

**ENVIRONMENTAL ASSESSMENT AND
FINDING OF NO SIGNIFICANT ENVIRONMENTAL IMPACT**

REVISION OF 10 CFR PARTS 21, 50, AND 54

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The Nuclear Regulatory Commission (NRC) is amending its regulations to allow the holders of operating licenses at currently operating reactors to voluntarily amend their design bases to replace the current accident source term with an alternative source term such as those described in NUREG-1465, "Accident Source Terms for Light-Water Nuclear Power Plants."

The proposed rule was published for public comment, and availability of the draft environmental assessment was noticed on March 11, 1999 (64 FR 12117). No comments on the draft environmental assessment were received. Therefore, no substantive changes have been made in this environmental assessment.

Identification of Action

The NRC is amending 10 CFR Part 50 by adding a new section, § 50.67, to address the use of alternative accident source terms. Section 50.67 would apply to all holders of operating licenses issued before January 10, 1997, and holders of renewed licenses under 10 CFR Part 54 whose initial operating license was issued prior to January 10, 1997, that seek to amend their facility design bases to replace the current accident source term with an alternative source term on or after the publication date of the final regulation. These licensees are required by § 50.67 to evaluate the radiological consequences of the design basis accidents previously analyzed in the safety analysis report and to request a license amendment under § 50.90. Acceptance criteria for the accident radiological consequence analyses appear in § 50.67. These criteria consist of accident dose guidelines for evaluating of releases of radioactivity to the environment and the resulting exposures to persons off site, and of dose criteria for plant personnel occupying the control room during postulated accidents.

The final rule amends a current regulation by establishing alternate requirements that licensees may voluntarily adopt. The NRC has determined that the existing analytical approach based on the current source term continues to be adequate to protect public health and safety; therefore, the NRC does not intend to backfit the alternative source terms or the changes in accident dose guidelines and control room habitability criteria for operating power reactors. Because the final revision to the regulation does not constitute a backfit, the bases for existing nuclear power plants must be preserved, and the current accident dose guidelines in § 100.11 and the current control room habitability criteria of Appendix A to 10 CFR Part 50 will remain in effect for licensees that do not apply to use an alternative source term.

The NRC is also amending 10 CFR Part 50 by revising 10 CFR Part 50, Appendix A, General Design Criterion (GDC) –19, to allow use of a dose criterion based on total effective dose equivalent. The revised criterion, which is an alternative to the current dose criterion in GDC-19, may be used only by applicants for construction permits under Part 50, applicants for design certification or combined licenses under 10 CFR Part 52, who apply on or after January 10, 1997, and holders of operating licenses using an alternative source term.

Need for the Action

Use of Alternative Source Terms

Current operating light-water reactors were licensed, in part, on the basis of safety analyses that used the fission product release assumptions of Technical Information Document (TID)-14844, "Calculation of Distance Factors for Power and Test Reactor Sites" (1962). Although initially used in the evaluating proposed reactor sites, these fission product release assumptions, known collectively as the "source term," have been used in several regulatory applications related to light-water reactors. This source term was a key input to many of the design analyses associated with currently operating reactors and figures significantly in the design bases for these facilities. Since the publication of TID-14844, significant advances have been made in understanding the timing, magnitude, physical form, and chemical form of fission product releases from severe nuclear power plant accidents. In 1995, the NRC published NUREG-1465, "Accident Source Terms for Light-Water Nuclear Power Plants," which utilized these source term insights to produce revised estimates of the accident source terms. These source terms are described in terms of radionuclide composition and magnitude, physical and chemical form, and timing of release. For design basis accident assessments, the NUREG-1465 source terms are comparable to the TID-14844 source term with regard to the magnitude of the noble gas and radioiodine release fractions. However, the alternative source terms provide a more representative description of the radionuclide composition and release timing.

NUREG-1465 gave alternative accident source terms for regulatory application for future light-water reactors (LWRs). The NRC's intent was to capture the major relevant insights available from severe accident research to provide, for regulatory purposes, a more realistic portrayal of the amount of the postulated accident source terms. These source terms were derived by examining a set of severe accident sequences for LWRs of current design. Because of general similarities in plant and core design parameters, these results are considered applicable to evolutionary and passive LWR designs. The NRC considered the applicability of the alternative source terms to operating reactors and determined that the current analytical approach based on the TID-14844 source term still adequately protected public health and safety and that operating reactors licensed under this approach would not be required to reanalyze design basis accidents using the alternative source terms. The NRC also concluded that some licensees might wish to use alternative source terms in analyses to support operational flexibility and cost-beneficial licensing actions to reduce unnecessary regulatory burden.

In January 1997, the NRC amended its regulations in 10 CFR Parts 21, 50, 52, 54, and 100 (61 FR 65157). This regulatory action provided siting criteria for future sites and relocated source term requirements for future plants to Part 50. Since the dose requirements tend to affect reactor design rather than siting, they were also relocated to Part 50. Because the revised criteria would not apply to operating reactors, the non-seismic and seismic reactor site criteria for operating reactors were retained as Subpart A and Appendix A of Part 100, respectively. The revised reactor site criteria were added as Subpart B of Part 100, and revised source term and dose requirements were relocated to § 50.34. The existing source term and dose requirements of Subpart A of Part 100 would remain as the licensing bases for operating reactors that do not elect to use an alternative source term. The NRC retained the requirements for the exclusion area and the low population zone, but revised the associated

numerical dose guidelines to replace the doses for the whole body and the thyroid gland with a single total effective dose equivalent (TEDE) value.

The dose guidelines for the whole body and thyroid and for the immediate 2-hour exposure period, were largely predicated by the assumed source term being predominantly noble gases and radioiodines instantaneously released to the containment and the assumed "single critical organ" method of modeling the internal dose used when Part 100 was originally published. However, the current dose guidelines, focusing on doses to the thyroid and whole body, assume that the major contributor to doses is radioiodine. Although this assumption may be appropriate with the TID-14844 source term, it may not be true for a source term based on a more complete understanding of accident sequences and phenomenology. The postulated chemical and physical forms of radioiodine in the alternative source terms are more amenable to mitigation and, as such, radioiodine may not always be the predominant radionuclide in an accident release. The alternative source terms include more radionuclides than did the TID-14844 source term, as implemented in regulatory guidance. The whole body and thyroid dose guidelines ignore these contributors to dose. The TEDE, using a risk-consistent methodology, assesses the impact of all relevant nuclides upon all body organs. Although it is expected that, in many cases, the thyroid could still be the limiting organ and radioiodine the limiting radionuclide, this conclusion cannot be assured in all potential cases.

The alternative source terms postulate that the core inventory is released in phases over several hours, with the most significant release beginning at about 30 minutes after the start of the event. The assumption that the 2-hour exposure period starts immediately at the onset of the release is inconsistent with the phased release postulated in the alternative source terms. A detailed rationale for the use of 0.25 Sv (25 rem) TEDE as an accident dose guideline and the use of the 2-hour exposure period resulting in the maximum dose for future LWRs is provided at 61 FR 65157. This rationale also applies to operating reactors that elect to use the alternative source term. The NRC considers that it is technically appropriate and logical to extend the dose guidelines, established for future LWRs using the alternative source term, to operating reactors that elect to use the same alternative source term.

The NRC determined that accident dose guidelines and control room habitability criteria used with the alternative source terms should be expressed in terms of TEDE, and that the 2-hour exposure period should be based on the 2-hour period that yields the maximum dose. The final § 50.67 incorporates these acceptance criteria.

Conforming Change to GDC-19

The revision to GDC-19 is not related to the use of alternative source terms at operating reactors but corrects a deficiency identified in the regulatory framework for early site permits, standard design certifications, and some combined licenses under Part 52. Sections 52.18, 52.48, and 52.81 establish that applications filed under Part 52 Subparts A, B, and C, respectively, would be reviewed according to the standards given in 10 CFR Parts 20, 50, 51, 55, 73, and 100 to the extent that those standards are technically relevant to the proposed design. GDC-19 is pertinent to applications under Part 52. The recent Part 100 rulemaking (61 FR 65157) established accident TEDE guidelines (in § 50.34) for applicants under Part 52, but did not establish an alternative control room dose criterion. Therefore, exemptions to the dose criterion in the current GDC-19 were necessary in the design certification process for the Westinghouse AP-600 advanced light water reactor in order to allow the use of the 0.05 Sv (5 rem) TEDE criterion deemed necessary for use with the alternative source terms. The

revision eliminates the need for exemptions by future applicants under Part 52. This change will also apply to future applications under Part 50 that are filed on or after January 10, 1997. However, the change does not apply to applications for combined licenses which reference an approved standard design certification, since the design certification establishes the relevant criteria.

Environmental Impacts of the Action

The implementation of an alternative source term at an operating power reactor would replace the traditional TID-14844 source term with a source term that is based on the insights gained from extensive accident research activities. Only the regulatory assumptions regarding the accident would be affected by substituting an alternative source term. The actual accident sequence and progression are not changed. By itself, use of an alternative source term would not increase the core damage frequency (CDF) or the large early release frequency (LERF) or actual offsite or onsite radiation doses. (Although *actual* doses would not increase, analysis results might show an increase in some *postulated* doses because additional radionuclides would be considered and dose modeling would be more comprehensive.) The source term is used to analyze the adequacy of the plant design to contend with a design basis accident (DBA) in order to ensure adequate defense in depth and adequate safety margins. The alternative source term could be used to justify changes in the plant design that could affect the CDF or the LERF, increase offsite or onsite doses, or other environmental impacts. Those plant changes that do not require prior NRC review and approval pursuant to § 50.59 are not likely to involve any significant increase in environmental impacts. The § 50.59 criteria are sufficiently stringent that any potential change in plant design that could have an adverse environmental impact in all likelihood could not be made by the licensee without prior NRC review and approval. Every plant change that requires NRC review and approval under § 50.59 requires a license amendment and, therefore, the preparation of an environmental assessment to determine whether the proposed change involves any significant environmental impact. Thus, this final rule, by itself, will not result in plant changes that involve any significant increase in environmental impacts.

The Commission directed the NRC staff to assess the effects of implementing the alternative source term at operating reactors. The results of this study were presented to the Commission in SECY-98-154, "Results of the Revised (NUREG-1465) Source Term Re-Baselining for Operating Reactors." The major effects examined were the effect on individual offsite and control room doses, the effect on doses used in equipment environmental qualification, and the effect of modifications that might be allowed by the alternative source term. The study also assessed the margin afforded by the alternative source term in comparison to assessments performed using the integrated severe accident assessment code, MELCOR. The study indicated that implementing the alternative source term at operating reactors would give lower postulated doses in most cases. The NRC has addressed the exceptions in the Draft Guide-1081, that is being published for comment in conjunction with this final rule.

The NRC will also address these exceptions in processing the individual license amendments. The best-estimate MELCOR analyses indicated that the design basis dose calculations using the alternative source terms still have a substantial margin (a factor of 2 or greater). The study also indicated that many of the plant systems that are likely to be considered for modification are not involved in risk-significant sequences and are, therefore, not likely to have a substantial offsite risk impact, using a measure such as the LERF.

There is an expectation that many of the alternative source term applications may improve safety, reduce occupational exposure, and save money. In light of the wide range of possible applications and the voluntary nature of this final rule, it is not feasible to quantify possible outcomes. Occupational exposures may be reduced through reduced maintenance associated with maintaining unnecessarily limiting leakage, timing, or filtration requirements. Overall safety may be improved through (1) staged or reduced emergency diesel generator loading, (2) improved containment ventilation system performance due to removal of filter media, and (3) closer synchronization of accident mitigation feature actuation with the onset of major fission product releases. Safety margins may be increased by the more realistic analysis assumptions, methods, and acceptance criteria.

Based on the conclusions of the re-baselining study, the radiological consequences of DBAs are not increased by the use of the alternative source term. The final dose guidelines are comparable, in level of protection, to the existing guidelines. The final rule does not affect nonradiological plant effluents and has no other environmental impact. Therefore, the NRC concludes that there are no significant nonradiological environmental impacts associated with the amendments to the regulations.

Alternatives to the Action

As required by Section 102(2)(E) of National Environmental Policy Act (NEPA) (42 U.S.C.A. 4332(2)(E)), the NRC staff considered possible alternatives to the final action. Most of the alternatives considered involved administrative details such as location of the final rule and the means of providing regulatory guidance. These alternatives are neutral with regard to environmental impact and will not be considered further. With regard to environmental impacts, the alternatives are (1) to retain the existing accident source term (the no-action alternative) or (2) to allow the use of the alternative source term.

Retaining the existing accident source term was considered unacceptable because it would preclude the potential reductions in unnecessary regulatory burden, potential improvements in overall safety, and potential reductions in occupational exposure. The environmental impact of a postulated DBA would be unchanged. The foreclosure of potential improvements in safety and reductions in occupational exposure could prevent some actions that could reduce the risk and/or consequences of accidents. Because it is not possible to predict with any degree of certainty the source term applications that licensees may voluntarily propose, these applications were not evaluated further.

The second alternative, allowing the voluntary use of the alternative source term at operating plants, including the use of dose guidelines and dose criteria consistent with the alternative source term, would establish the requirements for use of an alternative source term in a new section to Part 50 while retaining the existing regulations in 10 CFR 100 Subpart A and GDC-19. This was chosen as the better approach. The final rule would improve the allocation of NRC and for industry resources. They could propose applications of an alternative source term that could reduce unnecessary or ineffective requirements in the facility design basis. The NRC and the industry would gain from having appropriate regulatory requirements and guidance to facilitate preparation and NRC staff review of licensee submittals. Resources could be diverted to safety issues of greater significance. The environmental impacts of the proposed use of the alternative source term were addressed earlier in this assessment, and it was concluded that there would be no significant environmental impact. Because of the

potential safety and economic benefits, this alternative is clearly superior to the no-action alternative.

Alternative Use of Resources

No alternative use of resources was considered. The final rule applies only to existing operating reactors and the use of an alternative source term for analysis purposes has no impact on the use of resources. Although this rule also makes conforming changes related to future plant licensing, the environmental impact of the future plant licensing would, by regulation, be assessed as part of the plant licensing.

Agencies and Persons Consulted

The NRC staff developed the final rule and this environmental assessment. No outside agencies or consultants were used in developing this assessment. The NRC staff obtained advice from the NRC Advisory Committee on Reactor Safeguards.

The NRC published the proposed rule for public comment on March 11, 1999 (64 FR 12117). The NRC summarized the draft environmental assessment in the statements of consideration for the proposed rule and noticed the availability of the full document. The NRC requested comments on any aspect of the environmental assessment. No comments were received on the environmental assessment. Accordingly, no substantive changes have been made in this assessment.

Copies of the Federal Register notice for the proposed rule and draft environmental assessment were distributed to each State Liaison Officers with a request for comments. No comments were received.

Finding of No Significant Environmental Impact

The final amendments to 10 CFR Parts 21, 50, and 54 to allow the holders of operating licenses at currently operating reactors to voluntarily amend their design bases to replace the current accident source term with an alternative source term, do not have a significant effect on the quality of the human environment.

This conclusion is based foregoing environmental assessment and on the following:

1. The alternative accident source term and the accident dose guidelines were incorporated into the NRC's regulations in Parts 50 and 100 for future plant licensing by a final rulemaking on January 10, 1997. The environmental assessment for that final rule made a finding of no significant impact. Because this final rule would be a logical extension of those provisions to operating reactors, a similar finding is appropriate.
2. The alternative source term reflects the significant advances that have been made in understanding the timing, magnitude, and chemical form of fission product releases from severe nuclear power plant accidents. This alternative source term provides more physically based estimates of the accident source term. The NRC sponsored

significant review efforts by peer reviewers, foreign research partners, industry groups, and the general public (57 FR 33374).

References

1. "Use of Alternative Source Terms at Operating Reactors," Proposed Rule, 64 FR 12117, March 11, 1999.
2. "Draft Environmental Assessment: Revision of 10 CFR Parts 21, 50, and 54," Attached to SECY-98-289, December 15, 1998.
3. "Accident Source Terms for Light-Water Nuclear Power Plants," NUREG-1465, February 1995.
4. "Calculation of Distance Factors for Power and Test Reactor Sites," Technical Information Document (TID) 14844, March 1962.
5. "Results of the Revised (NUREG-1465) Source Term Re-Baselining for Operating Reactors," SECY-98-154, June 1998.
6. "Amendments to 10 CFR Parts 50, 52, and 100, and Issuance of New Appendix S to Part 50," SECY-96-118, May 1996.