DOE/RW-002

Nuclear Waste Policy Act

Screening and Iden of Sites for a Proposec red Retreivable Storage

April 1985

U.S. Department of Energy
Office of Civilian Radioactive Waste Management

DOE/RW-0023

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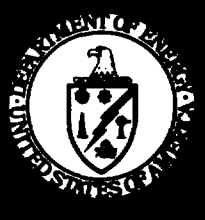

Screening and Identification of Sites for a Proposed Monitored Retreivable Storage Facility

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Office of Civilian Radioactive Waste Management

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1.0 EXECUTIVE SUMMARY

The Director, Office of Civilian Radioactive Waste Management (OCRWM), Department of Energy (DOE), has identified the Clinch River Breeder Reactor site, the DOE Oak Ridge Reservation and the Tennessee Valley Authority (TVA) Hartsville Nuclear Plant site as preferred and alternative sites, respectively, for development of site-specific designs as part of the proposal for construction of an integrated Monitored Retrievable Storage (MRS) Facility. The proposal, developed pursuant to Section 141(b) of the Nuclear Waste Policy Act of 1982, will be submitted to Congress in January 1986. The Director expects to propose to Congress that an MRS be constructed at the preferred site. His judgment could change based on information to be developed between now and January 1986. The decision to construct an MRS facility and final site selection are reserved by Congress for itself.

The Director's judgment is based on the results of a rigorous site screening and evaluation process described in this report. The three sites were selected from among eleven sites evaluated in detail. The eleven sites are located within a preferred geographic region where an MRS facility can significantly reduce spent fuel shipment miles and related impacts. They are either owned by the Department of Energy or have been docketed with the Nuclear Regulatory Commission (NRC) for licensing under 10 CFR Part 50 as production and utilization facilities. Each site has at least 1100 available acres without known land-use conflicts such as operating or planned commercial nuclear power plants.

The eleven sites present different conditions and requirements for construction, engineering, environmental control, infrastructure improvements, and regulatory compliance. The services and institutions of communities surrounding each site would experience different potential changes as a consequence of constructing and operating an MRS facility. These differences allow the Department and Congress to exercise discretionary preferences in choosing from a wide range of technically acceptable alternatives.

It is a matter of judgment as to which sites are most appropriate for detailed consideration as candidate MRS sites. The Director exercised his

judgment about the sites at which an MRS facility could successfully be deployed. Nine of the eleven sites present attractive opportunities for development as MRS sites.

The Department believes that an MRS facility could be constructed and operated safely with minimal environmental impacts at the three sites identified. The extensive information available for each site and judgments by the NRC of site suitability for construction of nuclear reactors at Clinch River and Hartsville give high confidence in this conclusion. The information available is more than adequate to support identification of candidate sites for detailed evaluation. Further, the quality of the information will result in a high quality and comprehensive environmental assessment to accompany the Department's proposal to Congress.

The three sites identified as candidate MRS sites were selected from among those sites owned by the federal government. After detailed consideration, the Director found that the privately owned sites do not present additional features which overcome the advantages of current federal ownership. Federal ownership reduces potential for conflict regarding use of the site and assures access for additional investigations. The Director believes that land should not be withdrawn from private domain for the MRS unless it is clearly superior to available federal lands.

The Clinch River Breeder Reactor site, owned by the Tennessee Valley Authority, was identified as the preferred site. It has several particularly desirable features including: 1) federal ownership and control by the Department of Energy; 2) particularly good transportation access (five miles to the nearest interstate highway and direct rail access); 3) site characteristics and current data base judged by the NRC in 1983 as sufficient for granting a limited work authorization for the now cancelled breeder reactor; and 4) a technical community in the vicinity of site which can provide experienced nuclear facility support functions.

The DOE Oak Ridge Reservation and the Hartsville Nuclear Plant site were chosen as alternative candidate MRS sites. All three sites are located within the State of Tennessee. The Department will assure that the State of Tennessee has adequate opportunity to understand the technical and nontechnical effects

of MRS development. In that the three sites are all in a single state, this can be accomplished without diverting attention to interstate procedural or programmatic parity. The decision to identify sites within a single state came only after determination that none of the other federal sites carried with them characteristics (technical, environmental or land use) which made them superior to the three sites identified.

It is expected that the State of Tennessee will reach independent judgments about the Department's program and rationale for an MRS facility. The Department will help facilitate independent state review by a program of grants and extensive information transfer. The scope and schedule of this program will be developed cooperatively with Tennessee. Through this interaction, the Department will work to resolve any questions or concerns by Tennessee regarding MRS authorization or deployment. A formal consultation and cooperation agreement will be negotiated with Tennessee should Congress authorize construction of the MRS at Clinch River or one of the alternative candidate MRS sites.

1.1 BACKGROUND

Within the context of the waste management system currently being evaluated by OCRWM, the integrated Monitored Retrievable Storage (MRS) Facility, if authorized by Congress, will:

1. receive spent fuel from most commercial power reactors;
2. consolidate and package spent fuel; and
3. store fuel temporarily pending shipment to the repository.

The MRS program was developed pursuant to the Nuclear Waste Policy Act of 1982 (NWPA or the Act) which directs the Department to "...complete a detailed study of the need for and feasibility of, and to submit to Congress a proposal for, the construction of one or more monitored retrievable storage facilities for high-level radioactive waste and spent nuclear fuel..."[1] The Act directs that the proposal include site-specific designs. Further, the proposal is to include "...at least three alternative sites and at least five alternative

[1]Public Law 97-425, 96 Stat. 2201, 42 U.S.C. 10101 et seq.

combinations of such proposed sites and facility designs..." as well as a recommendation of "...the combination among the alternatives that the Secretary deems preferable..."

Early planning for an MRS facility, as described in DOE's 1984 Draft Mission Plan, assumed it would serve as a backup facility to the repository. In that role, a backup MRS would have been built to provide storage of wastes only if a repository were significantly delayed. However, in evaluating the entire nuclear waste management system, DOE has identified important advantages to building an integral MRS facility as a receiving and handling facility to complement a repository. Deploying an MRS facility improves federal radioactive waste disposal capability through added flexibility, improved transportation arrangements, and improved system integration.

Pursuant to the NWPA, site-specific designs will be developed for each of the three sites. In addition, an Environmental Assessment will evaluate the impacts of developing an MRS for each of the site-design combinations, and according to the Act, will be based on available information. A preliminary analysis of the need for and feasibility of an MRS facility has been issued.[1]

1.2 SUMMARY OF THE SITING PROCESS

The primary considerations in identifying a preferred and two alternative sites for an MRS facility are:

1. to locate places where an MRS facility can be constructed and operated safely with minimal adverse impacts on the local community or environment, and
2. to enhance the role of an MRS facility as an integral part of the federal nuclear waste disposal system.

To identify sites which best meet these characteristics, the Department employed a four-step screening and selection process. The process is depicted in Figure 1 and described in detail in Sections 2-5.

[1] The Need for and Feasibility of Monitored Retrievable Storage--A Preliminary Analysis, DOE/RW-0022, Department of Energy, April 1985.

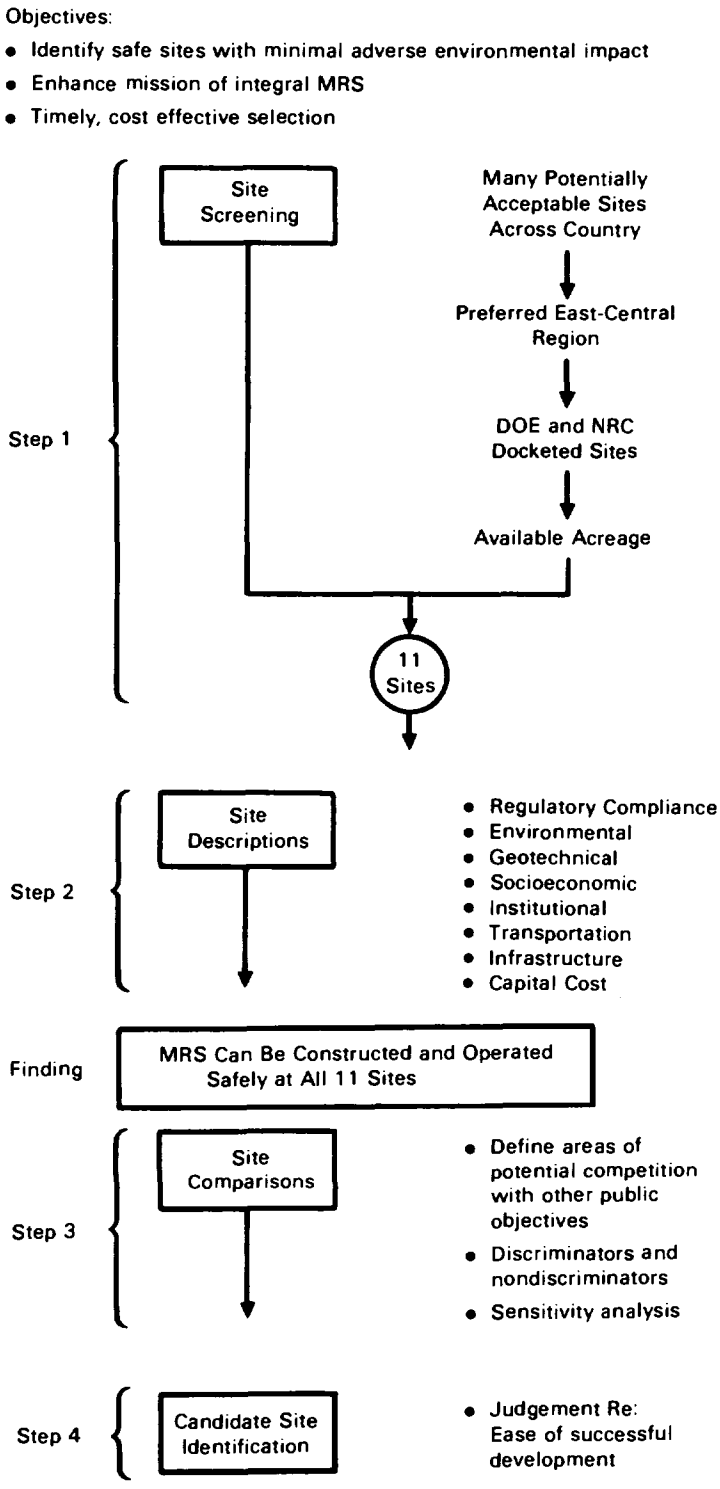


FIGURE 1. Process for Site Screening and Identification of Candidate MRS Sites

In the first step of the siting process, screening factors were developed and applied to identify potentially acceptable MRS sites (see Figure 2 and Section 2 for details). An MRS facility relies on engineered features to assure safe operation so potentially acceptable sites could be located throughout the United States. As a result of the application of screening factors, the Department identified eleven sites for review and comparison. The eleven sites are located within a preferred siting region (see Figure 3) in the east-central portion of the country. Locating an MRS within this region will reduce total shipment miles[1] of spent fuel through an MRS facility to a repository by 10 to 60 percent of the shipment miles that would occur if fuel were shipped directly from reactors to the first repository. Locating an MRS in the region generally ensures a greater reduction in shipment miles than locating it outside the region. While reducing overall transportation requirements, locating

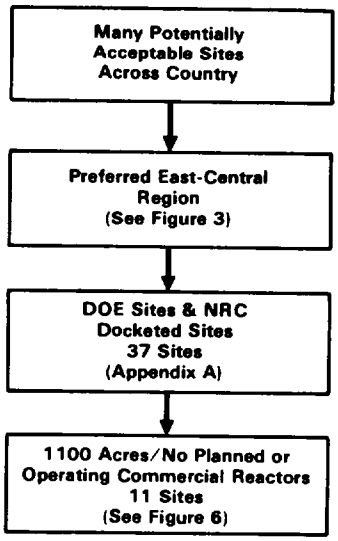
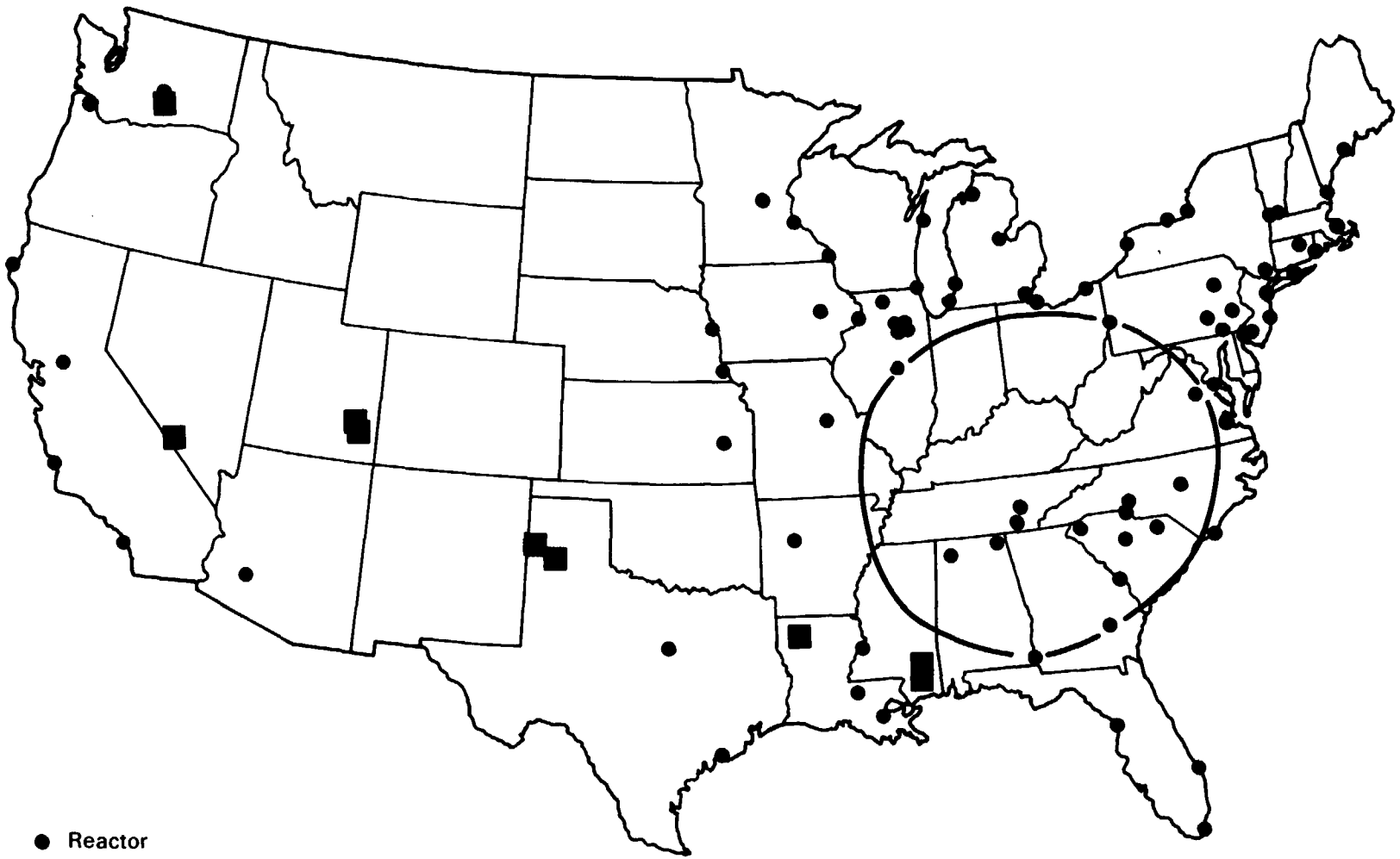


FIGURE 2. Screening for Potentially Acceptable MRS Sites

[1]Shipment miles are the number of miles traveled by each shipment of spent nuclear fuel from origin to destination. Thus, total shipment miles refers to the total number of miles all shipments travel over the life of the facility. A shipment may consist of as little as a single reactor assembly carried by a single truck cask or 60 assemblies carried by 5 rail casks on the same train.



● Reactor

■ Site Under Consideration for First Repository

The preferred region is that area of the country where locating an MRS for receipt and packaging of spent fuel and shipment by rail to the repository would result in total shipment miles within 20% of the minimum achievable.

FIGURE 3. The Preferred Region for Siting a Monitored Retrievable Storage (MRS) Facility

an MRS in the region also redistributes shipments away from some transportation corridors and into others. If an MRS is approved by Congress, shipments will be concentrated in the state in which the facility is located and some adjacent states. Any impacts from this concentration are expected to be minimal. They would be offset by reductions in total shipment miles.

Sites in the region were identified which are either owned by the DOE and are currently used for nuclear activities or are sites for which applications have been docketed with the Nuclear Regulatory Commission (NRC) for licensing as production or utilization facilities (under 10 CFR Part 50). Sites in these categories have extensive existing site data bases (environmental and safety information) which are particularly applicable for assessing site suitability as an MRS site. In addition, sites in either of these categories are expected to be more suitable for nuclear activities than sites chosen at random or sites chosen for specific physical characteristics.[1]

Finally, only those DOE owned and NRC docketed sites which have 1100 available acres without known use conflicts were evaluated further. There are eleven such sites. The 1100-acre criterion is a conservative estimate of the land required for developing an MRS facility, allowing sufficient flexibility to the Department and Congress to choose alternative technologies for storage and for storage expansion, if needed. Sites which have operating nuclear reactors or reactors under construction were not considered further because of potential land-use conflicts.

The eleven sites include six cancelled commercial light water reactor sites; the Clinch River Breeder Reactor site and the Barnwell Reprocessing Plant site, both licensed for construction by the NRC; and three DOE sites. The eleven sites are listed below in alphabetical order:

[1]The Department considered evaluating only DOE or federally owned sites but decided that it could not judge, a priori, that privately owned sites did not present clear technical or other advantages. Once the analyses were completed, it was determined that while the privately owned sites were attractive, they did not present additional features which outweighed the advantages of federal ownership.

Name	State	Owner[1]
Alan R. Barton Nuclear Power Plant	Alabama	Alabama Power Company
Barnwell Reprocessing	South Carolina	Allied Chemical Nuclear Products
Cherokee Nuclear Station	South Carolina	Duke Power Company
Clinch River Breeder Reactor	Tennessee	Project Management Company/ Tennessee Valley Authority
Hartsville Nuclear Plant	Tennessee	Tennessee Valley Authority
Oak Ridge Reservation	Tennessee	Department of Energy
Paducah	Kentucky	Department of Energy
Perkins Nuclear Station	North Carolina	Duke Power Company
Phipps Bend Nuclear Plant	Tennessee	Tennessee Valley Authority
Savannah River Plant	South Carolina	Department of Energy
Yellow Creek Nuclear Plant	Mississippi	Tennessee Valley Authority

[1]Non-federal owners are those listed in the application docketed by the NRC.

In the second step of the siting process, the eleven sites were thoroughly analyzed by a task force of specialists in eight areas important to evaluating site suitability:

1. ease of regulatory compliance
2. existing environmental setting
3. geotechnical site characteristics
4. socioeconomic setting and changes which might be induced by MRS development
5. institutional and administrative structure of the state
6. local transportation characteristics
7. access to physical infrastructure (e.g., utilities)
8. capital cost of construction

The data base for each site was drawn from the public record. The site information is substantial and judged adequate for identification of candidate

sites. The site data bases include the same information or types of information used by NRC in evaluating site characteristics.[1] The Department concluded, as a result of these descriptive evaluations, that there is a high likelihood that an MRS could be developed in compliance with health, safety, and environmental requirements at any of the eleven sites. This result is a confirmation of the validity of the screening process employed.

In the third step of the siting process, an analysis was performed to identify the potential for delay or other problems that might be encountered in developing an MRS at each of the eleven sites. Delay was considered possible if MRS development had the potential to compete with known land use, environmental, or other public objectives as expressed in NRC and EPA rulemaking proceedings or in federal environmental laws. From that analysis, the Department concluded that an MRS could be developed successfully at nine of the eleven sites. The Paducah and Yellow Creek sites each presented potential land use and environmental conflicts that were greater than those presented at the other nine sites.

In the fourth step of the siting process, the OCRWM Director, in consultation with his Executive Assistant, Associate Directors and their Deputies, selected from among the sites those at which he believed an MRS facility could most successfully be deployed. Among the factors considered were: the desirability of existing federal ownership; existing proximate nuclear infrastructure and an experienced technical community; current, substantial data bases; simplicity of construction at the site; low relative capital cost; and proximity to existing interstate highway and rail networks. The Director identified the Clinch River site as the preferred site, and the DOE Oak Ridge Reservation and the TVA Hartsville Nuclear Plant site as alternative sites for further evaluation.

The following sections describe the site screening and identification process employed. Detailed technical reports are available that describe both the analysis involved in identifying the preferred region for siting the

[1]The NRC's judgment considers the compatibility of facility design, construction techniques and site characteristics. For MRS analyses, site characteristics alone were assessed since designs are in the early conceptual stages.

MRS[1] and the data base and descriptive analysis of the eleven sites.[2] In addition, the Department has prepared a preliminary analysis of the need for and feasibility of constructing an MRS.[3]

Site-specific designs for the three sites identified through this process will be developed for each of two storage concepts--sealed storage cask and field drywell. An environmental assessment will be prepared for the site/design combinations. The designs and an environmental assessment will be prepared during the period April to December 1985. In addition, the Need and Feasibility Study will be updated and refined based on information developed and analyses conducted during this period. These documents will support the Department's proposal to Congress in January 1986 to construct an MRS.

During this entire period, the Department will be undertaking an extensive program of interaction with the state of Tennessee and local governments and citizens affected by developing an MRS at any of the three sites. The explicit purpose of this intergovernmental and public interaction program is to transfer programmatic and technical information sufficient for these entities to form independent judgments about the merits of the Department's proposal before the proposal is submitted to Congress. The scope of and approach to the interaction program will be developed in cooperation with the governments involved.

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[1] Siting of an MRS Facility: Identification of a Geographic Region that Reduces Transportation Requirements, G. M. Holter and J. L. Braitman, PNL-5424, April 1985, Pacific Northwest Laboratory.

[2] Monitored Retrievable Storage Facility Site Screening and Evaluation Report, Draft, April 1985, Golder Associates, Inc., et al.

[3] The Need for and Feasibility of Monitored Retrievable Storage--A Preliminary Analysis, DOE/RW-0022, Department of Energy, April 1985.

2.0 SITE SCREENING

Selecting a site for any facility involves setting priorities to help distinguish which parcels of land can help achieve the objectives of the facility or associated program. Establishing appropriate screening factors can help to eliminate large tracts of unsuitable or less desirable lands without having to perform detailed and costly evaluations. Screening factors can also be used to identify lands which are more likely to achieve the desired goals.

The primary objectives in identifying a preferred and two alternative sites for an MRS facility are: 1) to locate places where an MRS facility can be constructed and operated safely with minimal adverse impacts on the local community or environment, and 2) to enhance the role of an MRS facility as an integral part of the federal nuclear waste disposal system.

The Department identified a preferred and two alternative sites as required in Section 141(b) of the NWPA. The four-step process depicted in Figure 1 was employed. The first step--site screening--was designed to help ensure that the above objectives were fulfilled in a timely and efficient manner.

The site screening process involved:

1. the conclusion that potentially suitable sites could be found throughout the country;
2. identifying a preferred east-central region in which locating an MRS would reduce transportation impacts;
3. identifying within the region potentially suitable sites -- DOE sites and sites docketing with the NRC for licensing under 10 CFR 50; and
4. narrowing for further evaluation to those sites with 1100 available acres without site-use conflicts.

These factors were selected in order to meet the Department's objectives for MRS siting.

The screening factors were selected after considering several alternative sets of screening factors. For example, factors could have been employed to achieve remoteness or, alternatively, proximity to interstate highway corridors. If these objectives had priority, maps could be used to identify population or highway corridors across the country. Lands a certain distance from highways or with population densities below a certain threshold could then be identified for detailed consideration. Similarly, if certain physical features were considered to be important to the engineering integrity of the site, maps could be developed which identify those features. Annual rainfall, depth to groundwater or seismic zones are examples of physical features considered. Another approach to site screening is to be fully exhaustive and evaluate each parcel of land on which there is no existing site-use conflict. These types of screening factors were considered to be less appropriate than the factors employed when the two objectives listed above were considered.

As a different and more narrow siting approach, the Department considered restricting potential sites to those owned by the Department, or alternatively, facility sites owned by the federal government. These sites are likely to have better data bases than randomly selected sites, since federally owned sites on which construction has been considered have site data sufficient for design of the proposed facility. Federal ownership carries with it significant benefits in terms of access, control and construction schedules. Importantly, the Department would prefer not to withdraw lands from private ownership for the MRS unless these lands are clearly superior to other lands available. A priori, the Department could not, then, follow the more narrow approach of looking only at federal sites.

2.1 IDENTIFICATION OF A PREFERRED SITING REGION

For safety and environmental protection, the MRS facility relies on engineered isolation of the radioactive materials; thus, the performance of an MRS

facility is relatively independent of the specific conditions of the site.[1] In this respect, an MRS facility is quite different from a geologic repository, which is strongly dependent on site conditions for successful performance. Because of this relative independence from specific site conditions, an MRS facility could be built and operated safely and with minimal impacts at any of a large number of sites throughout the United States.

The goal of enhancing the role of an MRS as an integral part of the federal nuclear waste management system, then, becomes an important consideration in identifying desirable parcels of land on which to develop an MRS. Reducing transportation impacts, achieved through reducing shipment miles, is a logical area in which major system improvements can result from location of an MRS. As shown in Figure 4, transportation activities comprise a major portion of the

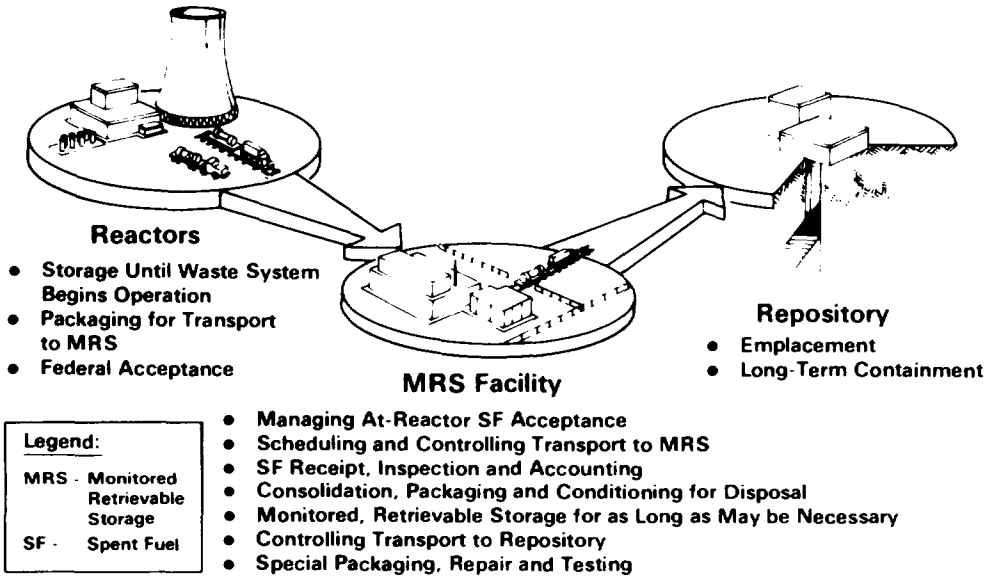


FIGURE 4. Distribution of Waste Management Functions in a System with an Integrated MRS Facility

[1]The "MRS Reference Site Environmental Report" (to be published) supports a conclusion that environmental impacts are relatively insensitive to physical site characteristics. The small differences in expected environmental and socioeconomic impacts are primarily population dependent.

federal waste disposal operations. The transportation of spent fuel is potentially of interest to the largest number of individuals. In commenting on past and current DOE plans and activities, interested groups and individuals have repeatedly identified transportation as a concern regarding the waste management system.

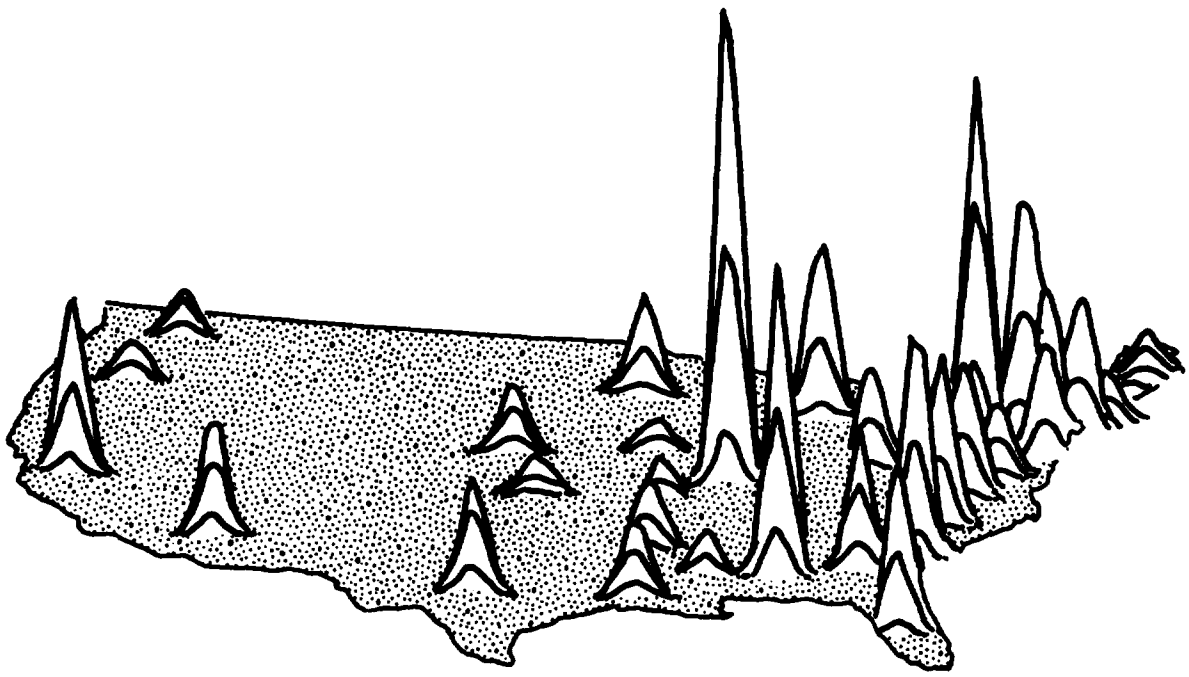
The distribution of reactors (and spent fuel), the location of potential first repository sites, and the functions of the proposed MRS facility are factors in finding lands on which locating an MRS will significantly reduce shipment miles. The majority of reactors and spent fuel is located in the midwest and eastern parts of the U.S. The first repository locations under consideration are all located in a crescent-shaped region in the western, southwestern and southern portions of the country (see Figure 5). Should Congress authorize construction, an MRS facility would combine a large number of relatively smaller shipments into larger and fewer shipments. Thus, locating an MRS facility near the majority of reactors is expected to present system advantages by reducing the total number of shipment miles.

2.1.1 Sensitivity Study

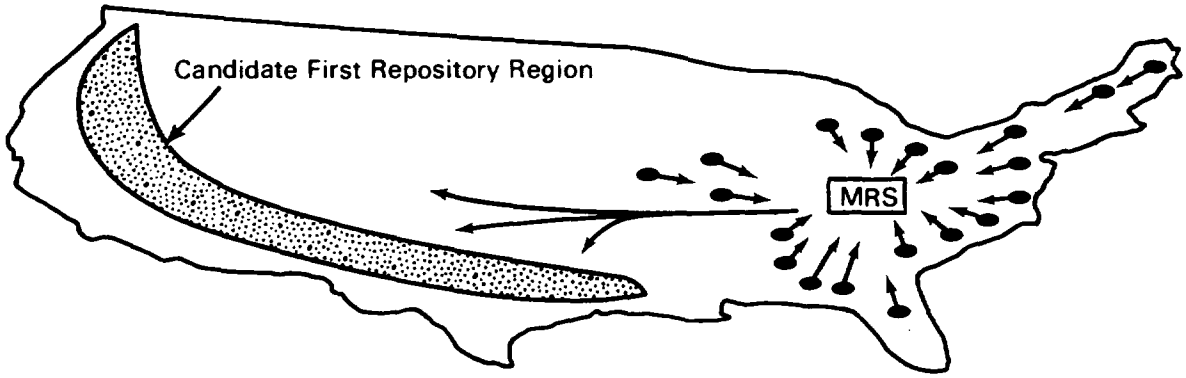
A study was undertaken as part of the site screening and evaluation activities for the MRS program to determine: 1) whether a programmatic objective of reducing total spent fuel shipment miles, when applied, would result in identification of a geographic region appropriate for siting an MRS facility; and 2) if so, how sensitive the shape and location of the region and reduction of total shipment miles would be to variations in waste management system logistics.

A number of decisions that will affect the logistics characteristics of the federal waste management system are yet to be made. Because these logistics considerations will, in turn, affect the number and geographic distribution of spent fuel shipments within the waste management system, a number of possible combinations of logistics factors were examined.

For each combination of logistics factors that was analyzed, calculations were made to identify contours of total shipment miles for potential



Weighted Distribution of First 70,000 MT of Spent Fuel



Movement of Spent Fuel

FIGURE 5. Spent Fuel Logistics

MRS locations. The region outlined by these contours varied in location, size, and shape depending on the specific combination of logistics factors considered.

The following variations in logistics factors were considered:

- repository location (9 potential sites for the first repository)

- lifetime spent fuel throughput of the MRS facility (from 70,000 MTU to all spent fuel projected to be discharged from currently planned or operating reactors, ~100,000 MTU)
- degree of volume reduction from spent fuel rod consolidation at the MRS facility (from no volume reduction to a 2:1 reduction)
- spent fuel shipping cask capacities (current casks versus DOE generic casks)
- use of single-cask or multiple-cask shipments (up to 10 casks/train)
- transportation modes to be used (truck and rail).

Other logistics factors, such as receipt schedules for the spent fuel shipments, were not considered in these analyses. Although they may affect the operation of the waste management system, they are not of importance in determining total spent fuel shipment miles.

For this analysis, spent fuel was assumed to move through the system by rail whenever possible. However, some reactors are not equipped to handle the larger rail casks for spent fuel transport. Therefore, these reactors (~30%) are realistically limited to shipping spent fuel to the MRS facility by truck.

2.1.2 Study Results

Based on the analyses performed, a geographic region was identified (see Figure 3) within which locating an MRS facility will reduce total shipment miles in the integrated waste management system. Total shipment miles throughout the waste management system are reduced because functions and operations performed at the MRS facility will combine fuel into fewer shipments leaving the MRS facility for the repository than are received at the MRS facility from the reactors. There are three reasons for this:

1. Spent fuel assemblies arriving at the MRS facility in truck casks are shipped out in rail casks with capacities 6 to 9 times greater than the truck casks.
2. Spent fuel assemblies can be disassembled and consolidated into a smaller volume at the MRS facility, further increasing the amount of spent fuel in outbound casks.

3. Rail shipments moving between the MRS facility and the repository can be optimized to reduce shipments by shipping multiple casks per train.

None of these operations will decrease the safety of the system. Instead, the reduction in shipment miles should reduce risk from transportation.

For any single combination of repository location and waste management system logistics factors, the MRS facility location that would result in the lowest achievable total shipment miles lies along a line between the repository location and the centroid of the spent fuel shipments from the individual reactors. Contours can be drawn to show how total shipment miles increase with movement away from the minimum point. These contours define geographic regions within which locating an MRS facility would keep total shipment miles within a given percentage of the lowest achievable total.

If the MRS facility performs no fuel-combining function (e.g., spent fuel rod consolidation, multiple-cask shipments, conversion of truck shipments to rail shipments, etc.), the location resulting in minimum total shipment miles is at the potential repository site. As functions are added to the MRS facility to combine the incoming fuel into fewer outgoing shipments, the point which minimizes total shipment miles moves toward the centroid of the shipments from the reactors, and the total-shipment-mile contours become closer together.

For all currently feasible combinations of logistics factors, including the different possible first repository locations, a composite "preferred" siting region was defined by the intersection (i.e., overlapping) of the individual 20% regions[1] for each combination of logistics factors. This composite "preferred" siting region (shown in Figure 3), which is somewhat smaller and more circular than the region that would be identified for any single combination of logistics factors, is located in the central-eastern portion of the U.S. Within the preferred region the variability in total shipment miles is

[1] For each system configuration, the 20% region is the contour containing all lands on which locating an MRS would reduce shipment miles to within 20% of the lowest mileage achievable for that configuration.

less than 20% of the lowest achievable total for all currently considered system logistic options which include an integral MRS facility. These options include:

- any first repository location currently under consideration;
- no consolidation of spent fuel at the MRS, or consolidating fuel and related hardware down to half its current volume;
- use of multi-cask or single-cask train shipments;
- use of current or future licensed transport casks; and
- shipment of fuel from western reactors either through the eastern MRS facility or to a western facility (a second, smaller MRS facility or the first repository).

While reducing overall transportation requirements, locating an MRS in the region also redistributes shipments away from some transportation corridors and into others. If an MRS is approved by Congress, shipments will be concentrated in the state in which the MRS facility is located and in some adjacent states. Any impacts from this concentration are expected to be minimal. They would be offset by reductions in total shipment miles.

The reduction in total shipment miles that can be achieved depends upon 1) the ratio of incoming and outgoing shipments, and 2) the distance between the centroid of spent fuel shipments from the reactors and the potential repository site. The greater this ratio and this distance, the larger the reduction in total shipment miles.

For a system with both truck and rail shipments from reactors to the MRS facility and only rail shipments from the MRS facility to the repository, the range of achievable reductions in total shipment miles is from about 6% to about 60% of the total shipment miles that would occur in a system without an MRS facility. Table 1 shows a comparison of total shipment miles for sample combinations of waste system logistics factors. The smallest reduction is for 1) an MRS facility with no fuel-combining functions other than the exclusive use of rail shipments from the MRS facility to the repository (i.e., truck shipments will only be used from some reactors to the MRS facility), and

TABLE 1. Comparison of Total Shipment Miles for Selected Combinations of Waste System Logistics Factors[a]

System Parameters	Northwest U.S. Respository		Southeast U.S. Repository	
	Total Shipment Miles	% Savings Compared to System Without MRS	Total Shipment Miles	% Savings Compared to System Without MRS
No MRS Facility in System[b]	1.51×10^8	--	6.74×10^7	--
MRS Facility (Mixed Shipments In/Rail Shipments Out)[c]	1.05×10^8	30	6.31×10^7	6
MRS Facility with 1.5:1 Rod Consolidation	8.81×10^7	42	5.97×10^7	11
MRS Facility with 2:1 Rod Consolidation	7.90×10^7	48	5.77×10^7	14
MRS Facility with No Rod Consolidation, 3 Casks Per Shipment to Repository	7.02×10^7	54	5.63×10^7	17
MRS Facility with 2:1 Rod Consolidation, 5 Casks Per Shipment to Repository	5.59×10^7	63	5.17×10^7	23

(a) Total shipment miles shown are based on the use of current-generation shipping casks.
(b) Spent fuel shipped directly from reactors to repository.
(c) For this and all following cases, all shipments are assumed to be by rail except from those reactors lacking rail-cask handling capabilities.

2) an assumed first repository located in the southeastern U.S. The greatest reduction is for 1) an MRS facility that uses all of the fuel-combining functions (i.e., spent fuel rod consolidation, multiple-cask shipments to the repository) and 2) an assumed first repository located in the northwestern U.S.

2.2 IDENTIFICATION OF SITES FOR CONSIDERATION AS POTENTIAL MRS SITES

The goal of the siting activities undertaken was to identify sites which are "among the best that could reasonably be found."[1] A method was needed to identify lands within the preferred region which were either unacceptable for development of an MRS or which were particularly desirable for development of the facility. The Department chose the second approach. Factors were identified which were likely to point out particularly desirable lands rather than to develop exclusionary criteria to screen out undesirable lands. In employing this approach, large amounts of land were eliminated from consideration even though acceptable sites could be found among such lands. No land was determined to be unacceptable; rather, the process quickly focused upon sites which were expected to be especially desirable and for which detailed information was available.

2.2.1 DOE-Owned and NRC-Docketed Sites

For identification of potential sites, the dominant screening factor was the ability to judge the suitability of the site for development of a nuclear facility. The ability to judge site suitability depends upon availability of site data. Two sets of sites have particularly appropriate and available data: 1) sites docketed with the Nuclear Regulatory Commission for development of production and utilization facilities (e.g., nuclear reactors), and 2) lands owned by DOE and used for nuclear activities.

Very high quality data especially relevant to construction of a nuclear facility is available for this set of sites. For the NRC docketed sites it is data that NRC, after years of rulemaking and refinement, judged important for determining site suitability for nuclear reactor construction. An almost

[1] NRC statement of consideration accompanying revisions to 10 CFR Part 51 (49 FR 9354).

equivalent data base is available for DOE sites and includes the information the Department has assembled for designing, constructing, or operating DOE nuclear production and utilization facilities. Substantial investments have already been made on these lands to determine whether they are suitable for nuclear development, including how well nuclear development fits with local values and objectives.

All NRC-docketed and DOE-owned sites in the region have publicly available site documents including environmental documentation or reports, safety analysis reports, or NRC findings regarding site characteristics. The availability of this data allows reasonable judgments about site suitability to be made early in the process before sites are selected for detailed evaluation. In addition, it saves several million dollars and one to two years in data gathering and site evaluation activities.

Those sites in the region which have already received NRC permits to begin construction of reactors or other utilization and production facilities carry with them particular confidence regarding suitability as potential MRS sites. The NWPA makes it clear that the MRS facility, if authorized by Congress, must receive an NRC license in order to operate. The NRC has indicated that the MRS facility would be licensed under 10 CFR Part 72. In response to comments that licensed reactor sites be automatically pre-qualified as acceptable for construction and operation of Part 72 facilities, the Commission stated that, "while a site that has undergone a full safety and environmental review and has been approved for a Part 50 facility is likely to be found acceptable for a properly designed ISFSI (Independent Spent Fuel Storage Installation), the pre-qualification of sites licensed under Part 50 without review in relation to the proposed design of the ISFSI does not seem prudent [emphasis added]." (See 45 FR 74693.) Thus, while prior consideration by NRC is not the same as "banking" a site, a site considered for a Part 50 facility (e.g., nuclear power plant or fuels reprocessing plant) is likely to be found acceptable for a properly designed MRS facility.

Granting of a construction permit by NRC implies that no conditions were found at the site which were unacceptable to NRC. In a licensing action, an applicant requests that the NRC approve the construction and operation of a

particular facility at a specific site. The applicant must demonstrate that the facility, as designed, can meet radiological performance objectives. These objectives are attained through both preventive engineering, as well as in the selection of a site for which the probability of unacceptable disruptive events is acceptably low, considering both frequencies and severities of such events. Granting of a permit for construction implies that the NRC has judged that the facility of a specific design can be constructed and operated to meet the radiologic limits imposed by NRC at the time of the licensing action. It further implies that the NRC staff has reviewed the site's data base and has determined that the data base was acceptable for the purposes of the licensing action at the time of the action.

A site docketed with NRC but not yet through the license review still carries with it the professional judgments of the applicant that the site is suitable for construction and operation of the proposed facility and that it will be licensed by the NRC. Such a site also has a data base similar to those sites which have successfully been licensed.

Thirty-seven sites, six owned by DOE and 31 docketed with NRC for licensing under 10 CFR 50, were identified in the preferred region. These sites were identified through searches of published literature, searches of the NRC public document room, and through professional knowledge of individual sites. The ownership status is listed as ownership at the time of docketing of the license application for NRC-docketed sites. It was not ascertained whether current ownership is the same as ownership at the time of docketing. The sites and their ownership, status, and available acreage are contained in Appendix A.

2.2.2 Available Acreage

Once potentially suitable sites were identified, the sites were further culled by identifying sites at which it is feasible to construct and operate an MRS. Sufficient acreage is needed on which no known site-use conflicts exist. Eleven sites were identified as potentially suitable sites with sufficient available acreage. These sites are listed below and are shown in Figure 6.

Name	State	Owner[1]
Alan R. Barton Nuclear Power Plant	Alabama	Alabama Power Company
Barnwell Reprocessing	South Carolina	Allied Chemical Nuclear Products
Cherokee Nuclear Station	South Carolina	Duke Power Company
Clinch River Breeder Reactor	Tennessee	Project Management Company/ Tennessee Valley Authority
Hartsville Nuclear Plant	Tennessee	Tennessee Valley Authority
Oak Ridge Reservation	Tennessee	Department of Energy
Paducah	Kentucky	Department of Energy
Perkins Nuclear Station	North Carolina	Duke Power Company
Phipps Bend Nuclear Plant	Tennessee	Tennessee Valley Authority
Savannah River Plant	South Carolina	Department of Energy
Yellow Creek Nuclear Plant	Mississippi	Tennessee Valley Authority

[1]Non-federal owners are those listed in the application docketed by the NRC.

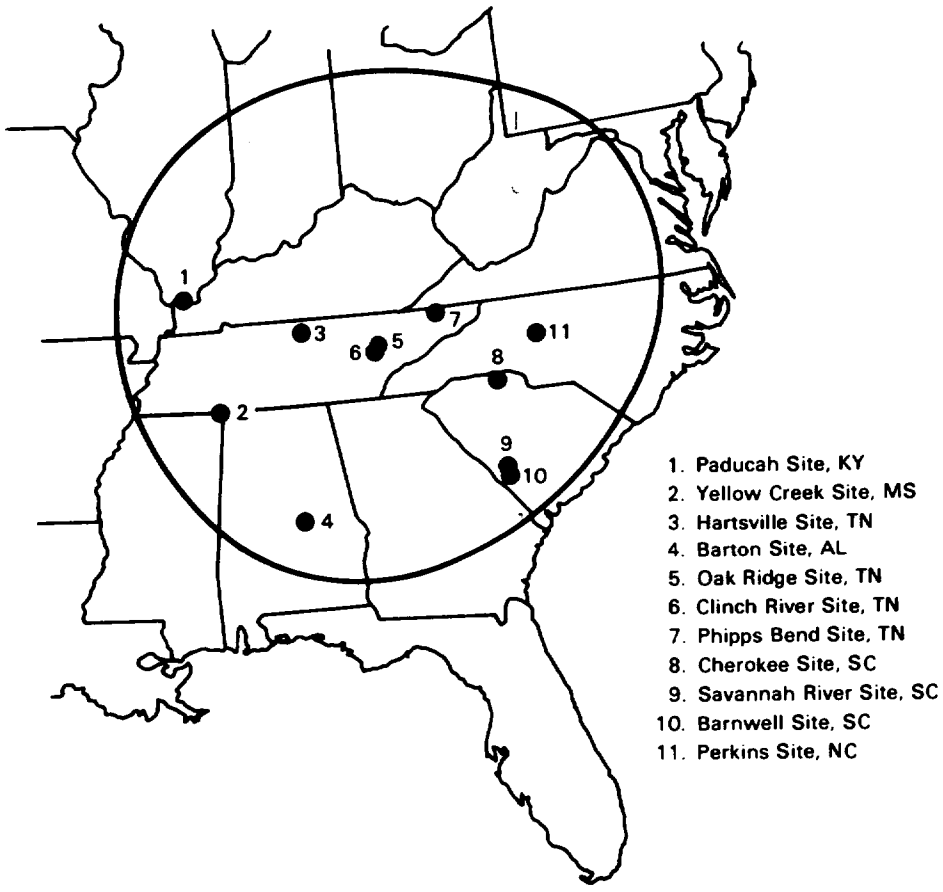


FIGURE 6. Eleven Sites Within the Preferred Region Evaluated for Suitability as MRS Sites

Eleven hundred (1100) acres is a conservative judgment of the maximum acreage that might be required at any point in the future. This acreage allows sufficient flexibility to employ any available storage technology during definitive design and does not constrain potential waste storage inventory. The final decision regarding storage concept and site selection are Congressional decisions. Use of this assumption preserves Congress' opportunity to modify the Secretary's proposal planned for January 1986 regarding storage concept and site selection. See Monitored Retrievable Storage Facility Site under Screening and Evaluation Report[1] for a more detailed description of how land requirements change, depending upon storage concept and waste storage inventory.

In the broadest sense, available acreage means lands on which no currently operating (or potentially operating) facilities exist. Thus, only those portions of DOE sites on which no construction has already taken place were considered as potential sites.

Only one potential site-use conflict was identified which led to elimination of some of the non-DOE sites from further evaluation. This was a determination not to co-locate an MRS on a site adjoining or shared by a licensed nuclear power plant. Locating an MRS adjacent to such a plant was judged undesirable because such siting might entangle existing utility licenses. In 10 CFR Part 72.72, the NRC requires that a facility licensed under Part 72, "...located near other nuclear facilities shall be designed and operated to ensure that cumulative effects of their combined operations will not constitute an unacceptable risk to the health and safety of the public." There is no belief that the combined risks of operation of an MRS facility and other nuclear facilities would constitute an unacceptable risk to the public. It is apparent, however, that providing demonstrations of such belief might entangle both the licenses for the MRS facility and that of the other facility.

[1]Monitored Retrievable Storage Facility Site Screening and Evaluation Report, Draft, April 1985, Golder Associates, Inc., et al.

3.0 DEVELOPMENT OF SITE DESCRIPTIONS AND ANALYSES

The eleven sites identified through the screening process were described and analyzed along dimensions important to determining site suitability. The purpose of this step of the siting process was to gather data on each site and to present the data in a consistent manner so that site analyses and technical comparisons could be made. An important piece of this step was the application of professional judgments regarding information or site features which are potentially important to site suitability and selection. The results of this step of the siting process are reported below.

3.1. COMPOSITION AND ACTIVITIES OF THE MRS SITE SCREENING TASK FORCE

A task force of specialists from contractor organizations was formed to develop the site descriptions. The task force membership is listed in Appendix B. It included specialists from six organizations:

- Pacific Northwest Laboratory
- Golder Associates, Inc.
- The Ralph M. Parsons Company
- Engineering Sciences, Inc.
- Battelle Project Management Division
- Battelle Human Affairs Research Centers

A task force director plus eight area leaders directed the work of approximately 50 professional and support personnel during a three-month period from mid-December 1984 through March 1985.

The area leaders were responsible, within their area, for (1) identifying and describing factors important to site evaluation, (2) compiling a data base for each site from open source literature (see next section), (3) evaluating the adequacy of the data base and its component parts for judging site characteristics and site suitability, (4) presenting the data in a manner to aid evaluations of site suitability and (5) making professional judgments about the technical strengths and weaknesses of each site compared relatively to the other ten sites and compared absolutely to lands generally found in the preferred region.

3.2 SITE DATA BASE

A data base was established for each site using only materials available in the open literature. Maps were obtained from public sources. The site information came from three primary sources:

1. material docketed with the Nuclear Regulatory Commission in support of the license application (for the 8 docketed sites) including:
   a. environmental reports,
   b. preliminary safety analysis reports;
2. environmental and other documentation on the three DOE sites;
3. open source literature published by federal, state, county and commercial sources.

In each discipline area, the task force determined whether the available data was sufficient to accomplish the site description and analyses stated above. The analyses presented in the task force report have been made without confirmatory visits. The Department judged the information available in the public record sufficient for preliminary analysis.

The data base on each site was judged adequate for purposes of site description and analysis to support site identification for detailed evaluation. While the data is not fully equivalent across the sites, in the judgment of the task force this does not weaken the confidence in the descriptions or the professional judgments about site conditions important to site selection. The Environmental Assessment (EA) which will accompany the proposal to Congress in January 1986 will be based on available information pursuant to the NWPA. The process used for site identification provides extensive data for use in the EA. If Congress authorizes MRS construction, some new or confirmatory field data will be required for each site prior to completing an Environmental Impact Statement (EIS) and prior to submittal of a license application to the Nuclear Regulatory Commission for construction and operation of MRS.

3.3 SITE DESCRIPTIONS

The eleven sites were thoroughly described and analyzed in eight areas important to evaluating site suitability. In each area, the objective was to identify key characteristics of the site and their significance to construction and operation (including health, safety and environmental quality) at the site, and changes which might be imposed on the surrounding community and region. The eight areas are:

1. Ease of Regulatory Compliance. The regulatory compliance analysis integrated the other task force areas of analysis. The purpose was to anticipate the ease with which each site could meet legally imposed requirements, especially those involved in gaining a license from the Nuclear Regulatory Commission and permits required in federal environmental laws (i.e., the Clean Air Act and Clean Water Act).

2. The Existing Environmental Setting. The existing environmental quality and its capacity to absorb potentially disruptive activities (e.g., construction and effluents) were evaluated. Ten attributes were considered: aesthetics, air quality, cultural resources, ecology, population potentially affected, land use, meteorology, noise and vibration, transportation and water quality.

3. Geotechnical Site Characteristics. Key geological and hydrological factors that might affect construction of an MRS were considered. Activities include the identification of faults, seismic history, depth to saturated zone, and site features such as limestone cavities and sinkholes.

4. Socioeconomic Setting. The existing socioeconomic setting around each site (including workforce composition, population distribution and governmental services) and the potential changes which might be induced by constructing and operating an MRS at the potential site.

5. Institutional and Administrative Structure of the State. The eleven sites are distributed within six states. The governmental, administrative and legal structures of each of these states (and to a much more limited extent, the potential host counties) were described.

6. Local and Regional Transportation Characteristics. The existing condition and expected use of transportation corridors within the vicinity of the site and in the surrounding region were described. Factors included the distance to interstate highways and Class-A rail networks, requirements for new construction or upgrading, travel through communities on non-interstates, terrain, traffic restrictions, availability of multiple rail carriers and access to barge transport.

7. Access to Physical Infrastructure. The existing infrastructure and its adequacy to support construction and operation of an MRS were evaluated in several areas including utilities (water supply, power supply, fuel supply, communications, sewage disposal), transportation (rail, barge and highway), and construction and operating labor availability.

8. Capital Cost of Construction. Capital cost factors were evaluated as a way of discriminating the incremental costs of developing an MRS at one site compared to the other sites. Thus, only factors which were a function of the site were considered. Discriminators were developed and normalized for eight areas: socioeconomic; physical site investigations required for definitive design and engineering; construction; site mitigations (e.g., engineering required to offset potential site instability); site modifications (e.g., clear and grub, and relocation of structures); mitigation of potential environmental impacts; upgrading transportation infrastructure; and costs of acquiring required power supplies. The task force found that costs were most sensitive to differences in required construction techniques and site mitigations, including required excavation.

The task force report, published in three volumes, contains raw data, summary data tables, significant findings, and professional judgments about the

importance to site suitability of the various factors analyzed. That report should be referred to for detailed information about the eleven sites. Appendix D contains very brief outlines of the features of each site.

3.4 CONCLUSIONS DRAWN FROM SITE DESCRIPTIONS AND ANALYSES

The Department has concluded that, at each of the eleven sites, 1) there is a very high likelihood that an MRS can be constructed and operated safely and 2) environmental impacts can be made acceptable without resorting to extensive mitigation measures. The sites present different conditions and requirements for construction, engineering, environmental control, infrastructure improvements, and regulatory compliance. The services and institutions of communities surrounding each site would experience different potential changes as a consequence of constructing and operating an MRS. These differences are described in detail in the task force report.

4.0 SITE COMPARISONS

The Department concluded that an MRS, if authorized by Congress, could be constructed and operated safely and with minimal impacts at all of the eleven sites evaluated. Thus, the evaluation confirmed the premise that the performance of an MRS is relatively insensitive to physical site characteristics. A methodology was developed to evaluate the ease and likelihood of success of deploying an MRS at the eleven sites. This analysis was performed 1) because the Department wanted to select the three sites with the highest potential for successful MRS development, and 2) because delay and potential disapproval result when development potentially competes with public priorities adopted in existing statutes or regulations.

4.1 TIME WHEN DELAY MIGHT OCCUR

Three stages of approval were identified where MRS development might be viewed as competing with land use, environmental or other public priorities as expressed in federal law and regulations. These stages are directly related to the legal requirements and structure according to which approval for construction and operation of the MRS is obtained:

1. Congressional Construction Authorization. Foremost in this area is potential competition with existing land use or community values. For example, proximity of the site to large population centers or wilderness areas would likely be seen as competing with existing regional priorities.

2. NRC License Approval. Factors which present potential conflicts in obtaining an NRC license to construct and operate an MRS were largely restricted to physical site characteristics which cannot be modified and which the NRC has already judged to be inconsistent with the conservatism built into 10 CFR Part 72. For example, proximity of the site to seismic sources or capable faults has been identified by NRC as undesirable.

3. Environmental Permits Granted by EPA. Granting by EPA (or a state authorized to administer federal environmental laws) of environmental

permits required under the Clean Air and Clean Water Acts or other environmental statutes. MRS development can potentially compete with priorities and rules established to meet land-use and environmental objectives. For example, MRS development in a Class I air area (an area where regulatory requirements are designed to maintain pristine conditions) would likely be seen as competing with environmental objectives even if there were zero releases from the facility.

4.2 DISCRIMINATORS AND NON-DISCRIMINATORS IN SITE COMPARISONS

The site screening task force (discussed in Section 3, above) identified characteristics which were potentially important to judging site suitability. Until the data bases were compiled, analyzed and compared, it could not be determined which characteristics were actual discriminators across the sites. This step of the siting process was designed to help make that determination.

4.2.1 Characteristics which are Non-Discriminators

Several characteristics were judged not to discriminate among the eleven sites. These characteristics 1) were relatively similar across the sites and 2) did not compromise safe construction and operation. These factors included:

- Existing environmental quality including air, water, aesthetics, meteorology and cultural resources. In the case of meteorology and cultural resources little variation was found. In the case of water and air quality, while there was variation, the professional judgment of the task force was that all potential impacts could be mitigated. The ease of gaining permit approvals might differ, but more information was required about the local and state permitting structure to make informed judgments about relative ease of gaining requisite permits.
- Socioeconomic conditions varied across the sites, but none of the surrounding communities were judged to be severely stressed by construction and operation of an MRS at the sites being considered.

- State institutional and administrative structures were generally noted but not considered further in considering the suitability of the eleven sites.
- Physical infrastructure posed no constraints at any of the sites.
- Capital costs for geotechnical site investigations, environmental mitigation activities, infrastructure requirements and transportation improvements constituted a very small fraction of the cost variation across the sites. Thus, capital cost comparisons were used only to approximate the differences in engineering and construction techniques to adapt to differing site conditions.
- Distribution of transportation flows through cities outside the region were relatively similar for the eleven sites and were not used to discriminate among the sites.

4.2.2 Characteristics Which Discriminated Among the Sites

A different set of factors vary significantly across the sites and are important in assessing the potential for MRS development to compete with public priorities as expressed in existing statutes and regulations. The presence or absence of any of these factors at a site does not necessarily result in a site being less technically suitable for development of an MRS. For example, site proximity to population centers is considered because of evidence in NRC rulemaking and the NWPA that siting nuclear facilities near population centers is less desirable than siting them in remote areas, all other things being equal. Other factors discriminate among the sites because of their potential to lengthen the schedule for review and construction. For example, solution cavities in limestone foundations will not compromise safety but might result in longer construction schedules. These geological features can be designed for and accommodated with normal construction and engineering techniques, but the level of regulatory evidence required might result in longer schedules or higher costs to demonstrate that proper techniques are employed. Additional costs in time and dollars might be considered worthwhile investments at sites with particularly desirable characteristics, such as good transportation access. The factors which discriminate among the sites are:

- Potential land-use competition, including proximity to large recreation areas and to rare, endangered or threatened species or their habitats.
- Potential competition with environmental regulatory objectives such as lands adjacent to Class I air areas, areas where the EPA is trying to prevent deterioration, or areas which do not conform with national ambient air quality standards.
- Potential geotechnical site conditions which might create delays in NRC licensing or which are above thresholds NRC has stated for certain conditions. For example, the NRC has suggested that sites be avoided which require engineering provisions to compensate for site deficiencies, require evaluation of soil instability/liquifaction, or have evidence of geologic instability.
- Potential problems with local transportation access, including: long distances to interstate highway and Class A rail networks; travel off interstates through communities; travel off interstates over mountainous terrain; and multiple east-west crossing over the Appalachians by spent fuel shipments originating west of the mountains.
- Proximity to population centers was considered both in terms of regional population density (e.g., within a radius of 50 miles) and immediately adjacent to the site.

Two potential site features are particularly desirable and can partially compensate for any potential regulatory delay. These features are 1) existing federal ownership and control and 2) the granting by NRC of a limited work authorization or construction permit. These permits carry preliminary NRC findings of site suitability for construction of a utilization or production facility.

4.3 SITE COMPARISONS

Table 2 summarizes the comparison of the eleven sites in terms of the relative potential of MRS deployment at those sites to compete with existing public priorities.

TABLE 2. Summary of Potential Competition with Existing Public Priorities

	Privately Owned				Federally Owned						
	Barton	Barnwell	Cherokee	Perkins	Clinch River	Hartsville	Oak Ridge	Paducah	Phipps Bend	Savannah River	Yellow Creek
ENVIRONMENTAL AND LAND USE											
High Recreational Use											-
Air Quality Conflicts[1]								-			
Habitat[2]		-	-		-			-		-	-
Rare & Endangered Species			?		-[3]					?	
POTENTIAL NEED FOR PHYSICAL SITE ADAPTATIONS											
Cost	+	+	+	+				-		+	-
Geotechnical Adaptations[4]		≡	-		-	-	-	≡	=	≡	≡
Import of Fill Materials									-		
Not 100% Flood Dry in Natural Condition		-	-	-	-	-	-		-		-
OTHER FEATURES											
Population			-	-		-					
Transportation Access	+				+		+	+			-
DESIRABLE FEATURES											
Federal Ownership					+	+	+	+	+	+	+
NRC Permit			+		+	+			+		+

Legend: + Particularly Favorable Condition = & ≡ Greater Competition
- Potential Competition ? Uncertain Competition

[1] Paducah is in a county which has not attained national ambient air quality standards for SO_2 and TSP. In addition, it is adjacent to an area designated by the EPA for maintenance of high quality conditions.

[2] Habitat for threatened rare and endangered plant and animal species is found on the site.

[3] Rare and endangered species exist on the site. It is expected that they can be fully protected but some uncertainty exists.

[4] Blank columns signify no potential instability found; one minus signifies potential presence of solution cavities or sinkholes; two minuses signify additional potential for liquifaction; three minuses signify solution cavities or other features above plus design earthquake estimated to be potentially greater than .25G.

Based on land-use and environmental considerations, the Yellow Creek and Paducah sites were eliminated from further consideration. Yellow Creek is located downstream of Pickwick Lake which has high recreational use (3.3 million visitor-days per year) and has been described as "the best bass fishing lake in the southeast." The site also provides habitat for a large diversity of animal species. Paducah is adjacent to an area designated by the EPA as one in which they wish to prevent deterioration of air quality and is in nonattainment with national ambient air quality standards for SO_2 and TSP. The Paducah site is also adjacent to a state wildlife management area and has a high local "carrying capacity"; that is, it supports a higher than average number of animal species per acre. The Department believes that an MRS could be developed in compliance with environmental regulations at these two sites. However, acceptable sites are available which do not pose potential for competition with land-use and environmental objectives; thus, the decision was made not to further consider these sites.

Other differences across the sites--in areas of geotechnical attributes, transportation and population--were unimportant or were considered not to outweigh the advantages of sites which were owned by the federal government. That is, the Director judged that an MRS was more likely to be successfully deployed at any of the remaining federal sites than at the non-federal sites. While the privately owned sites presented definite opportunities including somewhat lower capital costs for site adaptation, any advantages do not overcome the advantages which accrue to federal ownership--access to the site, absence of land-use conflicts and elimination of the potential for condemnation.

From among the remaining federal sites--Clinch River, Hartsville, Oak Ridge, Phipps Bend and Savannah River--the differences in geotechnical simplicity, transportation access and proximity to population centers were balanced against differences in the regulatory data bases. Each of the sites presents attractive opportunities and each has different features which might result in potential approval delays.

The Hartsville and Phipps Bend sites present moderate problems with transportation access. They are located 20 to 40 miles from the nearest interstate highways. This would require transport over hilly terrain and through small

communities on state and local roads. These conditions will increase the likelihood of vehicle accidents slightly. Moreover, they are conditions which the Department recognizes that state and local governments and citizen groups wish to avoid. Nonetheless, the risks presented by transportation activities are very low and are not expected to increase measurably if spent fuel is transported to either location. Phipps Bend presents certain geotechnical features which are less desirable than the other federal sites including solution cavities and potential for liquifaction. Import of fill materials might be required to develop certain storage concepts or inventories at Phipps Bend.

Clinch River and Oak Ridge have excellent transportation access. They are within 5 miles of an interstate highway and have direct rail access. Clinch River was granted a Limited Work Authorization in 1983 for the now-cancelled breeder reactor. The Oak Ridge site is coincident with a site earlier considered by Exxon for fuel reprocessing and thus also has a good regulatory data base. The two sites might experience some delay in NRC licensing in order to demonstrate that engineering and construction techniques adequately compensate for the existing solution cavities. The Clinch River site has some rare and endangered species; however, the Department expects that these can be adequately protected during construction and operation because of their location on the site. Most of the features which present the potential for delay are not in the form of competition with land use or environmental objectives but rather involve technical evidence to be submitted to the NRC during license review.

The Savannah River Plant site would require low capital costs for construction. It lies within the influence area of the Charleston earthquake, however, and thus presents potential for protracted licensing reviews to determine the seismic conditions for which the facility must be designed. In addition, the site lies east of the Appalachians. Savannah River does not possess a regulatory data base since the Savannah River Plant did not require NRC licensing.

5.0 CANDIDATE SITE IDENTIFICATION

The Nuclear Waste Policy Act requires the Department to include site-specific designs in its proposal to Congress for the construction of an MRS facility. This requires identification of at least three sites and five site/design combinations. The Act provides for state and tribal participation after Congress has authorized construction of the MRS at the site of its choice. The Department developed the siting process and made site evaluations and preliminary identification by use of a process internal to the DOE as described in Sections 2 through 4.

The Department has included, however, several features in the MRS siting process in an explicit effort to balance the NWPA spirit of state involvement in repository site selection with the MRS provision which provides for state participation after Congressional authorization. First, sites with extensive data bases particularly appropriate for judging potential MRS site suitability were identified. This provides the Congress with information to form judgments equivalent to that used by the NRC in making technical licensing judgments about site suitability. It also provides Tennessee state and local government agencies and officials access to the same data in making independent judgments about the Department's proposal to Congress for construction of an MRS when it is transmitted in January 1986.

Second, the Department considered potential MRS development at each of the sites in terms of land use, environmental and other public objectives, as developed in NRC and EPA rulemaking, and indirectly in comments received on the repository environmental assessments, repository siting guidelines and OCRWM Mission Plan. While some may question the judgments made and whether the correct values were applied, the judgments and data used by the Department in performing its evaluations are fully open to scrutiny and review.

Third, the Department will be undertaking an extensive program of information transfer with the state of Tennessee and local governments between the time of announcement of the preferred and alternative MRS sites and the submittal of the proposal to Congress for MRS construction. The explicit purpose of this intergovernmental and public interaction program is to allow the state

of Tennessee and local communities to form independent judgments in time for Congressional deliberations about the acceptability of developing an MRS at the preferred or alternative sites. The Department will be working with these governments to scope the final dimensions of the interaction program so that it is responsive to their requirements and capabilities. If desired, the program can provide resources and technical assistance to the state of Tennessee.

The Department is charged with exercising its judgment in proposing to Congress how, where and whether to construct an MRS facility. The siting process and the identification of a preferred candidate site and two alternative sites are the result of the first part of that judgment. The Department believes that the three sites chosen for further evaluation are of particularly high quality and locating an MRS at any of them will enhance the total federal nuclear waste disposal system.

Eleven sites were judged by the Department to be potentially acceptable MRS sites in terms of the ability to safely construct and operate an MRS facility. Two of the sites were judged, on the basis of land use and environmental considerations, to be less attractive than the other nine sites. Those nine sites were thought to be particularly suitable for MRS development, and MRS development at those sites did not appear to compete with public objectives as expressed in NRC and EPA rules.

The three sites identified as candidate MRS sites were selected from among those sites owned by the federal government. After detailed analysis, the Director found that the privately owned sites do not present additional features which overcome the advantages of current federal ownership. Federal ownership reduces potential for conflict regarding use of the site and assures access for additional investigations. The Director believes that land should not be withdrawn from the private domain for MRS use unless it is clearly superior to available federal lands.

The Clinch River Breeder Reactor site, owned by the Tennessee Valley Authority, was identified as the preferred site. The Clinch River site is located in east-central Tennessee, in the eastern part of Roane County (latitude 35 degrees 53 minutes 24 seconds North/longitude 84 degrees 22 minutes 57 seconds West) (Figure 5-22). The candidate site includes the entire site

area for the cancelled Clinch River Breeder Reactor Project (CRBRP). The site is located on a peninsula formed by a meander of the Clinch River. It is 25 miles west of Knoxville, Tennessee and 9 miles southwest of the city center of Oak Ridge, Tennessee, although the site lies within Oak Ridge's city limits. The site is adjacent to the Department's Oak Ridge reservation.

The topography at the site consists of moderate slopes up from the river to the crests of two northeast-trending ridges. The average slope is about 12 degrees and the maximum local relief is approximately 350 feet. The site is underlain by an average of 10 to 30 feet of soil, which in turn overlies limestone and siltstone bedrock. Land use in the site vicinity is primarily woodlands with some agriculture.

The CRBRP site has a total area of 1364 acres. The land is owned by the U.S. Government and in custody of the Tennessee Valley Authority (TVA). It is currently in the control of the Department, one of the applicants for the CRBRP license. A limited work authorization (LWA) was granted by the NRC in 1983. In 1984, the application was withdrawn and the LWA terminated. The site information docketed with the NRC in support of the license application is particularly current.

The site is adjacent to the Oak Ridge Reservation and, therefore, nuclear activities are compatible with the present land usage. Further, the Oak Ridge technical community can provide experienced manpower and nuclear facility support functions. The CRBRP site is within 5 miles of the nearest interstate highway: I-40 west from Knoxville and east from Nashville. The site has direct access (within 1.5 miles) to a main rail line. In addition, the site is on a navigable waterway--the Clinch River. Thus the site has good transportation access for any transport mode.

The DOE Oak Ridge Reservation and the Hartsville Nuclear Plant site were chosen as alternative candidate MRS sites. All three sites are located within the state of Tennessee. The Department will assure that the state of Tennessee has adequate opportunity to understand the technical and nontechnical consequences of MRS development. Since the three sites are all in a single state, this can be accomplished without diverting attention to interstate procedural or programmatic parity. The decision to identify sites within a single state

came only after determination that none of the other federal sites carried with them technical, environmental or land-use characteristics which made them superior to the three sites identified.

The Department's Oak Ridge Reservation offers many of the same advantages as does the CRBRP site. The Oak Ridge site is coincident with a site earlier considered by Exxon for fuel reprocessing and thus also as a regulatory data base, although no NRC findings have been issued.

The Hartsville site is located in north-central Tennessee in Smith and Trousdale Counties (latitude 36 degrees 21 minutes North/longitude 86 degrees 04 minutes West) (Figure 5-25). The candidate site includes the entire area of the Tennessee Valley Authority's (TVA) cancelled Hartsville Nuclear Power Plant. The site is located on the Cumberland River, approximately 40 miles northeast of Nashville, Tennessee. The closest towns to the site are Hartsville and Dixon Springs, located 5 miles west and 1-1/2 miles east, respectively. The topography across the site is low and rolling, with the exception of a ridge immediately north of the site that rises 300 feet higher than the surrounding area. The site is underlain by an average of 12 feet of residual, clayey soil overlying argillaceous shale and limestone bedrock. Agriculture is the predominant land use in the site vicinity.

The Hartsville Nuclear Power Plant included a site area of 1940 acres. Of the four cancelled units at the site, Unit 1 was 44 percent complete, Unit 2 was 7 percent complete, and work has not begun on Units 3 and 4.

The Department believes that at the three sites identified, an MRS facility can be constructed and operated safely with minimal environmental impacts. The extensive information available for each site and judgments by the NRC of site suitability for construction of nuclear reactors at Clinch River and Hartsville give high confidence in this conclusion. The information available is more than adequate to support identification of candidate sites for detailed evaluation. Further, the quality of the information will result in a high quality and comprehensive environmental assessment to accompany the Department's proposal to Congress.

Review of the Department's actions and upcoming recommendations will come through several forums: First, the final siting decision is reserved by Congress. The technical judgments and program philosophy will be transmitted to the Congress in the form of the proposal for construction of an MRS and the documents required by law to accompany that proposal. Congress will make the decision through its normal authorization and appropriations process. Second, as already discussed, the Department, prior to submitting the proposal to Congress, will enter into an extensive program of interaction with the state of Tennessee and local communities. Third, during Congressional deliberations on MRS facility need and siting, the potential host state of Tennessee will have the opportunity to express its views regarding site selection and construction authorization. Finally, if an MRS is authorized, an Environmental Impact Statement must be prepared and the Department must file a license application with the Nuclear Regulatory Commission. Both processes entail substantial and formal opportunity for involvement and review by interested parties. MRS construction and operation will not commence until a license is granted by the NRC.

A preliminary schedule for the activities planned to support the proposal is contained in Appendix C. A schedule for MRS development activities, should Congress authorize construction, is also presented in that appendix.

APPENDIX A

SITES LOCATED WITHIN THE PREFERRED MRS SITING REGION OWNED BY DOE OR DOCKETED BY NRC FOR LICENSING UNDER 10 CFR 50

NOTE: These sites were identified through searches of published literature, searches of the NRC's public document room and through professional knowledge of individual sites.

TABLE A.1. Sites Located Within the Preferred MRS Siting Region Owned by DOE or Docketed by NRC for Licensing under 10 CFR 50

State	Status	Name	Owner	Docket #	Size (acres)	Documents/Permits							Potential Site Conflicts	Comments	Source
						ER	SAR	SER	ES	LWA	CP	OL			
Alabama	Plants Cancelled, Suspended, or Converted	Alan R. Barton Nuclear Power Plant	Alabama Power Co.	50-524	2820	X	X		X					Cancelled; units 1, 2, 3, & 4 probably no construction	2 3 4 5 6
	Plants Operating or Under Construction	Bellefonte Nuclear Plant	Tennessee Valley Authority	50-438 50-439	1500	X	X	X	X	X	X			#1 (77%); #2 (57%) complete	1 3 5 6
		Browns Ferry Nuclear Power Station	Tennessee Valley Authority	50-259 50-260 50-296	840						X	X	Operating	3 units operating	2 3 5 6
	DOE and Other Facilities	Alternative-Fuel Production Facility		N/A?	Approx. 10									Site is only proposed	3 6
Georgia	Plants Cancelled, Suspended, or Converted	Alvin W. Vogtle Nuclear Plant Units 3 & 4	Georgia Power Co.	50-424 50-425	3177	X	X	X	X	X	X		Units 1 & 2 active	Cancelled; #3 (0%); #4 (0%) complete	3 4 5 6
	Plants Operating or Under Construction	Alvin W. Vogtle Nuclear Plant Units 1 & 2	Georgia Power Co.	50-424 50-425	3177	X	X	X	X	X	X			#1 (65%); #2 (22%) complete	1 2 3 5 6
		Edwin I. Hatch Nuclear Plant	Georgia Power Co.	50-321 50-366	2244						X	X	Operating	2 units operating	2 3 5 6
Illinois	Plants Cancelled, Suspended, or Converted	Clinton Power Station Unit 2	Illinois Power Co.	50-461	15000	X	X	X	X	X	X		Unit 1 active	#2 cancelled	1 3 4 5 6
	Plants Operating or Under Construction	Clinton Power Station Unit 1	Illinois Power Co.	50-461	15000	X	X	X	X	X	X			#1 (83%) complete	1 3 4 5 6
Indiana	Plants Cancelled, Suspended, or Converted	Marble Hill Nuclear Generating Station	Public Service Co. of Indiana	50-546 50-547	>987	X	X	X	X	X	X			Suspended indefinitely #1 (56%); #2 (35%) complete	1 2 3 5 6

TABLE A.1. (contd)

State	Status	Name	Owner	Docket #	Size (acres)	Documents/Permits ER	SAR	SER	ES	LWA	CP	OL	Potential Site Conflicts	Comments	Source
Kentucky	DOE and Other Facilities	Paducah	DOE	N/A	3425				X					On Federally owned reservation	3
Mississippi	Plants Cancelled, Suspended, or Converted	Yellow Creek Nuclear Plant	Tennessee Valley Authority	50-566 50-567	1160	X	X	X	X	X	X			Cancelled; #1 (33%) #2 (33%) complete	3 4 5 6
N. Carolina	Plants Cancelled, Suspended, or Converted	Thomas L. Perkins Nuclear Station	Duke Power Co.	50-488 50-489 50-490	1206	X	X		X					Cancelled; 3 units; probably no construction	3 4 5 6
		Shearon Harris Nuclear Power Plant - Units 2, 3, & 4	Carolina Power and Light Co.	50-400 50-401	18000	X	X	X	X		X		Unit 1 active	Cancelled; #3 (1%); #4 (1%); #2 (?) complete	3 4 5 6
	Plants Operating or Under Construction	Shearon Harris Nuclear Power Plant - Unit 1	Carolina Power and Light Co.	50-400 50-401	18000	X	X	X	X		X			#1 (85%) complete	1 2 3 5
		Wm. B. McGuire Nuclear Station	Duke Power Co.	50-369 50-370	>30000						X	X	Operating	2 (?) units operating second unit due on online in 1984	2 3 5 6
Ohio	Plants Cancelled, Suspended, or Converted	Wm. H. Zimmer Nuclear Power Station	Cincinnati Gas & Electric, Columbus, Ohio, Electric, Dayton Power & Light	50-358	491	X	X	X	X		X		Coal Conversion	Cancelled; #1 (85%); #2 (0%) complete	1 2 3 4 5 6
		Davis-Besse Nuclear Power Station - Units 2 & 3	Toledo Edison Co. & Cleveland Illuminating Co.	50-346	>900					X			Unit 1 operating	Cancelled; #2 (0%); #3 (0%) complete	4 5 6
	Plants Operating or Under Construction	Davis-Besse Nuclear Power Station - Unit 1	Toledo Edison Co. & Cleveland Illuminating Co.	50-346	>900						X	X	Operating	1 unit operating	2 5 6

TABLE A.1. (contd)

State	Status	Name	Owner	Docket #	Size (acres)	Documents/Permits ER	SAR	SER	ES	LWA	CP	OL	Potential Site Conflicts	Comments	Source
Ohio (contd)	DOE and Other Facilities	Portsmouth (Goodyear)	DOE	N/A?	3708				X						3
		Fernald Feed Materials Plant	DOE	N/A?	1080									Total property area unknown	3 5 6
Pennsylvania	Plants Operating or Under Construction	Beaver Valley Power Station	Duquesne Light Co.	50-334	420						X	X	Unit 1 operating	#2 (78%) complete	1 2 5 6
S. Carolina	Plants Cancelled, Suspended, or Converted	Cherokee Nuclear Station	Duke Power Co.	50-491 50-492	2091	X	X		X	X	X			#1 cancelled 1983; #2 & #3 cancelled 1982; (0%) complete	3 4 5 6
	Plants Operating or Under Construction	Catawba Nuclear Station	Duke Power Co.	50-413	23600	X	X	X	X	X	X	X		#1 (99%); #2 (72%) complete OL issued 07/18/84	1 2 3 5 6
		H. B. Robinson Plant	Carolina Power and Light Co.	50-261	>5000						X	X	Operating	2 units operating	2 3 5 6
		Oconee Nuclear Plant	Duke Power Co.	50-269 50-270 50-287	1 mi radius						X	X	Operating	3 units operating; property area unknown	2 3 5 6
		Virgil C. Summer Nuclear Station	S. Carolina Electric & Gas Co.	50-395	11000						X	X	Operating		2 3 5 6
	DOE and Other Facilities	Barnwell Reprocessing Plant	Allied Chemical Nuclear Products	50-332	1730	X	X		X						3 5 6
		Savannah River Plant	DOE	N/A	192323				X						3
Tennessee	Plants Cancelled, Suspended, or Converted	Clinch River Breeder Reactor Plant	Project Management Corp.	50-537	1364	X	X	X	X	X				Cancelled; some site work	3 4 5 6

TABLE A.1. (contd)

State	Status	Name	Owner	Docket #	Size (acres)	Documents/Permits ER	SAR	SER	ES	LWA	CP	OL	Potential Site Conflicts	Comments	Source
Tennessee (contd)		Phipps Bend Nuclear Plant	Tennessee Valley Authority	50-553	1270	X	X		X	X	X			Cancelled; #1 (27%); #2 (5%) complete	3 4 5 6
		Hartsville Nuclear Plant	Tennessee Valley Authority	50-518 50-519	1940	X	X	X	X	X	X			4 units cancelled; #1 (44%); #2 (7%) complete	1 2 3 4 5 6
	Plants Operating or Under Construction	Watts Bar Nuclear Plant	Tennessee Valley Authority	50-390 50-391	1770	X	X	X	X		X			#1 (98%); #2 (63%) complete	1 2 3 5 6
		Sequoyah Nuclear Plant	Tennessee Valley Authority	50-327 50-328	525						X	X	Operating	2 operating units	2 3 5 6
	DOE and Other Facilities	Oak Ridge Federal Reservation DOE	DOE	N/A	36868				X						3
Virginia	Plants Cancelled, Suspended, or Converted	North Anna Power Station Units 3 & 4	Virginia Electric & Power Co.	50-338 50-339	18643 (1075)						X		Units 1 & 2 operating	Cancelled; #3 (7%); #4 (4%) complete Area-Total/(site)	4 5 6
	Plants Operating or Under Construction	North Anna Power Station Units 1 & 2	Virginia Electric & Power Co.	50-338 50-339	18643 (1075)						X	X	Operating	2 operating units Area-Total/(site)	2 3 5 6

1. FRBNY Quarterly Review, Summer 1984.
2. Commercial Nuclear Power Reactors in the United States, DOE/TIF-0007(4/84).
3. Battelle list from 12/11/84 meeting in Richland, Washington.
4. NUREG-8071, Vol. 3, No. 1.
5. AIF Info., January 1983.
6. NRC docket information and UW research.

APPENDIX B

MEMBERSHIP OF THE MRS SITE SCREENING TASK FORCE

Siting Task Manager	J. L. Braitman, PNL
Siting Task Technical Staff	R. Wallace, PNL
Task Force Director	J. W. Voss, GAI
Production Manager	C. Ritchie, GAI
Task Force Data Manager	C. Knitter, GAI
Regulatory Compliance	B. H. Smith, BPMD
Socioeconomic Considerations	R. Moe, PNL (Lead) J. Brooks, PNL R. Austin, PNL L. Clark, PNL
Institutional Considerations	T. D. Overcast, HARC (Lead) S. Holmberg, HARC B. Schuknecht, HARC D. Minor, HARC
Transportation Considerations	H. K. Elder, PNL (Lead) J. D. Ludwick, PNL G. McNair, PNL R. Rhoads, PNL
Environmental Considerations	P. J. Morris, ESI (Lead) J. G. Artenel, ESI R. E. Burke, ESI D. G. Conaty, ESI E. G. Crowell, ESI L. B. McNairy, ESI J. A. Roberts, ESI B. Sheikh, ESI J. E. Sims, ESI P. J. Sizson, ESI A. L. Taft, ESI C. A. Tormey, ESI S. C. Walter, ESI C. Weiss, ESI

Geotechnical Considerations	J. L. Scott, GAI (Lead) D. L. Pentz, GAI D. Caldwell, GAI D. McCreath, GAI T. Burgess, GAI R. Plum, GAI P. Fennessy, GAI D. South, GAI L. Dally, GAI E. Gould, GAI R. Burk, GAI C. Knitter, GAI
Cost and Infrastructure	A. K. Jowdy, RMP C. L. McKinney, RMP C. E. George, RMP V. Mesec, RMP G. Hayese, RMP H. Tran, RMP

PNL - Pacific Northwest Laboratory
BPMD - Battelle Project Management Division
HARC - Battelle Human Affairs Research Centers
ESI - Engineering Sciences, Inc.
RMP - The Ralph M. Parsons Company
GAI - Golder Associates, Inc.

APPENDIX C

PROGRAM SCHEDULES FOR MRS DEPLOYMENT: PRE-PROPOSAL AND POST-PROPOSAL

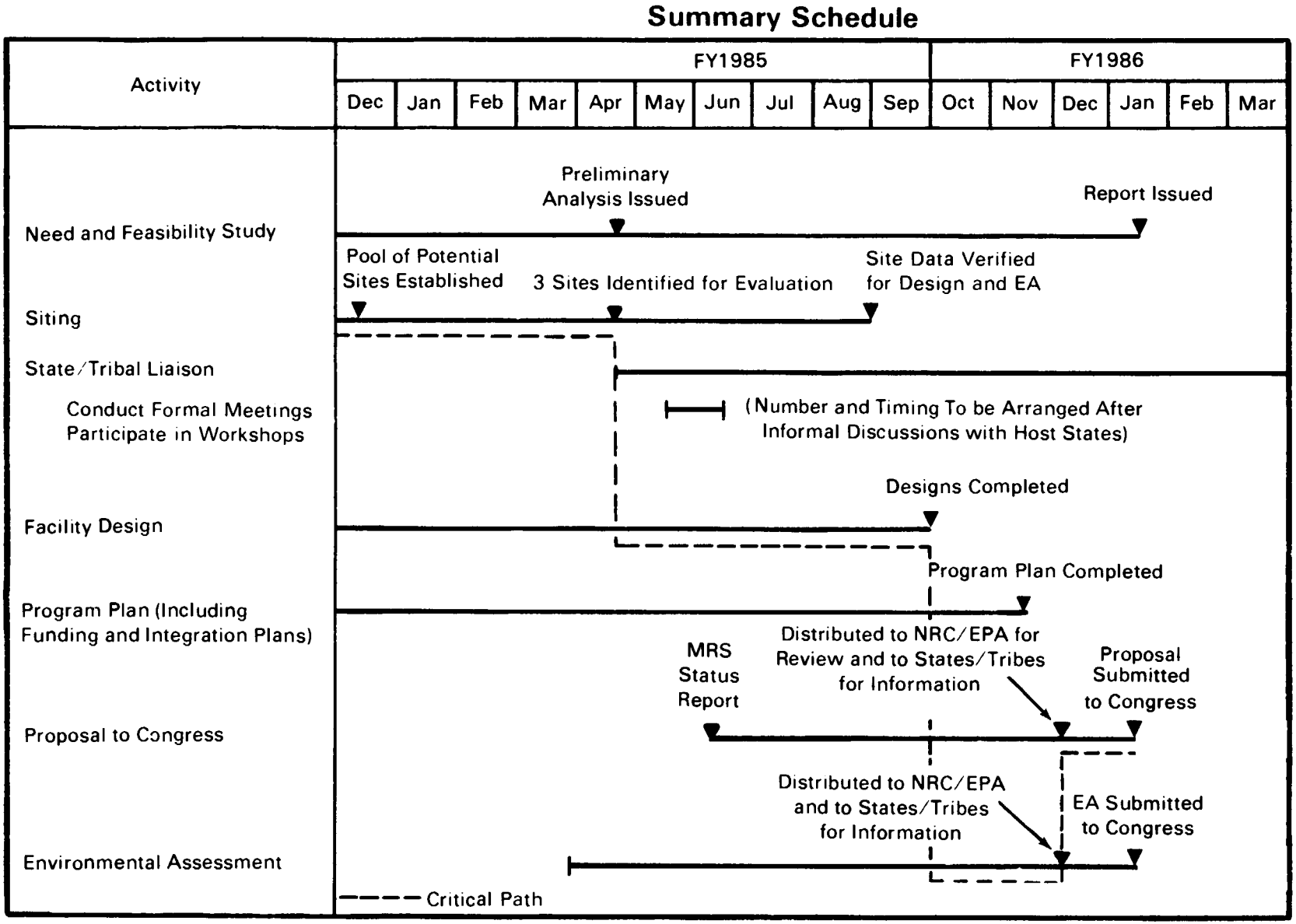


FIGURE C.1. MRS Program Pre-Proposal Summary Schedule

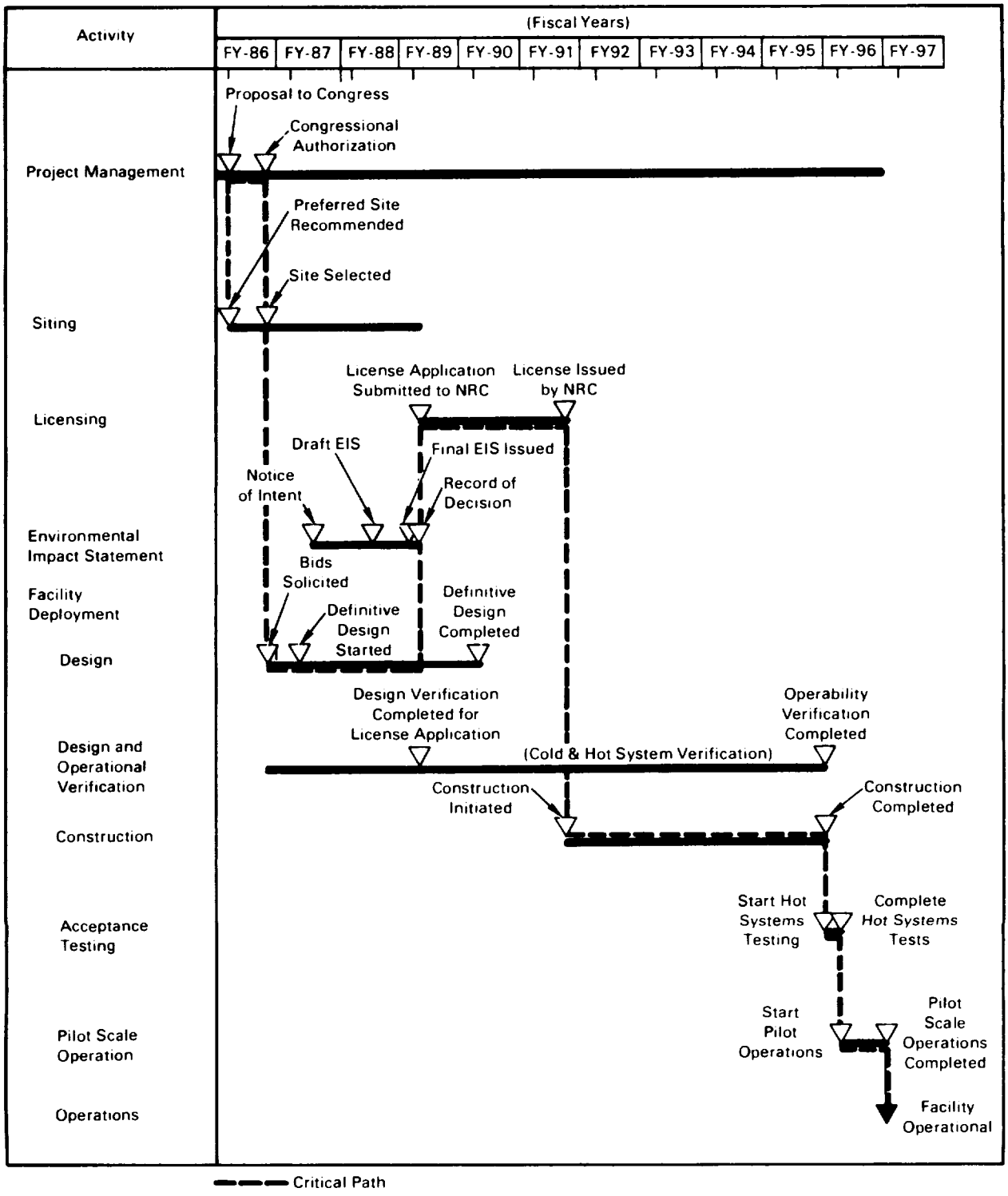


FIGURE C.2. Tentative Deployment Schedule (dependent on Congressional decision)(a)

(a) Represents a currently projected schedule subject to change.

APPENDIX D

BRIEF SITE DESCRIPTIONS

Figure D.1 shows the location of the eleven sites evaluated for potential suitability for an MRS facility.

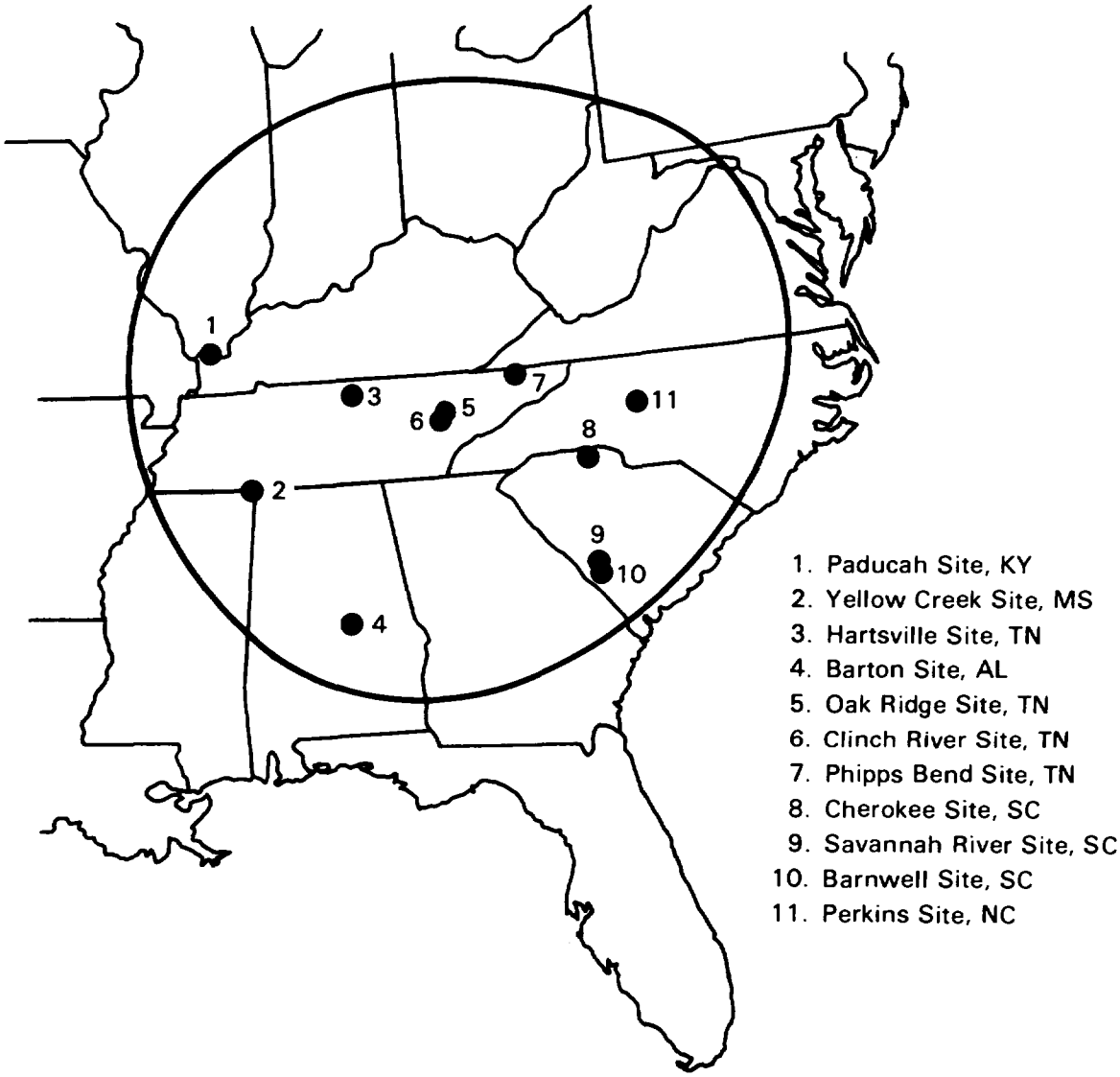


FIGURE D.1. Eleven Sites Within the Preferred Region Evaluated for Suitability as MRS Sites

D.1 ALAN R. BARTON NUCLEAR POWER PLANT SITE, ALABAMA - ALABAMA POWER COMPANY

The Barton site is located in east-central Alabama, on the west bank of the Coosa River, on the boundary between Chilton and Elmore Counties (latitude 32 degrees 45 minutes North/longitude 86 degrees 23 minutes 50 seconds West) (Figure 5-1). The proposed site includes the entire area of Alabama Power Company's cancelled Alan R. Barton Nuclear Plant site. The site is approximately 27 miles north of Montgomery, Alabama, and 60 miles southeast of Birmingham, Alabama. Verbena and Mountain Creek are the closest towns to the site at 6 miles and 5 miles respectively. The site is 5 miles downstream from the Mitchell Hydroelectric Dam and 13 miles upstream from the Jordan and Walter Bouldin Hydroelectric Dams.

The Alan R. Barton Nuclear Plant site has an area of approximately 2800 acres. It is assumed at this time that all this land is still owned by Alabama Power Company. Only site investigations for the nuclear power plant were performed at the site; construction activities did not commence.

The topography across the site is moderately rolling, with a maximum local relief of approximately 300 feet occurring between the Coosa River and the nearby ridges. The site is underlain by 25 to 65 feet of saprolite soil, which overlies gneissic bedrock. Land-use within the site and vicinity is primarily woodland, with open space used for agriculture. Cotton and hay are the principal crops.

- Geotechnical: Good site characteristics.
  Low cost for site mitigations.
- Environmental: 16 tornadoes per year in state--operating disruptions.
  Population sparse.
- Site Adaptation: Foundation improvements needed under R&H Facility.
- Regulatory Data Base: No NRC review.
  Less data than other sites (but still extensive data base).
- Transportation: Access good.

D.2 BARNWELL REPROCESSING PLANT SITE, SOUTH CAROLINA - ALLIED CHEMICAL NUCLEAR PRODUCTS

The Barnwell site is located in south-central South Carolina, in Barnwell County (latitude 33 degrees 15 minutes North/longitude 81 degrees 29 minutes 22 seconds West) (Figure 5-13). The site includes the area of the Barnwell Nuclear Fuel Processing Facility (BNFP). The site is seven and one-half miles west of Barnwell, South Carolina, and is contiguous with the eastern boundary of the U.S. Department of Energy's Savannah River Plant. The Barnwell site has an area of approximately 1730 acres.

The topography across the site is gently rolling to level. The ground surface is generally dry with occasional marshy areas. The site is underlain by approximately 1000 feet of unconsolidated sediments. Land use within the site vicinity is generally rural. The adjacent Savannah River Plant is currently engaged in various nuclear activities.

- Geotechnical: Low cost for site adaptation.
  Potential for >.25G seismic design.
  Potential for liquifaction.
  Solution cavities/sinkholes.
  Not 100% flood dry in natural condition.
- Environmental: 11 tornadoes per year--operating impacts.
  Habitat for rare and endangered species.
- Transportation: Good access--2 rail companies.
- Institutional: Good nuclear support infrastructure.
  Strong DOE local presence.

D.3 CHEROKEE NUCLEAR STATION SITE, SOUTH CAROLINA - DUKE POWER COMPANY

The Cherokee site is located in Cherokee County, South Carolina, approximately 40 miles southwest of Charlotte, North Carolina (latitude 35 degrees 02 minutes 12 seconds North/longitude 81 degrees 30 minutes 43 seconds West) (Figure 5-16). The candidate site includes the entire area of Duke Power Company's cancelled Cherokee Nuclear Station. The site is on the Broad River and is bounded on the north, east, and west by Ninety Nine Islands Reservoir.

The Cherokee Nuclear Station has an area of approximately 2090 acres. It is assumed that all this land is still owned by Duke Power Company. Only site investigations for the nuclear power station were performed; construction activities did not commence.

The topography across the site consists of moderately rolling ridges with dissected valleys. There is a maximum local relief at 240 feet. The site is underlain by gneissic bedrock overlain by an average of 60 to 70 feet of saprolite soil and weathered bedrock. Land use in the site vicinity is primarily woodland with approximately six percent of the land cleared.

- Geotechnical: Not 100% flood dry in natural condition.
- Environmental: Area of high population-->2.5 million (Charlotte).
  Habitat for rare and endangered species.
- Site Adaptation: Extensive earthwork required.
  11 tornadoes per year--operating impacts.
- Transportation: East slope of Appalachians.
  Good access.

D.4 CLINCH RIVER BREEDER REACTOR SITE, TENNESSEE - DOE/TVA MIXED CONTROL

The Clinch River site is located in east-central Tennessee, in the eastern part of Roane County (latitude 35 degrees 53 minutes 24 seconds North/longitude 84 degrees 22 minutes 57 seconds West) (Figure 5-22). The candidate site includes the entire site area for the cancelled Clinch River Breeder Reactor Project (CRBRP). The site is located on a peninsula formed by a meander of the Clinch River. It is 25 miles west of Knoxville, Tennessee, and 9 miles southwest of Oak Ridge, Tennessee, although the site lies within Oak Ridge's city limits. The site is adjacent to the U.S. Department of Energy's Oak Ridge reservation. The CRBRP site has a total area of 1364 acres. The land is owned by the U.S. Government and in custody of the Tennessee Valley Authority (TVA). Site investigations and some on-site construction and excavation was done at the site prior to cancellation.

The topography at the site consists of moderate slopes up from the river to the crests of two northeast-trending ridges. The average slope is about 12 degrees and maximum local relief is approximately 350 feet. The site is underlain by an average of 10 to 30 feet of soil overlying limestone and siltstone bedrock. Land use in the site vicinity is primarily woodlands with some agriculture. The site is adjacent to the Oak Ridge reservation and, therefore, nuclear activities are compatible with the present land usage.

- Geotechnical: Moderate cost for site mitigations.
  Solution cavities.
  Requires more than normal grading to reach flood dry conditions.
- Environmental: Rare and endangered plants and fish.
  Moderate population near site
- Site Adaptation: Cannot fit 70,000 MT on site--alternative concept.
  Significant blasting required.
- Regulatory Data Base: Received Limited Work Authorization from NRC.
- Transportation: Good access.

- Institutional: DOE control.
  Good nuclear support infrastructure.
  Strong DOE local presence.

D.5 HARTSVILLE NUCLEAR PLANT SITE, TENNESSEE - TVA

The Hartsville site is located in north-central Tennessee in Smith and Trousdale Counties (latitude 36 degrees 21 minutes North/longitude 86 degrees 04 minutes West) (Figure 5-25). The candidate site includes the entire area of the Tennessee Valley Authority's (TVA) cancelled Hartsville Nuclear Power Plant. The site is located on the Cumberland River, approximately 40 miles northeast of Nashville, Tennessee. The closest towns to the site are Hartsville and Dixon Springs, located 5 miles west and 1-1/2 miles east, respectively.

The Hartsville Nuclear Power Plant included a site area of 1940 acres. Of the four cancelled units at the site, Unit 1 was 44% complete, Unit 2 was 7% complete, and work had not begun on Units 3 and 4.

The topography across the site is low and rolling, with the exception of a ridge immediately north of the site that rises 300 feet higher than the surrounding area. The site is underlain by an average of 12 feet of residual, clayey soil overlying argillaceous shale and limestone bedrock. Agriculture is the predominant land use in the site vicinity.

- Geotechnical: Moderate cost for site mitigations.
  Solution cavities.
  Not 100% flood dry in natural condition.
- Environmental: High population (>1 million); close to Nashville.
- Regulatory Data Base: Received NRC construction permit.
- Institutional: Federal ownership.

D.6 DOE OAK RIDGE RESERVATION, TENNESSEE - DOE SITE

The Oak Ridge site is located in east-central Tennessee in Roane County (latitude 35 degrees 56 minutes 40 seconds North/longitude 84 degrees 20 minutes West) (Figure 5-28). The site is located on the U.S. Department of Energy's (USDOE) Oak Ridge reservation, in Bear Creek valley and south of Oak Ridge's turnpike. Oak Ridge is the closest town, approximately seven miles northeast of the site.

The candidate site lies entirely within the USDOE Oak Ridge reservation. No previous development has occurred on the candidate site.

The topography across the site is moderately steep with numerous gullies cross-cutting the site. A maximum of 450 feet of local relief is present. An average of less that 25 feet of soil overlies shale and limestone bedrock. Land use in the site vicinity is primarily woodland, with some industrial use related to the Oak Ridge nuclear facilities.

- Geotechnical: Moderate cost for site mitigations.
  Solution cavities.
  Not 100% flood dry in normal condition.
- Environmental: Moderate population near site.
- Regulatory Data Base: None.
- Transportation: Good access.
- Institutional: DOE ownership.
  Good nuclear support infrastructure.
  Strong DOE local presence.

D.7 PADUCAH GASEOUS DIFFUSION PLANT SITE, KENTUCKY - DOE SITE

The Paducah site is located in western Kentucky, in McCracken County (latitude 37 degrees 07 minutes North/longitude 88 degrees 49 minutes West) (Figure 5-4). The candidate site is within a U.S. Department of Energy owned reservation adjacent to and surrounding the Paducah Gaseous Diffusion Plant. The site is approximately 10 miles west of Paducah, Kentucky and immediately south of the Ohio River.

The U.S. Department of Energy reservation of Paducah covers 3425 acres. This area is surrounded by an additional 2780 acres that is owned by the U.S. Department of Energy but is currently leased to the Kentucky Department of Natural Resources and Environmental Protection. It is assumed that this leased land would be available for the MRS facility if needed. A large portion of the 3425 acre Paducah reservation is currently occupied by the Paducah Gaseous Diffusion Plant and appurtenant works.

The topography relief across the site is low. The average slope is approximately 1%, sloping toward the north. The site is underlain by a thick accumulation of unconsolidated to poorly consolidated loesses, alluvium, sand, and gravel. Land use within the site vicinity is predominantly agricultural and open space land. Eight small communities are located within a 5-mile radius of the site.

- Geotechnical:
  - >.25G ground acceleration.
  - Potential for liquifaction.
  - Close to seismic sources.
  - Very high cost for site mitigations.
- Environmental:
  - Adjacent to Class I Air Area (Mammoth Caves).
  - Habitat for rare and endangered species.
  - High frequency of winter inversions.
  - Non-attainment of natural ambient air quality standards in SO_2 and TSP.
- Site Adaptation:
  - Relocation of power lines.

- Regulatory Data Base: None.
- Transportation: Two rail companies.
- Institutional: DOE ownership.

D.8 PERKINS NUCLEAR STATION SITE, NORTH CAROLINA - DUKE POWER COMPANY

The Perkins site is located in Davie County in west-central North Carolina (latitude 35 degrees 50 minutes 53 seconds North/longitude 80 degrees 27 minutes 10 seconds West) (Figure 5-10). The site is on the Yadkin River, approximately seven miles east-southeast of Mocksville, North Carolina. The candidate site includes the entire area of Duke Power Company's cancelled Perkins Nuclear Station site.

The Duke Power Company owns approximately 1206 acres at the Perkins Nuclear Station site. The surrounding land is privately owned. Only site investigations for the nuclear station were performed at the site prior to cancellation. No construction activities were performed.

The topography across the site consists of low, rounded hills and gentle slopes. Elevations range from approximately 650 to 775 feet. The site is underlain by an average of 50 to 60 feet of saprolite soils and weathered rock overlying hard, granitic bedrock. Land use within the site vicinity is primarily agriculture.

- Geotechnical: Lowest cost.
  Not 100% flood dry in natural condition.
  Good site characteristics.
- Environmental: Near population centers >1.5 million (Winston-Salem).
- Regulatory Data Base: No NRC license review.
- Transportation: Good access/2 rail companies.
  East slope of Appalachians.
  Suburban population near sites.

D.9 PHIPPS BEND NUCLEAR PLANT SITE, TENNESSEE - TVA

The Phipps Bend site is located in northeastern Tennessee in Hawkins County (latitude 36 degrees 27 minutes 47 seconds North/longitude 82 degrees 48 minutes 32 seconds West) (Figure 5-31). The candidate site includes the entire area of the TVA's cancelled Phipps Bend Nuclear Power Plant. The closest community is Surgoinsville, Tennessee, about 2-1/2 miles west of the site. Knoxville, Tennessee is 70 miles southwest of the site.

The Phipps Bend Nuclear Power Plant site had an area of 1270 acres. Unit 1 was 27% complete and Unit 2 was 5% complete when the project was cancelled.

The topography across the site is moderate with incised drainage channels on the southern portion of the site. The northern portion of the site is underlain by alluvial terraces, and the southern portion by 20 to 60 feet of soil overlying shale bedrock. Land use in the site vicinity is primarily woodland and agriculture.

- Geotechnical: Solution cavities.
  Potential for liquifaction.
  Moderate cost for site mitigations.
  Extensive cut & fill.
  Requires more than normal grading to reach flood dry condition.
- Transportation: Access through mountains and communities.
- Regulatory Data Base: Received NRC Construction Permit
- Institutional: Federal ownership.

D.10 SAVANNAH RIVER PLANT SITE, SOUTH CAROLINA - DOE SITE

The Savannah River site is located in southwestern South Carolina, in Barnwell County (latitude 33 degrees 22 minutes 23 seconds North/longitude 81 degrees 30 minutes 20 seconds West) (Figure 5-19). The candidate site lies entirely within the U.S. Department of Energy's Savannah River Plant reservation. The site is approximately 25 miles southeast of Augusta, Georgia and approximately 55 miles southwest of Columbia, South Carolina. Aiken and Barnwell, South Carolina, are the closest towns of significant size to the site, approximately 18 miles north and 8 miles east respectively.

The Savannah River Plant reservation is a 300 square-mile controlled area managed by the U.S. Department of Energy. The candidate MRS facility site is located in the northwestern portion of the reservation. Currently, the site is undeveloped.

The topography across the site is relatively level. An ellipsoidal closed depression similar to the Carolina Bays occurs within the site area. The site is underlain by approximately 1000 feet of unconsolidated Cenozoic sediments. These sediments are predominantly clay, sand, and clayey-sand with some sandy-marl. The controlled area within the reservation is primarily woodland. Less than 5% of the total area is being used for nuclear-related activities.

- Geotechnical:
  - Low cost for site adaptation.
  - Potential for >.25g seismic design.
  - Potential for liquifaction.
  - Solution cavities/sinkholes.
  - Not 100% flood dry in natural condition.
- Environmental:
  - 11 tornadoes per year--operating impacts.
  - Habitat for rare and endangered species.
- Transportation:
  - Good access--2 rail companies.
- Institutional:
  - DOE ownership.
  - Good nuclear support infrastructure.
  - Strong DOE local presence.

D.11 YELLOW CREEK NUCLEAR PLANT SITE, MISSISSIPPI - TVA SITE

The Yellow Creek site is located in northeastern Mississippi, in Tishomingo County (latitude 34 degrees 47 minutes 25 seconds North/longitude 88 degrees 12 minutes 55 seconds West) (Figure 5-7). The candidate site includes the entire area of the Tennessee Valley Authority's (TVA) cancelled Yellow Creek Nuclear Plant site. The site is nine miles north of the closest town, Iuka, Mississippi, and is located on the Yellow Creek embayment of Pickwick Lake.

The Yellow Creek Nuclear Plant site included an area of approximately 1160 acres. All of this area is owned by the TVA with the exception of the Salem Church and Cemetery property. The two nuclear units were 33% complete when cancelled.

The topography across the site is generally steep with low rolling hills and incised valleys. Elevations across the site range from approximately 500 to 700 feet. The site is underlain by an average of 60 feet of unconsolidated sediments overlying silty-limestone and calcareous-siltstone. Land use in the site vicinity is primarily forest and agriculture.

- Geotechnical: .3G ground acceleration (NRC-CP).
  Solution cavities.
  High cost to mitigate site characteristics.
- Environmental: Potential land use conflict with Pickwick Lake (3.3 million visitor days per year).
  Habitat for rare and endangered species.
- Site Adaptation: Potential need to relocate houses, church, cemetery.
  Cannot accommodate 70,000 MT--Alternate concept.
- Transportation: 100 miles to interstate through several towns.
- Institutional: Federal ownership.
  Regional (3 state) influence area with regional watershed authority.
- Regulatory Data Base: Received NRC construction permit.