NUREG-0763

Guidelines for Confirmatory Inplant Tests of Safety-Relief Valve Discharges for BWR Plants

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ABSTRACT

Inplant tests of safety-relief valve (SRV) discharges are planned to confirm generically established specifications for SRV loads and suppression pool temperature limit and to explore possible effects of plant-unique parameters. These tests are required in those plants which have features that differ significantly from those previously tested. Guidelines for formulating appropriate test matrices, establishing test procedures, selecting necessary instrumentation, and reporting the test results are provided in this report. Guidelines to determine if inplant tests are required on the basis of the plant-unique parameters are also included in the report.

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FOREWORD

NUREG-0763 is being issued to provide guidance that the NRC staff believes should be followed in formulating test programs for inplant safety-relief valves to meet the requirements of General Design Criteria 16 and 29 in Appendix A to 10 CFR Part 50. NUREG-0763 is not a substitute for the regulations, and compliance is not a requirement. However, an approach or method different from the guidance contained herein will be accepted only if the substitute approach or method provides a basis for determining that the above-cited regulatory requirements have been met.

ACKNOWLEDGMENTS

A-39 REVIEW TEAM

The following individuals participated in the Generic Technical Activity A-39, "Determination of Safety-Relief Valve (SRV) Pool Dynamic Loads and Temperature Limits for BWR Containment," and contributed substantially to this report:

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GUIDELINES FOR CONFIRMATORY INPLANT TESTS OF SAFETY-RELIEF VALVE DISCHARGES FOR BWR PLANTS

1 INTRODUCTION

Nuclear power plants with boiling water reactors (BWRs) are equipped with safety-relief valves (SRVs) to provide overpressure protection for primary systems. The SRVs are mounted on the main steam lines inside the drywell, with discharge pipes routed into the suppression pool. When an SRV is actuated, steam released from the primary system will be discharged into the suppression pool. There it will be condensed.

The discharge of both the air which was in the SRV line and the steam into the suppression pool produces hydrodynamic loads on the containment structure, piping, and equipment. These SRV-related hydrodynamic loads have been studied and evaluated extensively under Unresolved Safety Issue--Task Action Plan A-39, "Determination of Safety-Relief Valve (SRV) Pool Dynamics Loads and Temperature Limits to BWR Containment." Results of the evaluation and associated acceptance criteria for the Mark I containments and Mark II lead-plant containments have been reported in NUREG-0661[1] and NUREG-0487[2], respectively. The evaluation and acceptance criteria for Mark II long-term plant containments and Mark III containments will be reported in the 2nd quarter of 1981.

Use of the acceptance criteria depends on the performance of certain inplant tests to confirm generically established SRV load specifications and to verify possible effects of plant-unique parameters. These confirmatory tests have narrower objectives than the generic test programs; they focus primarily on hydrodynamic loads that result from the actuation of a single valve and on pool-temperature gradients which develop during extended valve discharges. This report describes guidelines for formulating appropriate test matrices, establishing test procedures, and selecting necessary instrumentation. It also outlines the information that should be included in the test reports.

2 SRV-RELATED PHENOMENA

When an SRV is actuated, steam is discharged from the primary system through the SRV into a discharge line that leads to the pressure suppression pool. Air initially in the line is compressed by the influx of steam. The water column at the end of the line which is submerged in the pool is expelled first, through a discharge device (quencher) mounted at the submerged end of the line. This water column is followed by compressed air, which forms one or more air bubbles in the pool. Each bubble undergoes oscillatory expansions and contractions as it rises to the surface of the pool.

Following the air-clearing phase, steam is injected into the pool through the quencher. Tests have shown that the steam-water interfaces formed at the quencher during this phase are stable as long as the local pool temperature remains below the nominal boiling point of 212°F.[3] Current practice is to restrict the pool temperature allowable during reactor operation via the Technical Specifications; this practice ensures operation at temperatures within the range of stable discharge conditions which have been verified experimentally. Pool-temperature-limit evaluation and acceptance criteria will be presented in a NUREG report to be issued in the spring of 1981.

The actuation of a single SRV produces a variety of loads that must be evaluated to ensure that the affected structures, piping, and equipment are adequately designed. The SRV discharge creates loads on the SRV line, quencher, and quencher-support structure that result from the high pressures in the line and the acceleration of the water which is initially in the submerged section of the line. As the water is expelled from the line, water-jet loads may be developed on structures in the pool. When the SRV is closed, the steam in the line is rapidly condensed because of the relatively cold pipe. This rapid steam condensation creates a vacuum in the SRV pipe and causes water to reflood the line. The water reflood also produces loads on the quencher support, quencher, and discharge line.

As the air bubbles rise to the pool surface, their oscillation creates loads on submerged structures and on the pool boundaries. These loads decrease with distance from the bubble. When more than one valve is actuated, contributions of many bubbles to the loads on submerged structures and on the pool boundaries will be superimposed. The distance of the air bubbles from the structures and boundaries and their relative timing will determine the net loads created by these bubbles.

Stable steam discharge through a quencher creates lower amplitude, higher frequency pressure oscillations in the pool that must also be evaluated.

During an extended valve discharge, temperature gradients may develop in the pool. It is necessary to determine the magnitude of the temperature differences that may be created between the liquid in the immediate vicinity of the quencher (where instabilities might develop if the temperature became sufficiently elevated) and the temperature monitoring points elsewhere in the pool.

For licensing purposes, the effects of discharge-line and pool parameters on the loads or temperature gradients must be confirmed. Loads on the discharge line and quencher, for example, depend on the geometry of the line and quencher and on quencher submergence. Among the variables that may affect pool-boundary loads during air-bubble oscillation are the discharge-line air volume, the flowrate of steam into the line, pool temperature, quencher submergence, pool area per quencher, and the geometry of the quencher and its location in the pool.[1,2,4] During extended discharges, temperature gradients in the pool are probably most sensitive to the mass flowrate of steam, the duration of the discharge, the quencher geometry and orientation, the pool geometry, the time for initiating the residual heat removal (RHR) system, and the relative location and geometry of the RHR discharge.

3 GENERIC TEST PROGRAMS AND ANALYSES

There are three principal quencher designs in use or planned in domestic BWR plants: the Mark I T-Quencher[5], the Mark II T-Quencher[6,7] and the Mark II/Mark III X-Quencher.[4] The geometries of these devices are described in the references cited. Large-scale tests of these devices in test tanks[3,6,7] and in plants[5,8,9] have provided the experimental basis for generic approaches to most of the licensing issues relevant to SRV discharges. The scope of those tests and supporting analytical work will not be reviewed here, and the possibility of further large-scale test programs of similar scope is not excluded. However, the goals of such tests and the details of their execution are not appropriate subjects for broad advance guidelines. This report is intended to outline the ways in which inplant tests can be conducted to confirm and modestly extend or modify load specifications which were formulated on a generic basis before the inplant tests.

4 RATIONALE FOR PLANT-SPECIFIC TESTS

The key parameters that affect loads and pool-temperature gradients have been identified in extensive testing. However, there is enough uncertainty about the interdependence and quantitative effects of plant-specific variables that confirmatory testing should be done in plants in which those parameters are substantially different from those previously tested. These inplant tests should be planned in light of the existing data. Many specific issues have been resolved[1,2] or are being addressed on a generic basis; future tests need only demonstrate that the generically established specifications related to those issues conservatively bound any new inplant test data.

Inplant tests will continue to be required in those plants in which parameters potentially affecting SRV-discharge performance are deemed to be plant unique. The list below provides guidelines for identifying those conditions. However, applicants may be able to demonstrate that discharge conditions in their plants are sufficiently similar to conditions previously tested to obviate the need for any new tests or to curtail the scope of new tests.

Plant-specific tests shall generally be required when any of the following conditions are met:

(1) The discharge device is geometrically different from devices tested previously.

(2) The discharge-line parameters--line length, area and volume, quencher submergence, vacuum-breaker size, and available pool area per quencher--differ significantly from values previously tested. An assessment of "significant" differences shall be based on previously established empirical correlations between changes in these parameters and resultant changes in variables of interest, or on analytical considerations.

(3) The flowrate of the steam per unit area of discharge line and the net flowrate of the steam through the line may determine the air-column compression dynamics and pool-temperature gradients during an extended actuation. If either of these differs significantly from conditions previously tested, new inplant tests shall normally be required.

(4) Quencher location and orientation in the pool and the pool geometry may affect peak boundary pressures and frequencies of air-bubble oscillation. Thermal mixing in the pool is also expected to be affected by these variables. No quantitative criteria can be formulated for determining when quencher/pool configuration changes may be sufficient to require new inplant tests. As the range of plant and pool geometries that have been tested increases, the need for testing all new pool configurations may disappear. Present policy shall be to require inplant testing if it cannot be shown that all features of the pool configuration are similar to those previously tested in a plant.

(5) The characteristics of the containment structure may affect peak boundary pressure and frequencies of air-bubble oscillation. For example, inplant tests conducted in a concrete containment will not be considered to have direct application for a free-standing steel containment unless adequate justification for fluid/structure interaction has been demonstrated. Otherwise, inplant tests will be required for plants whose structural characteristics are significantly different from the previous tests.

5 SCOPE AND GOALS

It is expected that most plant-specific test programs will be of much narrower scope than the test tank or lead-plant generic tests.[5,7,8] One goal of most plant-specific tests will be a purely confirmatory one: to verify the conservatism of a limited number of key features of generically established load specifications. An additional goal may be to justify the use of empirically derived elements of generically determined loads for which the effects of plant-to-plant variations remain in question. Current examples of this latter type of goal are pool thermal-mixing criteria and the frequency variations of air-bubble oscillations during air-bubble rise.

Plant-specific tests should focus on the following areas:

(1) loads on discharge lines and quencher-support structures

(2) peak pool-boundary pressures during air clearing and steam discharge from a single valve under normal discharge conditions (normal water leg, cold pipe)

(3) frequency content of air-bubble-transient pressure signatures

(4) pool-temperature gradients during the extended actuation of a single valve

The pool-temperature limits for stable quencher discharge are determined from "single-cell" test data, that is, a quencher discharging into a test tank that roughly simulates the pool area per quencher in the full-scale pool. Single-cell tests yield information on the local pool-temperature limit. In normal plant operation, pool temperatures are recorded at a variety of sensor locations in the pool that together monitor the "bulk" pool temperature, which will typically be lower than the local temperature in the vicinity of a discharging quencher. This temperature difference is expected to vary with the steam discharge rate, with the discharge duration, and with the geometry of the quencher and its orientation and location in the pool. Thus, it may prove to be sensitive to plant-specific parameters.

The current position of the staff[1,2] is that thermal-mixing tests are needed of a scope sufficient to allow plant-specific determination of the differences between local and bulk pool temperatures for various operating conditions. This does not eliminate the possibility of developing generic pool-thermal-mixing models or bulk-temperature Technical Specifications. As such models evolve, inplant extended blowdown tests may become purely confirmatory and the scope of the tests may be correspondingly narrowed.

The staff expects that plant-specific tests will generally not be designed to provide extensive verification of certain other elements of the load specifications. These elements are:

(1) Analytical methods for predicting spatial variations in air-bubble loads. These methods should generally be developed and experimentally verified on a generic basis. Quencher locations and pool geometries which are highly atypical may require additional confirmatory tests.

(2) Load superposition methods for multiple valve actuations. These also must be reviewed on a generic basis. Some multiple-valve-discharge tests may be appropriate to investigate upper limits on pool-boundary peak pressures when clusters of quenchers in close proximity discharge simultaneously.

(3) The load changes that accompany consecutive valve actuations (CVA). These will generally be resolved on a generic basis. Limited plant-specific CVA confirmatory tests should be conducted nevertheless.

(4) The shifts in bubble frequency that result from variations in back pressure during the air clearing transient. These will be determined on a generic basis. Events which cause variations in back pressure are operation of the automatic depressurization system (ADS), anticipated trans[illegible]s without scram (ATWS), and small loss-of-coolant accidents (LOCAs).

The verification procedures described above are summarized in Table 1. All data from inplant SRV tests should be compared against load specifications. When an applicant seeks to use any load specification that is significantly different from that previously determined on a generic basis inplant test programs of considerably broader scope will normally be required.

6 TEST PROCEDURES AND MATRIX

Plant-specific tests should focus on single valve actuations under normal discharge conditions (cold pipe, normal water leg). If the volumes of air lines in the plant are not similar to, or bracketed by, those previously tested, the lines with the smallest and largest volumes should be tested to determine the highest pool-boundary loads. Testing the widest possible range of air-line volumes also will usually give the most complete data on the ranges of air-bubble frequency.

The location and orientation of quenchers in the pool may affect peak boundary loads, bubble frequencies, and thermal mixing in the pool. Depending on the pool geometry, it may be necessary to test two or more quenchers to investigate this possible dependence.

Normal, single-valve discharge conditions include a cold discharge line and a normal water leg in the submerged section of the line. A temperature sensor near the SRV should be monitored to detect leaking valve conditions before each test. An air-bleed line connecting the discharge line and the wetwell airspace will generally be required to adjust the water level in the line before each test.

Table 1 Summary of Procedures for SRV-Related Loads Specification Verification

Single SRV Actuation

Sequence of Events	Thermohydraulic Loads	Verification* Methods
SRV actuated		
Line clearing (water reflood)	Discharge-line loads	A & C
	Quencher-arm and support-structure loads	A & C
	Submerged-structure loads	A & C
Air discharging		
Air-bubble oscillation	Bubble peak pressures (positive and negative)	A & B
	Bubble frequencies	A & B
	Pressure spatial distribution	A
	Changes for consecutive and leaking valve actuation	C
Steam discharge	Steam-condensation oscillatory pressures	B
	Frequencies	B
Extended steam blowdown	Local temperature	B
	Bulk temperature	B

MULTIPLE SRV ACTUATION

Hydrodynamic loads established from the single valve actuation

Verified by limited multiple-valve tests

Load superposition for multiple-valve cases based on Method A

*A=Generically verified calculation procedures or test results
B=Systematic plant-specific confirmatory tests
C="Spot Check" plant-specific confirmatory tests

The total number and types of actuations in the test matrix will vary depending on the scope of the test program and its specific licensing goals. Two general considerations will determine the required scope of inplant tests. These are:

(1) the extent to which quenchers of the type being tested have already undergone full-scale tests with discharge lines similar to those in the present tests

(2) the extent to which the data from the present tests are required to justify modifications of generic load specifications or to provide the basis for plant-specific load specifications

The test matrix should include repetitions of single valve actuations which are nominally identical. Key features of the data should be evaluated immediately, and tests exhibiting the highest loads or pool-temperature gradients should be repeated.

Consecutive valve actuations can produce pool-boundary loads that differ in amplitude and frequency from those developed in single valve actuations; therefore, some CVA discharges should be included in most test matrices. When the test intervals between the consecutive actuations and the duration of each actuation are planned, available data from previous CVA tests with similar quenchers should be considered. CVA loads can be sensitive to the precise intervals between actuations during which the water line refloods; an actuation at the instant when the reflooding water column reaches its peak elevation is normally expected to produce peak loads. However, it is not anticipated that plant-specific tests will provide a comprehensive body of CVA data that always includes tests under these worst-case conditions. If load amplitude or frequency "multipliers" on first-actuation data are required to bracket the results of consecutive actuations, these should be established on the basis of generic full-scale tests. Later plant-specific CVA tests will usually have a narrower, confirmatory objective.

Plant-specific test matrices will generally not include "leaking valve" actuations (LVAs). It is important, however, that temperature sensors near the valve be monitored to avoid inadvertant testing under LVA conditions. Load changes associated with these conditions should be quantified on a generic basis.

Some multiple valve actuations (MVAs) in plant-specific tests may be useful to investigate the effects of load superposition in the immediate vicinity of two or more adjacent quenchers which discharge simultaneously. But, the main issues of load superposition and the response of structures and equipment to MVAs must be resolved generically.

When MVA tests are conducted, the test plan should outline how the several valves are to be actuated "simultaneously." Evaluation of the MVA data should consider whether the actuation was in fact "simultaneous."

Appropriate test conditions for pool thermal mixing will be assessed on a plant-specific basis. Ideally, measurements of differences between local and bulk pool temperatures as a function of time are needed for a range of flowrates of the steam mass. Tests at various reactor pressures to produce peak discharge rates and a broad range of lower mass flowrates are desirable. Discharge durations should be planned for at least 10 minutes, subject to changes dictated by the bulk pool temperatures specified by Technical Specifications. If the RHR system is used to promote pool mixing, the RHR flow should be initiated no sooner than 5 minutes after the SRV is opened. In addition, the pool should be maintained at ambient (that is, still) conditions before the SRV is opened. The differences between bulk and local pool temperatures derived from this test may be used directly to determine the local pool-temperature transient.

The quencher device selected for the pool thermal mixing should be not less than 20 feet from the RHR discharge or return, and should be that with closest proximity to the reactor side of the containment.

7 INSTRUMENTATION

Instrumentation requirements will vary depending on plant-unique features and the specific goals of each test program.

7.1 Discharge-Line Loads

Pressure sensors at the two ends of the line near the SRV and the quencher are appropriate to record peak steam/air pressures in the line and to monitor loads associated with the ejection of the water column. A temperature sensor in the line near the SRV is essential to monitor for leaking valve conditions.

The dynamics of water-reflood and concomittant loads on the quencher and line will normally be assessed generically; hence the acquisition of reflood data will be limited. Loads on the quencher and the line during reflood should be recorded in the same manner as line-clearing loads. Water level sensors should be installed at points above the normal water level to ensure that peak reflood heights can be identified or bracketed. Reflood dynamics are expected to be sensitive to line and quencher geometry, vacuum breaker size, and quencher submergence, but they are relatively insensitive to pool geometry and to quencher location or orientation. If applicants can demonstrate that important features of their lines and quenchers are similar to those previously tested at full scale, instrumentation to record the dynamics of reflooding the line may be unnecessary.

Temperature sensors can serve as acceptable water-level indicators.

7.2 Quencher and Quencher-Support-Structure Loads

Pressure transducers on or near the quencher arms and strain gages on the arms and quencher support provide adequate records of these loads. It is expected that loads on these structures are determined primarily by line clearing and bubble oscillation. The line-clearing loads are expected to be determined primarily on a generic basis, and the plant-to-plant changes in quencher-arm loads resulting from bubble oscillations can be assessed indirectly from peak pool-boundary pressure records. Thus, a reduced level of instrumentation to record these loads frequently will be appropriate.

7.3 Pool-Boundary Loads

One central goal of plant-specific tests should be to measure peak positive and negative pressures developed in the immediate vicinity of the discharging quencher during the air-clearing phase. A confirmation that these are within design specifications will serve as an important indirect indicator that line-clearing loads, loads on the quencher and quencher support, submerged-structure loads, and pool-boundary loads are also within expected ranges.

Pressure transducers should be installed on the pool walls and basemat, on submerged structures, and at other points close to the quencher being tested. Transducer locations should be selected in the light of prior tests of similar discharge devices, with the aim of recording peak loads as well as some representative average in the vicinity of the quencher. Some redundancy in instrumentation is essential.

It is not anticipated that extensive instrumentation to measure spatial variations in pressure amplitudes will normally be required. These trends should be verified in generic tests. When clusters of quenchers occurring in plant-unique configurations are to be tested in multiple valve actuations, some sensors should be located at points roughly equidistant from the quenchers so that the local effects of load superposition can be checked.

Acquiring data on the frequency content of air-bubble pressure signatures will normally be a second goal of plant-specific tests. Data evaluation reports should include records of the power spectral densities and times of air-bubble oscillation.

7.4 Submerged Structures

SRV-related load specifications for submerged structures will be determined on the basis of calculations of hydrodynamic loads during the SRV line-clearing transient and on the basis of calculations of loads resulting from bubble oscillation. Verification of these calculation procedures is a generic task. The plant-specific tests should confirm the conservatism of the empirical inputs and provide a limited body of additional data regarding the loads on submerged structures. These data will serve as a final, spot-check confirmation of the generic calculation procedures, but they are not generally intended to serve any broader purpose. Strain gages and pressure transducers on structures in the immediate vicinity of the quenchers being tested should normally provide sufficient data.

7.5 Response of Plant Structures and Equipment

Transient loads on the pool boundaries can excite structures and equipment in the reactor building. Calculational procedures for predicting such responses from the histories of pool-boundary pressures must be developed and verified on a generic basis. Plant-specific tests again are expected to provide only a very limited body of confirmatory data in this area. The accelerations of structures and equipment should be recorded at a few locations where the accelerations are expected to be the largest. Comparisons between these data and predictions for conditions corresponding to those tested can verify both pool-boundary load specifications and the response codes for structures and equipment.

7.6 Pool-Temperature Gradients During Extended Valve Discharges

An even distribution of temperature sensors throughout the pool is essential when plant-specific tests are intended to establish bulk pool-temperature Technical Specifications. Tests have shown that symmetric temperature distributions around the quencher should not be assumed in selecting sensor locations. Local temperatures should be measured near the discharging quencher. The local temperature sensors should be located both on the quencher support and on the containment walls at the same level as the quencher discharge. If the RHR pool-cooling mode is used during the local temperature measurements, the appropriate locations of the temperature sensors would be the downstream of RHR discharge (relative to the center of the quencher device) and on the reactor side of the containment wall.

8 REPORTING TEST RESULTS

8.1 Departures from Expected Results

In view of the confirmatory goals of the inplant tests addressed in these guidelines, test reports should highlight any measured data that do not conform to results expected before the tests. These results should include, but not be limited to, the following:

(1) measured pool-boundary pressure amplitudes that are larger than 80% of the design specification corresponding to the discharge conditions tested

(2) measured dominant bubble frequencies (averaged over the first four bubble cycles) that differ by more than 20% from expected mean values for the line volumes and discharge conditions tested

(3) measured dominant bubble frequencies (averaged over the entire transient) that fall outside the ranges of the design specification (When the design specification consists of a mean bubble frequency and a standard deviation on bubble frequency, dominant frequencies falling more than two standard deviations from the mean should be identified.)

(4) any significant components of bubble oscillation at frequencies that are substantially different from the average dominant bubble frequency for that discharge condition.

(5) measured line reflood transient after valve closure that exceed the normal water level in the line by more than 10% of the normal water-leg length

(6) peak line pressures that equal or exceed 80% of design specifications

(7) any anomalous pressure amplitudes or frequencies measured under leaking valve conditions

(8) pool temperatures in extended valve discharges that exceed average local temperatures by more than 9°F.

(9) strains measured on the quencher, quencher support, and other structures in the pool, as well as accelerations of plant and equipment that

(a) equal or exceed peak expected values or (b) fall within 80% of design specifications

This list is not intended to be all inclusive. The primary focus of all test reports should be on any data that appear to depart from expectations in any significant way.

8.2 Other Test Results

Test reports should include representative average data records, as well as a complete documentation of results from the tests under the worst conditions. In general, the following types of records have proved to be useful:

(1) pressure transients measured near discharging quenchers

(2) power spectral density analyses of pressure transients

(3) tabulated values of peak positive and negative pressures and dominant bubble frequencies for each test, as well as calculated means and standard deviations of these values

(4) measured bubble frequency as a function of cycle number

(5) the relative actuation times of valves in multiple-valve-discharge tests

(6) strain and acceleration data from various points in the pool and elsewhere in the plant

(7) pool temperature histories measured in the vicinity of a discharging quencher during an extended valve actuation, as well as corresponding bulk pool-temperatures measured at the permanent pool-temperature monitors and at other sensors installed for the tests

(8) tabulated values of line reflood heights, to the extent that these are available

8.3 Sensor Failures

The report should clearly describe (1) which sensors failed before or during the tests and (2) the reasons for failure, whenever these can be identified. Sensors which failed should be clearly shown on figures that identify their locations in relation to the quenchers tested and to other sensors that did not fail. An overall assessment of the extent to which failed sensors detracted from the usefulness of the tests should be provided.

8.4 Evaluation of Test Results

All test results should be evaluated in a manner consistent with the confirmatory objective of the inplant tests. Comparisons with expected mean values and design specifications should be provided wherever possible. A statistical analysis of data should be included when tests of a single discharge condition are of sufficient scope to make such an analysis meaningful. When the data depart from expected performance, the implications of the results to other possible discharge conditions not actually tested should receive special attention, even though the results are still within design specifications.

9 IMPLEMENTATION OF THE GUIDELINES

The following summarizes the recommended actions that should be taken to implement the guidelines described in this report.

9.1 Mark I Plants

Applicants/licensees for Mark I plants should document the SRV inplant test program in conjunction with the requirements for the Mark I Long Term Program (NUREG-0661). The test procedures, test matrix and instrumentation should follow the guidelines described in Sections 6 and 7. A report of the test results should follow the guidelines provided in Section 8. If the applicant/licensee elects not to perform the inplant tests, justification should be provided following the guidelines specified in Section 4.

9.2 Mark II and Mark III Plants

Applicants for Mark II and Mark III plants should document the SRV inplant test program during the FSAR review. The test procedures, test matrix and instrumentation should follow the guidelines described in Sections 6 and 7. A report of the test results should follow the guidelines provided in Section 8. If the applicant elects not to perform the inplant tests, justification should be provided following the guidelines specified in Section 4.

9.3 Recommended Changes to Standard Review Plan

To incorporate the guidelines described in this report, the following changes to Standard Review Plans should be made:

SRP Section 6.2.1.1C

I. Areas of Review
    10. The safety/relief valve inplant confirmatory test program

II. Acceptance Criteria
    8. The acceptability of the safety/relief valve inplant confirmatory test program shall be based on conformance with the guidelines specified in Sections 6, 7, and 8 of NUREG-0763. If the applicant/licensee elects not to perform the SRV inplant tests, the acceptability of this exception shall be determined in conformance with the guidelines specified in Section 4 of NUREG-0763.

9.4 Recommended Development of a Regulatory Guide

It is recommended that a Regulatory Guide should be developed to include Sections 4, 5, 6, 7 and 8. Such a Regulatory Guide will provide the industry with guidelines to determine if SRV inplant tests are required. This guide will also provide guidelines for development of a comprehensive inplant test program. Results of the tests will, therefore, provide the basis to confirm the SRV design loads and suppression pool temperature limit.

REFERENCES

The material referenced below is available for inspection and copying for a fee in the NRC Public Document Room, 1717 H Street, N.W., Washington, D.C. 20555. Material marked with an asterisk also is available for purchase from the NRC/GPO Sales Program, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, and the National Technical Information Service, Springfield, Virginia 22161.

(1) U.S. Nuclear Regulatory Commission, "Safety Evaluation Report: Mark I Containment Long-Term Program. Resolution of Generic Technical Activity A-7," USNRC Report NUREG-0661, July 1980.*

(2) U.S. Nuclear Regulatory Commission, "Mark II Containment Lead Plant Program Load Evaluation and Acceptance Criteria," USNRC Report NUREG-0487, October 1978, and Supplement No. 1, September 1980.*

(3) "Test Results Employed by GE for BWR Containment and Vertical Vent Loads," NEDE-21078-P, Class III, October, 1975.

(4) General Electric Co., "Mark II Containment Dynamic Forcing Functions Information Report," GE Report NEDO-21061-P, Revision 2, September 1977.

(5) General Electric Co., "Mark I Containment Program Final Report: Monticello T-Quencher Test," NEDE-21864-P, Class III, July 1978.

(6) Subsquehanna Steam Electric Station Unit 1 & 2 Design Assessment Report Volume 1. Docket No. 05000387 and 05000388.

(7) Ibid, Section 8 update.

(8) General Electric Co., "Caorso SRV Discharge Tests, Phase 1 Test Report," NEDE-25100-P, Class III, May 1979.

(9) General Electric Co., "Mark II Containment Supporting Program, Caorso Safety Relief Valve Discharge Tests, Phase II Test Report," NEDE-24757-P, Class III, May 1980.

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16. ABSTRACT *(200 words or less)*

Inplant tests of safety/relief valve (SRV) discharges may be required to confirm generically established specifications for SRV loads and the maximum suppression pool temperature, and to evaluate possible effects of plant-unique parameters. These tests are required in those plants which have features that differ substantially from those previously tested. Guidelines for formulating appropriate test matrices, establishing test procedures, selecting necessary instrumentation, and reporting the test results are provided in this report. Guidelines to determine if inplant tests are required on the basis of the plant unique parameters are also included in the report.

17. KEY WORDS AND DOCUMENT ANALYSIS
Safety/relief valve inplant tests guidelines.

17a. DESCRIPTORS

17b. IDENTIFIERS/OPEN-ENDED TERMS

18. AVAILABILITY STATEMENT
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19. SECURITY CLASS *(This report)*
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