U.S. NUCLEAR REGULATORY COMMISSION

STANDARD REVIEW PLAN

2.1.3 POPULATION DISTRIBUTION

REVIEW RESPONSIBILITIES

Primary - Organization responsible for the review of population distribution

Secondary - Organization responsible for the review of emergency preparedness

I. AREAS OF REVIEW

Chapter 2 of the SRP discusses the site characteristics that could affect the safe design and siting of the plant. The staff reviews information presented by the applicant for a construction permit (CP), operating license (OL), design certification (DC), early site permit (ESP), or combined license (COL) concerning the population distribution in the site vicinity. This SRP section applies to reviews performed for each of these types of applications. The review covers the following specific areas:

1. Population Data: For CP, ESP and COL (not referencing an ESP) applications, the staff will review data about the population in the site vicinity, including transient populations. The population information reviewed includes data from the latest census, and the projected population at the year of plant approval and 5 years thereafter.

2. Exclusion Area: The staff will review information about the population in the exclusion area. Although the exclusion area should not contain any residents, if such residents do exist, they should be subject to ready removal, if necessary.

3. Low-Population Zone: The staff will review the specified low-population zone (LPZ) to determine if appropriate protective measures could be taken on behalf of the populace in that zone in the event of a serious accident.

4. Nearest Population Center Boundary: The staff will review the nearest boundary of the closest population center containing 25,000 or more residents to determine if this boundary is at least one and one-third times the distance from the reactor to the outer boundary of the LPZ.

5. Population Density: The staff will review the population density in the site vicinity to determine if it is consistent with the guidelines given in Regulatory Position C.4 of Regulatory Guide 4.7.

6. Additional Information for 10 CFR Part 52 Applications: Additional information will be presented dependent on the type of application. For a COL application, the additional information is dependent on whether the application references an ESP, a DC, both or neither. Information requirements are prescribed within the "Contents of Application" sections of the applicable Subparts to 10 CFR Part 52.

Review Interfaces

Other SRP sections interface with this section as follows:

1. The radiological consequences of a design-basis accident as it affects the outer boundaries of the exclusion zone and the LPZ are reviewed under SRP Chapter 15 are verified for proper consideration of those physical characteristics of the site and of the proposed plant that may influence effluent releases.

2. The physical characteristics of the LPZ are reviewed to determine whether there is reasonable assurance that appropriate protective measures can be taken in this area in the event of a radiological emergency under SRP Section 13.3.

3. For DC applications and COL applications referencing a DC rule or DC application, review of the site parameters in the Design Control Document (DCD) Tier 1 and Chapter 2 of the DCD Tier 2[1] submitted by the applicant is performed under SRP Section 2.0, "Site Characteristics and Site Parameters." Review of site characteristics and site-related design parameters in an ESP or in COL applications referencing an ESP is also performed under Section 2.0.

The specific acceptance criteria and review procedures are contained in the referenced SRP sections.

II. ACCEPTANCE CRITERIA

Requirements

Acceptance criteria are based on meeting the relevant requirements of the following Commission regulations:

1. 10 CFR 50.34(a)(1), as it relates to consideration of the site evaluation factors identified in 10 CFR 100.3, 10 CFR 100 (including consideration of population density), 10 CFR 52.17, and 10 CFR 52.79, as they relate to provision by the applicant in the safety analysis report (SAR) of the existing and projected future population profile of the area surrounding the site.

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[1] Additional supporting information of prior DC rules may be found in DCD Tier 2 Section 14.3.

2. 10 CFR 100.20 and 10 CFR 100.21, as they relate to determining the acceptability of a site for a power reactor for applications on or after January 10, 1997. In 10 CFR 100.3, 10 CFR 100.20(a)[2], and 10 CFR 100.21(b), the NRC provides definitions and other requirements for determining an exclusion area, LPZ, and population center distance.

SRP Acceptance Criteria

Specific SRP acceptance criteria acceptable to meet the relevant requirements of the NRC's regulations identified above are as follows for the review described in this SRP section. The SRP is not a substitute for the NRC's regulations, and compliance with it is not required. However, an applicant is required to identify differences between the design features, analytical techniques, and procedural measures proposed for its facility and the SRP acceptance criteria and evaluate how the proposed alternatives to the SRP acceptance criteria provide acceptable methods of compliance with the NRC regulations.

1. Population Data: The population data supplied by the applicant in the SAR is acceptable under the following conditions:

   A. The SAR contains population data from the latest census and projected population at the year of plant approval and 5 years thereafter, in the geographical format given in Section 2.1.3 of Regulatory Guide 1.70 and in accordance with DG-1145.

   B. The SAR describes the methodology and sources used to obtain the population data, including the projections.

   C. The SAR includes information on transient populations in the site vicinity.

2. Exclusion Area: The exclusion area should either not contain any residents, or such residents should be subject to ready removal if necessary.

3. Low-Population Zone: The specified LPZ is acceptable if it is determined that appropriate protective measures could be taken on behalf of the enclosed populace in the event of a serious accident.

4. Nearest Population Center Boundary: The nearest boundary of the closest population center containing 25,000 or more residents is at least one and one-third times the distance from the reactor to the outer boundary of the LPZ. The boundary of the population center should be determined based on considerations of population distribution. Political boundaries are not controlling.

5. Population Density: If the population density at the CP, ESP, or COL (not referencing ESP) stage exceeds the guidelines given in Regulatory Position C.4 of Regulatory Guide 4.7, the applicant must give special attention to the consideration of alternative sites with lower population densities. A site that exceeds the population density guidelines of Regulatory Position C.4 of Regulatory Guide 4.7 can nevertheless be selected and approved if, on balance, it offers advantages compared with available alternative sites when all of the environmental, safety, and economic aspects of the proposed and alternative sites are considered.

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[2] For applications before January 10, 1997 the requirements are identified in 10 CFR 100.10 and 10 CFR 100.11.

Technical Rationale

The technical rationale for application of these acceptance criteria to the areas of review addressed by this SRP section is discussed in the following paragraphs:

1. Compliance with 10 CFR 50.34(a)(1) and 10 CFR 52.17, and 10 CFR 52.79 requires, in part, that the applicant provide a site description and safety assessment in the SAR, with site characteristics that comply with 10 CFR Part 100.

   The requirements of 10 CFR 50.34(a)(1) and 10 CFR Part 52 apply to this SRP section because the site description and safety assessment in the applicant's SAR must contain information on the exclusion area, LPZ, and population center distance. This information is an integral part of determining the suitability of the site in terms of population distribution. Regulatory Positions C.3 and C.4 in Regulatory Guide 4.7, Regulatory Guide 1.70, and Section 2.1.3 of DG-1145 provide guidance acceptable to the staff for meeting these requirements.

   Meeting the requirements of 10 CFR 50.34(a)(1), 10 CFR 52.17, and 10 CFR 52.79 as they relate to the site evaluation factors identified in 10 CFR 100 provides assurance that, in the event of an accident, public safety will be protected in that (a) the populace in the exclusion area will be subject to ready removal; (b) appropriate protective measures can be taken on behalf of the populace enclosed in the LPZ; and (c) the population distribution in the LPZ and the nearest population center are within acceptable limits.

2. 10 CFR 100.20 and 10 CFR 100.21, for power reactor applications on or after January 10, 1997, requires that site acceptability will be determined on a basis that gives particular consideration to population density and the use characteristics of the site environs, including the exclusion area, LPZ, and population center distance.

   The requirements of 10 CFR 100.20(a)[2] and 10 CFR 100.21(a)[2] apply to this SRP section because the staff determines whether the exclusion area, LPZ, and population center distance for the site are such that members of the public living in these areas/zones can either be protected or safely evacuated in the unlikely event of a serious radiological accident. SRP Section 2.1.3, Regulatory Positions C.3 and C.4 of Regulatory Guide 4.7, Regulatory Guide 1.70, and Section 2.1.3 of DG-1145 provide guidance acceptable to the staff for meeting these requirements.

   Meeting the requirements of 10 CFR 50.34(a)(1), 10 CFR 100.20(a)[2], and 10 CFR 100.21(a) for respective power reactor applications provides assurance that members of the public living in the proximity of an operating reactor will not be subjected to excessive radiological doses in the unlikely event of a radiological emergency.

III. REVIEW PROCEDURES

The reviewer will select material from the procedures described below, as may be appropriate for a particular case.

The procedures outlined below are used to review CP applications, ESP applications, and COL applications that do not reference an ESP to determine whether data and analyses for the proposed site meet the acceptance criteria given in Subsection II of this SRP section. For reviews of OL applications, these procedures are used to verify that the data and analyses

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[2] For applications before January 10, 1997 the requirements are identified in 10 CFR 100.10 and 10 CFR 100.11.

remain valid and that the facility's design specifications are consistent with these data. As applicable, reviews of OLs and COLs include a determination on whether the content of technical specifications related to is acceptable and whether the technical specifications reflect consideration of any identified unique conditions.

These review procedures are based on the identified SRP acceptance criteria. For deviations from these acceptance criteria, the staff should review the applicant's evaluation of how the proposed alternatives provide an acceptable method of complying with the relevant NRC requirements identified in Subsection II.

1. Population Data: The staff should determine that the population data contained in the SAR is in the detail and in the format described in Regulatory Guide 1.70 and Section 2.1.3 of DG-1145. The staff should compare the current population data provided in the SAR with data from independent sources, such as data from the Census Bureau and local and State agencies. Any significant differences between the data provided in the SAR and the data obtained from independent sources should be noted.

   The staff should evaluate the methodology used to generate the population projections provided in the SAR. The population projections in the SAR should be compared with independent population projections, if such projections are available. The staff should note any significant underestimates of the projected population that require clarification.

2. Exclusion Area: Although the exclusion area will not normally contain any residents, if such residents do exist, they should be subject to removal if necessary in the event of an accident. The staff should evaluate the mechanism used to ensure the ready removal of the exclusion area residents, if necessary.

3. Low-Population Zone: The staff will verify that the SAR includes a map of the LPZ and a table of population distribution as described in Section 2.1.3.4 of Regulatory Guide 1.70. The current and projected population data for the LPZ should include transients (e.g., workers, occupants of schools, hospitals, recreational facilities, and others who do not permanently reside in the area).

   The branch responsible for the review of emergency management determines the acceptability of the LPZ with respect to the protective measures that could be taken on behalf of the population within the LPZ in the event of a radiological emergency. That branch should transmit a memorandum stating this finding to the primary branch for use in preparing the staff's safety evaluation report.

4. Nearest Population Center Boundary: The staff should verify that the distance to the nearest population center is at least one and one-third times the distance to the outer boundary of the LPZ, as required by 10 CFR Part 100. The reviewer should evaluate the bases used by the applicant to establish the boundary of the nearest population center. The population center boundary should be established at that point nearest the plant where, in the reviewer's judgment, the population density may grow to a value comparable to the density of the community itself. Population density is the controlling criterion, and the corporate boundary of the community is not limiting. Communities that are closer to the plant than the design population center should also be evaluated to determine the likelihood that their population will grow to greater than 25,000 people within the lifetime of the existing or proposed power plant. The reviewer should use available data on land use, land use controls such as zoning, and the potential for growth to determine the potential growth in population. In cases where the nearest population center is a very large city, a greater distance than the one and one-third factor may be required, and appropriate additional compensating engineered safeguards may be necessary. The staff will evaluate this on a case-by-case basis.

5. Population Density: The staff should evaluate the population density in the vicinity of the site to determine if it exceeds the guidelines given in Regulatory Position C.4 of Regulatory Guide 4.7. These guidelines state that the population density, including the weighted transient population, projected at the time of initial site approval and 5 years thereafter should not exceed 500 persons per 2.59 square kilometers (1 square mile), averaged over any radial distance out to 32.2 kilometers (20 miles) (i.e., cumulative population at a distance divided by the area at that distance).

   The staff should use the population and its distribution projected at the time of initial site approval and within 5 years thereafter to independently calculate the population density in persons per square kilometer (mile) as a function of distance from the plant out to 32.2 kilometers (20 miles). The results should be compared with the SAR plot of population density verus distance and any significant discrepancies should be noted.

   If the population density of the proposed site exceeds but is not well in excess of the above preferred value, the analysis of alternative sites should pay particular attention to alterative sites having lower population density. However, consideration could be given to other elements such as safety, environmental, or economic factors, which may result in the site with the higher population density being found acceptable. Examples of such factors include, but are not limited to, the higher population density site having superior seismic characteristics, better railroad or highway access, shorter transmission line requirements, or less environmental impact upon undeveloped areas, wetlands, or endangered species. The staff should evaluate projected changes in population within about 5 years after initial site approval for the proposed site and any alternative sites considered. Population growth after initial site approval will not be a factor in license renewal, or used to impose any license conditions or restrictions on an operating plant.

6. Review Procedures Specific to 10 CFR Part 52 Application Type

   A. Early Site Permit Reviews

      Subpart A to 10 CFR Part 52 specifies the requirements and procedures applicable to the Commission's review of an ESP application for approval of a proposed site. Information required in an ESP application includes a description of the site characteristics and design parameters of the proposed site. The scope and level of detail of review of data parallel that used for a CP review.

      In the absence of certain circumstances, such as a compliance or adequate protection issue, 10 CFR 52.39 precludes the staff from imposing new site characteristics, design parameters, or terms and conditions on the early site permit at the COL stage. Accordingly, the reviewer should ensure that all physical attributes of the site that could affect the design basis of SSCs important to safety are reflected in the site characteristics, design parameters, or terms and conditions of the early site permit.

   B. Standard Design Certification Reviews

      DC applications do not contain general descriptions of site characteristics because this information is site-specific and will be addressed by the COL applicant. Pursuant to 10 CFR 52.47(a)(1), a DC applicant must provide site parameters postulated for the design. However, the identification of population distribution is not applicable for this area of review.

   C. Combined License Reviews: For a COL application referencing a certified standard design, the staff reviews that application to ensure sufficient information was presented to demonstrate that the characteristics of the site fall within the site parameters specified in the DC rule. Since there are no site parameters included in the DC for this SRP section, this demonstration is not applicable here.

For a COL application referencing an ESP, NRC staff reviews the application to ensure the applicant provided sufficient information to demonstrate that the design of the facility falls within the site characteristics and design parameters specified in the early site permit as applicable to this SRP section. In accordance with 10 CFR 52.79(b)(2), should the design of the facility not fall within the site characteristics and design parameters, the application shall include a request for a variance from the ESP that complies with the requirements of 10 CFR 52.39 and 10 CFR 52.93.

In addition, long-term environmental changes and changes to the region resulting from human or natural causes may have introduced changes to the site characteristics that could be relevant to the design basis. In the absence of certain circumstances, such as a compliance or adequate protection issue, 10 CFR 52.39 precludes the staff from imposing new site characteristics, design parameters, or terms and conditions on the early site permit at the COL stage. Consequently, the staff's review of a COL application referencing an ESP should not include a re-investigation of the site characteristics that have previously been accepted in the referenced ESP. However, in accordance with 10 CFR 52.6, "Completeness and Accuracy of Information," the applicant or licensee is responsible for identifying changes of which it is aware, that would satisfy the criteria specified in 10 CFR 52.39. Information provided by the applicant in accordance with 10 CFR 52.6(b) will be addressed by the staff during the review of a COL application referencing an ESP or a DC.

For a COL application referencing either an ESP or DC or both, the staff should review the corresponding sections of the ESP and DC FSER to ensure that any early site permit conditions, restrictions to the DC, or COL action items identified in the FSERs are appropriately handled in the COL application.

IV. EVALUATION FINDINGS

The review should document the staff's evaluation of site characteristics with respect to the relevant regulatory criteria. The evaluation should support the staff's conclusions as to whether the regulations are met. The reviewer should state what was done to evaluate the applicant's safety analysis report. The staff's evaluation may include verification that the applicant followed applicable regulatory guidance, performance of independent calculations, and/or validation of appropriate assumptions. The reviewer may state that certain information provided by the applicant was not considered essential to the staff's review and was not reviewed by the staff. While the reviewer may summarize or quote the information offered by the applicant in support of its application, the reviewer should clearly articulate the bases for the staff's conclusions.

The reviewer verifies that the applicant has provided sufficient information and that the review and calculations (if applicable) support conclusions of the following type to be included in the staff's safety evaluation report. The reviewer also states the bases for those conclusions.

1. Construction Permit and Combined License Reviews

The following statements should be preceded by a summary of the site characteristics and parameters used for the plant:

> As set forth above, the applicant has provided an acceptable description of current and projected population densities in and around the site. The staff has reviewed the information provided and, for the reasons given above, concludes that the population data provided is acceptable to meet the requirements of

10 CFR 50.34(a)(1), 10 CFR 52.79(a)(1), 10 CFR 100.20(a)[2], 10 CFR 100.20(b)[2], 10 CFR Part 100, and 10 CFR 100.3 with respect to determining the acceptability of the site for CPs and COLs. This conclusion is based on the applicant having provided an acceptable description and safety assessment of the site, which contains present and projected population densities that are within the guidelines of Regulatory Position C.4 of Regulatory Guide 4.7, and properly specified the low-population zone and population center distance. In addition, the staff has reviewed and confirmed, by comparison with independently obtained population data, the applicant's estimates of the present and projected populations surrounding the site, including transients. The applicant also has calculated the radiological consequences of design-basis accidents at the outer boundary of the low-population zone (SRP Chapter 15) and has provided reasonable assurance that appropriate protective measures can be taken within the low-population zone to protect the population in the event of a radiological emergency.

2. Early Site Permit Reviews

The following statements should be preceded by a summary of the site characteristics and design parameters to be included in any ESP that might be issued for the ESP site:

As set forth above, the applicant has provided an acceptable description of current and projected population densities in and around the site. The staff has reviewed the information provided and, for the reasons given above, concludes that the applicant has provided population data acceptable to meet the requirements of 10 CFR 50.34(a)(1), 10 CFR 52.17(vii), 10 CFR 100.20(a)[2], 10 CFR 100.20(b), 10 CFR Part 100, and 10 CFR 100.3. This conclusion is based on the applicant having provided an acceptable description and safety assessment of the site, which contains present and projected population densities that are within the guidelines of Regulatory Position C.4 of Regulatory Guide 4.7, and properly specified the low-population zone and population center distance. In addition, the staff has reviewed and confirmed, by comparison with independently obtained population data, the applicant's estimates of the present and projected populations surrounding the site, including transients. The applicant also has calculated the radiological consequences of design-basis accidents at the outer boundary of the low-population zone (SRP Chapter 15) and has provided reasonable assurance that appropriate protective measures can be taken within the low-population zone to protect the population in the event of a radiological emergency.

3. Design Certification Reviews

The population distribution is site-specific and will be addressed by the COL applicant.

V. IMPLEMENTATION

The staff will use this SRP section in performing safety evaluations of DC applications and license applications submitted by applicants pursuant to 10 CFR Part 50 or 10 CFR Part 52. Except when the applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the staff will use the method described herein to evaluate conformance with Commission regulations.

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[2] For applications before January 10, 1997 the requirements are identified in 10 CFR 100.10 and 10 CFR 100.11.

The provisions of this SRP section apply to reviews of applications submitted six months or more after the date of issuance of this SRP section, unless superseded by a later revision.

VI. REFERENCES

1. 10 CFR Part 50, “Domestic Licensing of Production and Utilization Facilities.”

2. 10 CFR Part 52, “Early Site Permits; Standard Design Certifications; and Combined Licenses for Nuclear Power Plants.”

3. 10 CFR Part 100, “Reactor Site Criteria.”

4. Regulatory Guide 1.206, “Combined License Applications for Nuclear Power Plants (LWR Edition).”

5. Regulatory Guide 1.70, “Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants.”

6. Regulatory Guide 4.7, “General Site Suitability for Nuclear Power Stations.”