RULEMAKING ISSUE
(Notation Vote)

January 26, 1994 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that the non-seismic provisions of the proposed revision of 10 CFR Part 100, issued for comment on October 20, 1992, be withdrawn; (2) that Part 50 be revised to use updated source term and dose calculations for evaluating plant design, and that Part 100 be revised to emphasize siting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[1]. 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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[1] 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 (χ/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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Enclosure 1

RESPONSES TO REQUESTS FOR INFORMATION IN THE SRM DATED AUGUST 12, 1993

1. The extent to which the source term can be decoupled from the siting criteria in view of technological advancements

It should be noted that the staff proposal did not represent a complete decoupling of reactor design from siting, but rather established prescriptively an exclusion area size independent of plant-specific source term and dose calculations. The proposed rule was based upon an exclusion area size consistent with the source term and dose calculation results for current and evolutionary reactor designs, employing the TID-14844 source term and a conservative evaluation of fission product removal systems.

Setting a minimum exclusion area distance in the rule independently of individual plant source term and dose calculations would have the benefit of assuring predictability in a licensing hearing context.

On the other hand, setting the exclusion area size prescriptively may serve as a disincentive to the implementation of potentially significant technological advancements in reactor design or fuel factors that could affect radiological consequences, such as improved fission product mitigation systems, or improved retention of fission products within the fuel itself.

2. The technical and safety-related basis for siting criteria as opposed to what the U.S. can accommodate

Some aspects of the technical and safety-related basis for non-seismic aspects of reactor siting criteria are discussed in Enclosure 4, "Revised Source Term, Safety Goal and Severe Accident Insights." As noted in that enclosure, use of revised accident source terms together with a more realistic evaluation of fission product removal systems indicates that an exclusion area distance of 0.25 miles, or less, would satisfy the dose criteria of Part 100. The prompt fatality QHO of the Safety Goal would be met for very small exclusion area distances.

As also noted in Enclosure 4, severe accident risk insights indicate that future reactors could be located virtually anywhere solely from a Safety Goal perspective, even within densely populated cities, and pose very low risk to the population. In the United States, and particularly outside of the northeastern region, it is evident that more stringent siting criteria could be considered and there still would be a reasonable number of potential reactor sites.

3. The extent to which proposed reactor site criteria reflect concerns of potential users in other countries

In order to reflect concerns of potential users outside the U.S., proposed reactor site criteria would need to consider the differing geographic and demographic conditions of other countries. Since these conditions are likely to differ considerably from those in the U.S., as well from country to

country, such criteria would need to be as flexible as possible. Hence, such criteria should be stated in general terms or objectives, and should not include numerical criteria for distances or population densities in the rule itself, but these should be relegated to regulatory guidance. While such a rule would reflect concerns of users in other countries, it may be more difficult to implement in the U.S. (i.e., differing interpretations and reliance on regulatory guides rather than a rule).

Another concept to state reactor siting criteria would be to express them in terms similar to ALARA conditions; i.e., select sites from among the best that are available within the region. This approach is consistent with the NRC review under the National Environmental Policy Act (NEPA) for alternative site considerations and should not cloud safety considerations.

4. The pros and cons of less prescriptive revisions to Part 100 than those issued for public comment

Less prescriptive revisions to Part 100 have a clear advantage of maintaining flexibility in that reactors with different design features or of varying power levels (radioactive material inventory) can be accommodated by use of a suitable methodology. In addition, less prescriptive revisions are more likely to be compatible with potential criteria of users in other countries.

On the other hand, less prescriptive criteria have the disadvantage of the likelihood of increased litigation during licensing hearings with a concomitant increase in uncertainty.

5. The extent to which the reactor siting criteria conform to stated risk objectives, such as the Safety Goals, and the extent to which emphasis should be given to less quantifiable objectives such as defense-in-depth or prudence

As noted in Enclosure 4, based strictly upon stated risk objectives, such as the Safety Goals, the quantitative health objectives (QHOs) of the Safety Goals could be satisfied with a very small exclusion area distance (0.1 miles or less). Since the QHOs impose a limitation of individual risk only, the Safety Goals alone provides no guidance with regard to setting population limits beyond the exclusion area.

Based upon revised accident source terms, a more realistic treatment of fission product removal systems, and maintaining the dose limits currently in Part 100, the staff concludes that significantly smaller exclusion area distances (0.25 miles or less) would satisfy the dose limits.

Based upon severe accident insights, including the risks associated with core-melt and early bypass of or containment failure, the staff concludes that future reactors are expected to pose very low risks to large population centers, even if they were located within such centers. The staff continues to believe, however, that future reactors should continue to be located "away from" densely populated centers as an additional measure of defense-in-depth. Any criteria defining "away from" should provide an additional degree of mitigation, but should not be so stringent as to impact upon the availability

of a suitable supply of potential sites. Implementation of any criteria in this regard is likely to vary significantly from one nation to another, depending upon geographical and population distribution considerations.

6. The appropriate balance between deterministic and probabilistic seismic evaluations

The staff believes that it has achieved an appropriate balance between deterministic and probabilistic seismic hazard evaluations to be used in the revision of the Seismic and Geologic Siting Criteria for Nuclear Power Plants. The key elements of this balanced approach, as presented at the August 3, 1993 Commission briefing, are repeated below (the staff has been referring to it informally as the hybrid approach).

PROPOSED HYBRID APPROACH - KEY ELEMENTS

- TARGET EXCEEDANCE PROBABILITY SET BY EXAMINING CURRENT NUCLEAR POWER PLANTS
- CONDUCT PROBABILISTIC SEISMIC HAZARD ANALYSIS
- CONDUCT SITE SPECIFIC AND REGION SPECIFIC GEOSCIENCE INVESTIGATIONS
- CHECK TO DETERMINE IF GEOSCIENCE INVESTIGATIONS CHANGE PROBABILISTIC RESULTS
- CALCULATE SITE SPECIFIC GROUND MOTION FOR PLANT
- INDEPENDENT STAFF CHECK OF PROBABILISTIC RESULTS AGAINST SIMPLIFIED DETERMINISTIC ANALYSIS
- UPDATE OF DATA BASE AND PROBABILISTIC METHODOLOGY EVERY TEN YEARS

The proposed balance is a probabilistic rule, anchored by the Commission Severe Accident Policy Statement, with a series of thorough site-specific geoscience investigations and a deterministic check by the NRC staff reviewer. The U.S. utility industry through its designated representative, NUMARC, and about a dozen individual utilities has endorsed revised siting criteria that follow a philosophy similar to the philosophy behind the NRC staff's hybrid approach. The U.S. Geological Survey provided a series of comments and recommendations that led to and can be met by the hybrid approach. Therefore, two of the principal domestic protagonists in this revision, NUMARC and U.S. Geological Survey, are, in general, on board with the philosophy of this approach. However, there are still important details on the implementation of that philosophy that must be worked in the comment resolution. One example of these important details is that while the NRC proposed using Standard Review Plan Sec. 2.5.2 to obtain the site-specific ground motion from the controlling earthquakes, NUMARC is proposing a probabilistic scaling technique.

The principal concerns of the foreign commenters are understood by the staff and will be fully addressed in the "Comment Resolution Memorandum". (They are very broadly addressed in Enclosure 2.) Thus, the staff believes that there are no "show stoppers" among the commenters and the staff recommendation is to proceed with the seismic portion of the rulemaking. Additional material concerning the public comments on the seismic portion of the rulemaking are included in Enclosure 2.

7. The extent to which timing of proposed revisions are being driven by the prospects of an early site permit

The schedule for the proposed rule was driven, in part, by the expectation that a utility would apply for an early site permit (ESP) in conjunction with the Department of Energy (DOE) ESP demonstration program. A prospective ESP candidate has not been identified to test the ESP regulations and is no longer likely to be identified in the near term. Hence, the urgency for any proposed revisions of the reactor site criteria has diminished. The staff still believes that a revision to siting criteria is best accomplished absent an application to review an early site permit to avoid any appearance of special favor.

8. The extent to which proposed revisions support the Commission policy of consistent and predictable practice (e.g., the issue of assurance versus flexibility afforded by the proposed revisions)

The proposed revisions to Part 100 support the Commission's policy of predictable practice. Specification of a minimum exclusion area distance and numerical values for population density in the rule would provide assurance of a highly predictable mechanism to resolve site safety issues. However, fixed numerical criteria specified in a rule imply an accuracy that may not be warranted in assessing sites and do not allow flexibility in the event of reactor and plant design differences.

9. Plans to ensure that there is feedback between the source term development effort and the severe accident rulemaking process

The staff plans to ensure that there will be feedback between the development and implementation of an updated source term and any severe accident rulemaking. The staff is currently preparing a paper regarding source term related policy, technical, and licensing issues pertaining to evolutionary and advanced light-water reactor designs. In this paper the staff will propose positions regarding the implementation of updated source terms in licensing of evolutionary and advanced reactors. Approved positions will be used in preparing the staff's Safety Evaluation Reports (SER) for these plants.

In staff paper SECY-93-226, "Public Comments on 57 FR 44513 - Proposed Rule on ALWR Severe Accident Performance," the staff recommended that a decision on the need for generic rulemaking to address severe accidents be delayed at least until after the Final Safety Evaluation Reports (FSER) are issued for the ABWR and the System 80+. In an SRM dated September 14, 1993, the Commission approved this recommendation.

Enclosure 2

SUMMARY AND ANALYSIS OF NON-SEISMIC PUBLIC COMMENTS

Overview: Almost all of the public comments received relating to this proposed rulemaking showed an overwhelming sentiment against the proposed rulemaking and urged that it not be issued in final form.

Comments from the public agreed with ones from law firms representing utilities, and comments from state or federal organizations agreed with Foreign utilities and governments. Almost all reached the same conclusions (i.e., that the proposed rule shou d not be issued in final form) even though their arguments and logic differed significantly. For example, no one that commented on the exclusion area distance or the population density agreed with the numerical criteria in the proposed regulations. Representatives of environmental groups and the public felt that the exclusion area should be larger, while the utilities and international community felt that the exclusion area could be smaller or need not be specified in the regulation at all. Similarly, the proposed population density criteria was considered too high by the public and environmental groups and too low or too restrictive by the utilities and the international community.

No commentors liked the proposed rule - the public and environmental groups felt that the Commission was relaxing siting requirements while the nuclear industry felt that the proposed requirements were too restrictive, prescriptive and unwarranted.

Summary of Public Comments on Major Issues

The NRC staff appreciates the extensive public comments on this important rulemaking proceeding. The NRC received 82 public comment letters on the proposed rule change. A number of these letters represented the concerns of more than one individual or an organization. From the nuclear industry, the Nuclear Management and Resources Council (NUMARC) provided extensive comments which were endorsed by 12 U.S. utilities. Many foreign organizations and governments showed great interest in this rulemaking and provided significant comments. A letter was received which provided the comments and concerns of 9 Japanese nuclear electric utilities, while a law firm (Newman and Holtzinger) also submitted comments on behalf of the concerns of 13 foreign utilities (collectively known as the International Siting Group, ISG).

Comments were also received from environmental organizations representing a number of members. These included the Sierra Club (New Jersey Chapter), San Luis Obispo Mothers for Peace, Toledo Coalition for Safe Energy, Alliance for Survival, Seacoast Anti-Pollution League, Ad Hoc Committee to Replace Indian Point, Ecology Center of Southern California, Ohio Citizens for Responsible Energy, and Public Citizer.

A complete listing of each of the commentors is provided in Attachment A. The following is a listing and discussion of the major issues that were raised by public comments.

Issue 1: Should reactor siting requirements be decoupled from plant design?

Discussion: Twenty comment letters addressed this issue. 16 letters originated from representatives of the nuclear industry, both domestic as well as foreign. Four letters from environmental groups addressed this issue. Virtually all of the commentors opposed the concept of decoupling reactor siting requirements from plant design. The utility groups and foreign commentors were emphatically against this proposal. Most felt strongly that the present practice, as embodied over the last thirty years, of coupling reactor siting and plant design in the determination of the exclusion area and low population zone radius via the use of a postulated accidental release of fission products into the containment (source term) and calculated doses to hypothetical individuals had worked well and had resulted not only in improved reactor designs but also in selection of reactor sites that were safe. A comment from the nuclear industry, as represented by NUMARC, typified this view by stating:

> "The industry recommends that the radiological dose consequence evaluation factors contained in the current 10 CFR Part 100 be retained as the key determinants of site suitability. ...We believe that criteria contained in the current Part 100, successfully used to safely site all licensed power reactors in the United States, have the prerequisite technical basis, provide for adequate protection of public health and safety, and are appropriate for the determination of exclusion area distance, low population zone, and population center distance of future nuclear power plant sites."

A comment from a private individual (J.Martin) was in a similar vein and stated:

> "As a benchmark, it is well to state initially that the current rules and practices have worked well for thirty years. They provide for the basic safety objectives (unstated in the proposed rules):
>
> - robust, tight containments,
> - moderate standoff distances to populations, and
> - a modicum of flexibility in design and siting.
>
> These objectives have been achieved under the current rules and practices... As a general overview, the proposed rule should be withdrawn."

Comments received from foreign organizations questioned the rationale for taking this action. A comment from a representative of the government of Italy (ENEA-DISP) in regard to decoupling reactor siting from design noted that:

> "This is clearly the case of the problems connected to the definition of the exclusion area. On this matter our opinion is that both the Exclusion Area and Emergency Planning should be correlated to reactor design and related safety features."

A similar combined comment from representatives of the governments of France and Germany noted as follows:

> "US-NRC intends to clearly decouple siting criteria from plant design features. In our meaning, the basis for demographic criteria is essentially the possibility to implement efficient emergency measures in case of an accidental situation (evacuation, sheltering, foodstuffs consumption control,...); accordingly, we think that a link must be maintained between demographic criteria and plant design features. Criteria defined for the present generation of nuclear power plants must not be renewed for the next generation of plants without considerations on the type, nominal power and containment characteristics of such plants."

Another comment from a utility in the United Kingdom (Nuclear Electric), foresaw possible negative impacts resulting from decoupling being used to relax plant design requirements, and stated that:

> "The existing US regulation defines the exclusion area based on dose limits at the boundary of this area. To decouple these aspects by setting a very restrictive exclusion area could allow a relaxation in reactor safety to be accepted and place the emphasis on the site itself rather than on the reactor design."

In view of the strong opposition to decoupling voiced by representatives of the nuclear industry as well as foreign organizations, is noteworthy that virtually all of the environmental groups and members of the public who commented on this issue also were opposed to this proposal.

A major concern voiced was that its implementation would eliminate explicit consideration of public accident risk in reactor siting requirements. Environmental groups commenting on this issue believed that eliminating explicit consideration of accidents in reactor siting was undesirable because it could lead to undue easing of future reactor siting requirements. As stated by one commentor (Public Citizen):

> "The Nuclear Regulatory Commission should not allow the removal of source term considerations from regulation. In fact, in the absence of a coherent safety goal policy, the site dose calculations provide a benchmark against which to measure the appropriateness of a reactor site.
>
> The NRC's desire to rid regulation of accident dose considerations is quite understandable. The NRC and the nuclear industry could not justify nuclear power plant operation if the source term were updated rather than eliminated."

Another environmental group (Nuclear Information and Resource Service, NIRS) stated similar views on this as follows:

> "Source term and dose calculations regulations were intended to help mitigate the consequences to the public and environment from a nuclear

reactor accident. Source term information provides the essential link in estimating what the impact on a particular geographical area around the plant after any given initiating event (such as a pipe break or an ECCS actuation signal failure.) Geographic location and associated demographic therefore remain important factors associated with the type and design of power station being proposed. It is illogical for NRC to assume that increasing the number of nuclear power plants is any reason to move towards less conservative regulations for siting.

NIRS objects to NRC assistance to a nuclear industry public relations campaign to sell the public on 'inherently safe reactor designs' for what must be vigilantly recognized as an inherently dangerous technology. Decoupling source term from reactor siting is, in fact, tantamount to abandoning concern for public health and safety to accommodate early site regulations."

One environmental group, Ohio Citizens for Responsible Energy, OCRE, did recommend setting a minimum exclusion area distance independently of source term and dose calculations, and proposed that the minimum exclusion area distance be 1.0 mile. Their comments are discussed as part of Issue 2, below.

Issue 2: Codification of a minimum distance to the exclusion area boundary (EAB) of 0.4 miles (640 meters).

Discussion: Twenty-two comment letters addressed this issue, and all were opposed to codification of the 0.4 mile exclusion area distance. Ten letters were from utilities, organizations representing utilities, foreign utilities and foreign governments. The overall thrust of this group of respondents was that the value of 0.4 miles for the exclusion area distance was not technically well justified and should not be codified but should be left in a regulatory guide. The commentors in this group also felt that the existing source term and dose evaluation methodology provided a technically superior methodology for determining the size of the exclusion area. In commenting on this proposal as well as on the question of the variation of exclusion area distance with reactor power level, NUMARC stated as follows:

"The exclusion area distance should be determined based on criteria contained in the current 10 CFR Part 100, since power level is not the sole determinant of risk....

The nuclear industry recommends that a suggested minimum exclusion area distance of 0.25 miles (400 meters) be adopted in Regulatory Guide 4.7 in place of the current 0.4 miles. Based on MELCOR Accident Consequence Code System (MAACS) calculations for prompt fatality consequences of postulated severe accidents, an exclusion area distance of 0.25 miles (400 meters) has been found to meet the quantitative health objective of the NRC Safety Goal Policy.... Therefore, future nuclear power plants will be guided to a minimum 0.25 mile exclusion area distance, but regulated to the current 10 CFR Part 100 requirements."

A comment from the Department of Energy (DOE) stated that it would be inconsistent to require improved future reactor designs to have larger exclusion areas than those for present plants, and noted that:

> "The selected value for the exclusion area distance would exclude a number of existing sites, if future plants were to be sited on them. In light of the expectation that future plants most likely will be Advanced Light Water Reactors (ALWRs), and that ALWRs have improved safety characteristics as well as severe accident risk profiles an order of magnitude lower than existing plants, this EAB criterion sends an incorrect and confusing signal to the public. Plants with improved safety characteristics should not require greater exclusion areas than operating plants, which have been found safe by the NRC. We recommend that the value selected as the minimum EAB distance be selected to be compatible with the minimum EAB found to be adequate by NRC for operating plants."

The same commentor went on to suggest that

> "... we recommend that the criteria for future site selections not be any more restrictive than the current criteria. We suggest that this can be accomplished by selecting a minimum exclusion area boundary of 0.25 miles, and keeping the concept of a LPZ, as presently defined in Part 100."

A number of foreign governments and utilities felt strongly against this proposal and indicated potentially severe consequences in the siting of future plants within their individual countries. One commentor from Taiwan noted:

> "...the proposed rule change will impose a very big impact, which we think is not absolutely necessary from the safety point of view, on the development of our nuclear applications. We would therefore suggest that, instead of requiring a minimum exclusion area distance, NRC place this distance as a recommended value in the Regulatory Guide."

Twelve letters that commented on this issue were from the public or environmental groups who generally felt the proposed 0.4 mile exclusion area distance to be too small. Most of the respondents in this group provided little technical basis for this opinion. However, one environmental group, OCRE, proposed a minimum exclusion area distance of 1.0 miles, and provided its basis as follows:

> "For the minimum EAB radius, OCRE would propose a distance of 1.0 mile. The basis for this distance is twofold: first, to minimize early fatalities, and second, to expand the zone of control by the licensee to exclude potential terrorist attackers. NUREG/CR-2239 [so-called Sandia Siting Study] notes that, for source term SST1 reduced tenfold, on the average fatalities would be confined to 1 mile. For the SST2 source term, early fatalities would be confined to 0.5 miles. It is concluded that for releases substantially than SST1, a 1 mile EAB can have a substantial impact even without an emergency response. NUREG-0625 [Report of the Siting Policy Task Force] also noted that increasing the

EAB to one mile would "provide significant additional protection against Class 9 accidents (p. 47).

OCRE believes that the EAB should serve not only to protect the public from the reactor, but also to protect the reactor from malevolent persons in society. A minimum EAB radius of 1.0 mile, within which the licensee has total control of all activities through ownership of property and the application of appropriate security measures, could help minimize the threat of terrorist acts of radiological sabotage."

This proposal that the exclusion area size should be determined so as to assure a high degree of mitigation for severe accidents (formerly referred to as Class 9 accidents), including those involving containment failure, was also echoed in a comment from another environmental group (Public Citizen), who stated:

"Nuclear industry efforts in the 1970's and 1980's concentrated on reducing the source term in order to persuade the public that nuclear power was perfectly benign. The NRC's risk studies rather than assuaging the public's fear of nuclear power has actually fanned it. NUREG-1150 completely undermines the assumptions necessary for the source term calculation. Basically, it explodes the myth that during a severe accident the reactor containment will hold. In its original form NUREG-1150 concluded that early containment failure could not be ruled out in a severe accident for any of the containments studied. (Reactor Risk Reference Document, NUREG-1150, February 1987, p. ES-14). If we were to create exclusion zones and low population zones based upon the reality of early containment failure, the public would be too alarmed to ever allow another nuclear reactor to be constructed."

Issue 3: Should existing reactor sites having an exclusion area distance of less than 0.4 miles be grandfathered for the possible placement of future nuclear power plants?

Discussion: Twenty three comment letters addressed this issue. Fourteen letters were from the public or environmental groups who were strongly opposed to grandfathering existing reactor sites having an exclusion area distance less than 0.4 miles for the possible placement of additional nuclear power units. The general sentiment in this regard was that safety standards, including siting regulations, should be applicable to all reactors, operating as well as proposed. Typical sentiments of the environmental groups on this aspect can be summarized by a quote from one of them (Public Citizen), as follows:

"As noted in the regulatory analysis accompanying the proposed rule, the effect of these requirements is to set both individual, and, to some extent, societal limits on dose (and implicitly risk)...'. This being the case, the grandfathering of existing reactors which violate the .4 mile exclusion zone would deprive certain individuals of equal protection under NRC regulations. The NRC should not grandfather those reactor sites which violate the .4 mile exclusion zone requirement. Ideally, the NRC should look to phase out those reactors which over time

have come to present a greater risk to the public health and safety. Since an NRC required phase-out is unlikely, the NRC should compensate by requiring enhanced emergency planning procedures for those closest the reactor."

A similar comment was received from NIRS who stated:

"NIRS objects to the 'grandfathering' of the 23 existing sites that could not meet the proposed standardized exclusionary zone. NRC continues to portray the operation of nuclear power plants as a benign technology, as if we are being asked to consider grandfathering an outhouse within city limits. If NRC is going to formulate standards, the basis for said standard should have solid foundations and it is then expected that NRC enforce the regulations at the substandard sites. 'Grandfathering' of aging and increasingly decrepit nuclear power plants underscores the NIRS' concern that the proposed standard represents 'old wine in a new skin.'

For the same reasons, NIRS objects to the siting of new reactors at 'grandfathered' sites. The public trust is further damaged by NRC formulating willynilly standards supposedly based on a public health and safety objective. New reactors should never be built where the sites are considered to be substandard."

A comment from a member of the public (B. Campbell) was shorter, but equally pointed:

"If a site has operating reactors that do not meet regulations, these should be shut down and certainly no more should be allowed to be built in the area."

Finally, another comment from an environmental group (Sierra Club-NJ Chapter) felt that grandfathering was unethical and stated that:

"Grandfathering of sites by the NRC is unethical. If plants can't meet inadequate existing safety standards, they shouldn't be operated at all, and new reactors should never be built on existing sites that already don't meet regulations."

One individual as well as several utilities or organizations representing utilities favored grandfathering. A comment from one utility (Yankee Electric) noted:

"Currently operating plant sites have demonstrated acceptable safety for current reactor designs. Once approved the site should never be challenged based upon later interpretation of minor aspects of the rule. The placement of additional units of advanced design on these sites should be determined on the basis that safety is maintained as a result of operating all the licensed units on a site. Expected dose is the measure that has been used very effectively to date. That same basis should be utilized for determining acceptability of unit placement on a site not occupied by an existing unit."

A comment from the Nuclear Power Plant Standards Committee (Nuppsco) of the American Nuclear Society (ANS), in response to the question whether sites with exclusion area distances less than 0.4 miles should be grandfathered, replied as follows:

> "Yes. The numerical limit provides guidance at the time a site is considered; but once approved, a site should never be challenged ex post facto based on later interpretation of minor technical aspects of a rule."

Another individual (J. Martin), in response to the same question stated:

> "Yes. But then why have the rule change? Since siting is such a political and emotional issue, rather than a technical one, the Commission should not tie its own hands in this regard. There is no need for a contorted generational set of rules. The proposed rule(s) should be withdrawn."

While representatives of some utilities favored grandfathering, not all utilities or utility representatives did. One letter from NUMARC, whose comments were endorsed by 12 utilities, stated as follows:

> "Grandfathering, which is necessary if a new approach to siting is required, would be unnecessary if the existing siting requirements were maintained. Siting requirements for future power reactors should achieve a level of acceptable safety that is consistent with requirements for currently licensed plants. Currently licensed plants have demonstrated acceptable safety for their reactor designs. The placement of additional units of advanced designs on a site should be determined on the basis that safety is maintained as a result of operating all the licensed units on that site. This same basis should be utilized for determining acceptability of unit placement on a site not occupied by an existing unit. The nuclear power industry believes that radiological dose consequence evaluation factors in the current 10 CFR Part 100 are the key and appropriate determinants for site suitability to host additional reactors on a site and that these determinants should be maintained in the rule."

Another nuclear utility (Entergy) indicated that grandfathering introduced the concept of dual siting standards which the commentor stated were inappropriate and that the problem lay with the proposed rule. This comment noted that:

> "The fact that existing sites have been evaluated for suitability from safety consideration apart from the proposed exclusion area and found acceptable is indicative of the problem with this proposed rule. The proposed basis for determining site suitability restricts NRC flexibility unnecessarily with no appreciable increase in health and safety. The key factors for determining site suitability for additional units at an existing site or evaluating new sites are the radiological dose consequence evaluation factors in the current 10 CFR 100. Dual siting safety standards are inappropriate and should be discouraged."

Issue 4: Codification of a population density not to exceed 500 people per square mile out to 30 miles at site approval and 1000 people per square mile 40 years thereafter.

Discussion: Twenty eight comment letters addressed this issue. Twelve letters were from the nuclear industry. These included letters from NUMARC, whose comments were endorsed by 12 U.S. utilities, as well as one representing the concerns of 9 Asian nuclear electric utilities. 16 letters were from members of the public and environmental groups. Virtually all commentors were opposed to this proposal; nonetheless their rationale was diametrically different. One environmental group (Sierra Club-NJ Chapter) did not provide its thinking as to whether population density criteria should be codified, but it felt strongly that the proposed distance of 30 miles was inadequate, since it stated:

> "The NRC's proposal to allow 1,000,000 people to reside about 30 miles from the plant, just because it represents present shoddy practice, for which many reactors have been granted grandfather siting rights (because they were built before the latest regulations were adopted) represents dereliction of responsibility by the NRC. 30 miles is a tiny distance. The poisons from Chernobyl traveled hundreds and even thousands of miles."

An environmental group (Public Citizen) that did favor specifying population density criteria in the regulation stated as follows:

> "The NRC should include numerical values for population density in the regulation. To place the values in a regulatory guide would essentially remove the teeth of the regulation. If its in the regulations it is, at least hypothetically, enforceable."

In regard to the proposed population density value of 500 persons per square mile out to a distance of 30 miles, this same commentor noted as follows:

> "As a public policy consideration, it would seem the NRC would want to site reactors as far from population centers as possible. One way to accomplish this would be to decrease the allowable population density. While Public Citizen has no specific values it would like to see codified, the values adopted by NRC should reflect certain realities. The values should acknowledge the reality of the Chernobyl accident and the fact that early containment failure can not be rule[d] out with high confidence for any of the plants studied in the Reactor Risk Reference Document, NUREG-1150.
>
> The population density criteria should be specified out to a distance of at least 30 miles. A case could be made to extend this distance based upon the experience of Chernobyl and the likelihood of early containment failure in the event of a severe accident."

Another environmental group, NIRS, also argued for reduced population density criteria as well as for larger distances, by stating:

> "NIRS is opposed to proposed NRC rule changes on population density and the NRC failure to consider population restrictions beyond a 30 mile radius. NIRS takes the position that population density for reactor siting criteria should not be increased; it should be decreased.
>
> The 1979 Siting Task Force held that from the exclusion zone to 5 miles the maximum population density should be at most 100 people per square mile; from 5-10 miles, 150 people per square mile; and from 10-20 miles, 400 people per square mile.
>
> NRC justifications for increased population density figures in the low population zone are based in the Commission's Policy Statement on Safety Goals quantitative health objective in regard to estimates for latent cancer fatalities and land contamination.
>
> NRC analyses that 'population density restrictions out to 40 miles could make it difficult to obtain suitable reactor sites in some regions of the country' is an outrageous admission on the part of NRC that easing of reactor siting criteria is more a priority than public health and safety. It can be construed that in this case 'suitable reactor sites' has more to do with marketability of electricity than with public safety. In light of far-reaching consequences demonstrated in the Chernobyl accident, the public is likely to be unwilling to believe that radiation contamination can be limited to arbitrarily drawn political lines, such as the 10 mile Emergency Planning Zone. While NIRS and the public are willing to distinguish technical design differences between the RBMK reactor and US models, both operational and new design, it is now broadly recognized that the release of any fission reactor's radioactive inventory once borne on the weather knows no arbitrary established boundary.
>
> NIRS objects to NRC basing any of it's regulations on the marketability of nuclear power and reasserts that protecting the public health and safety is the NRC primary responsibility in regulating nuclear power.
>
> NIRS takes the position that population restriction zones should be extended out to the currently established accident interdiction limits outlined in the 50 mile ingestion pathway zone (IPZ)."

Comments received from industry and foreign organizations did not focus on the specific proposed numerical criteria as such, but rather with the placement of numerical values of population density in a rule. The industry also believed that there was no strong technical basis for the population density values proposed and clearly preferred that any population criteria remain in a regulatory guide. The comments offered by NUMARC echoed this thought by noting:

> "Population density numeric limits should not be codified in regulation because such criteria provide essentially no contribution to the

protection of public health and safety regarding offsite radiological dose risk beyond the immediate area adjacent to the power plant. The NRC has determined that there are no measurable health and safety impacts to the public from normal operation of a nuclear power plant. NUREG-0880 states, 'For all plants licensed to operate, NRC has found that there will be no measurable radiological impact on any member of the public from routine operation of the plant. (Reference: NRC staff calculations of radiological impacts on humans contained in Final Environmental Statements for specific nuclear power plants, e.g., NUREG-0779, NUREG-0812, and NUREG-0854).' The remaining consideration for siting a nuclear power plant is the risk regarding offsite radiological dose from postulated fission product releases. Therefore, the appropriate determinants for site suitability should remain the radiological dose consequence evaluation factors contained in the current 10 CFR Part 100. Regulatory Guide 4.7 and other NRC guidance documents should be revised to provide guidance consistent with the latest accepted knowledge regarding postulated severe accident consequences and reflect the benefits afforded by the 10 CFR Part 52 process, standardization of future advanced nuclear plant designs, and conclusions of studies that have been performed by the NRC and the industry....

In addition, as stated in the Federal Register, these criteria should not be considered as an upper limit of acceptability. Much higher population density values have been determined as providing no undue risk to public protection and safety. Codification of requirements to forecast population density values forty years into the future and then compare them to an arbitrary numeric criteria (1000 person per square mile) for site suitability determinant is inappropriate since such requirements serve no useful purpose in determining risk to the public from radiological doses consequences."

One utility (General Atomic) stated simply that:

"It is our judgement that numerical values of population density should not appear in the regulation but be provided as general guidance in a regulatory guide."

A comment from the Department of Energy suggested retention of the concept of the low population zone (LPZ) as follows:

"... we conclude that the existing concept of a LPZ, as defined in Part 100, provides a better approach for factoring nearby population centers into siting decisions, and avoiding sites in proximity to high population densities... We recommend, therefore, that the population density criteria in the proposed revisions be deleted, and that the requirements for defining a LPZ surrounding the plant be retained in Part 100."

A large number of comments were from foreign governments, foreign utilities and organizations representing foreign interests. They were greatly concerned that codification of these numerical population density criteria would impact their countries and organizations since almost all European and Asian

countries would not be able to meet the proposed population density criteria. This concern could be characterized by the following quote from a law firm (Newman and Holtzinger, representing the International Siting Group, ISG) representing 13 foreign utilities:

> "... they are inconsistent with the internationally accepted principle of establishing site safety standards which permit (and recognize the necessity to have) flexibility in balancing the various factors important to the safe siting of nuclear power plants. If adopted, the regulation could unnecessarily force review of the presently accepted site safety principles and raise questions about whether presently operating nuclear power plants provide adequate protection of the public and environment when the plants were located in more densely populated areas or have smaller exclusion areas then the revised criteria would permit. Moreover, should these proposed revisions become the norm, they would preclude the siting of nuclear power plants in many areas of Western Europe and Asia and result in a dependence on energy alternatives with less favorable environmental impact."

Another comment from representatives of two foreign governments (France and Germany) commented on the need for flexibility and the distance of 30 miles by stating:

> "We agree that special attention has to be paid to the distances from the plants to cities and/or densely populated areas (and to the evolutions of the demographic characteristics of the sites during the operating life of the plants), as one among the various parameters concerning the preparation of emergency measures. But technically speaking, this problem cannot be dealt with by the means of a single population density limit of 500 persons per square mile up to a distance of 30 miles. Furthermore, the value of 30 miles seems high and not justified."

A nuclear utility located in Korea (Korea Electric Power Co.) also felt that numerical criteria in the regulation was not needed as well as potentially detrimental, since:

> "The numerical demographic criteria will lead to questions concerning the safety of current nuclear power sites which do not meet the proposed population density criteria, not only in the United States, but in other countries as well.
>
> There is no current need for codifying demographic criteria because the present Regulatory Guide 4.7 works sufficiently for regulatory purposes."

Still another comment from a utility in the U.K. noted:

> "We agree that current plant designs can and are being shown worldwide to have acceptable risks at sites that have significantly higher population densities than those being proposed in the regulation.

Hence if the proposed new criteria are to be used purely to determine whether alternative sites with lower population densities should be considered, this will lead to confusion, particularly outside the nuclear industry and in other countries. If this is the case then we recommend that these values remain in the Regulatory Guide alone as already suggested as an appropriate alternative."

Issue 5: Periodic Reporting of Offsite Hazards.

Discussion: This issue did not generate the strong views produced by the previous issues; nonetheless 9 comment letters addressed this issue. Four comment letters were in favor of periodically reporting changes in potential offsite hazards (new dams in local rivers, new airports, etc.). The 5 opposing letters were largely from utilities. One of these letters, from NUMARC, felt that such a requirement was inappropriate as well as redundant since they noted that:

"A new requirement for periodic reporting of offsite hazards is inappropriate. Such a requirement is redundant to current requirements (10 CFR 50.71(e)) for operating licenses (OL) to report potential offsite hazards impact on the plant, as the impact affects public health and safety, through the licensee's update and report to the NRC of its Final Safety Analysis Report (FSAR). During the term of the early site permits (ESP) or construction permits (CP) there is no regulatory purpose for periodically reporting changes in potential offsite hazards. Before a plant with a CP or ESP can begin operation the NRC must grant an OL or combined license (COL) (10 CFR 52.79(b)). The proceedings to obtain an OL or COL require consideration of any significant new information not previously considered in the ESP or CP, including changes in offsite hazards. Therefore, at the point where there is a regulatory purpose to have ESP or CP holders consider potential offsite hazards and make NRC aware of those with significant impact, there already exists an effective regulatory requirement. An added reporting requirement would be redundant and inappropriate."

One organization representing government and utility interests in Belgium (AIB-Vincotte Nuclear) was in favor of this proposal and stated that

"We also consider that a periodic update of the impact of conditions around a site should be performed. We recommend that this be done every 10 years rather than 5 years. This is consistent with the Belgian Special Review of the total plant."

Issue 6: Should recommendations of the Siting Policy Task Force report (NUREG-0625) be reconsidered if not already adopted by the Commission?

Discussion: Twenty one comment letters addressed this issue. Fifteen letters, all from environmental groups and members of the public, were in favor of this proposal and focussed on the concept of adopting minimum permissible standoff distances from man-made and natural hazards such as airports, liquid natural gas terminals, geologic faults, etc. Typical comments from representatives favoring adoption of minimum standoff distances for man-related potential

hazards were those given by the Nuclear Information and Resource Service (NIRS), as follows:

> " NIRS concurs with the 1979 Siting Task Force recommendations to establish minimum standoff distances for all nuclear power plant sites from major airports and military bases, Liquid Natural Gas terminals, large propane and natural gas pipelines, explosive and toxic material industrial sites, major dams, and capable faults. NRC is deferring its duty to protect public health and safety by failing to incorporate tough minimum standoff distance limits in the siting criteria."

The remaining 6 letters were from utility organizations. One of these letters was from NUMARC whose comments were additionally endorsed by 12 utilities. They focussed on the fact that the Commission is under no obligation to accept only Task Force recommendations. NUMARC comments on this issue stated:

> "There are no additional recommendations contained in the report of the Siting Policy Task Force (NUREG-0625), dated August 1979, that should be reconsidered for adoption. NUREG-0625 contains policy recommendations that may no longer be appropriate because the assumptions underlying those recommendations were based on information that predate the large amount of accepted knowledge about postulated severe accident phenomena, probability and consequences gained since 1979."

Issue 7: Should states have a veto over the siting of future nuclear power plants?

Discussion: Comments on this issue were not specifically requested by the Commission in the Federal Register notice. Nevertheless, 13 comment letters, all from members of the public or environmental groups, raised this issue. All strongly stated that states should have veto powers over the siting of nuclear power plants. Typical of the sentiment expressed for this issue is a quote from one group (NIRS) as follows:

> "NIRS argues that States should and do have the right to deny site permits. State governments are asked to assume many responsibilities with regard to nuclear power plants ranging from 'low-level' radioactive waste management to emergency planning. States therefore have the right to evaluate their resources and balance them with utility interests. NIRS argues that States have the right to exercise a more significant role in determining energy resource management in nonconventional fuel sources and energy efficiency and conservation programs for meeting energy needs."

Another environmental group (Alliance for Survival) expressed a similar reaction by stating:

> "States should have the right to deny sites for nuclear power plants--as well as hazardous waste incinerators and other projects which are a danger to public health and safety."

Issue 8: Will this rulemaking (if codified) have a positive or negative effect on the siting of future nuclear power plants?

Discussion: 10 comment letters discussed this proposal, all of these from utilities and foreign utilities and/or governmental entities. One of these letters was from a law firm (Newman and Holtzinger, representing the International Siting Group, ISG) representing the concerns of 13 foreign utilities and one was from NUMARC whose comments were endorsed by 12 utilities. All commentors felt that this rulemaking, if codified would have a significant negative effect on current operating nuclear power plants and disastrous effects on the siting of future plants. A comment from NUMARC stated:

> "This NRC action has the potential for significant unintended impacts to both currently licensed and future plants without providing any identifiable improvement to public health and safety. The proposed criteria could inappropriately disqualify a significant number of licensed nuclear power plant sites and otherwise acceptable new sites from availability to host a new nuclear power plant in the future. Furthermore, adoption of the proposed criteria may adversely affect public perception regarding the acceptable safety of existing plant sites during their operating term and during plant license renewal proceedings."

A particular point raised in this regard was the possible impact of the proposed rule upon foreign utilities. A law firm (Newman and Holtzinger) representing several foreign utilities (ISG) stated as follows:

> "Although foreign utilities are not legally bound by the proposed rule, their national nuclear standards are consistent with the nuclear safety standards of the International Atomic Energy Agency (IAEA), which were strongly influenced by the NRC's siting standards. If the proposed revisions to the siting regulations in 10 CFR Part 100 are adopted, the process for selecting new nuclear power plant sites would fundamentally change, thereby forcing reconsideration of IAEA and national nuclear safety siting standards and raising questions about the adequacy of present and future nuclear power plant sites to ensure adequate protection of the public health and safety in foreign countries."

A foreign utility in Taiwan noted that:

> "It is believed that the proposed rule change on 10 CFR 100 will impose a great impact to our local nuclear development yet have no significant safety enhancement. Therefore, serious reconsideration before any further action is strongly recommended."

This same utility also commented regarding the impact of the proposed rule on utilities in Taiwan, stating:

> "Last but not the least, the licensability in the country of origin for reactor design and siting is set forth as a minimum requirement in Taiwan. Once the proposed rule becomes effective, TPC (Taiwan Power

Company) may be forced to purchase reactors from countries other than the USA simply due to the problem associated with the rule compliance in siting."

Finally, a comment received from 9 Japanese utilities stated:

"Although it is true that nuclear safety regulation within a particular country remains the national responsibility of that country, it is also true that many countries made reference to the US rule when establishing their rules for LWR safety regulation and the US will continue be very influential in the arena of international safety standards. The proposed revisions, if adopted, will seriously impact the U.S. nuclear industry, as well as the nuclear industry in other countries.

In the earliest days of nuclear reactor siting, the exclusion area was set in relation to core thermal power. Later, however, with the incorporation of engineered safeguards into the design, U.S. siting standards were revised to take these design features into consideration. Many countries with commercial nuclear power plants adopted the U.S. approach. We are confident that this siting approach, together with the other codes, standards and practices to ensure safety, has been sufficient to ensure adequate protection of the health and safety of the public from any undue risk that may arise from the operation of nuclear power plants.

By setting certain predetermined numbers for population density and exclusion area, the proposed revisions, if adopted, would reverse this history of ensuring safety through the incorporation of safety technology into the design and would unnecessarily create confusion among the countries using nuclear power."

Issue 9: Was sufficient technical justification provided in the proposed rulemaking package to warrant codification?

Discussion: Eight comment letters focused on this question, all were from utilities and foreign utilities and/or governmental entities. One of these letters was from a law firm representing the concerns of 13 foreign utilities; and one was from NUMARC whose comments were endorsed by 12 utilities. All commentors felt that there did not exist sufficient technical justification to warrant codification of this proposed rulemaking. The following comment from NUMARC illustrates this view:

"Codifying in regulation the guidance contained in Regulatory Guide 4.7 (RG-4.7), numeric criteria for minimum exclusion area distance and population density is inappropriate. This guidance has no demonstrated technical basis and does not reflect the accumulated experience of operating reactors and studies performed by the NRC and the industry since 1975."

Enclosure 3

SUMMARY AND ANALYSIS OF SEISMIC PUBLIC COMMENTS

For the purpose of this paper, the comments are divided into domestic and international comment sources; the international comment sources can be subdivided into those from regulatory agencies and those from foreign utilities. While the staff is giving priority to the domestic comments, the foreign comments and concerns are being fully addressed, principally in the "Comment Resolution Memorandum" that will be part of the final rulemaking package.

Among the domestic commenters, the single greatest concern expressed was that about the potential difficulties with the reconciliation of the differences between the probabilistic and deterministic evaluations required by the parallel approach in the draft rulemaking package published for comment. Except for the few commenters who would not accept any form of probabilistic evaluation, the proposed hybrid approach, briefly described in the body of the Commission Paper in response to Issue 6. should accommodate the majority of domestic comments. The detailed "Comment Resolution Memorandum" will address how each of the specific comments was accommodated and will explain why the "deterministic only" approach was not accommodated.

The comments from the foreign utilities (particularly those from the Pacific rim countries, which have tectonic regimes significantly different from the eastern U. S.) principally concerned the maturity of probabilistic seismic hazard assessments (PSHA), vis. a vis, its use in a regulation, and the difficulties anticipated in applying the criteria in their individual country; they also noted the NRC staff's inability to reach consensus on the appropriate balance between deterministic and probabilistic evaluations. The hybrid approach should resolve the balance issue and its philosophical compatibility to the NUMARC and U. S. Geological Survey positions should address the maturity issue, at least, for the United States. The remaining element of concern, the adaptability of the U.S. probabilistic method to individual countries is a matter of recognition that the proposed method in the draft regulatory guide is specific to the U.S. situation and particularly the eastern U.S. where there is a history of the use of probabilistic concepts in resolving regulatory issues and for which two large seismic hazard programs exist with substantial data bases. It is imperative that the nature and emphasis on the probabilistic method must be consistent with the tectonic regime and available data base of the individual country. The DG-1015 clearly recognizes this situation for the western U. S. To alleviate the worries of the foreign commenters, the commentary for revised DG-1015 will emphasize that the purpose of the probabilistic method is to account for uncertainty, and the nature of uncertainty and how to account for it depends to a great extent on the tectonic regime and parameters, such as, the existence of known seismic sources, the existence of strong ground motion records, and the knowledge of geology. Both the probabilistic method and deterministic investigations should be and must be adapted to the particular situation. With the inclusion of such clarification in the commentary, the foreign commenters should not feel compelled to adopt DG-1015's specific probabilistic procedures but still can, in principle, accommodate the philosophy of the hybrid approach.

In addition to comments similar to those from the foreign utilities, the comments from the foreign regulatory agencies, principally from individual staff members rather than from the management of the agency, were generally on specific technical points of the revision published for comment. These specific comments would be addressed on their individual merit as the details of the hybrid approach and the "Comment Resolution Memorandum" are prepared.

Thus, the principal elements of a U.S. consensus on the acceptance of the hybrid approach are in hand, and the principal concerns of the foreign utility commenters are broadly addressed here and will be fully addressed in the "Comment Resolution Memorandum".

Enclosure 4

LIST OF COMMENTORS

NUMBER	DATE DOCKETED	COMMENTOR
1	01/04/93	COMMENT OF SIERRA CLUB (NEW JERSEY CHAPTER) (SIDNEY J. GOODMAN)
2	01/06/93	COMMENT OF PAUL MOSS
3	01/11/93	COMMENT OF SAN LUIS OBISPO MOTHERS FOR PEACE (JILL ZAMEK, TREASURER)
4	01/12/93	COMMENT OF DAVID NIXON
5	01/15/93	COMMENT OF JOHN O. KING
6	01/15/93	COMMENT OF TOLEDO COALITION FOR SAFE ENERGY (CHARLENE JOHNSTON)
7	01/19/93	COMMENT OF ALLIANCE FOR SURVIVAL (BARBARA GARTNER, DIRECTOR)
8	01/21/93	COMMENT OF BILL NIERSTEDT
9	02/01/93	COMMENT OF BOB BRISTER
10	02/01/93	COMMENT OF SEACOAST ANTI-POLLUTION LEAGUE (CHARLES W. PRATT)
11	02/02/93	COMMENT OF A. DAVID ROSSIN
12	02/04/93	COMMENT OF J. COURTLAND ROBINSON
13	02/08/93	COMMENT OF JAMES A. MARTIN, JR.
14	02/08/93	COMMENT OF ELIZABETH H. MEIKLEJOHN
15	02/12/93	COMMENT OF BRUCE CAMPBELL
16	02/16/93	COMMENT OF EVA MANSELL
17	02/16/93	COMMENT OF DEIRDRE DONCHIAN
18	02/16/93	COMMENT OF AD HOC COMMITTEE TO REPLACE INDIAN POINT (ANNA MAYO)
19	02/16/93	COMMENT OF JOHN W. G. TUTHILL
20	02/17/93	COMMENT OF DINI SCHUT

NUMBER	DATE DOCKETED	COMMENTOR
21	02/18/93	COMMENT OF REPUBLIC OF CHINA ATOMIC ENERGY COUNCIL (TSING-TUNG HUANG)
22	02/19/93	COMMENT OF A.N.S. SPECIAL COMM. ON NEW CONSTRUCTION (EDWARD L. QUINN & KYLE H. TURNER)
23	02/22/93	COMMENT OF DAVID LEISING
24	02/22/93	COMMENT OF GENERAL ATOMICS (R. M. FORSSELL, SR. V.P.)
25	02/23/93	COMMENT OF DR. Z. REYTBLATT
26	02/23/93	COMMENT OF ECOLOGY CENTER OF SOUTHERN CALIFORNIA (ALBERT PINKERSON)
27	02/26/93	COMMENT OF KOREA ELECTRIC POWER CORPORATION (CHUNG, BO HUN, V.P.)
28	03/02/93	COMMENT OF NUCLEAR SAFETY INSTITUTE [BELGIUM] (AIB-VINCOTTE) (J. VERLAEKEN & B. DE BOECK)
29	03/05/93	COMMENT OF CORPS OF ENGINEERS (ELLIS L. KRINITZSKY)
30	03/08/93	COMMENT OF ASSOCIATION OF ENGINEERING GEOLOGISTS (JEFFREY R. KEATON, PRESIDENT)
31	03/12/93	COMMENT OF W. SCOTT DUNBAR
32	03/12/93	COMMENT OF OHIO DEPARTMENT OF NATURAL RESOURCES (DR. MICHAEL C. HANSEN)
33	03/12/93	COMMENT OF NORTH DAKOTA GEOLOGICAL SURVEY (JOHN P. BLUEMLE)
34	03/15/93	COMMENT OF FEDERATION OF ELECTRIC POWER COMPANIES [JAPAN] (RYO IKEGAME, CHAIRMAN)
35	03/17/93	COMMENT OF ELECTRICITE DE FRANCE (REMY CARLE, EXEC. V.P.)
36	03/22/93	COMMENT OF NUCLEAR POWER ENGINEERING CORPORATION [JAPAN] (MASAYOSHI SHIBA, DIRECTOR GENERAL)
37	03/22/93	COMMENT OF VEREINIGUNG DEUTSCHER ELEKTRIZTATSWERKE [GERMANY] (DR. JOACHIM GRAWE)

NUMBER	DATE DOCKETED	COMMENTOR
38	03/22/93	COMMENT OF NEW YORK POWER AUTHORITY (RALPH E. BEEDLE)
39	03/23/93	COMMENT OF SCOTTISH NUCLEAR LIMITED (R. J. KILLICK)
40	03/23/93	COMMENT OF G C SLAGIS ASSOCIATES (GERRY C. SLAGIS)
41	03/23/93	COMMENT OF ENEL [ITALY] (INGG. VELONA-FORNACIARI)
42	03/24/93	COMMENT OF MONTANA BUREAU OF MINES AND GEOLOGY (EDWARD T. RUPPEL, DIRECTOR)
43	03/24/93	COMMENT OF OHIO CITIZENS FOR RESPONSIBLE ENERGY (SUSAN L. HIATT, DIRECTOR)
43A	03/25/93	CORRECTION NOTICE SUBMITTED BY THE OHIO CITIZENS FOR RESPONSIBLE ENERGY, INC., CORRECTING PAGE 11, PARAGRAPH ONE OF COMMENT NUMBER 43.
44	03/24/93	COMMENT OF YANKEE ATOMIC ELECTRIC COMPANY (D. W. EDWARDS)
45	03/24/93	COMMENT OF CALIFORNIA DEPARTMENT OF CONSERVATION (JAMES F. DAVIS)
46	03/24/93	COMMENT OF GEORGIA POWER COMPANY (J. T. BECKHAM, JR., V.P.)
47	03/24/93	COMMENT OF SOUTHERN NUCLEAR OPERATING COMPANY (J. D. WOODARD)
48	03/25/93	COMMENT OF VIRGINIA POWER (WILLIAM L. STEWART, SENIOR, V.P.)
49	03/25/93	COMMENT OF ENEA [ITALY] (GIOVANNI NASCHI)
50	03/25/93	COMMENT OF NUCLEAR MANAGEMENT AND RESOURCES COUNCIL (WILLIAM H. RASIN, V.P.)
51	03/25/93	COMMENT OF NUCLEAR INFORMATION AND RESOURCE SERVICE (NIRS)
52	03/25/93	COMMENT OF DEPARTMENT OF ENERGY (DWIGHT E. SHELOR)
53	03/25/93	COMMENT OF WESTINGHOUSE ELECTRIC CORP. ENERGY SYS. (N. J. LIPARULO)

NUMBER	DATE DOCKETED	COMMENTOR
54	03/25/93	COMMENT OF PUBLIC CITIZEN (JAMES P. RICCIO, ESQ.)
55	03/26/93	COMMENT OF NIAGARA MOHAWK POWER CORPORATION (C. D. TERRY, V.P.)
56	03/24/93	COMMENT OF WINSTON & STRAWN (MARK J. WETTERHAHN & K. M. KALOWSKY)
57	03/26/93	COMMENT OF GE NUCLEAR ENERGY (P. W. MARRIOTT)
58	03/29/93	COMMENT OF SUSAN BURKE
59	03/29/93	COMMENT OF ENTERGY OPERATIONS, INC. (JOHN R. MCGAHA, V.P.)
60	03/29/93	COMMENT OF TWELVE FOREIGN ELECTRIC COMPANIES (JANET E. B. ECKER)
61	03/30/93	COMMENT OF GULF STATES UTILITIES COMPANY (J. E. BOOKER)
62	03/30/93	COMMENT OF SOUTH CAROLINA ELECTRIC & GAS COMPANY (JOHN L. SKOLDS, V.P.)
63	04/01/93	COMMENT OF NUCLEAR ELECTRIC [UNITED KINGDOM] (DR. B. EDMONDSON)
64	03/30/93	COMMENT OF FLORIDA POWER & LIGHT COMPANY (W. H. BOHLKE, V.P.)
65	04/08/93	COMMENT OF MINISTERE DE L'INDUSTRIE ET DU COMMERCE EXTERIEUR AND BUNDESMINISTERIUM FUR UMWELT, NATURSCHUTZ UND REAKTORSICHERHEIT [FRANCE AND GERMANY] (MICHAEL LAVERIE & WALTER HOHLEFELDER)
66	04/14/93	COMMENT OF DELAWARE GEOLOGICAL SURVEY (THOMAS E. PICKETT, ASSOC. DIR.)
67	04/26/93	COMMENT OF TENNESSEE VALLEY AUTHORITY (MARK J. BURZYNSKI)
68	05/03/93	COMMENT OF FLORIDA POWER CORPORATION (ROLF C. WIDELL)
69	05/24/93	COMMENT OF DEPARTMENT OF ENERGY (JEFFREY K. KIMBALL)

NUMBER	DATE DOCKETED	COMMENTOR
70	05/26/93	COMMENT OF NATIONAL ATOMIC ENERGY AGENCY [INDONESIA] (DJALI AHIMSA, DIRECTOR GENERAL)
71	05/28/93	COMMENT OF NUCLEAR MANAGEMENT AND RESOURCES COUNCIL (WILLIAM H. RASIN)
72	06/01/93	COMMENT OF DEPARTMENT OF ENERGY (E. C. BROLIN)
73	06/01/93	COMMENT OF NORMAN R. TILFORD
74	06/01/93	COMMENT OF INTERNATIONAL SITING GROUP (WILLIAM O. DOUB, ESQ.)
75	06/14/93	COMMENT OF U. S. GEOLOGICAL SURVEY (DALLAS L. PECK, DIRECTOR)
76	06/17/93	COMMENT OF ILLINOIS STATE GEOLOGICAL SURVEY (MORRIS W. LEIGHTON, CHIEF)
77	06/17/93	COMMENT OF ATOMIC ENERGY COMMISSION OF ISRAEL (DR. Y. WEILER)
78	06/28/93	COMMENT OF AMERICAN NUCLEAR SOCIETY (DR. WALTER H. D'ARDENNE)
79	06/29/93	COMMENT OF SARGENT & LUNDY ENGINEERS (B. A. ERLER)
80	06/29/93	COMMENT OF VERMONT AGENCY OF NATURAL RESOURCES (LAURENCE R. BECKER)
81	06/29/93	COMMENT OF TU ELECTRIC (WILLIAM J. CAHILL, JR., V.P.)
82	06/29/93	COMMENT OF NORTHERN STATES POWER COMPANY (ROGER O. ANDERSON)

Enclosure 5

REVISED SOURCE TERM, SAFETY GOAL AND SEVERE ACCIDENT INSIGHTS FOR REACTOR SITING

The non-seismic, or demographic aspects of reactor siting involve primarily the determination of the size of the exclusion area and objectives regarding population density or distribution beyond the exclusion area. These are discussed below.

I. EXCLUSION AREA

The exclusion area, that area immediately surrounding the reactor where no residents are permitted and where the licensee has the authority to determine all activities, including the removal of persons in the event of an emergency, has been a requirement since promulgation of the rule in 1962. An earlier staff study by the Siting Policy Task Force (NUREG-0625) recommended continuation of this requirement. The staff continues to believe that an exclusion area should be required for the following reasons:

- to provide reasonable assurance that the radiological effluent design objectives associated with normal reactor operation, specified in 10 CFR Part 50, Appendix I, will be met;

- to provide reasonable assurance that the radiological consequences of a range of postulated accidents, up to and including the limiting design basis accident considered, will be acceptable for an individual located at the nearest boundary of the exclusion area for a specified time;

- to provide reasonable assurance that appropriate security plans can be made and measures established so that potential acts of sabotage pose no undue risk to the plant; and

- to provide reasonable assurance that adequate protective measures for members of the public can be taken in the event of an emergency.

Currently, the size of the exclusion area is based upon postulating a number of accidents (the so-called design basis accidents) and evaluating them to provide reasonable assurance that the radiological consequences of the limiting design basis accident are adequate to protect the public. The exclusion area serves to provide a limitation on individual accident risk. It should be noted that while the size of the exclusion area (together with plant design) assures acceptably low consequences for design basis accidents (up to and including degraded core accidents where the containment remains intact, but leaks at its maximum allowable leak rate), it is not intended to assure acceptable consequences in the unlikely event of severe accidents involving core-melt with containment failure.

Regulatory Guide 4.7 notes that the NRC staff has found that a minimum exclusion area distance of 0.4 miles (640 meters), even under adverse atmospheric relative dilution conditions, usually provides assurance that

engineered safety features can be designed so that the calculated doses would be within the guideline values of 10 CFR Part 100. This finding is based, however, upon the source term into containment given in Regulatory Guides 1.3 and 1.4, which is taken from TID-14844. Further, this distance is also based upon a relatively conservative evaluation of the efficacy of fission product removal by engineered safety features.

Using a more realistic evaluation of engineered safety features together with the revised source term into containment given in draft NUREG-1465, the staff believes that significantly smaller exclusion area distances could provide reasonable assurance that the calculated doses would be within the guideline values of 10 CFR Part 100. While a minimum distance has not been determined, it appears that distances of 0.25 miles (400 meters), or less could provide reasonable assurance that engineered safety features can be designed so that the calculated doses would be within the guideline values of 10 CFR Part 100.

Since the quantitative health objectives (QHOs) of the Safety Goal provide guidance on the individual risk of early fatality and risk of latent cancer fatality, the size of a proposed exclusion area can be evaluated with regard to the QHOs. A range of exclusion area distances (from 0.25 to 0.5 miles) has been investigated for plants with a reactor power level of 3800 megawatts (thermal) and having the risk characteristics of those studied in NUREG-1150. All of these distances were found to easily meet the early and latent fatality QHOs of the Safety Goal. In view of the expected frequency of core damage and containment failure of less than 10^{-5} per reactor year, even for existing plants, such a plant would be able to satisfy the early fatality QHO with an exclusion area no larger than the minimum area required to site the major plant structures and buildings. Such an exclusion area is likely to be 0.1 miles or less in radius.

It is important to recognize that the QHOs of the Safety Goal provide guidance on individual risk only, not societal risk. For this reason, while the Safety Goal can be used to evaluate a proposed exclusion area distance, it provides no guidance with respect to population density or distribution beyond the exclusion area.

II. POPULATION DENSITY CRITERIA

Restrictions on population density beyond the exclusion area have also been required since issuance of the rule in 1962. The current Part 100 requires a "low population zone" (LPZ) beyond the immediate exclusion area. The LPZ radius must be of such a size that an individual located at its outer radius must not receive a dose in excess of the values given in Part 100 over the course of the accident (currently evaluated as 30 days). While numerical values of population or population density are not specified for this region, the regulation also requires that the nearest boundary of a densely populated center of about 25,000 or more persons be located no closer than one and one-third times the LPZ outer radius. Part 100 has no population criteria other than the size of the LPZ and the proximity of the nearest population center, but notes that "where very large cities are involved, a greater distance may be necessary."

Whereas the exclusion area size is based upon limitation of individual risk, the imposition of population density requirements serves to set societal risk limitations. Further, since the radiological consequences of the limiting design basis accident are determined to be acceptable at the exclusion area boundary, limitation of population density beyond the exclusion area reflects consideration of societal risk as well. Accidents beyond the design basis were clearly a consideration in the original issuance of Part 100, since the Statement of Considerations notes as follows:

> "Further, since accidents of greater potential hazard than those commonly postulated as representing an upper limit are conceivable, although highly improbable, it was considered desirable to provide for protection against excessive exposure doses to people in large centers, where effective protective measures might not be feasible... Hence, the population center distance was added as a site requirement."

Limitation of population density beyond the exclusion area has the following benefits:

- it facilitates emergency preparedness and planning;
- it reduces potential doses to large numbers of people in the event of severe accidents; and
- it reduces potential property damage in the event of severe accidents.

As noted above, since the Safety Goal provides guidance on individual risk only, it cannot be applied to determine whether a particular population density would meet the QHOs of the Safety Goal.

However, results of severe accident risk studies, particularly those obtained from NUREG-1150, provide useful insights for considering potential criteria for population density. Severe accidents having the highest consequences are those where core-melt together with early bypass of or containment failure occurs. Such an event would likely lead to a "large release" (without defining this precisely). Based upon NUREG-1150, the probability of a core-melt accident together with early containment failure or bypass for the current generation of LWRs is estimated to be between 10^{-5} and 10^{-6} per reactor year. For future plants, this value is expected to be less than 10^{-6} per reactor year.

If a reactor were located within a large city, the likelihood of exposing a large number of people to significant releases of radioactivity would be the same as the probability of a core-melt and early containment failure, that is, less than 10^{-6} per reactor year for future reactor designs. This probability is sufficiently low that arguments could be made that siting a reactor within a large city would pose no undue risk from safety considerations. It is worth noting that the staff, in licensing actions, has regarded events of about 10^{-6} per reactor year or lower to be "incredible", and has not required them to be considered as part of the design basis of the plant.

If, however, the reactor were sited at some distance from the city, the likelihood of the city being affected is further reduced because of wind direction variability, the likelihood it would actually transport radioactive material towards the city is lower, and the inventory of the plume becomes depleted over time and distance. If the reactor were located at distances ranging from 10 to about 20-25 miles away from a city, depending upon its size, emergency planning is facilitated and the probability of exposure of large numbers of people within the city and possible contamination of major areas of the city would be reduced about one additional order of magnitude to less than 10^{-7} per reactor year. A population density guideline of 500 persons per square mile, as given in Regulatory Guide 4.7, provides an effective "standoff" distance of about 10 miles for cities having a population of about 100,000 or more persons, and a "standoff" distance of about 20 miles for cities of about 500,000 or more persons.

Siting reactors even more remotely than 10 to about 20 miles away from population centers would further reduce the potential risk for persons within the city, but at a lower rate. For example, to reduce the risk to a city to less than 10^{-8} per reactor year would require that reactors be sited at distances of about 50 or miles or more from cities. At these distances, site availability would be severely limited for many regions of the U.S.

In summary, next-generation reactors are expected to have risk characteristics sufficiently low that the safety of the public is reasonably assured by the reactor and plant design itself. Such a plant can satisfy the QHOs of the Safety Goal with a very small exclusion area distance (generally 0.1 miles or less). The consequences of design basis accidents, analyzed using revised source terms and with a realistic evaluation of engineered safety features, are likely to be found acceptable at distances of 0.25 miles or less. With regard to population density beyond the exclusion area, siting a reactor even within a densely populated city would pose a very low risk to the city from safety considerations. Hence, any population density restrictions on reactor siting should be viewed as a safety enhancement based upon defense-in-depth considerations, rather than as required to meet an adequate degree of safety. Locating reactors at distances ranging from 10 to about 20-25 miles away from population centers, where it is feasible to do so, can facilitate emergency planning and reduce the already low likelihood of exposure to large numbers of people by about an additional order of magnitude.

Since reactor sites must satisfy a number of criteria including water availability, environmental considerations and other land use restrictions, the staff believes that limitations on population density alone should not become so stringent as to preclude the use of otherwise suitable sites.

Enclosure 6

PROPOSED BASIC REACTOR SITING CRITERIA

Power reactor sites must meet the following basic safety criteria in order to be acceptable:

- site atmospheric dispersion characteristics must be evaluated and plant interface criteria established such that:

  (a) radiological effluent release limits associated with normal operation must be met for any individual located offsite; and,

  (b) radiological consequences of postulated accidents must be acceptable for an individual located at any point of the exclusion area boundary for a specified time;

- physical characteristics of the site, including meteorology, geology, seismology and hydrology must be evaluated and plant interface criteria established such that potential threats from such physical characteristics will pose no undue risk to the plant;

- potential hazards associated with nearby transportation routes, industrial and military facilities must be evaluated and plant interface criteria established such that potential hazards from such routes and facilities will pose no undue risk to the plant;

- site characteristics must be such that adequate security plans and measures can be developed;

- site characteristics must be such that adequate plans to take protective measures for members of the public in the event of emergency can be developed; and

- the reactor site must be located away from densely populated centers.