



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

SECTION 5.4.11

PRESSURIZER RELIEF TANK SYSTEM

REVIEW RESPONSIBILITIES

Primary - Auxiliary and Power Conversion Systems Branch (APCSB)

Secondary - Electrical, Instrumentation and Control Systems Branch (EICSB)
Reactor Systems Branch (RSB)
Mechanical Engineering Branch (MEB)
Materials Engineering Branch (MTEB)
Containment Systems Branch (CSB)I. AREAS OF REVIEW

The pressurizer relief tank is a pressure vessel provided in typical pressurized water reactor (PWR) primary systems to condense and cool the discharge from the pressurizer safety and relief valves. Discharges from small relief valves located inside the containment may also be piped to the tank. Tank capacity is based on a requirement to absorb the pressurizer discharge during a specified step load decrease.

The review of the pressurizer relief tank, as described in the applicant's safety analysis report (SAR), includes the tank, the piping connections from the tank to the pressurizer relief and safety valves, the tank spray system and associated piping, the nitrogen supply piping, and piping leaving the tank to the cover gas analyzer and to the reactor coolant drain tank.

The review covers the following specific areas:

1. The seismic design classification of the pressurizer relief tank system.
2. The quality standards to which the system will be designed, fabricated, erected, and tested.
3. The ability of the system to withstand a single active component failure without loss of function.
4. The measures taken in the design to prevent system performance degradation below acceptable levels as a result of failures of other nearby systems.
5. The steam condensing capacity of the tank compared to the largest anticipated plant step load decrease.

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 Revision 2 of 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.

9511010233 751124
PDR NUREG
75/087 R PDR

11/24/75

6. The instrumentation provided to measure and indicate pressurizer relief tank pressure, temperature, and liquid level, and to signal the operator in the event of high or low parameter levels.
7. The tank rupture disk relief capacity compared to the capacity of the pressurizer relief and safety valves.
8. The proposed technical specifications, for operating license applications, as they relate to areas covered in this plan.

The review of the pressurizer relief tank system will involve secondary reviews performed by other branches. The results of these reviews are used by APCS to complete overall evaluation of the system. The evaluations performed by others are as follows: the RSB will determine that the anticipated and maximum pressurizer relief and safety valve discharge rates are acceptable based on a review of the limiting transient and will determine that the piping between the valves and the tank is adequately sized. The MTEB will verify that inservice inspection requirements are met for system components and, upon request, will verify the compatibility of the materials of construction with service conditions. The MEB will review the transient fluid-induced load applied to the piping downstream of safety or relief valves. In addition, MEB will review the seismic qualification testing and operability of components and confirm that the system is designed in accordance with applicable codes and standards. The CSB will evaluate the blowdown, vent clearing, and condensing capabilities of the system for normal, anticipated, and maximum system flow rates upon request from APCS. In addition, CSB will, upon request, determine the containment pressure response in the event the rupture disks are blown. The EICSB will determine the adequacy of the design, installation, inspection, and testing of essential electrical components.

II. ACCEPTANCE CRITERIA

Acceptability of the design of the pressurizer relief tank system as described in the SAR, including related sections of SAR Chapters 2 and 3, is based on specific general design criteria and regulatory guides. An additional basis for determining the acceptability of the system is the degree of similarity of the design with that of previously reviewed plants with satisfactory operating experience. Listed below are specific criteria related to the pressurizer relief tank system.

The design of the pressurizer relief tank system is acceptable if the integrated system design is in accordance with the following criteria:

1. The rupture disks have a relief capacity at least equal to the combined capacity of the pressurizer relief and safety valves.
2. The pressurizer relief tank volume and the quantity of water initially stored in the tank should be such that no steam or water will be released to containment under any normal operating conditions or anticipated abnormal occurrences. The initial temperature of water inside tank should be assumed to be no lower than 120°F.

3. The pressurizer relief tank system is designed for pressures ranging from full vacuum to the disk rupture pressure setting and its corresponding saturation temperature with for rupture disc tolerance.
4. The pressurizer relief tank system may be classified as non-Seismic and Quality Group D.
5. High temperature, high pressure, high and low liquid level alarms for the pressurizer relief tank have been provided.

III. REVIEW PROCEDURES

The procedures below are used in the construction permit (CP) review to determine that the design criteria and bases and the preliminary design described in the SAR meet the acceptance criteria given in Section II of this plan. For operating license (OL) reviews, the procedures are used to verify that the initial design criteria and bases have been appropriately implemented in the final design.

The review for OL's includes a determination that the content and intent of the technical specifications prepared by the applicant are in agreement with the requirements developed as a result of the staff's review. The reviewer will select and emphasize material from the paragraphs below, as appropriate for a particular case.

1. The SAR is reviewed to establish that the pressurizer relief tank system description and related diagrams clearly delineate system operation and the system capability to accept the steam flow released from the pressurizer for step load decreases. The reviewer examines the adequacy of the design in terms of the seismic design classification (Regulatory Guide 1.29), quality group classification (Regulatory Guide 1.26), and conformance with industry standards. Where necessary, the review will include the requirements for system testing, minimum performance, and surveillance requirements.
2. The SAR is reviewed to determine that the rupture disks on the relief tank have a relief capacity at least equal to the combined capacity of the pressurizer relief and safety valves. The reviewer determines that the tank design pressure provides a conservative margin above the calculated pressure resulting from the maximum design relief and safety valve discharge, i.e., the maximum surge resulting from complete loss of load. The tank and rupture disks should be designed for full vacuum, so as to prevent tank collapse if the contents are cooled following a discharge without nitrogen being added.
3. The pressure suppression capability of the system is reviewed to assure proper system operation. This aspect of the review is similar to the evaluation of the vent clearing and vent flow model for pressure suppression containment systems. The review includes such effects as dynamic loadings and oscillatory behavior of the steam slug in the discharge line. The RSB will verify the mass and energy blowdown data to evaluate the above effects.

4. The piping and instrumentation diagrams are reviewed to verify that high temperature and pressure alarms and high and low liquid level alarms have been provided for the pressurizer relief tank.
5. The reviewer verifies that the system has been designed so that the system function can be maintained as required in the event of a loss of offsite power.
6. The reviewer verifies that the system will function following design basis accidents assuming a concurrent single active component failure. The reviewer evaluates the failure modes and effects analysis presented in the SAR to assure function of required components, traces the availability of these components on system drawings, and checks that the SAR information contains verification that minimum system flow and heat transfer requirements are met for each degraded situation over the required time spans. For each case, the design will be acceptable if minimum system requirements are met.
7. The reviewer determines that failure of portions of the system or of other systems not designed to seismic Category I standards and located close to the system, or of non-seismic Category I structures that house, support, or are close to the pressurizer relief tank system will not preclude essential operations. Reference to the general arrangement and layout drawings for structures and systems will be necessary.
8. The reviewer determines that the system is protected from the effects of high energy line breaks and moderate energy leakage cracks. Layout drawings are reviewed to assure that no high or moderate energy piping systems are close to the pressurizer relief system, or that protection from the effects of failure will be provided. The means of providing such protection will be described in Section 3.6 of the SAR and the procedures for reviewing this information are given in the corresponding review plans.

IV. EVALUATION FINDINGS

The reviewer verifies that sufficient information has been provided and his review supports conclusions of the following type, to be included in the staff's safety evaluation report:

"The pressurizer relief tank system includes components and piping such as the pressurizer relief and safety valve connections to the tank, the relief tank spray system piping, the nitrogen supply piping, and piping leaving the tank to the cover gas analyzer and reactor coolant drain tank. The scope of review of the pressurizer relief tank system for the _____ plant included layout drawings, piping and instrumentation diagrams, and descriptive information for the system and for supporting systems essential to its safe operation. [The review has included the applicant's proposed design criteria and design bases for the pressurizer relief tank system, the adequacy of those criteria and bases, and the requirements for performance of safety-related functions of the system during normal, abnormal, and accident conditions. (CP)] [The review has included the applicant's analysis of the manner in which the design of the pressurizer relief tank and supporting systems conform to the proposed design criteria and design bases. (OL)]

"The basis for acceptance in the staff review has been conformance of the applicant's designs, design criteria, and design bases for the pressurizer relief tank and supporting

systems to the Commission's regulations as set forth in the general design criteria, and to applicable regulatory guides, branch technical positions, and industry standards.

"The staff concludes that the design of the pressurizer relief tank system conforms to all applicable regulations, guides, staff positions, and industry standards, and is acceptable."

V. REFERENCES

1. Regulatory Guide 1.26, "Quality Group Classifications and Standards."
2. Regulatory Guide 1.29, "Seismic Design Classification."

11/24/75

SRP Co. 1-1