially hazardous to human health?
- What concentrations can analytical methods measure?

Each piece of data must be associated with a data generation activity and a data use. If no use is identified for the data, then it is not important in the decision process and the information should not be collected. It is critical that the data requirements be consistent with criteria against which they will be compared. Data collected at the parts per million level will not be useful if they are compared to criteria at the parts per billion level.

Define the boundaries

This step of the DQO process determines the boundaries of the media of concern, problem over time, spatial area, and population. Media or matrix refers to soil, water, air, biota, and waste. Examples of changes in the problem over time include but are not limited to movement of a plume, seasonal changes in water level, and removal of source contamination.

The spatial boundaries for each media to be sampled should be defined. Example boundary considerations include but are not limited to potential remediation areas, whether hot spots should be considered, geological differences, numbers of containers of waste or source material, regulatory boundaries, ORR boundaries, horizontal and vertical extent of contamination, and future land uses.

The receptor populations that may be effected by each media should be defined. All affected populations should be identified along with the path of their anticipated exposure.

Specify limits on decisional errors

Each decision carries with it error derived from the sum of sample-collection error; measurement error; and, if applicable, risk-assessment error. Taken together, these errors comprise the total study error. The purpose of this step is to define the acceptable decision-error rates based on a consideration of the consequences of making an incorrect decision.

One method used to assess the consequences of error is to establish a hypothesis and accept or reject the hypothesis. In most environmental analyses, the hypothesis is established so that a false positive error concludes that an analyte is present when it actually is not present. The result, typically, is that action such as remediation is taken when it is unnecessary. Conversely, a false negative error concludes that an analyte is not present when it actually is present. The result is that no action is taken when it is necessary.

The consequences of false positives and negatives are evaluated by the data users and data suppliers as a team. Statisticians become involved at this point to assist in the evaluation of the false positives and negatives.

The team should establish a theoretical concentration range over which data may appear for the most critical analytes. The range should include any regulatory action levels and levels based on risk assessment. The consequences of false positives and negatives are evaluated across the concentrations of interest. The data users and data suppliers agree on the concentrations and the associated level of false positives and negatives which are acceptable.

If no previous data are available for the site, reasonable assumptions should be made and theoretical concentrations and levels of false positives and negatives established. This will allow the data suppliers to propose several sampling and analysis designs that will meet the false positive and false negative levels and achieve measurements at proposed concentrations.

If previous data are available, the concentration levels and false positive and negative error rates can be estimated based on the previous data. If risk ranges are available, the risk range, concentration, and acceptable chance of deciding that the parameter exceeds the action level are stated.

Develop the decision rule

To arrive at a decision, the data users and data suppliers must combine the problems, solutions, necessary information, and boundaries in a logical statement that describes the basis for choosing an action. The decision rule states which environmental data will be summarized and used in making the decision. There will be a separate decision rule for each decision. A decision rule usually contains the following elements: measurement of interest, sample statistic, and an action level. The measurement of interest is the parameter, analyte, or variable to be measured. It may be the concentration of a contaminant or volume of waste or the physical properties. Sample statistic is the quantity computed from the sample data. It could be the arithmetic mean, the highest concentration in a given area, the median concentration, or some other statistical measurement.

The action level is the concentration against which the sample statistic will be compared. The concentration may be a regulatory threshold or action level based on risk assessment or a level based on the acceptable error.

Optimize the sampling and analysis design

The data suppliers will use the decision rule(s), the limits of error, necessary information requirements, and boundaries to generate one or more preliminary sampling and analysis strategies. The cost and resources for each preliminary strategy should be included. The data suppliers should present this information to the data users along with the cost versus benefits of each sampling and analysis strategy. The data user or decision makers should choose the most resource-effective sampling and analysis strategy.

Once a final design strategy is chosen by the data users, all applicable documentation is generated. This documentation may include work plans, sampling and analysis plans, and quality assurance plans. The result of the steps of the DQO process should be described with reasons given for adopting the particular sampling and analysis design strategy. At a minimum, documentation must include where samples are to be taken, actual or references to sampling and analysis procedures, decontamination procedures, the accuracy and precision of each measurement method or a plan for determining this information, the field and laboratory quality control samples and how they will be used, data validation and assessment procedures, and data management procedures.

DQO Iteration

Although each step is well defined in the written process, changes in information and additional data may require alteration of the DQOs. This is especially true in a phased data collection effort for which changes in DQOs may need to be made quickly. An example of the need for rapid changes in DQOs is when remediation is being done while rapid analysis measurements are being made. This allows removal of only soil measuring above a specified concentration. If much higher concentrations were measured, the assumptions used for the limits of error may change, resulting in the need to alter the DQOs. The alteration in the DQO would need to made quickly so that valuable soil-removal-equipment time was not wasted.

To go through iterations, the team decides which assumptions are altered by the new information. The team goes back to the appropriate step in the process and advances through the process considering the new information. Several iterations may be done in the process and may occur at any step in the process. It is important that data users and data suppliers be kept informed of the need to change the plan or actual changes made during data collection.

Summary

The DQO process allows all data users and suppliers to communicate effectively and efficiently. The process allows the most resource-effective strategy to be developed in a timely manner and ensures that all phases of data generation are well planned prior to implementation. It also allows all programs to have input in the data generation to allow effective use of data across environmental program boundaries. The process is iterative and allows changes in strategy based on the incoming data and information.