



January 26, 1994

**RULEMAKING ISSUE**  
(Notation Vote)

SECY-94-017

**FOR:** The Commissioners

**FROM:** James M. Taylor  
Executive Director for Operations

**SUBJECT:** OPTIONS WITH REGARD TO REVISING 10 CFR  
PART 100, REACTOR SITE CRITERIA

**PURPOSE:**

To provide the information requested by the Commission in the staff requirements memorandum (SRM) dated August 12, 1993, and to discuss options with regard to revising 10 CFR Part 100, Reactor Site Criteria and Appendix A, Seismic and Geologic Siting Criteria for Nuclear Power Plants.

**SUMMARY:**

This paper encloses responses to the request for information by the Commission in its SRM of August 12, 1993, and presents and discusses a number of options with regard to revising site criteria for future reactors. Three recommendations are provided: (1) that the non-seismic provisions of the proposed revision of 10 CFR Part 100, issued for comment on October 20, 1992, be withdrawn; (2) that Part 50 be revised to use updated source term and dose calculations for evaluating plant design, and that Part 100 be revised to emphasize siting aspects by including basic site criteria including a requirement that reactors be located "away from" densely populated centers (without specifying numerical criteria); and (3) that the proposed revision of Part 100 regarding the seismic provisions be streamlined and be permitted to continue through the NRC regulatory review process. An analysis of the public comments received on the proposed revisions is also enclosed.

**NOTE:** TO BE MADE PUBLICLY AVAILABLE  
WHEN THE FINAL SRM IS MADE  
AVAILABLE

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BACKGROUND:

On April 12, 1962, the Atomic Energy Commission (AEC) issued 10 CFR Part 100, "Reactor Site Criteria" (27 FR 3509). Except for certain revisions to the geosciences provisions, Part 100 has remained essentially unchanged. In the statement of considerations accompanying the rule, the Commission noted that these:

... are intended to reflect past practice and current policy of the Commission of keeping stationary power and test reactors away from densely populated centers.

From 1962 to the mid-1970s, as construction permit applications were under review, it became clear that except for guidance on the nearest population center, Part 100 provided no effective guidance on siting nuclear power plants near major metropolitan centers. With the issuance of Regulatory Guide 4.7 in 1975, the staff defined numerical values to be used in its review.

In August 1978, the Commission directed the staff to develop a general policy statement on nuclear power reactor siting. The major recommendation of that effort, "Report of the Siting Policy Task Force," NUREG-0625, was that siting criteria should be developed:

to strengthen siting as a factor in defense-in-depth by establishing requirements for site approval that are independent of plant design consideration. The present policy of permitting plant design features to compensate for unfavorable site characteristics has resulted in improved designs but has tended to deemphasize site isolation.

In the October 30, 1979, "Report of the President's Commission on the Accident at Three Mile Island" or the Kemeny Report, the Kemeny Commission recommended unanimously that:

In order to provide an added contribution to safety, the agency [NRC] should be required, to the maximum extent feasible, to locate new power plants in areas remote from concentrations of population. Siting determinations should be based on technical assessments of various classes of accidents that can take place, including those involving releases of low doses of radiation.

The Congress, in NRC's 1980 Authorization Act, PL 96-295, enacted on June 30, 1980, also stated that:

... the Nuclear Regulatory Commission is authorized and directed to use such sums [authorized by that Act] as may be necessary to develop and promulgate regulations establishing demographic requirements for the siting of utilization facilities.

The 1980 Authorization Act also included details about what such regulations should include.

Subsequently, on July 29, 1980, the NRC issued an advance notice of proposed rulemaking (ANPRM) (45 FR 50350) regarding the revision of reactor siting criteria that focussed on the non-seismic provisions of the rule; separately, the NRC issued an ANPRM on seismic issues (43 FR 2729) on January 19, 1978. The non-seismic ANPRM highlighted the following issues that are still relevant today:

- the practice to tradeoff unfavorable site characteristics by enhancing design safety features;
- the importance for continued improvement in reactor designs to reduce risk to the public as a complement to site isolation;
- the de-emphasis of site isolation as an independent safety feature by relying on dose assessment as the dominant measure of site suitability;
- the interrelationship between site safety reviews and alternative site environmental considerations under the National Environmental Policy Act (NEPA) before a site is acceptable; and
- the national and international perspectives regarding NRC siting criteria.

In December 1981, the Commission deferred the proposed rulemaking to await development of the Safety Goals and the resolution of research on accident source terms<sup>1</sup>. On August 4, 1986, the Policy Statement on Safety Goals was issued (51 FR 23044).

In SECY-90-341, "Staff Study on Source Term Update and Decoupling Siting From Design," dated October 4, 1990, the staff proposed that reactor siting be decoupled from plant design. As noted in that report:

Decoupling light water reactor (LWR) siting from plant design was suggested by the staff because of the potential benefits which could be realized by such an approach. Specifically, decoupling would replace existing siting dose calculation requirements (which traditionally have affected plant design more than siting) with explicit requirements more directly related to acceptable site characteristics. This would be accomplished by a significant change to 10 CFR 100 and its related guidance documents. A corresponding change to 10 CFR 50 would be required to regulate aspects of plant design now controlled by siting dose calculation requirements.

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<sup>1</sup> The legal delegation to issue new siting regulations was tied to the NRC use of FY-1980 funds and expired as a legal matter at the end of FY 1980.

In SECY-92-215, "Revision of 10 CFR Part 100, Revisions to 10 CFR Part 50, New Appendix B to 10 CFR Part 100 and New Appendix S to 10 CFR Part 50," the staff presented a proposed rule to revise Part 100 and outlined in detail the historical perspective and rationale for the proposed change to reactor siting criteria. The proposed rule change combined two separate initiatives dealing with non-seismic and seismic issues. The proposed rule was published for comment on October 20, 1992 (57 FR 47802), and the comment period, extended twice, expired on June 1, 1993.

Extensive comments, both domestic and international, were received. During the August 3, 1993, periodic briefing on the status of the new source term and related issues, the staff briefed the Commission on the status of the proposed rule and nature of the comments received. In an SRM dated August 12, 1993, the Commission raised several concerns regarding the prescriptive aspects of the proposed revisions to Part 100 as well as the form and content of the proposed rule issued for comment. The Commission identified nine issues and requested that any further staff considerations for proposed revisions to Part 100 and the proposed update of the source term address the specific issues. The staff provides a detailed response to each issue of the SRM in Enclosure 1. The staff considered these issues in developing the options for revising 10 CFR Part 100 which follow. Summaries and preliminary analyses of the public comments received regarding the non-seismic and seismic aspects are attached in Enclosures 2 and 3, respectively.

#### DISCUSSION:

As discussed above, the non-seismic provisions of NRC's site criteria have remained essentially unchanged since issuance in 1962. A number of groups have examined NRC's reactor siting policy, and have recommended changes to strengthen siting. These have included a staff effort (Siting Policy Task Force) in 1979, the Kemeny Commission investigating the accident at Three Mile Island that same year, and the Congress, in NRC's 1980 authorization act.

In response, the NRC issued advance notices of proposed rulemaking (ANPRM) in 1978 and 1980 regarding revision of the seismic and non-seismic criteria, respectively, but deferred the proposed rulemaking in 1981 to await development of the Safety Goals and resolution of research on accident source terms. In SECY-90-341, the staff proposed that reactor siting be decoupled from design, and in SECY-92-215, the staff presented a proposed rule to revise both seismic and non-seismic provisions of Part 100. The proposed rule was published for comment on October 20, 1992, and the comment period expired on June 1, 1993.

The extensive comments received have required the staff to re-examine its thinking in regard to the proposed rule. The staff continues to believe that NRC's site criteria should be clarified to reflect actual NRC policy with regard to siting reactors near major metropolitan centers.

A number of options in regard to revising Part 100 are examined in the discussion below. The staff recommends one that it believes will carry out the fundamental recommendation made by others in regard to improving reactor siting, while also reflecting the comments received on the proposed rule.

Proposed Rule Change:

Part 100 provides reactor siting criteria for protecting public health and safety. The present rule closely couples the reactor design and the site through the use of source term and dose calculations. The purposes for the current rulemaking effort are:

- to incorporate experience, research and technological advancements in areas covered by the existing regulations, including the significant advances in geoscience methods that have evolved since the mid-1970s;
- to allow consideration of severe accident research insights in the design of next-generation plants separately from site acceptability issues (decoupling); and
- to strengthen siting of future reactors as part of the NRC's defense-in-depth, as recommended by independent groups such as the Kemeny Commission.

The discussion that follows briefly notes the staff's current licensing activities under Part 52, particularly the design certification process, and the relationship of these activities to reactor siting. The relationship of site safety issues considered in Part 100 compared with site environmental issues considered in Part 51 is next discussed. A discussion of several options, both non-seismic and seismic, with regard to the revision of Part 100 concludes the paper.

Relationship to Current Licensing Activities Under Part 52

Although a revision to Part 100 is not required to implement the licensing process in Part 52, several options discussed later will be more in line with the Part 52 process. The design certification portion of Part 52 permits resolution of plant design issues separately from siting, while the early site permit portion permits resolution of siting issues separately from plant design. A combined license applicant may reference either certified designs or early site permits or both.

A design certification (DC) applicant must propose criteria for a variety of bounding site parameters used in the standard design. This includes design basis tornado wind loads, seismic loads, flooding, as well as bounding site parameters for adverse atmospheric relative dilution conditions ( $\chi/Q$ ). The bounding site atmospheric dilution parameters must be chosen so that the radiological consequences of postulated design basis accidents will meet the dose values of Part 100. DC applicants are not required to use the TID-14844 source term and may use an updated source term, provided that it is approved by the staff. No specific distance is set for the exclusion area boundary in the design certification review; rather it will be determined at the combined license stage when the actual site atmospheric dilution data is reconciled with the proposed bounding site parameters. Therefore, designs are certified based upon postulated site parameters rather than specific site reviews. At

the combined license stage, an applicant would demonstrate that the postulated site parameters envelop the actual site characteristics.

Similarly, an early site permit (ESP) applicant would postulate bounding plant design parameters to assess potential consequences and environmental impacts from the construction and operation of the plant. ESP applicants propose plant design features and operating characteristics for water use, thermal and radiological effluents, etc. for the plant. Additionally, requirements for the assessment of habitats, and physical and land use characteristics in the preferred and alternative site vicinities are needed to complete the environmental, site safety, and emergency preparedness reviews. The bounding design parameters would establish part of the bases for issuing an early site permit. A combined license applicant would need to demonstrate that the actual design falls within the bounding parameters assumed in the early site permit.

### Relationship to Environmental Issues Under Part 51

In addition to public health and safety issues which must be considered under the Atomic Energy Act, the NRC must also consider environmental protection issues under the National Environmental Policy Act (NEPA). The regulations for environmental protection are contained in Part 51. The fundamental requirement of NEPA is to consider the alternatives before taking a major Federal action. For reactor siting, this requires consideration of alternative sites based upon consideration of severe accident consequences to the population surrounding the proposed site and alternative sites, as well as of environmental effects of constructing and operating a plant on the proposed site and alternative sites.

Currently, the Commission uses a two-stage decision standard to assure that adequate consideration has been given to alternative sites for nuclear power plants. The first part of this standard requires that the applicant submit a slate of alternative sites which are "among the best that could reasonably be found" inside a region in which it is reasonable to construct a plant to meet the projected need for power. The second part of the standard requires that the proposed site be approved only if no obviously superior alternative site has been identified.

Consequently, an applicant satisfying the safety criteria of Part 100 is not guaranteed issuance of a construction permit, and must also demonstrate under Part 51 that there is no obviously superior site.

### Options with Regard to the Part 100 Rule Change

In this paper, the seismic provisions of the proposed rule are discussed separately from the non-seismic provisions. One option for each area would need to be pursued; they do not depend on each other to proceed.

### Non-Seismic Provisions

The staff has examined a number of options in regard to the non-seismic provisions of Part 100 and has evaluated them considering the factors provided

in the Commission's SRM. Based on the highly prescriptive form of the proposed rule, together with the large number of adverse comments received, the staff no longer recommends this approach. Hence, the staff recommends that the non-seismic portion of the proposed Part 100 rule be withdrawn. In its stead, the staff believes that Option 4, discussed below, would permit implementing recent severe accident research insights towards plant design, and by stating basic reactor siting criteria in the rule, would provide a performance based standard for reactor siting that would provide a rational and understandable basis for siting to the public, provide clear guidance to the industry, and would not be incompatible with the needs and conditions of the international community. For these reasons, the staff recommends Option 4. Several alternative options are also discussed.

**Option 1. Withdraw the proposed rule change. Retain present rule.**

This option would withdraw the proposed rule issued for comment on October 20, 1992 and would retain the present rule and regulatory guidance (i.e., continued use of TID-14844 and Regulatory Guide 4.7). The arguments favoring this option are that it is (1) familiar, and (2) provides flexibility to accommodate different designs. Retention of this option could also accommodate concerns of potential users in other countries, primarily because no numerical criteria for exclusion area size or population density appear in the rule itself.

There are a number of major arguments against this option, however. These are (1) it references an outmoded source term, inconsistent with recent severe accident research and inconsistent with that being implemented for advanced plants, (2) it utilizes an approach to seismic considerations that is out of date, and (3) it is not truly a siting regulation in that it continues to allow unlimited plant design and siting tradeoffs that are in fact discouraged by Standardization Policy, does not include items such as security within the scope of siting criteria (see Enclosure 6), and does not address the recommendations of such groups as the Kemeny Commission.

**Option 2. Issue the proposed rule with numerical criteria for the EAB and population density.**

This option would issue the rule issued for comment on October 20, 1992 as a final rule. This rule would specify a minimum distance to the exclusion area boundary of 0.4 miles and would specify population density values in the regulation. Source term and dose calculations would be relocated to Part 50 to be used in design of plant systems, including mitigation systems, control room habitability and equipment qualification.

The major argument favoring this option is that some administrative hearing litigation of site related issues would be significantly reduced and regulatory predictability somewhat enhanced once the rule were issued.

The major argument against this option is that it is highly prescriptive and rigid and has raised strong objections across a broad spectrum including the industry, environmental and public interest groups, and the international community.

**Option 3. Specify a minimum EAB distance (e.g., 0.25 miles) in the rule. Specify population density in a regulatory guide.**

This option would eliminate use of source terms and dose calculations in the determination of exclusion area distance, as in the proposed rule, and would specify an alternate value (0.25 miles rather than 0.4 miles) that is more in keeping with revised source term insights together with a realistic evaluation of engineered safety features. Population density values would not be in the rule, but would be stated in Regulatory Guide 4.7. Dose calculations would be relocated to Part 50 for plant design purposes, as in the proposed rule.

The arguments in favor of this option are that (1) it would provide a better technical basis for exclusion area size since it would be based upon a more realistic understanding of source terms and fission product removal systems, (2) it would reduce litigation and enhance regulatory stability, once adopted, and (3) it would lower, although not eliminate, concerns of potential users in other countries.

The arguments against this option are that it would eliminate flexibility for different reactor designs, and that some international concerns would remain since a numerical value for the minimum exclusion area distance would be stated in the rule.

**Option 4. Relocate dose calculations to Part 50. State basic site criteria in Part 100, with numerical values to be provided in regulatory guide(s).**

This option would relocate source term and dose calculations from Part 100 to Part 50 to more clearly demonstrate their role in affecting plant design rather than in determining site acceptability. This option would also revise Part 100 to strengthen reactor siting by stating basic site criteria (Enclosure 6) in Part 100. One of these criteria would require that nuclear power plants be sited "away from" densely populated centers as part of the NRC's defense-in-depth philosophy. However, numerical values for exclusion area size and population density would be contained in regulatory guides. This option would also delete reference to the TID-14844 source term and would be compatible with use of an updated source term. This option would likely require consideration of the impact of revised accident timing and additional nuclides other than iodine and the noble gases, and would also entail revising Regulatory Guides 1.3 and 1.4, or development of additional guides.

The arguments favoring this option are that it (1) retains the use of source term and dose calculations, which is familiar and which communicates an important risk parameter of reactor licensing, but clarifies that these play a more important role in plant design rather than siting, (2) provides flexibility to accommodate different designs, (3) would utilize updated accident source terms, (4) incorporates the advances made in the geosciences, and (5) would strengthen the role of siting, in accordance with recommendations by groups such as the Kemeny Commission. Because numerical criteria would not be in the rule, this option is also compatible with the needs and conditions of the international community.



The argument against this option is that there would be some decrease in predictability since there would be an increase in administrative hearing litigation until there is sufficient experience with the use of terminology such as "away from" and "densely." However, this difficulty should be no greater than the difficulty of administrative hearing litigation over severe accidents in the NEPA alternative site review. In effect, use of terminology like "away from" and "densely" puts off essential population risk considerations until later case-by-case reviews.

**Option 5. Retain present rule but use with updated source term.**

This option would retain use of source terms and dose calculations for the determination of exclusion area and low population zone outer radius size in Part 100. Population density values would be stated in Regulatory Guide 4.7. This option would also use an updated source term, and would likely require consideration of the impact of revised accident timing and additional nuclides other than iodine and the noble gases, and would entail revising Regulatory Guides 1.3 and 1.4, or development of additional guides.

The arguments favoring this option are that it would (1) be flexible, (2) would use consistent accident source terms for both reactor siting and design, and (3) would incorporate improvements in the geosciences.

The major argument against this option, however, is that it retains the present level of plant design and site tradeoffs, and consequently, does not represent a siting regulation.

**Seismic Provisions**

The staff has considered the following options for revising Part 100 and has evaluated them using the factors provided in the Commission's SRM. On the basis of the comments received and the convergence of positions among the NRC, other federal agencies and industry representatives, the staff recommends that the proposed revision proceed through the normal NRC review procedure toward the final rulemaking. Significant progress has been made in consensus building for the hybrid approach within the staff, the utility industry, as represented by NUMARC, and the U.S. Geological Survey. A rulemaking package developed along the lines of the hybrid approach will address and resolve the principal comments except those from the few commenters diametrically opposed to any use of probabilistic hazard assessments.

The staff further recommends that rather than retaining a separate Appendix B as contained in the proposed rule (Option 1 below), the final rule integrate basic seismic requirements in the main body of Part 100 (Option 2). Both options would maintain detailed guidance material in the regulatory guides.

**Option 1 Proceed with Resolution of Comments, Maintain Separate Appendix B**

This option would revise the proposed rule in response to public comments along the lines of the hybrid approach outlined to the Commission on August 3, 1993. In this option, a separate Appendix B outlining seismic requirements will be maintained.

Maintaining a separate Appendix B will retain a parallelism with the current regulation with some emphasis on the risk significance of the seismic hazard.

The argument against this option is that the NRC is treating seismic hazards significantly different from the other natural hazards by calling out specific "required" investigations in the rule as opposed to in regulatory guides as was done for the other natural hazards, meteorology, hydrology, flooding, etc.

#### Option 2    Incorporate Basic Streamlined Seismic Requirements in Part 100

This option is similar to Option 1 in that the rulemaking package would be revised in response to public comments along the lines of the hybrid approach. In addition, the staff would withdraw Appendix B and would significantly streamline seismic requirements in Part 100. The technical issues and guidance contained in Appendix B in the proposed rulemaking package would be incorporated into regulatory guides.

The staff recommends adoption of seismic Option 2. The staff believes that a streamlined version of the rule coupled with the development of new regulatory guidance will provide the proper level of details in the regulation.

#### RECOMMENDATIONS:

##### Non-Seismic Recommendation:

Because of its highly prescriptive and inflexible form which has raised concerns across a broad spectrum including members of the public, the industry, and the international community, the staff recommends that the non-seismic part of the proposed rule issued for comment on October 20, 1992 be withdrawn.

Because the existing Part 100 rule references an outmoded source term that is incompatible with severe accident research as well as with ongoing review of advanced reactor designs, because the state of seismic knowledge is not adequately reflected in the present rule, and because the recommendations of groups such as the Kemeny Commission are not reflected, the staff does not recommend Option 1, retaining the present siting rule.

The staff considers that Option 4 represents a performance based standard (in Part 50) that permits application of severe accident research insights toward design of advanced plants, while more clearly stating basic reactor site criteria and principles in Part 100. This represents a limited decoupling of reactor design and siting which emphasizes the role of siting in the NRC's defense-in-depth policy. Together, these revisions provide a rational and understandable basis for reactor siting to the public, clear guidance to the industry, and would not be incompatible with the needs and conditions of the international community. Option 4 would permit use of updated source term knowledge towards design of advanced plants, and would state basic siting criteria directly in Part 100, including a requirement that reactors must be sited "away from" densely populated centers. However, numerical values would not be in the rule itself, but would be in a regulatory guide.

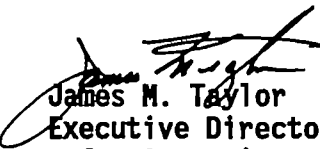
Seismic Recommendation:

As noted above, the staff recommends adoption of seismic Option 2. This would withdraw Appendix B and significantly streamline the seismic requirements in Part 100. The technical issues and guidance contained in Appendix B in the proposed rulemaking package would be incorporated into regulatory guides.

The staff believes that a streamlined version of the rule coupled with the development of new regulatory guidance will provide the proper level of details in the regulation.

COORDINATION:

The Office of the General Counsel has reviewed this paper and has no legal objection.

  
James M. Taylor  
Executive Director  
for Operations

Enclosures:

1. Response to SRM of August 12, 1993
2. Summary and Analysis of Non-Seismic Public Comments
3. Summary and Analysis of Seismic Public Comments
4. List of Commentors
5. Revised Source Term, Safety Goal and Severe Accident Insights for Reactor Siting
6. Proposed Basic Reactor Siting Criteria

Commissioners' comments or consent should be provided directly to the Office of the Secretary by COB Wednesday, February 9, 1994.

Commission Staff Office comments, if any, should be submitted to the Commissioners NLT Wednesday, February 2, 1994, with an information copy to the Office of the Secretary. If the paper is of such a nature that it requires additional review and comment, the Commissioners and the Secretariat should be apprised of when comments may be expected.

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