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OAK RIDGE NATIONAL LABORATORY

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Oak Ridge Reservation Site Evaluation Report for the Advanced Neutron Source

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Science Applications Intn'l. Corp.

Advanced Neutron Source

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

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OAK RIDGE RESERVATION SITE-EVALUATION REPORT

for the

ADVANCED NEUTRON SOURCE

Brent Sigmon, Anthony C. Heitzman, Jr., and Janice Morrissey

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. OVERVIEW AND SUMMARY

The Advanced Neutron Source (ANS) is a research reactor that the U.S. Department of Energy (DOE) plans to build for initial service late in this century. The primary purpose of the ANS is to provide a useable neutron flux for scattering experiments 5 to 10 times as high as that generated by any existing research reactor; secondary purposes include production of a variety of transuranic and other isotopes and irradiation of materials.

The ANS is proposed to be located on the DOE Oak Ridge Reservation (ORR) at Oak Ridge, Tennessee, and operated by the Oak Ridge National Laboratory (ORNL). This report documents the evaluation of alternative sites on the ORR and the selection of a site for the ANS.

Section 2 briefly describes the ANS and the ORR. The ANS will have a thermal output of approximately 350 Mw, three times the power of the High Flux Isotope Reactor (HFIR). The reactor will be cooled, moderated, and reflected by heavy water and enclosed by a full double-containment structure. Experiment areas in the reactor containment building and in an adjacent guide hall will include several dozen instruments for basic physics research, and it is anticipated that as many as 1000 visiting scientists per year will perform experiments at the ANS.

The 14,000-ha ORR contains three major DOE facilities: ORNL, a multipurpose research and development (R&D) laboratory; the Oak Ridge Gaseous Diffusion Plant (ORGDP), a former uranium enrichment plant now housing a variety of research and support services; and the Oak Ridge Y-12 Plant, a manufacturer of nuclear weapons components. Among the facilities operated by ORNL are a number of small research reactors, some of which are shut down, awaiting decontamination and decommissioning.

The three main DOE plants are intensively developed islands in a largely undeveloped reservation, although some undeveloped areas have been used extensively for environmental research and/or waste management. The ORR offers a variety of sites where the ANS can be isolated from large populations while being in close proximity to the scientific infrastructure needed by a major research facility.

Section 3 reviews siting regulations and other literature on siting considerations, methods, and criteria. The ANS is to be "licensable," although licensing by the Nuclear Regulatory Commission (NRC) is not required for DOE reactors. DOE Order 5480.6, "Safety of Department of Energy-Owned Nuclear Reactors," incorporates the NRC siting regulations of 10 CFR 100 as well as other NRC regulations and guidance.

Review of the applicable regulations and guidelines for site selection and of siting evaluations for commercial power plants and other nuclear facilities reveals a large number of potentially important considerations and criteria. Yet, site selection is fundamentally a subjective task. No objectively defined optimum site exists, and many sites can satisfy the regulations. The task of site selection is to eliminate less-suitable sites and focus on one site for the detailed analyses necessary to support licensing (or licensability).

The method used in this evaluation was a three-stage procedure in which each stage eliminated much of the remaining study area so that a few most likely alternatives could be examined in greater detail in the subsequent stage. Each stage reduced the area under consideration by approximately an order of magnitude.

Section 4 lists and describes the criteria specified by project staff for ANS site selection. These criteria fall under four main goals: safety, environmental protection, cost minimization, and operational compatibility. The criteria are organized into a three-level hierarchy in which the main goals are the first level, general criteria are the second level, and specific criteria are the third level. The second-level criteria are expressed as preferences (e.g., lower foundation, grading, and drainage costs are preferred). The specific criteria are expressed as absolutes (e.g., slopes >25% will be avoided). The specific criteria are not absolutes in any physical or regulatory sense but are a convenient way of eliminating areas of the ORR that would present unnecessary engineering, environmental, or regulatory challenges. In the three-stage procedure used for this study, the specific criteria are used in Stage 1 to screen out large areas of the ORR. For Stages 2 and 3, the more general criteria were used to make a comparative analysis of three or four alternatives.

Sections 5, 6, and 7 report on Stages 1, 2, and 3 of the procedure, respectively. For Stage 1, the specific criteria were mapped and overlaid to reveal candidate areas of the ORR, areas that satisfied all criteria. Four candidate areas were identified: Melton Valley, West Bear Creek Valley [west of State Road (SR) 95], Central Bear Creek Valley (east of SR 95 and west of the county line), and Interchange (east of the highway interchange where SR 95 intersects SR 58).

In Stage 2, reported in Sect. 6, a criterion-by-criterion comparative analysis of the four candidate areas formed the basis for selecting a preferred area. The Melton Valley area is the preferred choice because of its proximity to ORNL and utility services and the fact that it is less likely to contain habitats of protected species.

In Stage 3, three candidate sites in the Melton Valley area were identified and subjected to the same kind of comparative analysis employed for the candidate areas. The three sites are the Reference site just west of the HFIR, a site assumed for ANS reference and planning purposes over the past several years; the Central site, northeast of the HFIR; and the Eastern site, along the access road to the Health Physics Research Reactor. As reported in Sect. 7, the Eastern site is farther from utilities and the existing isotope processing facilities but has significantly less risk of foundation problems and complications from existing waste management problems and a setting that is more accessible, more attractive, and more appropriate for a major research facility to be used by thousands of visiting researchers. The Eastern site is the preferred location for the ANS.

2. BACKGROUND

The ANS is to be a new DOE research reactor serving three principal purposes: (1) to create an unprecedented capability for a wide variety of neutron beam experiments, (2) to produce quantities of transuranium isotopes, and (3) to irradiate materials samples. The ANS will be a user facility; scientists from universities, industries, and other federal laboratories will have access to the most intense beams of steady-state neutrons in the world, with available fluxes 10 to 20 times those produced by current U.S. experimental reactors. The ANS will also permit faster simulation of long-term irradiation effects on the properties of engineering materials and nuclear fuels.

The ANS design philosophy is that the facility will be licensable under NRC regulations, although actual licensing is not required or anticipated. DOE Order 5480.6, "Safety of Department of Energy-Owned Nuclear Reactors," which is the order governing the safety of DOE reactors, states that DOE reactors should be

> . . . sited, designed, constructed, modified, operated, maintained, and decommissioned . . . in accordance with uniform standards, guides, and codes which are consistent with those applied to comparable licensed reactors.

The order specifically incorporates 10 CFR 100, "Reactor Site Criteria," as well as other NRC regulations and guidance. These safety requirements, the National Environmental Policy Act (NEPA) requirements for evaluating environmental consequences of a proposed action and its alternatives, and DOE programmatic needs are the principal influences on site selection for the ANS.

The ANS will be built on the DOE ORR, shown in Fig. 2.1. The ORR contains more than 14,000 ha and is largely undeveloped except for three intensively developed plant complexes. It has been the site of nuclear reactors and other nuclear research, support, and waste management facilities for 45 years. In addition, site investigations for the Exxon Nuclear Fuel Recovery and Recycling Center[1] and the Clinch River Breeder Reactor[2,3] (CRBR) show the ORR to contain sites licensable under NRC regulations. (For the purpose of this investigation, the CRBR site will be treated as a part of the ORR, although it is currently owned by the Tennessee Valley Authority.) The ORR is large and diverse enough to provide a variety of potential sites for the ANS while maintaining adequate proximity to ORNL, which will design, build, and operate it.

This section describes (1) the ANS facilities and their general site-related requirements and (2) the ORR, the region from which the ANS site will be selected.

2.1 ANS SUMMARY DESCRIPTION[4]

2.1.1 Site Configuration

The ANS site will require ~10 ha of land to accommodate the facilities and structures. The current design consists of a four-building complex. The central structure is the cylindrical, domed, full-containment reactor building, which houses the reactor itself. Two lower floors will be used for beam and irradiation experiments, and the upper floor high-bay area is dedicated to reactor operations. The dominant interior feature is the

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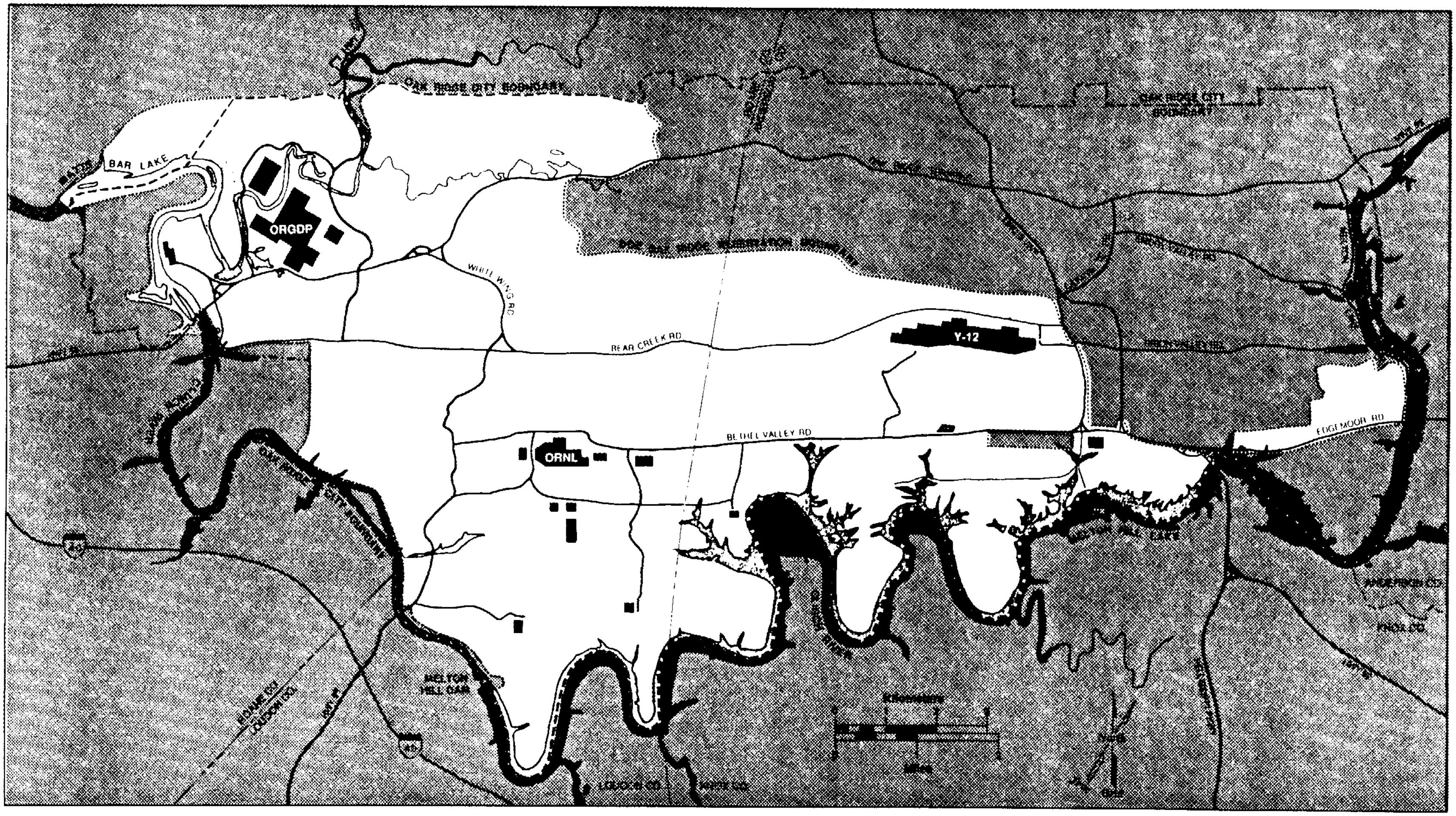


Fig. 2.1. Oak Ridge Reservation.

reactor pool and shield structure. A concrete biological shield surrounds the pool. The pipe and instrument tunnel leading to the reactor support building will also be shielded.

The reactor support building adjacent to this facility includes (1) the large reactor equipment, primary coolant pumps, and heat exchangers; (2) the general support equipment not necessary in the reactor building; (3) the main control room; and (4) a high-bay area and truck locks to facilitate replacement of major components. Locating the reactor equipment here requires that containment extend beyond a solitary facility; however, an advantage lies in the reduction of noise and vibration in the experiment area. This configuration is also more suitable for replacing major equipment. Containment in this building will include the heat-exchanger cells and the pipe tunnel. The control room will not be part of containment but will be hardened for protection.

The guide-hall building is a single-floor structure of standard industrial construction. This facility houses the beam guides and corresponding neutron instruments. The guide hall is not part of containment, but a shield surrounds the beams, limiting the radiation background in the guide hall to acceptable levels.

The office building will provide all the necessary facilities for users and operators. Conference areas, an auditorium, a reception area, offices, food services, and other typical administrative elements will provide adequate services for both permanent staff and guests. The building will not contain any radioactive materials and, thus, will be isolated from reactor containment and ventilation systems.

The four buildings in the reactor complex will be independent but contiguous. A few other necessary structures at the site will be detached. A reactor cooling tower will be provided for rejection of reactor heat to the atmosphere, and an auxiliary cooling tower will serve all other cooling needs for the complex. Stack and filter pits will supplement the reactor containment system as well as other ventilation systems containing radioactive materials. A detritiation plant, whose purpose is to remove tritium and protium contamination from the heavy water, will be adjacent to the central complex.

A perimeter drive will allow access to all facilities on the site. Users and operations personnel will have separate entrances so that security and contamination control are not complicated. Fencing will surround the site, and access to the area will be controlled from a guard house if required.

2.1.2 Reactor Characteristics and Experimental Systems

The ANS will be built around a reactor producing the most intense continuous beams of neutrons in the world, surpassing DOE's HFIR at ORNL and the High Flux Beam Reactor (HFBR) at Brookhaven National Laboratory by a factor of 10 to 20. The goal is to reach a thermal neutron flux in the reflector of 5×10^{19} to 10×10^{19} neutrons per square meter per second. The ANS core, with a thermal output of about 350 Mw, will have a power density about two orders of magnitude greater than the typical commercial power reactor. The core will be cooled, moderated, and reflected by heavy water.

The ANS will operate with a 14-d core life succeeded by approximately 3 d downtime for refueling. During the refueling, production targets and experiments can be replaced and any necessary maintenance and inspection will be performed. Reactor equipment will be replaced as required.

The reactor will be cooled by heavy water circulated through heat exchangers from which heat is transferred to the light-water secondary coolant system. A cooling tower is provided for removal of reactor heat from the secondary coolant system. Other water subsystems in the ANS include reflector heavy-water and component cooling, pressurized heavy water, transplutonium target cooling, the fuel-handling-cell heavy-water pool system, and the reactor and spent fuel light-water pool systems. Water treatment systems will include a detritiation plant to control concentrations of tritium and protium in the heavy water.

Several experimental systems and instruments will be integrated into the design of the ANS. State-of-the-art neutron scattering and physics instruments will be located on the ground floor of the reactor building.

2.1.3 Safety Features

The ANS will have a two-layer containment system surrounding the reactor. The two-layer containment will also extend to the pipe tunnel and heat-exchanger cells in the reactor support building. The primary containment is a steel inner dome in the reactor building and steel walls in the pipe tunnel and heat-exchanger cells. Outside of the steel structures, concrete containment provides a hardened shell against damage from natural phenomena. The annulus between the concrete and steel shells serves as a secondary ventilation zone. The outleakage from the primary ventilation zone (inside the steel shell) will be trapped between the steel and concrete. During normal operations, exhaust from both the primary and secondary ventilation zones is channeled to the filter pits at the stack. In the event of an accident that releases radioactivity into the primary zone, its ventilation would cease and any leakage into the secondary zone would be filtered before release into the atmosphere.

Outside the containment, supplementary ventilation systems prevent the spread of contamination. In the reactor support building, these systems are zoned by keeping potentially higher contamination areas at a pressure lower than areas having less contamination potential. Fresh air will flow progressively into zones of higher contamination potential; exhaust from these zones will be carried to filter pits at the stack.

The guide hall, which will have only small quantities of radioactive materials, will have an independent ventilation system. Exhaust will be monitored for contamination, but routine filtering is not expected from this building. The office building will not contain radioactive materials; therefore, a standard heating and air-conditioning system will be used. Neither the guide hall nor the office building is included in the containment structure.

Plant instrumentation and controls, as well as the reactor control system, are operated from the control room, which is located inside the reactor support building. This high-security area will be a fully hardened structure having access to outdoors for emergency situations. The control room will also have an independent ventilation system, allowing the area to remain habitable in the event of contamination spreading from the reactor containment area. Other major safety features include redundant power sources and a separate shutdown cooling system.

2.1.4 Utilities, Services, and Waste Streams

The ANS will require a number of services from off-site. The primary services are electricity, to be provided by two independent and redundant 13.8 kv feeders, and water. Natural gas may be needed by some of the experimental systems, and steam or an alternate energy supply will be necessary for space-conditioning. Industrial chemicals and gases, diesel fuel for the emergency generators, and other supplies will be delivered by truck.

Waste streams from the ANS will include ordinary sanitary and industrial wastes that normally will be handled using conventional technology and practice. Other wastes are radioactive solids, radioactive liquids, tritium, and spent fuel. The radioactive solids include contaminated trash, spent filters and ion exchange resins, and occasional reactor components and equipment. These will be integrated into the ORNL waste management system and disposed of on the ORR. Radioactive liquid wastes result primarily from process upsets and accidents rather than from routine operation. They, too, will be integrated into the ORNL waste management system, which will have to be modified to accommodate potential tritium contamination. Tritium from the detritiation plant is a separate, routine waste stream that can be designed to produce high-purity tritium for sale. Alternatively, the tritium might be stored in the form of a titanium hydride until it decays to helium (half-life of 12 years). Spent fuel will be stored in the spent fuel pool in the reactor building until shipped to the Savannah River Plant for reprocessing.

Isotope production in the ANS will require a separate facility to prepare fresh targets and separate the resultant isotopes from irradiated targets. The Transuranic Processing Plant (TPP), which performs these functions for HFIR isotope production and is located just to the north of the HFIR in Melton Valley, could play the same role in ANS isotope production.

Currently, material is transferred between the TPP and HFIR by uncertified shipping containers about three times a year and also by a frequently used hydraulic rabbit system that runs underground between the two facilities.[5] The frequency, volume, and mode of material transfers between the ANS and its isotope processing facility have not yet been determined.

2.2 REGION OF INTEREST[6]

The ORR, located between the Cumberland Plateau and the Smoky Mountains of eastern Tennessee, is one of DOE's largest operations complexes. The ORR and surrounding area are shown in Fig. 2.2. The ORR is situated in Oak Ridge, Tennessee, 30 km west of the city of Knoxville, in Roane and Anderson counties. For over 45 years, the ORR has served as a site for reactors and other nuclear activities. Three plant complexes are located on the ORR. The largest, the Y-12 Plant, is a production plant for nuclear weapons components. ORGDP houses a uranium enrichment process, which has been permanently shut down, and various ongoing DOE R&D and support functions. ORNL is an R&D facility specializing in energy, materials, and environmental technology. ORNL operates the HFIR and will operate the ANS.

The ORR land was purchased by the federal government during World War II. The initial purpose for acquiring the 23,000-ha tract was to support the Manhattan Project.

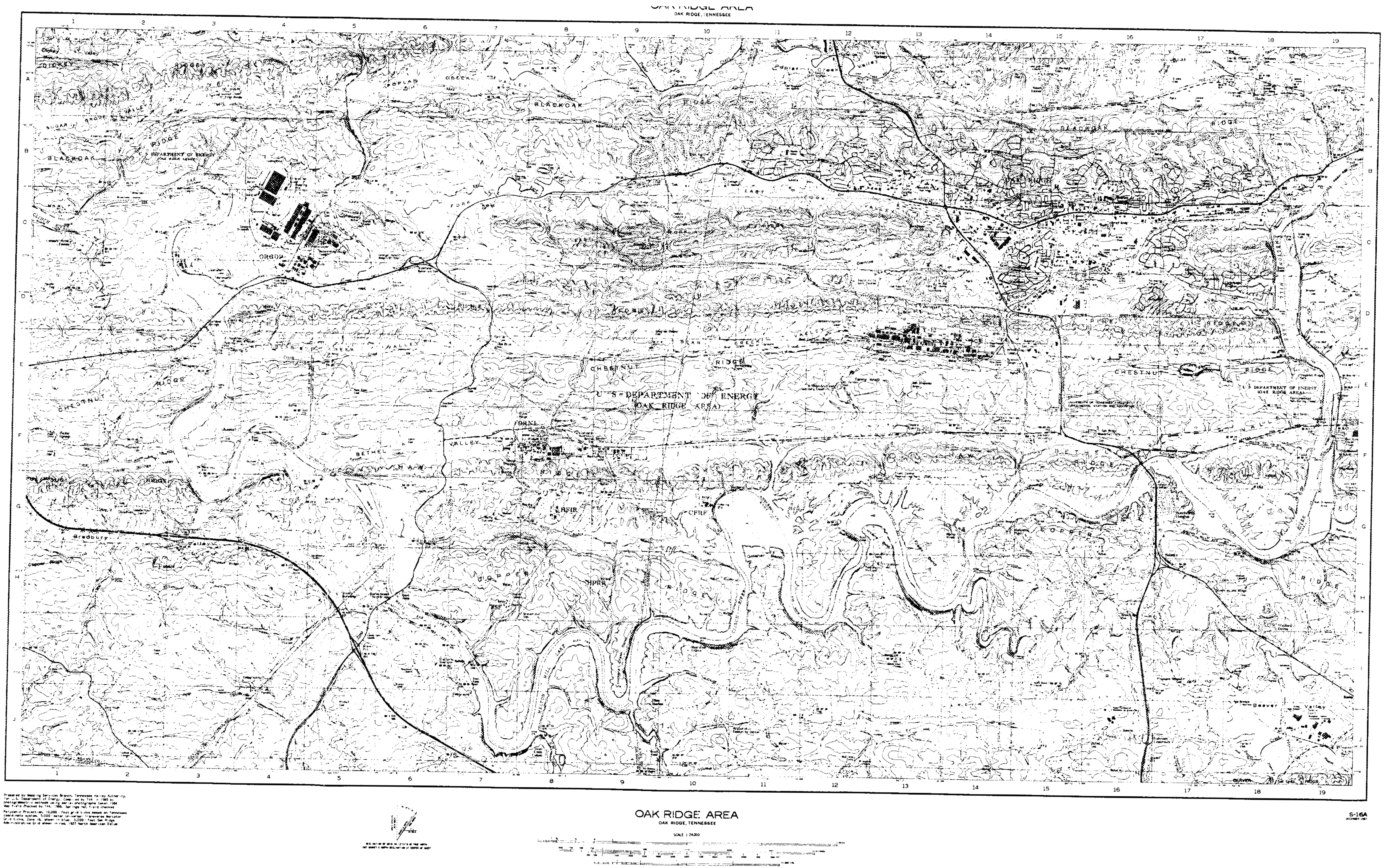


Figure 2.2. Oak Ridge Area Map

The city of Oak Ridge was originally built on the ORR to house the people who constructed and operated the three plant complexes. Subsequent sale of residential and business areas of the city have reduced the ORR to its current size of 14,272 ha, on which about 900 buildings are located at the three plant sites. These facilities have an annual operating budget of over $1.5 billion. The direct employment is in excess of 18,000 people, and the annual payroll is more than $550 million. Other DOE facilities near the ORR include the Office of Scientific and Technical Information, the Oak Ridge Operations Office, and the American Museum of Science and Energy.

The three plant complexes, which occupy less than one-tenth the ORR, are intensively developed "islands" in the largely undeveloped tract. Ecological research, waste facilities, and other isolated activities are dispersed throughout the ORR, but much open space remains in which new DOE programmatic initiatives, support functions, and other activities can be accommodated. Land use on the ORR is guided by an ongoing land-use planning process that includes both DOE and its operating contractor, Martin Marietta Energy Systems, Inc.

The regional economy around the ORR is closely tied to it and to the city of Knoxville. The Knoxville Metropolitan Statistical Area, which includes Anderson County, is a regional center for trade, services, and diverse manufacturing. The University of Tennessee and the Tennessee Valley Authority are also major influences on the regional economy.

2.2.1 Population Considerations

The ORR contains no permanent residents, but more than 17,000 government-contractor employees work on the ORR, and an additional 900 are located in area DOE facilities. The largest employment concentration is found on the east end, where the Y-12 Plant accommodates approximately 9000 employees. ORNL employs around 5500, and ORGDP, located on the west end, about 2550.

Half of the ORR is geographically located in Roane County, the other half in Anderson County. The working populations on the ORR are divided similarly. Table 2.1 is a summary of area county populations and densities. As discussed further in Sect. 4.1.3.5, demographic studies performed for the CRBR[7] and the proposed Hot Experimental Facility[8] showed current and projected population densities well below the guidance found in NRC Regulatory Guide 4.7.[9]

Table 2.1. 1980 population and 1984 estimated population for the Oak Ridge area

Counties	Population		Land area		1980 av pop. density
	1980	1984	km^2	$miles^2$	
Anderson County	67,346	69,200	878	339	199
Knox County (Knoxville)	319,694	329,400	1,310	506	632
Loudon County	28,553	30,300	609	235	122
Morgan County	16,604	17,200	1,354	523	32
Roane County	48,425	49,200	666	257	136

Source: U.S. Department of Energy, *Monitored Retrievable Storage Submission to Congress, Volume II, Environmental Assessment for Monitored Retrievable Storage Facility,* DOE/RW-0035/1, February 1986.

2.2.2 Geology and Seismology

Located in the Tennessee section of the Ridge and Valley province, the ORR is structurally characterized by major subparallel thrust faults. All ridges and valleys tend southwest to northeast, whereas underlying rock units dip to the southeast. Three major thrust faults in the area are the Kingston, White Oak Mountain, and Copper Creek. Although minor seismic activity has been recorded in the region, no evidence of surface rupturing associated with any faults is present within the ORR. Consequently, these faults are not major constraints to future development. As discussed further in Sect. 4.1.1, the seismology of the region is well known and suitable for NRC licensing of reactors.

Four principal rock groups represent the oldest formations on the site. The more-resistant ridge-producing formations are the Rome and the Knox groups. Most of the valleys are underlain by the Conasauga group and the Chickamauga limestone. Existing facilities are primarily found above the Conasauga and Chickamauga groups. The Knox group is subject to high-water solution, and heavy construction on this type must be carefully evaluated. Formations of the Rome group are generally characterized by steep slopes, limiting the feasibility for building sites.

2.2.3 Hydrology

The Clinch River, which borders one side of the ORR, controls the hydraulic system for the area. Numerous small streams are tributary, forming a network with the Clinch River. The water levels on the river, which are regulated by the Tennessee Valley Authority, have an impact on these tributary streams and creeks draining the ORR. The local topography is conducive to quick, concentrated runoffs in the event of a heavy rainfall.

Precipitation is plentiful on the ORR (mean annual rainfall = 1.36 m). Seasonal variations exist, the winter months claiming the peak period. About 55% of the total annual precipitation is lost through evapotranspiration. The highest rate of precipitation loss occurs during the vegetation growing season, July to September. Runoff is highest during the winter, when precipitation is high and temperatures are lower.

Groundwater is generally in an unconfined (water-table) condition on the ORR, but locally perched water exists, and confined conditions are likely. Groundwater storage is reflected by fluctuating water-table elevations. Groundwater recharge is derived primarily from precipitation, and storage levels respond accordingly.

2.2.4 Meteorology

The Oak Ridge area enjoys a mild, humid climate with few extreme conditions in temperature, precipitation, or winds. Spring and fall usually have pleasant, dry, and sunny weather with mild temperatures. The heaviest precipitation periods occur in the winter months and early spring. The summers have peak periods of sunlight duration and intensity when strings of cloudy days are rare. Meteorological hazards from hail, tornados, hurricanes, and strong winds are of low probability in the region; ice storms are a moderate hazard.

The atmospheric-dispersion characteristics of the region are well known. Meteorological data have been collected over various periods from a variety of sites on the

ORR, including the U.S. Weather Bureau's Oak Ridge City Office, the CRBR site, the Exxon site, and a site near ORNL.[2,3] Additionally, the National Oceanic and Atmospheric Administration's Atmospheric Turbulence and Diffusion Laboratories in Oak Ridge have used the ORR as the site of numerous experiments in atmospheric dispersion.[10]

2.2.5 Ecological Systems and Biota

The ORR consists of moderately to heavily forested land on shallow, infertile soil, overlying shale and dolomitic rock formations. About 80% of the ORR is forest that is characteristic of the intermountain regions of central and southern Appalachia. The dominant deciduous forest is an alliance of oak and hickory. Maple, sourwood, dogwood, redbud, hackberry, elder, sycamore, oak, elm, tulip, yellow poplar, and willow are other hardwoods inhabiting the area. Coniferous forests are largely cedar, hemlock, white pine, and shortleaf pine.

Six animal habitats have been identified on the ORR: old fields and grasslands, hardwood/mixed hardwood forests, pine plantations, aquatic and riparian areas, caves, and buildings. The various species of mammals, birds, amphibians, reptiles, invertebrates, and fish within the six habitats are representative of eastern Tennessee wildlife.

The Oak Ridge National Environmental Research Park (NERP) was established in 1980 to provide protected land areas for research and education. NERP programmatic goals fall under two categories, research and preservation. A total of 1442 ha, distributed over 53 locations, are identified as Environmental Sciences Research Sites on the ORR. Aside from these restricted locales, DOE NERP Natural Areas protect rare plant species or species under review and DOE NERP Reference Areas preserve representative or unique plant or animal habitats. These latter two categories restrict an additional 553 ha.

2.2.6 Industrial, Military, and Transportation Facilities

The three DOE plants dominate the industrial activity within 5 miles of the ORR. The primary missions of the Y-12 Plant include the production of nuclear weapons components, fabrication support to weapons design, and support for ORNL facilities at the Y-12 site. ORNL performs large-scale R&D in the areas of hazardous wastes, nonnuclear defense technologies, energy, and many other selected areas. A number of facilities associated with ORNL, including the HFIR, are scattered over Melton Valley and Copper Ridge to the south of the main ORNL complex. Because the uranium enrichment operation at ORGDP is currently shut down, most activity at that site is related to support of other DOE-owned enrichment facilities.

Other, much smaller, industrial facilities are near the ORR: on the west end, within the Clinch River Consolidated Industrial Park and, on the east end, within the Commerce, Union Valley, and Bethel Valley industrial parks. Boeing Tennessee, Inc., has begun construction of a new plant west of ORGDP to be operational in 1989.[11]

Interstate 40 passes within 1 km of the southern boundary of the ORR. The major link between Knoxville and Oak Ridge is the Pellissippi Parkway (SR 162), which extends from I-75/I-40 just west of Knoxville. SR 58 enters the ORR from the west, and SR 95 enters from the south. SRs 162 and 62 provide access to the eastern end of the ORR.

The ORR is served by two railroads, Norfolk Southern Railway at ORGDP and CSX Transportation at the Y-12 Plant. The Clinch River provides another transportation system to the ORR. Although this mode has rarely been used for DOE purposes, it does provide an alternative means for receiving shipments for which transport by truck or rail is impractical.

The closest regional airport is Knoxville's McGhee Tyson, ~65 km from the ORR. One municipal airport and two private airports are also in the Knoxville vicinity. The closest air transportation facility to Oak Ridge is a private, grass runway northwest of Oak Ridge in Oliver Springs.

There are no active duty military installations in the Oak Ridge area.

3. SITE-SELECTION METHODOLOGY

Regulations, regulatory guides, and other sources provide general guidance for site-selection methods and criteria but leave specific procedures and evaluation criteria for case-by-case development. This section reviews the major sources of site-selection guidance and describes the methodology used in this study. Section 4 describes the criteria developed for the ANS site-selection process and their application to the methodology.

3.1 REACTOR SITE-SELECTION GUIDANCE

Commercial power reactor siting is subject to NRC licensing requirements, notably 10 CFR 100, "Reactor Site Criteria," and 10 CFR 50, Appendix A, "General Design Criteria for Nuclear Power Plants." DOE reactors are not subject to NRC regulation but, under DOE Order 5480.6, "Safety of Department of Energy-Owned Nuclear Reactors," are to conform to "uniform standards, guides, and codes which are consistent with those applied to comparable licensed reactors." The order specifically incorporates 10 CFR 100 and Appendix A of 10 CFR 50. Effectively, the ANS must satisfy the same siting standards as would a commercial power reactor.[12]

The applicable standards are general and performance oriented rather than specific and prescriptive. The general design criteria in Appendix A of 10 CFR 50 state that the facility should be protected against natural phenomena and environmental conditions. The reactor site criteria in 10 CFR 100 list three factors for consideration in site acceptability:

1. characteristics of reactor design and proposed operation;
2. population density and use characteristics of the site environs; and
3. physical characteristics of the site, including seismology, meteorology, geology, and hydrology.

A draft DOE policy statement on nuclear safety objectives also addresses siting of new DOE nuclear facilities. It states that considerations in the choice of a site are to include "natural factors and man-made hazards" and "the radiological impact of potential accidents." These are the same considerations demanded by the NRC criteria. Additionally, site selection "is to be compatible with off-site countermeasures that may be necessary to limit the effects of accidental releases of radioactive materials."[13] These factors leave applicants with many acceptable sites. The NRC licensing process subjects applicants' choices to rigorous analysis and scrutiny to determine whether the combination of plant and site characteristics provides adequate safeguards; yet, the regulations do not provide a specific checklist for determining site suitability.

Regulations implementing NEPA (40 CFR 1502) apply to construction and operation of both civilian and DOE reactors. These regulations require that an Environmental Impact Statement discuss alternatives to a proposed action and evaluate the effects of the proposed action and its alternatives on the natural and human environment. Again, these requirements are general, not specific. Insofar as the alternatives include alternative sites, the regulations require that the site-selection process be explicit and systematic and that the selection criteria include environmental quality.

Regulatory guidance issued by the NRC is more specific. The appendixes of NRC Regulatory Guide 4.7, *General Site Suitability Criteria for Nuclear Power Stations,*[9] list safety and environmental "considerations for assessing site suitability," along with a regulatory position on each consideration. The list is reproduced in Table 3.1. For safety considerations, the list is comprehensive and some regulatory positions (relating to seismicity and nearby population densities) provide quantitative guidance. The listed environmental considerations are less comprehensive (e.g., neglecting archeological and historic resources), and the regulatory positions are only qualitative.

NRC Regulatory Guide 4.2, *Preparation of Environmental Reports for Nuclear Power Stations,*[14] specifies that Environmental Reports for nuclear power plants should include evaluation of alternative sites and energy sources. The guide lists a host of potential "evaluatory factors" for use in assessing site-source alternatives, including cost and operational as well as regulatory criteria. Some of the listed criteria apply to plants proposed for energy supply but not to research reactors. The NRC intends this list (reproduced in Table 3.2) to be suggestive rather than prescriptive.

Another broad catalog of regulatory and nonregulatory siting considerations is found in a general guide for nuclear power plant siting published by the Atomic Industrial Forum.[15] Table 3.3 is a compilation of considerations listed in the text of that report. The document also reviews the wide variety of methods for applying site-selection criteria to evaluate alternatives and choose a preferred site.

Table 3.1. Considerations for assessing site suitability for nuclear power stations

Safety	Environmental
Geology/seismology	Preservation of important habitats
Atmospheric dispersion	Migratory routes of important species
Population considerations	Entrainment and impingement of aquatic organisms
Hydrology	Entrapment of aquatic organisms
Flooding	Water quality
Water supply	Water availability
Water quality	Established public amenity areas
Industrial, military, and transportation facilities	Prospective amenity areas
	Public planning
	Visual amenities
	Local fogging and icing
	Cooling-tower drift
	Cooling-tower-plume lengths
	Plume interaction

Source: U. S. Nuclear Regulatory Commission, *General Site Suitability Criteria for Nuclear Power Stations,* Regulatory Guide 4.7, November 1975, Appendixes A and B.

Table 3.2. Factors used to evaluate and select site-plant candidates

Engineering and environmental Meteorology Geology Seismology Hydrology Population density Access to transportation Fuel supply and waste disposal routes Cooling-water supply Sensitivity of habitats Commitment of resources Dedicated areas Recreational usage Scenic values	Land use Compatibility with zoning Use changes Institutional Siting regulations Cost Construction costs Fuel costs Maintenance costs Operating Load-following capability Transient response
Transmission Access to existing system Routing of new lines Reliability Line losses Construction Access for equipment and materials Construction workers	Alternative site cost Land and water rights Base-station facilities Cooling system Transmission facilities Access Site preparation and investigation

Source: U.S. Nuclear Regulatory Commission, ***Preparation of Environmental Reports for Nuclear Power Stations,*** Regulatory Guide 4.2, January 1975, pp. 4.2–40.

3.2 PROCEDURE FOR ANS SITE SELECTION

Regulatory and other guidance on nuclear facility site selection includes a myriad of factors to be considered; yet, the general nature of the criteria and the absence of cookbook methods leave considerable flexibility. Review of several site-selection studies performed for other facilities, including some on the ORR, shows that regulatory suitability requirements admit many sites and that other considerations are necessary for discriminating among candidates.[7,16–18*] The principal task of the ANS site evaluation is to focus on the more-favorable areas of the ORR and eliminate the less favorable, until one most-favorable site emerges for detailed field investigation.

In the ANS site evaluation, the task of eliminating and focusing was done in three stages:

1. screening of the ORR to eliminate from further consideration obviously less-favorable portions and to identify distinct candidate areas within the remainder,
2. comparative analysis of the candidate areas to identify the one that best meets ANS objectives, and
3. evaluation of the preferred area to identify candidate sites and select one site for detailed field investigation.

*The sections "Alternative Energy Sources and Sites" of numerous commercial nuclear power plant Environmental Reports are also used here as source material.

Table 3.3. Siting considerations for nuclear power plants

System planning	Environmental
Service area	Land use: dedicated and sensitive areas, compatibility, recreation
Loads	Ecological communities
Transmission system	Hydrology
Generation needs: schedule, size, type	Meteorology
Reliability	Geographic features
	Demography
Safety	Public attitudes
Population	Socioeconomic factors
Seismology	Aesthetics
Flooding	Water quality
Geology	Air quality
Security	Transmission corridors
Isolation	Effluents
Emergency cooling water	Noise
	Construction activity
Engineering	Fogging and icing
Cooling water	Entrainment
Equipment transportation	Environmental enhancements and public benefits
Geology and soils	
Topography	Institutional (regulatory)
Availability of land	
Availability of materials and labor	Economic
Cooling-water structures	Cooling system
Plant layout	Site development
Site preparation	Access
	Transmission connections

Source: J. D. Calvert, Jr., et al., *Nuclear Power Plant Siting: A Generalized Process*, AIF/NESP-002, New York, Atomic Industrial Forum, August 1974.

Each stage had a successively narrower geographic focus, reducing the size of the search area by approximately an order of magnitude. Stage 1 reduced the search area from about 10^4 ha (the entire ORR) to about 10^3 ha; Stage 2 further reduced the search area to a preferred candidate area of $\sim 10^2$ ha; and Stage 3 selected a preferred site ~ 20 ha in size.

Performing the evaluation in stages reduced the amount of information to be evaluated at any one time and allowed large-scale and small-scale issues to be evaluated separately.

In Stage 1 of the evaluation, criteria were expressed as absolute requirements (e.g., avoid slopes >25%). Portions of the ORR not satisfying a criterion were eliminated from further consideration, leaving only those areas that satisfy every criterion. The criteria used for screening in Stage 1 are generally not absolute in any physical or legal sense but were set as absolutes in this study to eliminate from detailed analysis areas that are obviously inferior to others on the ORR. They steer the project away from unnecessary engineering challenges, regulatory scrutiny, and environmental controversy.

In Stages 2 and 3, the criteria were expressed as preferences (e.g., lower earth-moving and excavation costs are preferred). Candidate areas or sites were judged relative to the other candidate areas or sites according to how well they satisfy all criteria simultaneously.

No single criterion can eliminate a candidate area or site because a low ranking on one can be offset by higher rankings on others. These stages of the evaluation use primarily qualitative measures of the criteria and subjective trade-offs among them. Only a few of the criteria are relevant for distinguishing among areas at any one stage because only for those few do their measures differ significantly among the candidates.

For Stage 2 of the evaluation, the portion of the ORR not eliminated in Stage 1 was divided into discrete candidate areas. Comparative analysis in Stage 2 distinguishes among the candidate areas based on their overall performance on all the criteria taken together and selects a preferred area.

In Stage 3, several candidate sites were identified within the preferred area and evaluated relative to each other to select a preferred site. This evaluation used essentially the same criteria as in Stage 2 but focused on finer details and smaller areas.

This study used two sets of analysts: site planners and the ANS project team. The role of the site planners was to design, manage, and document the site-selection process. Design and management of the process included developing appropriate selection criteria (in consultation with the ANS project team) and identifying the key trade-offs to be made in Stages 2 and 3 of the evaluation. The role of the ANS project team was to oversee the process, ensure that it incorporated project needs and constraints, and make the necessary trade-offs. In essence, the site planners formulated questions and the project team answered them.

The study procedure involved frequent interaction between the two analyst groups. For each step of the process (i.e., each section of this report), the two groups met to discuss the analyses before the section was written and again after it had been reviewed. The two groups also shared the data-gathering responsibilities: the site planners furnished site-related data, and the project team provided the construction and operation information. Interviews with specialists in various programs and disciplines augmented written data sources. (See Appendix.)

The next section describes the criteria developed for the ANS and their application to the three-stage evaluation methodology.

4. SITE-SELECTION CRITERIA

The criteria developed for selecting a site for the ANS express four major goals: safety, environmental protection, site-related cost minimization, and operational compatibility. Each major goal includes several general criteria against which sites are evaluated relative to each other. Under some general criteria, one or more specific criteria are expressed as absolute requirements. The major goals, general criteria, and specific criteria form a hierarchy as shown in Table 4.1. Each goal and criterion is separately discussed in the remainder of this section. The criteria-numbering system used in the table corresponds to the section-numbering system used in this section except for the section (4) designation (i.e., Sect. 4.1.1 discusses Criterion 1.1).

The specific or absolute criteria are the basis for Stage 1 of screening the ORR. They allow a ready elimination of a large portion of the study area, retaining only the most favorable portion for more-detailed analysis. The more-general criteria are used in Stages 2 and 3 of the evaluation. The final part of this section explains how the criteria apply to each of the stages of the selection process described in Sect. 3.

Table 4.1. ANS site-selection criteria

1. SAFETY
    - 1.1 Geology/Seismology
    - 1.2 Meteorology
    - 1.3 Population
        - 1.3.1 Inner Exclusion Area
        - 1.3.2 Low-Population Zone
        - 1.3.3 Outer Exclusion Area
        - 1.3.4 Population Center Distance
        - 1.3.5 Population Density
    - 1.4 Hydrology
        - 1.4.1 Avoid Areas Subject to Probable Maximum Flood
        - 1.4.2 Dependable Water Supply
        - 1.4.3 Discharges Meet Water Quality Regulations
    - 1.5 Industrial, Military, and Transportation Facilities

2. ENVIRONMENTAL PROTECTION
    - 2.1 Species, Habitats, and Ecological Systems
        - 2.1.1 Avoid Protected (Natural and Reference) Areas
    - 2.2 Water Quality
    - 2.3 Air Quality
    - 2.4 Archeological, Cultural, and Historical Resources
        - 2.4.1 Avoid Protected Areas
    - 2.5 Social and Economic Systems

3. ENGINEERING AND SITE-DEVELOPMENT COSTS
    - 3.1 Foundations, Grading, and Drainage
        - 3.1.1 Avoid Slopes > 25%
        - 3.1.2 Avoid Knox Formations
        - 3.1.3 Avoid Major Thrust Faults
    - 3.2 Roads, Utilities, and Relocations
    - 3.3 Containment, Safety, and Waste Treatment Systems

4. OPERATIONAL COMPATIBILITY
    - 4.1 Compatibility with Surroundings
        - 4.1.1 Avoid Environmental Sciences Research Areas
    - 4.2 Proximity to Related Facilities and Services
    - 4.3 Emergency Planning

4.1 SAFETY

Safety, location, and cost are interrelated; plant structures and systems can compensate for less-favorable site conditions to provide equivalent safety. NRC regulations (10 CFR 100) recognize this interdependence of plant and site by including reactor design and operation characteristics among the factors to be considered in assessing site suitability.

In this major goal category, the specific (screening) safety criteria are used to eliminate areas that would require extraordinary engineering or management efforts or invite special regulatory attention. Within the remaining area, structures and systems can be engineered to provide equivalent safety for any remaining sites and the safety and cost criteria are largely redundant. Thus, Stages 2 and 3 of this analysis assume an equivalent level of safety and compare the differential costs among locations.

The safety criteria are primarily derived from 10 CFR 100 and NRC Regulatory Guide 4.7.[9] Appendix A of the Guide is as close to a checklist for safety considerations as can be found in NRC literature and is followed closely in the listing of safety criteria.

4.1.1 Geology/Seismology

The geologic criterion is that sites with less-severe seismology and foundation constraints are preferred. (This criterion cannot be used to distinguish among locations on the ORR because all of eastern Tennessee, including the ORR, is in the Southern Appalachian Tectonic Province and seismological hazards are considered virtually identical throughout. The Province contains no surface capable faults and has been demonstrated to satisfy the NRC seismological criteria.[19–21] Additionally, DOE experience on the ORR has shown depths to bedrock to be sufficiently shallow so that any location can be expected to provide a competent bedrock foundation for major structures. Some locations do provide less-costly foundation conditions, a consideration addressed by Criterion 3.1.)

4.1.2 Meteorology

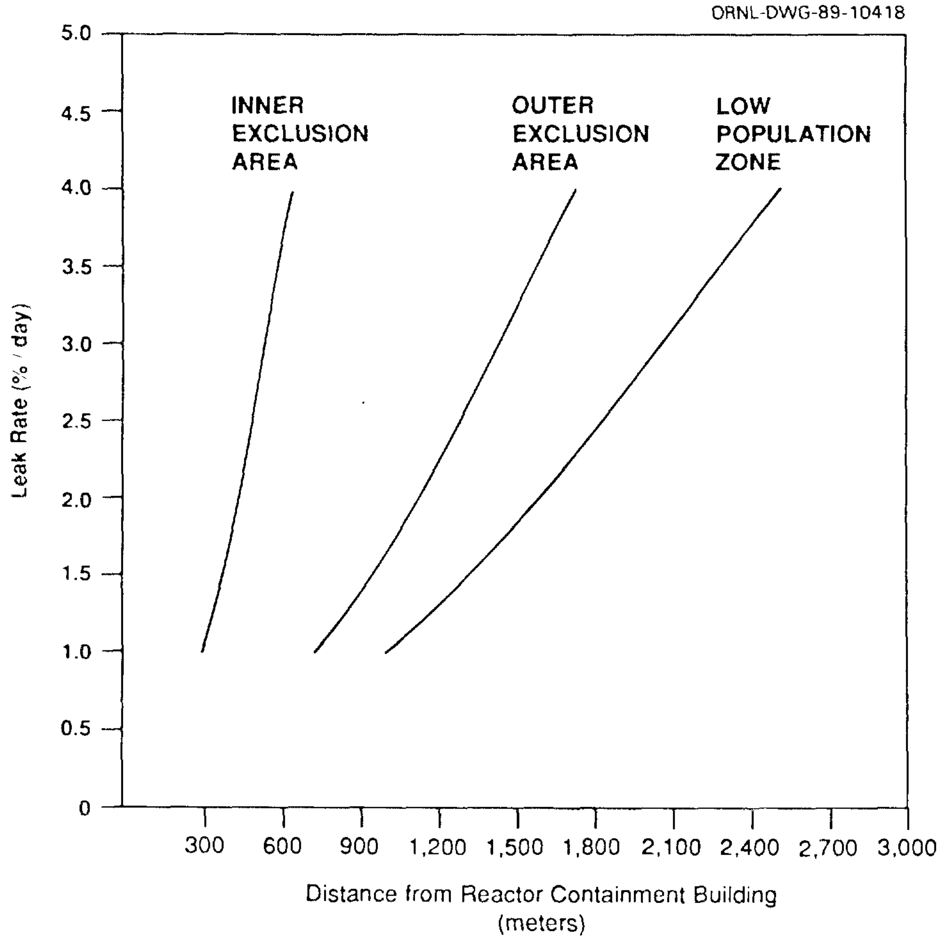
The criterion that nearby populations be adequately protected from airborne releases of radioactivity is expressed in the population criteria (Sect. 4.1.3).

4.1.3 Population

The general criterion is that potential radiation doses to the surrounding population be controlled through a combination of plant systems (that limit the quantity of radiation released) and distance (through which the radioactivity is diluted and dispersed). Four of the five specific criteria discussed under this section establish minimum separation distances between the ANS and cultural features that may be occupied by populations not working at the ANS. These separation criteria are expressed as setback distances from the cultural features.

The separation distances are established by specifying dose limitations that meet or exceed those specified in 10 CFR 100 and computing doses at various distances that would result from conservatively chosen accident scenarios and atmospheric dispersion conditions. Containment leak-tightness is a design parameter not yet chosen, so the dose-distance computations were performed for the range 1 to 4%/d. Minimum separation criteria are those required by the most stringent leak rate (1%/d). Sites that meet these minimum separation requirements will be evaluated under Criterion 3.3 for their potential to permit a relaxation of the leak rate constraint while providing equivalent protection.

The relationship between leak rate and required setback distances is shown in Fig. 4.1. The computations on which the figure is based incorporate assumptions about meteorological dispersion that are conservative enough to accommodate the terrain features, wind directionality, and other location-specific variables of the ORR; thus, the setback requirements are sufficiently large that local effects need not be considered in this site comparison and selection analysis.[22,23]



Source: Mike Harrington, Martin Marietta Internal Correspondence to Colin West, February 16, 1989.

Fig. 4.1. Setback requirements vs leak rate.

4.1.3.1 Inner exclusion area

NRC regulations in 10 CFR 100 specify that an individual located on the boundary of an "exclusion area" for 2 h immediately following the postulated major accident not receive a radiation dose in excess of 25 rem to the whole body or in excess of 300 rem to the thyroid from iodine exposure. As defined in the regulation, "exclusion area"

> means that area surrounding the reactor, in which the reactor licensee has the authority to determine all activities including exclusion or removal of personnel and property from the area. This area may be traversed by a highway, railroad, or waterway, provided these are not so close to the facility as to interfere with normal operations of the facility and provided appropriate and effective arrangements are made to control traffic on the highway, railroad, or waterway, in case of emergency, to protect the public health and safety.

The ANS project team has adopted a requirement more stringent than this regulation, defining an Inner Exclusion Area at whose boundary the above dose limits are not exceeded and from which public roads and principal evacuation routes are excluded. Figure 4.1 shows that, at 1%/d leak rate, this criterion requires the site to be at least 0.29 km from SRs 58 and 95 and Bethel Valley Road.

4.1.3.2 Low-population zone

The NRC regulations specify that an individual located on the boundary of the "low-population zone" (LPZ) for the entire period after the postulated accident not receive a dose in excess of 25 rem to the whole body or 300 rem to the thyroid. As defined in 10 CFR 100, the LPZ

> means the area immediately surrounding the exclusion area which contains residents, the total number and density of which are such that there is a reasonable probability that appropriate protective measures could be taken in their behalf in the event of a serious accident.

Again, the ANS project team has adopted a more stringent requirement, specifying a lower maximum dose at the boundary of the LPZ and further specifying that the LPZ be entirely contained within the ORR, thus containing no permanent residents. The specified dose limit is the protective action guides (PAG) recommendation of 5 rem to the whole body or 25 rem to the thyroid.[24] Effectively, this criterion requires the site to be at least 1.0 km from the ORR boundary.

4.1.3.3 Outer exclusion area

The ANS project team has also adopted an additional requirement for the protection of the sizable employee population of the ORR. The requirement defines an outer exclusion area at whose boundary the PAG dose (5 rem whole-body or 25 rem thyroid) would not be exceeded over the 2 h immediately following the postulated accident and from which the three main plant sites are excluded. This criterion requires the site to be at least 0.74 km from the three main DOE plants.

4.1.3.4 Population center distance

A "population center distance" is defined in 10 CFR 100 as "the distance from the reactor to the nearest boundary of a densely populated center containing more than about 25,000 residents" and is required to be at least one and one-third times the distance from the reactor to the boundary of the LPZ.

The portion of the ORR boundary separating the DOE property from the residential and commercial area of the city of Oak Ridge is taken to be the appropriate boundary; the site must be located at least 1.33 km away.

4.1.3.5 Population density

Following guidance in Regulatory Guide 4.7,[9] this criterion states that the site will not be located where the population density in any circle centered on the plant at any radius up to 30 miles (48 km) exceeds 500 persons per $mile^2$ or where the projected density over the lifetime of the facility exceeds $1000/mile^2$. (Demographic studies for the CRBR[7] and HEF[8] proposals established that the densities around the ORR fall well under these guidelines. Thus, this criterion does not discriminate among sites.)

4.1.4 Hydrology

The three specific criteria discussed in this section express conditions for adequate safety and water quality compliance. The extent to which sites meeting these criteria can do so more cheaply or provide greater environmental protection will be evaluated under the relevant environmental and cost criteria.

4.1.4.1 Avoid areas subject to the probable maximum flood (PMF)

The ANS will be located away from areas that would be inundated by the PMF.

4.1.4.2 Dependable water supply

The ANS site will be able to provide a dependable source of water for essential plant functions. (Any site on the ORR will use the Clinch River as its water source, so dependability cannot discriminate among sites. The ANS water requirements are small enough that the plant can be served by pipeline and need not be located adjacent to its water source.)

4.1.4.3 Discharges meet water quality regulations

Wastewater discharges from the ANS will meet the applicable regulations of 10 CFR 20 and 10 CFR 50. (Meeting the quality regulations is independent of location.)

4.1.5 Industrial, Military, and Transportation Facilities

The potential for accidents at nearby facilities to cause a release from the ANS must be analyzed, as must the possibility that an ANS accident may affect the safety of nearby facilities. (Any location on the ORR will require this type of analysis. The relative operational constraints and costs of protecting the ANS and neighboring facilities will be compared for each potential site under Criteria 3.3 and 4.1.)

4.2 ENVIRONMENTAL PROTECTION

The criteria for environmental protection generally express a preference for minimal alteration of the natural or human environment on or around the ORR. The analysis assumes that the ANS facilities will be constructed and operated in accordance with applicable regulations and standards for radiological safety, air and water quality, worker safety, waste management, etc. Sites are preferred if they offer additional environmental protection (e.g., through dilution potential or distance from affected communities).

4.2.1 Species, Habitats, and Ecological Systems

Sites having lower potential for disturbing ecological systems are preferred. Specific Criterion 2.1.1 states that all areas designated for the protection of communities or species (e.g., Natural Areas and Reference Areas) will be avoided.

4.2.2 Water Quality

Sites offering lower impacts on water quality are preferred.

4.2.3 Air Quality

Sites offering lower impacts on air quality are preferred.

4.2.4 Archeological, Cultural, and Historical Resources

Sites offering lower impacts on these resources are preferred. Some locations on the ORR are protected by law, namely the Graphite Reactor and the numerous cemeteries. Additionally, a number of locations have been identified where extensive archeological investigations would be required before development. Specific Criterion 2.4.1 states that all of these areas will be avoided.

4.2.5 Social and Economic Systems

This criterion includes economic activity, land uses, social systems, and other features of the human environment in surrounding communities. Sites having less effect on local communities are preferred. (Impacts on surrounding communities will be similar regardless of the location on the ORR chosen for the ANS. Thus, this criterion does not discriminate among sites.)

4.3 ENGINEERING AND SITE-DEVELOPMENT COSTS

Criteria under this major heading consider costs of construction and operation that are location dependent. Sites having lower costs are preferred.

4.3.1 Foundations, Grading, and Drainage

Considerations are topography, depth to competent bedrock, and the quality and predictability of the bedrock. As described in the three specific criteria under this heading, some locations will be ruled out of consideration because obviously superior sites are available.

4.3.1.1 Avoid slopes > 25%

Very steep slopes can be avoided without seriously restricting the number of suitable sites.

4.3.1.2 Avoid Knox formations

Of the major geologic formations on the ORR, the Knox is the most unpredictable and potentially the most costly to develop, being prone to deep weathering and solutioning. This formation will be avoided.

4.3.1.3 Avoid major thrust faults

The thrust faults on the ORR are not capable faults and are not a seismic concern. However, the quality of the rock at some locations on the faults is not suitable for foundations of major structures and would require excavation to the underlying formation. The faults will be avoided.

4.3.2 Roads, Utilities, and Relocations

The costs of providing utilities and access to the ANS and the cost of any necessary relocations of roads, pipelines, or powerlines will be considered.

4.3.3 Containment, Safety, and Waste Treatment Systems

Sites that are further than the minimum distances from the protected populations offer the potential for relaxing the specifications on the containment and treatment systems, thus saving some of the construction cost. Figure 4.1 illustrates the trade-off between containment leak-tightness and distance from the ANS to the boundaries of the inner and outer exclusion areas and LPZ as defined by Criteria 1.3.1, 1.3.2, and 1.3.3. These criteria are more stringent than the requirements of 10 CFR 100. The selection of a site more remote from the specified cultural features would allow the use of a relaxed containment-leak-rate specification without reducing the margin of safety.

Separation of the ANS from other facilities on the ORR may also reduce the cost of containment, safety, and waste treatment systems. Nearby facilities may pose a safety threat to the ANS, requiring additional protective measures (e.g., protection of the control-room environment against toxic gases). Sites that allow savings of structural or systems cost are preferred.

4.4 OPERATIONAL CONSIDERATIONS

The criteria under this heading account for the effects of site location on ANS operations and other DOE operations and programs.

4.4.1 Compatibility with Surroundings

Compatibility of the ANS with its surroundings is desirable, yet compatibility is difficult to define. The ANS will not displace existing facilities or functions, including, as stated in specific Criterion 4.1.1, undeveloped sites used as Environmental Sciences Research Sites. More generally, compatibility between the ANS and its surroundings has at least three aspects: similarity of nearby functions and activities, risk that one will harm or disrupt the other, and appropriateness of the aesthetic setting.

Similarity of functions and activities is the most obvious aspect of compatibility: the more similar, the more compatible; the more consonant with land-use plans and planning principles, the more compatible.

The risk that a nearby activity could compromise the safety of or disrupt the operation of the ANS is a measure of incompatibility, as is the risk that a mishap at the ANS could disrupt or compromise the safety of nearby activities. The greater the risk, the less desirable the location.

The final aspect is the most difficult to define because it deals with the subjective criteria relating to siting of the ANS and the degree to which the setting or surroundings reflect and modify these criteria. The ANS is to be a public and accessible research facility. Large numbers of visiting scientists from many institutions will work at the ANS for short periods, performing experiments in basic science. Thus, its public face is important; the ANS should be located in an accessible and aesthetically pleasing setting.

4.4.2 Proximity to Related Services and Facilities

The ANS is to be an ORNL facility and will depend on the Laboratory for administrative and personnel services, visitor control, motor pool, general maintenance, and other services. These services are more difficult to provide if the ANS is distant from the main ORNL complex, and the ANS will not be a large enough facility to provide these services for itself. Integration of the ANS into the ORNL scope of activities would also be facilitated if it were located nearby. Thus, proximity to the main ORNL complex in Bethel Valley is desirable.

Production of transuranic isotopes in the ANS will require a separate facility for target preparation and isotope separation. For HFIR isotope production, these functions are performed in the TPP, located just north of the HFIR. Transfers of most targets between the TPP and the HFIR are currently handled in noncertified containers, allowable because the transport route avoids public roads. Other targets, used for producing different isotopes with short half-lives, are transported by a hydraulic rabbit tube from the HFIR pool to a shielded cave in the TPP. Both transportation methods require the reactor and the processing facility to be near each other.

Location of the ANS close to the TPP appears desirable, but this desirability is subject to three qualifications. First, the long-term financial viability of the transuranic isotope program is unknown; the program's future is frequently questioned. Second, the continued acceptability of uncertified shipment methods is uncertain; DOE is under increasing pressure to cease exempting itself from the regulations by which other entities must live.

Third, the long-term viability of the TPP is uncertain; it will be 35 years old when the ANS begins operation and is already in need of significant upgrading. Thus, proximity to the TPP is of some importance, but the degree of importance is unknown. Alternatives are available, including new shipment methods or construction of a new isotope separation facility near the ANS.

4.4.3 Emergency Planning

The criterion is that the site be compatible with existing emergency planning. Emergency planning for the ORR geographically includes a "two-mile immediate notification zone" of nominal 2-mile (3-km) radius around each of the three plants and a "five-mile emergency planning zone" encompassing a nominal 5-mile (8-km) radius around each plant. A site that can be accommodated within the existing planning areas is preferred over one that requires significant expansion, especially an expansion of the "immediate notification zone" into a heavily populated residential area.

For the ANS, at a containment leak rate of 1%/d, the lower PAG level (1 rem) is not exceeded at 3 km (2 miles) over the entire course of the hypothetical accident and at 2.4 km (1.5 miles) the 1-rem dose is not exceeded for the first 4 h.[23] At a 4%/d leak rate, the 1-rem dose is never exceeded 8 km (5 miles) downwind. Thus, the size of the area required for ANS emergency planning is comparable to current practice on the ORR. Whether it would fit within, or require expansion of, the existing zones will depend on the particular location. At the higher leak rates, a larger immediate notification zone may be required.

4.5 APPLICATION TO SITE-SELECTION METHODOLOGY

The criteria described above and listed in Table 4.1 form a hierarchy in which specific screening criteria are organized under more general comparative criteria, which are in turn organized under four major categories or goals. The preceding subsections of this section ordered the criteria according to that hierarchy and included some safety criteria that are listed for completeness but not useful for discriminating among possible sites. Tables 4.2 and 4.3 reorder the criteria according to their function in the site-selection methodology described in Sect. 3 and list only those criteria that distinguish among locations on the ORR.

The screening criteria to be used in Stage 1 of the site-selection process are listed in Table 4.2. Each criterion listed is used to eliminate from further consideration those areas of the ORR not meeting the criterion. The areas remaining after each screening criterion has been applied are (1) suitable for the ANS site and (2) clearly superior to areas that were eliminated.

Stages 2 and 3 of the process involve successively more-detailed comparison of the remaining areas against the general criteria listed in Table 4.3. Because safety is a function of the combination of site features and engineered systems and structures, relative comparison of sites using both safety and cost criteria is redundant. Stage 2 and 3 evaluations consider the relative costs of providing a constant level of safety. Thus, the general criteria listed in Table 4.3 represent only three of the four major goal categories: environmental protection, cost minimization, and operational compatibility.

Table 4.2. Screening criteria for Stage 1

1.3.1	Inner Exclusion Area
1.3.2	Low-Population Zone
1.3.3	Outer Exclusion Area
1.3.4	Population Center Distance
1.4.1	Avoid Areas Subject to Probable Maximum Flood
2.1.1	Avoid Protected Natural and Reference Areas
2.4.1	Avoid Protected Archeological, Cultural, and Historic Areas
3.1.1	Avoid Slopes > 25%
3.1.2	Avoid Knox Formations
3.1.3	Avoid Major Thrust Faults
4.1.1	Avoid Environmental Sciences Research Areas

Table 4.3. Comparative criteria for Stages 2 and 3

2.1	Impact on Species, Habitats, and Ecological Systems
2.2	Impact on Water Quality
2.3	Impact on Air Quality
2.4	Impact on Archeological, Cultural, and Historical Resources
2.5	Impact on Social and Economic Systems
3.1	Cost of Foundation, Grading, and Drainage
3.2	Cost of Roads, Utilities, and Relocation
3.3	Cost of Containment, Safety, and Waste Treatment Systems
4.1	Compatibility with Surroundings
4.2	Proximity to Related Facilities and Services
4.3	Emergency Planning

5. SCREENING OF THE RESERVATION

In the preceding section, Table 4.2 listed the screening criteria to be used in identifying candidate areas of the ORR. Each criterion is mapped in this section to delineate between areas that satisfy the screening criterion and those that do not. The maps are then superimposed, and only those areas not eliminated by any criterion are candidates for the ANS site.

5.1 INDIVIDUAL SCREENING CRITERIA

The population criteria, 1.3.1 through 1.3.4, set minimum distances for isolating the ANS from the surrounding population. These criteria are mapped in Fig. 5.1, in which the shaded areas are those not satisfying the four criteria. Briefly, the criteria are

— Criterion 1.3.1: 0.29 km from SR58, SR95, and Bethel Valley Road,

— Criterion 1.3.2: 1.0 km from ORR boundary,

— Criterion 1.3.3: 0.74 km from main plant sites, and

— Criterion 1.3.4: 1.33 km from boundary with city.

Criterion 1.4.1 states that areas subject to the PMF are to be avoided. This criterion eliminates the lower reaches of the East Fork Poplar Creek and White Oak Creek basins, as shown in Fig. 5.2. The Natural and Reference Areas are mapped in Fig. 5.3 (Criterion 2.1.1), and the cemeteries and archeological sites are shown in Fig 5.4 (Criterion 2.4.1).

Figure 5.5 shows the areas having slopes >25%, which are excluded by Criterion 3.1.1. Figure 5.6 identifies the areas underlain by Knox geological formations, excluded by Criterion 3.1.2. The figure also maps the major thrust faults on the ORR, which Criterion 3.1.3 specifies will be avoided. (None are capable faults.) Figure 5.7 shows the Environmental Sciences Research Areas (Criterion 4.1.1).

5.2 CANDIDATE AREAS

Overlays of Figs. 5.1 through 5.7 were stacked to identify areas not eliminated by the above criteria. These areas were then examined to determine (1) if they were large enough to accommodate the ANS facilities (<0.5 × 0.5 km) and (2) if they were free of existing facilities or uses.[6,25,26]

Three general areas remain: Melton Valley, the Roane County portion of Bear Creek Valley, and an area east of the SR 58 and 95 interchange and north of the White Oak Mountain fault, labeled the Interchange candidate area. White Wing Road (SR 95) divides Bear Creek Valley into two candidate areas, labeled West Bear Creek Valley and Central Bear Creek Valley. The four candidate areas are shown on Fig. 5.8.

ORNL-DWG-89-10419

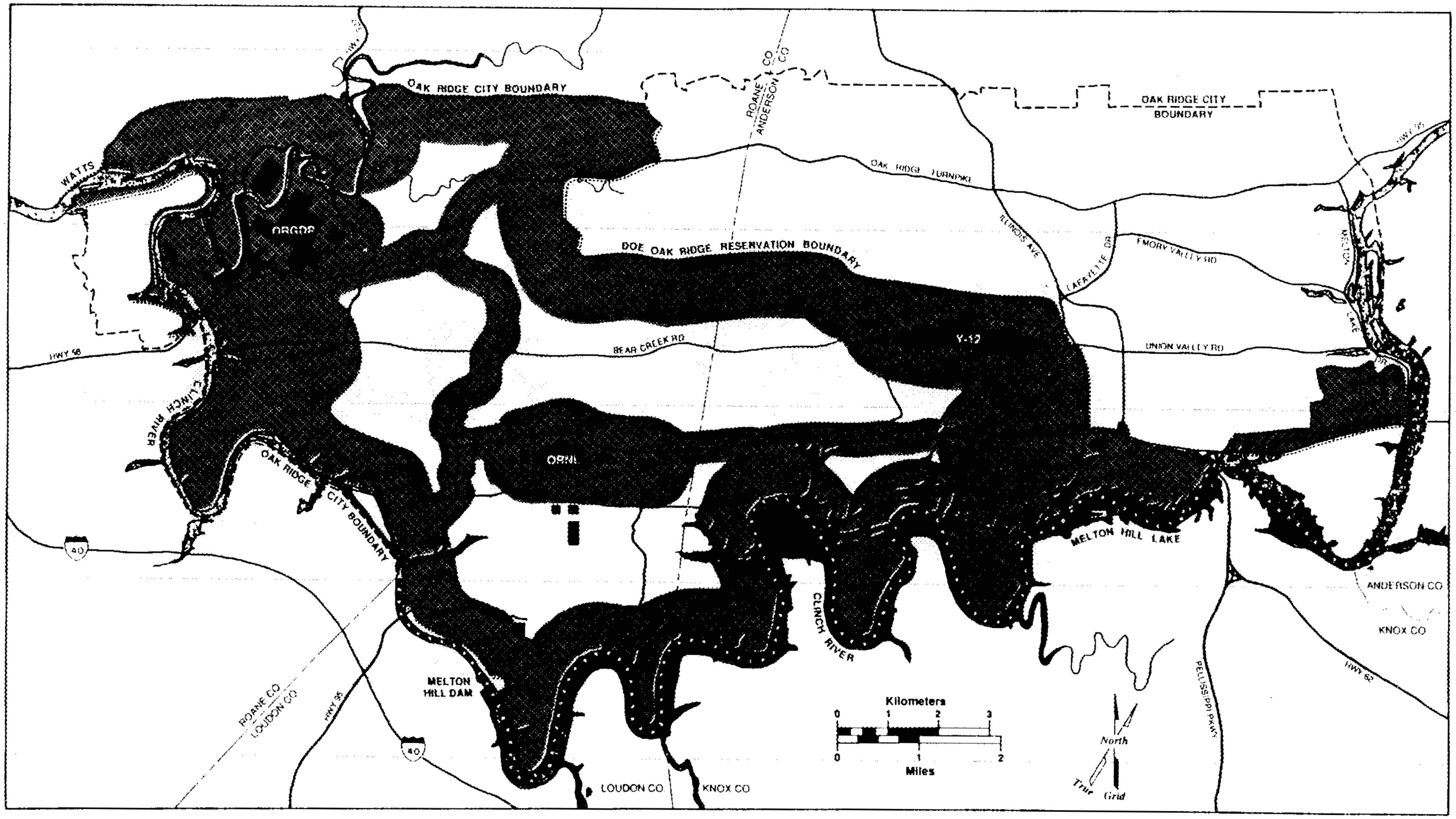
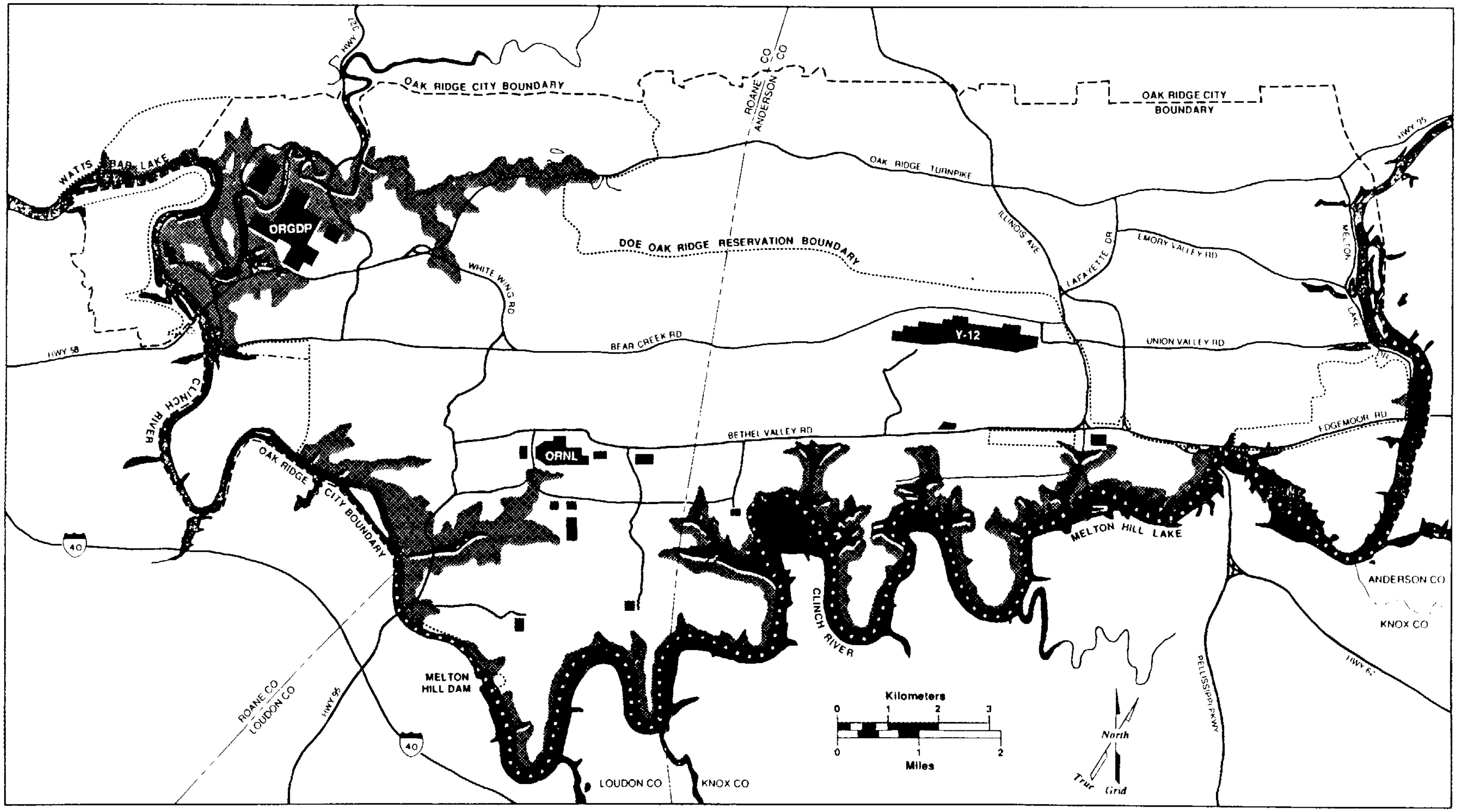


Fig. 5.1. Areas eliminated by setback criteria.

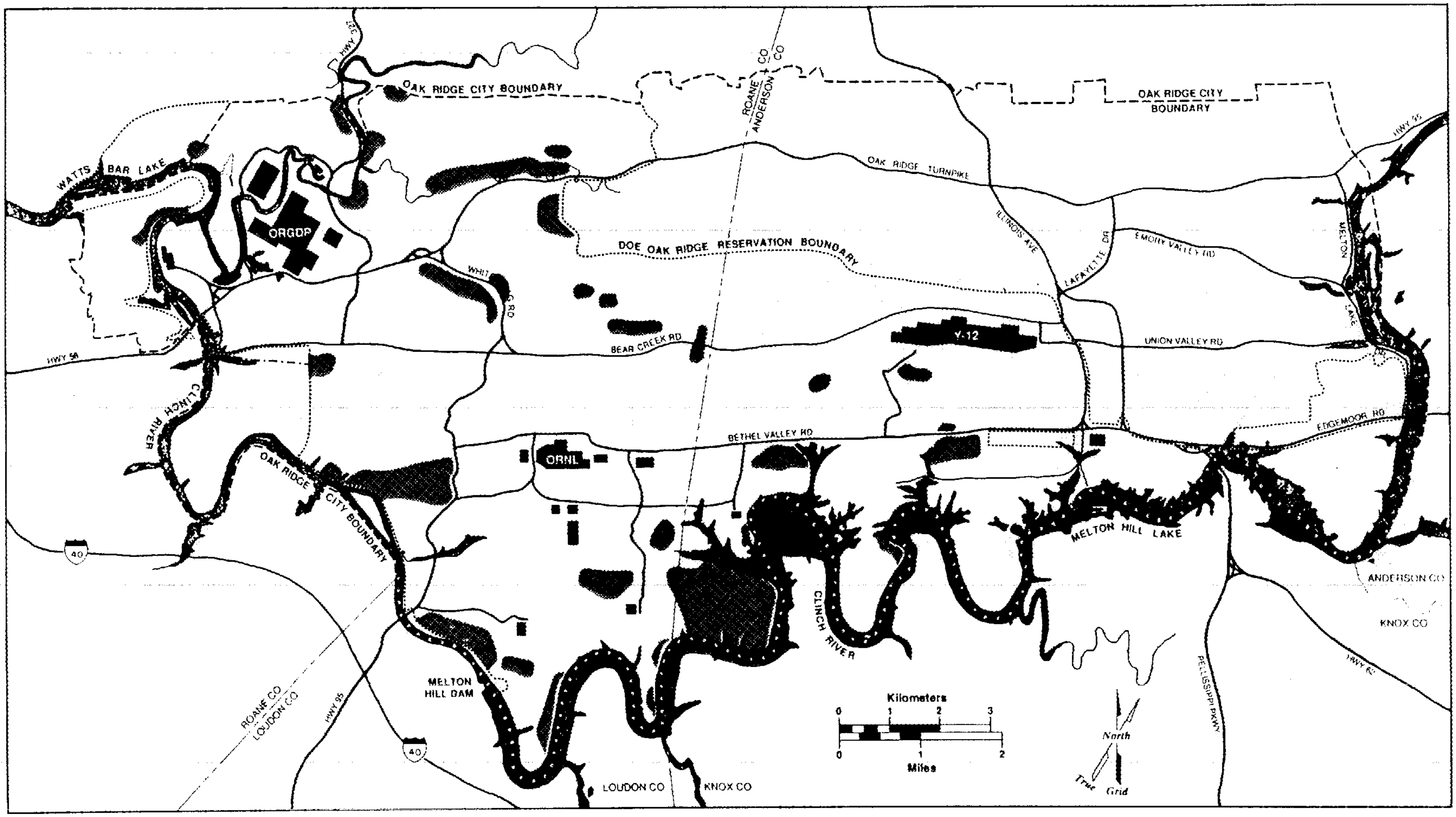
ORNL-DWG-89-10420



Source: *Oak Ridge Reservation Site Development and Facilities Utilization Plan*, DOE/OR-855, March 1988 (draft), Figure 4.3, pg. 4-4.

Fig. 5.2. Areas eliminated by flood-protection criterion.

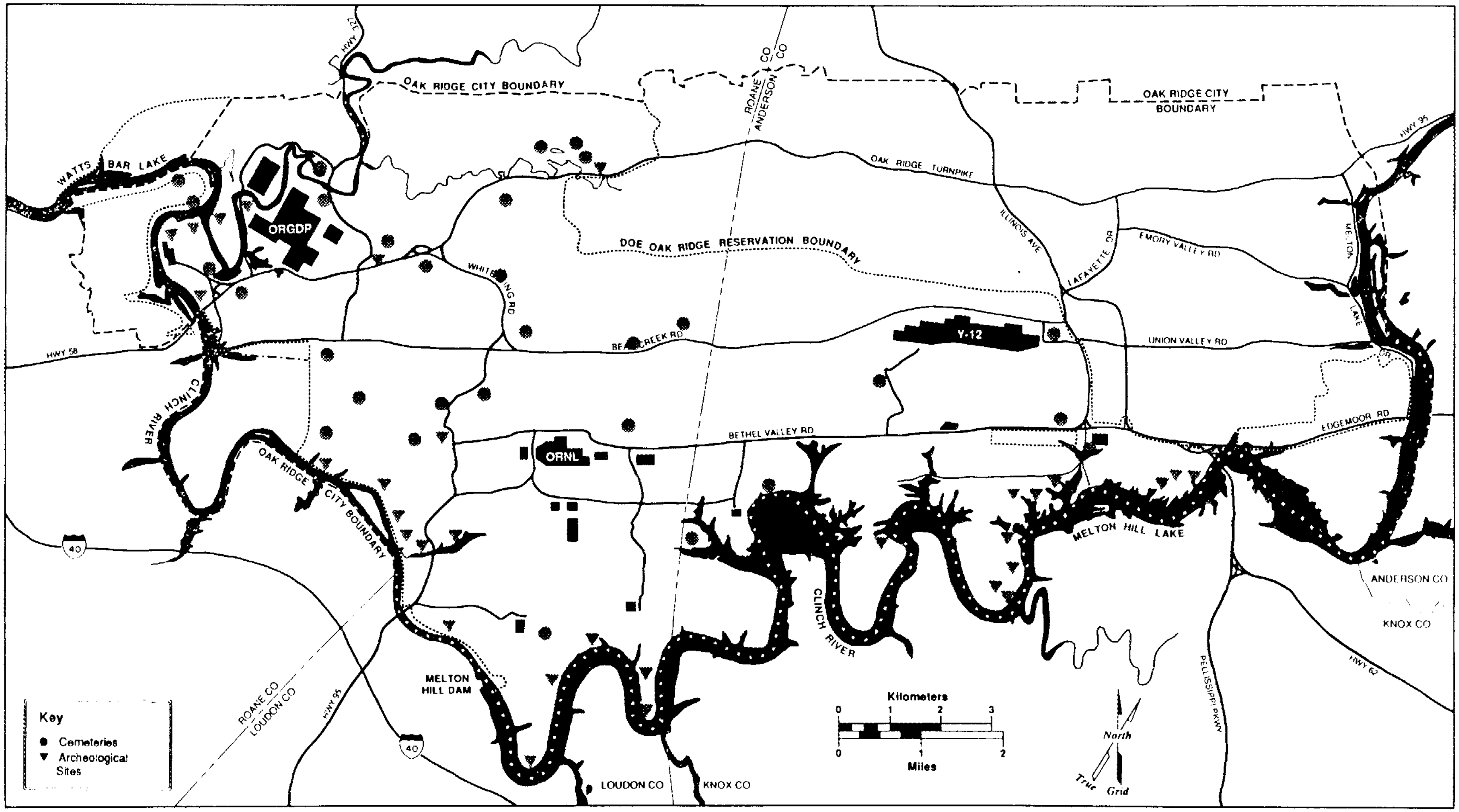
ORNL-DWG-89-10421



Source: *Oak Ridge Reservation Site Development and Facilities Utilization Plan*, DOE/OR-855, March 1988 (draft), Figure 3.20, pg. 3-23.

Fig. 5.3. Natural and reference areas.

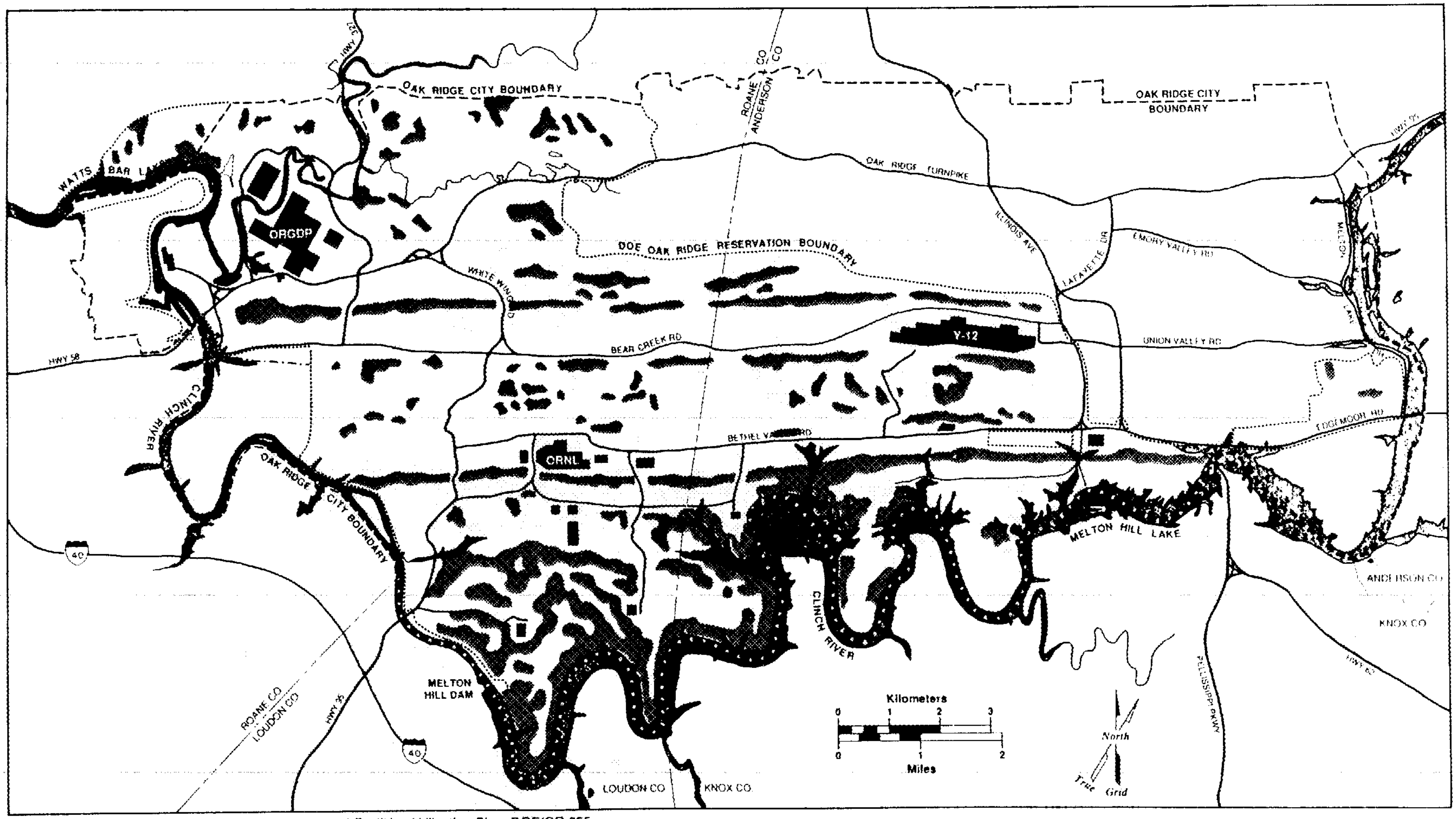
ORNL-DWG-89-10422



Source: *Oak Ridge Reservation Site Development and Facilities Utilization Plan*, DOE/OR-855, March 1988 (draft), Figure 2.15, pg. 2-15.

Fig. 5.4. Cemeteries and archeological sites.

ORNL-DWG-89-10423



Source: *Oak Ridge Reservation Site Development and Facilities Utilization Plan*, DOE/OR-855, March 1988 (draft), Figure 4.2, pg. 4-3.

Fig. 5.5. Areas eliminated by slope criterion.

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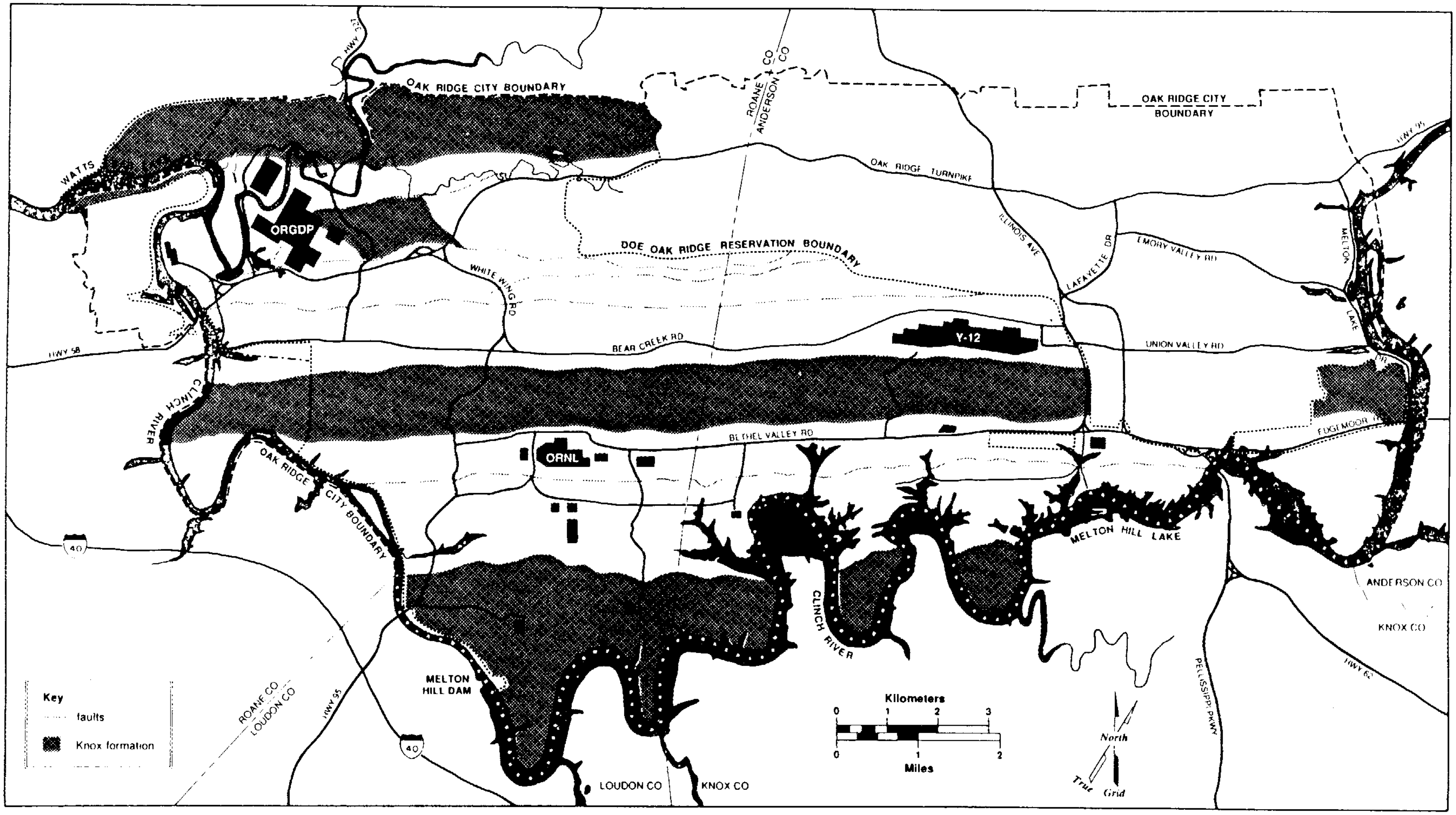

Source: Geologic Map of the Oak Ridge Area Tennessee. Geology by W.M. McMaster, U.S. Geological Survey, 1958. Prepared in cooperation with the United States Atomic Energy Commission. Printed by Army Map Service, Corps of Engineers, February 1962.

Fig. 5.6. Areas eliminated by geologic criteria.

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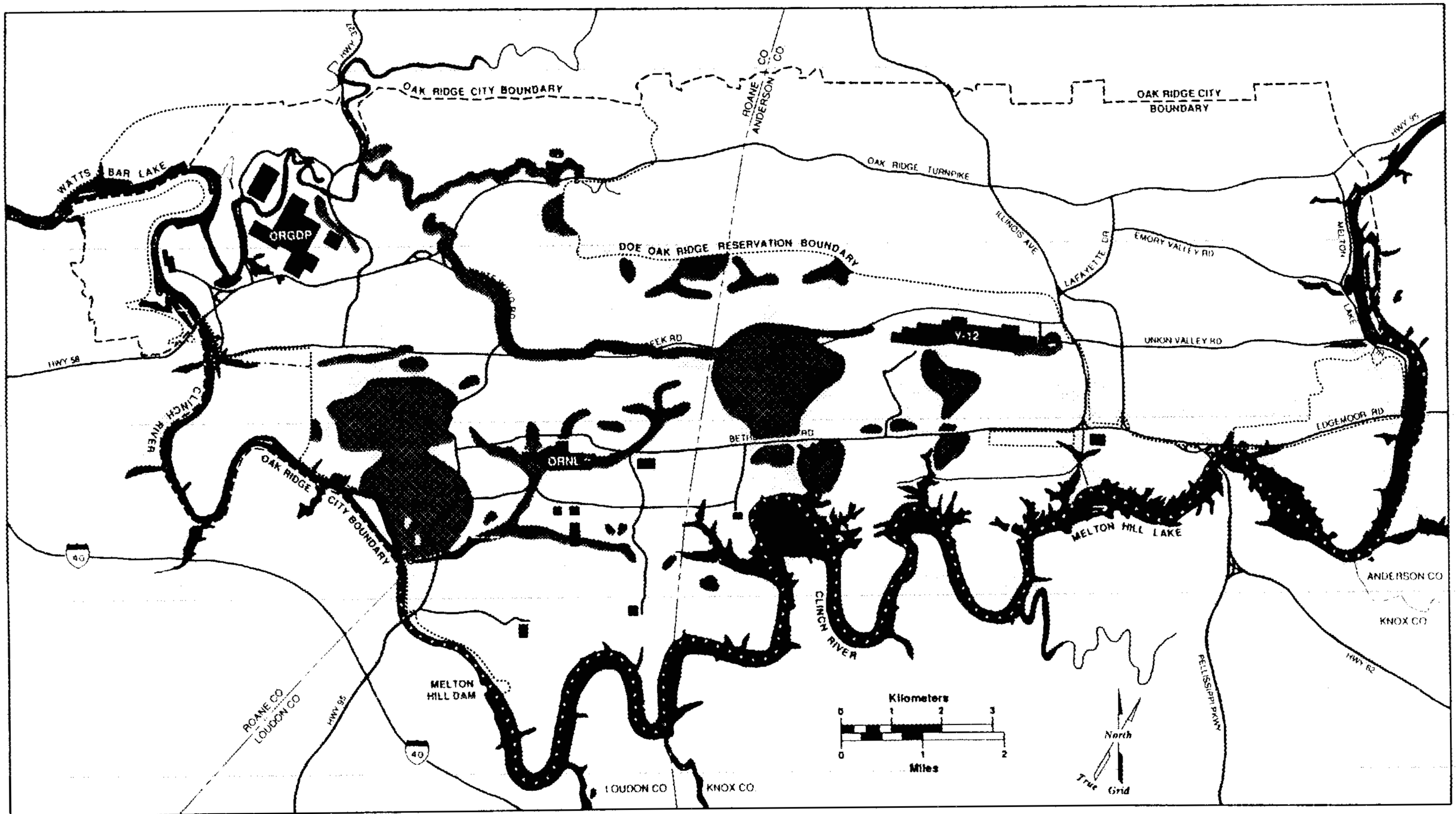

Source: *Oak Ridge Reservation Site Development and Facilities Utilization Plan*, DOE/OR-855 March 1988 (draft), Figure 3.19, pg. 3-22.

Fig. 5.7. Environmental Sciences Research Sites.

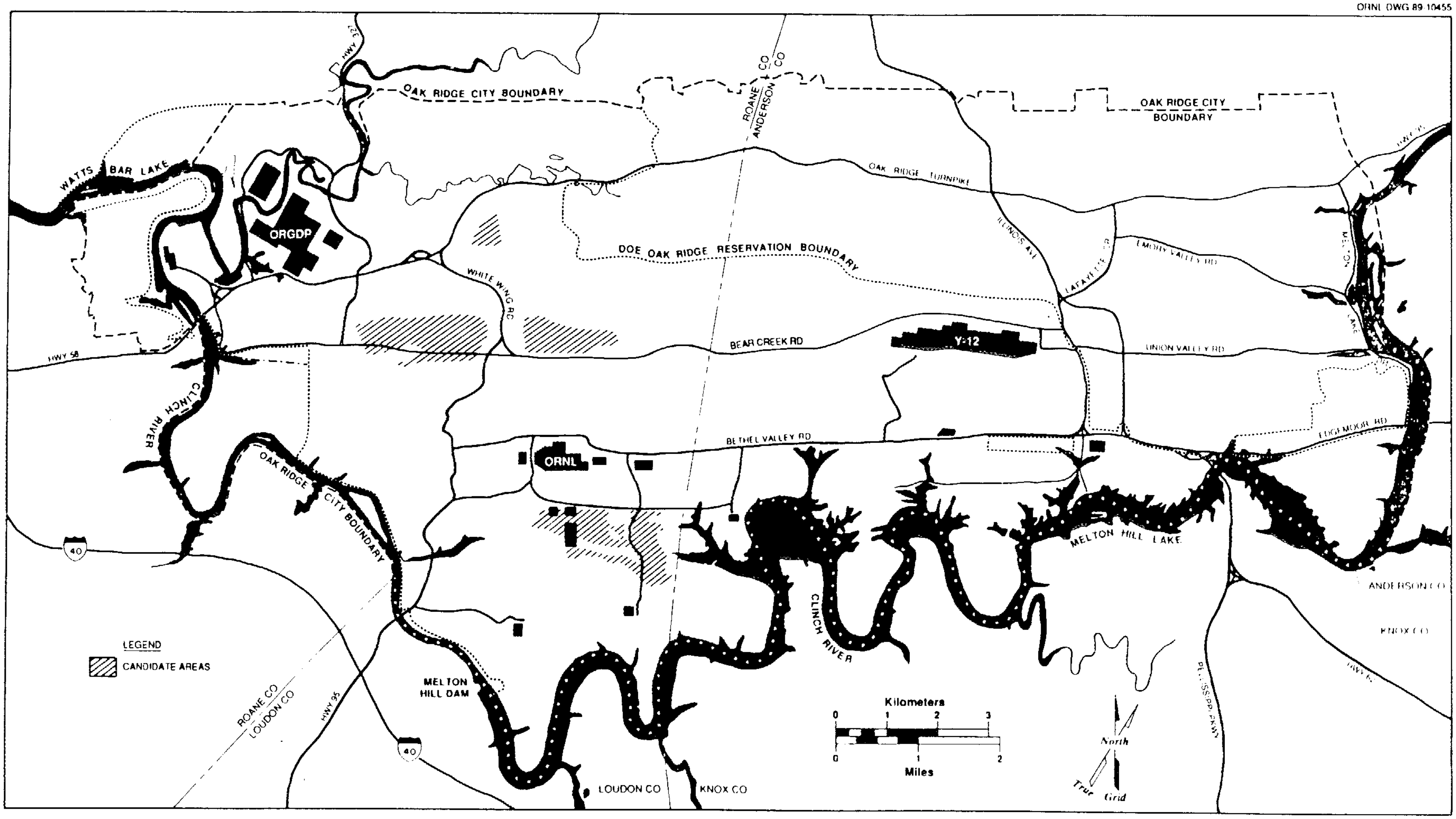

Fig. 5.8. Candidate areas for ANS Site.

6. COMPARATIVE ANALYSIS OF CANDIDATE AREAS

The information for comparing the candidate areas was obtained primarily through a series of interviews with Martin Marietta employees whose expertise and responsibilities were relevant to the selection criteria. Appendix A documents these interviews.

This section is divided into five subsections. The first describes each of the candidate areas. The second, third, and fourth subsections analyze the candidate areas by each criterion. [The section and subsection numbering corresponds to the criterion numbers used in earlier chapters (e.g., Sect. 6.2.1 discusses Criterion 2.1).] The final subsection summarizes the analysis and selects the preferred area.

6.1 DESCRIPTION OF CANDIDATE AREAS[6,25–29]

6.1.1 Melton Valley Candidate Area

The Melton Valley candidate area, shown in Fig. 6.1, lies approximately 1 km southeast of ORNL in Melton Valley between Copper Ridge and Haw Ridge. Elevations in Melton Valley range from approximately 240 to 270 m above mean sea level. The vegetative cover in the candidate area is primarily deciduous forest. The Melton Valley candidate area is drained by Melton Branch, a tributary of White Oak Creek. This candidate area is underlain by rock types of the Conasauga group, which are characterized by low permeability and by a thick residuum that is highly adsorptive to radionuclides. Extensive geological investigations have been done in Melton Valley.

On three sides, this candidate area is bounded by the screening criteria of Sect. 5: on the north, by the Outer Exclusion Area setback from ORNL; on the south, by the Knox geology of Copper Ridge; and on the east, by the steep slopes east of the access road to the Health Physics Research Reactor (HPRR). The western boundary, the small creek flowing south from the Homogenous Reactor Experiment (HRE) just east of Solid Waste Storage Area (SWSA) 5, is a practical limit; waste management activities west of the creek leave insufficient space for the ANS. Within the candidate area, the Melton Branch research area and the steep hills east of HFIR are excluded from consideration.

The candidate area contains two active sets of facilities: the High Flux Isotope Reactor-Transuranium Reprocessing Facility (HFIR-TURF) complex and nonradioactive hazardous waste facilities in the southeast section of the area, along the road to the HPRR. The candidate area contains a site, known as SWSA 7, proposed for future disposal of low-level radioactive wastes.

The HFIR-TURF complex contains the HFIR, a research reactor that is to be replaced by the ANS, two isotope-separation facilities, and several support buildings. One of the isotope-separation facilities, the TPP, receives irradiated targets from HFIR and may play a similar role for ANS.

The HRE and the Molton Salt Reactor Experiment (MSRE), located north of the HFIR-TURF complex, are inactive reactors awaiting decontamination and decommissioning. A transuranic waste packaging facility, the Waste Handling Pilot Plant, is to be constructed west of the candidate area.

Utility services that would be necessary to the ANS are already available in the Melton Valley area, supplied by ORNL. These services include electricity, steam, potable

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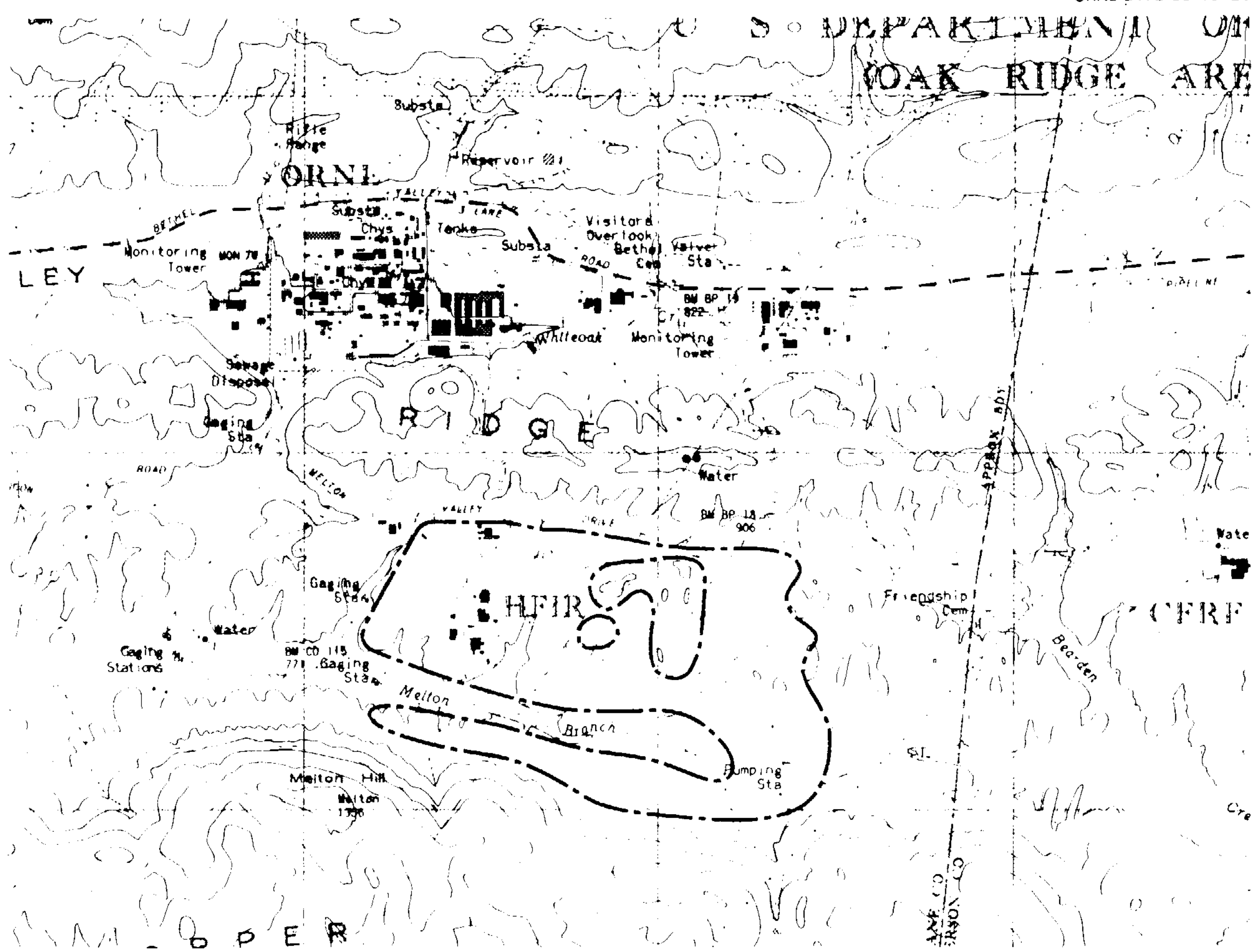

— · — Melton Valley

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Fig. 6.1. Melton Valley candidate area.

Source: Oak Ridge Area Map, S-16A, December, 1987 water, sanitary sewage, telecommunications, and process-wastewater-collection lines. The *ORNL Site Development and Facilities Utilization Plan*[27] states that these distribution systems are adequate; although some upgrading to handle the larger loads of the ANS might be anticipated, much of the needed utility infrastructure is already in place. The reliability of water supply to ORNL is currently inadequate—in need of additional storage and/or looping of the supply line from the Y-12 treatment plant. The *ORNL Site Development and Facilities Utilization Plan*[27] does not identify any other supply problems.

6.1.2 Central Bear Creek Candidate Area

The Central Bear Creek candidate area, shown in Fig. 6.2, lies in the north central portion of the reservation in Bear Creek Valley. It is bounded by the setback from the city-ORR boundary to the north and the Knox geology of Chestnut Ridge to the south. The western boundary is the setback from White Wing Road, and the eastern boundary is a DOE Natural Area. Elevations range from approximately 240 to 300 m above mean sea level.

The vegetative cover in the candidate area is primarily planted stands of pine. It is part of the NERP. The candidate area is underlain by rock types of the Conasauga group and drained by a network of small branches that are tributary to Bear Creek. No buildings or structures are contained in the candidate area. Active and inactive waste burial grounds lie to the east of the candidate area and west of the Y-12 Plant.

Although no utilities are available within the candidate area, electric power transmission-line corridors run through it. A potable-water main extends in a southwesterly direction from the treatment facility at the Y-12 Plant to ORNL, following Bear Creek Road near the Anderson/Roane County line before crossing Chestnut Ridge. Telecommunications cables also follow Bear Creek Road just south of the candidate area.

Two paved roads, SR 95 (White Wing Road) and Bear Creek Road, provide access to the candidate area. Gum Branch Road runs through the area in a north-south direction, connecting Bear Creek Road to Midway Road on the boundary between the ORR and the city of Oak Ridge. McNew Hollow Road provides access between Gum Branch Road and White Wing Road.

6.1.3 West Bear Creek Candidate Area

The West Bear Creek candidate area, shown in Fig. 6.3, lies in the western portion of the ORR in Bear Creek Valley. It is bounded on the west, near Flannagan Loop Road, by the LPZ criterion, and on the east by the setback from White Wing Road. The steep slopes of Pine Ridge and Bear Creek Road, which abuts the Knox geology of Chestnut Ridge, form the northern and southern boundaries, respectively. Elevations in the candidate area range from about 240 to 300 m above mean sea level. The vegetative cover is mostly planted stands of pine.

The candidate area is underlain by rock types of the Conasauga group. It is drained by tributaries of Grassy Creek, which drains directly to the Clinch River, and by tributaries of Bear Creek. No buildings or structures are located within the candidate area.

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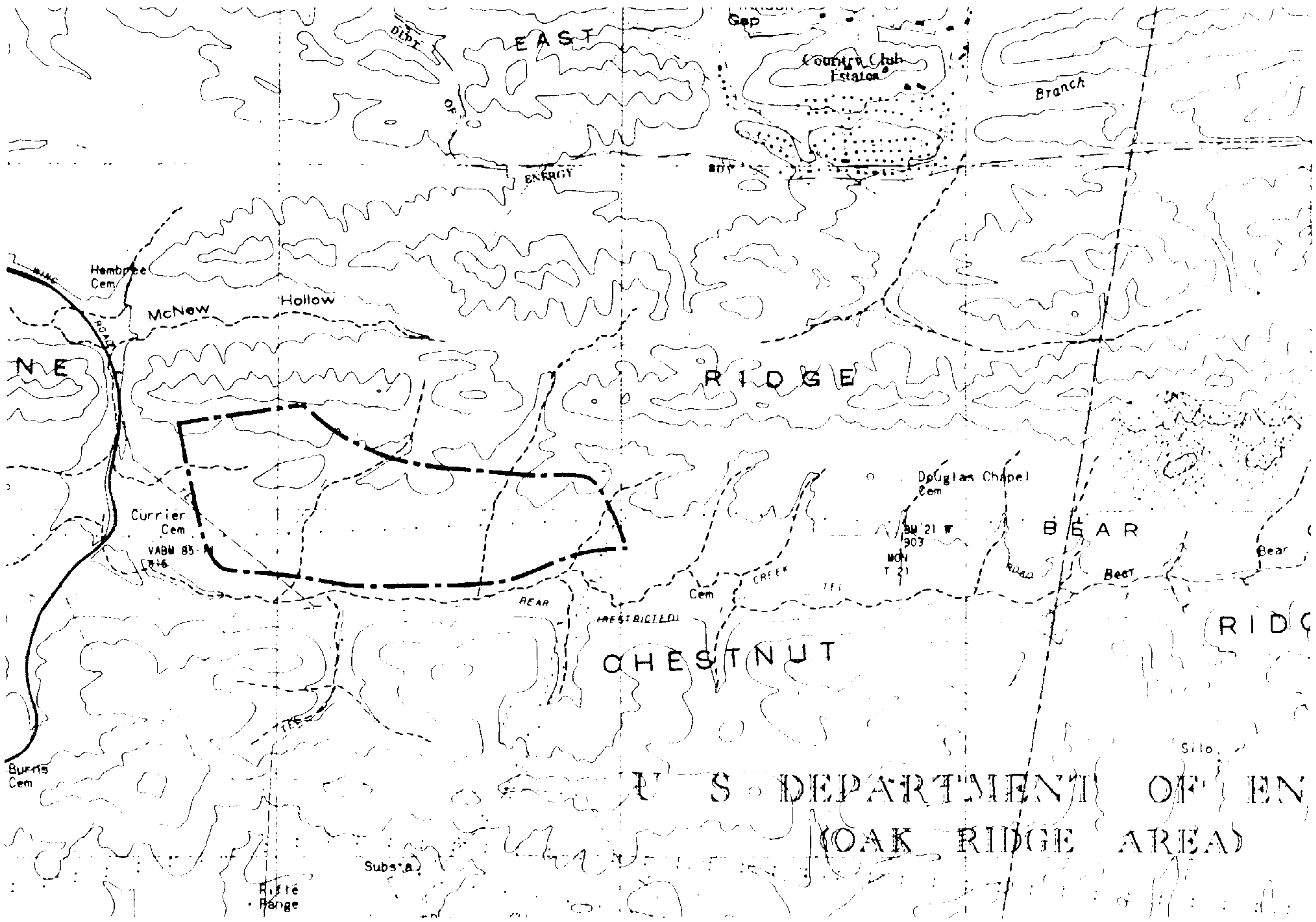

— · — Central Bear Creek Valley
______ Creek
- - - - Creek .

Fig. 6.2. Central Bear Creek candidate area.

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Source: Oak Ridge Area Map, S-16A, December, 1987.

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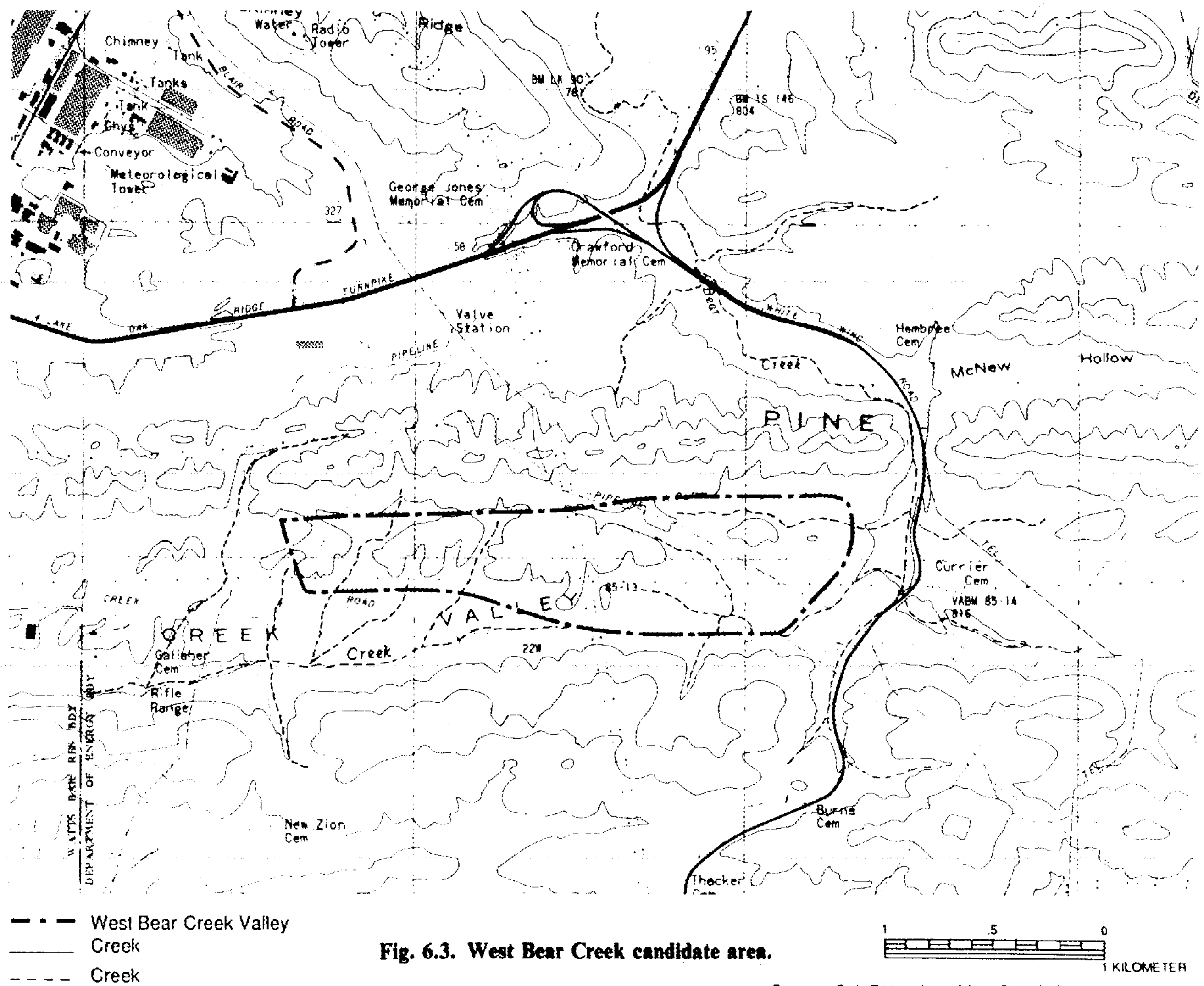

Fig. 6.3. West Bear Creek candidate area.

Source: Oak Ridge Area Map, S-16A, December, 1987.

Although no utilities service the area, several electrical power transmission lines cross it. Additionally, a natural gas main extends across the candidate area. Telecommunications cables are routed along White Wing Road near the eastern boundary of the area.

Transportation access in the vicinity of the candidate area is provided by White Wing Road, which runs north to south, and by Bear Creek Road, which runs east to west along the southern boundary of the area. Flannagan Loop Road connects Bear Creek Road to SR 58, providing direct access to Blair Road and ORGDP.

6.1.4 Interchange Candidate Area

The Interchange candidate area, shown in Fig. 6.4, is located in East Fork Valley. It is bounded on the east by the setback from the city-ORR boundary and on the north and west by the setback from SR 95, which intersects with SR 58 to the southwest of the site. The southern extent of the area is limited by the White Oak Mountain fault. Beyond SR 95 to the west is McKinney Ridge, which also provides the eastern boundary of ORGDP. Elevations in the candidate area are about 240 to 270 m above mean sea level.

The Interchange candidate area is underlain by rock types of the Chickamauga group and a syncline containing Reedsville, Sequatchie, and Rockwood formations. The candidate area is drained by a tributary of East Fork Poplar Creek. The vegetative cover in the candidate area is planted stands of mostly pine. The area is designated as part of the NERP.

No buildings or structures are located in the candidate area. A power transmission corridor crosses the site, and telecommunications cables lie near the site along SR 58. The nearest utilities are at ORGDP, 2.5 km to the west.

Public access along the interchange of SRs 95 and 58 is restricted by a chain link fence. A partially paved road, Salvage Yard Road, and several unpaved roads provide limited access to the site.

6.2 COMPARISON OF AREAS BY ENVIRONMENTAL PROTECTION CRITERIA

6.2.1 Impact on Species, Habitats, and Ecological Systems

Two species of wildlife protected by Tennessee law may be affected by development of one or more of the candidate areas. The hardwood forests of the East Fork Poplar Creek Valley, including the Interchange candidate area, are suspected breeding areas for the Indiana bat, listed as an endangered species by the Tennessee Wildlife Resources Commission. If the Indiana bat actually breeds in the area (surveys have not been done), then use of this area for the ANS would probably be precluded (see Appendix).[30]

The mountain redbelly dace, a small fish classified as "wildlife in need of management" by the Tennessee Wildlife Resources Commission, is found in Bear Creek and several of its tributaries and in some tributaries of East Fork Poplar Creek. It is found in each of the candidate areas except for Melton Valley. This classification is less restrictive than "endangered" or "threatened" and would probably not preclude development but would require protection of the stream habitat.[31]

By this criterion, the Melton Valley candidate area is preferred because it does not have the potential barriers to development found in the other three candidate areas.

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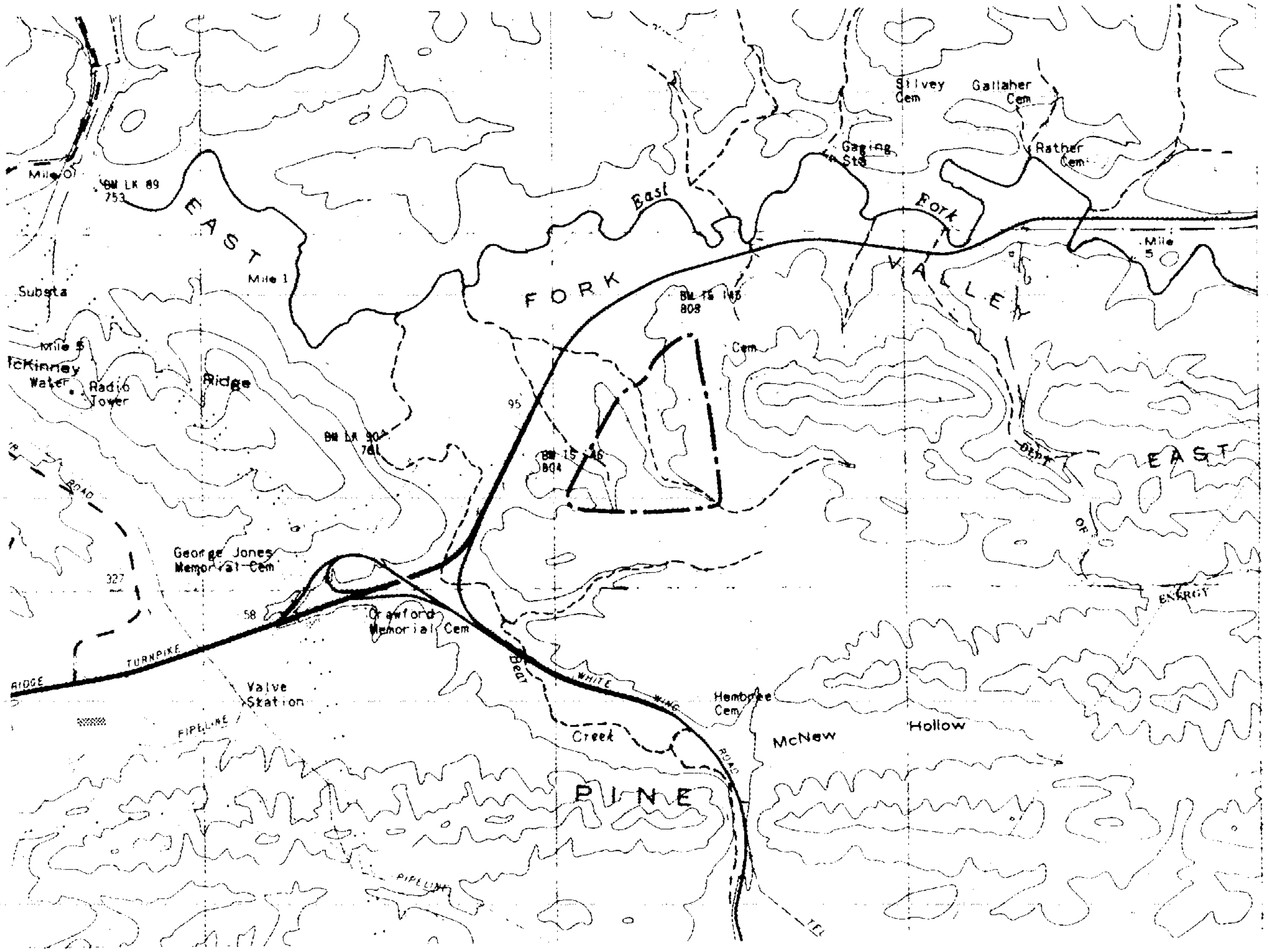

— - — Interchange Area

_____ Creek

- - - - Creek

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Fig. 6.4. Interchange candidate area.

Source: Oak Ridge Area Map, S-16A, December, 1987.

6.2.2 Impact on Water Quality

All of the streams in the candidate areas are either already affected or are very small. In either case, the streams have little or no carrying capacity for additional waste loadings. Stringent water quality controls will be required no matter where the ANS is constructed, and none of the candidate areas is particularly better or worse than the others on this criterion.

6.2.3 Impact on Air Quality

Air quality impacts do not differ significantly among the four candidate areas.

6.2.4 Impact on Archeological, Cultural, and Historical Resources

The screening process used in Stage 1 of this site-selection study (Sect. 5) eliminated from consideration any cemeteries or archeological sites that may require extensive investigation. Although some of the candidate areas contain cemeteries, each has sites for the ANS that would not require disturbing the cemeteries. These impacts do not differ significantly among the candidate areas.

6.2.5 Impact on Socioeconomics

All sites on the ORR are so close to each other that the impacts on surrounding communities from building the ANS are the same no matter which location is chosen.

6.3 COMPARISON OF AREAS BY ENGINEERING AND SITE-DEVELOPMENT COST CRITERIA

6.3.1 Foundations, Grading, and Drainage

Three of the candidate areas are located in valleys underlain by Conasauga formations. The Conasauga is generally considered to be the best formation on the ORR for locating heavy structures such as the ANS. By contrast, the Interchange area is located primarily on Chickamauga formations, containing much limestone and subject to solution cavities. A syncline associated with East Fork Ridge also intrudes into the area. The Interchange area is geologically far more complex than are the other candidate areas and inferior to them for reactor siting.[32] In addition, the small size of the Interchange area allows little flexibility for changing structure locations in response to local geologic conditions. It is the least favorable on this criterion.

6.3.2 Utilities, Roads, and Relocations

Melton Valley is the only candidate area currently served by electric, steam, potable-water, and waste-collection utilities. Extensions of these utilities onto a particular Melton Valley site would be measured in hundreds of meters; extensions onto a site in another candidate area would be measured in thousands of meters. A Melton Valley site could use the ORNL steam plant and waste treatment plants, whereas new heat and waste treatment facilities would be necessary for sites outside Melton Valley. (Because the ANS will be a heavy-water reactor and process wastes may contain deuterium and tritium, separate treatment facilities may be required regardless of location. Waste management strategies are still being developed.)

Sites in any of the areas are close to existing roads. Melton Valley roads are closer to the feasible sites but may require upgrading to handle ANS traffic. Thus, road costs do not show any clear preferences among the areas.

All candidate areas except for Melton Valley are crossed by high-voltage powerlines, and the West Bear Creek Valley area is also crossed by a high-pressure gas pipeline. Whether and to what extent these lines would need to be relocated depends on the choice of particular sites and cannot be evaluated at this stage of the site-selection process. Relocation would make these areas even more expensive relative to Melton Valley, whose costs under this criterion are cheapest of the four candidate areas.

6.3.3 Containment Systems

Among the screening criteria used in Stage 1 of this study were a series of minimum setbacks designed to keep the LPZ on the ORR and to separate the ANS from certain roads and the three DOE plants. The minimum setback distances were computed assuming a containment leak rate of 1%/d. Sites that are more distant from the roads, plants, and ORR boundary would allow relaxation of the 1%/d design criterion at some savings in system cost.

The West Bear Creek Valley area offers sites on which the leak rate could be relaxed to 4%/d. All other candidate areas would require the minimum 1%/d. The extent of containment cost savings owing to relaxation from 1 to 4%/d is unknown, and some of the savings would probably be offset by the necessity of moving the gas pipeline and electric transmission lines that cross the West Bear Creek Valley area. Thus, West Bear Creek Valley allows for relaxing the stringency of the containment design criteria, but the value of this allowance is unknown.

6.4 COMPARISON OF AREAS BY OPERATIONAL CONSIDERATIONS CRITERIA

6.4.1 Compatibility with Surroundings

The first of the three aspects of compatibility is similarity of nearby activities. Melton Valley has long been used for research reactors and other ORNL facilities requiring separation from the bulk of the Laboratory's working population. Site-development plans for the ORNL and the ORR, as well as for the ANS itself, assume that the ANS will be located in Melton Valley.

The two Bear Creek Valley areas are virtually undeveloped; the Central Training Facility, just to the southwest of the West area, is the only permanent facility in the immediate proximity. Various waste management plans assume use of the Central area, and a portion of the Central area is identified in the ORR Site Development Plan (SDP)[6] as a new site for Y-12 programs, should such a need arise in the future. Several facilities not associated with either ORNL, the Y-12 Plant, or ORGDP have been proposed for these areas in the past (the Hot Experimental Facility, the Exxon reprocessing plant, and the Monitored Retrievable Storage facility), but none has been built (for various reasons unrelated to site suitability).

The Interchange area is also undeveloped, but the area has been identified as one of a number of sites for a sludge farming research operation involving disposal of sludge from Oak Ridge municipal sewage treatment.[33] The area is too small to accommodate both sludge farming and the ANS. (The West Bear Creek Valley area also contains sludge farming sites but is large enough to accommodate both activities.)

The existing or proposed uses in the Bear Creek Valley candidate areas are not in insurmountable conflict with siting the ANS. The required land area is small and the facilities could be located adjacent to waste management facilities, just as research reactors and waste management operations have coexisted in Melton Valley for years.

Yet the other uses of Melton Valley are more similar to the ANS than are uses in the other areas because they are managed by ORNL. The assumption in current planning that the ANS will be located in Melton Valley reflects a widespread perception that ORNL facilities "belong" in Bethel Valley or Melton Valley. Other areas of the ORR are perceived as related to Y-12 or ORGDP. This perception that the ORR is divided into three spheres of influence is ingrained into the DOE/Energy Systems mindset; such biases are real management challenges.

The bias is reinforced by the potential for physical conflicts arising out of the differing missions of the three DOE Oak Ridge plants. ORNL is in the research business and, particularly with the ANS, needs relatively free access for visiting scientists, both U.S. citizens and foreign nationals. The national security mission of the Y-12 Plant, with its increasing emphasis on tighter security around the weapons production operations, already restricts visitors' access to some ORNL research activities at the Y-12 Plant. One can imagine circumstances under which a Bear Creek Valley or Interchange location for ANS could be subjected to restricted access, for example, if ORGDP were to be converted to defense use and/or if some new national security activity were to be initiated in Bear Creek Valley or elsewhere between ORGDP and the Y-12 Plant sometime before the end of the ANS' working lifetime (i.e., sometime in the next 40 to 50 years). Thus, on this aspect of compatibility, Melton Valley is the preferred area.

The second aspect of compatibility is the risks that nearby operations impose on the ANS and vice versa. On this aspect, Melton Valley is at a disadvantage because it is the only candidate area currently having other operations. None is believed to present serious problems, yet each will need to be analyzed in preparing the Safety Analysis Report. The HFIR is to be permanently shut down when the ANS begins operation, so the only nearby activities will be waste management, remediation, and any isotope processing still occurring in the TPP or TURF. The eastern part of the Melton Valley area is well removed from these current activities. Proposed waste management activities in Central Bear Creek Valley and in eastern Melton Valley at SWSA 7 would be slight detriments for those areas.

The third aspect of compatibility, accessibility and aesthetics, puts some parts of Melton Valley at a disadvantage; it is congested with industrial and waste management facilities. Again, the eastern part of Melton Valley and the other candidate areas satisfy these criteria well, having good access and no existing facilities.

Considering all these aspects of compatibility together, Melton Valley emerges somewhat more compatible than the others.

6.4.2 Proximity to Related Facilities and Services

The Melton Valley area is by far the better location for satisfying this criterion. Of the four candidates, it is the nearest to the main Laboratory complex and includes the TPP.

6.4.3 Emergency Planning

The "two-mile immediate notification zone" for ORNL is centered on the HFIR, so the Melton Valley candidate area easily fits into the existing plans. Each of the other candidate areas would require a new focus for emergency planning. West Bear Creek Valley is not within 3 km (2 miles) of any residential areas, but its immediate notification zone would include the small industrial park at the western end of Bear Creek Road. The Interchange and Central Bear Creek areas are both within 3 km of the Country Club Estates subdivision, and Interchange is also within 3 km of Hartland Estates. On this criterion, Melton Valley and West Bear Creek Valley are preferred.

6.5 PREFERRED AREA

Table 6.1 summarizes the preceding discussion. Melton Valley ranks higher than the other candidate areas on four criteria: impact on species and habitats; road, utility, and relocation cost; compatibility with surroundings; and proximity to related facilities (ORNL and the TPP). Additionally, Melton Valley does not rank below another candidate area on any criterion except containment cost, in which only West Bear Creek is superior. Melton Valley and West Bear Creek would have minimal impact on emergency planning requirements.

The Interchange area ranks worst on foundation, drainage, and grading costs because its geological uncertainties are severe and its usable land is only marginally large enough for the ANS. Thus, Melton Valley is the Preferred Area and Interchange is the least favorable area.

Should site investigations or other future information make Melton Valley less attractive, one of the Bear Creek Valley areas would be the second choice. The West area has less competition from other potential users, less impact on emergency planning, and may afford savings in containment cost.

Table 6.1 Comparison of ANS candidate areas

Criterion	Melton Valley	W. Bear Creek Valley	Central Bear Creek Valley	Interchange
2. Environmental Impacts				
2.1 Species, Habitats	low	potential	potential	potential
2.2 Water	NSD[a]	NSD	NSD	NSD
2.3 Air	NSD	NSD	NSD	NSD
2.4 Archeological, Cultural, Historical	NSD	NSD	NSD	NSD
2.5 Socioeconomic	NSD	NSD	NSD	NSD
3. Cost				
3.1 Foundation, Grading Drainage	moderate	moderate	moderate	high
3.2 Roads, Utilities, Relocation	moderate	high	high	high
3.3 Containment (leak rate, %/d)	1	perhaps >1	1	1
4. Operations				
4.1 Compatibility	more	less	less	less
4.2 Proximity to Related facilities	close	far	far	far
4.3 Emergency Planning Impact	small	small	greater	greater

[a]NSD = no significant difference.

7. SELECTION OF PREFERRED SITE

7.1 CANDIDATE SITES

The preferred Melton Valley area contains three candidate sites for the ANS. The first has been called the Reference site in earlier ANS planning documents. It is the trapezoidal area bounded on the west by SWSA 5, on the north by Melton Valley Drive, on the south by Melton Branch, and on the east by the HFIR-TURF complex and access road.

The second, named the Central site, is the triangular area to the magnetic north (grid northeast) of HFIR, bounded by Melton Valley Drive and the two small streams.

The third site, called the Eastern site, is the gently rolling area bisected by the HPRR access road to the east of proposed SWSA 7. The candidate sites are shown on Fig. 7.1.

7.2 COMPARATIVE ANALYSIS OF CANDIDATE SITES

On the environmental criteria (Criteria 2.1 through 2.5), the three sites are indistinguishable at this level of analysis.

All three sites are underlain by the same geologic formations and have similar topography. However, the Central site is suspected of being bisected by a tear fault and is too small to permit much flexibility in the location of structures.[34] The spoil material from HFIR construction, which fills the central part of the Reference site, is a minor drawback because its composition and depth are unknown. Tear faulting is a possibility throughout Melton Valley, but the larger size of the Eastern site may permit more flexible location of facilities in response to local conditions. Thus, Criterion 3.1 favors the Eastern site and disfavors the Central site.

The Eastern site is farthest from existing steam, telecommunication, electrical, sewage, and process-waste utilities, meaning that costs for these services would be somewhat higher. All sites are equally well served by the potable-water-distribution system. Criterion 3.2 favors the Reference and Central sites.

All Melton Valley sites would require a 1%/d leak rate, so Criterion 3.3 is not a discriminating factor.

The Eastern site is favored by Criterion 4.1, Compatibility. All Melton Valley facilities are in uses related to research reactors. The Eastern site is less likely to encounter interference from these activities. It is larger and, thus, more able to accommodate future expansion and related facilities (e.g., a TPP replacement), and it is removed from the clutter of contaminated land and facilities that fills much of Melton Valley. Both Reference and Central sites are adjacent to or surrounded by relics of past waste management practices from which DOE is trying to move. These artifacts pose three risks for the ANS: contamination could disrupt ANS construction or operations, the association between existing contamination and the new facility could delay or complicate the approval process for the ANS, and the old facilities are an unaesthetic backdrop for a facility planned to be a showcase focal point for the Laboratory's entry into the 21st century.

Existing contamination requiring eventual cleanup or, at least, further field investigation is documented adjacent to the Reference and Central sites. Excavation for

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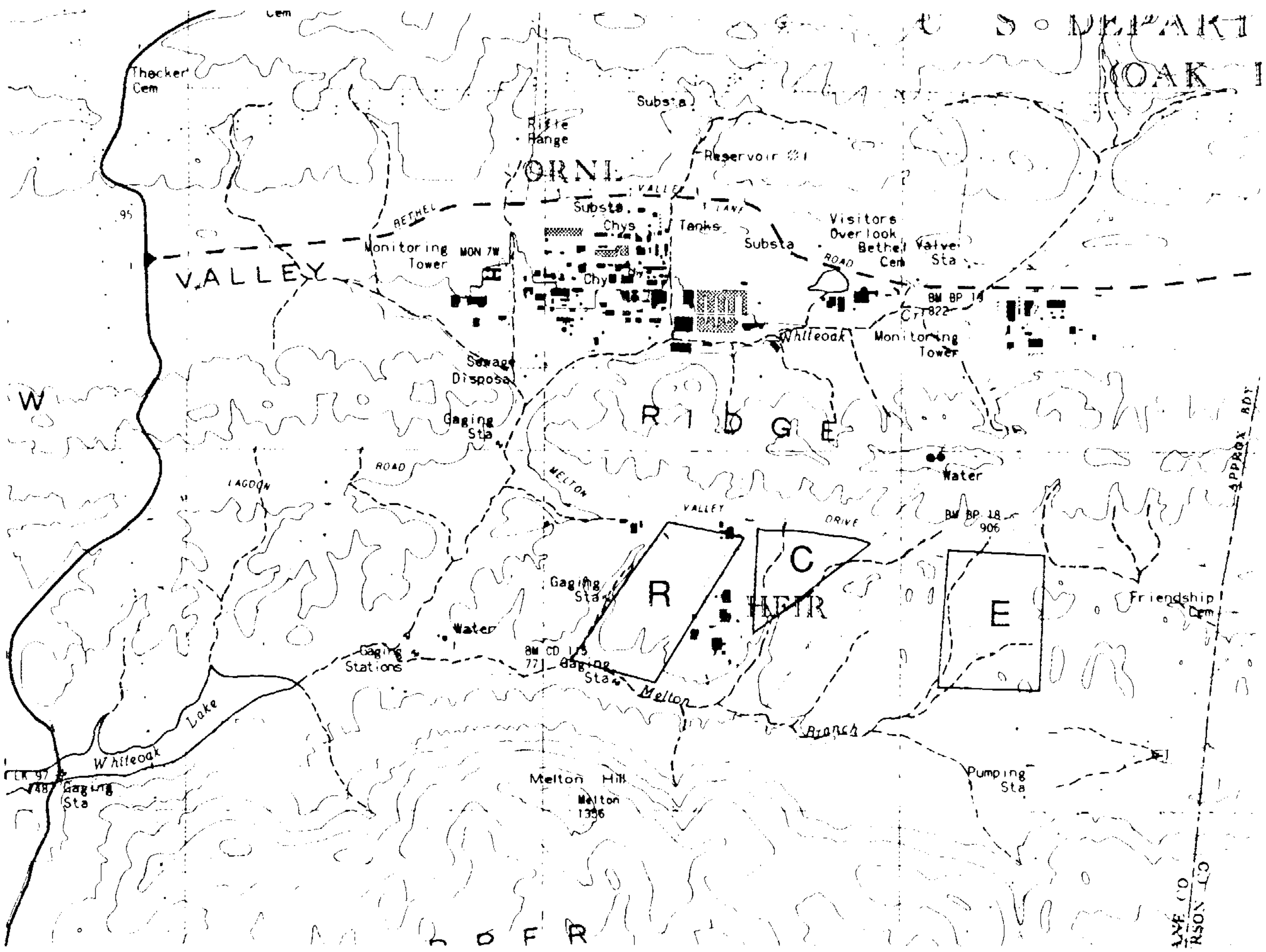

R — Reference Site
C — Central Site
E — Eastern Site
- - - - Creek

Fig. 7.1. Melton Valley candidate sites.

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Source: Oak Ridge Area Map, S-16A, December, 1987.

ANS construction that could intersect existing contamination would require special procedures. Further contamination, for example, during decontamination and decommissioning of HFIR or MSRE, could disrupt operation.

The approval process for ANS could also be affected by existing contamination adjacent to the site. Both the SAR and the EIS will have to address adjacent facilities and any possible interactions between them, leading to the possibility that approval for the ANS could be linked to cleanup of these areas, delaying the project. The Eastern site is more easily disassociated from the other Melton Valley activities, past and present.

Finally, the image and aesthetic surroundings of the ANS are important. If it is to be a high-profile research facility and if it is to be perceived as an example of DOE's new way of doing business, then the setting and accessibility of the Eastern site are far superior to the other alternatives.

Proximity to ORNL is nearly the same for all three sites, but they differ in proximity to the TPP. All three sites would allow cask transportation between the ANS and the TPP without using public roads, but the Eastern site is too far from the TPP for a rabbit system to be practical. Cask transportation in lieu of a rabbit system is feasible.[35] Criterion 4.2 slightly favors the nearer Central and Reference sites.

The Reference and Central sites would require almost no adjustment of the existing "two-mile immediate notification zone" centered on the HFIR. The Eastern site is 1 km to the east of the HFIR and may push the immediate notification zone across the lake into Knox County, encompassing a few scattered residences. Criterion 4.3 puts the Eastern site at a slight disadvantage.

7.3 PREFERRED SITE

The preceding analysis is summarized in Table 7.1. The table shows the Eastern site to have higher utilities costs, to have more impact on emergency planning, and to be less convenient to the TPP. In its favor, the Eastern site appears to have less risk of foundation problems, less risk of complications from existing waste management problems, and a more attractive setting than either of the other sites. To a large degree, the trade-off is between cost and risk of disruptions to development and operation. For its lower risk and more attractive setting, the Eastern site is preferred. The Reference site is the second choice, offering more room for development and less likelihood of tear faulting than the Central site.

Figure 7.2 shows a preliminary layout of ANS facilities on the Eastern site.

Table 7.1. Comparison of ANS candidate sites

Criterion	Reference	Central	Eastern
2. Environmental Impacts			
2.1 Species, Habitats	NSD[a]	NSD	NSD
2.2 Water	NSD	NSD	NSD
2.3 Air	NSD	NSD	NSD
2.4 Archeological, Historical	NSD	NSD	NSD
2.5 Socioeconomic	NSD	NSD	NSD
3. Cost			
3.1 Foundation, Grading, Drainage	intermediate	most uncertain	least uncertain
3.2 Roads, Utilities, Relocation	moderate	moderate	higher
3.3 Containment (leak rate, %/d)	1	1	1
4. Operation			
4.1 Compatibility	least compatible	intermediate	most compatible
4.2 Proximity	adjacent to TPP	adjacent to TPP	further from TPP
4.3 Emergency Planning	least impact	least impact	small impact

[a]NSD = no significant difference.

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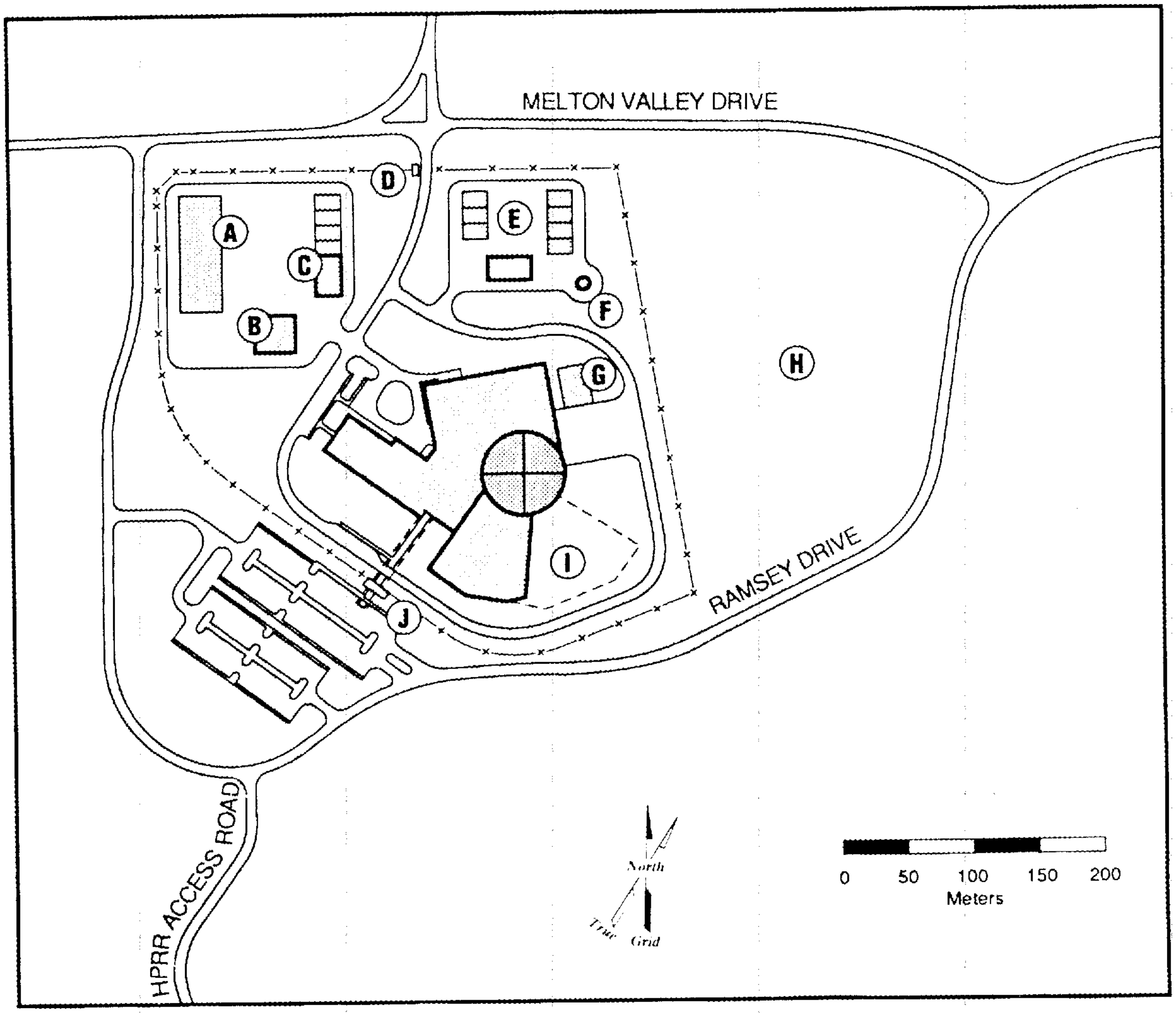

INDEX

Ⓐ PROCESS WASTE HANDLING AREA
Ⓑ DETRITIATION FACILITY
Ⓒ AUXILIARY COOLING TOWER/PUMP HOUSE
Ⓓ VEHICULAR PORTAL
Ⓔ REACTOR COOLING TOWERS/PUMP HOUSE
Ⓕ STACK
Ⓖ FILTER PITS
Ⓗ FUTURE DEVELOPMENT
Ⓘ GUIDE HALL EXPANSION AREA
Ⓙ PEDESTRIAN PORTAL

This conceptual layout is intended to demonstrate feasibility only; further study will be required to ensure that the final layout is integrated into the ORNL site development plans.

Fig. 7.2. Conceptual site layout.

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31. J. M. Loar, personal communication, November 16, 1988.

32. W. E. Manrod, personal communication, November 15, 1988.

33. D. M. Bradburn, personal communication, November 22, 1988.

34. R. R. Lee, personal communication, December 14, 1988.

35. John Hayter, Martin Marietta Energy Systems Internal Correspondence, December 13, 1988.

Appendix A

DOCUMENTATION OF INTERVIEWS

MEMORANDUM

TO: Boyd Maxon, Advanced Neutron Source Project

FROM: Brent Sigmon, SAIC

DATE: November 10, 1988

SUBJECT: Meeting with Bob Wendt, ORNL Facility Planning
ORNL Facility Plans and ANS Siting
November 8, 1988

Lou Arnold and I met with Bob Wendt to discuss the Candidate Areas. Bob noted that the ANS is not large enough to provide all its own services and will depend on the Laboratory for such services as general administration, motor pool, visitor reception, and facility maintenance. Locating the ANS farther away from the Laboratory than Melton Valley would not only make these services more costly, but would also hinder its integration into the Laboratory culture. The farther away from X-10, the more it will "feel" like a separate entity. (He also noted that the growth of the city's residential area westward along the Turnpike makes the Interchange Area less desireable. We should check with Mr. Pat Nicholson, DOE's Real Property Mgr., for current boundaries and future sale plans.)

Bob also observed that the ANS is a 21st century facility; planning for its location should include a long-term vision of the Laboratory's future. If the ANS is to be the flagship facility for the Laboratory, perhaps leading a resurgence in nuclear research and spawning other related facilities and projects, then its location takes on additional significance. The location should be a showplace, and it should be large enough for future related projects. The reference site is not ideal for these purposes. The site is surrounded with and constrained by utility corridors, inactive reactors, waste burial sites, and other forms of contamination. The eastern end of the Melton Valley Candidate Area would afford easier access, more room, and more pleasant environs for the large number of expected visitors and users.

Use of an eastern site would require extending utilities (including the LLW collection line) eastward, but he notes that excavation to extend utilities into the reference site may also be expensive because of existing contamination.

Bob cautioned against tying this 21st century facility too tightly to existing mid-20th century ones. In particular, by the time the ANS is operational, the TPP will be 35 years old. Already, it needs significant upgrading (waste treatment, ventilation, mechanical systems, and hot cell manipulators). The economic viability of the isotope program is continually questioned; long-term reliance on the TPP may be imprudent. Building new isotope separation facilities next to the ANS reactor building may be a preferable alternative.

cc: Bob Wendt

SAIC MEMORANDUM

To: Boyd Maxon, Advanced Neutron Source Project

From: Tony Heitzman, SAIC Tony

Date: November 16,1988

Subject: Meeting with REDC Staff
ANS/REDC Interactions and ANS Siting
November 2, 1988

Steve Grady, Tony Heitzman, and Brent Sigmon of SAIC met with Les King, John Bigelow, and Fred Chattin of the Radiochemical Engineering Development Center (REDC), and Mike Harrington of the ANS projection team to discuss subject. In particular, we intended to identify the advantages and disadvantages of siting the ANS in Melton Valley relative to a more isolated location further from existing facilities. MMES gave us one handout on REDC/HFIR Interactions, a draft copy of Safety Analysis: TURF, Building 7930 (ORNL/TM-9505), and a draft copy of Safety Analysis: Transuranium Processing Plant, Building 7920, (ORNL/TM-7688).

Interactions: The REDC group anticipates that REDC would have the same operating relationship with the ANS as it has with HFIR. When operating, REDC receives approximately 1 shipment per year of transuranium element targets for processing and returns two or three shipments of recycled targets for irradiation. Two different (on-site) casks are used to transport these targets, but neither is a certified cask. Should the ANS be located outside of Melton Valley, it is expected that shipments between REDC and the ANS would have to be transported with certified casks. Procurement and certification of casks would involve substantial costs. In addition, a hydraulic rabbit line from the HFIR pool to a hot cell in 7920 is used to transfer small samples. Without this system, transporting samples with short half-lifes would require enormous casks because of the intense radiation. The REDC group feels that this system will also be needed with the ANS, especially so that cross-section experiments can be performed. Preferably, the rabbit system would be incorporated into the ANS as a pneumatic line. The rabbit system would be infeasible should the ANS be located outside of Melton Valley.

Services: Building 7920 was completed in 1966 and is still one of the most modern of its kind in the DOE complex. The REDC group expects the facility to serve throughout the lifetime of the ANS, although upgrade will be necessary, especially in the area of waste management. The major problem waste streams are liquid wastes that are currently handled by ORNL.

Items 5-11 of REDC/HFIR Interactions handout are services currently provided from HFIR which REDC needs but does not necessarily have to get from HFIR. These items should not impact siting considerations. However, the cost of replacing these services is of concern to ORNL and REDC.

Safety: In the siting process, the repercussions of an accident in the ANS or a nearby facility must be considered. (An evaluation of nearby facilities will be required in the Safety Analysis Report for the ANS). The overall view of the REDC staff is that an accident in REDC will not likely cause a release from HFIR (or ANS) and vice-versa. The REDC personnel explained that the most severe accident in the Transuranic Processing Plant (TPP) SAR refers to processes and materials that are no longer a part of TPP operations, thus the current overall TPP risk is reduced. In addition, the REDC staff explained that most of the radioactivity that could be released by an accident at REDC is filterable so that a filtered air supply to the ANS control room should provide adequate operator protection.

Should an accident occur in HFIR (or ANS), the REDC staff stated that operators in the REDC facilities are trained to simply leave the area. The REDC operations can be readily stopped and abandoned without requiring continuous control or monitoring.

cc: L.J. King
Mike Harrington

MEMORANDUM

TO: Boyd Maxon, Advanced Neutron Source Project

FROM: Brent Sigmon, SAIC

DATE: November 7, 1988

SUBJECT: Telecon with Larry Rackstraw, Y-12 Facility Planning
Y-12 Facility Plans and ANS Siting
October 31, 1988

Larry said that there are no current plans for Y-12 use of central and western Bear Creek Valley to serve its programmatic mission. The Oak Ridge Reservation Site Development Plan does identify a site just east of White Wing Road as a possible location should future Y-12 programmatic mission requirements require a greenfield site, and maintaining such future flexibility is important to Y-12 management. If this site were needed for another project, Y-12 management would want an alternative for future expansion to be identified and agreed to.

cc: Larry Rackstraw

MEMORANDUM

TO: Boyd Maxon, Advanced Neutron Source Project

FROM: Brent Sigmon, SAIC

DATE: November 23, 1988

SUBJECT: Telecon with Dennis Bradburn, MMES
Sludge Farming Experiment Plans and ANS Siting
November 22, 1988

I talked with Dennis about the locations proposed for sludge farming on the ORR. These are long term experiments in forest fertilization and a number of pine and hardwood site have been chosen for the experiments, including most of our Interchange Candidate Area, east of the SR 58/95 interchange. Some sites in Bear Creek Valley are also on the list, on both sides of White Wing Road. These are typically small sites near Bear Creek Road, and would not likely interfere with an ANS site in Bear Creek Valley. If we want to identify specific sites in Bear Creek Valley, I will obtain maps and other details of these experiments.

cc: Dennis Bradburn

MEMORANDUM

TO: Boyd Maxon, Advanced Neutron Source Project

FROM: Brent Sigmon, SAIC

DATE: November 11, 1988

SUBJECT: Meeting with Roger Clapp, et al, Environmental Sciences Div.
Hydrologic Concerns and ANS Siting
November 10, 1988

Tony Heitzman and I met with Roger Clapp, Dick Ketelle (Energy Div.), and Bill Boegley to discuss the Candidate Areas.

They noted that the complex geology of the Interchange Candidate Area and the competing uses for the Central Bear Creek Valley Area make them less desireable for ANS. The Interchange Area is also near a city residential growth area. They prefer the Melton Valley Area.

They question whether the 'reference' site is the best site in Melton Valley, noting that it was used as a disposal area for spoils during construction of HFIR, and that the spoils may contain hazardous materials, eg, asbestos. The site is contaminated from various leaks, spills, and other sources, and may be expensive to develop. They noted that an uncontaminated site could be found along the access road to the Health Physics Research Reactor, although the site should probably stay south of the old "contractor's burial area", which contains construction debris. If a site were chosen in this area, drainage into Melton Branch would be preferable to drainage into Bearden Creek, because of the existing baseline and monitoring network. Another possible Melton Valley site is the triangle NE of HFIR and NW of SWSA 7.

In a later telephone conversation, Mr. Clapp stated that he was sending a list of references that should be consulted about specific sites.

cc: Roger Clapp

MEMORANDUM

TO: Boyd Maxon, Advanced Neutron Source Project

FROM: Brent Sigmon, SAIC *Brent Sigmon*

DATE: January 25, 1989

SUBJECT: Meeting with Michael Knazovich, MMES Emergency Preparedness Coordinator, Joe Inman, ORNL Emergency Preparedness Coordinator, and Dick Brown, ANS Project, re Offsite Countermeasures and ANS Siting, January 24, 1989

We met to review the siting study and to discuss how the criterion about compatibility with offsite countermeasures, stated in the draft DOE policy statement on nuclear safety objectives (October 21, 1988), affects the analysis.

The emergency planning zone for the ORR extends nominally five miles from the existing facilities and encompasses all areas where the radiological dose after a severe accident could exceed 1 rem to the whole body or 5 rem to the thyroid. Given the buffer zone criteria already established for the ANS, any site on the ORR will be compatible with the existing planning zone. Offsite countermeasures do not appear to be a significant consideration in distinguishing among locations on the Reservation. However, offsite countermeasures should be explicitly recognized as a criterion and discussed in the site evaluation report.

We discussed the continued availability of SR 95 south over White Oak Dam as an evacuation route. They felt this was not a significant concern, as the issue of the dam's stability is about to be satisfactorily resolved and more than one alternative route is available in any case.

cc: Michael Knazovich
Joe Inman

MEMORANDUM

TO: Boyd Maxon, Advanced Neutron Source Project

FROM: Brent Sigmon, SAIC

DATE: December 21, 1988

SUBJECT: Meeting with Bob Holmes, MMES Engineering
Melton Valley Flood Studies and ANS Siting
December 12, 1988

I met with Bob Holmes to get copies of maps showing the Probable Maximum Flood (PMF) levels in the Melton Valley area. The basis for the maps is a PMF on the Clinch River plus Probable Maximum Precipitation in the White Oak Creek watershed. Backwater computations were then performed for White Oak Creek, but not for Melton Branch. These maps show PMF levels well below the three candidate sites in Melton Valley.

cc: Bob Holmes

MEMORANDUM

TO: Boyd Maxon, Advanced Neutron Source Project

FROM: Brent Sigmon, SAIC BSL

DATE: November 16, 1988

SUBJECT: Meeting with Ed Krieg, ORNL Engineering Site Manager
ORNL Facility Plans and ANS Siting
November 16, 1988

I met with Ed Krieg to describe our site selection study and to inquire about any engineering/facility planning issues and concerns related to the choice of a preferred area. He feels that the Melton Valley Candidate Area is superior to the others for provision of utilities and services, for plant protection, and for its isolation from the public mainstream. He noted the competition for the Central Bear Creek Valley Area, the proximity of the Interchange Candidate Area to the Oak Ridge Turnpike, and the public accessibility of the West Bear Creek Valley Area as factors against selection of either of them as our preferred area.

He suggested checking with several people for further details on the Melton Valley Area: Tony Wylie (6-3723), who has recently done flood studies in the White Oak Creek watershed; Ranaye Dreier, for details of the geology; and Steve Stow (4-7830) for a general knowledge of the area. He also suggested inquiring whether the hydrofracture activities have affected any of the possible sites in Melton Valley.

cc: Ed Krieg

MEMORANDUM

TO: Boyd Maxon, Advanced Neutron Source Project

FROM: Brent Sigmon, SAIC BSS

DATE: November 11, 1988

SUBJECT: Telecon with Roger Kroodsma, Environmental Sciences Div.
Endangered Animals and ANS Siting
November 7, 1988

I called Roger to discuss the ANS Candidate Areas and any concerns with endangered animals. He stated that the East Fork Poplar Creek Valley, including our Interchange Candidate Area, is a possible breeding area for the Indiana bat, an endangered species. He knows of no other potential problems with the ANS Candidate Areas.

cc: Roger Kroodsma

MEMORANDUM

TO: Boyd Maxon, Advanced Neutron Source Project

FROM: Brent Sigmon, SAIC

DATE: December 21, 1988

SUBJECT: Meeting with Rich Lee, Energy Div.
Geohydrology and ANS Siting
December 14, 1988

I met with Rich Lee to talk about the geohydrology of the Melton Valley area. Monitoring wells in and around the SWSA 7 area show groundwater depths generally 10 to 20 feet below the surface, depending on season and rainfall. For the southeastern corner of the candidate area, the depths are much shallower, ranging from 0 to 5 feet.

The SWSA 7 investigations found a discontinuity in the strike of outcrops on either side of the small streams where they join at the southern corner of the Central site, suggesting the possibility of a tear fault running through that site. The site is small and would not allow much flexibility in the location of structures.

cc: Rich Lee

SAIC MEMORANDUM

TO: Boyd Maxon, Advanced Neutron Source Project

FROM: Brent Sigmon, SAIC

DATE: November 16, 1988

SUBJECT: Meeting with Jim Loar, Environmental Sciences Division
Aquatic Habitats and ANS Siting
November 16, 1988

I met with Jim Loar to discuss the ANS site evaluation study, particularly to evaluate the candidate areas for their associated aquatic habitat impacts.

Jim stated that streams in both the Interchange and Central Bear Creek Valley Candidate Areas contain a small fish, the mountain redbelly dace, listed by the State of Tennessee as "wildlife in need of management". This fish does not exist in Melton Valley or in Grassy Creek, but a tributary of Bear Creek originating in the West Bear Creek Valley Candidate Area does contain the species. Presence of this species in a stream would not preclude development in the surrounding watershed but would require extra efforts for its protection.

He also noted the presence of Biological Monitoring and Abatement Program (BMAP) reference sites in Grassy Creek and in the upper reaches of Melton Branch. The BMAP is a requirement of the NPDES permits, requiring biological monitoring of disturbed and undisturbed sites to assess the extent of impacts on the disturbed sites. Development upstream of these reference sites would complicate this monitoring program but could probably be accommodated, particularly if ANS discharges were directed elsewhere (e.g., into the ORNL systems).

Jim stated that cooling tower blowdown is an aquatic problem everywhere cooling towers exist on the Reservation. The concentrations of biocide (generally chlorine) in the blowdown are toxic to the aquatic organisms. He expects that untreated blowdown would not be allowed from new towers.

The Interchange Area has been targeted as one of several sites to replace the existing sludge farm where Oak Ridge municipal sludge is disposed. Dennis Bradburn (4-7446) would know the current status.

Jim favors the Melton Valley Candidate Area because it is already developed. He also notes that loss of deer hunting area - to Boeing, Seward Norris, and the city industrial park - has been a concern and that use of any of the other Candidate Areas would further erode the hunting area.

cc: Jim Loar

MEMORANDUM

TO: Boyd Maxon, Advanced Neutron Source Project

FROM: Brent Sigmon, SAIC *BS*

DATE: November 16, 1988

SUBJECT: Meeting with Bill Manrod, MMES Engineering
Geological Engineering Concerns and ANS Siting
November 15, 1988

Lou Arnold and I met with Bill to discuss the geology of the Candidate Areas and any concerns with building ANS structures on those Areas. Bill urged that we avoid the Interchange Area. The Chickamauga formation, which underlies most of that area, is subject to cavities and not a good foundation for heavy structures. The intrusion of the syncline associated with East Fork Ridge further complicates the area.

Bill offered to walk over specific sites for us when we get to that stage, and I feel that we should accept that offer.

Bill also suggested some sources of more specific information:

Ray Daugherty (4-9638), latest flood studies and an overlay for map S-16A showing springs;

Allen Petree, old fills around HFIR;

Tony Wylie, maps of groundwater wells;

Fred Kalb, previous site selection studies (GCEP);

Dirk VanHoesen, plans for Central Bear Creek Valley; and

Tim Myrick or Dick Ketelle, information on Waste Area Groups (WAGs).

cc: Bill Manrod

To: Boyd Maxon

From: Tony Heitzman AGH

Date: November 8,1988

Subject: Summary of 11/4/88 Meeting Regarding Impact of ORR Waste Management Plans on ANS Site Evaluation

Steve Grady, Tony Heitzman, and Brent Sigmon of SAIC met with Lance Mezga and Beth McDougal of MMES to discuss subject. In particular, we intended to pinpoint those locations (which MMES has identified as future waste management sites) that coincide with areas we have determined to be viable candidates for the ANS facilities.

In Bear Creek Valley, Mr. Mezga stated that MMES plans to dispose of Class III and/or Class II wastes in the area east of White Wing Road. He also noted a location for disposal of mixed waste in the same general area and suggested we contact Steve Cross to get the exact location.

In Melton Valley, Mr. Mezga referred to a site known as SWSA 7 as an expected area for disposal of Class II waste. This area covers most of the candidate area east of the HFIR facility but does not conflict with the ANS reference site to the west. The Waste Handling Pilot Plant is to be located west of the reference site. Mr. Mezga knew of no other plans for new waste facilities in Melton Valley but suggested we verify this with either Tim Myrick or Gene McNeese.

Mr. Mezga stressed that the sites identified by MMES for future hazardous waste disposal have no good alternatives; they are virtually the only areas adequate for this purpose on the Oak Ridge Reservation.

cc: L. Mezga

MEMORANDUM

TO: Boyd Maxon, Advanced Neutron Source Project

FROM: Brent Sigmon, SAIC

DATE: November 11, 1988

SUBJECT: Telecon with Tim Myrick, ORNL Waste Management Staff
Waste Management Plans in Melton Valley and ANS Siting
November 10, 1988

I asked about any waste management plans that might affect location of the ANS in Melton Valley, besides the Waste Handling Pilot Plant, to be located west of our Candidate Area, and Solid Waste Storage Area 7, to be east of HFIR. He noted that there is a staging area for RCRA wastes awaiting shipment off-site, located along the road to the Health Physics Research Reactor, and that there may be a future need to expand this facility.

He sees no conflicts between the ANS and the existing and planned waste management activities in Melton Valley.

cc: Tim Myrick

MEMORANDUM

TO: Boyd Maxon, Advanced Neutron Source Project

FROM: Brent Sigmon, SAIC

DATE: December 21, 1988

SUBJECT: Telecon with Pat Nicholson, DOE Property Mgr.
Land Sale Plans and ANS Siting
November 21, 1988

I asked Mr. Nicholson whether any of the four candidate areas was near DOE property being considered for possible sale. He said that no sales were contemplated near those areas.

cc: Pat Nicholson

MEMORANDUM

TO: Boyd Maxon, Advanced Neutron Source Project

FROM: Brent Sigmon, SAIC

DATE: November 11, 1988

SUBJECT: Meeting with Pat Parr, NERP Mgr.
NERP Plans, Endangered Plants, and ANS Siting
November 8, 1988

Lou Arnold and I met with Pat Parr to discuss the ANS Candidate Areas. Pat's major concerns are endangered plants and the Natural Areas of the Reservation. She pointed out the Natural Areas along Bear Creek south of the SR 58 & 95 interchange.

She also noted that any NEPA documentation, even an ADM, now requires a survey for endangered species. For plants, this survey can only be performed in the spring or summer, so advance planning is required. An ADM may be required before any geologic site investigations; we should consult with Jim Rogers or Rich McLean on this. Pat can arrange for the survey for us.

In a later telephone conversation, I asked about the possible site in eastern Melton Valley, and whether its proximity to the Reference Area to the east was of any concern. Pat said that there was no conflict.

cc: Pat Parr

MEMORANDUM

TO: Boyd Maxon, Advanced Neutron Source Project

FROM: Brent Sigmon, SAIC

DATE: November 28, 1988

SUBJECT: Telecon with Jim Rogers, Ch., ORR Resource Management Organiz.
NEPA Documentation and ANS Site Investigations
November 15, 1988

I called Jim to ask whether an Action Decision Memorandum (ADM) would be required before site investigations (core drilling, etc.) could be performed on the site chosen for the ANS. He said that you should contact Johnnie Cannon or Rich McLean, who do EIS work, or Paul Rohwer or Helen Braunstein, who do ADM's for DOE, to get a definitive answer. He suggested that the prudent course is to get an endangered species investigation and an ADM done before any site disturbances.

cc: Jim Rogers

MEMORANDUM

TO: Boyd Maxon, Advanced Neutron Source Project

FROM: Brent Sigmon, SAIC

DATE: November 11, 1988

SUBJECT: Meeting with Merwyn Sanders, Y-12 Environmental Staff
Archeological Concerns and ANS Siting
November 9, 1988

I met with Mr. Sanders to see if there were any archeological concerns not covered by our screening criterion. He saw no obvious conflicts with any of the Candidate Areas. The known sites are documented in ORNL/TM-4694 and -5811, which cover prehistoric and historic sites, respectively.

He offered to walk over our preferred site once it has been chosen, to field check whether any sites would require additional surveys. He will be retiring around January 1, so we should schedule this walkover before Christmas.

cc: M. Sanders

MEMORANDUM

TO: Boyd Maxon, Advanced Neutron Source Project

FROM: Brent Sigmon, SAIC

DATE: November 7, 1988

SUBJECT: Telecon with Shields Smith, ORNL Plant Protection
ORNL Security Issues and ANS Siting
November 7, 1988

Smith said there were no security issues that would affect the site choice. Location of the ANS in Melton Valley is neither advantageous nor disadvantageous relative to a location elsewhere.

cc: Shields Smith

MEMORANDUM

TO: Boyd Maxon, Advanced Neutron Source Project

FROM: Brent Sigmon, SAIC

DATE: November 7, 1988

SUBJECT: Telecon with Pete White, MMES Safeguards and Security
Security Issues and ANS Siting
October 31, 1988

White's only concern for a Bear Creek Valley site is that the facility stay outside Y-12's "229" boundary. The western end of this boundary is just west of the burial grounds. He suggested that I talk to Larry Rackstraw about any Y-12 facility plans in Bear Creek Valley. He also suggested that I should consult with Shields Smith about any ORNL security concerns in Melton Valley.

cc: Pete White

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