



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

15.7.3 POSTULATED RADIOACTIVE RELEASES DUE TO LIQUID-CONTAINING TANK FAILURES  
REVIEW RESPONSIBILITIES

Primary - Effluent Treatment Systems Branch (ETSB)

Secondary - Hydrologic & Geotechnical Engineering Branch (HGEB)

I. AREAS OF REVIEW

At the construction permit (CP) stage of review, ETSB reviews the information in the applicant's safety analysis report (SAR) in the specific areas that follow. At the operating license (OL) stage of review, ETSB review consists of confirming the design accepted at the CP stage and evaluating the adequacy of the applicant's technical specifications in these areas.

1. The ETSB determines the tanks and associated components which could contain radioactive liquids outside containment and evaluates the consequences of single failures involving these tanks and components.
2. A secondary review is performed by HGEB to complete the overall evaluation. The HGEB will review information on the surface and groundwater hydrology and the parameters governing liquid waste movement through the soil. This review by HGEB is conducted as part of the primary review responsibility of SRP Section 2.4.12.

In addition, ETSB will coordinate the branch evaluation that interfaces with the overall review of tanks and components containing radioactive liquids outside of containment as follows: The review for Technical Specifications is coordinated and performed by the Licensing Guidance Branch (LGB) as part of its primary review responsibility for SRP Section 16.0.

For the area of review identified above as being reviewed as part of the primary review responsibility of LGB, the acceptance criteria necessary for the review and the methods of application are contained in the referenced SRP section.

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USNRC STANDARD REVIEW PLAN

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

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

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

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## II. ACCEPTANCE CRITERIA

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

1. General Design Criterion 60 as it relates to the radioactive waste management systems being designed to control releases of radioactive materials to the environment.
2. 10 CFR Part 20 as it relates to radioactivity in effluents to unrestricted areas. Tanks and associated components containing radioactive liquids outside containment are acceptable if failure does not result in radionuclide concentrations in excess of the limits in 10 CFR Part 20, Appendix B, Table II, Column 2, at the nearest potable water supply,\* in an unrestricted area, or if special design features are provided to mitigate the effects of postulated failures for systems not meeting these limits.

## III. Review Procedures

1. The ETSB will select the tanks and components for which a failure is assumed based on the nuclide concentration and the total radioactive material content in the tank and its components that will result in the highest concentrations of radioactive material at the nearest potable water supply in an unrestricted area.
  - a. The radionuclide inventory in failed components is based on assuming 80% of the liquid volume in each component and the expected failed fuel fraction, i.e., 0.12% of the fuel producing power in a pressurized water reactor (PWR) per NUREG-0017 or consistent with an offgas release rate of 15  $\mu\text{Ci}/\text{sec-Mwt}$  after 30 minutes delay for a boiling water reactor (BWR) per NUREG-0016. The radionuclide inventory in failed components is calculated based on the techniques given in Chapter 4 and Appendices A and B of NUREG-0133.
  - b. The ETSB will consider the design features, e.g., steel liners or walls in building areas housing components, dikes for outdoor tanks, and overflow provisions incorporated to mitigate the effect of a postulated failure. Because of the potential radionuclide inventory, the failed components that are considered are typically waste collector tanks or evaporator concentrate tanks. However, the components selected for evaluation are based on the individual plant design. Selection of the components should be coordinated with the HGEB reviewer to assure that the assessment considers access to the hydrosphere and the magnitude of potential dilution and decay for various pathways as well as size and inventory.

Credit for liquid retention by unlined building foundations will not be given regardless of the building seismic category because of the

\*"Supply" means a well or surface water intake that is used as a water source for direct human consumption or indirectly through animals, crops, or food processing.

potential for cracks. Credit is not allowed for retention by coatings or leakage barriers outside the building foundation.

2. The radionuclide concentrations at the nearest potable water supply are calculated by HGEB using the values of hydrological parameters they developed with the guidance in SRP Section 2.4.12 and using the ETSB calculated radionuclide concentration in failed components. HGEB will transmit a summary of the results to ETSB to permit ETSB to complete the safety evaluation report.
3. Compliance with the acceptance criteria given in subsection II will be determined by ETSB based on the HGEB calculation of radionuclide concentrations at the nearest potable water supply.
4. The ETSB will review the technical specification limiting the curie content of liquid containing tanks to ensure that the technical specification is consistent with the safety evaluation. The curie content is based on that quantity which would not exceed the concentration limits of 10 CFR Part 20, Appendix B, Table II, Column 2 at the nearest potable water supply if the tank and components should fail, or will be limited to 10 curies in any mobile or portable tank used more than one calendar quarter.

#### IV. EVALUATION FINDINGS

If the ETSB confirms that the consequences of liquid-containing tank failures would be acceptable according to the criteria stated in subsection II of this SRP section, conclusions of the following type are provided for the staff's safety evaluation report:

The scope of the review included the calculation of radionuclide concentrations in the applicable failed components based upon the expected fuel failure rate for the plant and the effect of site hydrology for those systems that have not been provided with special design features to mitigate the effects of failures. Radionuclide concentrations at the nearest potable water supply were found to be acceptable. The basis for acceptance has been that the staff's review shows that the postulated failure of a tank and its associated components would not result in radionuclide concentrations in excess of 10 CFR Part 20, Appendix B, Table II, Column 2 at the water source(s) noted above.

For those cases where special design features were incorporated to mitigate the consequences of a failure of a tank and the associated components, the following type of statement is made:

Tanks for which special design features were incorporated to mitigate the consequences of failures such as steel liners or walls or dikes surrounding the failed components and overflow provisions were evaluated and found to be acceptable. The basis for the staff's acceptance was the capability of these design provisions to prevent the release of radioactivity from entering a potable water supply system. Therefore, the staff concludes that the design provisions incorporated by the applicants to mitigate the effects of a tank and its associated components failure involving radioactive liquids are acceptable.

In any case, the staff concludes that the postulated failure of a tank and its associated components has been evaluated and the design is acceptable and meets the requirements of General Design Criterion 60 for the control of releases of radioactive materials to the environment. This conclusion is based on the following:

The applicant has met the requirements of General Design Criterion 60 with respect to the control of releases of radioactive materials to the environment by providing controls to reduce the potential impact of the failure of a radioactive liquid-containing tank and its associated components. Such a release will not result in concentrations exceeding the limits of 10 CFR Part 20, Appendix B, Table II, Column 2 in the unrestricted area.

#### V. IMPLEMENTATION

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

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

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

#### REFERENCES

1. NUREG-0016; "Calculation of Releases of Radioactive Materials in Gaseous and Liquid Effluents from Boiling Water Reactors."
2. NUREG-0017, "Calculation of Releases of Radioactive Materials in Gaseous and Liquid Effluents from Pressurized Water Reactors."
3. NUREG-0133, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants."