

Appendix A – Summary of Site Evaluation Process

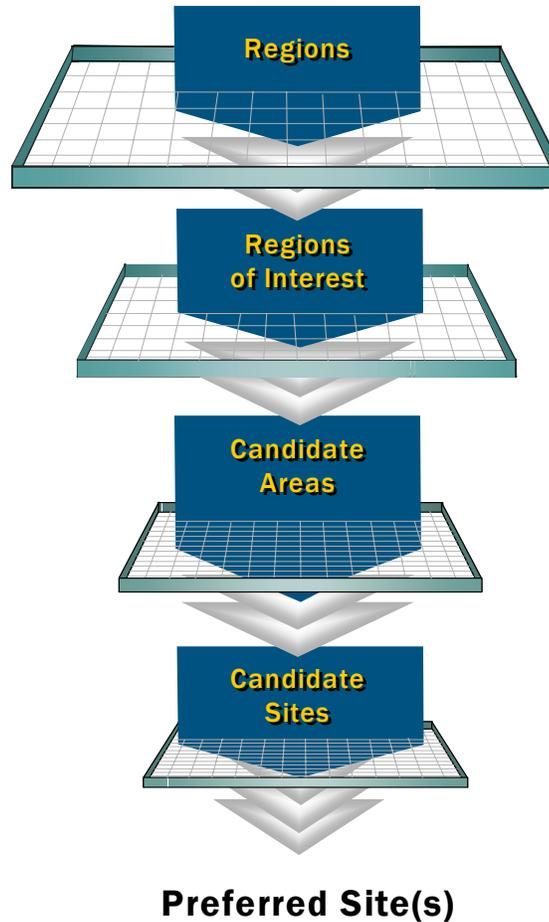
A.1 Overview

This Appendix provides a summary of Bechtel's "Site Evaluation Process for New Nuclear Generation," Bechtel Document No. 23654-100-G67-GEVE-00001. Bechtel's process can be used to screen and evaluate prospective regions, areas, and specific sites in North America (United States, Canada, and Mexico) for the construction and operation of new commercial nuclear power facilities. This process is shown in Figure A-1 and involves the use of screening and evaluation criteria to:

- Identify regions of interest (ROIs) based on electricity and service market projections.
- Identify candidate areas based on screening potential areas against (1) exclusionary criteria and (2) avoidance criteria by calculating area merit (AM) scores.
- Identify candidate sites based on screening potential sites against (1) exclusionary criteria and (2) avoidance criteria by calculating preliminary site merit (SM) scores.
- Identify preferred sites based on evaluating candidate sites against suitability criteria by calculating final site merit scores.

The screening and evaluation process is centered on determining area merit and site merit scores in accordance with the following equation:

Figure A-1. Overview of Site Evaluation Process



$$AM \text{ or } SM = \sum_{i=1}^4 \left[W_i \sum_{j=1}^{b_i} W_{ij} R_{ij} \right] \quad (1)$$

Where,

AM or SM	=	Area merit or site merit (0 to 500)
i	=	Criterion group number (1 to 4)
W_i	=	Criterion group weighting factor (0 to 1.0)
j	=	Criterion number
b_i	=	Number of criteria in criterion group i
W_{ij}	=	Weighting factor for criterion j in criterion group i (0 to 100)
R_{ij}	=	Rating assigned to a potential area or site for criterion j in criterion group i (0 or 1 to 5)

Candidate areas are ranked in descending order by area merit score. Preferred sites are ranked in descending order by site merit score. A detailed description of the process is provided in Section A.3, including a discussion of the exclusionary, avoidance, and suitability criteria.

A.2 Siting Criteria

Screening and evaluation criteria are identified in Parts 2 and 3, Table 5-1 and Process Table 2-1. The criteria were established based on a review of previous nuclear industry siting information and current-day approaches to the siting of power facilities and industrial facilities.

A.2.1 Criteria Grouping

The screening and evaluation criteria are divided into four groups:

■ Group 1 – Economic Criteria

This group includes criteria to assess electricity and market projections, transmission access, stakeholder support, and site development costs.

■ Group 2 – Engineering Criteria

This group includes those regional, environmental, site, or other characteristics that will potentially impact the design, construction, operation, or decommissioning of a prospective new commercial nuclear power facility. Subgroups in Group 1 include general, seismology/geology, hydrology, and meteorology.

■ Group 3 – Environmental Criteria

This group includes criteria to assess the potential adverse impacts of plant construction, operation, and decommissioning on the site, surrounding environment, and people.

■ Group 4 – Sociological Criteria

This group includes criteria to assess the potential impacts of plant construction, operation, and decommissioning on sociological issues.

A.2.2 Criteria Weighting

The relative importance of each criterion to the selection of areas and sites for prospective new commercial nuclear power facilities is reflected as a numerical weight value in the calculation of area merit or site merit. The weights are assigned using a ratio weighting technique to ensure the importance or weights assigned reflected the collective judgment of experts involved in the process. The following process is used to establish the weightings.

Step 1

Each expert completes several worksheets to rank the criteria groups and individual criteria in order of importance.

- Criteria groups are placed in rank order with a value of 1.0 assigned to the least important group. Weight values are assigned to the remaining three groups depicting how much more important each remaining group is relative to the lowest ranked group. For example, if one group is viewed to be equally as important as the lowest ranked group, a weight of 1.0 is assigned. If the group is considered to be twice as important, a weight of 2.0 is assigned. Weights are assigned to nearest tenth (e.g., 1.0, 1.2, 1.5, 2.3).
- Individual criteria in each of the four groups are ranked in a similar fashion. Criteria are placed in rank order with a value of 1.0 assigned to the least important criterion. Weight values are assigned to the remaining criteria depicting how much more important each remaining criterion is relative to the lowest ranked criterion. For example, if one criterion is viewed to be equally as important as the lowest ranked criterion, a weight of 1.0 is assigned. If the criterion is considered to be twice as important, a weight of 2.0 is assigned. Weights are assigned to nearest tenth (e.g., 1.0, 1.2, 1.5, 2.3).

Step 2

- The worksheet results are normalized and analyzed and final weightings assigned.
- The weights reflect the consensus opinion of the experts involved. For the site evaluations, the weights determined by Dominion and Bechtel experts are shown Parts 2 and 3, Table 5-1.

A.2.3 Criteria Ranking

The ranking method for each criterion is based on a common ranking scale of 1 to 5, where 1 is the lowest ranking and 5 is the highest. For those criteria that are identified as area or site exclusionary criteria (see Table 2-1 in the Site Evaluation Process, columns 2 and 3), a rank of 0 is used as the lowest ranking. Ranking methods for each of the criterion are provided in the detailed process document.

A.3 Process Description

A.3.1 Process Steps

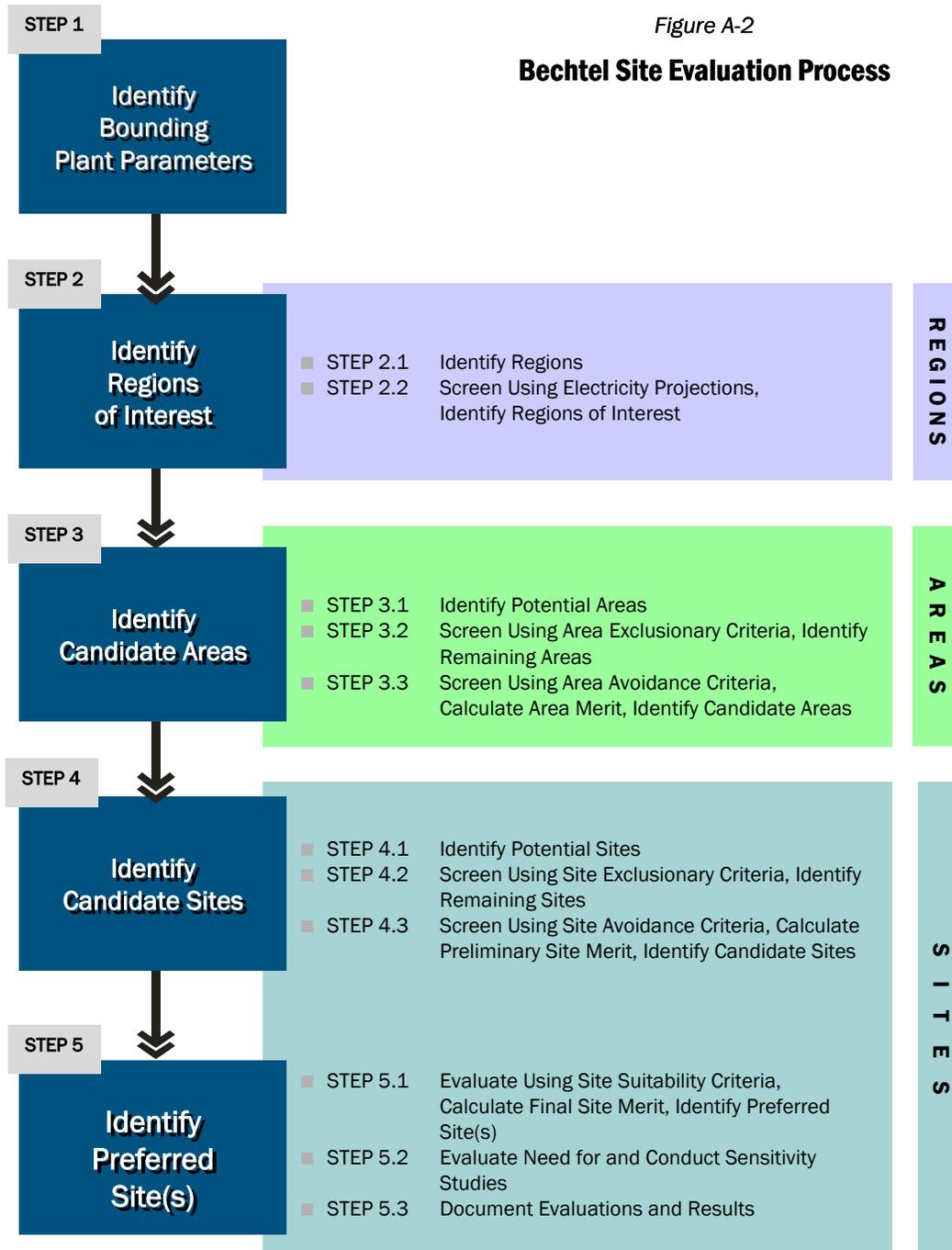
The following paragraphs provide a detailed description of the process. Figure A-2 provides a flowchart of the process.

Step 1 – Identify Bounding Plant Parameters

Design information is needed on the reactor designs being considered in order to facilitate the exclusionary, avoidance, and suitability reviews to be conducted in Steps 3, 4, and 5. The type of information would include, but not necessarily be limited to:

- Plant size, number of units or modules of each type
- Dimensions, general arrangement, general plant description
- Required excavation
- Minimum site size
- Power level
- Major equipment sizes and weights, and foundation bearing pressures
- Cooling and water use requirements
- Routine emissions, expected radiation dose versus distance
- Releases from postulated operational occurrences and accidents
- Design basis for natural phenomena (e.g., seismic, winds, rain, snow)
- Hazardous chemical usage
- Labor force required to support construction, operation, and decommissioning

Figure A-2
Bechtel Site Evaluation Process



The collection of plant design information can be done in parallel with Step 2. The bounding Plant Parameter Envelope (PPE) approach used in the Electric Power Research Institute (EPRI) studies of the early 1990s would represent an acceptable process.

Step 2 – Identify Regions of Interest

- Step 2.1 Divide the U.S., Canada, and Mexico into regions. Regions may include several whole states, may correspond to established Regional Electric Councils, etc.
- Step 2.2 Identify region(s) of interest in North America for new power generation based on electricity needs in each region.

Step 3 – Identify Candidate Areas

- Step 3.1 Divide each Region of Interest into Potential Areas (e.g., states or portions of states).
- Step 3.2 Screen each potential area using the area exclusionary criteria identified in Process Table 2-1, column 2. Refer to Section A.3.2 Item (1). Identify remaining areas that have not been excluded.
- Step 3.3 Screen each remaining area using the area avoidance criteria [i.e., those criteria that have been assigned weights (AW_{ij}) in Process Table 2-1, column 4]. Refer to Section A.3.2, Item (2). Assign AM scores. Identify candidate area(s) based on the highest AM score(s).

Step 4 – Identify Candidate Sites

- Step 4.1 Identify potential sites in each candidate area using U.S. Geological Survey (USGS) maps and other appropriate information.
- Step 4.2 Screen each potential site using the site exclusionary criteria identified in Process Table 2-1, column 3. Refer to Section A.3.2 Item (1). Identify remaining sites that have not been excluded.
- Step 4.3 Screen each remaining site using the site avoidance criteria [i.e., those criteria that have been assigned weights (SW_{ij}) in Process Table 2-1, column 5]. Refer to Section A.3.2 Item (2). Assign preliminary site merit (SM) scores. Identify candidate sites based on the highest preliminary site merit scores.

Step 5 – Identify Preferred Site(s)

- Step 5.1 Evaluate each candidate site using the suitability criteria [i.e., those criteria that have been assigned weights (SW_{ij}) in Process Table 2-1, column 5]. Refer to Section A.3.2 Item (3). Assign final site merit scores to each candidate site. Select a preferred site(s) based on the highest final site merit score(s).

Step 5.2 Evaluate the need for and conduct sensitivity analyses on the final site merit scores. Consider the need for sensitivity analyses on:

- Criterion group weights
- Individual criterion weights
- Impacts on cost, schedule, and other affected criteria to improve selected criterion rankings.

In particular, sensitivity studies should be conducted to ensure appropriate consideration of non-U.S. regions, areas, and sites. The criterion group and individual criterion weights, shown in Part 1, Tables 6-3 through 6-5 and Part 2, Tables 6-3 and 6-4, reflect conditions, regulatory approaches, etc., in the U.S. and may not be appropriate for other countries in North America (i.e., Canada and Mexico). Sensitivity studies can be performed to modify these weights consistent with the conditions, regulatory approaches, etc. of other countries such as Canada and Mexico.

Step 5.3 Perform cost analyses as described in Process Section 2.3.3 and prepare a report documenting the results of the various screenings and evaluations. The report should include a detailed presentation of the information collected, the basis for assigned rankings, and the results of any sensitivity studies performed.

* * *

Note that the screening and evaluation process is flexible and allows entry into the process at the region, area, or site level:

- If region-level information is the best available, the process would be entered at Step 1 and proceed through all 5 steps to the selection of a preferred site(s).
- If area-level information is the best available, the process would be entered at Step 3 and proceed through Steps 4 and 5 to the selection of a preferred site(s). The bounding plant design information in Step 1 would still be needed.
- If specific sites have been identified for evaluation, the process would be entered at Step 5 and proceed through to the selection of a preferred site(s). The bounding plant design information in Step 1 would still be needed.

For the evaluations in this report, the process was entered at Step 5.

A.3.2 Criteria Type and Application

The four Criterion Groups discussed in Section A.2.1 (Group 1 – Economic, Group 2 – Engineering, Group 2 – Environmental, and Group 3 – Sociological) divide the siting criteria by a similarity of characteristics that is generally consistent with past practice and NRC regulatory requirements. However, consistent with the document "Early Site Permit Demonstration Program, Siting Guide: Site Selection and Evaluation Criteria for an Early Site Permit Application," March 1993, a hierarchy has been established to facilitate the successive screening and evaluation steps of the process. Each of the siting criteria has been assigned to one or more levels of the hierarchy as described below.

(1) Exclusionary Criteria

Exclusionary criteria represent requirements that, if not satisfied, would preclude the siting of a new commercial nuclear power facility.

Area exclusionary criteria are identified in Process Table 2-1, column 2, and are applied in process Step 3.2. Potential areas would be eliminated from further consideration if a minimum criterion ranking was not achieved for any one of the area exclusionary criteria.

Site exclusionary criteria are identified in Process Table 2-1, column 3, and are applied in process Step 4.2. Potential sites would be eliminated from further consideration if a minimum criterion ranking was not achieved for any one of the site exclusionary criteria.

The screening of areas and sites against the exclusionary criteria would use reconnaissance-level information¹ only. Area and site visits would not be expected.

(2) Avoidance Criteria

Avoidance criteria are used to identify candidate areas and candidate sites for a new commercial nuclear power facility.

Area avoidance criteria are those criteria listed in Process Table 2-1 that have been assigned weights (AW_{ij}) in column 4. Areas that are not eliminated from consideration after screening using the area exclusionary criteria would be further screened in Step 3.3 using the area avoidance criteria and the calculation of area merit scores. Candidate areas would be identified based on the highest area merit scores.

¹ As defined for this study, reconnaissance-level information consists of information that is available from open literature, the Internet, published or unpublished reports, existing records, authoritative sources, or which can be obtained by telephone conversations with local personnel.

Site avoidance criteria are those criteria listed in Process Table 2-1 that have been assigned weights (SW_{ij}) in column 5. Sites that are not eliminated from consideration after screening using the site exclusionary criteria would be further screened in Step 4.3 using the site avoidance criteria and the calculation of preliminary site merit scores. Candidate sites would be identified based on the highest preliminary site merit scores.

The screening of areas and sites against the avoidance criteria would use reconnaissance-level information only. Area and site visits may or may not be involved.

(3) Suitability Criteria

Suitability criteria are used to identify the preferred site(s) for a new commercial nuclear power facility.

The site suitability criteria are those criteria listed in Process Table 2-1 that have been assigned weights (SW_{ij}) in column 5. Candidate sites would be evaluated in Step 5.1 using the site suitability criteria and the calculation of final site merit scores. A preferred site(s) would be identified based on the highest final site merit score(s).

The evaluation of sites against the site suitability criteria would use best-available information. Site visits would be required.

Note that the site suitability criteria are the same as the site avoidance criteria discussed in Section A.3.2 Item (3) and differ only in their application. The site avoidance criteria are used in screening-level assessments to calculate preliminary site merit scores based on reconnaissance-level information. The site suitability criteria are used in detailed evaluations to calculate final site merit scores based on best-available information and actual site visits. Also, sensitivity analyses may be performed for the site suitability criteria and final site merit scores as discussed in Section A.3.1, Step 5.2.