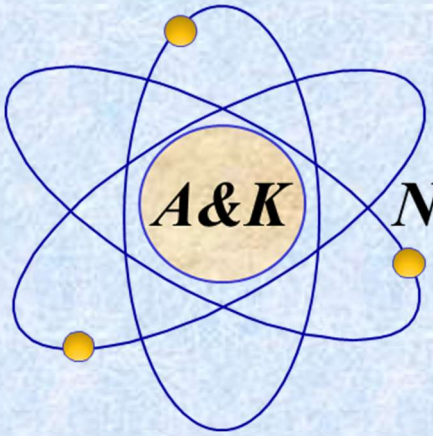

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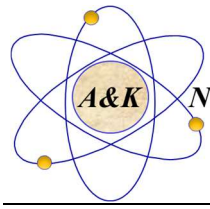
August 2020

Generic
Nuclear Power Plant
Siting Guidance

Kurt T. Schaefer



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SAFETY CLASSIFICATION

This document contains generic information, which cannot directly affect any safety-related function at any nuclear power plant, thus is not safety-related as defined in 10 CFR 50.2. Therefore, 10 CFR 50 Appendix B does not apply.

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List of Abbreviations and Acronyms

CSP	Concentrated solar plant
EMF	Electric and magnetic field
EPA	Environmental Protection Agency
EPRI	Electric Power Research Institute
FAA	Federal Aviation Administration
IAEA	International Atomic Energy Agency
IUCN	International Union for Conservation of Nature
NAAQS	National Ambient Air Quality Standards
NPP	Nuclear power plant
ORNL	Oak Ridge National Laboratory
PSD	Prevention of Significant Deterioration
PWR	Pressurized Water Reactor
SMR	Small modular reactor
SSEC	Site selection and evaluation criteria
TEDE	Total effective dose equivalent
USGS	US Geological Survey

1. INTRODUCTION

This guideline lists factors that are to be considered when a developer is determining where to locate a new nuclear power plant (NPP). Locating the plant is often termed "siting."

The siting selection and evaluation criteria (SSEC) herein address potential concerns from a broad range of interested parties, including utilities, independent power producers, regional planners, government agencies, interveners, and members of the public.

The SSEC are provided in a checklist, and can be used to:

- Compare potential sites;
- Understand why a particular site may be chosen;
- Determine which factors of importance to them were considered; and
- Influence siting or other project decisions.

1.1 Bases

The content and structure of this guideline is based on the information and power plant siting criteria in Reference 1, Public Service Commission of Wisconsin document "Common Power Plant Siting Criteria."

Additional details, supplemental information and criteria are based on the following references:

- Reference 2, Federal Aviation Administration Advisory Circular, "A Model Zoning Ordinance to Limit Height of Objects Around Airports;"
- Reference 3, US Nuclear Regulatory Commission, Regulatory Guide 4.7, "General Site Suitability Criteria for Nuclear Power Stations;"
- Reference 4, US Nuclear Regulatory Commission, 10 CFR 100, "Reactor Site Criteria," including Appendix A, "Seismic and Geologic Siting Criteria for Nuclear Power Plants;"
- Reference 5, International Atomic Energy Agency document "Managing Siting Activities for Nuclear Power Plants;"
- Reference 6, Oak Ridge National Laboratory document "Application of Spatial Data Modeling and Geographical Information Systems (GIS) for Identification of Potential Siting Options for Various Electrical Generation Sources;"
- Reference 7, Electric Power Research Institute document "Siting Guide: Site Selection and Evaluation Criteria for an Early Site Permit Application;"
- Reference 8, Oak Ridge National Laboratory, "Evaluation of Suitability of Selected Set of Coal Plant Sites for Repowering with Small Modular Reactors;"
- Reference 9, Southern California Edison, "Method-of-Service Study" form;
- Reference 10, State of California, "California Environmental Quality Act," and "Guidelines for Implementation of the California Environmental Quality Act;" and

- Reference 11, US Nuclear Regulatory Commission, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition — Site Characteristics and Site Parameters," NUREG-0800, Chapter 2, Current Revision.

1.3 Scope

Section 2 provides and discusses SSEC that can be generically applied to the siting of a NPP. The SSEC are included within Table 2-1, which is in the form of a generic checklist for reviewing a site.

Section 3 provides other published SSEC, because some of their criteria are valid for NPP SSEC, and provide insights applicable to siting a NPP.

2. SITE SELECTION AND EVALUATION CRITERIA

Table 2-1 provides a generic SSEC checklist. The checklist is divided into six major categories, which are each discussed below. (Note: additional criteria can be added, and some criteria may be deleted, as the NPP design progresses).

Acceptance categories for the criteria are *suitable*, *avoid*, and *exclude*.

A SSEC result is categorized as *suitable*, if the criterion can be met at no cost or lower than average cost.

A SSEC result is categorized as *avoid*, if the criterion can be met with additional cost but within technical and budgetary constraints.

A SSEC result is categorized as *exclude*, if the criterion cannot be met or can only be met at a cost that is not within budgetary constraints.

2.1 Site Requirements

2.1.1 Access

Power plant construction and operation can require road, rail, or barge access to the site. The number and location of site entrances and the distances to and quality of nearby roads and rail lines can be important.

Sites with access solely from heavily traveled roads are less desirable than sites on less heavily traveled routes. However, closeness to major highways is desirable. The objective is to allow easy access to the site without causing traffic congestion or safety problems.

Transport of large and heavy equipment to the site is an important site selection aspect. The distance, loading capacity of roads/bridges, curvatures, clearances and slopes on the route to a proposed site should be investigated. The availability of rail networks should be studied with respect to the dimensions and weights of equipment.

Some equipment transport issues can be avoided if a site is accessible by vessels, thus existing harbors capacities should be assessed. The possibility of ship transport for large machinery and equipment to the site may be advantageous. However, rail transport is also capable of transporting heavy loads, though with a size limitation. Road transport is usually the most restrictive method for large equipment delivery.

2.1.2 Air Quality

Some areas do not meet the air quality standards set by current laws and regulations. These areas are called “non-attainment areas.” It may be possible to locate a plant in a non-attainment area by replacing a current pollutant source. The resulting emissions level must be less than the existing level. If local air quality and meteorological data are available for site area, they may include the site’s attainment status and air quality.

Prevention of Significant Deterioration (PSD) increments represent the amount of air quality that may be “consumed” by new emission sources without violating air quality standards. Generally,

sites in attainment areas with ample PSD increments are more favorable than sites in attainment areas with limited PSD increments. Sites in non-attainment areas with good offset potentials should also be viable.

Sites that are not in non-attainment areas are more desirable.

2.1.3 Air Space Restrictions

Federal guidelines restrict the height of structures near airports. These regulations may cause difficulties for plant structures like towers or chimneys. It should be verified that a site can comply with Federal Aviation Administration (FAA) and other airspace guidelines. Generally, sites at greater distances from airports and designated clear zones are desirable, as are sites offset from runway alignments. Developers must also consider possible restrictions on the location of power plant-related landfill sites near airports. The following values are based on Reference 2.

Height Above Runway Elevation*	Minimum Distance to Runway Centerline*	Maximum Allowable Height Above Runway Elevation**
1 ft upward to 20 ft outward	5000 ft, ~ 1 mile	250 ft at 5000 ft
1 ft upward to 34 ft outward	10000 ft, ~ 2 miles	294 ft at 10000 ft
1 ft upward to 50 ft outward	40000 ft, ~ 8 miles	800 ft at 40000 ft
0.3 m upward to 6.1 m outward	1.52 km	76.2 m at 1.52 km
0.3 m upward to 10.4 m outward	3.05 km	89.6 m at 3.05 km
0.3 m upward to 15.2 m outward	12.2 km	244 m at 12.2 km

* Taken from Reference 2. ** Based on first two columns

Based on Regulatory Guide 4.7 (Reference 3), a NPP should not be sited within 16 km (10 miles) of a major airport.

2.1.4 Buffering

Buffering is to minimize the visual and noise effects of a plant by increasing the distance to neighbors, through the use of surrounding land that provides visual and sound barriers. "Buffer area" refers to land between the plant facilities and adjacent property owners, especially residential property owners. Needed information includes the acreage, distance, and type of land that acts as a buffer, both on the property owned by the plant developer and on adjacent property owned by others. The potential for changes in the status and condition of these lands should also be described. Generally, sites with more or better buffer areas are more desirable.

2.1.5 Potential for Site Flooding

The potential for flood damage must be minimized. Designs typically locate critical equipment above the 100-year flood level. Non-critical portions of plant systems (e.g., roads and buffer zones) below the 100-year level can be raised, diked, or otherwise protected. Generally, sites

completely out of the floodplain or sites with room to locate major plant equipment out of the floodplain are preferred over sites where major equipment could be located in a floodplain.

The potential for and history of flood-producing natural phenomena should be investigated. A site with a history of or reasonable potential for any of the following phenomena may need to be avoided.

- Past floods at the site location
- Stream flooding
- Tidal surges due to a hurricane, tropical storm or windstorm
- Seiches and Tsunamis
- Seismically and design/age induced dam failure
- Landslide induced flooding
- Ice formation in water bodies

2.1.6 Fuel Delivery for Auxiliary Power

A NPP may require a fossil fuel powered auxiliary electric power supply. Information is needed on access and distance to existing fuel transport systems, competing fuel transporters, and alternate fuel delivery systems. On-site space may be needed for fuel storage. Generally, sites with access to competing fuel transporters and alternate fuels are preferable to sites without this access.

2.1.7 Geotechnical Design Parameters

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 that contain uniform, consistent, and non-complex soil conditions are more favorable than areas that do not, because of the less rigorous investigations that will be needed. 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 also be avoided. Areas that may contain soils subject to liquefaction, thick layers of soft soil, anomalous soil conditions, a high ground water table, subsurface cavities (natural or manmade), or rock that is subject to dissolving in water should be avoided.

Geotechnical design parameters must be estimated to control costs. These include foundation material dry, saturated and natural densities, static modulus of elasticity, static Poisson's ratio, seismic event frequency and response, dynamic modulus velocity, dynamic Poisson's ratio, dynamic shear modulus, and foundation bearing capacity.

A limit on design ground response spectra for the horizontal and vertical directions along with the corresponding damping, acceleration and velocity values should be considered. Locations with more frequent seismic activity or higher potential seismic responses would result in higher seismic design and construction costs, and could have more difficult permit processes and more public involvement. Generally, sites with lower seismic activity and responses are preferred.

Geologic hazards should be avoided. The following geologic and related man-made conditions should be avoided in locating a facility.

- Areas of active (and dormant) volcanic activity.
- Subsidence areas caused by withdrawal of subsurface fluids such as oil or groundwater, including areas which may be affected by future withdrawals.
- Potential unstable slope areas, including areas demonstrating paleo-landslide characteristics.
- Areas of potential collapse (e.g., karstic areas in limestone, salt, or other soluble formations).
- Mined areas, such as near-surface coal mined-out areas, as well as areas where resources are present and may be exploited in the future.
- Areas subject to seismic and other induced water waves and floods.

2.1.7.1 Earthquake Faults

Based on 10 CFR 100 Appendix A, fault lengths within 200 miles of a proposed site should be evaluated for establishing the site's Safe Shutdown Earthquake design requirements. Sites with faults greater than 1000 feet long and within 5 miles should be avoided. Table 2-2 addresses the suitability of different fault lengths versus distances from a proposed site.

2.1.8 Land Purchasing Difficulties

Buying land for a power plant can be expensive, and a difficult task that involves different stakeholders; including environmentalists and local population interference, and costs to obtain zoning changes. The logistics of initial construction and expectations for plant expansion should be considered.

2.1.9 Need for Power

This factor identifies areas where future power needs will be greater than current power plant or transmission capacities. This factor is of interest to electrical system planners, because a power plant sited in such an area could reduce system inefficiencies and transmission line losses. Generally, sites where there is a local or regional need for generation capacity may be preferred.

2.1.10 Population Density

Power plants that generate radioactive material always have a percentage of the population objecting to a plant being built near them. To minimize the number of people who could object to a power plant, it is recommended that the population density at the site boundary be less than as shown in Table 2-1.

From 10 CFR 100.21(h), "Reactor sites should be located away from very densely populated centers. Areas of low population density are, generally, preferred. However, in determining the acceptability of a particular site located away from a very densely populated center but not in an

area of low density, consideration will be given to safety, environmental, economic, or other factors, which may result in the site being found acceptable."

NRC Regulatory Guide 4.7 Position C.5, "A reactor should be located so that, at the time of initial plant approval within about 5 years thereafter, the population density, including weighted transient population, averaged over any radial distance out to 20 mi (cumulative population at a distance divided by the circular area at that distance), does not exceed 500 persons per square mile. A reactor should not be located at a site where the population density is well in excess of this value."

In contrast, if wastewater is to be used for cooling, a power plant would require a sufficiently large population density nearby. Therefore, a power plant using wastewater for cooling must be close to a city to have available water. In this case, the 500 people per square mile guideline may not be practical.

2.1.11 Site Adaptability

Technical, economic, and environmental developments may affect site adaptability. Information is needed about the ability of the site (in acreage and conditions) to support the installation of new technologies.

2.1.12 Site Expandability

A site might be able to support more generating capacity than proposed. It's usually more economical and environmentally acceptable to add generating capacity at an existing site than to build at a new site. Information is needed on the potential or plans for a site to support more capacity than initially proposed, including the number and size of potential, future generating units or other facilities. Often, an expandable site may be more desirable.

2.1.13 Site Geography

Site geography can affect construction costs and environmental effects. The features of most interest are the general site topography (ground slope), soil types and depths, and depth to groundwater. These factors affect the amount of earthwork required and plant design requirements such as foundation and piping installation. Generally, sites with relatively flat topography are preferred over rolling hills or steep grades. Soil types with good weight-bearing capacity are preferred over soils with poor engineering characteristics. Favorable sites also have adequate groundwater depths to support plant construction and avoid shallow water table problems.

During construction, large quantities of aggregates and cement will be needed. Availability in the vicinity of a site helps to reduce transportation costs.

A site should not have large scale topographic features that cannot be relocated or altered; such as stream channels, deep incised valleys, knobs, sinkholes, and abandoned mines.

2.1.14 Site Size

This criterion is used to clarify the land area requirements for a proposed plant. Power plant types and designs have a wide range of land requirements. A plant will need a buffer zone within the site boundary, i.e., more area than just for the building, generation facilities and storage. In

addition, extra readily useable land will be needed during construction. Therefore, the needed information includes the site size (acres), the portion of the site (acres) that would be occupied by plant buildings, and additional acres used during construction. Generally, sites with ample space are preferred.

10 CFR 100.11 requires a NPP site to include an "exclusion area," a "low population zone," and a minimum distance from a "population center distance."

- An *exclusion area* shall be "of such size that an individual located at any point on its boundary for two hours immediately following onset of the postulated fission product release would not receive a total radiation dose to the whole body in excess of 25 rem or a total radiation dose in excess of 300 rem to the thyroid from iodine exposure."
    - From 10 CFR 100.3, "*Exclusion area* means that area surrounding the reactor, in which the reactor licensee has the authority to determine all activities including exclusion or removal of personnel and property from the area. This area may be traversed by a highway, railroad, or waterway, provided these are not so close to the facility as to interfere with normal operations of the facility and provided appropriate and effective arrangements are made to control traffic on the highway, railroad, or waterway, in case of emergency, to protect the public health and safety. Residence within the exclusion area shall normally be prohibited. In any event, residents shall be subject to ready removal in case of necessity. Activities unrelated to operation of the reactor may be permitted in an exclusion area under appropriate limitations, provided that no significant hazards to the public health and safety will result."
- A *low population zone* shall be "of such size that an individual located at any point on its outer boundary who is exposed to the radioactive cloud resulting from the postulated fission product release (during the entire period of its passage) would not receive a total radiation dose to the whole body in excess of 25 rem or a total radiation dose in excess of 300 rem to the thyroid from iodine exposure."
    - From 10 CFR 100.3, "*Low population zone* means the area immediately surrounding the exclusion area which contains residents, the total number and density of which are such that there is a reasonable probability that appropriate protective measures could be taken in their behalf in the event of a serious accident. These guides do not specify a permissible population density or total population within this zone because the situation may vary from case to case. Whether a specific number of people can, for example, be evacuated from a specific area, or instructed to take shelter, on a timely basis will depend on many factors such as location, number and size of highways, scope and extent of advance planning, and actual distribution of residents within the area."
- A *population center distance* shall be "at least one and one-third times the distance from the reactor to the outer boundary of the low population zone. In applying this guide, the boundary of the population center shall be determined upon consideration of population distribution. Political boundaries are not controlling in the application of this guide. Where very large cities are involved, a greater distance may be necessary because of total integrated population dose consideration."

- From 10 CFR 100.3, "*Population center distance* means the distance from the reactor to the nearest boundary of a densely populated center containing more than about 25,000 residents."

Note; it is recommended that radiation dose limits used in determining site acceptability be based on 10% of the above values, i.e., 2.5 rem whole body dose and 30 rem to the thyroid from radioactive iodine exposure.

2.1.15 Solid Waste Management

The amount and type of (non-radioactive) wastes depend on the number of NPP units installed on a site. A plant must meet on-site landfill, off-site landfill, or other waste disposal requirements. If there are landfill requirements, information is needed on the acreage, location, groundwater conditions, and soil types of potential on-site, or nearby off- site landfill or waste management areas. Generally, a preferred site may have suitable on-site conditions (or correctable inadequacies) to meet solid waste standards. Least-preferred sites may be those where suitable landfill conditions exist only off site with a long haul-out distance.

2.1.16 Transmission

Any new transmission line required to connect the power plant into the electrical transmission system can be a significant cost of plant siting and a major cause of community concern. Generally, shorter new power lines are preferred to longer new lines, and lower-voltage lines are preferred to higher-voltage lines. Upgrading or rebuilding existing lines is sometimes preferred to installing new lines. Transmission connections that increase system reliability and stability and decrease system losses are desirable.

A major practical consideration in the location of a new power plant is that potential sites should be strategically placed, both for connection to the transmission grid and to supply electricity to large areas of demand. The grid system must be able to accept power in-feed at a particular site location without requiring costly and time-consuming reinforcement. Moreover, due to their high capital cost and low running costs, a NPP should be sited so as to operate as a base load plant and the grid infrastructure should enable its continuous operation at full power. The objective of the siting studies is to evaluate the connection of new NPPs to the transmission system grid, to determine if the capacities of the existing transmission lines and switchyards are adequate to handle the additional power, and if not to evaluate the costs of doing so. Note that the approval of new grid lines can sometimes be harder to achieve than authorization of the site itself.

The stability of the grid system in the event of the sudden shutdown of a NPP and the effect of a large loss of grid load on the plant have to be evaluated as part of the review of site suitability. This issue is strongly related to the planned capacity of the installation. The proximity of the grid system to the site itself is also important as it will affect the cost.

2.1.17 External Electric Load Requirements

Any industrial facility would require at least one external source of electricity, thus the existing local electricity supplier must be capable of providing the maximum potential and daily electric

loads for the plant. In addition, two or more independent offsite power supplies may be required. Therefore, the SSEC must include external electric load (supply) requirements.

2.1.18 Water Discharge

Many power plant technologies discharge wastewater into rivers, lakes, or municipal treatment systems. Local water resources must be able to absorb additional water that is hot or acidic. Generally, sites with more discharge capacity available nearby with fewer competing uses and restrictions on it are more desirable. Sites with access to municipal treatment systems with adequate capacity may also be desirable. Sites where the receiving water has ample physical and chemical assimilative capacity are more desirable than sites with no existing legal waste load allocation and no competing or complicating discharges.

2.1.19 Water Supply

A NPP may use water from a lake, river, municipal water utility (waste water), or groundwater. Surface water may be used for plant cooling and groundwater may be used for plant processes. Generally, the presence of adequate and usable water resources at or near a site is preferred over sites with remote, inadequate, or low-quality water resources. Sites with no competing water uses are generally preferred to sites with many uses.

Cooling water supply values should be based on a maximum ambient dry bulb temperature of 100°F and wet bulb temperature of 80°F, whichever is more limiting.

2.1.19.1 Potential Issues

All thermal power plants are cooled by water, thus the cost and availability of an adequate supply of cooling water are important considerations. Evaluation of water supply capability should also include the effects on water quantity left in the source water body, and the effects on water quality as a result of reduced waste assimilation capacity. The quantity of water depends on the adopted system, the power of the plant, the condenser design, and the temperature of the cooling water. The following cooling systems may be used at a power plant.

- *Once-through cooling system*. These are cheaper to construct than evaporative cooling systems. However, they can increase the temperature of the source water by several degrees, and may result in "downstream" adverse effects. Sea water cooling is preferable if available, due to the greater effect of dilution on water temperature.
- *Recirculating wet cooling system* (closed loop system). These use cooling towers but still require significant quantities of water. If fresh water is being used, this may be the preferred option. These systems consume more electricity than once-through systems.
- *Dry-cooling system*. These rely on air flow to cool water flowing inside tubes or pipes and require significantly less water than a wet cooling system. However, they are more expensive to construct and impose an additional capital cost, as well as using approximately 1.5% of the average annual electricity production.
- *Hybrid cooling system*. These are a combination of wet cooling and dry cooling systems through use of a wet cooling tower and an air-cooled condenser.

For a plant on a river site, minimum/maximum flows, selection of intake location/invert level with respect to sedimentation/erosion and stability of banks are important considerations. For plants on coasts, flood levels/recedes, pumping head, bathymetry, water chemistry and stability of shore are important considerations.

Constructing pumping stations and developing infrastructure, to transport water from the source to the site, results in an increased construction cost. In addition, any right of way or land lease costs associated with water transport as well as the operational costs (e.g., pumping power) need to be account for as factors for site selection. An avoidance distance could therefore be set, based on professional judgment as to the range of distances likely to be available and the likely costs.

Other important considerations include the maximum number of NPP units for the site, the water licenses and needed authorizations.

2.1.19.2 7-Day, 10-Year Low Flow Period Drought Indication

The US Geological Survey (USGS) has data for 7-day, 10-year low flows (7Q10s) for some specific stream locations. The 7-day, 10-day low flow is a statistical estimate of the lowest average flow that would be experienced during a consecutive 7-day period with an average recurrence interval of 10 years. Because it is predicted to recur on average only once in 10 years, it is usually an indicator of low-flow conditions during a drought.

2.1.19.3 Percent of Stream Flow

A power plant shall not take more than 10% of an available stream flow. However, to account for future increase water demand, a new power plant should not take more than 5% of an available stream flow.

2.1.20 External Hazards

From 10 CFR 100.20(b), choosing a site must consider "The nature and proximity of man-related hazards (e.g., airports, dams, transportation routes, military and chemical facilities) must be evaluated to establish site characteristics for use in determining whether a plant design can accommodate commonly occurring hazards, and whether the risk of other hazards is very low."

According to 10 CFR 100.21(e), "Potential hazards associated with nearby transportation routes, industrial and military facilities must be evaluated, and site parameters established such that potential hazards from such routes and facilities will pose no undue risk to the type of facility proposed to be located at the site."

Regulatory Guide 4.7 guidance 9 states that "Potentially hazardous facilities and activities within 8 km (5 mi) of a proposed site, and major airports within 16 km (10 mi) of a proposed site, should be identified. If a preliminary evaluation of potential accidents at these facilities indicates that the potential hazards from shock waves and missiles approach or exceed those of the design-basis tornado for the region or there are potential hazards such as flammable vapor clouds, toxic chemicals, or incendiary fragments, the suitability of the site should be determined by detailed evaluation of the degree of risk imposed by the potential hazard." (Note: airports are addressed in Section 2.1.3.)

2.2 Effect on the Community

2.2.1 Aesthetics

Aesthetic effects are often a concern to the local community, where there is specific interest in clarifying the types and levels of visual effects that may be associated with a proposed plant. Information of interest includes (a) the degree of visibility of the plant and other facilities, (b) the facilities' appearance from homes or scenic locations and overlooks such as wild and scenic rivers and state parks, (c) the number of people who can see the plant, (d) the amount of night sky disturbance from plant lighting or aircraft warning lights, and (e) changes in visibility caused by plumes from stacks or cooling towers. Generally, sites that are well-hidden or limited in visibility may be more desirable than sites that are highly visible, produce night lighting effects, or have plume adverse effect potential.

2.2.2 Archeological and Historical Sites

Society values artifacts and structures of archeological and historical significance. They are considered rare resources and listed with the state's historical society records, which should list the presence of known archeological sites, cemeteries, and historic buildings. The probability of finding artifacts, burials, or historic buildings is also important. So is the potential visibility of the plant from historic sites or in a historic view. Certain plant facilities might require relocation or redesign to avoid damaging a site or view. Generally, sites that have no such resources and little potential for finding them are more desirable than sites that have resources on the site property.

2.2.2.1 Native American Tribal Cultural Resources

A Native American tribe means a tribe that is on the contact list maintained by the Native American Heritage Commission. A tribal cultural resource is a site, feature, place, cultural landscape, sacred place, and object with cultural value to a Native American tribe that is included or determined to be eligible for inclusion in a State's register of historical resources or sites.

Affecting (e.g., building on) a Native American tribal cultural resource must be avoided, except if the changes have been accepted by the affected tribe(s) and governing regulatory agencies.

2.2.3 Costs to/of Community Services

Local communities would be expected inquire about the services that a proposed plant may require, how the plant developer would pay for them, and/or what they would cost. Community services can include water supplies, water treatment, fire protection, security, and snow plowing. Indirect/direct costs to the community may include new roads, sewer and water extensions, more school-age children to serve, or more use of library or other services. More desirable sites are those sites where costs to the community are minimal or where potential opportunities to strengthen community services exist. The need and projected costs for police, fire protection, water and sanitary sewer, and storm sewer services must be examined, in addition to other incidental needs such as road upgrades to handle increased traffic and heavier transportation weights.

2.2.4 Labor Availability

A power plant requires labor for construction and operation. Local communities can benefit from these employment opportunities. Generally, sites that can make use of local labor are more desirable. These sites would have a larger skilled work force within a short distance from the plant site.

2.2.5 Relocation Costs

The effects of a new power plant are of significant concern to local communities. One concern is how many homeowners and businesses are located at the proposed site and would have to be moved if the plant were built. Generally, sites needing fewer relocations are more desirable.

2.2.6 Public Attitude

The location of a power plant has many effects that are of interest to the local community. There are both advantages and disadvantages to be considered. Measures of local interest and concern include the current attitudes of local citizens and officials regarding a potential power plant in the local community, the local questions raised, the public input received, and public support or opposition to a particular site. In addition, a community may have a negative (anti-) attitude about any facility that produces radioactive material. Generally, a site where the public attitude is positive or supportive is preferred.

2.2.7 Effects on Wells

The use of water by a power plant has the potential to affect the local water supply and the surrounding environment. To meet water supply requirements, power plants may use groundwater wells, the local municipal supply, or both. This use may place a heavy load on the local system, lowering water yields from nearby wells. It may also not affect the system or nearby wells, or it may enhance the local system. Generally, sites where plant water use will have limited water supply effects or those that support upgrades of local systems are more desirable over sites where plant water use will have an adverse effect on the local water supply.

2.3 Public Health and Safety Concerns

2.3.1 Degradation of Local Air Quality

A NPP needs an auxiliary electric AC power supply, which will be powered by diesel oil, and a natural gas fired auxiliary boiler. Potential air-related health and safety concerns are measured three ways; attainment status, PSD, and information on sensitive populations. Attainment status evaluates compliance with air quality standards. PSD evaluates the use of air resources in areas that meet attainment. Information on sensitive populations provides an understanding of where people, who may be sensitive to changes in air quality, located in relation to the plant site. Generally, the more desirable sites are in attainment areas with an ample PSD increment to maintain air quality and allow other growth, and they have few sensitive populations that are likely to be affected.

- **Attainment status**: Public exposure to air emissions is regulated through the National Ambient Air Quality Standards (NAAQS) for major air pollutants including sulfur dioxide, oxides of nitrogen, carbon monoxide, ozone, particulates, and toxic elements such as lead, arsenic, and beryllium. A site evaluation should identify any NAAQS for which pollutant concentration in the site area is above attainment levels. For areas not in attainment, the evaluation should identify the state plan required to bring this area back into attainment and any emissions available as either netting or offset credits.
- **Prevention of significant deterioration**: For areas where all NAAQS regulations are met, the developer must consider the amounts of "clean air" which can be used ("consumed"). This use of the existing clean air is regulated by the PSD regulations. The site evaluation should include how much of the PSD increment is available and what quantity of pollutants can be emitted without using up the available increment below NAAQS levels.
- **Sensitive populations**: The purpose of power plant pollution regulations and emissions limits is to avoid harm to public health and the environment. The concern is elevated for nearby populations of elderly, sick, and very young people, who may have an increased sensitivity to plant-related emissions.

  Nearby facilities such as hospitals, nursing homes, day care centers, and grade schools may have populations with increased sensitivities.

2.3.2 Dust

The "nuisance" effects of fugitive dust could be a concern to nearby residents. There is public interest in understanding the sources, types, and levels of fugitive dust that may be associated with a proposed plant, and the distance of dust sources from sensitive locations such as nearby residences. Generally, more desirable sites are those with fewer sources of fugitive dust and greater distances to adjacent residences and sensitive locations.

The potential dust releases during construction should be estimated, and their effects on nearby residents evaluated.

There should not be a dust issue during plant operations.

2.3.3 Radioactive Material Limits

A community may have laws prohibiting any facility the produces radioactive material. City, county, etc. officials should be contacted to determine if the amounts of radioactive material at a NPP would be legally acceptable.

2.3.4 Electric and Magnetic Fields

Public concern about potential health effects associated with exposure to magnetic fields has focused attention on electric facilities. Although scientific uncertainty persists, public concerns should be considered in siting facilities. Information of interest includes how magnetic fields near the power plant and associated lines will change. Generally, more desirable sites are those with no increases in electric and magnetic field (EMF) on existing lines (decreases are more desirable). Sites that require new lines may be more desirable if fewer people are exposed to the EMF

produced by the lines. Transmission line routes that minimize the number of residences, schools, etc., within the area of influence may be more desirable.

2.3.5 Noise

Noise could be a concern to nearby residents. Information of interest includes noise caused by plant construction and operations, distance of noise sources from sensitive locations such as parks and residences, and applicability of local noise ordinances or other thresholds. Generally, more desirable sites maximize the distance between the noise source and the public, have landscape features that would absorb noise between the plant and the public, and have no receptors within any areas where noise guidelines or ordinances are exceeded. It is preferred that no sudden, loud, or unpleasant noise characteristics be perceptible to most people in the area.

2.3.6 Traffic Safety

There are normally two categories of traffic safety concern. One is the increase in local traffic, particularly in truck and rail traffic. The other is the potential for cooling tower drift to cause fogging or icing of roadways adjacent to a plant. In general, sites with little potential for causing traffic increases or congestion and little or no potential for effect by cooling tower drift are more desirable.

2.3.7 Wastewater Treatment

Each site should be evaluated for the ability to meet wastewater treatment and discharge laws and regulations. In general, sites that have minimal toxic wastewater characteristics and provide ample treatment and assimilative capacity are more desirable because of the ability of the local receiving water to absorb discharges from plant water treatment systems.

2.4 Environmental Effects

2.4.1 Air Quality

This criterion is used to evaluate the potential for adverse effects on the non-human components of the environment such as vegetation, aquatic life, wildlife, building materials, etc. At a NPP, only diesel generator and auxiliary boiler operations have the potential to affect air quality.

Sites with few sensitive natural resource elements (forest, acid-sensitive lakes, etc.) likely to be affected by air pollutant emissions are also more desirable. It would be particularly desirable for a site to be remote from Class 1 PSD areas, such as wilderness areas in national forests and large national parks or other resources whose use and enjoyment could be adversely affected by air pollution.

2.4.2 Groundwater Effects - Recharge, Discharge, Quantity and Quality

Direct water effluent discharges from a plant may affect the volume and chemical contents of local ground water. Measures must be taken to ensure that local ground water is not adversely affected, e.g., no potential buildup of chemicals in ground water.

Groundwater effects include the effects of a power plant and related facilities upon groundwater hydrology (underground water levels and flows) and the quality of groundwater. Potential power plant effects include (a) the effect of water withdrawal on the groundwater supply and the quantity of groundwater available for other uses and (b) the extent of paving and other activities that reduce the percolation of water into the ground. Adverse effects on local aquifers that support wetlands, springs, and stream base flow should be minimized. Sites with more limited groundwater resources on or near the site may be less desirable. The presence of groundwater-dependent resources on or near the site should also be considered.

2.4.3 Species Protection

Protected species are state or federally listed rare, threatened, or endangered plant or animal species and their habitats, including special biological communities. In general, sites where no protected species are affected are more desirable than sites where protected species are located in off-site areas affected by operations or where protected species exist in the buffer area. Sites where protected species are located in the active site area are less desirable.

Species may have a commercial, cultural, or supporting value. Commercial species are important for the fishing industry and their disruption will adversely affect it. Disruption of species with cultural value or flagship species can affect the tourist industry, but it may also promote a negative reaction to the project by the public. Species that support the previous two types should also be taken into consideration as their disruption will directly affect the species with cultural and commercial value.

The International Union for Conservation of Nature (IUCN) categorizes species as *critically endangered*, *endangered*, *vulnerable*, *near threatened*, and *least concern*.

Presence of species that are characterized *critically endangered* or *endangered should* be used as exclusion criteria. These IUCN categories are equivalent to the US Environmental Protection Agency (EPA) *endangered* category.

Presence of species that are characterized as *vulnerable* or *near threatened* should be used as avoidance criteria. These IUCN categories are equivalent to the EPA *threatened* category.

Special attention should be given to avoidance of habitat fragmentation. A species depends on enough individuals to maintain its genetic diversity, as well as on access to feeding, breeding or wintering areas. Threatened and endemic species are particularly of interest in such cases because fragmentation can lead to declining population size.

Areas where the habitat fragmentation is likely to increase the status for the species to a more threatened level should be avoided, if possible.

A species of *least concern* is one that does not qualify as *near threatened* or *threatened*.

2.4.4 Storm Water Runoff

The site must be able to support construction and operation in a way that minimizes erosion, sedimentation, and transport of pollutants by storm water runoff to waters of the state. Sites that

pose problems for runoff management (highly erodible soils, steep slopes, etc.) are less desirable. In addition, management of the floodwaters themselves could be a concern to local residents.

2.4.5 Waste Minimization, Recycling or Reuse

There might be site-specific opportunities to reduce the volume and strength of liquid or solid waste produced in generating electric power, and to recycle or reuse those waste products that are produced. These might include local industries or programs that could use power generation waste products or power plant facilities that reduce wastes going to landfills by using the wastes as fuel.

2.4.6 Wastewater Treatment Discharge

The ability of waters to receive wastewater treatment discharges and absorb them varies. The waters must have the capacity to absorb chemical differences such as added biocides or differences in pH or physical differences in heat without adversely affecting aquatic life and ecology. Sites with nearby water resources that have a large ability to absorb water treatment discharge without adverse effects are desirable. Least desirable are those sites where water resources have little or no ability to absorb water treatment discharge without adverse effects. A NPP should process all water wastes that could contain radioactive material, such that there would be no radioactive waste water discharge.

2.4.7 Wetlands

Generally, sites with no wetlands or no potential for adverse wetland effects are desirable. Sites with minor wetlands or limited potential for wetland effects are more desirable than sites with larger areas of wetlands and more significant potential wetland effects. A site near a wetland requires at least one US Army Corps of Engineers permit, which takes 6 to 24 months to obtain. Therefore, sites near wetlands are less desirable.

2.4.8 Wildlife and Natural Lands

Constructing a generation facility and auxiliary structures could have a direct effect on wildlife, habitat, and lands with good characteristics of natural ecological communities. Sites with little or no effect on wildlife and natural lands are more desirable than sites with more significant effects on these natural resources.

2.4.9 Wildlife Effects from Operation

There are potential operational effects on wildlife and wildlife habitat besides effects from air and water quality changes due to a combustion process (e.g., NPP auxiliary power). They include effects related to fossil fuel burning, effects related to cooling such as fish caught in cooling water systems or the discharge of heated cooling water into streams or lakes, or other effects such as bird mortality from striking structures or new power lines. Sensitive sites are those that support greater wildlife use (proximity to good habitat, migration routes, food resources, etc.). However, facilities can also be designed to enhance habitat by incorporating naturalized buffer areas or use of cooling water for fishponds. Generally, sites that minimize negative effects on wildlife from power plant operations are preferred.

2.5 Land Use Effects

2.5.1 Industrial Forests

Industrial forests are a valuable commodity. Site evaluation should address the forest resources of the site and nearby lands, and the effects of plant construction and operation on these resources. Generally, more desirable sites have fewer effects on these resources.

2.5.2 Land Acquisition

Each site will have unique land acquisition requirements and associated effects. Generally, sites that have lower land acquisition costs and require shorter acquisition times are more desirable.

The cost of land varies from one region to another. In some cases, it may be necessary to purchase additional land for a town with all the suitable facilities to support the workforce, if there are not adequate existing facilities in the vicinity. It could be necessary to purchase land in other areas for grid enhancements, transportation arrangements etc. It may also be necessary to provide compensation (financial or provision of other land areas) for land of special interest.

2.5.3 Land Use Compatibility

Typically, active or vacant industrial lands may be more compatible, while urban residential lands may be less compatible with power plants. Generally, sites that are more compatible with present and planned land uses are more desirable, as are those where the plant would comply with existing land use regulations.

2.5.4 Previous Land Use

Previous land use may have caused site contamination. The existence of site contamination and the costs of cleanup (e.g., removal and disposal of contaminated soil and/or water) must be considered in the selection of a power plant site. Sites without environmental contamination are more desirable. Vacated industrial sites may present opportunities for siting power plants when these sites are not contaminated with hazardous materials or otherwise complicated by existing concerns. Contaminated site may provide a “win-win” situation if site clean-up can be accomplished while still providing a cost-effective site opportunity.

2.5.5 Prime Agricultural Land

The U.S. Department of Agriculture classifies prime farmland as land that holds prime agricultural soils for crop production. These farmlands are considered a valuable resource. Site studies should address the presence of prime farmland on the site and the effects of plant construction and operation on this farmland. Other farmlands, although not classified as “prime,” may also be important to consider during siting (e.g., highly productive irrigated lands or less productive fields that are necessary for local farms to survive). Generally, sites that use or negatively affect important agricultural land may be less desirable.

2.5.6 Recreational Areas

Recreational areas are public or private lands of interest and value, including parks, hunting grounds, and designated recreation lands. They could be displaced by a new plant or damaged by noise or aesthetic effects. Generally, sites that minimize effects on recreational areas, are near fewer recreational areas, and/or are near to less heavily used recreational areas are more desirable.

2.5.7 Landscapes

Landscape effects involve changes to individual landscape elements and characteristics, and the consequential effect on landscape character. This also includes the close in area of sea where there is shared inter-visibility between land and sea. The coastal landscape includes areas of significant heritage and scenic value and provides an important recreational resource. A visual assessment should be concerned with potential adverse effects of the power plant on views of the landscape through intrusion, obstruction or changing the content or focus of views.

Changes in landscape and seascape may have an adverse effect not just on tourism and recreational activities, but on the general public's opinion on the NPP's acceptance. Clearance of the site will affect existing landscape features and habitat. A substantial amount of construction could be involved, and it may have implications on views of the surrounding area. The construction work itself may be more visible from the surrounding area in the short term than the finished development. Tower cranes may be used to lift and position elements of the buildings into place and this clearly affects the landscape during construction.

There is a potential for night-time visual effect from the lighting associated with construction and operation.

Generally, sites with less scenic value are more desirable.

2.6 Local Economic Effects

2.6.1 Delivered Cost of Energy

Sometimes, the cost of siting and constructing a power plant is included in the electric rates charged to customers. If so, the cost should be evaluated to determine both the immediate and long-term effects on customer rates and the effect on competitiveness of business and industry. Generally, sites that provide a lower delivered cost of electrical power are more desirable.

2.6.2 Future Development Limitations

The construction of a plant at a particular site may create limitations on future development in the local area through its effect on land use, or through its consumption of local PSD air increments, water resources, of water discharge capacity. Generally, sites that impose fewer limitations on future development may be more desirable.

2.6.3 Jobs and Purchases

The economic effect of a plant includes the jobs and purchases associated with the construction and operation of a plant. A project may also help to keep existing industry jobs in the community. Generally, sites that generate or preserve more jobs in the local area may be more desirable.

2.6.4 Local Tax Effects

One of the economic benefits of a power plant is the effect on local taxation. A portion of the taxes paid by the plant to the state are distributed or paid to the local community, including the host municipality and the host county. On the other hand, community services required by the plant may cause local taxes to increase.

Generally, sites associated with no increases in local taxes for plant services may be more desirable. Also, sites where plant tax payments increase tax assistance or distributions to local communities may be more desirable.

2.6.5 Property Values

A potential concern of local property owners is the effect of a power plant on nearby property values. Local property value effects can be difficult to predict. An increase in well-paying jobs could increase property values, while an adverse effect on scenic or recreational land could decrease property values. Generally, sites that enhance property values or minimize the decrease in property values are more desirable.

2.6.6 Transmission and Distribution Changes

A new power plant requires transmission and distribution changes to connect the plant to the electrical transmission system. The potential for effects from those changes is also of interest to local communities and adjacent landowners. Economic effects of transmission and distribution changes, such as land use and right-of-way restrictions, should be identified. Generally, more desirable sites have fewer restrictions and effects associated with required transmission and distribution changes.

2.7 Use of the Siting Selection and Evaluation Criteria Checklist

The Table 2-1 SSEC checklist is intended to contain most if not all of the generic issues that may need to be addressed when evaluating a potential industrial construction site.

Column 1 of the table lists each of the generic issues. However, additional issues may be added on a State or local basis, and issues that are not applicable to the project should be deleted.

Column 2 provides the Plant Constraints/Limits, i.e., acceptance and rejection criteria for each issue. The plant owner and contractors must review, update and complete all of the Column 2 criteria. Column 2 should be completed prior to the investigating potential building sites.

Column 3 should be completed for each specific site, which is evaluated.

Table 2-1
Generic Site Selection and Evaluation Criteria Checklist

Variable	Plant Constraints/Limits [1]	Site Specific Value/Conclusion
1. Site Requirements		
1.1 Access:		
• Required roadway weight capacity	>	
• Required roadway width capacity	>	
• Required new (5 m/16 ft wide) roadway(s) (km/miles)	- Suitable, if ≤ __/__. - Avoid, if > __/__ and < __/__. - Exclude, if > __/__.	
• Distance to major roadway	< ___ km(___ mi) to road capable of transporting largest needed construction equipment and largest plant components	
• Required railway weight capacity	>	
• Required railway length capacity	>	
• Required railway width capacity	>	
• Distance to rail access	< 32 km (20 mi)	
1.2 Air quality		
1.3 Air space restrictions	Site > 13 km (8 mi) from nearest small airport, **and** > 16 km (10 mi) from nearest major airport.	
1.4 Buffering		
• Minimum distance to adjacent property	>	

[1] All values are typical, thus may change on a site-specific basis.

Table 2-1
Generic Site Selection and Evaluation Criteria Checklist

Variable	Plant Constraints/Limits [1]	Site Specific Value/Conclusion
• Wild/scenic river or shore	> 3.2 km (2 mi)	
• Acreage	>	
• Land Type	Vacant or roadway	
• Hospitals, Correctional facilities, schools	> 0.4 km (0.25 mi) from all points on the site perimeter	
1.5 Potential for Site Flooding		
• Floodplain, 100-yr	Exclude	
• History of flood-producing natural phenomena	Avoid if the site has a history of or reasonable potential for any of the following. • Past floods at the site location • Stream flooding • Tidal surges due to a hurricane, tropical storm or windstorm • Seiches and Tsunamis • Seismically and design/age induced dam failure • Landslide induced flooding • Ice formation in water bodies	
1.6 Fuel delivery for auxiliary power		
1.7 Geotechnical design parameters:		
• Seismic acceleration	< 2% chance in a 50-year return period of a ground acceleration > 0.3 g.	
• Distance to fault	Avoid faults > than 1000 feet and within 5 miles of the site. Minimum allowable distance to a fault, see Table 2-2.	

Table 2-1
Generic Site Selection and Evaluation Criteria Checklist

Variable	Plant Constraints/Limits [1]	Site Specific Value/Conclusion
• Distance to surface fault (tectonic surface deformation)	> 40 km (25 mi) suitable. < 40 km (25 mi) avoid.	
• Soil suitability		
○ Foundation material dry		
○ Saturated and natural densities		
○ Static modulus of elasticity		
○ Static Poisson's ratio		
○ Dynamic modulus velocity		
○ Dynamic Poisson's ratio		
○ Dynamic shear modulus,		
○ Foundation bearing capacity		
• Geologic hazards		
○ Volcanic activity	- Suitable, if none. - Avoid, if dormant. - Exclude, if active.	
○ Subsidence areas caused or to be by withdrawal of subsurface fluids	Avoid or exclude	
○ Potential unstable slope areas, including areas demonstrating paleo-landslide characteristics	Avoid or exclude	

Table 2-1
Generic Site Selection and Evaluation Criteria Checklist

Variable	Plant Constraints/Limits [1]	Site Specific Value/Conclusion
○ Areas of potential collapse (e.g., karstic areas in limestone, salt, or other soluble formations)	Avoid or exclude	
○ Mined areas	Avoid or exclude	
○ Areas subject to seismic and other induced water waves and floods	Avoid or exclude	
1.8 Land Purchase Difficulties		
1.9 Need for power		
1.10 Population density (after 5 yrs) averaged over any radial distance out to 20 miles.	< 193 people per km^2 (500 people per square mile), except if wastewater is to be used for cooling	
1.11 Site adaptability		
1.12 Site expandability	≤ __ NPP units per site	
1.13 Site geography:		
• Maximum allowable slope	- Suitable, if ≤ 9% (~5°). - Avoid, if > 9% and 12% (~7°). - Exclude, if > 12%.	
• Topographic features limits	Exclude land with a moderate or high landslide hazard susceptibility.	
• Minimum available source of aggregates	>	
1.14 Site size (for maximum planned number of NPP units):		
• Facility area	> ____/___ usable km^2/acres	
• Addition onsite area during construction	> ____/___ usable km^2/acres	

Table 2-1
Generic Site Selection and Evaluation Criteria Checklist

Variable	Plant Constraints/Limits [1]	Site Specific Value/Conclusion
• Total exclusion area	(see Buffering)	---
1.15 Solid waste management	Land fill capacity for the site > ___	
1.16 Transmission:		
• Existing grid available excess capacity (MWe)	- Suitable, if ≤ ____. - Avoid, if ____ to ____. - Exclude, if > ____.	
• Distance to existing grid (km/mi)	- Suitable, if ≤ ___/___. - Avoid, if ___/___ to ___/___. - Exclude, if > ___/___.	
• Minimum grid reliability	- Suitable, if ≤ ____. - Avoid, if ____ to ____. - Exclude, if > ____.	
• Acceptability of new transmission lines		
1.17 External Electric Load Requirements:		
• Maximum Design Load	Suitable, if _____ kW, and _____ kVAR are available	
• Load factor	Suitable, if _____ 8 hrs/day and _____ 365/yr are available	
• Maximum Projected Load (1-10 yrs)	Suitable, if _____ would be available	
• Power Factor	Suitable, if 0.9 (expected) would be available	
• Number of (independent) offsite power supplies	Suitable, if __ can be installed within __ years. Avoid, if __ can be installed within __ years. Exclude, if neither of the above conditions can be met.	
1.18 Water discharge	Nearby discharge capacity >	

Table 2-1
Generic Site Selection and Evaluation Criteria Checklist

Variable	Plant Constraints/Limits [1]	Site Specific Value/Conclusion
1.19 Water supply		
• Ambient water temperature (°C/°F)	Dry & wet bulb temperatures < 37.8/100 & 26.7/80	
• Water supply for per PEG unit	Nominal: > ___/___ m^3/gal per min > ___/___ m^3/gal per month Available during a 7-day, 10-year low period:[2] > ___/___ m^3/gal per min > ___/___ m^3/gal per month	
• % of an available stream flow (if applicable)	- Suitable, if ≤ 5%. - Avoid, if > 5% and ≤ 10%. - Exclude, if > 10%.	_____ % or NA
• Distance to water supply (km/miles)	- Suitable, if ≤ 8/5. - Avoid, if 8/5 to 32.2/20. - Exclude, if > 32.2/20.	
1.20 External Hazards	Potentially hazardous facilities, activities and transportation routes > 8 km (5 mi)	
2. Effects on Community		
2.1 Aesthetics		
• Scenic landscapes, rivers or shores	Sites that are hidden or limited in visibility are preferred.	
• Wild/scenic river or shore	> 3.2 km (2 mi) to nearest	
2.2 Archeology-historic sites	Suitable, if none. Avoid, if indirectly affected. Exclude, if directly affected.	
2.2.1 Native American tribal cultural resources	Suitable, if none. Avoid, if affected. Exclude, if adversely affected.	

[2] If stream/river water is to be used, these values may be based on USGS 7-day, 10-year flow data, if available.

Table 2-1
Generic Site Selection and Evaluation Criteria Checklist

Variable	Plant Constraints/Limits [1]	Site Specific Value/Conclusion
2.3 Costs to/of community services	- Suitable, if ≤ $_____. - Avoid, if > Suitable but < $_____. - Exclude, if > Avoid limit.	
2.4 Labor availability		
• Road construction	>	
• Building construction	>	
• Engineers	>	
• Electrical technicians	>	
• Plumbers	>	
• Fabricators	>	
• Machinists	>	
• Welders	>	
2.5 Worker relocation costs	- Suitable, if ≤ $_____. - Avoid, if > $_____ and < $_____. - Exclude, if > $_____.	
2.6 Public attitude		
2.7 Effects on wells	- Suitable, if no ground water is needed or > _____ m^3/min (_____ gpm) is readily available. - Avoid, if special consideration/permits are required. - Exclude, if supply < _____ m^3/min (_____ gpm).	

Table 2-1
Generic Site Selection and Evaluation Criteria Checklist

Variable	Plant Constraints/Limits [1]	Site Specific Value/Conclusion
3. Public Health & Safety Concerns		
3.1 Degradation of local air quality	Suitable, if NPP would be < attainment levels (i.e., an air quality standard is not challenged) and no sensitive population would be adversely affected. Avoid, if additional costs must be incurred to obtain an air quality related permit or ensure that no sensitive population would be adversely affected. Exclude, if Avoid criterion is not met.	
3.2 Dust		
3.3 Radioactive material limits	Exclude, if local radioactive material limits are more restrictive than State/Federal limits.	
3.4 Electric and magnetic fields		
3.5 Noise (construction/operating)	State limits (dBA) < 65* & 60**/55* & 50** * 10%/hr, ** 50%/hr	_____/_____
3.6 Traffic safety		
3.7 Water treatment		
4. Environments Effects		
4.1 Air quality	(Address with item 3.1.)	
4.2 Groundwater (GW) effects:		
• GW recharge		
• Plant discharges		
• GW quantity used		
• Discharge quality (chemical concentrations)		

Table 2-1
Generic Site Selection and Evaluation Criteria Checklist

Variable	Plant Constraints/Limits [1]	Site Specific Value/Conclusion
4.3 Species protection:		
• Commercial species	Avoid	
• Critically endangered and endangered	Exclude	
• Vulnerable and near threatened	Avoid	
• Habitat fragmentation	Exclude	
• Ecosystem disruption	Exclude	
• Migratory species	- Suitable, if no migratory species. - Avoid, if there is a high cost to not disrupt a migratory path. - Exclude, if there would be a disruption in migration path.	
4.4 Storm water runoff	Exclude erodible soils and steep slopes	
4.5 Waste minimization, recycling or reuse		
4.6 Wastewater treatment discharge		
4.7 Wetlands	Avoid or exclude	
4.8 Wildlife and natural lands		
4.9 Wildlife effects from operation		
5. Land Use Effects		
5.1 Industrial forests	Avoid	
5.2 Land acquisition		

Table 2-1
Generic Site Selection and Evaluation Criteria Checklist

Variable	Plant Constraints/Limits [1]	Site Specific Value/Conclusion
5.3 Land use compatibility	Active or vacant industrial lands, and/or zoned as industrial are preferred.	
5.4 Previous land use		
• Industrial, including existing/retired fossil power plants	- Suitable, if decontamination cost ≤ $_____. - Avoid, if decontamination cost > _____ and ≤ $_____. - Exclude, if decontamination cost > $_____.	
• Retired fossil (e.g., coal) power plants	- Suitable, if past plant output ≥ max from total NPPs. - Avoid, if past plant output < max from total NPPs, but site can be readily uprated. - Exclude, if past plant output < max from total NPPs, and high cost to uprate.	
• Existing zoning	- Heavy industry is preferred. - Re-zoning to heavy industry is realistically possible.	
5.5 Prime agricultural land	Avoid if re-zoning will be a major issue	
5.6 Recreational areas, including local, state and national parks, historic areas, and wildlife refuges	- Suitable, if a Rec. area will not be directly or indirectly be affected. - Avoid, if a Rec. area is > _____ miles from the site boundary, and the plant will not directly or indirectly affect the Rec. area. - Exclude, if a Rec. area will be directly affected or indirectly affected in an adverse manner.	

Table 2-1
Generic Site Selection and Evaluation Criteria Checklist

Variable	Plant Constraints/Limits [1]	Site Specific Value/Conclusion
5.7 Landscapes	- Suitable, if no/low scenic value. - Avoid, if there will be minimal effects of scenic views. - Exclude, if area has scenic significant heritage or value.	
6. Local Economic Effects		
6.1 Delivered costs of energy ($/KWh)	- Suitable, if cost ≤ $_____. - Avoid, if cost > $_____ and ≤ $_____. - Exclude, if > $_____.	
6.2 Future development limitations		
6.3 Jobs and purchases		
6.4 Local tax effects		
6.5 Property values	- Suitable, if property values increase, will not change, or existing trend of decreasing values will be minimized. - Avoid or exclude, if property values will directly be decreased by the plant.	
6.6 Transmission and distribution changes	- Suitable, if no/few effects. - Avoid, if there will be some adverse (but manageable) effects. - Exclude, if effects will be burdensome.	

Table 2-2
Fault Length vs. Distance from Fault Guideline Categories

Fault Length [1] (km/mi)	**Guideline Distance to Site Boundary** [1] (km/mi)		
	Suitable [2]	**Avoid** [2]	**Exclude** [2]
< 1.6/1	All	NA	NA
≥ 1.6/1 and < 8/5	> 32.3/20	1.6/1 to 32.2/20	< 1.6/1
≥ 8/5 and < 16.1/10	> 80/50	32.2/20 to 80/50	< 32.2/20
≥ 16.1/10 and < 32.2/20	> 161/100	80/50 to 161/100	< 80/50
≥ 32.2/20 and < 64.4/40	> 241/150	161/100 to 241/150	< 161/100
> 64.4/40	> 322/200	241/150 to 322/200	< 241/150

[1] Conservatively based on Table 1 in Appendix A of 10 CFR 100 (Reference 4).

[2] Guideline values, thus are not requirements.

3. OTHER SOURCES OF NUCLEAR POWER PLANT SITE SELECTION AND EVALUATION CRITERIA

The SSEC for selecting nuclear power plant (NPP) or other types of power plant sites are either directly applicable to a NPP site or bound the criteria for a NPP site. Therefore, different plant siting criteria are provided below. As judged to be appropriate, some of the following SSEC are incorporated into Section 2 and Table 2-1.

3.1 Large Nuclear Reactor Site Selection and Evaluation Criteria

A summary of the SSEC selected for large nuclear reactors siting (Reference 6) is provided below.

- Land with a population density greater than 500 people per square mile (including a 32 km /20 mile buffer) is excluded.
- Land with safe shutdown earthquake peak ground acceleration (2% chance in a 50-year return period) greater than 0.3g is excluded.
- Land too close to fault lines (length determines standoff distance) is excluded.
- Protected lands (e.g., national parks, historic areas, wildlife refuges) are excluded.
- Land with a slope greater than 12% (~7°) is excluded.
- Land with a moderate or high landslide hazard susceptibility is excluded.
- Wetlands and open water are excluded.
- Land that lies within a 100-year floodplain is excluded.
- Land areas that are more than 32 km (20 mi) from cooling water makeup sources with at least 757 m^3/min (200,000 gpm) are excluded for large reactor plant applications.
- Land located in proximity to hazardous facilities is avoided.

3.2 Small Modular Reactor Siting

3.2.1 Site Selection and Evaluation Criteria for a New Power Plant Site

Reference 6 provides a summary of the SSEC (shown below) for small modular reactors (SMRs) on new power plant sites.

- Land with a population density greater than 500 people per square mile (including a 32 km/ 20 mi buffer) is excluded.
- Land with safe shutdown earthquake peak ground acceleration (2% chance in a 50-year return period) of greater than 0.3 g is excluded.
- Land too close to fault lines (length determines standoff distance) is excluded.
- Protected lands (e.g., national parks, historic areas, wildlife refuges) are excluded.
- Land with a slope greater than 12% (~7°) is excluded.

- Land with a moderate or high landslide hazard susceptibility is excluded.
- Wetlands and open water are excluded.
- Land that lies within a 100-year floodplain is excluded.
- Land areas that are greater than 32.2 km (20 mi) from cooling water makeup sources with at least 189 m^3/min (50,000 gpm) are excluded for small reactor plant applications.
- Land located in proximity to hazardous facilities is avoided.

3.2.2 Site Selection and Evaluation Criteria on an Existing Coal Plant Site

Reference 8 provides a summary of the SSEC (shown below) for SMRs on existing coal power plant sites.

- Land with a population density greater than 500 people per square mile (including a 16.1 km/10 mi buffer) is excluded.
- Wetlands and open water are excluded.
- Protected lands (e.g., national parks, historic areas, wildlife refuges) are excluded.
- Land with moderate or high landslide hazard susceptibility is excluded.
- Land that lies within a 100-year floodplain is excluded.
- Land with a slope of greater than 18% (~10°) is excluded.
- Land areas that are more than 16.1 km (20 mi) from cooling water makeup sources with at least 246 m^3/min (65,000 gpm), based on a 540 MWe modular pressurized water reactor (PWR) installation, are excluded for nominal SMR plant applications.
- Land too close to fault lines is excluded (the length of the fault line determines the standoff distance).
- Land located in proximity to hazardous facilities (airports and oil refineries) is avoided.
- Land with safe-shutdown earthquake peak ground acceleration (2% chance in a 50-year return period) greater than 0.5 g is excluded.

4. REFERENCES

1. Public Service Commission of Wisconsin, "Common Power Plant Siting Criteria," September 1999.
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3. US Nuclear Regulatory Commission, Regulatory Guide 4.7, "General Site Suitability Criteria for Nuclear Power Stations," Revision 3, March 2014.
4. US Nuclear Regulatory Commission, US Code of Federal Regulations, 10 CFR 100, "Reactor Site Criteria," including Appendix A to Part 100—Seismic and Geologic Siting Criteria for Nuclear Power Plants."
5. International Atomic Energy Agency, IAEA Nuclear Energy Series, "Managing Siting Activities for Nuclear Power Plants," NG-T-3.7, June 2012.
6. Oak Ridge National Laboratory, "Application of Spatial Data Modeling and Geographical Information Systems (GIS) for Identification of Potential Siting Options for Various Electrical Generation Sources," ORNL/TM-2011/157/R1, May 2012.
7. Electric Power Research Institute, Technical Report, "Siting Guide: Site Selection and Evaluation Criteria for an Early Site Permit Application," 10066878, March 2002.
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9. Southern California Edison, "Method-of-Service Study" form, 2018 version.
10. State of California, "California Environmental Quality Act," Public Resources Code 21000-21189, and "Guidelines for Implementation of the California Environmental Quality Act," California Code of Regulations, Title 14, Division 6, Chapter 3, January 2016.
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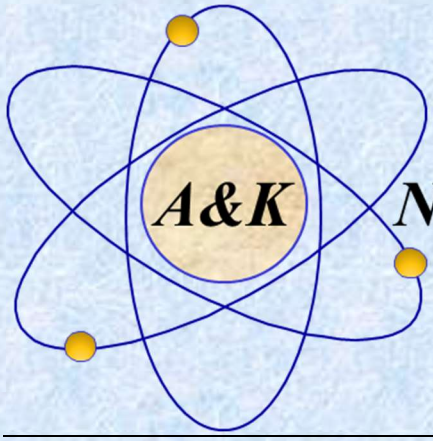

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