1 of 2

EARLY SITE PERMIT DEMONSTRATION PROGRAM

SNH/NM--699795-6

Siting Guide: Site Selection and Evaluation Criteria for an Early Site Permit Application

18-93

Prepared by the *Joint Contractors* (Southern Electric International, Commonwealth Research Corporation, and Public Service Corporation of New Jersey), in cooperation with the Electric Power Research Institute, the Nuclear Management and Resources Council, the U.S. Department of Energy and Sandia National Laboratories.

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*Siting Guidel:
Site Selection and Evaluation Criteria
For an Early Site Permit Application*

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EARLY SITE PERMIT DEMONSTRATION PROGRAM (ESPDP)

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**EARLY SITE PERMIT
DEMONSTRATION PROGRAM**

**SITING GUIDE:
SITE SELECTION
AND EVALUATION CRITERIA
FOR AN
EARLY SITE PERMIT APPLICATION**

Prepared by:

**Dames & Moore
With
Gilbert/Commonwealth, Inc.
Under
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ACRONYMS

ALWR	advanced light water reactor
BOD	Biological Oxygen Demand
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COL	construction and operating license
CSRL	Construction Engineering research Laboratory
DO	dissolved oxygen
DOE	Department of Energy
EA	exclusion area
ECRA	Environmental Clean-Up Responsibility Act
EPA	Environmental Protection Agency
EPRI	Electric Power Research Institute
ER	Environmental Report
ESP	early site permit
ESRP	Environmental Standard Review Plan
ETIS	Environmental Technical Information System
FD	fault distance
FEMA	Federal Emergency Management Agency
FL	fault length
GIS	Geographic Information System
GWe	Gigawatt (electric)
JC	Joint Contractors
LPSIRS	Line Printer Soils Information Retrieval System
MPSS	Multiple Parameter Series Search
NCC	National Climatic Center
NEPA	National Environmental Policy Act
NEHRP	National Earthquake Hazard Reduction Program
NOAA	National Oceanic and Atmospheric Administration
NPOC	Nuclear Power Oversight Committee
NRC	Nuclear Regulatory Commission
NUMARC	Nuclear Management and Resources Council
MWe	Megawatt (electric)

pga	peak ground acceleration
PPE	plant parameter envelope
PMP	Portable Maximum Precipitation
RCER	Regulatory Criteria Evaluation Report
RFQ	Request for Quotation
ROI	Region of Interest
SCS	Soil Conservation Service
SDWA	Safe Drinking Water Act
SEI	Southern Electric International
SIC	Standard Industrial Code
SIRS	Soils Information Retrieval System
SNL	Sandia National Laboratories
SSE	Safe Shutdown Earthquake
STAR	Stability Array (data)
T&E	Threatened & Endangered
URD	Utility Requirements Document
USACOE	U.S. Army Corps of Engineer
USGS	United States Geological Survey

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ESP SITING GUIDE - TASK 3

1.0 INTRODUCTION

In August 1991, the Joint Contractors came to agreement with Sandia National Laboratories (SNL) and the Department of Energy (DOE) on a workscope for the cost-shared Early Site Permit Demonstration Program. One task within the scope was the development of a guide for site selection criteria and procedures. A generic Siting Guide has been prepared that is a roadmap and tool for applicants to use developing detailed siting plans for their specific region of the country. The guide presents three fundamental principles that, if used, ensure a high degree of success for an ESP applicant.

- First, the site selection process should take into consideration environmentally diverse site locations within a given region of interest.
- Second, the process should contain appropriate opportunities for input from the public.
- Third, the process should be applied so that it is clearly reasonable to an impartial observer, based on appropriately selected criteria, including criteria which demonstrate that the site can host an advanced light water reactor (ALWR).

The Siting Guide provides for a systematic, comprehensive site selection process in which three basic types of criteria (exclusionary, avoidance, and suitability) are presented via a four-step procedure. It provides a check list of the criteria for each one of these steps. Criteria are applied qualitatively, as well as presented numerically, within the guide. The applicant should use the generic guide as an exhaustive checklist, customizing the guide to his individual situation.

1.1 BACKGROUND

In November 1990, the Nuclear Power Oversight Committee (NPOC) prepared a strategic plan for building new nuclear power plants. An essential element in the strategy (Building Block 5) consists of initiating a project to obtain Nuclear Regulatory Commission (NRC) approval through newly issued 10 CFR Part 52 (Early Site Permits; Standard Design Certifications and Combined Licenses for Nuclear Power Reactors). The plan may be implemented either through attainment of an early site permit (ESP) or through the submission of and NRC approval of a combined construction and operating license (COL) application for a design certified ALWR under NRC's standardization rule. In 1990 SNL issued a Request for Quotation (RFQ) to test the ESP process in a demonstration program. In early 1991, the Joint Contractors (JC), consisting of Southern Electric International (SEI), Commonwealth Research Corporation, and Public Service Corporation of New Jersey, was formed and was selected by the DOE through SNL to implement the Early Site Permit Demonstration Program. The JC is being assisted by the Electric Power Research Institute (EPRI) and the Nuclear Management and Resources Council (NUMARC). The JC has developed a phased approach to the preparation, review, and application to NRC for acceptance of an early site permit as follows:

Phase I - Regulatory Review and Technical Evaluation

Phase II - Applicant Selection and Planning for Phase III

Phase III - Site Specific Activities, Licensing, and Approval

Two initial tasks within Phase I (Tasks 1 and 2) are nearing completion. Task 1 is a technical review and assessment of regulatory issues related to ESP. Task 2 includes plant parameter envelope development for ESP. The subject of this study is Task 3, site selection and evaluation criteria for ESP application. The product of Task 1, the "Regulatory Criteria Evaluation Report" (RCER) (Halliburton NUS, March 1993) and the Task 2 product, the "Plant Parameters Envelope" Volume 1 (Bechtel Corporation, March 1993) provided major input to this Task 3 report. In addition to these Task 1 and 2 products, the "Advanced Light Water Reactor Utility Requirements Document" (EPRI), referred to in this report as the URD, was a resource

document for this Task 3 report. Dames & Moore was supported by Gilbert/Commonwealth, Inc. in the preparation of Section 3.4.

1.2 PURPOSE AND GOALS

The purpose of Task 3 is to develop a generic siting guide that is responsive to 10 CFR 52 and related regulations and forms a roadmap for an applicant to use in developing a detailed siting plan for a specific region of the country. The scope of work for the siting guide development includes the following:

- Review of the results of prior Early Site Permit Demonstration Program tasks;
- Development of screening and evaluation (suitability) criteria using the compilation of federal siting requirements in ESP Task 1, the plant parameters envelopes, and the results of a review of state regulatory requirements applicable to ESP (see Appendix A for a detailed discussion of state requirements);
- Development of procedures for application of the criteria into an overall siting methodology which:
 - Incorporates the opportunity for early and continued public participation;
 - Includes a mechanism to consider previously identified sites in the screening and evaluation process; and
 - Addresses the generic plant parameter envelopes in the siting criteria and process.

It should be noted that the purpose of this guide is to define a procedure whereby an applicant can identify site(s) that can be the subject of a successful ESP application. The siting criteria developed in this guide require consideration of many of the environmental impacts addressed in the Environmental Report (ER) that is required to accompany the ESP application (see Regulatory Guide 4.2). Execution of the process outlined in this guide will also provide specific material required for Section 9.0 of the ER. Applicants should note, however, that ER

preparation will require additional detailed environmental impact analyses beyond those undertaken in the siting process.

1.3 REPORT STRUCTURE

This section provides an overview of the balance of the report. Section 2.0 presents an overview of the proposed siting procedure including:

1. A discussion of the phased approach (Section 2.1);
2. The siting criteria (Section 2.2) are presented in four groups:
 - Health and Safety;
 - Environmental;
 - Socioeconomic/Land Use; and
 - Engineering and Cost;
3. Procedures for scoring criteria (Section 2.3);
4. Procedures for developing criteria importance weightings (Section 2.4).

A detailed list of siting criteria and how they are applied in the siting process appears in Section 3.0. Section 4.0 discusses the public participation process.

The results of the review of applicable state requirements is presented in Appendix A. A description of the use of Geographic Information Systems (GIS) as a tool in modern siting studies is provided in Appendix B; the modified Delphi technique, one tool for deriving criterion importance values, is described in Appendix C; and, tables outlining the plant parameter envelopes are provided in Appendix D.

2.0 SITING PROCEDURE

This section contains a description of suggested elements of an overall siting procedure. It is a general guide to be used to assist applicants in the development of region-specific Siting Plans. It also serves as a comprehensive checklist of siting criteria that should be considered and provides methods for the evaluation of criteria. Consideration has been given to the full spectrum of siting criteria, all of which may not be applicable to a particular region; accordingly, applicants must "customize" the process through development of a detailed siting plan using this Guide as a roadmap.

There are five primary components of the ESP siting procedure. They are defined and discussed in the following section:

1. Siting procedure overview - Section 2.1
(Functional steps required to screen a region of interest down to sites which can be the subject of an ESP application)
2. Siting Criteria - Section 2.2
(Criteria which represent regulatory, plant design, and environmental requirements which should be taken into account in site selection)
3. Criterion Scoring - Section 2.3
(Development of "utility functions" which quantify the relative suitability of a site with respect to a single criterion)
4. Weighting/Composite Suitability - Section 2.4
(Development of weight factors which reflect the relative importance of individual criteria in siting and development of a composite suitability value which reflects siting tradeoffs among criteria)
5. Public Involvement - Section 2.1, Section 4.1
(Development of a process for integrating public information and public participation in the siting process. Reference to interaction between the functional siting process and public involvement is made in Section 2.1; a more detailed discussion of the subject is provided in Section 4.1.)

It should be noted that the discussion which follows requires some "forward referencing" in that some concepts are introduced before they are formally defined (e.g. siting criteria are referenced in Section 2.1 but are defined in Section 2.2). It is strongly recommended that the reader review Section 2.0 once in its entirety to develop a familiarity with the siting concepts, and a second time to fully understand the overall siting procedure.

2.1 SITING PROCEDURE OVERVIEW

A comprehensive decision tree process for ESP site selection is given on Figure 2-1. This decision tree illustrates the flow of the process, how the various steps incorporate and apply the three types of criteria (exclusionary, avoidance, and suitability), and points of opportunity for public participation. The elements of the procedure for ESP siting are tabulated in Table 2-1. For each of the steps, the starting point; the process employed at the step; the type of criteria to be used; the map scale likely to be most useful; the nature of the data sources; and the end product of each step are indicated.

For purposes of developing this Guide, it has been assumed that the applicant has identified a Region of Interest (ROI) which defines the geographic area within which their site must be located and that the need for obtaining an ESP have been established. In defining the public participation requirements for the siting process, it has also been assumed that the applicant has obtained tacit concurrence from the appropriate public/regulatory bodies on both the need for a site and the ROI. Although assumptions regarding ROI and public participation have been made to provide a starting point for the Guide, the public may participate at earlier stages; and ROI definition and approval may vary for individual applicants.

Steps 1 and 2 of the process are areal in nature, screening from a relatively large region of interest to a number of discrete "site-sized" parcels, each of which can be evaluated as a potential nuclear power plant site. These steps are accomplished using mappable information

FIGURE 2-1
EARLY SITE PERMIT SITE SELECTION
COMPREHENSIVE DECISION TREE PROCESS

Table 2-1
Outline of Phased ESP Siting Approach

STEP	1	2	3	4
STARTING POINT	Region of Interest	Candidate Areas	Potential Sites	Candidate Sites
PROCESS	Area Screening	Area Screening	Site Screening	Site Selection: Issue By Issue Analysis
CRITERIA E-Exclusionary A-Avoidance S-Suitability	E&A	E&A	Principally S Some Redefinition of E&A Boundaries	Principally S
RESULT	Candidate Areas	Potential Sites	Candidate Sites	Acceptable Sites or Preferred Sites
DATA SOURCES	Published 1:250,000 or Smaller	Published 1:125,000 to 1:24,000	Published and Reconnaissance 1:24,000	Detailed On-site Verification Surveys 1:24,000 or Larger

and can be greatly facilitated by employing a computerized Geographic Information System (GIS). A more detailed description of this important siting tool is provided in Appendix B.

Comparison of individual sites on the basis of their relative suitability is the focus of Steps 3 and 4. This portion of the procedure begins with the use of mapped and other published information and concludes with detailed information collected through on-site investigations, as necessary, culminating in the selection of a preferred site for which an ESP application can be submitted. It will be noted that, throughout the siting process, the level of information detail and the corresponding level of confidence in site characterizations increases continuously as the process unfolds. Accordingly, previous conclusions should be evaluated at each step of the process to ensure that they remain valid in light of new data. A summary description of each step follows (please see Section 2.2 for a discussion of the criterion types discussed below):

Step 1 - The ROI is first screened using exclusionary criteria to eliminate those areas in which a nuclear plant cannot feasibly be located due to regulatory, institutional, plant design, and/or environmental constraints.

Further screening is performed using avoidance criteria to eliminate feasible -- but less favorable -- areas, thus further reducing the area remaining under consideration. Should this process result in an area too small for identification of an adequate number of potential sites, the criteria can be relaxed and the process repeated. If the area remaining is too large and additional avoidance criteria can be defensibly applied, the criteria may be made more stringent and the process can be repeated. The avoidance screening is repeated until candidate areas identified are adequate (but not unreasonably large) to present multiple siting options or until no more restrictive avoidance criteria can be justifiably applied.

Step 2 - Candidate areas identified in Step 1 are further screened using refined exclusionary and avoidance criteria to identify optimum areas for plant. As in Step 1, screening is conducted as an iterative process with refinement of criteria until an appropriate number of potential sites can be identified. Potential sites are identified as discrete parcels of land approximating the size

of an actual plant site (e.g., 2-5 times the minimum land area required). While areal screening is used to identify areas within which potential sites can be identified, professional judgment should be incorporated in defining potential sites to ensure they are feasible, optimized to the degree possible, and allow some flexibility in the site layout process.

Step 3 - The objective of Step 3 is to identify and rank a relatively small number of candidate sites for a more detailed study. As discussed in Section 2.4, sensitivity analysis of criterion weights can be performed to provide confidence in the Step 3 results. Published data and reconnaissance-level data are utilized in Step 3. This more detailed data used during Step 3, allows one to arrive at a suite of sites (the highest ranked sites) which are, based on the data, acceptable candidates for an ESP application (e.g., acceptable sites: any site which survives this step should be capable of obtaining an ESP).

Step 4 - The purpose of this step is to select a preferred site from acceptable sites identified in Step 3. To accomplish this objective, this step may be used to conduct additional screening of the acceptable sites and/or can be simply a confirmation of the results of Step 3, at a higher confidence level, using more detailed site specific data (Step 4A). Actual logistics of Step 4A should be designed based on the applicant's needs and the number of sites remaining after Step 3. Detailed on-site studies designed to provide verification of critical site suitability characteristics (which have been based up to this point on published data and reconnaissance information) should be conducted first. These studies will provide the basis for an issue-by-issue analysis that will allow the applicant to identify the cost and environmental tradeoffs associated with developing each of the acceptable sites during Step 4B. Costs for these verification studies have proven to be justified in that they provide a higher level of assurance that the preferred site has no fatal flaws that may result in extended licensing delays and costs. This approach has also become the norm in recent siting of low-level radioactive waste and similar facilities.

In contrast to the composite suitability analyses conducted in earlier steps which "roll up" all site suitability considerations into a single composite value, this analysis allows the decision-maker to consider actual tradeoffs in environmental impacts and site-specific costs quantitatively

(e.g., acres of wetlands, miles of transmission line, etc.). This information should be presented in a tabular format using Table 5 of Regulatory Guide 4.2 as a model.

2.2 SITING CRITERIA

This section contains a definition of the siting criteria types as used in this Guide and an overview of the criteria. A detailed description of the siting criteria and their application appears in Section 3.0.

2.2.1 Criteria Types

In defining types of criteria to be applied at each siting step, it is noted that the criteria can be assigned to a hierarchy according to the severity of constraint imposed by consideration of the underlying requirement. Three such levels of hierarchy are identified in this Guide. Exclusionary criteria represent requirements which, if not satisfied by site conditions, would preclude an ESP. Examples include site parameters which do not fall within applicable Plant Parameters Envelopes (PPEs), National Parks, and high population densities. Exclusionary criteria are used to exclude areas based on consideration of go no-go situations based, for the most part, on regulatory requirements and/or plant design (e.g., PPEs).

Avoidance criteria have the same site screening effect as applying exclusionary criteria but are more flexible in their application. They are utilized to identify broad areas with more favorable than unfavorable conditions; an example might be increasing distance from population centers. The boundaries between these areas are not well defined in regulation and thus are flexible to other goals of an effective siting approach. One of the goals of an effective siting approach is to strike a balance between 1) having a sufficient number and diversity of potential sites for further study in Step 3; and 2) having too large a number of potential sites to practically consider in Step 3. This balance is achieved in Steps 1 and 2 through application of avoidance criteria. Should the use of a suite of avoidance criteria combined with exclusion criteria in

Steps 1 and 2 result in too few or too many potential sites for use in Step 3, the avoidance criteria can be redefined accordingly.

The third, and last, level of the hierarchy is that of suitability criteria. Criteria falling into this category are those which affect the relative environmental suitability or cost of developing the site but do not represent unacceptable environmental stress, severe licensing problems, or excessive additional cost. Examples of suitability criteria are local topographic features, access considerations, important species habitat, impingement/entrainment effects, and location of the site as near the load center as possible. Evaluation of sites with respect to suitability criteria requires assessing trade-offs among the various criteria, as described in Section 2.3.

2.2.2 Criteria Grouping

The site selection process utilizes criteria applied as exclusionary, avoidance, and suitability. However, past practice and regulatory requirements have grouped criteria according to similarity of characteristics. In order to provide an easier correlation to other groupings of criteria, four groups of criteria have been provided within the Guide.

- Health and Safety;
- Environmental;
- Land Use and Socioeconomics;
- Engineering and Cost-related;

The criteria identified within each group are presented in Tables 2-2 through 2-5. This organization provides for separate consideration of the effect of construction and operation, each with regard to the Health and Safety and Environmental criteria. The Environmental criteria were further divided based on the consideration of effects to aquatic and terrestrial ecology. The Health and Safety criteria were further divided into accident cause-related, accident effects-related, and operational effects-related criteria. Health and Safety; transportation and

transmission; and land use/socioeconomics factors comprise the Engineering and Cost-Related criteria. It is important to note that detailed hard and fast cost estimates are not possible for ESP. These criteria reflect site attributes which affect relative costs.

An overview of the grouping along with how criteria are applied to the screening process is provided in Tables 2-2 through 2-5. Also shown in the tables are the disciplines which are utilized in applying each of the criteria. This allows correlation with the typical discipline breakdown utilized in many ER and related National Environmental Policy Act (NEPA) documents. It also facilitates the weighting of criteria.

2.3 CRITERION SCORING

To evaluate the suitability of each Potential Site in Step 3 and each Candidate Site in Step 4, each criterion is first evaluated independently. This evaluation is accomplished by defining a utility function that translates quantifiable site characteristics into a common suitability scale expressing preferences for one site over another. A typical suitability scale ranges from 1 to 5, where 1 is the lowest level of suitability (least preferable) and 5 is the highest (most preferable). An example of this utility function translation might be distance to population centers, where a site at a distance "x" (in miles) would be assigned a suitability of, say, 2 and distance "y" ($y > x$) assigned a suitability of 3. Using this utility function as an example, sites at distance "y" from population centers are more preferable than those at distance "x". Several additional examples of utility functions can be found in the individual criteria discussions of Chapter 3.

Table 2-2
HEALTH & SAFETY CRITERIA

Siting Guide Section	CRITERIA	STEPS			
		1	2	3	4
3.1.1	Accident Cause-Related				
3.1.1.1	Geology/Seismology (GEOL)				
3.1.1.1.1	Vibratory Ground Motion	E	E	S	S
3.1.1.1.2	Capable Faults	E & A	E & A	S	S
3.1.1.1.3	Geologic Hazards	A	A	S	S
3.1.1.1.4	Soil Stability			A & S	S
3.1.1.2	Cooling System Requirements				
3.1.1.2.1	Cooling Water Supply (HYDRO)	A	A	S	S
3.1.1.2.2	Ambient Air Requirements (MET)	E			
3.1.1.3	Flooding (HYDRO)	E	E	S	S
3.1.1.4	Nearby Hazardous Land Uses (LU, SOCEC)				
3.1.1.4.1	Existing Facilities	A	A	S	S
3.1.1.4.2	Projected Facilities			S	
3.1.1.5	Extreme Weather Conditions (MET)				
3.1.1.5.1	Winds	E&A		S	
3.1.1.5.2	Rainfall	E&A			
3.1.2	Accident Effects-Related				
3.1.2.1	Population (DEM)	E	E	S	S
3.1.2.2	Emergency Planning (DEM, LU, SOCEC)			S	S
3.1.2.3	Atmospheric Dispersion (MET)			S	
3.1.3	Operational Effects-Related				
3.1.3.1	Surface Water - Radionuclide Pathway				
3.1.3.1.1	Dilution Capacity			S	S
3.1.3.1.2	Baseline Loadings			S	S
3.1.3.1.3	Proximity to Consumptive Users (HYDRO & RAD)			S	
3.1.3.2	Groundwater Radionuclide Pathway (HYDRO & RAD)	A	A	S	S
3.1.3.3	Air Radionuclide Pathway (MET, RAD)				
3.1.3.3.1	Topographic Effects	A	A	S	
3.1.3.3.2	Atmospheric Dispersion			S	
3.1.3.4	Air-Food Ingestion Pathway (MET, RAD, LU)			S	
3.1.3.5	Surface Water-Food Radionuclide Pathway (HYDRO, RAD, & LU)			S	S
3.1.3.6	Population (DEM)	E	E	S	S
3.1.3.7	Transportation Safety (MET, LU)			S	

KEY: E = Exclusionary
A = Avoidance
S = Suitability
(MET,) = Discipline

**TABLE 2-3
ENVIRONMENTAL CRITERIA**

Siting Guide Section	CRITERIA	STEPS			
		1	2	3	4
3.2.1	Construction-Related Effects on Aquatic Ecology				
3.2.1.1	Disruption of Important Species/Habitats (ECOL)			S	S
3.2.1.2	Bottom Sediment Disruption Effects (HYDRO)				
3.2.1.2.1	Contamination			S	S
3.2.1.2.2	Grain Size			S	S
3.2.2	Construction-Related Effects on Terrestrial Ecology				
3.2.2.1	Disruption of Important Species/Habitats and Wetlands (ECOL)			A&S	S
3.2.2.1.1	Important Species/Habitats			S	S
3.2.2.1.2	Woodlands	E	E	S	S
3.2.2.1.3	Wetlands				
3.2.2.2	Dewatering Effects on Adjacent Wetlands (ECOL)			A&S	S
3.2.2.2.1	Depth to Water Table			S	S
3.2.2.2.2	Marginal Wetlands				
3.2.3	Operational-Related Effects on Aquatic Ecology				
3.2.3.1	Thermal Discharge Effects (ECOL & HYDRO)			S	S
3.2.3.1.1	Migratory Species Effects			S	S
3.2.3.1.2	Disruption of Important Species/Habitats			S	S
3.2.3.1.3	Water Quality				
3.2.3.2	Entrainment/Impingement Effects (ECOL & HYDRO)			S	S
3.2.3.2.1	Entrainment Organisms				
3.2.3.3	Dredging/Disposal Effects (LU & HYDRO)			S	S
3.2.3.3.1	Upstream Contamination sources			S	S
3.2.3.3.2	Sedimentation Rates				
3.2.4	Operational-Related Effects on Terrestrial Ecology				
3.2.4.1	Drift Effects on Surrounding Areas (ECOL)			S	S
3.2.4.1.1	Important Species/Habitat Areas			S	S
3.2.4.1.2	Source Water Suitability				

**TABLE 2-4
SOCIOECONOMIC-LAND USE CRITERIA**

Siting Guide Section	CRITERIA	STEPS			
		1	2	3	4
3.3.3	Construction and Operation Effects (LU & SOCEC)	E	E	S	S

KEY: E = Exclusionary
A = Avoidance
S = Suitability
(MET.) = Discipline

**Table 2-5
ENGINEERING AND COST-RELATED CRITERIA**

Siting Guide Section	CRITERIA	STEPS			
		1	2	3	4
3.4.1	Related to Health & Safety				
3.4.1.1	Water Supply (HYDRO)	A	A	S	S
3.4.1.2	Pumping Distng Distance (ENG)	A	A	S	
3.4.1.3	Flooding (HYDRO)	E	E	S	S
3.4.1.4	Vibratory Ground Motion (GEOL)	E	E		
3.1.5	Soil Stability (GEOL)			S	S
3.4.2	Related to Transportation and Transmission (LU & ENG)				
3.4.2.1	Railroad Access		A	S	S
3.4.2.2	Highway Access		A	S	S
3.4.2.3	Barge Access		A	S	S
3.4.2.4	Transmission		A	S	
3.4.3	Related to Socioeconomic/Land Use (LU & SOCEC)				
3.4.3.1	Site Size (ENG)		E		
3.4.3.2	Topography (ENG)	E	A	S	S
3.4.3.3	Land and Water Rights (LU)			S	S
3.4.3.4	Labor Rates (ENG-COST)			S	

KEY: E = Exclusionary
A = Avoidance
S = Suitability
(MET,) = Disciplines

Many utility functions relate attributes to the suitability scale on a linear function. However, other nonlinear functions are appropriate for other situations and would be defined based on the professional judgment of the discipline specialist. Functions can be continuous when the suitability attribute can be represented by a quantitative continuum or can be stepwise where the suitability attribute is grouped into classes or groups, such as land use categories and scored by the professional according to increased suitability. It will be important for applicants to ensure that utility functions defined in their Siting Plan properly reflect site conditions and technical concerns unique to their ROI.

2.4 CRITERIA/IMPORTANCE WEIGHTING

In evaluating the inevitable tradeoffs between suitability criteria, it is necessary to assign a relative importance to each criterion in selecting a nuclear power plant site; the relative importance should be reflected as a numerical weight value. In a simple example, if thermal impacts are considered to be twice as important as entrainment effects, the former criterion might be assigned a weight twice as large as that for the former. Assignment of weights is a sensitive issue in siting studies because the opinions and value judgments as to the relative importance of individual criteria vary with the perspectives of the individual or interest group (e.g., utility, regulator, public interest group, etc.).

There are a number of techniques for assigning importance weights to criteria. It is recommended that a ratio weighting technique be utilized. In this process, criteria are placed in rank order and a value of 1 is assigned to the least important criterion. The evaluator then assigns numerical weights such that each of the remainder of the criteria receives a weight value depicting how much more important it is relative to the other ranked criteria. These relative rates are then normalized to 1.0. These normalized weights are then multiplied by the utility scores (1-5) and summed to get an overall weighted score (composite suitability value) for each site. These composite suitability values can then be used to rank or compare sites in terms of their overall favorability.

A possible variation on the use of a single consensus weighting for each criterion would be the determination of separate site rankings using the consensus weightings of various interest groups. These groups and their resulting site rankings could then be brought together in an open, moderated group discussion to find common ground for an agreed-upon identification of the top few sites to be analyzed further in Step 3.

This process of criterion weighting and composite suitability scoring can be applied at both site screening and site evaluation stages, although a GIS application is required for the former. Sensitivity studies using difference criterion weight sets (thereby reflecting different viewpoints) can be conducted to assess the effect on the selection of a preferred site and thereby lend additional credibility to the decision process.

There are a variety of methods for developing criteria weight values (e.g., nominal group technique, modified Delphi, Kepner-Tregoe, etc.), each of which can be employed at both site screening and site evaluation stages of the siting process. While detailed discussion of these techniques is beyond the scope of this Guide, a summary of one (the modified Delphi) is provided in Appendix C.

DETAILED DISCUSSION OF SITING CRITERIA

3.0 INTRODUCTION

Provided in this section is a detailed description of each siting criterion and its application in the siting procedure. It should be noted that these criteria descriptions have been designed to be generic so that they can be applied to an ESP application anywhere in the continental United States. Accordingly, some "customization" of utility functions may be appropriate for specific regions; and some criteria may not be applicable for some siting applications.

Insofar as is possible in a generic siting procedure, state regulations which may have a bearing on the process have been incorporated along with federal requirements in designing these criteria (e.g., see the discussion on ground water protection and Environmental Assessments (EAs) for real estate transactions in Appendix A). In general, state requirements closely follow their federal analogs. However, individual states have unique requirements which could require modifications to or addition or deletion of criteria; the user is referred to Appendix A for examples which were found in the review conducted in support of this effort.

Each applicant should conduct a review of the materials in this guide; the state siting, emergency planning, and environmental regulations applicable to his region of interest; and the physical characteristics of the region of interest as the first step in the siting process. Based on this review, the applicant will be able to design a detailed Siting Plan.

A summary breakdown of the criterion categories is provided in Tables 2-2 through 2-5. Also shown in these tables are the disciplines which are utilized in evaluating each of the criteria. This allows correlation with the typical discipline breakdown utilized in many ERs and related NEPA documents and illustrates the fact that evaluation may involve more than one discipline. This structure also facilitates the criteria importance weighting activities which are required as part of the suitability evaluations for Steps 3 and 4.

It should be noted that ESP Task 1 results identified a number of regulatory questions that are being addressed by ongoing activities. Where these questions are related to the siting process, they are identified and discussed in the appropriate criterion discussions below; applicable RCER Discussion Papers from ESP Task 1 are referenced.

A number of other evolving regulatory applications have been identified in the review of non-federal siting requirements, such as 1) land use restrictions related to the Safety Drinking Water Act (SDWA) ground water protection and well head protection issues; and 2) the growing trend for the conduct of environmental site assessments for real estate transactions to assess the potential for sites to contain contamination effects from former use which would require expensive and time consuming remediation. These developments are discussed in Appendix A.

Plant Parameter Envelopes

One product of Early Site Permit Demonstration Program, Task 2, was the development of PPEs for the individual ALWR evolutionary and passive plant designs and for evolutionary, passive, and composite* envelopes (Reference: Plant Parameter Envelopes, Volumes I and II, Early Site Permit Demonstration Program, March 1993). These PPEs define the envelope of the plant/site interface conditions which, if not satisfied by the site, may preclude locating a given ALWR plant on the selected site.

The composite ALWR PPEs appear in Appendix D, Table D-1. They are also addressed, as appropriate, in the individual criterion discussions in the following subsections. Because of the complexity of evaluating many of the PPEs and because detailed site-specific data are often required, a site's ability to fall within the envelopes cannot be explicitly determined, in most cases, until Step 4. Where data are likely to allow PPE evaluations earlier in the process, a discussion of these applications is included; in any event, a detailed parameter-by-parameter evaluation should be conducted prior to completion of Step 4B to ensure that ALWRs can be

* "Composite" means combining the features of the four ALWR designs to create one generally applicable envelope.

accommodated at selected sites. Appendix D, Table D-2, provides the individual ALWR PPEs for the passive and the evolutionary plants.

Several of the plant parameter envelopes define site size requirements in the form of acreages, minimum setoff distances for station facilities, or site boundaries; these are PPEs 2.7.1, 2.8.1, 2.10.1, 3.6.1, 3.8.1, 9.6.6, 18.3.1, 18.3.2, 18.3.3, 25.1.1, 28.2.1, 28.2.2, 28.2.3, 28.2.4, 28.2.5, 29.2.1, and 29.2.2. A minimum site size for use in the siting process is suggested as 500 acres. This size does not include consideration of cooling ponds for normal heat sink. For evolutionary plants, the cooling ponds would require about 3,000 acres (PPE 2.10.1).

It is also important to note that this Guide has been prepared using the composite, or most restrictive, set of envelope values; applicants wishing to consider only certain ALWR designs should reference the full plant parameter envelopes list (Appendix D, Table D-2) and adjust the criteria accordingly.

3.1 HEALTH & SAFETY CRITERIA

3.1.1 Accident Cause-Related Criteria

3.1.1.1 Geology/Seismology

The Geology/Seismology criteria and their application in the various siting steps are as follows:

	Criteria	Step	1	2	3	4A	4B
3.1.1.1.1	Vibratory Ground Motion		X	X	X	X	X
3.1.1.1.2	Capable Faults		X	X	X	X	X
3.1.1.1.3	Geologic Hazards		X	X	X	X	X
3.1.1.1.4	Soil Stability				X	X	X

Note: NRC is currently in the process of revising 10 CFR 100 with regard to Seismic Issues (refer to Regulatory Criteria Evaluation Report, March 1993.)

3.1.1.1.1 Vibratory Ground Motion

Step 1 - The URD indicates that the safe shutdown earthquake (SSE) is 0.30g. Exclude areas where regional mapping indicates the peak ground acceleration (PGA) exceeds 0.30g (PPE 1.5.2) at a probability level of 0.0004, roughly corresponding to a return interval of 2500 years, approximating the SSE, using maps such as those of the recent study by Algermissen et al., in the "1991 Edition of National Earthquake Hazard Reduction Program (NEHRP), Recommended Provisions For the Development of Seismic Regulations For New Buildings", Federal Emergency Management Agency (FEMA). Where a site parameter, such as SSE, exceeds a plant parameter value, evaluations may demonstrate that the site parameter does not exceed the capability of the plant design to accommodate the site parameter. Schedule delays and additional costs would need to be considered. In addition, the applicant should acknowledge the specific ALWR design(s) he would propose to use at the site.

Step 2 - No further analysis is required for Step 2. Exclusion areas should simply be transposed to larger scale maps for better definition of boundaries.

Step 3 - The applicant should develop a utility function based on the range of pga values from Step 1 data represented by the potential sites identified in Step 2, with 5 assigned to the lowest value of pga and 1 assigned to the highest.

Step 4 - Based on detailed site information, including geologic and geotechnical site verification investigations in Step 4A, the applicant should conduct seismic risk analysis using applicable current guidance and develop utility function to score the alternative sites accordingly. Evaluate the site response (input) to the design response spectra and time history (PPEs 1.5.1, 1.5.3), respectively; from further consideration any sites which fail to meet either standard should be eliminated.

3.1.1.1.2 Capable Faults

Step 1 - Exclusion, as noted above, NRC is revising 10 CFR 100; and the details related to capable faults is likely to change. However, Regulatory Guide 4.7 indicates that sites that include capable faults are not suitable and that sites within about 5 miles of a capable fault greater than 1000 feet in length are usually not suitable. Thus for Step 1, areas should be excluded where faults which may be considered capable based on available information and are over 1000 feet in length and are located within 5 miles of a site.

Avoidance - While the details of Part 100 may change, the concept of avoiding areas based on the consideration of the size (length) of faults and their distance to the site should still be a valid basis for the approach outlined below. Table 1 of Part 100 identifies the minimum fault lengths for various distance range classes from the site out to 200 miles, which are considered non-significant and would not require detailed determinations as to whether they are capable. Table 1 is as follows (tabulation of fault distance (FD)/fault length (FL) has been added to the Table and is explained below):

Table 1		
<u>Distance from the site</u>	<u>Minimum Fault Length (mi) (FL)</u>	<u>FD/FL</u>
0 to 20	1	20
greater than 20 to 50	5	10
greater than 50 to 100	10	10
greater than 100 to 150	20	7.5
greater than 150 to 200	40	8

It should be pointed out that the Report of the Siting Policy Task Force (NUREG 0625, 1979) indicated that capable faults should be no closer to a site than 12.5 miles. From Table 1 it can be seen that the significance of faults is proportional to their length and inversely proportional to their distance from the site. Thus, the ratio of FD from the site to FL within a distance of 200 miles of the site can be used as a parameter representing potentially significant faults (SF); ($SF = FD/FL$). The range of SF for the Table 1 categories is from 20 to about 8.

The SF value for the exclusion condition for a fault greater than 1000 feet long within 5 miles of the site is about 26. The parameter to be utilized in this step would be the based on the maximum value of SF within 200 miles of the site.

Areas with high SF values should be avoided, if feasible. The regional summary statistics for range of maximum SF values should be compiled with the aid of a GIS. The upper 90 percentile value should be determined and used to identify avoidance areas. If subsequent siting factors and analysis are such that adequate candidate sites are identified, no further effort will be required. If the cumulative effects of the process do not allow adequate delineation of candidate sites, this and other avoidance criteria can be reexamined as discussed in Section 2.1.

Step 2 - No further analysis is required for Step 2 beyond detailed delineation of exclusionary and avoidance boundaries at the larger scale maps of Step 2.

Step 3 - A utility function should be developed based on the range of maximum site SF values as determined in Step 1, with the range of values represented by 5 for the lower SF values and 1 for the upper SF range values.

Optional Criterion - Capable Fault Demonstration Feasibility - In areas where it may be necessary to conduct further geologic and geophysical survey to demonstrate whether faults within a 200-mile radius of the site are capable or not, a further suitability analysis can be conducted with regard to evaluating the degree of difficulty of this demonstration. One of the characteristics which determines whether a fault is capable is evidence of movement at or near the ground surface once during the past 35,000 years or movement of a recurring nature within the past 500,000 years. These characterizations are conducted through the analysis and dating of surficial geologic formations or soils. Thus the presence of dateable surficial geologic deposits such as Pleistocene materials which contain stratigraphic structure to enable continuity demonstration are favored. Based on professional judgment, utility function classes would be established to score potential sites with regard to this factor.

Step 4 - The results of site-specific geologic studies conducted in this step will be integrated into the seismic risk analysis and evaluation discussed in Step 4 of Section 3.1.1.1.1, Vibratory Ground Motion. This analysis is used to evaluate an overall suitability for the Geology/Seismology criterion as part of the selection of the preferred site, including considerations of whether capable faults are present on the site.

3.1.1.1.3 Geologic Hazards

The following geologic and related man-made conditions should be avoided in locating the facility:

- Potential unstable slope areas;
- Areas of active volcanic activity;
- Areas of potential collapse (karstic areas in limestone, salt, or other soluble formations)
- Mined areas, such as near-surface coal mined-out areas, as well as areas where resource is present and may be exploited in the future;
- Subsidence areas caused by withdrawal of subsurface fluids such as oil or groundwater, including potential areas which may be effected by future withdrawals.

Step 1 - These areas should be mapped based on professional judgment and identified as avoidance areas.

Step 2 - The boundaries of these avoidance areas should be further defined based on the more detailed information available at the Step 2 scale.

Step 3 - Utility functions would be developed and related to distance from such adverse features based on professional judgment and regional conditions. Areas furthest away from the feature would be scored 5 and areas closest would be scored 1.

Step 4 - The utility functions and analysis of Step 3 would be updated and reevaluated for the remaining candidate sites, based on site-specific information developed for Step 4.

3.1.1.1.4 Soil Stability

Sites with competent bedrock generally have suitable foundation conditions. If bedrock areas are not available, areas with competent and stable solid soils such as dense sands and glacial tills should be selected. Areas with soils that might be unstable because of their mineralogy, lack of consolidation, water content, or potentially undesirable response to seismic or other events should be avoided. The URD indicates that the maximum ground water level is 2 feet below plant grade (PPE 1.8.2) and that the minimum bearing capacity demand is greater than or equal to 15 ksf (PPE 1.9.2). Site-specific information will be required to confirm these data, although areal data may allow elimination of some areas early in the process. Sites/areas which are found incapable of meeting these requirements at any step of the process should be excluded from further consideration.

While detailed on-site investigations will be required to determine the static and engineering properties of the site soils, initial screening can be conducted based on available information about related soil properties to guide the selection toward sites with suitable soil characteristics. A comprehensive database is available for use in the screening of sites based on soil properties. The Environmental Technical Information System (ETIS) was developed by the U.S. Army Corps of Engineers (USACOE) to support preparation of environmental impact documents and for designing and planning facilities. Three of the several systems within ETIS which can be utilized in conducting siting studies related to soil properties are: 1) the Soils Information Retrieval System (SIRS); 2) the Line Printer Soils Informational Retrieval System (LPSIRS); and 3) the Multiple Parameter Series Search (MPSS). The soil systems were developed in cooperation with the Soil Conservation Service (SCS), which gathers and compiles data on soil series as they are identified throughout the United States. The data, which apply to the properties and characteristics of more than 14,000 soils, is maintained and updated by SCS. The USACOE Construction Engineering Research Laboratory (CERL) has adapted this soil series

data and created these systems with interactive and search capabilities. For example, MPSS allows the user to search the SCS database with combinations of user-selected criteria. These criteria include soil properties. A partial listing of the soil properties associated with soil series includes the following:

engineering classification	available water capacity
bulk density	depth to bedrock
hydrologic group	permeability
shrink/swell capacity	grain size distribution
depth of high water table	mineralogy

In addition, MPSS includes geographic region criteria (either states or major land resource areas) and taxonomic soil codes. At any level in the search, the user can request a list, by series names and record numbers, of all qualifying soils defined in the search. This information can then be related to maps showing the distribution of the soil series with the qualifying properties.

Steps 1 and 2 - See Step 3 below.

Step 3 - Soil mapping at the series level is generally not available at scales smaller than SCS county soil maps (1:20,000). In some areas, such as glaciated areas, where detailed mapping of glacial deposits has been conducted and correlations can be made to general soil suitability characteristics, avoidance mapping of unfavorable areas may be possible at larger map scales used. These avoidance areas would be based on the available database and professional judgement.

For Step 3, avoidance areas would be defined and a utility function defined to relate the range and combination of unsuitable soil properties to mappable series areas using the ETIS soil system databases as discussed above. This utility function would be based on professional judgment and the nature of the soil properties characterizing the potential sites. Scores of 5 would relate to the most suitable soils among the potential sites and a score of 1 would relate to the least suitable soils. If sites are characterized by areal variation on the soil suitability

categories, areal average scores can readily be determined through the GIS mapping and analysis capabilities. If areal data allow, an evaluation of liquefaction potential and/or a shear wave velocity estimate for soils should be conducted at this step; any area which shows liquefaction potential at the site-specific SSE (PPE 1.9.1) or a shear wave velocity less than 1000 ft/sec (PPE 1.9.3) should be excluded from further consideration.

Step 4 - Based on site-specific geotechnical investigations conducted in this step, candidate sites would be evaluated by a utility function of soil stability, based on professional judgement using a similar approach as outlined above for Step 3. Based on site-specific soils data collected, final analyses should be conducted for PPEs 1.9, and, any sites falling outside the envelopes should be eliminated.

3.1.1.2 Cooling System Requirements

The Cooling System Requirements criteria and their application in the various siting steps are as follows:

	Criteria	Step	1	2	3	4A	4B
3.1.1.2.1	Cooling Water Supply		X	X	X	X	X
3.1.1.2.2	Ambient Air Requirements		X				

3.1.1.2.1 Cooling Water Supply

Guidance on cooling water requirements has been developed as part of the plant parameter envelopes; specifics are as follows:

<u>PPE</u>	<u>Requirement</u>	<u>Composite Plant Value</u>
2.7.15 2.8.18 2.10.10	Makeup Flow Rate (Closed Cycle Systems)	20,600(34,500) GPM

<u>PPE</u>	<u>Requirement</u>	<u>Composite Plant Value</u>
2.7.16 2.8.15 2.10.11	Maximum Consumption of Water (Closed Cycle System)	17,700 GPM
2.7.17 2.8.16 2.10.12	Monthly Average Consumption of Raw Water (Closed Cycle Systems)	15,400 GPM
2.9.2	Cooling Water Flow Rate (Once-through)	1,100,000 GPM

Sites which are incapable of providing these levels of water supply within applicable physical and regulatory constraints should be excluded from further consideration.

The allocation policies and laws operable at the state level govern the use and consumption of cooling water. In some cases, federal regional agencies such as the River Basin commissions may also have jurisdiction. Evaluations of the ability to supply the plant water requirements must take such allocations for other uses into account. For ESP, this would require projections of use and consumption into the future not only at the initiation of operations but through the operating period as well (up to 65 years). This timeframe may be beyond the range of periods typically planned for in state water supply plans. In the preamble to the final 10 CFR 52, the question of adequate data for such future information requirements was addressed by the Commission. The NRC stated that it is confident that there will be information adequate to support site approvals. They go on to indicate that where adequate information is not available, ESPs will not be issued. This would suggest that the approach to evaluating water supply requirements set forth in the PPEs should be conservative to allow for the uncertainties related to projecting such future use and consumption constraints.

Step 1 - The evaluation of water supply adequacy involves the comparison of 1) site supply characteristics associated with low-flow conditions as modified by other use allocations as projected into the period of plant operations with 2) the design basis plant water consumption rate in cfs. As noted above, the allowance for nonplant future allocations should be based on conservative assumptions developed in consultation with state water supply planning officials.

The US Geological Survey compiles data on the 7-day average low-flow for a recurrence interval of 10 years for streams and rivers throughout the United States. This data source should be utilized for the analysis of low-flow supply. For example, Stankowski, Limerinos, and Buell (1977) used the database and screened out areas for nuclear power plants where the data did not exceed 300 cfs. The 300 cfs was selected based on the assumption that many states would not permit more than 10 percent of the dependable flow to be withdrawn for a consumptive use. Analogous criteria which apply to the unique physical and regulatory characteristics of the ROI under study should be defined, using the PPEs outlined above as the measure of plant requirements.

Using such data, stretches of rivers or streams which show a minimum flow of record less than the total of the plant consumption rate and the future nonplant consumption rate would be mapped as avoidance areas. Areas along segments of streams or rivers which meet the criteria and which are located beyond realistic pumping distances as outlined in the discussion of Engineering and Cost-Related Issues (Section 3.4) will also be avoided. That an adequate water supply can be provided at estuarine and ocean sites with similar pumping distance constraints is assumed. For lakes, the supply capacity would be evaluated considering the lake capacity and lake levels, as well as historic low levels.

If this analysis results in inadequate availability of areas for further analysis, groundwater supply sources would be included in the evaluation as independent sources or as supplemental sources to the surface water supply. The same conservative approach to future projections of nonplant consumptive use would be applied for groundwater use. Assuming reasonably sized well fields based on cost considerations, the groundwater supply component can be estimated based on the aquifer yield characteristics. As with the surface water supply, the areas which do not meet the total of the plant consumption rate and projected future nonplant consumptive uses would be mapped as avoidance areas. Groundwater source areas which meet the supply requirements will be bounded by the aquifer distribution plus reasonable pumping distances from the margin of the aquifer. In cases where both surface and groundwater sources are considered, the source and pumping constraints would be overlain and combined.

Step 2 - The avoidance areas outlined in Step 1 would be further defined at the more detailed map scale of Step 2.

Step 3 - In this step, the potential sites should be evaluated and scored with regard to the degree with which the supply at low-flow conditions, based on 7-day, 10-year low-flows and historical drought stages or water surface elevations, exceed the design basis consumption rate and the projected future use requirements. For streams, the evaluation would include consideration of the potential for water loss from existing or planned downstream dams. This consideration would be based on professional judgment and may include evaluation of not only projected volume effects should failure occur but also evaluation of the likelihood of failure given the age, condition, and seismic characteristics at these locations.

The supply exceedance value would form the basis for a utility function with a score of 5 for sites with the highest degree of excess supply and a score of 1 for the lowest. The scoring of dam failure potential would score the site with the lowest potential for downstream failure with a 5 and the highest potential with a 1. The two scores would be averaged to form a composite suitability score. The related pumping distance suitability evaluation would be treated as a utility function in Step 3 as described in Section 3.4 as an Engineering and Cost-Related Issue.

Step 4 - The suitability analysis developed for Step 3 would be reevaluated in the light of site-specific data developed in Step 4A.

3.1.1.2.2 Ambient Air Requirements

Step 1 - PPE 2.1 lists a variety of ambient air requirements which must be met at prospective sites in order to meet the design envelope for the Normal Plant Heat Sink. These requirements are as follows:

<u>PPE</u>	<u>Requirement</u>	<u>Composite Plant Value</u>
2.1.1	Normal Shutdown Max Ambient Temp (1% Exceed) Coincident	100 F DB/77 F WB
2.1.2	Normal Shutdown Max Wet Bulb Temp (1% Exceed) Noncoincident	80 F WB
2.1.3	Normal Shutdown Min Ambient Temp (1% Exceed)	-10 F
2.1.5	RX Thermal Power Max Ambient Temp (0% Exceed) Coincident	115 F DB/80 F WB
2.1.6	RX Thermal Power Max Wet Bulb Temp (0% Exceed) Noncoincident	81 F WB
2.1.7	RX Thermal Power Min Ambient Temp (0% Exceed)	-40 F
2.7.3	Approach Temperature	10 F
2.8.2		
3.6.3		

Data required for the analyses necessary to establish these statistical measures of site meteorological conditions are available from most National Oceanic and Atmospheric Administration (NOAA) weather stations; additional site-specific data may be available from other sources (e.g. nuclear plant sites, private airfields, etc.). Analysis of available data to establish the status of the ROI with respect to these PPEs should be accomplished in Step 1 of the process; the level of detail of this analysis will depend on the meteorological conditions extant in the region (e.g., if conditions are clearly within the PPE requirements the analysis need not be detailed). Areas which clearly do not meet one or more of these PPEs should be excluded from further study.

It should be noted that weather station data is completely accurate only for the location of the station itself. Interpretation of this data for other locations is a matter of professional judgement, and no other sources are available to provide data at higher confidence levels in succeeding steps of the siting process. Actual data for a selected site will only be available once the site is developed and an on-site meteorological program is initiated. Accordingly, some

conservatism should be used in mapping exclusions for these PPEs. Step 1 exclusions should provide a high level of confidence that no remaining areas will fall outside these envelopes.

Steps 2, 3, and 4 - No further analysis is required.

3.1.1.3 Flooding

Step 1 - Using USGS 1:250,000-scale topographic maps, exclude major floodplain areas, based on professional judgment of topographic expression of floodplain areas. This exclusionary mapping will overlap to a large degree the Step 1 exclusionary mapping of major wetlands as described in Section 3.2.2.1.3. PPE 1.8.1 requires that the maximum flood must be at least one foot below plant grade. Any areas incapable of meeting this standard should also be excluded.

Step 2 - Using FEMA flood hazard maps, refine the exclusion areas developed in Step 1 and exclude areas within the 100-year floodplain.

Step 3 - Using FEMA flood hazard maps and related data on the elevations and areas associated with the 100- and 500-year flood levels, together with topographic information of the potential sites, develop a utility function related to the degree of exceedance of the 100-year flood level elevations on an areal percentage basis. This function would be modified based on the potential for ice jam flooding effect evaluated through a review of historical data for the downstream areas. In coastal areas, considerations must include storm-related flooding as well as seismically induced flood levels. Previous studies addressing these considerations have been conducted for many coastal areas and could form the basis for the utility function evaluations at this step in coastal areas. An additional consideration with regard to coastal sites which will likely require evaluation is the effects of potential sea level rise.

For riverine sites, an evaluation of the potential for flooding effects from upstream dam failure as discussed above for water supply considerations would combine the utility function

scores by averaging the water level suitability score and the dam failure potential score. It was suggested in NUREG 0625 by the Siting Policy Task Force that no floodplain (riverine) sites should be closer than to a major dam 5 miles downstream.

Step 4 - Update the suitability utility functions from Step 3, based on site-specific data.

3.1.1.4 Nearby Hazardous Land Uses

Activities at present or projected hazardous industrial, military or transportation facilities may affect the safety of the plant. If potentially hazardous facilities are identified within 5 miles of the plant, a preliminary evaluation must be conducted to assess whether accidents at such facilities would exceed design considerations to mitigate such events.

The Nearby Hazardous Land Uses criteria and their application in the various siting steps are as follows:

	Criteria	Step	1	2	3	4A	4B
3.1.1.4.1	Existing Facilities		X	X	X	X	X
3.1.1.4.2	Projected Facilities				X		

3.1.1.4.1 Existing Facilities

Step 1 - Map as avoidance criteria, areas within 5 miles of the following facilities:

- Airports and flight, holding and landing patterns
- Military bases, missile bases, firing or bombing ranges
- Oil pipelines
- Oil and gas storage areas

Step 2 - Map the following additional facilities as avoidance criteria and adjust the boundaries of the Step 1 avoidance features at the Step 2 scale:

- Significant manufacturing plants
- Chemical plants
- Refineries
- Mining and quarrying operations

The following avoidance distances should be used, as suggested by the Siting Policy Task Force (NUREG 0625, 1979):

- Large propane pipelines should be no closer than 1.5 miles
- Large natural gas pipelines should be no closer than 0.5 miles

Step 3 - Develop a suitability utility function related to the distance away from the hazardous facilities mapped in Step 3 as well as the following facilities:

- Land and water transportation routes for hazardous materials
- Dock and anchorages for hazardous materials
- Drilling operations or wells

The utility function would be scaled with regard to distance from the various hazardous categories, based on the facility details, using professional judgment. Areas with facilities located farther away would be scored 5 and areas with the closest facilities would be scored 1.

Step 4 - The utility function developed in Step 3 would be updated, based on site-specific information developed in Step 4A.

3.1.1.4.2 Projected Facilities

Two considerations can form the basis for projecting the likelihood for future potentially hazardous facilities to be located within 5 miles of the plant: 1) suitability and compatibility of land use plans and zoning; and, 2) projected economic growth related to the particular type of facility.

Step 3 - For each of the categories of facilities noted above, conduct an evaluation of the projected growth potential in the site area, based on historical trends and the presence of and abundance of area physical and socioeconomic attributes typically required for such growth. Develop a utility function to relate growth potential from 5, for high potential, to 1, for low potential, based on the results of the analysis and professional judgment. In a similar fashion, evaluate the compatibility of land use plans and zoning ordinances for each category of facility and develop a utility function with a score of 5 for cases where the type of facility is not allowed and a score of 1 for cases where the plans and ordinances allow or encourage such facilities. The two utility functions would then be combined by averaging the scores for a composite evaluation of the potential for such facilities to be located near the plant.

3.1.1.5 Extreme Weather Conditions

The following plant parameter envelopes define the extreme weather conditions of interest in site selection:

<u>PPE</u>	<u>Requirement</u>	<u>Composite Plant Value</u>
1.11	Tornado (Design Bases)	
1.11.1	Maximum Pressure Drop	1.46 PSID
1.11.2	Maximum Rotational Speed	240 MPH
1.11.3	Maximum Translational Speed	57 MPH
1.11.4	Maximum Wind Speed	260 MPH
1.11.6	Radius of Maximum Rotational Speed	150 FT
1.11.7	Rate of Pressure Drop	1.2 PSI/SEC
1.12	Wind	
1.12.1	Basic Wind Speed	110 mph
1.12.2	Importance Factors	1.0 (NSR)/1.11 (SR)
1.4	Precipitation	
1.4.1	Maximum Rainfall Rate	19.4 in/hr (0.2 in/5 min)
1.4.2	Snow Load	50 lbs/sq ft

These PPEs are addressed in the criteria, which are as follows:

	Criteria	Step	1	2	3	4A	4B
3.1.1.5.1	Winds		X		X		
3.1.1.5.2	Precipitation		X				

3.1.1.5.1 Winds

Step 1 - The URD for passive plants indicates that the wind loadings on structures is based on an extreme wind design of 110 mph for a 50-year return interval. Based on data provided in the National Atlas of 1970, only the very southern portion of Florida and coastal portions of Washington and Northern Oregon have maximum expected wind speed for a 50-year return interval exceeding 110 mph. If siting is conducted in these regions, the PPE related to the appropriate importance factor should be used to define avoidance areas for Step 1.

Step 2 - No further analysis would be required for Step 2.

Step 3 - The National Severe Storm Forecast Center at Kansas City, Missouri has compiled data since 1955 on severe storms - defined as storms with gusts equal to or greater than 50 knots (58 mph). The annual frequency of such severe storms measured over a 10,000 square-mile area has been compiled. In the central mid-west, the frequency varies from 1 to 20. This parameter would be used as a suitability consideration in Step 3. A utility function would be developed to relate the range in the annual frequency of severe storms for the potential sites. The sites characterized by the lower frequencies would be scored high and the higher frequency sites would be scored low.

Step 4 - No further evaluations would be conducted in Step 4.

3.1.1.5.2 Precipitation

Step 1 - Using data from the U.S. Weather Service on the 1 hr 1 sq mi Probable Maximum Precipitation (PMP), map areas exceeding the design level PMP as avoidance areas. Using data from local building design codes, accepted design practices, or other available sources, map as avoidance areas any areas where the maximum snow load exceeds 50 pounds per square foot.

Steps 2 through 4 - No further analysis is required.

3.1.2 Accident Effects-Related Criteria

3.1.2.1 Population

As mentioned earlier in this report, the NRC is considering changes to 10 CFR 100 to codify guidance which is outlined in Regulatory Guide 4.7 (1875). Currently, 10 CFR 100 defines areas over which offsite doses from severe accidents must be controlled and provides the following dose limits that set the boundaries for these doses:

- Exclusion Area: 25 rem whole body, 300 rem thyroid, in 2 hours;
- Low-Population Zone (LPZ): 25 rem whole body, 300 rem thyroid, accident duration;
- Population Center: At least 1.33 times the distance of the EA boundary.

Regulatory Guide 4.7 (1975) indicates that a minimum exclusion distance of 0.4 miles should be used and that "if the population density, including weighted transient population, projected at the time of initial operations of a nuclear power station exceeds 500 persons per square mile averaged over any radial distance out to 30 miles (cumulative population at a distance averaged over the area at that distance) or the projected population density over the lifetime of the facility exceeds 1,000 persons per square mile averaged over any radial distance

out to 30 miles, special attention should be given to the consideration of alternative sites with lower population density." The RCER points out that there is no direct tie for limiting population density adjacent to the nuclear power plant sites to the NRC's Safety Goal Policy. On a technical basis only, the safe siting of an ALWR plant on any suitable site is possible.

Guidance with regard to the issue of demonstrating that there is no obviously superior site to the preferred site which is now codified in 10 CFR 52, can be found in the environmental Standard Review Plan (ESRP) (NUREG 0555), Section 9.2. Appendix C of ESRP has been set aside to contain descriptions of those analyses that have led to the identification of obviously superior sites. The only topic addressed in Appendix C is demography, as follows:

"1. Demography

In terms of a review of demographic aspects of the site-selection process, the population density guidelines of Regulatory Guide 4.7 have been interpreted by the staff to mean:

- (a) Where, on balance, there are alternative sites of approximate equal merit regarding factors other than population density,
- (b) Where the proposed site has a population substantially greater than one of the alternative sites, and
- (c) If that density is in excess of the stated guideline values, there does exist a site obviously superior to the proposed site."

Thus, it is clear that the NRC Staff views the demographic siting criteria as central to the evaluation of alternative sites and demonstration that no obviously superior site exists.

The siting procedure details for the demographic factor will depend on the details of the 10 CFR 100 revisions which may occur. It is expected that a population exclusion criterion related to population density limits within annuli distances from the site will need to be addressed and perhaps further qualified by sector population distribution criteria. Such criteria would be

applied as exclusionary criteria in Step 1 and further refined in Step 2 and would be applied as a suitability criterion in Steps 3 and 4.

Minimum exclusion separation distance criteria, recommended as 0.4 miles in Regulatory Guide 4.7 and identified as 0.5 miles in the URD, would be treated as Site Size criteria within the Engineering/Cost-Related Criteria section and mapped as exclusion criteria in Step 2 and would be applied as suitability criteria in Step 3.

3.1.2.2 Emergency Planning

10 CFR 52 Section 17 (b)(1) requires that the applicant identify physical characteristics unique to the site, such as egress limitations from the area surrounding the site, that could pose a significant impediment to the development of emergency plans. This should be used as the basis for evaluating site suitability with regard to emergency planning. (See NRC's July 13, 1992 letter to the Industry Siting Group, entitled, "Summary of June 30, 1992, Meeting with Industry Siting Group on the Technical and Regulatory Review of Siting Issues - Emergency Planning Area" for recent NRC guidance on this topic.)

Steps 1 and 2 - See Step 3.

Step 3 - Utility functions would be established for the following emergency planning elements (as defined in NUREG/0654) described below: 1) definition of evacuation network and subareas; 2) definition of evacuation characteristics with subareas; and, 3) definition of evacuation population characteristics.

Evacuation Network and Sub-area - The boundaries of sub-areas within the EPZ will be defined following guidance from NUREG 0654-Rev 1 - November 1980 or the latest update. Considerations include the following:

<u>Radius</u>	<u>Area</u>
about 2 miles	four 90° Sectors
about 5 miles	four 90° Sectors
about 10 miles (EPZ)	four 90° Sectors
about 10 miles (EPZ)	entire EPZ

The boundaries of sub-areas shall be based upon the same factors as the EPZ, namely demography, topography, land characteristics, access routes, and local jurisdictions. To the extent practical, the sector boundaries should not divide densely populated areas.

Evacuation Characteristics - The sub-areas network segments should be characterized with regard to the following features:

- Traffic capacity (if not uniform, use the narrowest segment)
- Number of lanes in both directions
- Network type: 1) freeway or expressway; 2) urban streets, or 3) rural roads
- On ramp capacities for freeways
- Number of traffic control points per network segment
- Terrain characteristics (curves, steep slopes), etc.
- Climatic conditions

Population Characteristics - Population for sub-areas would be grouped into the following categories:

- Permanent residents
- Transients, including tourists
- Persons in special facilities (such as schools, hospitals, orphanages, prisons, nursing homes, correction and convalescence facilities)

The analysis would also incorporate an evaluation of damage scenarios which may result from natural hazards such as earthquakes or floods which might be associated with an accident event and have the potential to modify the evacuation network elements. The results of an

integrated analysis would be scored using the utility functions to relate evacuation capacity from a 1 to a 5 score, with 5 representing the highest capacity and 1 the lowest capacity.

Given the difficulties of future projections, the analysis should incorporate the consideration of variations in the degree of confidence which may reasonably be associated with projecting future conditions, similar to that discussed for hazardous land uses (Section 3.1.1.4.2).

Step 4 - At this stage of the siting process, the evacuation network and sub-area, evacuation characteristics, and population characteristics analyses should be refined based on more detailed site-specific data available at this step.

3.1.2.3 Atmospheric Dispersion

Steps 1 and 2 - See Step 3 below.

Step 3 - The methodology discussed in Section 3.1.3.3.2, Atmospheric Dispersion in consideration of the Air Radionuclide Pathway for operational effects, would also be applied for accident-related effects with the following modifications: A worst-case condition for the meteorological data would be used. For example, a low wind speed (3 meters per second or the 10 percentile value) would be used rather than the annual mean and the 10 percentile of the annual stability class data rather than the annual mean would be used.

Step 4 - No further analysis would be conducted in Step 4.

3.1.3 Operational Effects-Related Criteria

3.1.3.1 Surface Water - Radionuclide Pathway

Two plant parameter envelopes are applicable to this criterion. Each deals with dose standards codified in Title 10 of the Code of Federal Regulations:

<u>PPE</u>	<u>Requirement</u>	<u>Composite Plant Value</u>
10.1.1	Dose Consequences - Normal	10 CFR 50, Appendix I 10 CFR 20
10.1.2	Dose Consequences - Post Accident	10 CFR 20 10 CFR 100

Liquid pathway dose consequences depend primarily on source terms (PPE 10.3) and on dilution in the receiving water body. The latter parameter can be accurately estimated only with detailed analysis and site specific data. Utility functions described below have been derived to provide a surrogate for these PPEs for siting purposes. Detailed dose consequence calculations should be performed to confirm site suitability at Step 4 of the process.

The Surface Water - Radionuclide Pathway criteria are as follows:

	<u>Criteria</u>	<u>Step</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4A</u>	<u>4B</u>
3.1.3.1.1	Dilution Capacity				X	X	X
3.1.3.1.2	Baseline Loadings				X	X	X
3.1.3.1.3	Proximity to Consumptive Users				X		

3.1.3.1.1 Dilution Capacity

Steps 1 and 2 - See Step 3 below.

Step 3 - The EPA employs the Probabilistic Dilution Model as an analytical tool in the screening of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites to determine which sites have the potential to cause unacceptable health risks to downstream users and would thus require a detailed environmental fate analysis. The model is applicable to rivers and streams but not to estuaries. The model is based on the fact that, in general, the most important process affecting a contaminant's concentration in a surface water body is the degree of dilution. The model uses stream flow data from a sub-basin and contaminant loading data to predict health-based effects for persons using the water body (EPA 1988).

However, information on the radioactive source term will be design-specific. For siting consideration where such information is not available, surrogate parameters, representing the dilution capacity of a stream, can be used. The greater the dilution capacity of a stream, the shorter will be the mixing length downstream defined as the zone within which complete mixing of a discharge contaminant occurs. Mixing length varies approximately in proportion to the product of the stream velocity and the square of the stream width and inversely to the product of the stream depth and the shear velocity. The shear velocity is the square root of the product of the acceleration of gravity, the hydraulic radius (cross-section area divided by the wetted perimeter) and the energy gradient of the stream (slope of the channel). A utility function would be developed using the stream characteristics listed above and an approved analytical estimate for mixing length. EPA (1988) suggests an equation adapted from a number of sources for use in estimating stream mixing length. The shortest mixing lengths among the potential sites would be scored 5 and the longest mixing length sites would be scored 1.

Step 4 - Based on site-specific verification studies in Step 4A, including dye tracer studies, the utility function developed in Step 3 would be reevaluated. If adequate data is available, the dose consequences specified in PPEs listed above should be estimated and compared to standards referenced therein.

3.1.3.1.2 Baseline Loadings

The capacity of a stream to impact health and safety of downstream consumers is also related to the existing, or baseline loadings of, radionuclides which are present in the system or can be anticipated in the future.

Steps 1 and 2 - See Step 3 below.

Step 3 - Using data collected and reported by the USGS, the variation in radionuclide loading to streams can be evaluated for the potential sites. Where such data is not available for the potential sites, or as a supplement to this database, the upstream radionuclide discharge data from state and/or federal discharge permit information can be utilized to estimate pollutant loads from upstream sources. This information would be developed into a utility function to score each potential site with regard to existing radionuclide stream loadings. Additionally, these scores would be modified based on the potential for future land uses which would be associated with radionuclide discharges. Sites with low levels of existing and projected radionuclide loadings would be scored 5 and those with high levels would be scored 1.

Step 4 - Based on site specific information, the evaluation of radionuclide loadings would be updated in this step.

3.1.3.1.3 Proximity to Consumptive Users

Steps 1 and 2 - See Step 3 below.

Step 3 - Identify the downstream locations of sources of public water supply and recreational contact uses for each potential site and develop a combined utility function related to the distance to these uses, with greater scoring for consumptive users. Sites with greater pathway lengths to these users would be scored 1 and closer pathways would be scored 5.

Step 4 - No further analysis would be required in Step 4.

3.1.3.2 Groundwater Radionuclide Pathway

The EPA issued its Groundwater Protection Strategy in August, 1984 and provided Guidance for Groundwater Classification in December, 1986 (EPA 1986) under its responsibilities as outlined in the SDWA. The Strategy established three general classes of ground water representing a hierarchy of groundwater resource values to society as follows:

- Class I - Special groundwater
- Class II - Groundwater currently and potentially a source of drinking water
- Class III - Groundwater not a source of drinking water

Class I ground waters are resources of unusually high value. They are highly vulnerable to contamination and are (1) irreplaceable sources of drinking water and/or (2) ecologically vital. Many states have adopted their own system based on the EPA strategy and have mapped the locations of groundwater classes.

Steps 1 and 2 - Map as avoidance areas the location of Class I ground waters.

Step 3 - Within a two-mile area of the potential sites, develop a utility function based on the percentage of Class II and Class III groundwaters. If these groundwaters have not been designated, utilize the procedures and data outlined in EPA guidance to evaluate the groundwaters within two miles of the site. For example, the considerations to be evaluated for a designation of Class I includes the following:

- Highly vulnerable groundwater
- Irreplaceable source of drinking water
- Ecologically vital groundwater

The EPA has developed a numerical ranking system called DRASTIC, using readily available information on the following seven hydrogeologic characteristics to evaluate vulnerability:

- D - Depth to the water table
- R - Net Recharge
- A - Aquifer media
- S - Soil media
- T - Topography
- I - Impact of the vadose zone
- C - Hydraulic conductivity of the subject ground-water flow system

The numerical value obtained is related to two broad climatic regions in the country, based on whether the annual evapotranspiration exceeds mean annual precipitation.

Step 4 - Using site-specific information developed in Step 4A, the utility function developed in Step 3 would be updated.

3.1.3.3 Air Radionuclide Pathway

The Air Radionuclide Pathway criteria are as follows:

	Criteria	Step	1	2	3	4A	4B
3.1.3.3.1	Topographic Effects		X	X	X		
3.1.3.3.2	Atmospheric Dispersion				X		

3.1.3.3.1 Topographic Effects

Step 1 - Based on topographic data and using a GIS, determine the maximum topographic relief within a five-mile radius of each grid cell. Calculate the 90th percentile of the distribution of maximum relief values and plot the areas which exceed this value as avoidance areas.

Step 2 - Apply at the Step 2 the avoidance boundaries scale which were developed in Step 1.

Step 3 - Develop a utility function to score the potential sites with regard to the range of maximum relief values within 5 miles of the site with the lower values scored as 5 and the higher values score as 1.

Step 4 - No further analysis is required in Step 4.

3.1.3.3.2 Atmospheric Dispersion

Several plant parameter envelopes have been identified which define the dispersion meteorological envelope which must be satisfied for successful ALWR siting. These are as follows:

<u>PPE</u>	<u>Requirement</u>	<u>Composite Plant Value</u>
9.1.1	Atmospheric Dispersion (Chi/Q) - Accident	
	0.5 mile, 0-2 hr	1.0E-3 sec/m ³
	2 mile, 0-8 hr	1.35E-4 sec/m ³
	2 mile, 8-24 hr	1.0E-4 sec/m ³
	2 mile, 1-4 day	5.4E-5 sec/m ³
	2 mile, 4-30 day	2.2E-5 sec/m ³
9.2	Atmospheric Dispersion (X/Q)	0.5 mile 7.2E-5
	Annual Average	1.0 mile 1.5E-5

The utility function described below provides a surrogate for the computation of annual average χ/Q values for comparing the relative dispersion capability of sites being considered. National Climatic Center (NCC) data can be used for this analysis. However, it must be noted that NCC data are valid only for the immediate vicinity of the weather station and that extrapolations to other sites requires professional judgment.

Computation of accident scenario X/Q's (PPE 9.1.1) requires hourly meteorological observations which are not normally available from NCC data, and extrapolation of short term meteorological dispersion factors from one location to another is problematic. However, ALWR certified designs are based on these meteorological assumptions, and applicants should confirm, to the degree practicable and as early as possible in the siting process, that sites are capable of conforming to this PPE.

Steps 1 and 2 - See Step 3 below.

Step 3 - An evaluation of the relative variation in atmospheric dispersion characteristics would be developed using the following approach. Using Stability Array data (STAR) compiled by the NOC from airports and other facilities around the country, determine the mean annual stability classification for each of the potential sites and the mean annual wind speed (μ). Using the conversion charts of Turner (1970) and a selected downwind distance of 10 km, determine the vertical and horizontal dispersion coefficients, σ_y and σ_x , respectively. Assume a fixed release rate, Q, and calculate $C(x)$ as follows:

$$C(X) = \frac{Q}{\pi \times \sigma_y \times \sigma_x \times \mu}$$

A utility function would be developed based on the variation in the results of this analysis with lower values of $C(x)$ being scored a 5 and higher values scored a 1.

Step 4 - No further analysis would be conducted in Step 4.

3.1.3.4 Air-Food Ingestion Pathway

A potential human exposure pathway is airborne radionuclides emissions from the power station through the food chain for adjacent crops and pasture operations.

Steps 1 and 2 - See Step 3 below.

Step 3 - The amount of crop and pasture lands in the adjacent areas would be determined and used to develop a utility function related to the potential for impacts via the air-food pathway. Using GIS, the acreage of crop and pasture lands within the following annuli would be measured: 1) 0 to 10 miles; 2) 10 to 20 miles; and, 3) 20 to 30 miles. The acreage would be weighted on a graduated scale with the nearer areas receiving a greater emphasis. The cumulative weighted average for each potential site would form the basis for the utility function, with the higher acreage sites receiving a score of 5 and the lower sites a score of 1.

Step 4 - The site-specific studies to be conducted in Step 4A would not allow site specific determination of the annual wind sector data such as will be needed at the preferred site for ESP. Therefore, no additional analysis would be conducted.

3.1.3.5 Surface Water-Food Radionuclide Pathway

In addition to the potential pathways addressed in Section 3.1.3.1 Surface Water, and Section 3.1.3.2, Groundwater Radionuclide Pathway, use of irrigation waters in downstream areas is a potential pathway for radionuclides.

Steps 1 and 2 - See Step 3 below

Step 3 - Potential sites would be evaluated based on the proximity in the downstream direction to plant stream discharge locations and the acreage of the irrigation usage. A utility

function would be developed to reflect these combined variables and sites with greater potential for this irrigation pathway would be scored a 5 and those with low potential would be scored a 1.

Step 4 - The utility function and analysis developed for Step 3 would be updated based on the site-specific information from Step 4A.

3.1.3.6 Population

Population would also be included in the operational effects factors, since the operational effects will vary, other things being equal, based on the variations in population and their proximity to the power station. Pending the resolution of the population aspects of 10 CFR 100 currently under review by NRC, a population criteria would be included both here and in the consideration of accident effects (see Section 3.1.2.1).

3.1.3.7 Transportation Safety

Potential impacts from plant operations on transportation safety could occur as a result of increased hazards such as fog and ice due to the effect of plant emissions. Sites with a greater potential for such occurrences, other things being equal, would be less desirable.

Steps 1 and 2 - See Step 3 below.

Step 3 - Develop a utility function considering information about the frequency of ice storm occurrence and the number of hours per year of fog occurrence. Potential sites with low occurrences would be scored a 5 and sites with high occurrences would be scored a 1.

Step 4 - No further analysis would be required in Step 4.

3.2 ENVIRONMENTAL CRITERIA

3.2.1 Construction-Related Effects on Aquatic Ecology

3.2.1.1 Disruption of Important Species/Habitats

Regulatory Guide 4.7 points out that proper siting of nuclear power stations should consider effects on populations of important species or ecological systems. The Guide defines important species as follows:

"A species, whether animal or plant, is important (for the purpose of this guide) if a specific causal link can be identified between the nuclear power station and the species and if one or more of the following criteria applies:

- 1) If the species is commercially or recreationally valuable,
- 2) If the species is endangered or threatened,
- 3) If the species affects the well-being of some important species within criteria (1) or (2) or if it is critical to the structure and function of a valuable ecological system or is a biological indicator of radionuclides in the environment."

Of particular concern are the following habitat areas which are utilized by the significant important species, including considerations of seasonal use:

- breeding and nursing
- nesting and spawning
- wintering
- feeding

Important considerations regarding the evaluation of disruptive effects include the uniqueness of the habitat within the region and the amount of habitat that would be destroyed

or disturbed relative to the total amount in the region, considering also the effects on the reproductive capacity of the important species.

Steps 1 and 2 - See Step 3 below.

Step 3 - Evaluate the potential sites identified in Step 2 for presence of important species habitats such as marine grasses, commercial shellfish beds, spawning, nursing, and feeding areas. Based on an evaluation of the relative proportion of comparable habitat at the site to the surrounding region, considering the importance of reproductive capacity, develop a utility function with a rating of 5 assigned to sites where no potential impact is expected, 3 assigned to sites where a potential moderate impact is expected, and 1 where potential severe impact is expected. Intermediate judgments will be based on professional judgment.

Step 4 - The utility functions and analysis completed in Step 3 would be updated and reevaluated for the remaining candidate sites, based on site-specific information.

3.2.1.2 Bottom Sediment Disruption Effects

Potential short-term impacts to aquatic resources may occur as a result of dredging and related operations which disturb bottom sediments. Two considerations can be used to evaluate the degree of impact which might occur from these activities: 1) the extent of contamination or potential for contamination; and, 2) the grain size of sediments. Based on a number of recent studies by EPA's Office of Water Studies (EPA 1985 and 1987) and a 1989 report by the National Academy of Science, "Contaminated Marine Sediments -- Assessment and Remediation," EPA indicated that sediments in all types of waterbodies, at hundreds of locations across the country, are contaminated at levels that harm benthic and other aquatic communities and that potentially threaten human health and wildlife. The sediment contaminants of greatest concern appear to be heavy metals and persistent, toxic, bioaccumulative organic compounds.

Based on this finding, EPA formulated and issued for public comment in March 1992 a strategy for contaminated sediment management. EPA may include chemical-specific sediment contaminate level guidelines for the protection of benthic organisms. Preliminary focus has been on the following organic contaminants: acenaphthene, dieldrin, endrin, fluoranthene, and phenanthrene.

In general, fine-grained sediments (muds) have higher water content and higher concentrations of contaminants than coarser (sandy) sediments, due to their capacity for adsorbing contaminants.

The following Bottom Sediment Disruption Effects criteria and their application in the various siting steps are as follows:

	Criteria	Step	1	2	3	4A	4B
3.2.1.2.1	Contamination				X	X	X
3.2.1.2.2	Grain Size				X	X	X

3.2.1.2.1 Contamination

Steps 1 and 2 - See Step 3 below.

Step 3 - Using data compiled by EPA, NOAA, and state agencies as part of EPA Contaminated Sediment Strategy, the level of sediment contamination for areas within the potential sites where dredging may occur would be identified. Scoring would be based on professional judgment and/or related guidance from EPA or state agencies.

Step 4 - The utility functions and analysis completed in Step 3 would be updated and reevaluated for the remaining candidate sites, based on site-specific information. Detailed site information and ecological investigations would be used to score the alternative sites.

3.2.1.2.2 Grain Size

Steps 1 and 2 - See Step 3 below.

Step 3 - The range of sediment grain sizes for the potential sites identified in Step 2 would be identified. Data sources include the USGS stream database, state publications, or NOAA studies. Develop a utility function to score the sites with higher percentages of silt and clay as 1 and the sites with the lower percentages of silt and clay as 5. Where sediment grain size data are not available, the scoring would be made on the basis of professional judgment based on stream morphology information at the site. The use of grain-size data would provide a supplement to the contamination evaluation discussed above.

Step 4 - The utility functions and analysis completed in Step 3 will be updated and reevaluated for the remaining candidate sites, based on site-specific information.

3.2.2 Construction-Related Effects on Terrestrial Ecology

3.2.2.1 Disruption of Important Species/Habitats and Wetlands

The Disruption of Important Species/Habitats and Wetlands criteria and their application in the various siting steps are as follows:

	Criteria	Step	1	2	3	4A	4B
3.2.2.1.1	Important Species/Habitats				X	X	X
3.2.2.1.2	Ground Cover/Habitat				X	X	X
3.2.2.1.3	Wetlands		X	X	X	X	X

3.2.2.1.1 Important Species/Habitats

Steps 1 and 2 - Map designated critical habitats of endangered species as exclusionary, if information is readily available.

Step 3 - Avoidance - Screen the potential sites identified in Step 2 for the presence of Threatened or endangered (T&E) species. Avoid sites areas where T&E species (either flora or fauna) are known to be present on the site.

Suitability - Score the remaining sites according to the potential presence of all important species habitats, including feeding, wintering, or nesting areas relative to the surrounding region. Develop a utility function with a rating scale of 5 to 1. A score of 5 would be assigned to sites that are outside the known range of important species; 4 would be assigned to sites within the known range of important species but where no suitable habitat is present; 3 would be assigned to sites within the known range of important species, where suitable habitat is present, but where no sightings have been recorded; 2 would be assigned to sites within the known range of important species, where suitable habitat is present, and where reports of such species in transient through the area; and 1 would be assigned to sites within the known range of important species and where there are reports of the species present in the general area.

Step 4 - The utility functions and analysis completed in Step 3 would be updated and reevaluated for the remaining candidate sites, based on site-specific information.

3.2.2.1.2 Groundcover/Habitat

Steps 1 and 2 - See Step 3 below.

Step 3 - Two factors, the ecological value and acreage of each ground cover type (e.g., woodlands, scrub, grasslands, etc.) covering the site, would determine the impact that construction would have on terrestrial ecology.

- **Ecological Value** - The potential sites identified in Step 2 would be scored by a biologist, according to the ecological value of the ground cover present. The ecological value is dependent on several factors: type of vegetation, the successional stage, and the commonality of the species (both flora and fauna) contained within each

habitat type. Based on professional judgment, sites will be scored from 5 (highest) to 1 (lowest) in respect to their ecological value.

- Acreage of Ground Cover Covering Site - The potential sites identified in Step 2 would be scored according to the percentage of each ground cover type on each site that may be impacted. For example, for woodlands sites that contain 0-10% woodlands would be scored 5, sites that contain 11-35% woodlands would be scored 4, sites that contain 36-70% woodlands would be scored 3, sites that contain 71-85% woodlands would be scored 2, and sites that contain 85-100% woodlands would be scored 1.

Using the GIS, an overall weight average for each site would be determined based on the value category score weighted by its acreage, summed over the whole site.

Step 4 - The utility functions and analysis completed in Step 3 would be updated and reevaluated for the remaining candidate sites, based on site-specific information.

3.2.2.1.3 Ground Cover/Habitat

Step 1 - Exclude major wetlands shown on USGS topographic maps and land use and land cover maps (1:250,000 scale).

Step 2 - No further analysis; simply transpose exclusions to larger scale maps for better definition of boundaries. National Wetlands Inventory maps (1:24,000 scale) could be utilized, if available.

Step 3 - Sites would be scored a 5 where no or minimal amount of wetlands are affected and a 1 where a substantial amount is affected. Use USGS and wetland inventory maps (1:24,000 scale) to determine the amount of wetlands present at each of the potential sites identified in Step 2.

Step 4 - The utility functions and analysis completed in Step 3 would be updated and reevaluated for the remaining candidate sites based, on site-specific information, including wetland delineation mapping.

3.2.2.2 Dewatering Effects on Adjacent Wetlands

The Dewatering Effects on Adjacent Wetlands criteria and their application in the various siting steps are as follows:

	Criteria	Step	1	2	3	4A	4B
3.2.2.2.1	Depth to Water Table				X	X	X
3.2.2.2.2	Marginal Wetlands				X	X	X

3.2.2.2.1 Depth to Water Table

Steps 1 and 2 - The ALWR plant site design parameters contained in the URD (PPE 1.8.2) prescribe that the maximum allowable groundwater level is two feet below grade. Areas with groundwater higher than two feet below grade should be avoided. Initial screening can be conducted by using the SIRS within the ETIS database (see Section 3.1.1.1.4) and SCS maps. The ETIS database provides detailed information about many soil properties, including the depth of the water table. Because detailed information regarding the water table is not available at scales smaller than SCS county soil maps (1:20,000), it is not possible to utilize water table depths as a criterion in Step 1 or 2.

Step 3 - The potential sites identified in Step 2 would be evaluated using the ETIS database and the soils analysis data mapped as a part of the soil stability criteria (see Section 3.1.1.1.4). The types of soils identified, the location of the potential sites would be entered into the SIRS portion of the ETIS database so that the depth of the water table at the potential sites can be related to soil series locations. Sites where the water table is less than two feet above grade would be mapped as avoidance areas.

A utility function would also be developed to score the remaining sites according to the depth of the water table. A score of 5 would be assigned to sites where the maximum depth to

the water table occurs. A score of 1 would be assigned to sites where the depth of the water table is 2 feet below grade. Intermediate scores will be based on professional judgment.

Step 4 - The utility functions and analysis completed in Step 3 would be updated and reevaluated for the remaining candidate sites based on site specific information.

3.2.2.2 Marginal Wetlands

Steps 1 and 2 - See Step 3 below.

Step 3 - Develop a utility function to score the potential sites according to their relative proximity to wetlands. Areas farthest away from wetlands would be scored 5 and areas closest would be scored 1, and an overall site average distance to wetlands score would be developed using GIS.

Step 4 - The utility functions and analysis completed in Step 3 would be updated and reevaluated for the remaining candidate sites, based on site-specific information.

3.2.3 Operational-Related Effects on Aquatic Ecology

3.2.3.1 Thermal Discharge Effects

The Thermal Discharge Effects Criteria and their application in the various siting steps are as follows:

	Criteria	Step	1	2	3	4A	4B
3.2.3.1.1	Migratory Species Effects				X	X	X
3.2.3.1.2	Disruption of Important Species/Habitats				X	X	X
3.2.3.1.3	Water Quality				X	X	X

3.2.3.1.1 Migratory Species Effects

Steps 1 and 2 - See Step 3 below.

Step 3 - Three factors, the stream capacity flow, the width of the stream, and the abundance of the species, will determine the effect that a thermal discharge will have on migratory species.

- **Stream Capacity Flow** - Develop a utility function to score the potential sites according to the stream capacity flows. High flows would be scored 5 and low flows would be scored 1, using the methods outlined in Section 3.1.3.1.
- **Width of the Stream** - Develop a utility function to score the potential sites according to the width the streams which migrate past the site. Large widths would be scored 5 and small widths would be scored 1.
- **Species Abundance** - Develop a utility function to score the potential sites according to the relative abundance of migratory species present at the site. Sites with small numbers of migratory species would be scored 5 and sites with large numbers of migratory species would be scored 1.

The migratory species scores would be a combination of the scores for the three factors discussed above. The highest combined scores would be assigned to sites that have high flows and large widths. For example, a final score of 5 would correspond to a site that either does not have migratory species or a site that contains migratory species but a minimal impact is expected as a result of a thermal discharge. Likewise a final score of 1 would be assigned to sites where potentially severe impacts to migratory species would occur as a result of a thermal discharge.

Step 4 - The utility functions and analysis completed in Step 3 would be updated and reevaluated for the remaining candidate sites, based on site-specific information.

3.2.3.1.2 Disruption of Important Species/Habitats

Steps 1 and 2 - See Step 3 below.

Step 3 - Following the methods and considerations outlined in Section 3.2.1.1, a utility function would be developed, based on the potential effects on these resources, beyond those identified due to construction, which may result from operational activities.

Step 4 - The utility functions and analysis completed in Step 3 would be updated and reevaluated for the remaining candidate sites, based on site-specific information.

3.2.3.1.3 Water Quality

Steps 1 and 2 - See Step 3 below.

The plant parameter envelopes establish values which bound the chemical, thermal and flow characteristics of blowdown from ALWR cooling systems; they are as follows:

<u>PPE</u>	<u>Requirement</u>	<u>Composite Plant Value</u>
2.7.4 2.8.3 2.10.2 3.6.4 3.8.2	Blowdown Constituents and Concentrations	See Table 3-1
2.7.5 2.10.3	Blowdown Flow Rate (Mech Draft & Pond)	5,200(17,700) GPM
2.8.4	Blowdown Flow Rate (Natural Draft)	5,200(17,700) GPM
2.7.6 2.8.5 2.10.4	Blowdown Temperature (Closed Cycle)	100 F

2.7.9	Cycles of Concentration (Closed Cycle)	4
2.8.8		
2.10.7		
2.9.1	Cooling Water Discharge Temp (Once-through)	118 F
2.9.3	Cooling Water Temperature Rise (Once-through)	18 F
2.9.5	Heat Rejection Rate (Once-through)	9.7E9 BTU/hr

Table 3-1
Blowdown Constituents and Concentrations

Constituent	Concentration		
	River Source	Well/Treated Water	Envelope
chlorine demand	10.1	--	10.1
free available chlorine	.5	--	.5
chromium	--	--	--
copper	--	6	6
iron	.9	3.5	3.5
zinc	--	.6	.6
phosphate	--	7.2	7.2
sulfate	599	3,500	3,500
oil and grease	--	--	--
total dissolved solids	--	17,000	--(1)
total suspended solids	49.5	150	150
BOD, 5-day	--	--	--

(1) Assumed cycles of concentration equals 4.

These parameters define the thermal and water quality impacts that cooling system blowdown effluents will have on the receiving water body for the various cooling system configurations. For a site to be acceptable, it must be possible for the ESP applicant to obtain permits for these discharges. This, in turn, will depend on the applicable state and federal

regulations, existing water quality, existing thermal loading, and, in some cases, biological sensitivity of the receiving water body. Due to the current regulatory atmosphere for once-through (open-cycle) cooling systems, applicants should specifically consult with permitting agencies to ensure that this option remains viable before eliminating sites based on PPEs 2.9.1, 2.9.3, or 2.9.5.

Step 3 - The following factors should be considered in determining the effect that thermal discharges will have on overall water quality: baseline thermal loadings (from upstream facilities), baseline ambient water temperature, stream capacity flow, the width of the stream, the sensitivity of the species present, and baseline concentrations of dissolved oxygen (DO), dissolved solids, and nutrients. An expert in the field of aquatic ecology will score the potential sites according to the magnitude of the potential impacts to water quality by taking into account all of the factors named above and considering applicable state standards regarding thermal pollution. Sites would be scored 5 (low impact) to 1 (high impact) according to the overall impacts to water quality. The PPE permitting analysis should be reevaluated in light of more specific data (if applicable).

Step 4 - The utility functions and analysis completed in Step 3 would be updated and reevaluated for the remaining candidate sites, based on site-specific information.

3.2.3.2 Entrainment/Impingement Effects

3.2.3.2.1 Entrainable Organisms

Steps 1 and 2 - See Step 3 below.

Step 3 - Develop a utility function to score the potential sites according to the density of potentially entrainable organisms such as phytoplankton and zooplankton. Low densities would be scored 5 and high densities would be scored 1.

Step 4 - The utility function and analysis completed in Step 3 would be updated and reevaluated for the remaining candidate sites, based on site-specific information.

3.2.3.3 Dredging/Disposal Effects

The Dredging/Disposal Effects criteria and their application in the various siting steps are as follows:

	Criteria	Step	1	2	3	4A	4B
3.2.3.3.1	Upstream Contamination Sources				X	X	X
3.2.3.3.2	Sedimentation Rates				X	X	X

3.2.3.3.1 Upstream Contamination Sources

Steps 1 and 2 - See Step 3 below.

Step 3 - Develop a utility function to score the potential sites according to the amount of contamination that is released from facilities upstream. A score of 5 would be assigned to sites with a low potential for upstream contamination sources and a score of 1 would be assigned to sites with a high potential for upstream contamination.

Step 4 - The utility functions and analysis completed in Step 3 would be updated and reevaluated for the remaining candidate sites, based on site-specific information.

3.2.3.3.2 Sedimentation Rates

Steps 1 and 2 - See Step 3 below.

Step 3 - Using data from sediment and hydrology studies, an assessment will be made on the range of sediment rates for each of the potential sites for areas which may require

maintenance dredging around intake structures. Sites with high sedimentation rates would be scored 1 and sites with low sedimentation rates would be scored 5.

Step 4 - The utility functions and analysis completed in Step 3 would be updated and reevaluated for the remaining candidate sites, based on site-specific information.

3.2.4 Operational-Related Effects on Terrestrial Ecology

3.2.4.1 Drift Effects on Surrounding Areas

The Drift Effects on Surrounding Areas criteria and their application in the various siting steps are as follows:

	Criteria	Step	1	2	3	4A	4B
3.2.4.1.1	Important Species/Habitat Areas				X	X	X
3.2.4.1.2	Source Water Suitability				X	X	X

3.2.4.1.1 Important Species Habitat Areas

Steps 1 and 2 - See Step 3 below.

Step 3 - Areas within 10 miles of the site where habitats of important species occur (including wetland areas) would be mapped based on 2-, 4-, 6-, 8-, and 10-mile annuli. The acreage of these important habitats within each annulus would be measured and weighted as a function of distance to provide an overall distance weighted measure of nearby important habitats. A utility function would be developed for this data to score sites with a high weighted acreage of important habitats as 1, and those with low values as 5. This evaluation may be delayed to Step 4 for sites where drift problems are unlikely (e.g., noncoastal sites).

Step 4 - The utility functions and analysis completed in Step 3 would be updated and reevaluated for the remaining candidate sites, based on site-specific information.

3.2.4.1.2 Source Water Suitability

Steps 1 and 2 - See Step 3 below.

Step 3 - Several factors should be considered in evaluating the magnitude of the potential drift effects as a result of variations in the chemical character of source water. Such factors vary regionally and include: evapotranspiration and concentrations of dissolved solids. Using data regarding the various potential concentrations of dissolved solids for various potential water sources, an expert in the field of water resources would score the potential sites according to the magnitude of the potential impacts to water quality from cooling tower drift. Sites would be scored 5 for sites with low levels of dissolved solids and 1 for sites with high levels of dissolved solids.

Step 4 - The utility functions and analysis completed in Step 3 would be updated and reevaluated for the remaining candidate sites, based on site-specific information.

3.3 SOCIOECONOMICS/LAND USE CRITERIA

Socioeconomic criteria related to siting a nuclear power plant are defined by a number of factors that relate to the communities affected by the construction and operation of the facility. Specifically, socioeconomic factors include:

- Impacts on local labor supply
- Impacts of importing labor
- Impacts to local infrastructure and community services such as fire protection, police protection, health care, education, recreation and transportation
- Impacts on local taxes and community expenditures

- Impacts on community culture and character
- Impacts on historical, archaeological and cultural resources

The land use criteria related to siting a nuclear power plant have to do with the fact that certain land uses are incompatible with industrial development of this type. On the one hand, there are land uses such as national parks, preserves, or ecologically sensitive areas (e.g., wetlands) which are protected from nuclear power plant construction. On the other hand, there are certain land uses that are incompatible with such construction because of the hazards they pose to the operation of a nuclear power plant. Thus, for example, military facilities, airports, or industrial plants containing explosives or hazardous chemicals, and gas and petroleum product storage facilities all pose a significant risk to the safe operation of a nuclear power plant. These incompatible land uses, referred to as "nearby hazardous land uses," are discussed in Section 3.1.1.4.

The following sections discuss the socioeconomic and land use criteria associated with construction of a nuclear power plant and operation of such a facility.

3.3.1 Socioeconomic/Land Use - Construction Related Effects

The plant parameter envelope relevant to this criterion is as follows:

<u>PPE</u>	<u>Requirement</u>	<u>Composite Plant Value</u>
29.4.1	Plant Population - Construction	2600 - 6410 People

Plant construction force is likely to be available at any location which is otherwise found suitable for a nuclear power plant. The issue in siting is rather the potential socioeconomic impact associated with temporary influx of construction workers to areas where they cannot commute from their residence. The criterion described below is designed to consider sites from this perspective; no other application of this PPE to the siting process is required.

The construction of a nuclear power plant is very labor-intensive. For the ALWR, skilled and unskilled workers are projected to be needed over a period of approximately 4 to 5 years. Socioeconomic impacts of nuclear power plant construction are directly related to two factors:

- The number of construction workers who will move into the plant site vicinity with their families; and
- The capacity of the communities surrounding the plant site to absorb these new arrivals.

The first factor—the number of immigrant workers—is a function of labor availability within commuting distance of the plant site. If an adequate supply of workers is available to work on the project within commuting distance of the job site, few (if any) workers are likely to relocate themselves to the site vicinity.

The second factor—the capacity of communities to absorb an increase in population—depends on the availability of sufficient resources, such as adequate housing, teachers, classrooms, policemen, and firemen to service the new arrivals without straining existing services.

Also, there can be a significant impact on a small community even from cases where workers do not relocate to the site areas. For example, a few thousand workers traveling through a small town can create a significant impact.

Simply stated, the trigger for socioeconomic impacts is the relocation of construction workers and their families into local communities. The severity of socioeconomic impacts is proportional to the level of stress put on community services by workers and their families. Thus, the degree and extent of socioeconomic impacts resulting from construction are directly tied to a community's ability to provide or accept such a large influx of workers. A highly populated urban area would probably have a sufficient labor pool to accommodate the demands of nuclear power plant construction. By contrast, an area which is sparsely populated is unlikely to have an adequate labor pool. In such an instance, workers would migrate into the area,

frequently in the company of their families, and may place a burden on available housing and public services such as fire, police, sanitation, and education. If new housing is constructed and public services are expanded to meet the demands created by nuclear plant construction workers, other outsiders may decide to move in to take advantage of these improvements. The character of the local community can be significantly altered as a consequence of this sudden growth. Moreover, fiscal impacts of this growth can become very significant, and disruptive.

To find a site that would result in the least amount of socioeconomic impacts requires identifying sites that are within a 2-hour commuting distance of a major town or city that could provide the available labor force, including the appropriate mix of skilled and unskilled laborers. Such information is available in Census Bureau data. Alternatively, the site should be within approximately 1½-hour commute from a town or community that can absorb much of the influx of construction workers with little disruption. Careful planning on the part of the utility and community in question can help to minimize these impacts.

From a socioeconomic perspective, the information that needs to be considered to lessen the impacts of construction are:

- Labor requirements
- Location of labor pool
- Number of immigrants
- Fiscal assessment of affected communities

In considering socioeconomic impacts, it is important to understand the interrelationship among socioeconomic, population, and emergency planning criteria. From a socioeconomic perspective, the closer a plant site is located to major urban centers where there is likely to be an adequate labor supply, the better. However, from a health and safety perspective, the larger the plant vicinity population is, the more complex the health and safety factors (such as emergency planning) become. Population and emergency planning considerations are discussed in Section 3.1.2 of this report.

In addition to avoiding protected and/or sensitive land uses in siting a nuclear facility, there is a need to consider the impact of nuclear power plant construction on the economic value of surrounding land uses. It has been argued that construction of a nuclear power plant may create a "stigma effect" on the value of adjacent land uses, based on perceived effects. According to this argument, residential properties would decline in value and agricultural lands would become less valuable as a result of nuclear power plant construction. The concern is that, since no one can guarantee the absolute safety of nuclear power plant *operation*, the *possibility* of an accidental release always exists. Given this possibility, people would avoid purchasing residences, or even agricultural products in areas containing "potentially contaminated lands."

Interestingly, even though the concern expressed is related to nuclear power plant *operation*, proponents of this view believe that this type of socioeconomic impact actually occurs during construction (in anticipation of operation). Little data exists as to whether this perceived socioeconomic impact translates into an actual, measurable impact. Nevertheless, it is an important public concern that relates to siting.

From a siting perspective, consideration of the "stigma effect" is appropriate at the Candidate Site evaluation phase (Step 4) and is as much a public involvement/public participation siting issue as a socioeconomic one.

3.3.2 Socioeconomics/Land Use - Operation

The operation of an ALWR requires a labor force of about 800 skilled workers. Thus, the greatest socioeconomic impacts occur during the construction rather than during operation. Therefore, the socioeconomic impacts of operation tend to be a function of negotiations between the utility and affected communities regarding benefits that the utility might provide during the life of the plant. Such benefits can include special tax plans, support to local emergency planning efforts, educational programs, etc. These can be viewed as income provided to affected communities by the utility.

A key priority for selecting a nuclear power plant site is ensuring that the site will allow for safe operation of the facility. To this end, it is important that the site be located near compatible land uses that pose no safety threat to the facility. Examples of land uses that could impact safety include: military installations; chemical plants; airports; petroleum product storage facilities; and railroads and highways (or waterways) along which hazardous substances are transported. It is also important to site a nuclear facility in areas which can be readily evacuated in the event of a major, *accidental release*. Conclusively, transportation networks need to be examined. This is discussed in Section 3.1.2.2.

Another land use consideration is the potential for induced growth as a result of the availability of a major new source of electrical power in the area. Industries that are very power consumptive (such as aluminum plants) locate near major, reliable power sources.

3.3.3 Construction- and Operation-Related Criteria

Step 1 - Using USGS 1:250,000-scale maps, identify land use areas that are protected or sensitive, including:

- Parks
- Wildlife Reserves or Preserves
- Public Recreation Facilities
- National Historic Landmarks or Monuments

Once these have been identified and mapped, exclude these areas from site consideration.

Step 2 - Using regional and state land use maps, soils maps, vegetation maps, historical maps, and any other sources of land use/land cover information or archaeological information, refine the map prepared in Step 1 and map the following land uses as avoidance or exclusionary areas, as appropriate:

- Hospitals
- Correctional facilities
- Schools
- Prime agricultural lands
- Archaeological sites

Step 3 - The suitability analysis for Step 3 will include consideration and development of utility functions for the two concepts discussed above: 1) availability of an adequate labor force with commuting distance and/or ability of the community to absorb the influx of workers should they relocate, and 2) compatibility with adjacent present and future land uses. Information to be utilized includes Census Bureau data, information from state and local planning agencies, and from state economic development agencies (e.g., zoning and land use planning categories). Potential sites with an adequate labor force within commuting distance would be scored 5, sites with on inadequate labor pool and potentially significant impacts due to labor force influx would be scored 1. Communities without a labor force within commuting distance, but with a lesser degree of potential impact would be scored intermediate values, based on professional judgment.

For on-site and adjacent land uses, a utility function would be developed to relate the suitability of adjacent existing and future land use, based on type and proximity to the site. Hazardous land uses are considered separately in Section 3.1.1.4. Sites with few existing or projected incompatible land uses would be scored a 5 and sites with a high degree of incompatible land use (present and future) would be scored a 1. Land uses identified but not excluded in Step 2 should also be considered in this analysis.

Step 4 - Using the utility scoring function prepared in Step 3, compare Candidate Sites from a socioeconomic and land use perspective, taking into account both current predicted conditions.

3.4 ENGINEERING AND COST-RELATED CRITERIA

This section addresses those criteria are cost-sensitive with regard to both construction and operation, or are related to practical engineering considerations. Consideration of these criteria allows important site-related cost differentials to be considered in the site selection process. It is important to note that the site selection under ESP will occur prior to detailed design evaluations, which will be developed many years after the ESP site-selection effort. Thus, the development of detailed cost is not the objective of this portion of the study. Rather, site attributes which are cost-sensitive will be outlined, based on the general nature of the cost-attribute function, and treated accordingly. Where the criteria have been considered in other sections, such as in Health and Safety, a cross-reference is made to that analysis.

3.4.1 Health and Safety Related Criteria

A number of these criteria have been treated within the Health and Safety section and may be treated in a similar manner and reassessed as part of the considerations for the Engineering and Cost-Related section. A derivative of these health and safety utility functions may be required for cost consideration in this category.

3.4.1.1 Water Supply

Water supply is treated in Health and Safety (Section 3.1.1.2). This analysis may be additionally considered in this section.

3.4.1.2 Pumping Distance

Step 1 - Areas beyond a practical pumping distance would be mapped as avoidance areas. For example, a maximum distance of 20 miles from the water source or 20 miles upstream from the points of required minimum flow was used as in the New York Power Pool Statewide Site Selection Guide (1976). The avoidance distance could have been set using the statistical analysis

of the distribution of region-wide pumping distances compiled from the GIS and having chosen a percentile such as the 75th percentile of distances, based on professional judgment as to cost effects.

Step 2 - The avoidance distances developed in Step 1 would be transposed to the Step 2 scale maps and boundaries delineated.

Step 3 - A utility function would be developed relating the distances from source water to the avoidance distance of Step 1 with closer distances scored a 5 and further distances scored a 1.

Step 4 - No further analysis is required for Step 4.

3.4.1.3 Flooding

The results of the analysis conducted for flooding for the Health and Safety criteria (Section 3.1.1.3) would be utilized for this category as well.

3.4.1.4 Vibratory Ground Motion

For the ALWR, which has an SSE of 0.3g, cost increments as a function of pga do not exist as a result of standardization. Thus, no cost differentials for designing the site SSE are appropriate for the next generation reactors.

3.4.1.5 Soil Stability

The utility function related to soil stability developed in Section 3.1.1.4 would be used to reflect cost considerations associated with the range of possible conditions.

Steps 1 and 2 - See Step 3 below.

Step 3 - A utility function would be developed using the results of Section 3.1.1.1.4 to relate soil stability characteristics to a cost function based on professional judgment of foundation design/construction requirements.

Step 4 - The Step 3 utility function would be updated, based on the site-specific information from Step 4A.

3.4.2 Transportation or Transmission Related Criteria

The following plant parameter envelopes have been identified which pertain to access routes:

<u>PPE</u>	<u>Requirement</u>	<u>Composite Plant Value</u>
28.1	Heavy Haul Routes	17,562 sq ft
29.1	Heaviest Construction Shipment	1,546,000 lbs

Applicants should review areas/sites under consideration to confirm that access routes capable of accommodating these requirements (either under existing conditions or with appropriate improvements) are available. Any sites which fail this review should be excluded from further consideration.

The following transportation methods are based on suggested utility functions in the New York Power Pool Statewide Siting Guide (1976).

3.4.2.1 Railroad Access

Step 1 - See step 2 below.

Step 2 - A suitability/avoidance evaluation would be conducted to assess access to existing railroads using straight line distances to the site locations and a utility function such as: a score of 1 for sites with an existing railroad over 10 miles from the site and a 5 for a railroad

between 2 and 4 miles of the site. Where the average slope between the railroad and site is greater than 2%, the score would be downgraded by 1. Areas scored as 1 or 2 would be mapped as avoidance areas.

Step 3 - The suitability evaluation conducted at Step 2 would be updated based on considerations of more detailed information such as site topography, stream crossings, and land uses along potential connection links to existing railroads. Sites would be scored in respect to the degree of difficulty with regard to a feasible route to the site, with a score of 5 for a site with minimum difficulties and a 1 for 2 site with several problems.

Step 4 - The utility function developed for Step 3 would be updated based on site-specific data from Step 4A.

3.4.2.2 Highways Access

Step 1 - See Step 2 below.

Step 2 - In a similar fashion to the railroad, using straight line distances to existing major roads, a utility function is developed such as: score the site a 5 if the road is within 2 miles of the site and a 1 if it is over 5 miles. Major roads are considered adequately paved and are at least two lanes wide. Areas identified as 1 or 2 would be mapped as avoidance areas.

Step 3 - As with the railroads, a utility function would be developed to score sites with regard to the likely development of feasible routes from the site to an existing major road, given site conditions as revealed in USGS topographic and related land use maps. Sites would be scored a 5 for those best cases where minimal impediments exist to developing access roads and would be scored 1 for the worst cases with many difficulties.

Step 4 - The utility function developed for Step 3 would be updated based on site-specific data developed for Step 4A.

3.4.2.3 Barge Access

Step 1 - See Step 2 below.

Step 2 - Identify existing facilities or areas where facilities could be developed and measure straight line distances to the site and develop a utility function such as: score 5 for sites with barge or ship access at the site and a 1 for sites where barge or ship access is over 4 miles. Areas identified as 1 or 2 would be mapped as avoidance areas.

Step 3 - Develop a utility function in a similar fashion to that outlined above for highway access in Step 3 to evaluated road access to the barge facility.

Step 4 - Update the utility function developed for Step 3 based on site-specific data developed for Step 4A, including consideration of dredging volumes required.

3.4.2.4 Transmission

The siting methods to be employed follow that used in the siting of Nuclear Energy Centers for the Western United States conducted for Western Interstate Energy Board (Dames & Moore 1977).

Step 1 - See Step 2 below.

Step 2 - The transmission line requirements to carry power to the regional load centers is measured in gigawatt electric (GWe)-miles. They are estimated by first defining the load centers and forecasting the generating capacity increment required to support the expected load growth for the projected operating period. These projections are based on demographic and economic forecasts most appropriate for the region and utility planning analyses. The methods of application are as follows:

1. Rank the load centers according to their distance from each site.
2. Allocate the generating capacity, taking the capacity increment for each load center in sequence according to the ranking by distance (#1 above), and assigning a portion of the generating capacity until all of the capacity has been used up.
3. Multiply the distance to each load center by the generating capacity allocated to that load center and sum over all load centers (which have been allocated power) to get the total GWe-miles for a site.

Develop a utility function to relate costs (for construction and right-of-way in nonurban areas) on a per GWe basis, including a cost escalation factor for the projected period of construction, with the lower cost areas scored a 5 and the higher cost areas scored a 1. Areas identified as 1 or 2 would be mapped as avoidance areas.

Step 3 - The utility function developed in Step 2 would be redefined for Step 3 as Suitability Criteria.

Step 4 - No further analysis is required in Step 4.

3.4.3 Criteria Related to Land Use or Socioeconomics

3.4.3.1 Site Size

Step 1 - See Step 2 below.

Step 2 - Using the ALWR URD 0.5 miles as the minimum exclusion distance, a minimum size of 500 acres^{**} would be used to exclude candidate areas which do not meet this size requirement. The 0.5 mile minimum meets the guidance provided in Regulatory Guide 4.7 (0.4 miles). As discussed in Section 3.0, this size does not include considerations for cooling ponds

^{**} The value of 500 acres is derived based on a hypothetical circular site with a radius of 0.5 miles. The use of geometrics will yield other values.

for normal heat sink for evolutionary plants. Other considerations, such as location of a spent fuel storage facility, cooling ponds, etc. may lead to larger site sizes.

Steps 3 and 4 - No further analysis is required for these steps.

3.4.3.2 Topography

Step 1 - Large areas characterized by mountainous terrain would be mapped as exclusion areas because of the excessive relief present.

Step 2 - Map as avoidance areas, areas with slopes greater than 12% mean slope, or greater than 400 feet relief within the minimum site area.

Step 3 - Develop a utility function for the potential sites, based on average slope, and score sites with low average slope a 5 and sites with a high average slope a 1.

Step 4 - Update the Step 3 utility function based on site specific information from Step 4A.

3.4.3.3 Land and Water Rights

Steps 1 and 2 - See Step 3 below.

Step 3 - A utility function would be used to relate estimated land and water rights cost for the potential sites and would score them accordingly.

Step 4 - The Step 3 utility function would be updated based on site-specific data for Step 4A.

3.4.3.4 Labor Rates

Steps 1 and 2 - See Step 3 below.

Step 3 - A utility function would be developed for each potential site, based on data from trade associations, weighted by the expected distribution of labor categories to the overall construction, and scored accordingly from 1 to 5.

Step 4 - No further analysis is required for Step 4.

4.0 CONSIDERATIONS DURING THE SITE SELECTION PROCESS

Public involvement is a necessary and desirable part of the ESP process. This part will enable the applicant to consult with, and/or include, interested and affected individuals in their decisions. This public involvement process provides a means by which the public's questions and concerns (if they exist) can be identified in advance of decisions, so that those decisions reflect the views of the public to the extent possible. The key point is that the public, (e.g., the applicant's own employees, federal, state, and local officials, and the general public in the vicinity of the candidate sites) should be involved early and often in the process, as depicted in Figure 2-1. The specific nature and timing of public involvement activities should be developed in the applicant's siting plans. A generic public involvement plan is under development by the Early Site Permit Demonstration Program.

4.1 PUBLIC INVOLVEMENT AND ACCEPTANCE

Step 1 - This early stage of siting, identifying broad candidate areas, primarily involves public information activities such as:

- Regional media releases and background reports should be provided on a periodic basis and at key decision points.
- Informal networking (small meetings, briefings, etc.) with state and local officials, educational institutions, industry groups, media, and other opinion makers should be initiated. In addition, this is the point at which an overall public participation plan should be developed.

Step 2 - As avoidance and exclusionary criteria are being applied in this stage, it is important to continue the general media releases and to increase efforts to contact and build local and regional networks of expertise. These networks may be composed of technical experts in health, regional planning, land-use, and other fields. Such networks may contribute to the scoping function by identifying and further refining important criteria to be applied in subsequent

steps. In addition, they may become future communication resources as the project reaches the site-specific stage. Other activities may include:

- Building communication channels with local and regional elected officials so that clear lines are established before the announcement of candidate sites.
- Identifying other interested and affected parties which will need/want to be contacted immediately upon announcement of candidate sites.
- Creating a technical review group (for example, composed of local and regional technical experts from universities, planning commissions, consulting organizations) which can be used to verify difficult choices through the use of Delphi and other decision-aiding techniques.

Step 3 - As suitability criteria are being applied at this stage, key activities may include:

- Conducting community interviews to identify interested and affected parties and to identify membership for a potential community advisory group (for example, composed of elected and appointed officials, and leaders of community, environmental, and neighborhood groups) which could provide useful input to the process.
- Developing a draft public participation plan for each candidate site.
- Establishing information repositories within each community which hosts a candidate site.
- Conducting small meetings, workshops, and open houses at the information repositories.
- Organizing and supporting a speakers' bureau, composed of project staff members, and advisory and technical review group members, who would be trained to make presentations to local civic and community groups.
- Arranging tours of and/or visits from similar nuclear facilities for selected parties. Utility staff, government personnel, and/or private citizens could make commitments to be available to answer questions.

Step 4 - At this site-specific stage, the public participation process should become even more interactive and specifically tailored to the site. Some adjustments to earlier plans may occur as the final preferred site is identified. Networks should be refined, and more formalized mechanisms for soliciting public input should be devised. Activities should include the initiatives resulting from Step 3 above, as well as additional efforts such as:

- Formally designating a site-specific advisory or working group
- Tailoring the public participation plan to the site
- Starting a site-specific newsletter, hotline, and other communication devices

Public involvement in siting can be seen as a continuum. The goal is for each siting process to achieve its own optimum position on the continuum. A public participation process that is tailored to the local culture and its values will provide appropriate opportunities for these values to be factored into decision-making.

4.2 SITE OWNERSHIP

Sites that are owned represent committed investments by the applicant; therefore, their merit should be recognized. This section provides a discussion of how "company owned" sites should be considered within the site selection process.

The ESP applicant must fulfill his obligations under the NEPA and as such, cannot limit site screening to only "company-owned" sites. The process within the Siting Guide provides a framework to objectively include these "company-owned sites".

The Guide provides within the process opportunities for their merits to be weighed against other (i.e., greenfield) sites.

If a "company owned" site is screened out based on application of exclusionary criteria in Step 1, the site should be excluded from further consideration. The site will not be acceptable

based on either regulatory or technical reasons. The application of avoidance criteria in Step 2 may show a "company-owned" site to have undesirable characteristics. It is probable that most "company-owned" sites would still be under consideration at this stage because the site(s) were most likely acquired utilizing many of the same criteria as outlined in the Siting Guide. However, if the site is screened out at this stage, attempting to "force fit" a site may make defense of the "no obviously superior alternative" difficult.

As the avoidance criteria and the suitability criteria become less restrictive in Step 3, the merits of the "company-owned" site should become more apparent. For example, the benefit of owning the site and the degree of technical information available on the site should favor areas that include the "company-owned" site over others. As the evaluation progresses through Step 4, all of the identified sites should be acceptable, based on exclusionary, avoidance, and suitability criteria. At this point in the process, assuming the "company-owned" site is still one of the site areas under consideration, it should have even more merit compared to other sites, for the reasons stated earlier.

Therefore, even though the "company-owned" site has not been given any special consideration, the process outlined in the Guide allows the additional merits of "company-owned" sites to be fully considered at the appropriate stages.

4.3 EARLY SITE PERMIT ALTERNATIVE SITE REVIEWS

This section to be inserted during Rev. 1 of the document.

4.3.1 ESP versus COL Plant Concepts

During the site selection process, ALWR plant parameters will have been used which ultimately affect the final selection of the preferred site. Many of the plant parameters (see Appendix D) have common values regardless of the type of ALWR utilized for the site. However, some parameters differ, based on the type of plant (e.g., passive vs. evolutionary) or

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the total thermal/electrical output desired for the site (e.g., total plant water use). During the site selection process, certain criteria used for decision making may need to be reviewed to determine if changes in their quantitative values would have an impact on the final site(s) selected. This review becomes very desirable when conservative enveloping* is utilized. The goal would be to understand any sensitivities to the values used at the early site permit stage to ensure the finality of decisions at COL stage.

At ESP the applicant may have a firm indication of the type and number of units which may be placed on the site at some future time. If so, he should use the specific PPEs associated with the actual plant and number of units during site screening and evaluation. In this case, no further review of the values should be necessary.

Should the ESP applicant wish to delay such decisions, more conservative envelopes would be required to cover a sufficient array of applicant options. In this case, it is recommended that the applicant do additional evaluations to determine the "impact" that such conservatism presents. Such evaluations would provide the applicant with a documented record that, given the range of options considered, the preferred site selected has no obviously superior alternative.

10 CFR 52, Subpart A, "Early Site Permits", requests in part that the applicant's Environmental Report (ER) include an evaluation of alternative sites to determine whether there is an obviously superior alternative to the site proposed. This section addresses the relationship between alternate site review and the proposed action concept and possible variations which may occur between siting, ESP application, and the COL stage.

The Plant Parameters utilized for the Siting Guide were derived for single units of each of the four ALWR designs:

* e.g., use of the composite envelope to represent any of the ALWR designs or use of a conservative thermal/electrical output to encompass a range of outputs (such as siting for up to 4900 MWe when actual use of the site will range from 600 MW to 4800 MW).

Evolutionary

ABWR (1355 MWe)

SYS 80+ (1300 MWe)

Passive

AP 600 (600 MWe)

SBWR (615 MWe)

If the siting study and ESP are based on one proposed plant concept (e.g., 4,800 MWe), and at COL stage the applicant selects a different concept (e.g., 600 MWe), the siting results and the ESP could be at risk. Obviously, the most conservative approach is to decide on the plant concept, conduct siting, and ESP accordingly, and not deviate from the concept at COL.

If greater flexibility is desired by the applicant with regard to possible future plant concept choices, this desire must be incorporated into the planning process for the development and execution of the region-specific siting plan. For multiple-unit concepts, or for combinations of multiple units and plant types, new plant parameter envelopes representing the actual mix of proposed designs should be generated for use in the applicants Siting Plan. In essence, the siting process would become a multi-track process within which each concept is treated discretely as one moves through the siting process. As the process proceeds, an ongoing sensitivity analysis is conducted to allow the evaluation of the areas or sites chosen at each step with regard to each of the concepts considered. Some insight on how this might be accomplished has been provided in a September 28, 1992 letter from NUMARC to EPRI:

"The purpose of this letter is to provide additional information and a recommendation on the subject of finality of alternative site reviews conducted at ESP stage beyond that previously communicated in our letter of June 11, 1992. This added input results from the dialogue that occurred at the meeting between the ESP Program and NRC on September 3, 1992. The NRC staff suggested a method that they believe will achieve finality regarding ESP stage selection of a preferred site. The proposed method would perform the ESP alternate site review, using both the smallest ALWR Plant Parameters (e.g., 600 MWe passive ALWR parameters) and the maximum anticipated capacity desired for the site (e.g., 6,000 MWe; if multiple plants totalling 6,000 MWe is the desired capacity to be located on the site). Site selection performed in this way at ESP may provide justification for a COL applicant to not reconsider alternative sites."

The tradeoff for this greater flexibility would be the increased siting cost and potential confusion of siting participants (particularly in the public involvement) associated with a "multiple-track" siting process.

4.3.2 Composite versus Design-Specific Plant Parameter Envelopes

Criteria defined in the Siting Guide have also been developed based on the composite plant parameter envelopes, which represent the most conservative, or restrictive, case for site selection. Applicants who wish to consider only specific designs (e.g., passive) should reformulate the criteria to reflect PPEs for those designs. As discussed above, this process should also be undertaken if multiple designs are to be considered at a single site. In either case, this process will ensure that siting is conducted using plant parameter envelopes, and related criteria, which are most appropriate to the applicants actual proposed plant configuration.

Plant parameter envelopes for evolutionary and passive plant designs are presented separately in Appendix D, Table D-2.

5.0 REFERENCES

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APPENDIX A
RESULTS OF REVIEW OF STATE REQUIREMENTS

APPENDIX A

RESULTS OF REVIEW OF STATE REQUIREMENTS

A.1 STATE POWER PLANT SITING LAWS AND REGULATIONS

A.1.1 Approach

To identify non-Federal regulatory siting criteria, Dames & Moore examined state power plant siting regulations and environmental regulations which could impact the site selection process. The power plant siting statutes and implementing regulations of each State, excluding Alaska, were examined, and telephone interviews of key regulatory personnel were conducted to provide supplemental information. Table A.1: Summary of State Laws and Siting Regulations provides a synopsis of the regulatory analysis.

Ten states were chosen for a more detailed review by determining which states had the highest number of nuclear power plants and then selecting a sample representing the geographic regions of the United States (Attachment A). The study of these states focused on state regulations such as land use, air quality and water quality, which could restrict siting, as well as the siting regulations.

A.1.2 Findings

Review of the power plant siting regulations of 49 states revealed that the pre-construction licensing process for nuclear power plants has several steps which differ somewhat from state to state. The two basic approval requirements are usually site and design certification. Certain states have a formal siting application which incorporates multi-disciplinary analysis and documentation, other states have a less prescriptive pre-construction procedure which concentrates more on financial assurance requirements.

All states have requirements for considering environmental impacts, and in most cases this analysis must be provided before commencing any major construction project. Fifteen states have specific Acts and regulations that govern the siting and construction of power generation facilities. This type of statute generally includes a prescription for environmental assessments. Minnesota's Power Plant Siting Act, for example, regulates all generating facilities over 50 MW and requires that the impacts of facility construction and operation be determined and publicly reviewed.

Public and municipal input into the pre-construction decision-making process is mandated in each of the twenty-two states that require siting or construction certification. A lengthy public comment, hearing and review process, lasting between six months and a year, is expected as part of the evaluation. In addition to state utility regulating commissions, other state agencies (such as the Department of Natural Resources) may need to approve of the certification application thereby adding several months to the review process.

The interaction of state power plant siting and environmental regulations which could affect siting was examined for ten selected states (Attachment A). Air quality, water quality, and land use regulations were evaluated. Of these, land use restrictions are most likely to affect the siting of electric generating facilities, including constraints on construction in coastal zones, floodplains and wetlands. Natural resource protection laws, such as laws preserving threatened and endangered species and natural and scenic rivers further limit the use of some potential sites.

Laws developed to maintain the quality of surface and groundwater, or to address the problems associated with contamination of these waters have been broadened in the last decade. Many of the new Federal and state provisions have significant influence on the nuclear facility siting decision. The Safe Drinking Water Act (SDWA) is the principal Federal statute protecting groundwater and surface water, setting primary drinking water standards for public supplies. This key Federal Statute is implemented at the State level.

Specifically, the SDWA authorizes states to implement programs to protect drinking water, including wellhead protection programs (Table A.2). These programs are developed by states and approved by EPA. Under the wellhead protection program, a wellhead protection area is delineated as the area surface or subsurface surrounding a water well or wellfield supplying a public water system, that could convey contaminants to the water supply. A variety of approaches is employed to manage the designated wellhead protection area, including numerous land use controls such as limitations of construction in the wellhead area. The programs must be sufficient to prevent contamination of potable groundwater supplies in wellhead protection areas. Due to the voluntary nature of the program, EPA does not have authority to implement a wellhead protection program in states that choose not to participate.

Authority to implement the voluntary sole source aquifer program designed to protect aquifers that are the primary source of potable water for a given area, is also provided to states by SDWA. The program provides special protection for the aquifer by requiring the development of a management plan to maintain the quality of the aquifer. Once a sole source aquifer and corresponding critical aquifer protection area are designated, partially federally-funded projects located within the designated area are subject to review. Suggestions are made to redesign projects that threaten the aquifer to minimize potential adverse impacts. Both the wellhead protection program and the sole source aquifer program may preclude locating a nuclear power plant in the protected area.

State regulations for groundwater protection, as well as other environmental regulations vary widely, from those which simply adopt mandated federal requirements to others which institute thorough programs to prevent any degradation and remediate all contamination. Most states adopt the required federal regulations and supplement them with more stringent restrictions.

Other laws passed since the last time nuclear power plants were sited and that could potentially affect the siting decision include the Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation and Liability Act

(CERCLA). These laws govern the management of solid and hazardous wastes and provide the authority to respond to hazardous substance spills and to remediate hazardous waste sites, respectively.

Taken together, these statutes provide "wrap around" coverage: RCRA establishes a cradle to grave regulatory program for current hazardous waste management activities, while CERCLA provides a comprehensive response program for historic hazardous waste activities. RCRA is implemented at both the federal and the state levels, while CERCLA is implemented primarily at the federal level. RCRA requires generators of hazardous wastes to register with the appropriate regulatory authority and to comply with stringent waste management requirements. Facilities that will treat, store or dispose of hazardous wastes must obtain a permit and, within the definitions of the statute, such new facilities must comply with siting requirements.

Implications under RCRA for facility siting processes can arise if an existing RCRA site becomes contaminated. Likewise, CERCLA sites, by definition, consist of a contaminated environment. In either instance, remediation measures would be required. Remediation efforts are extremely costly and lengthy processes that require significant interaction with the appropriate regulatory authorities. Therefore, identifying existing RCRA and CERCLA sites for exclusion from the site selection process appears to be a prudent measure.

Recent proactive trends in property contamination assessment are illustrated by lending institutions and some state governments. Financial institutions, such as banks, have initiated programs requiring environmental assessments of properties prior to transfer of ownership, or in the instance where a property is put up as collateral on a loan application. State governments, most notably New Jersey, have taken comparable actions. New Jersey's Environmental Clean-Up Responsibility Act (ECRA) requires that companies within certain Standard Industrial Code (SIC) codes have an environmental assessment conducted prior to sale, transfer, or other like change in a company status. If the assessment determines the property to be unimpaired, a negative declaration is provided by the state that allows the sale or transfer to proceed. If

contamination is identified, remediation efforts are conducted in concert with the state authority. Once the site has been remediated, a negative declaration is provided and the pending action proceeds.

Environmental assessments can be conducted at varying levels. A Phase I assessment typically involves a site inspection, review of current and historic property and regulatory records, and interviewing of appropriate personnel. A Phase II investigation is typically intrusive in nature, involving soil and/or groundwater sampling to determine the presence and extent of the contamination in a conclusive manner.

A.2 REPRESENTATIVE STATE REGULATIONS APPLICABLE TO POWER PLANT SITING

Many states have siting requirements for electrical generating facilities which also apply to nuclear generating stations, although most rely on Federal NRC requirements for siting regulations that specifically address nuclear facilities. Although the licensing of nuclear plants is conducted by the NRC, some states have their own certification process for power plants. Some states, such as New York, California and Ohio require an analysis of the need for power as an integral part of the evaluation. Others require consideration of the project's financing arrangements.

The states that do not have siting laws regulate the site selection process through pollution control. The Illinois Environmental Protection Act of 1970 requires that projects funded in part by public money meet all regulatory requirements and obtain the necessary permits. Illinois also requires a certificate of Convenience and Necessity issued by the Illinois Commerce Commission.

The approval process in states with comprehensive siting laws, such as California, may require the endorsement of specific agencies although the notification would be submitted to the siting agencies. The California Energy Commission requires the applicant to file a Notice of

Intent with supporting documents, including an air quality modeling plan which must be approved by the regional air quality management district. Requirements for the submission of a Notice of Intent for a proposed nuclear power plant to the California Energy Commission include a description of the methods considered to prevent illegal diversion of nuclear fuels. Thus the ultimate disposition of nuclear waste must be contemplated even at the earliest planning stages. In Florida, the state Department of Environmental Regulation must certify environmental compliance and the Division of State Planning must determine a project's compatibility with the land use and industrial development criteria in the State Comprehensive Plan. The Public Service Commission determines whether a specific type of energy facility should be sited at a particular location.

Although the site approval process may be either multi-layered or comprehensive, requiring approval of one agency, the documentation and environmental assessments necessitated by the various statutes focus on many of the same issues, particularly the mitigation or prevention of adverse impacts on the environment. Occasionally, there is duplication between state and federal programs which could contribute to delays in approval or increased costs due the need to replicate information already provided to the federal agencies. In Florida, for example, state certification was denied to a utility because radiological issues were not addressed at the local level, although the subject was thoroughly reviewed at the federal level.

TABLE A.1
SUMMARY OF STATE LAWS AND SITING REGULATIONS

STATE	SITING LAW	REGULATORY/STATUTORY REFERENCE	AUTHORITY	DESCRIPTION
ALABAMA	YES	TITLE 37, CICHAPTERS 4, 28	PUBLIC SERVICE COMMISSION	CERTIFICATE: REQUIRES A BROAD RANGE OF INFORMATION FOR EXAMPLE: ENVIRONMENTAL ASSESSMENTS, PUBLIC INVOLVEMENT, PURPOSE AND NEED FOR THE FACILITY.
ARIZONA	YES	AZ CODE TITLE 14 CHAPTER 2	STATE CORPORATION COMMISSION AND STATE POWER PLANT SITING COMMITTEE	SITING APPLICATION.
ARKANSAS	YES	AR CODE ANN. 1977 SECTION 23-18-501	PUBLIC SERVICE COMMISSION	REGULATES ANY FACILITY OVER 50MW.
CALIFORNIA	YES	CA ADMIN CODE TITLE 20 CHAPTER 2	ENERGY COMMISSION	SITE CERTIFICATION APPLICATION.
COLORADO	NONE			
CONNECTICUT	YES	CGS 16-50J	PUBLIC UTILITIES COMMISSION SITING COUNCIL	CERTIFICATE: REVIEW SITING ISSUES

SUMMARY OF STATE SITING REGULATIONS (CONTINUED)

Table A.1 (continued)

STATE	SITING LAW	REGULATORY/STATUTORY REFERENCE	AUTHORITY	DESCRIPTION
DELAWARE	NONE			
FLORIDA	YES	FL STATUTES CHAPTER 403 PART 2; F.L. ADMINISTRATIVE CODE 1717 PART 2	DEPT. OF ENVIRONMENTAL REGULATIONS AND PUBLIC SERVICE COMMISSION	REGULATE SITING, CONSTRUCTION AND OPERATION.
GEORGIA	NONE			
HAWAII	NONE			
IDAHO	NONE	NO REGULATIONS	PUBLIC SERVICE COMMISSION	THE PUBLIC SERVICE COMMISSION MUST APPROVE OF SITING.
ILLINOIS	NONE			

SUMMARY OF STATE SITING REGULATIONS (CONTINUED)

Table A.1 (continued)

STATE	SITING LAW	REGULATORY/STATUTORY REFERENCE	AUTHORITY	DESCRIPTION
INDIANA	YES	IN STATE CODE 8-1-8.5	UTILITY REGULATORY COMMISSION	CERTIFICATE: PERMITS INVESTIGATION OF POTENTIAL SITE BY COMMISSION PRIOR TO AUTHORIZATION OF CONSTRUCTION.
IOWA	YES	IA CODE CHAPTER 476; ADMINISTRATIVE CODE 199, CHAPTER 24	STATE COMMERCE COMMISSION	REGULATES SITING AND CONSTRUCTION OF POWER PLANT GENERATION FACILITIES.
KANSAS	YES	KAS 66-1, 158 KAR 82-8-1 THRU 82-8-4	STATE CORPORATION COMMISSION	CERTIFICATE: SUBMIT APPLICATION FOR EVALUATION OF SITE LOCATION.
KENTUCKY	YES	KRS 278.1025	PUBLIC SERVICE COMMISSION	CERTIFICATE OF ENVIRONMENTAL COMPATABILITY: INCLUDES LOCATION ISSUES.
LOUISIANA	YES	TITLE 21 OF THE STATE CONSTITUTION	PUBLIC SERVICE COMMISSION	A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY. SITE REVIEWED BY PUBLIC UTILITY COMMISSION AND EPA.
MAINE	YES	SITE DEVELOPMENT AND LOCATION LAW	PUBLIC UTILITY COMMISSION, MAINE DEP	RECEIVE APPROVAL FOR DEVELOPMENT. REVIEW OF APPLICATION INCLUDES SITE LOCATION.

SUMMARY OF STATE SITING REGULATIONS (CONTINUED)

Table A.1 (continued)

STATE	SITING LAW	REGULATORY/STATUTORY REFERENCE	AUTHORITY	DESCRIPTION
MARYLAND	YES	PSC OF MD CODE; ARTICLE 78 SECTION 54A & B	PUBLIC SERVICE COMMISSION	CERTIFICATE: REQUIRES ALL RELEVANT STATE AND LOCAL GOVERNMENTS TO BE NOTIFIED AND A PUBLIC HEARING HELD FOR COMMENTS.
MASSACHUSETTS	YES	GENERAL LAWS OF MA CHAPTER 164 69G-69O. CODE OF MA 980, SECTION 1-12 (REGULATIONS)	ENERGY FACILITY SITING COUNCIL	ENERGY FACILITY SITING ACT: THIS ACT GIVES THE COUNCIL JURISDICTION FOR SITE FACILITIES OVER 100MW. AS OF SEPTEMBER 1992, THESE REGULATIONS WILL CHANGE, BECAUSE THE ENERGY FACILITY SITING COUNCIL WILL BECOME PART OF THE DEPT. OF PUBLIC UTILITIES.
MICHIGAN	NONE			
MINNESOTA	YES	MN STATUTES 116C.51 THROUGH 116C.69; MN. RULES CHAPTER 4440.020-4440.490	ENVIRONMENTAL QUALITY BOARD	POWERPLANT SITING ACT: REGULATES ALL GENERATING PLANTS OVER 50 MW. EVALUATES THE EFFECT ON LAND, WATER, AIR RESOURCES AND THE PUBLIC.
MISSISSIPPI	YES	SECTION 77-3-1 THROUGH 80 MISS. STATUTES	PUBLIC SERVICE COMMISSION	PUBLIC UTILITIES SITING ACT: REGULATES TRANSMISSION, SITING GENERATION AND JURISDICTION OF ENERGY FACILITIES.
MISSOURI	YES	MO REVISED CODE 393.170 PSC RULE 4CFR 240-2.060:2	PUBLIC SERVICE COMMISSION	CERTIFICATE: THIS CERTIFICATE IS REQUIRED ONLY WHEN A FACILITY OR COMPANY IS NOT ALREADY ESTABLISHED IN THE AREA.

SUMMARY OF STATE SITING REGULATIONS (CONTINUED)

Table A.1 (continued)

STATE	SITING LAW	REGULATORY/STATUTORY REFERENCE	AUTHORITY	DESCRIPTION
MONTANA	YES	MT CODE; STATUTE 75-20-101 (REGULATION). IMPLEMENTED BY SITING ACT ADMIN. RULE 36.7.1501	PUBLIC SERVICE COMMISSION	MAJOR FACILITY SITING ACT: GOVERNS SITING OF GENERATION UNITS OF UTILITIES OVER 50 MW.
NEBRASKA	NONE			
NEVADA	YES	NV REVISED STATUTES 704.820-900	PUBLIC SERVICE COMMISSION	UTILITY AND ENVIRONMENTAL PROTECTION ACT: PERMITS THE CONSTRUCTION AND OPERATION OF UTILITIES. REQUIRES ENVIRONMENTAL ANALYSIS, COST BENEFIT, ALTERNATIVES AND PUBLIC INVOLVEMENT.
NEW HAMPSHIRE	YES	NH STATUTES, CHAPTER 162 H	SITE EVALUATION COMMITTEE	ENERGY FACILITY EVALUATION REGULATES APPLICATIONS, SITING REQUIREMENTS, TIMEFRAME, PUBLIC INVOLVEMENT AND ENFORCEMENT.
NEW JERSEY	YES	NJ CODE 48:7-16 THROUGH 25	DEPT. OF ENVIRONMENTAL PROTECTION AND ENERGY	CERTIFICATE OF NEED: DETERMINES NEED FOR FACILITY AND OPTIMUM TYPE OF POWER GENERATION. REQUIRES ALTERNATIVE SITE ANALYSIS. APPLIES TO UTILITY-OWNED FACILITIES OVER 100 MW.
NEW MEXICO	YES	NM STATUTES CHAPTER 62-9-3	PUBLIC SERVICE COMMISSION	PUBLIC UTILITY ACT

SUMMARY OF STATE SITING REGULATIONS (CONTINUED)

Table A.1 (continued)

STATE	SITING LAW	REGULATORY/STATUTORY REFERENCE	AUTHORITY	DESCRIPTION
NEW YORK	YES	ARTICLE 8 OF PUBLIC SERVICE LAW (EXPIRED)	PUBLIC SERVICE COMMISSION	CERTIFICATE: APPROVAL THROUGH STATE ENVIRONMENTAL AUTHORITY.
NORTH CAROLINA	YES	NC STATUTES CODE 62-1-10.1	N.C. UTILITY COMMISSION	CERTIFICATE: CERTIFICATE FOR THE SITING, OPERATION AND CONSTRUCTION OF A ENERGY FACILITY.
NORTH DAKOTA	YES	ND RULES AND REGULATIONS CHAPTER 69-06-1 THROUGH 09	PUBLIC SERVICE COMMISSION	ENERGY CONSERVATION AND TRANSMISSION FACILITY SITING ACT AND REGULATIONS.
OHIO	YES	CH.4906 OHIO REV. CODE CH.4906 OHIO ADMIN CODE	POWER SITING BOARD STATE EPA	CERTIFICATE OF ENVIRONMENTAL COMPATABILITY AND PUBLIC NEED: NO SPECIFIC LOCATION RESTRICTIONS APPLIES TO 50 MW OR GREATER.
OKLAHOMA	NONE			
OREGON	YES	ORS 469.300 ORS CHAPTER 345	PUBLIC UTILITY COMMISSION AND ENERGY FACILITY SITING BOARD	APPLICATIONS ARE REVIEWED BY BOARD. SPECIFIC LOCATION RESTRICTIONS APPLY.

SUMMARY OF STATE SITING REGULATIONS (CONTINUED)

Table A.1 (continued)

STATE	SITING LAW	REGULATORY/STATUTORY REFERENCE	AUTHORITY	DESCRIPTION
PENNSYLVANIA	YES	66 PA CSA 518, 519	PUBLIC UTILITY COMMISSION	REQUIRES COMMISSION APPROVAL PRIOR TO FACILITY CONSTRUCTION. DOES NOT PROVIDE SITING CRITERIA BUT REQUIRES CONSIDERATION OF ENVIRONMENTAL IMPACTS.
RHODE ISLAND	YES	SECTION 4298 OF THE GENERAL LAWS	ENERGY FACILITY SITING BOARD – PUBLIC UTILITY COMMISSION	CERTIFICATE OF PUBLIC NECESSITY: NO SPECIFIC LOCATION RESTRICTIONS MUST PROVE NEED – HEARINGS ARE HELD.
SOUTH CAROLINA	YES	58 SC CODE 1976 CHAPTER 33	PUBLIC SERVICE COMMISSION	UTILITY FACILITY SITING AND ENVIRONMENTAL PROTECTION ACT: REQUIRES PRECONSTRUCTION CERTIFICATION. NO SPECIFIC SITING REQUIREMENTS BUT REGULATIONS SET DECISION CRITERIA.
SOUTH DAKOTA	YES	SEC. 49–41B OF SD CODE	PUBLIC UTILITY COMMITTEE	PERMIT: NO SPECIFIC LOCATION RESTRICTIONS. APPLIES TO 100 MW OR GREATER.
TENNESSEE	NONE			
TEXAS	NONE			

SUMMARY OF STATE SITING REGULATIONS (CONTINUED)

Table A.1 (continued)

STATE	SITING LAW	REGULATORY/STATUTORY REFERENCE	AUTHORITY	DESCRIPTION
UTAH	YES	UTAH STATE CODE TITLE 54; CH. 9	PUBLIC SERVICE COMMISSION	CERTIFICATE: NO SPECIFIC LOCATION RESTRICTIONS.
VERMONT	YES	TITLE 30; SEC. 248 ACT 250	PUBLIC SERVICE BOARD	CERTIFICATE OF PUBLIC GOOD
VIRGINIA	NONE			
WASHINGTON	YES	REV. CODE CH. 80.50 WA ADMIN CODE TITLE 463	GOVERNORS ENERGY FACILITY SITE EVALUATION COUNCIL	CERTIFICATION AGREEMENT: NO SPECIFIC LOCATION RESTRICTIONS.
WEST VIRGINIA	YES	STATE CODE TITLE 24; CH. 211	PUBLIC SERVICE COMMISSION	CERTIFICATE: NO SPECIFIC LOCATION RESTRICTIONS.
WISCONSIN	YES	STATE STATUTE SEC. 196.491	PUBLIC SERVICE COMMISSION	CERTIFICATE OF APPROVAL: NO SPECIFIC LOCATION RESTRICTIONS. REQUIRES APPROVAL BY PSC AND DNR.
WYOMING	YES	WYOMING STATE CODE SEC 35-12-101-119	DEPT. OF ENVIRONMENTAL QUALITY INDUSTRIAL SITING DIV.	PERMIT: APPLIES TO 113 MW AND LARGER.

TABLE A.2
STATE WELLHEAD PROTECTION
PROGRAM SUMMARY

State	Wellhead Protection Program
AL	Under development.
AK	Under development.
AZ	Approved.
AR	Approved.
CA	No program.
CO	Under development.
CT	Approved.
DE	Approved.
FL	In revision/ review.
GA	Under development.
HI	Under development.
ID	Under development.
IL	In revision/ review.
IN	In development.
IA	In development.
KS	In revision/ review.
KT	In revision/ review.

State	Wellhead Protection Program
LA	Approved.
ME	Approved.
MD	Approved.
MA	Approved.
MI	In development.
MN	In revision/ review.
MS	None.
MO	In revision/ review.
MT	Under development.
NE	Approved.
NV	In development.
NH	Approved.
NJ	In revision/ review.
NM	Approved.
NY	Approved.
NC	Under development.
ND	In revision/ review.
OH	Under development.

State	Wellhead Protection Program
OK	Approved.
OR	Under development.
PA	Under development.
RI	Approved.
SC	In revision/ review.
SD	In revision/ review.
TN	Under development.
TX	Approved.
UT	In revision/ review.
VT	Approved.
VA	No wellhead protection program.
WA	Under development.
WV	In revision/ review.
WI	Under development.
WY	Under development.

**ATTACHMENT TO
APPENDIX A**

**REGULATIONS RELATED TO POWER PLANT SITING
FOR SELECTED STATES**

ALABAMA

1. Alabama Coastal Management Act: Title 9 Conservation and Natural Resources Chapter 7.
Activities in the coastal area are reviewed by the Office of State Planning and Federal Programs and regulated by the Department of Alabama Environmental Management.
2. Alabama Coastal Management Rules: Rules and Regulations of the Alabama Department of Environmental Management Division 8.
Regulations by which the coastal area activities are prohibited or approved. Including 335-8-1.06 Siting, Construction and Operation of Energy Facilities, 335-8-1.13 Wetlands and Submerged Grassbeds, 335-8-1.20 Protection of Wildlife and Wildlife Habitats.

CALIFORNIA

1. Permits for Activities in Coastal Zones
CA Administrative Register Title 14; Chapter 5; Section 13050
A coastal zone development permit is required for development located within a coastal zone.
2. Historical Preservation
CA Ann. Code Article 2 and Article 3
No alteration of historical property.
2. Archeological, Paleontological, and Historical Site
Public Resources Code; Chapter 1.7 Section 5097
3. CA Integrated Waste Management Act
Public Resources Code; Divisions 30 and 31; part 1; Chapter 4
Countywide Siting Elements -- description of areas to be used for development of solid waste disposal facilities.
3. CA Hazardous Waste Management Act
CA Health and Safety Code; Division 20, Chapter 6.98
Article 8.6 -- Development of Hazardous Waste Management Facilities on Indian Country.
Article 8.7 -- Procedures for the approval of new hazardous waste facilities.
4. CA Solid Waste Management Regulations
CA Code of Regs; Title 14; Division 7 Chapter 3
Article 7.2 -- Disposal Site Siting and Design
5. California Hazardous Waste Management Regulations
CA Code of Regs; Title 22, Division 4.5 Ch. 14 Standards for Owners and Operators of Hazardous Waste TSD Facilities.
Section 66264.18 -- Location Standards
Section 66264.25 -- Seismic and Precipitation Design Standards.
Chapter 15 -- Interim Status Requirements
Section 66265.18 -- Location Standards
Section 66265.25 Seismic and Precipitation Design Standards.

CALIFORNIA (Continued)

6. Coastal Resources Planning and Management Policies
CA Public Resources Code Division 20 Chapter 3
Article 5 -- Land Resource -- restrict development in environmentally sensitive areas;
agricultural areas
Article 6 -- Development -- location guidance
Article 7 -- Industrial development -- encourage to take place within existing sites.
Chapter 7 -- Development control in coastal zones.
7. CA Water Regs
CA Code of Regs; Title 23; Division 3
Chapter 15 -- Water quality aspects of waste discharge to land.
Establish waste and site classification for TSD in landfills, surface impoundments, etc.
Article 3 -- Waste Management Unit Classification and Siting
Section 2530 -- Classification and Siting Criteria -- landfills, etc. wastes at a minimum
5 ft. above any underlying groundwater.
Table 3.1 -- Geologic and Siting Criteria for classified waste management units.

CONNECTICUT

1. Connecticut Public Utility Environmental Standards Act: Title 16; Chapter 277a.
Regulates siting of power facilities.
2. Inland Wetlands and Watercourses Act: Title 22a; Chapter 440
Regulates activities in wetlands via commissions through permitting authority.
3. Coastal Management Act: Title 22a; Chapter 440 (92 (a)(10)).
May be sited outside coastal boundary (100 year coastal flood zone, or 1,000 foot set back from mean high water mark).
4. Connecticut Tidal Wetlands Act: Title 22a; Chapter 440
No regulated activity in wetlands without a permit. States what activities may and may not do in terms of impacts.
5. Surface Water Quality Standards: Conn. State DEP Surface Water Quality Standards
Regulates type of discharge depending on receiving water quality. High quality surface water may receive only select discharges. Tidal wetlands and tidal creeks are considered high quality waters.
6. Endangered Species Act: Public Act No. 89-224, Section 9
No state agency can destroy or adversely modify a state listed endangered species habitat. Private land owners are not restricted.
7. Stream Channel Encroachment Lines: State Statutes No. 22a-342 through -349
Permit required for activities within the encroachment lines.
8. Connecticut Coastal Zone Management Act: CGS Chapter 444; Section 22a-110 through 22a-111
Activities in a coastal area must reviewed and approved by commission.
9. Historic Preservation: State Statutes 7-147a through 7-147k
Limits activities within historic districts.
10. Coastal and Tidal Structures and Dredging: CGS 446
No activities in tidal, coastal or navigable Connecticut waters waterward of the high tide without a permit.

CONNECTICUT (Continued)

11. Archeological Investigations: State Statutes Title 10, Chapter 184a
No construction that would endanger the archeological integrity or sacred importance of a site designated as a state archeological preserve. No activities that would disturb a native american burial, sacred site, or cemetery including associated objects without a permit or under the direction of the state archeologist.
12. Surface Water Quality Standards: State DEP - Water Quality Standards
Radioactive discharges limited to concentrations which would not be harmful to humans, animal or aquatic life. Allowable temperature discharges dependent on water quality classification.

FLORIDA

1. Florida Environmental Land and Water Act of 1972: Title 28 - Natural Resources; Conservation, Reclamation and Use, Chapter 380.
Regulates land and water use through the State land planning agency and resources and management planning committees. This includes protection and restoration of areas of critical state concern, land development regulations, reconstruction of a structure, new construction and siting.
2. Florida Beach and Shore Preservation Act: Title XI, Chapter 161. Part 1: Regulation of reconstruction and new construction on coastal areas. Part 2: Beach and shore preservation districts.
3. Florida Coastal Management Act: Title 26, Chapter 380.
Activities on coastal areas are reviewed by a committee for approval or disapproval.
4. Florida Wetlands Protection Act: Title 29, Public Health Chapter 403. Regulates prohibiting and permitting of activities in wetlands.
5. Florida Multipurpose Hazardous Waste Facility Siting Act: Title 29; Public Health, Chapter 403. Certification program for the siting, construction, and operation of a multipurpose hazardous waste facility.
6. Florida Hazardous Waste Facility Siting Regulations: Title 17, Dept. of Environmental Regulations Chapter 17-733. Siting criteria for land use.
7. Preservation of Native Flora of Florida Act: Sections 581.185 and 581.186. Regulates activities which affect E&T plant species, including land use.
8. State Parks and Preserves (Land Use): Title 18: Public Lands and Property, Chapter 258. Restrict activities pertaining to all wilderness areas.
9. Marine Turtles Protection Act, Florida Statutes: Section 370.12; Subsection 1. Protection of Marine Turtles and their natural habitat.
10. Marine Corals and Sea Fans Protection Act: Section 370.114; Subsection 1. Protection of Corals and Sea Fans.
11. Florida Manatee Sanctuary Act: Section 370.12; Subsection 2. Protection of Manatees and their natural habitat.

FLORIDA (Continued)

12. **Endangered or Threatened Species:** Section 39-27.002, Florida Administrative Code Supplement: Chapter 39. Protection of Endangered or threatened species and their habitat.
13. **Rules and Procedures for Coastal Construction and Excavation and Setback Lines:** Rules of the Department of Natural Resources; Division of Marine Resources; Chapter 16B-33: Rules and Procedures for Coastal Construction and Excavation and Chapter 16B-26. Provides guidelines for coastal construction.

ILLINOIS

1. Construction Permits for FLOOD PLAINS -- permit required from IL Dept. of Transportation -- floodplains defined on a case by case basis.
2. Erosion and Sediment Control
Title 8 Ill. Adm. Code, Chapter 1; Subchapter q; Part 650 Encourages the use of erosion minimization techniques on non-agricultural land and construction sites.
3. Aboriginal Records and Antiquities
Il. Adm. Code, Chapter 127, Section 133
No destruction of a Registered Ill. Historic Place unless obtain Certificate of Compliance.
4. Siting Requirement for Drinking Water Supply Systems
35 Il. Rules & Regs. Subtitle F; Ch. 1; Sec. 602
Avoid locating facility at site which is at risk of floor fire; not within 100yr floodplain.
5. Protection of Endangered Species
Endangered Species Protection Act, Section 332 -335.
Unlawful to possess take or dispose of endangered plant or animal.
6. Great Lakes Basin Compact
Il. Revised Statutes Chapter 127; Section 192.1 et seq.
Great Lakes Basin Commission reviews all activities which impact the Great Lakes and their tributary water systems.
7. Illinois Environmental Protection Act
Il. Revised Statutes Chapter III; Title V. -- Land Pollution and Refuse Disposal
Section 21 -- Acts Prohibited 1) location of hazardous waste disposal facility above mine; distance from municipality; prohibition from locating within 1000 feet of well.
8. Illinois Responsible Property Transfer Act
PA 86-648
Environmental Liabilities disclosure
Hazardous Substance Construction Disclosure Act -- procedures in the event of a discovery of hazardous substance during construction.

ILLINOIS (Continued)

9. Illinois Solid and Special Waste Management Regulations
II. Administrative Code Title 35; Subtitle G; Chapter 1
Part 811 -- Standards for New Solid Waste Landfills -- 811.102 -- Location Standards
10. Illinois Hazardous Waste Management Regulations
Title 35; Subtitle G; Chapter 1
Part 724 -- Standards for Owners of TSDF
Section 724.118 -- location Standards

MICHIGAN

1. Michigan Hazardous Waste Act: Chapter 299. -- related but not directly applicable-- State hazardous waste management plan includes proposed criteria for determining acceptable locations for hazardous waste facilities.
2. Michigan Solid Waste Mgmt Regulations: -- related but not directly applicable-- Limits locations for sanitary waste landfills in relation to waterways, wetlands and floodplains
3. Michigan Hazardous Waste Rules: Chapter 299. -- related but not directly applicable -- Sets location standards
4. Michigan Shorelands Protection and Management Act: Chapter 281. Regulates uses of high risk, flood risk, and environmentally sensitive areas.
5. Michigan Wetland Protection Act: Chapter 281. Sets requirements for activities in wetland areas. No construction activities permitted without a permit. Permit can not be issued unless activity is in the public interest.
6. Michigan Water Resources Commission Act: General Rules Section R 323.5 Permit required to fill or grade floodplain, streambeds and channels.
7. Michigan Drinking Water Regulations: General Rules Part 8; Section R 325 -- Groundwater Resources. Water supply wells must be 2000 feet from known major sources of contamination.
8. Act 245 -- covers sole source aquifer regs.
9. Inland Lakes and Streams Act; Sections R281.812-R281.814: Michigan Statutes Annotated, Title 11. Must submit permit application and demonstrate no impact to rare resource and no feasible alternative.
10. Endangered and Threatened Plants and Wildlife: Sections R299 No taking of Federal or State listed species.

MICHIGAN (Continued)

11. High Risk Erosion Areas: Michigan Administrative Code Section R281.22.
Permit required for structures in high risk erosion areas.
12. Discharges to State Waters: Michigan Administrative Code Part 21, Section R323.
No radiological discharges. Temperature limits have been set for discharges and vary with the type of receiving water body and the time of year.

NEW YORK

1. **New York Wetlands Laws: Articles 24 (fresh water) and 71 (Tidal).**
County, town and village ordinances are allowed for fresh water wetlands protection in addition to the state law. Allows only limited land use within wetlands. Land use must be compatible with wetlands and is controlled through a permit process. Tidal--no alteration to tidal wetlands without a permit. Commission must develop land use regs for wetlands. No permits allowed that vary from these regs.
2. **New York Coastal Erosion Law: Article 34.**
Requires identification of coastal erosion areas, promulgation of hazard ordinances that restrict or prohibit, if necessary, actions that exacerbate erosion in the erosion areas identified.
3. **New York Water Pollution Control Regs: Title 6, Chapter 5 Subchapter D.**
Permit required to disturb a stream bed or to excavate or place fill in navigable waters.
4. **New York Water Classifications and Quality Standards: Title 6, Chapter 5.**
No discharges will be permitted that degrade high quality waters, as designated by the State. No discharge over 70 degrees to trout streams. No discharge from June to September that will raise stream temps by more than 2 degrees, or lakes by more than 3 degrees. No temp changes at all allowed in enclosed bays.
5. **New York Environmental Bond Act: Article 57, title 7, Section 51-0703.**
Wetlands acquired or restored with state money can not be sold or used for any purpose inconsistent with the character of the wetlands. No structures.
6. **Threatened and Endangered Species: Title 6, Chapter I, Part 182:**
No taking of T & E species or species of special concern.
7. **Flood Control Lands: Title 6, Chapter 5, Part 501.**
No activity in flood control lands without a permit.
8. **Coastal Zone and Tidal Wetland Activities: Title 6, Chapter 10, Section 661.**
No regulated activities without a permit. Regulated activities are those that would change the character of the area, such as drilling or erecting structures.
9. **Freshwater Wetland Activities: Title 6, Part 663.**
Permits required for structures, filling, grading, or pollution in a wetland.

NEW YORK (Continued)

10. Delaware River Basin Commission Administration Manual, Part III: Basin/Floodplain Regulations; Articles 6.1 through 6.5.
Applies to flood hazard areas in the nontidal portions of the Delaware River and its tributaries. No structures in floodway or flood fringe.
11. Natural Protective Feature Areas: Title 6, Part 505.
Applies to near shore areas, beaches, bluffs and primary and secondary dunes. No activities allowed that diminish protection afforded by these areas.

NORTH CAROLINA

1. North Carolina Land Policy Act: General Statutes of N.C. Chapter 113A, Article 9, specifically 113A-153 - 156. Establishes a land use policy, which includes the development of a land classification system which will give guidelines and policy for land use, through the Land Policy Council.
2. North Carolina Coastal Area Management Act: General Statutes of N.C., Chapter 113A, Article 7, 113A-102 -111, Part 3 section 113A-113-115. Cooperative regulation of Coastal area land use and development.
3. Coastal Land Use Guidelines: N.C. Administrative Code; Title 15: Chapter 7. Provides criteria for land use plans in coastal areas. Includes land use classification system guidelines, and public participation in local land use planning.
4. North Carolina Hazardous Waste Management Commission Act: General Statutes of N.C., Chapter 130B-11-13, 19-20. Regulates activities for the siting, construction and operation of hazardous wastes facilities through a commission and local review committees.
5. North Carolina Solid and Hazardous Waste Management Act: General Statutes of N.C., Chapter 130A - Public Health, Article 9., p.1266:
6. Endangered and Threatened Species: N.C. Administrative Code; Title 15 Dept. of Natural and Economic Resources; Chapter 10: Wildlife Resources and Water Safety; Subchapter 101.
Protection of E&T species.

PENNSYLVANIA

1. Erosion Control Plans and Measures
25 PA Code Ch. 102 -- Section 102.4 -- Earthmoving activities conducted in such a way as to prevent accelerated erosion and sedimentation.
Section 102.5 Erosion and Sedimentation Control Plan
2. Endangered Fishes, Amphibians and Reptiles
Fishing and Boating Regulations Chapter 75; Section 1 Prohibits taking, killing, selling of endangered species.
3. Coastal Zone Management in Pennsylvania: Bluff Recession and Setback
25 PA Code Subpart C; Article I; Chapter 85
Minimum requirements for construction of structures along the shoreline of Lake Erie.
4. Public Water Systems: Design Criteria
25 PA Code Chapter 109; Subchapter F
Includes location criterias for the construction of public water systems.
5. Native Wild Plants: Endangered, Threatened and Rare.
25 PA Code Chapter 82
No negative impacts as a result of activity. Must notify Bureau of Forestry of any change in land use
6. Permits for Floodplain Activities
25 PA Code; Chapter 106
Restrictions on and permit requirement for construction activities in a floodplain.
7. Susquehanna River Basin Commission: Regulations for Projects
25 PA Code Section 803
Projects with significant potential impact on the Basin require approval from the Commission.
8. Delaware River Basin Commission
Projects which adversely impact water quality in the Delaware River Basin area must obtain approval from the Commission.

PENNSYLVANIA (Continued)

9. Delaware River Basin Commission: flood plains in non-tidal areas
Requirements for land use within a flood hazard area. Includes restriction on structures cover land areas exceeding 50,000 sq. ft.
10. Delaware River Basin Commission: Comprehensive Plan and Water Resources Program
Applications for projects impacting the Basin's water resources must be incorporated into the comprehensive plan for the area. Applications for major electric generating projects shall include a master siting study, a site selection analysis, and an environmental statement.

APPENDIX B
GEOGRAPHIC INFORMATION SYSTEMS

APPENDIX B

GEOGRAPHIC INFORMATION SYSTEMS

B.1 GEOGRAPHIC INFORMATION SYSTEMS

Geographic Information Systems (GIS) are computerized hardware and software systems that facilitate the entry, analysis, display, and overall management of mappable information. GIS originated in the early 1970s as rudimentary map-drawing programs. They have since evolved into powerful tools that perform sophisticated analyses on mapped data and create high-quality cartographic products. GIS technology has experienced phenomenal growth in acceptance and usage since its inception in the early 1970's, and today is used on a widespread basis worldwide. Typical users of GIS today include government agencies (at all administrative levels); universities and centers of research; special interest groups (e.g. political parties and environmental groups); utility companies and energy development companies; engineering and environmental consultants; and various segments of the manufacturing, retailing, and service industries. As a result of this demand, several ancillary GIS support services abound: software and hardware manufacturers, data conversion services, GIS management consulting, educational and training services, GIS conferences, and industry publications. Clearly, GIS is no longer an arcane or exotic technology; it is a fundamental data analysis tool that is used for a variety of applications, in a variety of settings throughout the world.

Several GIS packages are available commercially or in the public domain. In addition, several GIS data bases, including elevation, transportation, hydrography, and population distributions, are available for many areas in the U.S. from government agencies. The easy availability of GIS packages and digitized data, along with decreasing costs and increasing performance of hardware, contribute to today's interest in the technology.

B.1.1 Data Structure

GIS packages store geographic information as a set of data layers (also called "coverages"), where each layer represents a specific data theme, such as transportation, surface hydrology, or topography. Map layers are typically stored in two principal formats: vector and raster. Vector data structures represent geographic features as an ordered set of X,Y coordinate pairs in standard real-world coordinate systems, such as UTM or State Plane. In many systems, vector data files can be related to tabular attribute files that contain specific characteristics related to the mapped features; for example, a map coverage of county boundaries could be accompanied by an attribute table containing population, number of households, tax revenue, etc. Rasterized GIS data represent features in a regularly-spaced grid of sample locations called grid cells. Both types of data structures are acceptable for supporting site screening and evaluation projects.

B.1.2 GIS Analytical Operations

The true power of GIS lies in its analytical capabilities, because it allows data computations that would be difficult and laborious, if possible at all, by using manual methods. Typical GIS operations that can be performed on mapped data include the following:

- Arithmetic - Addition, subtraction, division, and multiplication of maps;
- Logical/Boolean - Comparison of two or more maps to return maximum, minimum, intersection, union, or other results.
- Spatial Operations - Distance buffering, network modeling, and least-path modeling.
- Topographic Operations - Slope, aspect, visibility, precipitation runoff, and other models that consider changes in terrain elevation.

The individual analytical operations or commands in most modern GIS packages can be logically arranged into powerful models that yield valuable decision-making information. The results of the operations can be portrayed as high quality color maps and statistical reports to assist decision-makers in evaluating sites.

B.1.3 GIS Application in Site Screening and Evaluation

Because of the map overlay and analytical operations available in modern GISs, they are excellent tools for conducting site screening and evaluation. In fact, since the early 1970s, GIS has been applied toward site selection for nuclear and coal-fired power plants.¹

GIS-based approaches to site evaluation often emulate the McHargian² method of overlaying several map themes to arrive at a composite suitability map. A common, generalized process is outlined in the sections below.

B.1.3.1 Identify Factors of Concern

The factors that will influence the siting decision are identified. These factors include legal requirements, professional judgements, and economic factors that will affect the permitting, licensing, construction, operation, and decommissioning of the facility. Typical factors of concern include, but are not limited to: biological sensitivity; health and safety; land use suitability; site preparation costs; and cooling costs.

It is possible that one "issue" map may detail exclusionary categories, representing areas that are eliminated for siting due to one or more legal or practical considerations.

B.1.3.2 Data Base Construction

Mapped data are identified to support the development of issue maps. Data are compiled onto standard base maps for the area of concern, and entered into the GIS through digitization or reformatting of existing digital data.

¹ For example, *A Report on Data Management For Power Plant Siting: Delmarva Interface Study*, Dames & Moore, 1975.

² McHarg, Ian L. *Design with Nature*. Garden City, NY, Doubleday, 1969.

B.1.3.3 Data Analysis

A flow diagram is prepared to illustrate the analytical techniques used to create issue maps (see Figure B-1). GIS operations are performed on map layers in a systematic, predetermined sequence. A typical GIS operation would be to create a buffer zone at some defined distance from wetlands. The result of this step is the creation of a set of issue maps, where each map evaluates potential sites relative to a specific siting issue. (Suitability evaluation techniques are described in Section B.3). Typically, suitability is expressed as an index on a relative scale, for example, 1 to 5.

Issue maps are combined through a logical map overlay to create a composite site suitability map, through weighted or unweighted methods (weighting techniques are described in Section 2.4).

B.1.3.4 Presentation of Results

Issue maps and composite suitability maps are presented as hard-copy GIS products, accompanied by statistical reports which show the distribution and statistical parameters (mean, median, standard deviation, etc.) of map values.

B.1.3.5 Selection of Candidate Sites

Candidate siting areas can be identified with the assistance of GIS statistical techniques, such as: percentile ranking (for example, displaying those areas in the top ten percentile of suitability ratings); identifying contiguous areas larger than a defined threshold size and shape.

B.1.4 Site Specific Applications

The site screening procedure described above assumes the development of a regional database of various screening criteria. Large regional databases typically generalize features in

FIGURE B-1

Dames & Moore

DATA STRUCTURE DIAGRAM

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order to save storage space and to speed data computations. Once a set of candidate sites is identified, it is possible to construct GIS databases for the sites with more resolute and detailed information to support detailed site-specific applications. The results of these applications can then be used to help differentiate the suitability of individual sites.

APPENDIX C
SUMMARY OF DELPHI PROCESS

APPENDIX C

SUMMARY OF DELPHI PROCESS

The Delphi technique, as an integral element of the site selection process, is used to establish, through the collective judgement of a group of siting and energy experts, the relative importance of each of the issues of concern (or major criteria) for nuclear energy center site selection. This importance value or weight can then be applied to the issue evaluation for each site and a composite weighted evaluation derived for each potential site area.

C.1 DELPHI PROCESS DEFINED

The Delphi technique described herein is a modified form of the traditional Delphi procedure and has been used successfully in numerous applications on site selection projects. As with all Delphi techniques, it is characterized by an iterative methodology that begins with autonomous assessments or value assignments by each participant. These value assignments are then statistically summarized providing a group-based measure to which each participant can respond. A group discussion is then conducted completing one iteration. The next iteration is initiated with the reassignment of values based on feedback gained through the discussion process.

The overall procedure is conducted in six major steps:

- Define problem objectives
- Select participant group
- Define issues of concern
- Assign individual importance weights
- Conduct statistical analysis
- Conduct group discussion

C.1.1 Define Problem Objectives

Definition of the objectives of the Delphi includes selection of the issues of concern to be evaluated. Each issue is comprehensively documented including: (1) a general statement of the issue's relationship to the siting process (such as mandated by federal regulatory definition), (2) the method for collecting or generating information used to evaluate the issue for each potential site area, and in some cases, (3) the historical background of the issue. This documentation can then be disseminated to the participant group in preparation for the Delphi assessment.

C.1.2 Select Participant Group

After the objectives of the Delphi have been established and each of the issues of concern documented, a participant group is selected. The participant group may be formed in a variety of ways. It may be a multidisciplinary group, a multi-interest group, or both. Multidisciplinary groups, including geotechnical, hydrological, engineering, demographic and ecological experts to list a few, would explore the problem, primarily from a technical viewpoint. In contrast, interested groups (such as the conservation groups, utility associations, and politicians) would evaluate the problem from a somewhat less technical perspective. A typically balanced group might include professionals in different applied sciences, planners, managers, lawyers, and the lay public representing specific interests. The group must include participants who can speak on the issues of concern and impart their specific knowledge to other people in the group. In addition, the group should include some generalists, people who may have come from a specific area of application and have, through their experience, developed broad general knowledge within the area of power plant siting.

C.1.3 Define Issues of Concern

At a suitable meeting place, the facilitator begins the first group meeting. The principal investigators from the project team present each of the issues of concern to be considered and

evaluated. Having been made aware of a general definition of each issue, the participants gain a detailed understanding of how source data are collected and developed into information, resulting in a map showing the relative suitability of potential site area locations based on that particular issue of concern. The discussion of each issue continues until the group feels that it has a common understanding of the issue. This does not imply that the group accepts the issue as being a valid site determinant, or pertinent to the particular problem, but that the participants have achieved a basic understanding of the issue. This activity assures that all participants are operating from a common information base. Each participant will be able to express his or her feelings about the validity of each issue by assigning importance weights during the iterative assessment process.

C.1.4 Assign Importance Weights

Each participant assigns a value to each of the issues. This value represents the weighting or importance value of each specific issue and is a measure of its level of contribution to the composite evaluation of power plant site suitability. These values are assigned confidentially and at the conclusion of each participant's assessment, the participant's ballot is collected by the facilitator so that his values can be included as part of the group statistical summary.

C.1.5 Conduct Statistical Analysis

Once all participants have finished value assignments, the facilitator performs a statistical analysis of the results. The results of the analysis are reported to the participants, including each individual's values which are normalized to a common scale and the group averages. By comparing the group average results of each iteration, it is apparent how the group values are changing as a result of the interactive discussion process. In addition to the group average, the standard deviation for each issue is computed and reported to the group to show the group how it may be converging or diverging for any particular issue.

After the statistics have been computed and reported to the participants, each participant reviews the values that he or she assigned (which have been normalized to a common sum total for comparative purposes) and compares them with the group average values. During a short period of review, each participant determines if he or she feels the group average should be higher or lower, and then prepares arguments to present to the group hoping to convince them to change their value assignments during the next iteration.

C.1.6 Conduct Group Discussion

The group discussion is conducted in two parts. During the first part, each participant has the opportunity to speak, without interruption, to present specific views or arguments concerning each issue. Once each participant is given the opportunity to speak, an open discussion is held where additional information may be presented.

When the open discussion is concluded, the process is iterated. Each participant assigns new values based on the information or the learning that has occurred during the group discussion. If one participant is particularly convincing in his presentation, then others may change their values. At the conclusion of the next value assignments, the statistics are computed again and reported to the group. After review of the group statistics, each individual is aware of how the group value has changed and will then develop additional arguments or restate previous arguments to persuade the group to move a value in a desired direction. The group discussion is reconvened, and the entire process is iterated.

C.2 ACHIEVING GROUP STABILITY

The first iteration of the procedure is primarily considered to be a learning iteration; that is, each individual who is usually conversant with only some of the issues will learn a great deal about the other issues.

In the second round, a greater exploration of the siting problem begins to take place. As the participants learn more about the problem, new ideas occur to them, new thoughts about the problem are presented, and a greater exploration or a more comprehensive view of the problem is achieved. After the process iterates several times, with the facilitator continually monitoring several key statistical indicators, the group average opinion tends to become stabilized.

Upon achieving a stabilized group opinion or value for each issue, the Delphi is complete, and the final group averages are considered to be the collective group judgement concerning the importance of each of the issues of concern.

**TABLE D-1
PLANT PARAMETERS ENVELOPES SITING SUMMARY**

Structure, System, Component/Primary Parameter/ Secondary Parameter		Composite Plant (Value)	Siting Consideration (Siting Guide Section No.)
1.	<u>Structures</u>		
1.1	Foundation Embedment	66' 4" to top of basemat	*
1.2	Height	207'-3"	*
1.4	Precipitation (for Roof Design)		
1.4.1	Maximum Rainfall Rate	19.4 in/hr - 6.2 in/5 min	3.1.1.5.2
1.4.2	Snow Load	50 lb/sq ft	3.1.1.5.2
1.5	Safe Shutdown Earthquake (SSE)		
1.5.1	Design Response Spectra	Regulatory Guide 1.60	3.1.1.1
1.5.2	Peak Ground Acceleration	0.30 g	3.1.1.1.1
1.5.3	Time History	Envelope SSE Response Spectra	3.1.1.1
1.8	Site Water Level (Allowable)		
1.8.1	Maximum Flood (or Tsunami)	1 ft below Plant Grade	3.1.1.3
1.8.2	Maximum Ground Water	2 ft below Plant Grade (4)	3.2.2.2.1
1.9	Soil Properties Design Bases		
1.9.1	Liquefaction	None at Site-specific SSE	3.1.1.1.4
1.9.2	Minimum Bearing Capacity (Static)	>= 15 KSF	3.1.1.1.4
1.9.3	Minimum Shear Wave Velocity	>= 1000 FPS	3.1.1.1.4

*PPE has no implication for site selection.

(1) Included in an overall site size criterion.

(2) Bounded by PPE for normal plant heat sink.

(3) Compliance with X/Q and source term PPEs should be adequate to address these PPEs for siting purposes. More detailed calculations should be performed at Step 4B to confirm.

(4) Open item - Refer to latest URD for resolution of this PPE.

TABLE D-1
PLANT PARAMETERS ENVELOPES SITING SUMMARY (cont.)

Structure, System, Component/Primary Parameter/ Secondary Parameter		Composite Plant (Value)	Siting Consideration (Siting Guide Section No.)
1.11	Tornado (Design Bases)		
1.11.1	Maximum Pressure Drop	1.46 PSI	3.1.1.5
1.11.2	Maximum Rotational Speed	240 mph	3.1.1.5
1.11.3	Maximum Translational Speed	57 mph	3.1.1.5
1.11.4	Maximum Wind Speed	260 mph	3.1.1.5
1.11.5	Missile Spectra	Spectrum A of SRP 3.5.1.4 (4)	3.1.1.5
1.11.6	Radius of maximum Rotational Speed	150 ft	3.1.1.5
1.11.7	Rate of Pressure Drop	1.2 psi/sec	3.1.1.5
1.12	Wind		
1.12.1	Basic Wind Speed	110 mph	3.1.1.5.1
1.12.2	Importance Factors	1.0 (NSR)/1.11 (SR)	3.1.1.5.1
2.	<u>Normal Plant Heat Sink</u>		
2.1	Ambient Air Requirements		
2.1.1	Normal Shutdown Max Ambient Temp (1% Exceed)	100 F DB/ 77 F WB Coincident	3.1.1.2.2
2.1.2	Normal Shutdown Max Wet Bulb Temp (1% Exceed)	80 F WB Non-Coincident	3.1.1.2.2

*PPE has no implication for site selection.

- (1) Included in an overall site size criterion.
- (2) Bounded by PPE for normal plant heat sink.
- (3) Compliance with X/Q and source term PPEs should be adequate to address these PPEs for siting purposes. More detailed calculations should be performed at Step 4B to confirm.
- (4) Open item - Refer to latest URD for resolution of this PPE.

TABLE D-1
PLANT PARAMETERS ENVELOPES SITING SUMMARY (cont.)

Structure, System, Component/Primary Parameter/ Secondary Parameter		Composite Plant (Value)	Siting Consideration (Siting Guide Section No.)
2.1.3	Normal Shutdown Min Ambient Temp (1% Exceed)	-10 F	3.1.1.2.2
2.1.5	RX Thermal Power Max Ambient Temp (0% Exceed)	115 F DB/ 80 F WB Coincident	3.1.1.2.2
2.1.6	RX Thermal Power Max Wet Bulb Temp (0% Exceed)	81 F WB Non-Coincident	3.1.1.2.2
2.1.7	RX Thermal Power Min Ambient Temp (0% Exceed)	-40 F	3.1.1.2.2
2.2	Blowdown Pond Acreage	24 hr Blowdown	(1)
2.3	Condenser/Heat Exchanger Duty	9.7 E9 Btu/hr	*
2.6	Maximum Inlet Temp Condenser/Heat Exchanger	91 F	*
2.7	Mech Draft Cooling Towers		
2.7.1	Acreage	50 acres	(1)
2.7.3	Approach Temperature	10 F	3.1.1.2.2
2.7.4	Blowdown Constituents and Concentration	See Table D-1.1	3.2.3.1
2.7.5	Blowdown Flow Rate	5200 (17,700) gpm	3.2.3.1
2.7.6	Blowdown Temperature	100 F	3.2.3.1

*PPE has no implication for site selection.

(1) Included in an overall site size criterion.

(2) Bounded by PPE for normal plant heat sink.

(3) Compliance with X/Q and source term PPEs should be adequate to address these PPEs for siting purposes. More detailed calculations should be performed at Step 4B to confirm.

(4) Open item - Refer to latest URD for resolution of this PPE.

TABLE D-1
PLANT PARAMETERS ENVELOPES SITING SUMMARY (cont.)

Structure, System, Component/Primary Parameter/ Secondary Parameter		Composite Plant (Value)	Siting Consideration (Siting Guide Section No.)
2.7.7	Cooling Tower Temperature Range	Condenser Temp Rise 29 F	*
2.7.8	Cooling Water Flow Rate	696,000 gpm	*
2.7.9	Cycles of Concentration	4 (2 minimum)	3.2.3.1
2.7.10	Evaporation Rate	15,400 (17,700) gpm	*
2.7.12	Heat Rejection Rate	26 E6 Btu/hr	*
2.7.13	Height	60 ft	*
2.7.15	Makeup Flow Rate	20,600 (35,400) gpm	3.1.1.2.1
2.7.16	Maximum Consumption of Raw Water	17,700 gpm	3.1.1.2.1
2.7.17	Monthly Average Consumption of Raw Water	15,400 gpm	3.1.1.2.1
2.7.18	Noise	55 dBA at 1000 ft	*
2.7.22	Stored Water Volume	10,500,000 gal	(1)
2.8	Natural Draft Cooling Towers		
2.8.1	Acreage	6 acres	(1)
2.8.2	Approach Temperature	10 F	3.1.1.2.1
2.8.3	Blowdown Constituents and Concentrations	See Table D-1.1	3.2.3.1

*PPE has no implication for site selection.

(1) Included in an overall site size criterion.

(2) Bounded by PPE for normal plant heat sink.

(3) Compliance with X/Q and source term PPEs should be adequate to address these PPEs for siting purposes. More detailed calculations should be performed at Step 4B to confirm.

(4) Open item - Refer to latest URD for resolution of this PPE.

**TABLE D-1
PLANT PARAMETERS ENVELOPES SITING SUMMARY (cont.)**

Structure, System, Component/Primary Parameter/ Secondary Parameter		Composite Plant (Value)	Siting Consideration (Siting Guide Section No.)
2.8.4	Blowdown Flow Rate	5,200 (17,700) gpm	3.2.3.1
2.8.5	Blowdown Temperature	100 F	3.2.3.1
2.8.6	Cooling Tower Temperature Range	Condenser Temp Rise 29 F	*
2.8.7	Cooling Water Flow Rate	696,000 gpm	*
2.8.8	Cycles of Concentration	4 (2 minimum)	3.2.3.1
2.8.9	Evaporation Rate	15,400 (17,700) gpm	*
2.8.11	Heat Rejection Rate	26 E6 Btu/hr	*
2.8.12	Height	550 ft	*
2.8.14	Makeup Flow Rate	20,600(35,400) gpm	3.1.1.2.1
2.8.15	Maximum Consumption of Raw Water	17,700 gpm	3.1.1.2.1
2.8.16	Monthly Average Consumption of Raw Water	15,400 gpm	3.1.1.2.1
2.8.17	Noise	55 DBA at 1000 ft	*
2.8.20	Stored Water Volume	10,500,000 gal	(1)
2.9	Once-Through Cooling		
2.9.1	Cooling Water Discharge Temperature	118 F	3.2.3.1

*PPE has no implication for site selection.

- (1) Included in an overall site size criterion.
- (2) Bounded by PPE for normal plant heat sink.
- (3) Compliance with X/Q and source term PPEs should be adequate to address these PPEs for siting purposes. More detailed calculations should be performed at Step 4B to confirm.
- (4) Open item - Refer to latest URD for resolution of this PPE.

**TABLE D-1
PLANT PARAMETERS ENVELOPES SITING SUMMARY (cont.)**

Structure, System, Component/Primary Parameter/ Secondary Parameter			Composite Plant (Value)	Siting Consideration (Siting Guide Section No.)
	2.9.2	Cooling Water Flow Rate	1,100,000 gpm	3.1.1.2.1
	2.9.3	Cooling Water Temperature Rise	18 F	3.2.3.2
	2.9.4	Evaporation Rate	9,300 (10,700) gpm	*
	2.9.5	Heat Rejection Rate	9.7 E9 Btu/hr	3.2.3.1
2.10	Ponds			
	2.10.1	Acreage	3000 acres W/O Spray	(1)
	2.10.2	Blowdown Constituents and Concentrations	See Table D-1.1	3.2.3.1
	2.10.3	Blowdown Flow Rate	5,200 (17,700) gpm	3.2.3.1
	2.10.4	Blowdown Temperature	100 F	3.2.3.1
	2.10.5	Cooling Pond Temperature Range	Cond Temp Rise 29 F	*
	2.10.6	Cooling Water Flow Rate	696,000 gpm	*
	2.10.7	Cycles of Concentration	4 (2 minimum)	3.2.3.1
	2.10.8	Evaporation Rate	15,400 (17,700) gpm	*
	2.10.9	Heat Rejection Rate	26 E6 Btu/hr	*
	2.10.10	Makeup Flow Rate	20,600 (35,400) gpm	3.1.1.2.1

*PPE has no implication for site selection.

(1) Included in an overall site size criterion.

(2) Bounded by PPE for normal plant heat sink.

(3) Compliance with X/Q and source term PPEs should be adequate to address these PPEs for siting purposes. More detailed calculations should be performed at Step 4B to confirm.

(4) Open item - Refer to latest URD for resolution of this PPE.

TABLE D-1
PLANT PARAMETERS ENVELOPES SITING SUMMARY (cont.)

Structure, System, Component/Primary Parameter/ Secondary Parameter		Composite Plant (Value)	Siting Consideration (Siting Guide Section No.)
2.10.11	Maximum Consumption of Raw Water	17,700 gpm (12,400 W/O Spray)	3.1.1.2.1
2.10.12	Monthly Average Consumption of Raw Water	15,400 gpm (10,800 W/O Spray)	3.1.1.2
2.10.13	Stored Water Volume	14.7 E9 gal	3.1.1.2
3.	<u>Ultimate Heat Sink</u>		
3.1	Ambient Air Requirements		
3.1.1	Maximum Ambient Temperature (0% Exceedance)	115 F DB/80 F WB Coincident	(2)
3.1.2	Maximum Wet Bulb Temperature (0% Exceedance)	81 F WB (Non-Coincident)	(2)
3.1.3	Minimum Ambient Temperature (0% Exceedance)	-40 F	(2)
3.2	CCW Heat Exchanger Duty	104 (374 S/D) E6 Btu/hr	(2)
3.5	Maximum Inlet Temp to CCW Heat Exchanger	95 F	3.1.1.2.1
3.6	Mech Draft Cooling Towers	0.5 acre	(1)
3.6.1	Acreage		
3.6.3	Approach Temperature	10 F	(2)
3.6.4	Blowdown Constituents and Concentrations	See Table D-1.1	(2)

*PPE has no implication for site selection.

- (1) Included in an overall site size criterion.
- (2) Bounded by PPE for normal plant heat sink.
- (3) Compliance with X/Q and source term PPEs should be adequate to address these PPEs for siting purposes. More detailed calculations should be performed at Step 4B to confirm.
- (4) Open item - Refer to latest URD for resolution of this PPE.

TABLE D-1
PLANT PARAMETERS ENVELOPES SITING SUMMARY (cont.)

Structure, System, Component/Primary Parameter/ Secondary Parameter		Composite Plant (Value)	Siting Consideration (Siting Guide Section No.)
3.6.5	Blowdown Flow Rate	100 (700) gpm	(2)
3.6.6	Blowdown Temperature	95 F	(2)
3.6.7	Cooling Tower Temperature Range	25 F	*
3.6.8	Cooling Water Flow Rate	28,150 gpm (Shutdown)	*
3.6.9	Cycles of Concentration	4 (2 minimum)	(2)
3.6.10	Evaporation Rate	250 (700) gpm	(2)
3.6.12	Heat Rejection Rate	0.5 E6 Btu/hr	(2)
3.6.13	Height	60 ft	*
3.6.15	Makeup Flow Rate	350 (1,400) gpm	(2)
3.6.16	Maximum Consumption of Raw Water	700 gpm	(2)
3.6.17	Monthly Average Consumption of Raw Water	250 gpm	*
3.6.18	Noise	55 DBA at 1000 ft	*
3.6.22	Stored Water Volume	30.6 E6 gal	(1)
3.7	Once-through Cooling		
3.7.1	Cooling Water Discharge Temperature	120 F	3.2.3.1

*PPE has no implication for site selection.

(1) Included in an overall site size criterion.

(2) Bounded by PPE for normal plant heat sink.

(3) Compliance with X/Q and source term PPEs should be adequate to address these PPEs for siting purposes. More detailed calculations should be performed at Step 4B to confirm.

(4) Open item - Refer to latest URD for resolution of this PPE.

TABLE D-1
PLANT PARAMETERS ENVELOPES SITING SUMMARY (cont.)

Structure, System, Component/Primary Parameter/ Secondary Parameter			Composite Plant (Value)	Siting Consideration (Siting Guide Section No.)
3.8	3.7.2	Cooling Water Flow Rate	28,150 gpm	(2)
	3.7.3	Cooling Water Temperature Rise	25 F	3.2.3.1
	3.7.4	Evaporation Rate	150 (400) gpm	(2) None
	3.7.6	Minimum Essential Flow Rate	14,500 gpm	(2) None
	Ponds			
	3.8.1	Acreage	60 acres (No Spray)	(1)
	3.8.2	Blowdown Constituents and Concentrations	See Table D-1.1	(2)
	3.8.3	Blowdown Flow Rate	100 (700) gpm	(2)
	3.8.4	Blowdown Temperature	95 F	(2)
	3.8.5	Cooling Pond Temperature Range	25	*
	3.8.6	Cooling Water Flow Rate	28,150 gpm (Shutdown)	*
	3.8.7	Cycles of Concentration	4 (2 minimum)	(2)
	3.8.8	Evaporation Rate	250 (700) gpm	(2)
	3.8.9	Heat Rejection Rate	0.5 E6 Btu/hr (0.3 E6 W/O Spray)	(2)
3.8.10	Makeup Flow Rate	350 (1,400) gpm	(2)	

*PPE has no implication for site selection.

- (1) Included in an overall site size criterion.
- (2) Bounded by PPE for normal plant heat sink.
- (3) Compliance with X/Q and source term PPEs should be adequate to address these PPEs for siting purposes. More detailed calculations should be performed at Step 4B to confirm.
- (4) Open item - Refer to latest URD for resolution of this PPE.

TABLE D-1
PLANT PARAMETERS ENVELOPES SITING SUMMARY (cont.)

Structure, System, Component/Primary Parameter/ Secondary Parameter		Composite Plant (Value)	Siting Consideration (Siting Guide Section No.)
3.8.11	Maximum Consumption of Raw Water	700 gpm (500 W/O Spray)	(2)
3.8.12	Monthly Average Consumption of Raw Water	250 gpm (150 W/O Spray)	(2)
3.8.13	Stored Water Volume	196,000,000 gal	*
4.	<u>Containment Heat Removal System (Post-Accident)</u>		
4.1	Ambient Air Requirements		
4.1.1	Maximum Ambient Temperature (0% Exceedance)	115 F DB/80 F WB	(2)
4.1.2	Minimum Ambient Temperature (0% Exceedance)	-40F	(2)
5.	<u>Potable Water/Sanitary Waste System</u>		
5.2	Discharge to Site Water Bodies		
5.2.1	Flow Rate	35 (70) gpm	(2)
5.4	Raw Water Requirements		
5.4.1	Maximum Use	100,000 gpd (70 gpm)	(2)
5.4.2	Monthly Average Use	1,500,000 gal/month-35 gpm	(2)
6.	<u>Demineralized Water System</u>		
6.2	Discharge to Site Water Bodies		
6.2.1	Flow Rate	50 (135) gpm	(2) None

*PPE has no implication for site selection.

(1) Included in an overall site size criterion.

(2) Bounded by PPE for normal plant heat sink.

(3) Compliance with X/Q and source term PPEs should be adequate to address these PPEs for siting purposes. More detailed calculations should be performed at Step 4B to confirm.

(4) Open item - Refer to latest URD for resolution of this PPE.

TABLE D-1
PLANT PARAMETERS ENVELOPES SITING SUMMARY (cont.)

Structure, System, Component/Primary Parameter/ Secondary Parameter		Composite Plant (Value)	Siting Consideration (Siting Guide Section No.)
6.4	Raw Water Requirements		
6.4.1	Maximum Use	625 gpm	(2) None
6.4.2	Monthly Average Use	150 gpm	(2)
7.	<u>Fire Protection System</u>		
7.1	Raw Water Requirements		
7.1.1	Maximum Use	300,000 gal/2 hr (2500 gpm)	(2)
7.1.2	Monthly Average Use	225,000 gal/mo (5 gpm)	(2)
7.1.4	Stored Water Volume	775,000 gal	(2)
8.	<u>Miscellaneous Drain</u>		
8.2	Discharge to Site Water Bodies		
8.2.1	Flow Rate	25 (50) gpm	(2)
9.	<u>Unit Vent/Airborne Effluent Release Point</u>		
9.1	Atmospheric Dispersion (CHI/Q) (Accident)		
9.1.1	0.5 mile - 0-2 hr	1.0E-3 sec/M3	3.1.3.3.2
9.1.2	2 mile - 0-8 hr	1.35E-4 sec/M3	3.1.3.3.2
9.1.3	2 mile - 1-4 day	5.4E-5 sec/M3	3.1.3.3.2
9.1.4	2 mile - 4-30 day	2.2E-5 sec/M3	3.1.3.3.2
9.1.5	2 mile - 8-24 hr	1.0E-4 sec/M3	3.1.3.3.2

*PPE has no implication for site selection.

- (1) Included in an overall site size criterion.
- (2) Bounded by PPE for normal plant heat sink.
- (3) Compliance with X/Q and source term PPEs should be adequate to address these PPEs for siting purposes. More detailed calculations should be performed at Step 4B to confirm.
- (4) Open item - Refer to latest URD for resolution of this PPE.

TABLE D-1
PLANT PARAMETERS ENVELOPES SITING SUMMARY (cont.)

Structure, System, Component/Primary Parameter/ Secondary Parameter		Composite Plant (Value)	Siting Consideration (Siting Guide Section No.)
9.2	Atmospheric Dispersion (CHI/Q) (Annual Average)	0.5 mi 7.2E-5/1 Mi 1.5E-5 sec/M3	3.1.3.3.2
9.3	Containment Leakage Rate	0.5% day (+35 SCFH/MS Line BWR Only)	*
9.5	Dose Consequences		
9.5.1	Normal	10 CFR 20, 10 CFR 50 APP I	(3)
9.5.2	Post-Accident	10 CFR 20, 50 APP I, 100	(3)
9.5.3	Severe Accidents	25 REM WB in 24 hr @ 0.5 mi <1E-6/RX-yr	(3)
9.6	Release Point		
9.6.1	Configuration (Horiz vs Vert)	Vertical	*
9.6.3	Elevation (Normal)	249'-4"	*
9.6.4	Elevation (Post-Accident)	Ground Level	*
9.6.6	Minimum Distance to Site Boundary	0.5 mi Exclusion Area	(1)
9.6.7	Temperature	120 F (max)	*
9.6.8	Volumetric Flow Rate	323,750 SCFM	*
9.7	Source Term		
9.7.1	Gaseous (Normal)	200 CI/yr (PWR), 2000 CI/yr (BWR)	*
9.7.2	Gaseous (Post-Accident)	See Chapter 15 Tables - Reg Guide 1.70	*
9.7.4	Tritium	1200 CI/yr	*

*PPE has no implication for site selection.

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- (2) Bounded by PPE for normal plant heat sink.
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- (4) Open item - Refer to latest URD for resolution of this PPE.

TABLE D-1
PLANT PARAMETERS ENVELOPES SITING SUMMARY (cont.)

Structure, System, Component/Primary Parameter/ Secondary Parameter		Composite Plant (Value)	Siting Consideration (Siting Guide Section No.)
10.	<u>Liquid Radwaste System</u>		
10.1	Dose Consequences		
10.1.1	Normal	10 CFR 50 APP I, 10 CFR 20	3.1.3.1
10.1.2	Post-Accident	10 CFR 20, 10 CFR 100	3.1.3.1
10.2	Release Point		
10.2.1	Flow Rate	100 gpm +10,000 gpm Dilution	(2)
10.3	Source Term		
10.3.1	Liquid	0.05 CI/yr	*
10.3.2	Tritium	690 CI/yr	*
12.	<u>Solid Radwaste System</u>		
12.1	Acreage		
12.1.1	Low Level Radwaste Storage	6 mo + 1 vehicle + 25%	(1) None
12.2	Solid Radwaste		
12.2.1	Activity	2700 CI/yr	*
12.2.2	Principal Radionuclides	See Table for Nuclides	*
12.2.3	Volume	1750 (PWR)/3500 (BWR) cu ft/yr DEWTRD	*

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(2) Bounded by PPE for normal plant heat sink.

(3) Compliance with X/Q and source term PPEs should be adequate to address these PPEs for siting purposes. More detailed calculations should be performed at Step 4B to confirm.

(4) Open item - Refer to latest URD for resolution of this PPE.

TABLE D-1
PLANT PARAMETERS ENVELOPES SITING SUMMARY (cont.)

Structure, System, Component/Primary Parameter/ Secondary Parameter		Composite Plant (Value)	Siting Consideration (Siting Guide Section No.)
18.	<u>Spent Fuel Storage</u>		
18.3	Spent Fuel Dry Storage		
18.3.1	Acreage	15 acres	(1)
18.3.2	Minimum Distance to Nearest Residence	3500 ft	(1)
18.3.3	Minimum Distance to Power Block	1500-2200 ft	(1)
18.3.4	Storage Capacity	60 yrs Dry Storage	(1)
21.	<u>Auxiliary Boiler System</u>		
21.1	Exhaust Elevation	150 ft above Plant Grade	*
21.2	Flue Gas Effluents	See Table D-1.2	*
21.3	Fuel		
21.3.2	Type	No. 2	*
21.4	Heat Input Rate (Btu/hr)	200,000,000 Btu/hr	*
24.	<u>Heating, Ventilation and Air Conditioning System</u>		
24.1	Ambient Air Requirements		
24.1.2	Non-Safety NVAC Max Ambient Temp (1% Exceed)	100 F DB/ 77 F WB Coincident	(2)
24.1.3	Non-Safety HVAC Min Ambient Temp (1% Exceed)	-10 F	(2)

*PPE has no implication for site selection.

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(2) Bounded by PPE for normal plant heat sink.

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(4) Open item - Refer to latest URD for resolution of this PPE.

TABLE D-1
PLANT PARAMETERS ENVELOPES SITING SUMMARY (cont.)

Structure, System, Component/Primary Parameter/ Secondary Parameter		Composite Plant (Value)	Siting Consideration (Siting Guide Section No.)
24.1.4	Safety HVAC Max Ambient Temp (0% Exceed)	115 F DB/80 FWB Coincident	(2)
24.1.5	Safety HVAC Min Ambient Temp (0% Exceed)	-40 F	(2)
24.1.6	Vent System Ambient Temp (5% Exceed)	5% Exceedance	*
24.1.7	Vent System Min Ambient Temp (5% Exceed)	5% Exceedance	*
25.	<u>Onsite/Offsite Electrical Power System</u>		
25.1	Acreage		
25.1.1	Switchyard	12 acres	(1)
25.3	Duty Cycles	35 peak-to-peak per day	*
26.	<u>Standby Power System</u>		
26.1	Diesel Capacity (kw)	3 x 5000 kw	*
26.2	Diesel Exhaust Elevation	50 ft	*
26.3	Diesel Flue Gas Effluents	See Tables D-1.3 and D-1.4	*
26.4	Diesel Fuel		*
26.4.1	Resupply Time	7 days	*
26.4.2	Type	2D per ASTM D975	*

*PPE has no implication for site selection.

(1) Included in an overall site size criterion.

(2) Bounded by PPE for normal plant heat sink.

(3) Compliance with X/Q and source term PPEs should be adequate to address these PPEs for siting purposes. More detailed calculations should be performed at Step 4B to confirm.

(4) Open item - Refer to latest URD for resolution of this PPE.

TABLE D-1
PLANT PARAMETERS ENVELOPES SITING SUMMARY (cont.)

Structure, System, Component/Primary Parameter/ Secondary Parameter		Composite Plant (Value)	Siting Consideration (Siting Guide Section No.)
26.5	Diesel Noise	55 DBA at 1000 ft	*
26.6	Gas-Turbine Capacity (kw)	13,000 kw	*
26.7	Gas-Turbine Exhaust Elevation	100 ft	*
26.8	Gas-Turbine Flue Gas Effluents	See Table D-1.5	*
26.9	Gas-Turbine Fuel	Distillate	*
26.9.2	Type		
2.6.10	Gas-Turbine Noise	55 DBA at 1000 ft	*
28.	<u>Plant Characteristics</u>		
28.1	Access Routes	7 acres	3.4.2.1-3
28.1.3	Heavy Haul Routes		
28.1.5	Spent Fuel Cask Weight		
28.2	Acreage	1.09 acre (47,600 sq ft) Approx 20 acres Approx 4.2 acres Approx 5 acres Approx 75 acres	(1) (1) (1) (1) (1)
28.2.1	Office Facilities		
28.2.2	Parking Lots		
28.2.3	Permanent Support Facilities		
28.2.4	Power Block		
28.2.5	Protected Area		

*PPE has no implication for site selection.

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- (2) Bounded by PPE for normal plant heat sink.
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- (4) Open item - Refer to latest URD for resolution of this PPE.

TABLE D-1
PLANT PARAMETERS ENVELOPES SITING SUMMARY (cont.)

Structure, System, Component/Primary Parameter/ Secondary Parameter		Composite Plant (Value)	Siting Consideration (Siting Guide Section No.)
28.4	Megawatts - Thermal	3926 MWT	*
28.5	Plant Design Life	60 years	*
28.6	Plant Population		
	28.6.1 Operation	795 people	*
	28.6.2 Refueling	1000 people	*
28.9	Station Capacity Factor	87%	*
29.	<u>Construction</u>		
29.1	Access Routes		3.4.2.1-3
	29.1.1 Construction Module Dimensions	22(H)x21(W)x67(L)	
	29.1.2 Heaviest Construction Shipment	1,546,000 lbs	3.4.2.1-3
29.2	Acreage		
	29.2.1 Laydown Area	29 acres	(1)
	29.2.2 Temporary Construction Facilities	52 acres	(1)
29.3	Construction		
	29.3.5 Noise	76-101 DB @ 50 ft	*
29.4	Plant Population		
	29.4.1 Construction	2600-6410 people	33.1
29.6	Site Preparation Duration	18 months	*

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- (4) Open item - Refer to latest URD for resolution of this PPE.

TABLE D-1.1
BLOWDOWN CONSTITUENTS AND CONCENTRATIONS

Constituent	River Source	Concentration	
		Well/Treated Water	Envelope
chlorine demand	10.1	-	10.1
free available chlorine	.5	-	.5
chromium	-	-6	-
copper	-	3.5	6
iron	.9	.6	3.5
zinc	-	7.2	.6
phosphate	-	3,400	7.2
sulfate	599	-	3,500
oil and grease	-	17,000	-
total dissolved solids	-	150	-(1)
total suspended solids	49.5		150
BOD, 5-day	-		-

(1) Assumed cycles of concentration equals 4.

**TABLE D-1.2
YEARLY EMISSIONS AUXILIARY BOILERS**

Pollutant Discharged	ABWR/ SBWR	System 80+	AP600
Particulates	9,900	8,600	1,150
Sulfur oxides	29,600	26,000	3,450
Carbon monoxide	-	-	-
Hydrocarbons	-28,600	-	-3,340
Nitrogen oxides		25,000	

NOTES:

1. Emissions are based on 4 hrs/month operation for each of the generators.

**TABLE D-1.3
YEARLY EMISSIONS FROM TWO 7000 KW STANDBY DIESEL
GENERATORS**

Pollutant Discharged	Quantity (LB)
Particulates	700
Sulfur Oxides	3,400
Carbon Monoxide	10
Hydrocarbons	140
Nitrogen oxides	2,800

NOTES:

1. Emissions are based on 4 hrs/month operation for each of the generators.

TABLE D-1.4
YEARLY EMISSIONS FROM TWO 3500 KW STANDBY DIESEL
GENERATORS

Pollutant Discharged	Quantity (LB)
Particulates	350
Sulfur Oxides	1,700
Carbon Monoxide	5
Hydrocarbons	70
Nitrogen oxides	1,400

NOTES:

1. Emissions are based on 4 hrs/month operation for each of the generators.

TABLE D-1.5
STANDBY POWER SYSTEM
GAS TURBINE FLUE GAS EFFLUENTS (26.8)

FUEL: Distillate 20F Ambient 9,890 BTU/KWH (LHV)
 10,480 BTU/KWH (HHV)
 96,960 LB/HR Fuel Consumption Rate

Effluent

NO _x (PPMVD @ 15% O ₂)	77
NO _x as NO ₂ (LB/HR)	583
CO (PPMVD)	20
CO (LB/HR)	67
UHC (PPMVD)	7
UHC (LB/HR)	15
VOC (PPMVD)	3.5
VOC (LB/HR)	7.5
SO ₂ (PPMVD)	44
SO ₂ (LB/HR)	370
SO ₃ (PPMVD)	3
SO ₃ (LB/HR)	24
SULFUR MIST (LB/HR)	39
PARTICULATES (LB/HR)	17

EXHAUST ANALYSIS % VOL

ARGON	0.86
NITROGEN	72.56
OXYGEN	11.2
CARBON DIOXIDE	5.19
WATER	9.87

NOTES:

1. Emissions are based on 4 hrs/month operation for each of the generators.

TABLE D-2
PLANT PARAMETERS ENVELOPES (cont.)

Structure, System, Component/Primary Parameter/ Secondary Parameter		Parameter Type	EVOLUTIONARY Plant (Value/Refer/Rev)	PASSIVE PLANT (Value/Refer/Rev)	Siting Consideration (Siting Guide Section No.)
1.	<u>Structures</u>				
1.1	Foundation Embedment	P	66'4" to top of Basemat	53'10" to top of Basemat	*
1.2	Height	P	174 ft	207'-3"	*
1.4	Precipitation (for Roof Design)				
1.4.1	Maximum Rainfall Rate	P	19.4 in/hr - 6.2 in/5 min	19.4 in/hr - 6.2 in/5 min	3.1.1.5.2
1.4.2	Snow Load	P	50 lb/sq ft	50 lb/sq ft	3.1.1.5.2
1.5	Safe Shutdown Earthquake (SSE)				
1.5.1	Design Response Spectra	P	Regulatory Guide 1.60	Regulatory Guide 1.60	3.1.1.1
1.5.2	Peak Ground Acceleration	P	0.30 g	0.30 g	3.1.1.1.1
1.5.3	Time History	P	Envelope SSE Resp Spectra	Envelope SSE Resp Spectra	3.1.1.1
1.8	Site Water Level (Allowable)				
1.8.1	Maximum Flood (or Tsunami)	P	1 ft below plant grade	1 ft below plant grade	3.1.1.3
1.8.2	Maximum Ground Water	P	2 ft below plant grade	2 ft below plant grade	3.2.2.2.1
1.9	Soil Properties Design Bases				
1.9.1	Liquefaction	P	None at Site-Specific SSE	None at Site-Specific SSE	3.1.1.1.4
1.9.2	Minimum Bearing Capacity (Static)	P	>= 15 ksf	>= 15 ksf	3.1.1.1.4
1.9.3	Minimum Shear Wave Velocity	P	>= 1000 fps	>= 1000 fps	3.1.1.1.4

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- (2) Bounded by PPE for normal plant heat sink.
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- (4) Open item - Refer to latest URD for resolution of this PPE.

TABLE D-2
PLANT PARAMETERS ENVELOPES (cont.)

Structure, System, Component/Primary Parameter/ Secondary Parameter			Parameter Type	EVOLUTIONARY Plant (Value/Refer/Rev)	PASSIVE PLANT (Value/Refer/Rev)	Siting Consideration (Siting Guide Section No.)	
1.11	Tornado (Design Bases)						
	1.11.1	Maximum Pressure Drop	P	2.0 psi	1.46 psi	3.1.1.5	
	1.11.2	Maximum Rotational Speed	P	240 mph	240 mph	3.1.1.5	
	1.11.3	Maximum Translational Speed	P	60 mph	57 mph	3.1.1.5	
	1.11.4	Maximum Wind Speed	P	300 mph	260 mph	3.1.1.5	
	1.11.5	Missile Spectra	P	Spectrum A of SRP 3.5.1.4	Spectrum I of SRP 3.5.1.4	3.1.1.5	
*	1.11.6	Radius of Maximum Rotational Speed	P	150 ft	453 ft	3.1.1.5	
	1.11.7	Rate of Pressure Drop	P	1.2 psi/sec	0.27 psi/sec	3.1.1.5	
1.12	Wind						
	1.12.1	Basic Wind Speed	P	110 mph	110 mph	3.1.1.5.1	
	1.12.2	Importance Factors	P	1.0 (nsr)/1.11 (sr)	1.0 (nsr)/1.11 (sr)	3.1.1.5.1	
2.	<u>Normal Plant Heat Sink</u>						
	2.1	Ambient Air Requirements					
		2.1.1	Normal Shutdown Max Ambient Temp (1% Exceed)	P	100 f db/77 f wb coincident	100 f db/77 f wb coincident	3.1.1.2.2
		2.1.2	Normal Shutdown Max Wet Bulb Temp (1% Exceed)	P	80 f wb non-coincident	80 f wb non-coincident	3.1.1.2.2

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- (4) Open item - Refer to latest URD for resolution of this PPE.

TABLE D-2
PLANT PARAMETERS ENVELOPES (cont.)

Structure, System, Component/Primary Parameter/ Secondary Parameter		Parameter Type	EVOLUTIONARY Plant (Value/Refer/Rev)	PASSIVE PLANT (Value/Refer/Rev)	Siting Consideration (Siting Guide Section No.)
2.1.3	Normal Shutdown Min Ambient Temp (1% Exceed)	P	-10 F	-10 F	3.1.1.2.2
2.1.5	Rx Thermal Power Max Ambient Temp (0% Exceed)	P	115 f db/80 f wb coincident	115 f db/80 f wb coincident	3.1.1.2.2
2.1.6	Rx Thermal Power Max Wet Bulb Temp (0% Exceed)	P	81 f wb non-coincident	81 f wb non-coincident	3.1.1.2.2
2.1.7	Rx Thermal Power Min Ambient Temp (0% Exceed)	P	-40 F	-40 F	3.1.1.2.2
2.2	Blowdown Pond Acreage	P/S	24 hr blowdown	24 hr blowdown	(1)
2.3	Condenser/Heat Exchanger Duty	P	9.7 E9 btu/hr	4.56 E9 btu/hr	*
2.6	Maximum Inlet Temp Condenser/Heat Exchanger	P	100 F	91 F	*
2.7	Mech Draft Cooling Towers				
2.7.1	Acreage	P/S	50 acres	25 acres	(1)
2.7.3	Approach Temperature	P/S	10 F	10 F	3.1.1.2.2
2.7.4	Blowdown Constituents and Concentrations	P/S	See Table D-1.1	See Table D-1.1	3.2.3.1
2.7.5	Blowdown Flow Rate	P/S	5,200 (17,700) gpm	2,500 (8,500) gpm	3.2.3.1

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- (2) Bounded by PPE for normal plant heat sink.
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- (4) Open item - Refer to latest URD for resolution of this PPE.

**TABLE D-2
PLANT PARAMETERS ENVELOPES (cont.)**

Structure, System, Component/Primary Parameter/ Secondary Parameter			Parameter Type	EVOLUTIONARY Plant (Value/Refer/Rev)	PASSIVE PLANT (Value/Refer/Rev)	Siting Consideration (Siting Guide Section No.)
2.7	2.7.6	Blowdown Temperature	P/S	100 F	95 F	3.2.3.1
	2.7.7	Cooling Tower Temperature Range	P/S	Cond Temp Rise 29F	23 F	*
	2.7.8	Cooling Water Flow Rate	P/S	696,000 gpm	446,000 gpm	*
	2.7.9	Cycles of Concentration	P/S	4 (2 minimum)	4 (2 minimum)	3.2.3.1
	2.7.10	Evaporation Rate	P/S	15,400 (17,700) gpm	7,400 (8,500) gpm	*
	2.7.12	Heat Rejection Rate	P/S	26 E6 btu/hr	12.5 E6 btu/hr	*
	2.7.13	Height	P/S	60 ft	60 ft	*
	2.7.15	Makeup Flow Rate	P/S	20,600 (35,400) gpm	9,900 (17,000) gpm	3.1.1.2.1
	2.7.16	Maximum Consumption of Raw Water	P/S	17,700 gpm	8,500 gpm	3.1.1.2.1
	2.7.17	Monthly Average Consumption of Raw Water	P/S	15,400 gpm	7,400 gpm	3.1.1.2.1
	2.7.18	Noise	P/S	55 dba at 1000 ft	55 dba at 1000 ft	*
	2.7.22	Stored Water Volume	P/S	10,500,000 gal	7,000,000 gal	(1)
	2.8	Natural Draft Cooling Towers				
2.8.1	Acreage	P/S	6 acres	2.3 acres without basin	(1)	

*PPE has no implication for site selection.

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- (2) Bounded by PPE for normal plant heat sink.
- (3) Compliance with X/Q and source term PPEs should be adequate to address these PPEs for siting purposes. More detailed calculations should be performed at Step 4B to confirm.
- (4) Open item - Refer to latest URD for resolution of this PPE.

TABLE D-2
PLANT PARAMETERS ENVELOPES (cont.)

Structure, System, Component/Primary Parameter/ Secondary Parameter			Parameter Type	EVOLUTIONARY Plant (Value/Refer/Rev)	PASSIVE PLANT (Value/Refer/Rev)	Siting Consideration (Siting Guide Section No.)
	2.8.2	Approach Temperature	P/S	10 F	10 F	3.1.1.2.1
	2.8.3	Blowdown Constituents and Concentrations	P/S	See Table D-1.1	See Table D-1.1	3.2.3.1
*	2.8.4	Blowdown Flow Rate	P/S	5,200 (17,700) gpm	3,500 (8,500) gpm	3.2.3.1
	2.8.5	Blowdown Temperature	P/S	100 F	91 F	3.2.3.1
	2.8.6	Cooling Tower Temperature Range	P/S	Condenser Temp Rise 29 F	23 F	*
	2.8.7	Cooling Water Flow Rate	P/S	696,000 gpm	466,000 gpm	*
	2.8.8	Cycles of Concentration	P/S	4 (2 minimum)	4 (2 minimum)	3.2.3.1
	2.8.9	Evaporation Rate	P/S	15,400 (17,700) gpm	2.6% of cw flow (10,036 gpm)	*
	2.8.11	Heat Rejection Rate	P/S	26 E6 btu/hr	12.5 E6 btu/hr	*
	2.8.12	Height	P/S	550 ft	500 ft	*
	2.8.14	Makeup Flow Rate	P/S	20,600 (35,400) gpm	10,900 (18,536) gpm	3.1.1.2.1
	2.8.15	Maximum Consumption of Raw Water	P/S	17,700 gpm	10,660 gpm	3.1.1.2.1
	2.8.16	Monthly Average Consumption of Raw Water	P/S	15,400 gpm	7,400 gpm	3.1.1.2.1

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- (4) Open item - Refer to latest URD for resolution of this PPE.

TABLE D-2
PLANT PARAMETERS ENVELOPES (cont.)

Structure, System, Component/Primary Parameter/ Secondary Parameter			Parameter Type	EVOLUTIONARY Plant (Value/Refer/Rev)	PASSIVE PLANT (Value/Refer/Rev)	Siting Consideration (Siting Guide Section No.)
	2.8.17	Noise	P/S	55 dba at 1000 ft	55 dba at 1000 ft	*
	2.8.20	Stored Water Volume	P/S	10,500,000 gal	7,000,000 gal	(1)
2.9	Once-Through Cooling					
	2.9.1	Cooling Water Discharge Temperature	P/S	118 F	118 F	3.2.3.1
	2.9.2	Cooling Water Flow Rate	P/S	1,100,000 gpm	515,000 gpm	3.1.1.2.1
	2.9.3	Cooling Water Temperature Rise	P/S	18 F	18 F	3.2.3.2
	2.9.4	Evaporation Rate	P/S	9,300 (10,700) gpm	4,400 (5,000) gpm	*
	2.9.5	Heat Rejection Rate	P/S	9.7 E9 btu/hr	4.63 E9 btu/hr	3.2.3.1
2.10	Ponds					
	2.10.1	Acreage	P/S	3000 acres w/o spray	1300 acres w/o spray	(1)
	2.10.2	Blowdown Constituents and Concentrations	P/S	See Table D-1.1	See Table D-1.1	3.2.3.1
	2.10.3	Blowdown Flow Rate	P/S	5,200 (17,700) gpm	2,500 (8,500) gpm	3.2.3.1
	2.10.4	Blowdown Temperature	P/S	100 F	95 F	3.2.3.1
	2.10.5	Cooling Pond Temperature Range	P/S	Cond Temp Rise 29 F	23 F	*
	2.10.6	Cooling Water Flow Rate	P/S	696,000 gpm	466,000 gpm	*

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- (2) Bounded by PPE for normal plant heat sink.
- (3) Compliance with X/Q and source term PPEs should be adequate to address these PPEs for siting purposes. More detailed calculations should be performed at Step 4B to confirm.
- (4) Open item - Refer to latest URD for resolution of this PPE.

TABLE D-2
PLANT PARAMETERS ENVELOPES (cont.)

Structure, System, Component/Primary Parameter/ Secondary Parameter		Parameter Type	EVOLUTIONARY Plant (Value/Refer/Rev)	PASSIVE PLANT (Value/Refer/Rev)	Siting Consideration (Siting Guide Section No.)
2.10.7	Cycles of Concentration	P/S	4 (2 minimum)	4 (2 minimum)	3.2.3.1
2.10.8	Evaporation Rate	P/S	15,400 (17,700) gpm	7,400 (8,500) gpm	*
2.10.9	Heat Rejection Rate	P/S	26 E6 btu/hr	12.5 E6 btu/hr	*
2.10.10	Makeup Flow Rate	P/S	20,600 (35,400) gpm	9,900 (17,000) gpm	3.1.1.2.1
2.10.11	Maximum Consumption of Raw Water	P/S	17,700 gpm (12,400 w/o spray)	8,500 gpm (6,000 w/o spray)	3.1.1.2.1
2.10.12	Monthly Average Consumption of Raw Water	P/S	15,400 gpm (10,800 w/o spray)	7,400 gpm (5,300 w/o spray)	3.1.1.2
2.10.13	Stored Water Volume	P/S	14.7 E9 gallons	6.4 E9 gallons	3.1.1.2
3.	<u>Ultimate Heat Sink</u>				
3.1	Ambient Air Requirements				
3.1.1	Maximum Ambient Temperature (0% Exceedance)	P	115 F db/80 f wb coincident	---	(2)
3.1.2	Maximum Wet Bulb Temperature (0% Exceedance)	P	81 F wb (non-coincident)	---	(2)
3.1.3	Minimum Ambient Temperature (0% Exceedance)	P	-40 F	---	(2)
3.2	CCW Heat Exchanger Duty	P	104 (374 S/D) E6 btu/hr	---	(2)

*PPE has no implication for site selection.

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- (4) Open item - Refer to latest URD for resolution of this PPE.

TABLE D-2
PLANT PARAMETERS ENVELOPES (cont.)

Structure, System, Component/Primary Parameter/ Secondary Parameter		Parameter Type	EVOLUTIONARY Plant (Value/Refer/Rev)	PASSIVE PLANT (Value/Refer/Rev)	Siting Consideration (Siting Guide Section No.)
3.5	Maximum Inlet Temp to CCW Heat Exchanger	P	95 F	---	3.1.1.2.1
3.6	Mech Draft Cooling Towers	P/S	0.5 acre	---	(1)
3.6.1	Acreage				
3.6.3	Approach Temperature	P/S	10 F	---	(2)
3.6.4	Blowdown Constituents and Concentrations	P/S	See Table D-1.1	---	(2)
3.6.5	Blowdown Flow Rate	P/S	100 (700) gpm	---	(2)
3.6.6	Blowdown Temperature	P/S	95 F	---	(2)
3.6.7	Cooling Tower Temperature Range	P/S	25 F	---	*
*	3.6.8 Cooling Water Flow Rate	P/S	28,150 gpm (shutdown)	---	*
	3.6.9 Cycles of Concentration	P/S	4 (2 minimum)	---	(2)
	3.6.10 Evaporation Rate	P/S	250 (700) gpm	---	(2)
	3.6.12 Heat Rejection Rate	P/S	0.5 E6 btu/hr	---	(2)
	3.6.13 Height	P/S	60 ft	---	*
	3.6.15 Makeup Flow Rate	P/S	350 (1,400) gpm	---	(2)

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(4) Open item - Refer to latest URD for resolution of this PPE.

TABLE D-2
PLANT PARAMETERS ENVELOPES (cont.)

Structure, System, Component/Primary Parameter/ Secondary Parameter			Parameter Type	EVOLUTIONARY Plant (Value/Refer/Rev)	PASSIVE PLANT (Value/Refer/Rev)	Siting Consideration (Siting Guide Section No.)
3.7	3.6.16	Maximum Consumption of Raw Water	P/S	700 gpm	---	(2)
	3.6.17	Monthly Average Consumption of Raw Water	P/S	250 gpm	---	*
	3.6.18	Noise	P/S	55 dba at 1000 ft	---	*
	3.6.22	Stored Water Volume	P/S	30.6 E5 gal	---	(1)
	Once-Through Cooling					
	3.7.1	Cooling Water Discharge Temperature	P/S	120 F	---	3.2.3.1
	3.7.2	Cooling Water Flow Rate	P/S	28,150 gpm	---	(2)
	3.7.3	Cooling Water Temperature Rise	P/S	25 F	---	3.2.3.1
	3.7.4	Evaporation Rate	P/S	150 (400) gpm	---	(2) None
	3.7.5	Heat Rejection Rate	P/S	104 (374 S/D) E6 btu/hr	---	(2) None
*	3.7.6	Minimum Essential Flow Rate	P	14,500 gpm	---	(2) None
3.8	Ponds					
	3.8.1	Acreage	P/S	60 acres (no spray)	---	(1)
	3.8.2	Blowdown Constituents and Concentrations	P/S	See Table D-1.1	---	(2)

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TABLE D-2
PLANT PARAMETERS ENVELOPES (cont.)

Structure, System, Component/Primary Parameter/ Secondary Parameter		Parameter Type	EVOLUTIONARY PLANT (Value/Refer/Rev)	PASSIVE PLANT (Value/Refer/Rev)	Siting Consideration (Siting Guide Section No.)	
*	3.8.3	Blowdown Flow Rate	P/S	100 (700) gpm	---	(2)
	3.8.4	Blowdown Temperature	P/S	95 F	---	(2)
	3.8.5	Cooling Pond Temperature Range	P/S	25 F	---	*
	3.8.6	Cooling Water Flow Rate	P/S	28,150 gpm (shutdown)	---	*
	3.8.7	Cycles of Concentration	P/S	4 (2 minimum)	---	(2)
	3.8.8	Evaporation Rate	P/S	250 (700) gpm	---	(2)
	3.8.9	Heat Rejection Rate	P/S	.5E6 btu/hr (.3E6 w/o spray)	---	(2)
	3.8.10	Makeup Flow Rate	P/S	350 (1,400) gpm	---	(2)
	3.8.11	Maximum Consumption of Raw Water	P/S	700 gpm (500 w/o spray)	---	(2)
	3.8.12	Monthly Average Consumption of Raw Water	P/S	250 gpm (150 w/o spray)	---	(2)
	3.8.13	Stored Water Volume	P/S	196,000,000 gallons	---	*
	4.	<u>Containment Heat Removal System (Post-Accident)</u>				
	4.1	Ambient Air Requirements				
4.1.1	Maximum Ambient Air Temperature (0% Exceedance)	P	---	115 F db/80 F wb	(2)	

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- (4) Open item - Refer to latest URD for resolution of this PPE.

TABLE D-2
PLANT PARAMETERS ENVELOPES (cont.)

Structure, System, Component/Primary Parameter/ Secondary Parameter		Parameter Type	EVOLUTIONARY Plant (Value/Refer/Rev)	PASSIVE PLANT (Value/Refer/Rev)	Siting Consideration (Siting Guide Section No.)
4.1.2	Minimum Ambient Temperature (0% Exceedance)	P	---	-40 F	(2)
5.	<u>Potable Water/Sanitary Waste System</u>				
5.2	Discharge to Site Water Bodies				
5.2.1	Flow Rate	P/S	20 (24) gpm	35 (70) gpm	(2)
5.4	Raw Water Requirements				
* 5.4.1	Maximum Use	P/S	24 gpm	100,000 gpd (70 gpm)	(2)
* 5.4.2	Monthly Average Use	P/S	20 gpm	1,500,000 gal/month-35 gpm	(2)
6.	<u>Demineralized Water System</u>				
6.2	Discharge to Site Water Bodies	P/S	50 (135) gpm	25 (70) gpm	(2) None
* 6.2.1	Flow Rate				
6.4	Raw Water Requirements				
6.4.1	Maximum Use	P/S	400 gpm	200 gpm	(2) none
6.4.2	Monthly Average Use	P/S	150 gpm	75 gpm	(2)
7.	<u>Fire Protection System</u>				
7.1	Raw Water Requirements				
7.1.1	Maximum Use	P	625 gpm	625 gpm	(2)
7.1.2	Monthly Average Use	P/S	0 gpm	225,000 gal/mo (5gpm)	(2)
7.1.4	Stored Water Volume	P	600,000 gallons (tank storage)	775,000 gallons	(2)

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(4) Open item - Refer to latest URD for resolution of this PPE.

TABLE D-2
PLANT PARAMETERS ENVELOPES (cont.)

Structure, System, Component/Primary Parameter/ Secondary Parameter		Parameter Type	EVOLUTIONARY Plant (Value/Refer/Rev)	PASSIVE PLANT (Value/Refer/Rev)	Siting Consideration (Siting Guide Section No.)
8.	<u>Miscellaneous Drain</u>				
8.2	Discharge to Site Water Bodies				
*	8.2.1 Flow Rate	P/S	25 (50) gpm	25 (50) gpm	(2)
9.	<u>Unit Vent/Airborne Effluent Release Point</u>				
9.1	Atmospheric Dispersion (CHI/Q) (Accident)				
9.1.1	0.5 mi - 0-2 hr	P	1.0E-3 sec/m3	1.0E-3 sec/m3	3.1.3.3.2
9.1.2	2 mi - 0-8 hr	P	1.35E-4 sec/m3	1.35E-4 sec/m3	3.1.3.3.2
9.1.3	2 mi - 1-4 day	P	5.4E-5 sec/m3	5.4E-5 sec/m3	3.1.3.3.2
9.1.4	2 mi - 4-30 day	P	2.2E-5 sec/m3	2.2E-5 sec/m3	3.1.3.3.2
9.1.5	2 mi - 8-24 hr	P	1.0E-4 sec/m3	1.0E-4 sec/m3	3.1.3.3.2
9.2	Atmospheric Dispersion (CHI/Q) (Annual Average)	P	0.5 mi 7.2E-5/1 mi 1.5E-5 sec/m3	2E-5 sec/m3	3.1.3.3.2
9.3	Containment Leakage Rate	P	0.5%/day (+35scfh/ms line bwr only)	0.5%/day (+35scfh/ms line bwr only)	*
9.5	Dose Consequences				
9.5.1	Normal	P	10CFR20, 10CFR50 APP I	10CFR20, 10CFR50 APP I	(3)
9.5.2	Post-Accident	P	10CFR -20,-50 APP I, -100	10CFR -20, -50 APP I, -100	(3)

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- (4) Open item - Refer to latest URD for resolution of this PPE.

TABLE D-2
PLANT PARAMETERS ENVELOPES (cont.)

Structure, System, Component/Primary Parameter/ Secondary Parameter		Parameter Type	EVOLUTIONARY Plant (Value/Refer/Rev)	PASSIVE PLANT (Value/Refer/Rev)	Siting Consideration (Siting Guide Section No.)
9.5.3	Severe Accidents	P	25 rem wb in 24 hr @ 0.5 mi <1E-6/rx-yr	25 rem wb in 24 hr @ 0.5 mi <1E-6/rx-yr	(3)
9.6	Release Point				
9.6.1	Configuration (Horiz vs Vert)	P	Vertical	Vertical	*
9.6.3	Elevation (Normal)	P	249'-4"	187'-2" (22M above Rx bldg)	*
9.6.4	Elevation (Post Accident)	P	Ground Level	Ground Level	*
9.6.6	Minimum Distance to Site Boundary	P	0.5 mi exclusion area	0.5 mi exclusion area	(1)
9.6.7	Temperature	P	120 F (max)	50-100 F (estimate)	*
9.6.8	Volumetric Flow Rate	P	323,750 SCFM	171, 500 SCFM (Norm)	*
9.7	Source Term				
9.7.1	Gaseous (Normal)	P	200 ci/yr (pwr), 2000 ci/yr (bwr)	200 ci/yr (pwr), 2000 ci/yr (bwr)	*
9.7.2	Gaseous (Post-Accident)	P	See Chap 15 Tables - Reg Guide 1.70	See Chap 15 Tables - Reg Guide 1.70	*
*	9.7.4 Tritium	P	1200 ci/yr	77 ci/yr	*
10.	<u>Liquid Radwaste System</u>				
10.1	Dose Consequences				
10.1.1	Normal	P	10CFR50 APP I, 10CFR20	10CFR50 APP I, 10CFR20	3.1.3.1
10.1.2	Post-Accident	P	10CFR20, 10CFR100	10CFR20, 10CFR100	3.1.3.1

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(4) Open item - Refer to latest URD for resolution of this PPE.

TABLE D-2
PLANT PARAMETERS ENVELOPES (cont.)

Structure, System, Component/Primary Parameter/ Secondary Parameter			Parameter Type	EVOLUTIONARY Plant (Value/Refer/Rev)	PASSIVE PLANT (Value/Refer/Rev)	Siting Consideration (Siting Guide Section No.)
10.2	Release Point					
*	10.2.1	Flow Rate	P	100 gpm+10,000 gpm dilution	100 gpm+10,000 gpm dilution	(2)
10.3	Source Term					
	10.3.1	Liquid	P	0.05 ci/yr	0.05 ci/yr	*
	10.3.2	Tritium	P	360 ci/yr	690 ci/yr	*
11.	<u>Gaseous Radwaste System</u>					
12.	<u>Solid Radwaste System</u>					
	12.1	Acreage				
	12.1.1	Low Level Radwaste Storage	P	6 mo + 1 vehicle + 25%	6 mo + 1 vehicle + 25%	(1) None
	12.2	Solid Radwaste				
	12.2.1	Activity	P	2700 ci/yr	2700 ci/yr	*
	12.2.2	Principal Radionuclides	P	See Table for Nuclides	See Table for Nuclides	*
	12.2.3	Volume	P	1750 (pwr)/3500(bwr)cuft/yr	1750 (pwr)/3500(bwr)cuft/yr dewtrd	*
13.	<u>Reactor Coolant System</u>					
14.	<u>RCS Cleanup System</u>					
15.	<u>CVCS Letdown Subsystem</u>					
16.	<u>CVCS Purification Subsystem</u>					

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TABLE D-2
PLANT PARAMETERS ENVELOPES (cont.)

Structure, System, Component/Primary Parameter/ Secondary Parameter		Parameter Type	EVOLUTIONARY Plant (Value/Refer/Rev)	PASSIVE PLANT (Value/Refer/Rev)	Siting Consideration (Siting Guide Section No.)
17.	<u>CVCS Shim/Bleed Subsystem</u>				
18.	<u>Spent Fuel Storage</u>				
18.3	Spent Fuel Dry Storage				
*	18.3.1 Acreage	P/S	15 acres	15 acres	(1)
	18.3.2 Minimum Distance to Nearest Residence	P/S	3500 ft	3500 ft	(1)
	18.3.3 Minimum Distance to Power Block	P/S	1500-2200 ft	1500-2200 ft	(1)
	18.3.4 Storage Capacity	P	60 yrs dry storage	60 yrs dry storage	(1)
19.	<u>Steam Generator Blowdown System</u>				
20.	<u>Standby-Gas Treatment System</u>				
21.	<u>Auxiliary Boiler System</u>				
21.1	Exhaust Elevation	P/S	150 ft above plant grade	150 ft above plant grade	*
21.2	Flue Gas Effluents	P/S	See Table D-1.2	See Table D-1.2	*
21.3	Fuel				
	21.3.2 Type	P/S	No. 2	No. 2	*
*	21.4 Heat Input Rate (btu/hr)	P/S	200,000,000 btu/hr	200,000,000 btu/hr	*
22.	<u>Condensate Cleanup System</u>				

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**TABLE D-2
PLANT PARAMETERS ENVELOPES (cont.)**

Structure, System, Component/Primary Parameter/ Secondary Parameter		Parameter Type	EVOLUTIONARY Plant (Value/Refer/Rev)	PASSIVE PLANT (Value/Refer/Rev)	Siting Consideration (Siting Guide Section No.)
23.	<u>Gas Storage System</u>				
24.	<u>Heating, Ventilation and Air Conditioning System</u>				
24.1	Ambient Air Requirements				
24.1.2	Non-safety hvac max ambient temp (1% Exceed)	P	100 f db/77 f wb coincident	100 f db/77 f wb coincident	(2)
24.1.3	Non-safety hvac min ambient temp (1% Exceed)	P	-10 F	-10 F	(2)
24.1.4	Safety hvac max ambient temp (0% Exceed)	P	115 f db/80 fwb coincident	115 f db/80 f wb coincident	(2)
24.1.5	Safety hvac min ambient temp (0% Exceed)	P	-40 F	-40 F	(2)
24.1.6	Vent System max ambient temp (5% Exceed)	P	5% Exceedance	5% Exceedance	*
24.1.7	Vent System min ambient temp (5% Exceed)	P	5% Exceedance	5% Exceedance	*
25.	<u>Onsite/Offsite Electrical Power System</u>				
25.1	Acreage				
25.1.1	Switchyard	P/S	12 acres	12 acres	(1)
25.3	Duty Cycles	P	35 peak-to-peak per day	35 peak-to-peak per day	*

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(4) Open item - Refer to latest URD for resolution of this PPE.

TABLE D-2
PLANT PARAMETERS ENVELOPES (cont.)

Structure, System, Component/Primary Parameter/ Secondary Parameter		Parameter Type	EVOLUTIONARY Plant (Value/Refer/Rev)	PASSIVE PLANT (Value/Refer/Rev)	Siting Consideration (Siting Guide Section No.)
26.	<u>Standby Power System</u>				
26.1	Diesel Capacity (kw)	P	3 x 5000 kw	2 x 4000 kw	*
26.2	Diesel Exhaust Elevation	P	50 ft	50 ft	*
26.3	Diesel Flue Gas Effluents	P/S	See Table D-1.3 and D-1.4	See Tables D-1.3 and D-1.4	*
26.4	Diesel Fuel				
26.4.1	Resupply Time	P	7 days	7 days	*
26.4.2	Type	P	2D per ASTM D975	Oil Per ASTM D 975	*
26.5	Diesel Noise	P/S	55 dba at 1000 ft	55 dba at 1000 ft	*
26.6	Gas-Turbine Capacity (kw)	P	13,000 kw	---	*
26.7	Gas-Turbine Exhaust Elevation	P/S	100 ft	100 ft	*
26.8	Gas-Turbine Flue Gas Effluents	P/S	See Table D-1.5	See Table D-1.5	*
26.9	Gas-Turbine Fuel	P/S	Distillate	---	*
26.9.2	Type				
26.10	Gas-Turbine Noise	P/S	55 dba at 1000 ft	---	*
27.	<u>Severe Accident Features</u>				

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- (4) Open item - Refer to latest URD for resolution of this PPE.

**TABLE D-2
PLANT PARAMETERS ENVELOPES (cont.)**

Structure, System, Component/Primary Parameter/ Secondary Parameter		Parameter Type	EVOLUTIONARY Plant (Value/Refer/Rev)	PASSIVE PLANT (Value/Refer/Rev)	Siting Consideration (Siting Guide Section No.)
28.	<u>Plant Characteristics</u>				
28.1	Access Routes				
	28.1.3 Heavy Haul Routes	P/S	7 acres	7 acres	3.4.2.1-3
	28.1.5 Spent Fuel Cask Weight	P	150 tons	150 tons	*
28.2	Acreage				
*	28.2.1 Office Facilities	P/S	1.09 acre (47,600 sq ft)	0.75 acre (32,670 sq ft)	(1)
*	28.2.2 Parking Lots	P/S	Approx 20 acres	2.28 acres	(1)
	28.2.3 Permanent Support Facilities	P/S	Approx 4.2 acres	2.81 acres	(1)
	28.2.4 Power Block	P/S	Approx 5 acres	3 acres	(1)
	28.2.5 Protected Area	P/S	Approx 75 acres	Approx 46 acres	(1)
28.4	Megawatts - Thermal	P	3926 mwt	2000 mwt	*
28.5	Plant Design Life	P	60 years	60 years	*
28.6	Plant Population				
	28.6.1 Operation	P/S	795 people	500 people	*
*	28.6.2 Refueling	P/S	875-955 People	1000 people	*
28.9	Station Capacity Factor	P	87%	87%	*

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- (4) Open item - Refer to latest URD for resolution of this PPE.

TABLE D-2
PLANT PARAMETERS ENVELOPES (cont.)

Structure, System, Component/Primary Parameter/ Secondary Parameter		Parameter Type	EVOLUTIONARY Plant (Value/Refer/Rev)	PASSIVE PLANT (Value/Refer/Rev)	Siting Consideration (Siting Guide Section No.)
29.	<u>Construction</u>				
29.1	Access Routes				
	29.1.1 Construction Module Dimensions	P/S	22(H)x21(W)x67(L)	15(H) x 15(W) x 69(L)	3.4.2.1-3
	29.1.2 Heaviest Construction Shipment	P/S	1,546,000 lbs	500 tons (RPV) (1,000,000 lbs)	3.4.2.1-3
29.2	Acreage				
	29.2.1 Laydown Area	P/S	29 acres	17 acres	(1)
	29.2.2 Temporary Construction Facilities	P/S	52 acres	31 acres	(1)
29.3	Construction				
	29.3.6 Noise	P/S	76-101 db @ 50 ft	76-101 db @ 50 ft	*
29.4	Plant Population				
	29.4.1 Construction	P/S	2600-6410 people	1800 people (max)	33.1
29.5	Site Preparation Duration	P	18 months	18 months	*

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- (4) Open item - Refer to latest URD for resolution of this PPE.

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