



U.S. NUCLEAR REGULATORY COMMISSION  
**STANDARD REVIEW PLAN**  
OFFICE OF NUCLEAR REACTOR REGULATION

2.1.3 POPULATION DISTRIBUTION

REVIEW RESPONSIBILITIES

Primary - Siting Analysis Branch (SAB)

Secondary - Emergency Preparedness Licensing Branch (EPLB)

I. AREAS OF REVIEW

The SAB reviews the population data in the site environs as presented in the applicant's SAR, to determine whether the exclusion area, low population zone and population center distance for the site comply with the requirements of 10 CFR Part 100, and (at the CP stage) to determine whether the population density is such, as given in Position C.3 of Regulatory Guide 4.7, that consideration should be given by the applicant to alternate sites with lower population density.

A secondary review is performed by EPLB and the written results are used by SAB to complete the overall evaluation of the facility.

The EPLB reviews the low population zone (LPZ), to determine whether there is reasonable assurance that appropriate protective measures can be taken in this area, in the event of emergency. The results of the analysis are transmitted to SAB for inclusion in the safety evaluation report.

II. ACCEPTANCE CRITERIA

SAB acceptance criteria are based on meeting the relevant requirements of the following regulations:

1. 10 CFR Part 50, §50.34 as it relates to having each applicant provide a description and safety assessment of the site in his SAR, with special attention to the site evaluation factors identified in 10 CFR Part 100.
2. 10 CFR Part 100, §100.10 as it relates to determining the acceptability of a site for a power or testing reactor. The staff will take the following item, among others, into consideration:

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USNRC STANDARD REVIEW PLAN

Standard review plans are prepared for the guidance of the Office of Nuclear Reactor Regulation staff responsible for the review of applications to construct and operate nuclear power plants. These documents are made available to the public as part of the Commission's policy to inform the nuclear industry and the general public of regulatory procedures and policies. Standard review plans are not substitutes for regulatory guides or the Commission's regulations and compliance with them is not required. The standard review plan sections are keyed to the Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants. Not all sections of the Standard Format have a corresponding review plan.

Published standard review plans will be revised periodically, as appropriate, to accommodate comments and to reflect new information and experience.

Comments and suggestions for improvement will be considered and should be sent to the U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Washington, D.C. 20555.

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Population density and use characteristics of the site environs, including the exclusion area, low population zone, and population center distance.

10 CFR Part 100 also provides definitions and other requirements for determining an exclusion area, low population zone, and population center distance in Sections 100.3 and 100.11, respectively.

The requirements of 10 CFR Part 50, §50.34 and 10 CFR Part 100 are deemed to have been met if the population density and use characteristics of the site meet the following:

1. Either there are no residents in the exclusion area, or if so, such residents are subject to ready removal, in case of necessity.
2. The specified low population zone is acceptable if it is determined that appropriate protective measures could be taken in behalf of the enclosed populace in the event of a serious accident.
3. The nearest boundary of the closest population center (as defined in 10 CFR Part 100) is at least one and one third times the distance from the reactor to the outer boundary of the low population zone.
4. The population center distance is acceptable if there are no likely concentrations of greater than 25,000 people over the plant lifetime closer than the distance designated by the applicant as the population center distance. The boundary of the population center shall be determined upon considerations of population distribution. Political boundaries are not controlling.
5. The population data supplied by the applicant in his SAR is acceptable if (a) it contains population data for the latest census, projected year of plant startup and projected year of end of plant life, all in the geographical format given in Section 2.1.3 of Reference 3, (b) it describes the methodology and sources used to obtain the population data, including the projections, (c) it includes information on transient populations in the site vicinity, and (d) the population data in the site vicinity, including projections, is verified by other means such as U.S. Census publications, publications from state and local governments, and other independent projections, to be reasonable.
6. If the population density at the CP stage exceeds the guidelines given in Position C.3 of Regulatory Guide 4.7, "General Site Suitability Criteria for Nuclear Power Stations" (Ref. 4), the applicant will be required to give special attention to the consideration of alternative sites with lower population densities. A site that exceeds the population density guidelines of Position C.3 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.

### III. REVIEW PROCEDURES

Selection and emphasis of various aspects of the areas covered by this SRP section will be made by the reviewer on each case. The judgment on the areas to be given attention during the review is to be based on an inspection of the material presented, the similarity of the material to that recently reviewed on other plants, and whether items of special safety significance are involved.

Determine that the population data contained in the SAR is in the detail and in the format described in Reference 3, Section 2.1.3.

Compare the SAR present population data against whatever independent population data is available (e.g., Census Bureau CED tapes, special census which may have been conducted, local and state agencies, Councils of Government, etc). Note any significant differences which require clarification.

Compare the SAR population projections against whatever independent population projections are available (e.g., local and state agencies and Councils of Government, Census Bureau projections, Bureau of Economic Analysis, etc). Note any significant underestimates in the SAR which require clarification.

At the construction permit stage, use the population and its distribution, including weighted transients, projected to the year of plant startup and projected over the lifetime of the plant, to determine the population density in persons per square mile as a function of distance from the plant out to 30 miles. Compare results to the SAR plot of population density vs distance (Reference 3, Section 2.1.3.6). If the population density, including weighted transient population, projected at the time of initial operation exceeds 500 persons per square mile averaged over any radial distance out to 30 miles (cumulative population at a distance divided by the area at that distance), or the projected population density over the lifetime of the facility exceeds 1,000 persons per square mile averaged over any radial distance out to 30 miles, a memorandum should be prepared advising appropriate staff personnel that an evaluation of alternative sites having lower population densities will be required.

Determine that the SAR includes a map of the low population zone and a table of population distribution which includes transients (Reference 3, Section 2.1.3.4). Determine the method used by the applicant to establish the boundary of the nearest population center (Reference 3, Section 2.1.3.5). Evaluate communities which are closer to the plant than the design population center to determine the likelihood that any of them can be projected to 25,000 people within the plant lifetime. Compare the distance to the boundary of the population center to the distance to the outer boundary of the low population zone and establish that the population center distance is at least one and one-third times the low population zone distance as required by 10 CFR Part 100.

Population and population density data of specific towns and cities within the low population zone can be checked against population data as contained in the Department of Commerce publication, "1970 Census of Population - Characteristics of the Population," or other Census Bureau publications.

Determine that the current and projected population data for the LPZ includes transients (e.g., workers, occupants of schools, hospitals, etc., recreational facilities).

The EPLB determines the acceptability of the LPZ with respect to the necessary finding that there is reasonable assurance that appropriate protective measures could be taken in behalf of the people within the LPZ in the event of a radiological emergency. [10 CFR Part 100, Section 100.3(b)]

A memorandum stating this finding should be transmitted to SAB for use in preparing the staff's safety evaluation report.

Determine that the nearest boundary of the closest population center is at least one and one-third times the distance to the outer boundary of the low population zone. Evaluate the characteristics of the land area between the plant and the nearest population grouping which has, or is projected to have during plant lifetime, a population of about 25,000. Use whatever data is available on land use, land use controls such as zoning, potential for growth, or factors which are likely to limit growth between the population grouping and the plant to determine the potential growth in population density toward the site. The population center boundary should be established at that point nearest the plant where, in the reviewers judgment, the population density may grow to a value comparable to the density of the community itself. Population density is the controlling criteria, and in this regard, the corporate boundary of the community itself is not limiting. The detail to which this aspect of the site is reviewed will depend on the distance of the nearest probable population center relative to the distance to the outer boundary of the low population zone. (See References 5 and 6.) Where a very large city is involved, a greater distance than the one and one-third factor may be required, and appropriate additional compensating engineered safeguards may be required. These will be evaluated on a case-by-case basis, and where appropriate, a memorandum should be prepared by SAB providing any recommendations.

Results of the review under this SRP section should be forwarded to the Division of Licensing, Assistant Director for Operating Reactors whenever the site contains a previously licensed and operating nuclear unit.

#### IV. EVALUATION FINDINGS

The reviewer verifies that sufficient information has been provided, and that his evaluation is sufficiently complete and adequate to support conclusions of the following type, to be included in the staff SER:

The staff concludes that the population data provided is acceptable and meets the requirements of 10 CFR Part 50, §50.34, and 10 CFR Part 100. 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 which, at the CP stage, are within the guidelines of Position C.3 of Regulatory Guide 4.7 and has 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 Emergency Preparedness Licensing Branch shall determine that:

The applicant also has calculated the radiological consequences of design basis accidents at the outer boundary of the low population zone (Section 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.

#### V. IMPLEMENTATION

The following is intended to provide guidance to applicants and licensees regarding the NRC staff's plans for using this SRP section.

Except in those cases in which the applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the method described herein will be used by the staff in its evaluation of conformance with Commission regulations.

Implementation schedules for conformance to parts of the method discussed herein are contained in the referenced regulatory guides and NUREGs.

V. REFERENCES

1. 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities."
2. 10 CFR Part 100, "Reactor Site Criteria."
3. Regulatory Guide 1.70, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants."
4. Regulatory Guide 4.7, "General Site Suitability for Nuclear Power Stations."
5. NUREG-0308 Safety Evaluation Report, Arkansas Nuclear One, Unit 2. November 1977 and supplements.
6. NUREG-75/054 Safety Evaluation Report, Pilgrim Nuclear Generating Station, Unit 2. June 1975 and supplements.