UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

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NRC PDR

November 29, 1978

Docket No.: 50-285

Mr. Theodore E. Short
Division Manager - Production
Operations
Omaha Public Power District
1623 Harney Street
Omaha, Nebraska 68102

Dear Mr. Short:

RE: CONTAINMENT PURGING DURING NORMAL PLANT OPERATION

A number of events have occurred over the past several years which directly relate to the practice of containment purging during normal plant operation. During recent months, two specific events have occurred which have raised several questions relative to potential failures of automatic isolation of the large diameter purge penetrations which are used during power operation. On July 26, 1978, the Northeast Nuclear Energy Company reported to the NRC such an event at Millstone Unit No. 2, a pressurized water reactor located in New London County, Connecticut. On September 8, 1978, the Public Service Electric and Gas Company reported a similar event at Salem Unit No. 1, a pressurized water reactor located in Salem County, New Jersey.

During a review of operating procedures on July 25, 1978, the licensee discovered that since May 1, 1978, intermittent containment purge operations had been conducted at Millstone Unit No. 2 with the safety actuation isolation signals to both inlet and outlet redundant containment isolation valves (48 inch butterfly valves) in the purge inlet and outlet penetrations manually overridden and inoperable. The isolation signals which are required to automatically close the purge valves for containment integrity were manually overridden to allow purging of containment with a high radiation signal present. The manual override circuitry designed by the plant's architect/engineer defeated the high radiation signal and all other isolation signals to these valves. To manually override a safety actuation signal, the operator cycles the valve control switch to the closed position and then to the open position. This action energized a relay which blocked the safety signal and allowed manual operation independent of any safety actuation signal. This circuitry was designed to permit reopening these valves after an accident to allow manual operation of certain safety equipment.

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On September 8, 1978, the staff was advised that, as a matter of routine, Salem Unit No. 1 has been venting the containment through the containment ventilation system valves to reduce pressure. In certain instances this venting has occurred with the containment high particulate radiation monitor isolation signal to the purge and pressure-vacuum relief valves overridden. Override of the containment isolation signal was accomplished by resetting the train A and B reset buttons. Under these circumstances, six valves in the containment vent and purge systems could be opened with a high particulate isolation signal present. This override was performed after verifying that the actual containment particulate levels were acceptable for venting. The licensee, after further investigation of this practice, determined that the reset of the particulate alarm also bypasses the containment isolation signal to the purge valves and that the purge valves would not have automatically closed in the event of an emergency core cooling system (ECCS) safety injection signal.

These events and information gained from recent licensing actions have raised several concerns relative to potential failures affecting the purge penetration valves which could lead to a degradation in containment integrity and, for PWR's, a degradation in ECCS performance. Should a loss-of-coolant accident (LOCA) occur during purging there could be insufficient containment backpressure to assure proper operation of the ECCS. As the practice of containment purging during normal operation has become more prevalent in recent years, we have required that applicants for construction permits or operating licenses provide test results or analyses to demonstrate the capability of the purge isolation valves to close against the dynamic forces of a design basis LOCA. Some licensees have Technical Specifications which prohibit purging during plant operation pending demonstration of isolation valve operability.

In light of the above, we request that you provide within 30 days of receipt of this letter your commitment to cease all containment purge during operation (hot shutdown, hot standby, startup and power operation) or a justification for continuing purging at your facility. Specifically, provide the following information:

(1) Propose an amendment to the plant Technical Specifications based upon the enclosed model Technical Specification, or

(2) If you plan to justify limited purging, you must propose a Technical Specification change limiting purging during operation to 90 hours per year as described in the enclosed Standard Review Plan Section 6.2.4, Revision 1. Your justification must include a demonstration (by test or by test and analysis similar to that required by Standard Review Plan 3.9.3) of the ability of the containment isolation valves to close under postulated design basis accident conditions. Within thirty days of receipt of this letter, you are requested to provide a schedule for completion of your evaluation justifying continuation of limited purging during power operation.

(3) If you plan to justify unlimited purging you need not propose a Technical Specification change at this time. You must, however, provide the basis for purging and a schedule for responding to the issues relating to purging during normal operation as described in the enclosed Standard Review Plan Section 6.2.4, Revision 1, and the associated Branch Technical Position CSB 6-4. As discussed in these documents, purging during normal operation may be permitted if the purge isolation valves are capable of closing against the dynamic forces of a design basis loss-of-coolant accident. Also, basis for unlimited purging must include an evaluation of the impact of purging during operation on ECCS performance, an evaluation of the radiological consequences of any design basis accident requiring containment isolation occurring during purge operations, and an evaluation of containment purge and isolation instrumentation and control circuit designs. Within thirty days of receipt of this letter, you are requested to provide a schedule for completion of your evaluation justifying continuation of unlimited purging during power operation.

Pending completion of the NRC staff review of the justification for continued purging in (2) or (3) above, you should commit to either cease purging or limit purging to an absolute minimum, not to exceed 90 hours per year.

The staff believes that both the Millstone and Salem events resulted from lack of proper management control, procedural inadequacies, and possible design deficiencies. While the containment atmosphere was properly sampled and the purging (venting) discharges at both facilities were within regulatory requirements, the existing plant operating procedures approved by the licensee's management did not adequately address the operability of the purge valves and the need for strict limitations on (or prohibition of) overriding a safety actuation closure signal. The requirements for valve operability were not discussed and the related Technical Specifications were not referenced in the procedures. Design deficiencies probably contributed to the events as the safety actuation bypass condition is not annunciated nor is a direct manual reset of the safety actuation signal available. Consequently, we have developed the position specified below to assure that the design and use of all override circuitry in your plant is such that your plant will have the protection needed during postulated accident conditions.

Whether or not you plan to justify purging you should review the design of all safety actuation signal circuits which incorporate a manual override feature to ensure that overriding of one safety actuation signal does not also cause the bypass of any other safety actuation signal, that sufficient physical features are provided to facilitate adequate administrative controls, and that the use of each such manual override is annunciated at the system level for every system impacted. Within thirty days of receipt of this letter, you are requested to provide (1) the results of your review of override circuitry and (2) a schedule for the development of any design or procedural changes imposed or planned to assure correction of any non-conforming circuits. Until you have reviewed circuitry to the extent necessary to verify that operation of a bypass will affect no safety functions other than those analyzed and discussed on your docket, do not bypass that signal. Our Office of Inspection and Enforcement will verify that you have inaugurated administrative controls to prevent improper manual defeat of safety actuation signals as a part of its regular inspection program.

Sincerely,

Robert W. Reid

Robert W. Reid, Chief
Operating Reactors Branch #4
Division of Operating Reactors

Enclosures:
1. Model Technical Specification
2. Standard Review Plan
3. Branch Technical Position CSB 6-4

cc: w/enclosures
See next page

Omaha Public Power District

cc:

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

SECTION 6.2.4 CONTAINMENT ISOLATION SYSTEM

REVIEW RESPONSIBILITIES

Primary - Containment Systems Branch (CSB)

Secondary - Accident Analysis Branch (AAB)
Instrumentation and Control System Branch (ICSB)
Mechanical Engineering Branch (MEB)
Structural Engineering Branch (SEB)
Reactor Systems Branch (RSB)
Power Systems Branch (PSB)

I. AREAS OF REVIEW

The design objective of the containment isolation system is to allow the normal or emergency passage of fluids through the containment boundary while preserving the ability of the boundary to prevent or limit the escape of fission products that may result from postulated accidents. This SRP section, therefore, is concerned with the isolation of fluid systems which penetrate the containment boundary, including the design and testing requirements for isolation barriers and actuators. Isolation barriers include valves, closed piping systems, and blind flanges.

The CSB reviews the information presented in the applicant's safety analysis report (SAR) regarding containment isolation provisions to assure conformance with the requirements of General Design Criteria 54, 55, 56 and 57. The CSB review covers the following aspects of containment isolation:

1. The design of containment isolation provisions, including:

   a. The number and location of isolation valves, i.e., the isolation valve arrangements and the physical location of isolation valves with respect to the containment.

   b. The actuation and control features for isolation valves.

   c. The positions of isolation valves for normal plant operating conditions (including shutdown), post-accident conditions, and in the event of valve operator power failures.

   d. The valve actuation signals.

   e. The basis for selection of closure times of isolation valves.

f. The mechanical redundancy of isolation devices.

g. The acceptability of closed piping systems inside containment as isolation barriers.

2. The protection provided for containment isolation provisions against loss of function from missiles, pipe whip, and earthquakes.

3. The environmental conditions inside and outside the containment that were considered in the design of isolation barriers.

4. The design criteria applied to isolation barriers and piping.

5. The provisions for detecting a possible need to isolate remote-manual-controlled systems, such as engineered safety features systems.

6. The design provisions for and technical specifications pertaining to operability and leakage rate testing of the isolation barriers.

7. The calculation of containment atmosphere released prior to isolation valve closure for lines that provide a direct path to the environs.

PSB has primary responsibility for the qualification test program for electric valve operators, and the ICSB has primary responsibility for the qualification test program for the sensing and actuation instrumentation of the plant protection system located both inside and outside of containment. The MEB has review responsibility for the qualification test program to demonstrate the performance and reliability of containment isolation valves. The MEB and SEB have review responsibility for mechanical and structural design of the containment isolation provisions to ensure adequate protection against missiles, pipe whip, and earthquakes. The AAB reviews the radiological dose consequence analysis for the release of containment atmosphere prior to closure of containment isolation valves in lines that provide a direct path to the environs. The RSB reviews the closure time for containment isolation valves in lines that provide a direct path to the environs, with respect to the prediction of onset of accident induced fuel failure.

II. ACCEPTANCE CRITERIA

The general design criteria establish requirements for isolation barriers in lines penetrating the primary containment boundary. In general, two isolation barriers in series are required to assure that the isolation function is satisfied assuming any single active failure in the containment isolation provisions.

The design of the containment isolation provisions will be acceptable to CSB if the following criteria are satisfied:

1. General Design Criteria 55 and 56 require that lines that penetrate the primary containment boundary and either are part of the reactor coolant pressure boundary or

connect directly to the containment atmosphere should be provided with isolation valves as follows:

a. One locked closed isolation valve[1/] inside and one locked closed isolation valve outside containment; or

b. One automatic isolation valve inside and one locked closed isolation valve outside containment; or

c. One locked closed isolation valve inside and one automatic isolation valve[2/] outside containment; or

d. One automatic isolation valve inside and one automatic isolation valve[2/] outside containment.

2. General Design Criterion 57 requires that lines that penetrate the primary containment boundary and are neither part of the reactor coolant pressure boundary nor connected directly to the containment atmosphere should be provided with at least one locked closed, remote-manual, or automatic isolation valve[2/] outside containment.

3. The general design criteria permit containment isolation provisions for lines penetrating the primary containment boundary that differ from the explicit requirements of General Design Criteria 55 and 56 if the basis for acceptability is defined. Following are guidelines for acceptable alternate containment isolation provisions for certain classes of lines:

a. Regulatory Guide 1.11 describes acceptable containment isolation provisions for instrument lines. In addition, instrument lines that are closed both inside and outside containment, are designed to withstand the pressure and temperature conditions following a loss-of-coolant accident, and are designed to withstand dynamic effects, are acceptable without isolation valves.

b. Containment isolation provisions for lines in engineered safety features or engineered safety feature-related systems may include remote-manual valves, but provisions should be made to detect possible leakage from these lines outside containment.

c. Containment isolation provisions for lines in systems needed for safe shutdown of the plant (e.g., liquid poison system, reactor core isolation cooling system, and isolation condenser system) may include remote-manual valves, but provision should be made to detect possible leakage from these lines outside containment.

1/Locked closed isolation valves are defined as sealed closed barriers (see item II.3.f).

2/A simple check valve is not normally an acceptable automatic isolation valve for this application.

d. Containment isolation provisions for lines in the systems identified in items b and c normally consist of one isolation valve inside and one isolation valve outside containment. If it is not practical to locate a valve inside containment (for example, the valve may be under water as a result of an accident), both valves may be located outside containment. For this type of isolation valve arrangement, the valve nearest the containment and the piping between the containment and the valve should be enclosed in a leak-tight or controlled leakage housing. If, in lieu of a housing, conservative design of the piping and valve is assumed to preclude a breach of piping integrity, the design should conform to the requirements of SRP section 3.6.2. Design of the valve and/or the piping compartment should provide the capability to detect leakage from the valve shaft and/or bonnet seals and terminate the leakage.

e. Containment isolation provisions for lines in engineered safety feature or engineered safety feature-related systems normally consist of two isolation valves in series. A single isolation valve will be acceptable if it can be shown that the system reliability is greater with only one isolation valve in the line, the system is closed outside containment, and a single active failure can be accommodated with only one isolation valve in the line. The closed system outside containment should be protected from missiles, designed to seismic Category I standards, classified Safety Class 2 (Ref. 5), and should have a design temperature and pressure rating at least equal to that for the containment. The closed system outside containment should be leak tested, unless it can be shown that the system integrity is being maintained during normal plant operations. For this type of isolation valve arrangement the valve is located outside containment, and the piping between the containment and the valve should be enclosed in a leak tight or controlled leakage housing. If, in lieu of a housing, conservative design of the piping and valve is assumed to preclude a breach of piping integrity, the design should conform to the requirements of SRP section 3.6.2. Design of the valve and/or the piping compartment should provide the capability to detect leakage from the valve shaft and/or bonnet seals and terminate the leakage.

f. Sealed closed barriers may be used in place of automatic isolation valves. Sealed closed barriers include blind flanges and sealed closed isolation valves which may be closed manual valves, closed remote-manual valves, and closed automatic valves which remain closed after a loss-of-coolant accident. Sealed closed isolation valves should be under administrative control to assure that they cannot be inadvertently opened. Administrative control includes mechanical devices to seal or lock the valve closed, or to prevent power from being supplied to the valve operator.

g. Relief valves may be used as isolation valves provided the relief set point is greater than 1.5 times the containment design pressure.

4. Isolation valves outside containment should be located as close to the containment as practical, as required by General Design Criteria 55, 56, and 57.

5. The position of an isolation valve for normal and shutdown plant operating conditions and post-accident conditions depends on the fluid system function. If a fluid system does not have a post-accident function, the isolation valves in the lines should be automatically closed. For engineered safety feature or engineered safety feature-related systems, isolation valves in the lines may remain open or be opened. The position of an isolation valve in the event of power failure to the valve operator should be the "safe" position. Normally this position would be the post-accident valve position. All power-operated isolation valves should have position indication in the main control room.

6. There should be diversity in the parameters sensed for the initiation of containment isolation.

7. System lines which provide an open path from the containment to the environs should be equipped with radiation monitors that are capable of isolating these lines upon a high radiation signal. A high radiation signal should not be considered one of the diverse containment isolation parameters.

8. Containment isolation valve closure times should be selected to assure rapid isolation of the containment following postulated accidents. The valve closure time is the time it takes for a power operated valve to be in the fully closed position after the actuator power has reached the operator assembly; it does not include the time to reach actuation signal setpoints or instrument delay times, which should be considered in determining the overall time to close a valve. System design capabilities should be considered in establishing valve closure times. For lines which provide an open path from the containment to the environs; e.g., the containment purge and vent lines, isolation valve closure times on the order of 5 seconds or less may be necessary. The closure times of these valves should be established on the basis of minimizing the release of containment atmosphere to the environs, to mitigate the offsite radiological consequences, and assure that emergency core cooling system (ECCS) effectiveness is not degraded by a reduction in the containment backpressure. Analyses of the radiological consequences and the effect on the containment backpressure due to the release of containment atmosphere should be provided to justify the selected valve closure time. Additional guidance on the design and use of containment purge systems which may be used during the normal plant operating modes (i.e., startup, power operation, hot standby and hot shutdown) is provided in Branch Technical Position CSB 6-4 (Ref. 9). For plants under review for operating licenses or plants for which the Safety Evaluation Report for construction permit application was issued prior to July 1, 1975, the methods described in Section B, Items B.1., a, b, d, e, f, and g, B.2 through B.4, and B.5.b, c, and d of Branch Technical Position 6-4 should be implemented. For these plants, BTP Items B.1.c and B.5.a, regarding the size of the purge system used during normal plant operation and the justification by acceptable dose consequence analysis, may be

waived if the applicant commits to limit the use of the purge system to less than 90 hours per year while the plant is in the startup, power, hot standby and hot shutdown modes of operations. This commitment should be incorporated into the Technical Specifications used in the operation of the plant.

9. The use of a closed system inside containment as one of the isolation barriers will be acceptable if the design of the closed system satisfies the following requirements:

   a. The system does not communicate with either the reactor coolant system or the containment atmosphere.

   b. The system is protected against missiles and pipe whip.

   c. The system is designated seismic Category I.

   d. The system is classified Safety Class 2 (Ref. 5).

   e. The system is designed to withstand temperatures at least equal to the containment design temperature.

   f. The system is designed to withstand the external pressure from the containment structural acceptance test.

   g. The system is designed to withstand the loss-of-coolant accident transient and environment.

   Insofar as CSB is concerned with the structural design of containment internal structures and piping systems, the protection of isolation barriers against loss of function from missiles, pipe whip, and earthquakes will be acceptable if isolation barriers are located behind missile barriers, pipe whip was considered in the design of pipe restraints and the location of piping penetrating the containment, and the isolation barriers, including the piping between isolation valves, are designated seismic Category I, i.e., designed to withstand the effects of the safe shutdown earthquake, as recommended by Regulatory Guide 1.29.

10. The design criteria applied to components performing a containment isolation function, including the isolation barriers and the piping between them, or the piping between the containment and the outermost isolation barrier, are acceptable if:

   a. Group B quality standards, as defined in Regulatory Guide 1.26 are applied to the components, unless the service function dictates that Group A quality standards be applied.

   b. The components are designated seismic Category I, in accordance with Regulatory Guide 1.29.

11. The design of the containment isolation system is acceptable if provisions are made to allow the operator in the main control room to know when to isolate fluid systems that are equipped with remote manual isolation valves. Such provisions may include instruments to measure flow rate, sump water level, temperature, pressure, and radiation level.

12. Provisions should be made in the design of the containment isolation system for operability testing of the containment isolation valves and leakage rate testing of the isolation barriers. The isolation valve testing program should be consistent with that proposed for other engineered safety features. The acceptance criteria for the leakage rate testing program for containment isolation barriers are presented in SRP section 6.2.6.

For those areas of review identified in subsection I of this SRP section as being the responsibility of other branches, the acceptance criteria and their methods of application are contained in the SRP sections corresponding to those branches.

III. REVIEW PROCEDURES

The procedures described below provide guidance on review of the containment isolation system. The reviewer selects and emphasizes material from the review procedures as may be appropriate for a particular case. Portions of the review may be done on a generic basis for aspects of containment isolation common to a class of containments, or by adopting the results of previous reviews of plants with essentially the same containment isolation provisions.

Upon request from the primary reviewer, the secondary review branches will provide input for the areas of review stated in subsection I. The primary reviewer obtains and uses such input as required to assure that this review procedure is complete.

The CSB determines the acceptability of the containment isolation system by comparing the system design criteria to the design requirements for an engineered safety feature. The quality standards and the seismic design classification of the containment isolation provisions, including the piping penetrating the containment, are compared to Regulatory Guides 1.26 and 1.29, respectively.

The CSB also ascertains that no single fault can prevent isolation of the containment. This is accomplished by reviewing the containment isolation provisions for each line penetrating the containment to determine that two isolation barriers in series are provided, and in conjunction with the PSB by reviewing the power sources to the valve operators.

The CSB reviews the information in the SAR justifying containment isolation provisions which differ from the explicit requirements of General Design Criteria 55, 56 and 57. The CSB judges the acceptability of these containment isolation provisions based on a comparison with the acceptance criteria given in subsection II.

The CSB reviews the position of isolation valves for normal and shutdown plant operating conditions, post-accident conditions, and valve operator power failure conditions as listed in the SAR. The position of an isolation valve for each of the above conditions depends on the system function. In general, power-operated valves in fluid systems which do not have a post-accident safety function should close automatically. In the event of power failure to a valve operator, the valve position should be the position of greater safety, which is normally the post-accident position. However, special cases may arise and these will be considered on an individual basis in determining the acceptability of the prescribed valve positions. The CSB also ascertains from the SAR that all power-operated isolation valves have position indication capability in the main control room.

The CSB reviews the signals obtained from the plant protection system to initiate containment isolation. In general, there should be a diversity of parameters sensed; e.g., abnormal conditions in the reactor coolant system, the secondary coolant system, and the containment, which generate containment isolation signals. Since plant designs differ in this regard and many different combinations of signals from the plant protection system are used to initiate containment isolation, the CSB considers the arrangement proposed on an individual basis in determining the overall acceptability of the containment isolation signals.

The CSB reviews isolation valve closure times. In general, valve closure times should be less than one minute, regardless of valve size. (See the acceptance criteria for valve closure times in subsection II.) Valves in lines that provide a direct path to the environs, e.g., the containment purge and ventilation system lines and main steam lines for direct cycle plants, may have to close in times much shorter than one minute. Closure times for these valves may be dictated by radiological dose analyses or ECCS performance considerations. The CSB will request the AAB or RSB to review analyses justifying valve closure times for these valves as necessary.

The CSB determines the acceptability of the use of closed systems inside containment as isolation barriers by comparing the system designs to the acceptance criteria specified in subsection II.

The MEB and SEB have review responsibility for the structural design of the containment internal structures and piping systems, including restraints, to assure that the containment isolation provisons are adequately protected against missiles, pipe whip, and earthquakes. The CSB determines that for all containment isolation provisions, missile protection and protection against loss of function from pipe whip and earthquakes were design considerations. The CSB reviews the system drawings (which should show the locations of missile barriers relative to the containment isolation provisions) to determine that the isolation provisions are protected from missiles. The CSB also reviews the design criteria applied to the containment isolation provisions to determine that protection against dynamic effects, such as pipe whip and earthquakes, was considered in the design. The CSB will request the MEB to review the design adequacy of piping and valves for which conservative design is assumed to preclude possible breach of system integrity in lieu of providing a leak tight housing.

Systems having a post-accident safety function may have remote-manual isolation valves in the lines penetrating the containment. The CSB reviews the provisions made to detect leakage from these lines outside containment and to allow the operator in the main control room to isolate the system train should leakage occur. Leakage detection provisions may include instrumentation for measuring system flow rates, or the pressure, temperature, radiation, or water level in areas outside the containment such as valve rooms or engineered safeguards areas. The CSB bases its acceptance of the leakage detection provisions described in the SAR on the capability to detect leakage and identify the lines that should be isolated.

The CSB determines that the containment isolation provisions are designed to allow the isolation barriers to be individually leak tested. This information should be tabulated in the safety analysis report to facilitate the CSB review.

The CSB determines from the descriptive information in the SAR that provisions have been made in the design of the containment isolation system to allow periodic operability testing of the power-operated isolation valves and the containment isolation system. At the operating license stage of review, the CSB determines that the content and intent of proposed technical specifications pertaining to operability and leak testing of containment isolation equipment is in agreement with requirements developed by the staff.

IV. EVALUATION FINDINGS

The information provided and the CSB review should support concluding statements similar to the following, to be included in the staff's safety evaluation report:

"The scope of review of the containment isolation system for the (plant name) has included schematic drawings and descriptive information for the isolation provisions for fluid systems which penetrate the containment boundary. The review has also included the applicant's proposed design bases for the containment isolation provisions, and analyses of the functional capability of the containment isolation system.

"The basis for the staff's acceptance has been the conformance of the containment isolation provisions to the Commission's regulations as set forth in the General Design Criteria, and to applicable regulatory guides, staff technical positions, and industry codes and standards. (Special problems or exceptions that the staff takes to specific containment isolation provisions or the functional capability of the containment isolation system should be discussed.)

"The staff concludes that the containment isolation system design conforms to all applicable regulations, guides, staff positions, and industry codes and standards, and is acceptable."

V. REFERENCES

1. 10 CFR Part 50, Appendix A, General Design Criterion 54, "Piping Systems Penetrating Containment."

2. 10 CFR Part 50, Appendix A, General Design Criterion 55, "Reactor Coolant Pressure Boundary Penetrating Containment."

3. 10 CFR Part 50, Appendix A, General Design Criterion 56, "Primary Containment Isolation."

4. 10 CFR Part 50, Appendix A, General Design Criterion 57, "Closed System Isolation Valves."

5. Regulatory Guide 1.141, "Containment Isolation Provisions For Fluid Systems."

6. Regulatory Guide 1.11, "Instrument Lines Penetrating Primary Reactor Containment."

7. Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants."

8. Regulatory Guide 1.29, "Seismic Design Classification."

9. Branch Technical Position CSB 6-4, "Containment Purging During Normal Plant Operations," attached to this SRP section.

Branch Technical Position CSB 6-4

CONTAINMENT PURGING DURING NORMAL PLANT OPERATIONS

A. BACKGROUND

This branch technical position pertains to system lines which can provide an o:·n path from the containment to the environs during normal plant operation; e.g., the ,u ge and vent lines of the containment purge system. It supplements the position tc ·· in SRP secti)n 6.2.4.

While the containment purge system provides plant operational flexibility, its design must consider the importance of minimizing the release of containment atmosphere to the environs following a postulated loss-of-coolant accident. Therefore, plant designs must not rely on its use on a routine basis.

The need for purging has not always been anticipated in the design of plants, and therefore, design criteria for the containment purge system have not been fully developed. The purging experience at operating plants varies considerably from plant to plant. Some plants do not purge during reactor operation, some purge intermittently for short periods and some purge continuously.

The containment purge system has been used in a variety of ways, for example, to alleviate certain operational problems, such as excess air leakage into the containment from pneumatic controllers, for reducing the airborne activity within the containment to facilitate personnel access during reactor power operatiun, and for controlling the containment pressure, temperature and relative humidity. However, the purge and vent lines provide an open path from the containment to the environs. Should a LOCA occur during containment purging when the reactor is at power, the calculated accident doses should be within 10 CFR 100 guideline values.

The sizing of the purge and vent lines in most plants has been based on the need to control the containment atmosphere during refueling operations. This need has resulted in very large lines penetrating the containment (about 42 inches in diameter). Since these lines are normally the only ones provided that will permit some degree of control over the containment atmosphere to facilitate personnel access, some plants have used them for containment purging during normal plant operation. Under such conditions, calculated accident doses could be significant. Therefore, the use of these large containment purge and vent lines should be restricted to cold shutdown conditions and refueling operations.

The design and use of the purge and vent lines should be based on the premise of achieving acceptable calculated offsite radiological consequences and assuring that emergency core cooling (ECCS) effectiveness is not degraded by a reduction in the containment backpressure.

Purge system designs that are acceptable for use on non-routine b::is during normal plant operation can be achieved by providing additional purge and vent lines. The size of these lines should be limited such that in the event of a loss-of-coolant accident, assuming the purge and vent valves are open and subsequently close, the radiological consequences calculated in accordance with Regulatory Guides 1.3 and 1.4 would not exceed the 10 CFR 100 guideline values. Also, the maximum time for valve closure should not exceed five seconds to assure that the purge and vent valves would be closed before the onset of fuel failures following a LOCA.

The size of the purge and vent lines should be about eight inches in diameter for PWR plants. This line size may be overly conservative from a radiological viewpoint for the Mark III BWR plants and the HTGR plants because of containment and/or core design features. Therefore, larger line sizes may be justified. However, for any proposed line size, the applicant must demonstrate that the radiological consequences following a loss-of-coolant accident would be within 10 CFR 100 guideline values. In summary, the acceptability of a specific line size is a function of the site meteorology, containment design, and radiological source term for the reactor type; e.g., BWR, PWR or HTGR.

B. BRANCH TECHNICAL POSITION

The system used to purge the containment for the reactor operational modes of power operation, startup, hot standby and hot shutdown; i.e., the on-line purge system, should be independent of the purge system used for the reactor operational modes of cold shutdown and refueling.

1. The on-line purge system should be designed in accordance with the following criteria:

   a. The performance and reliability of the purge system isolation valves should be consistent with the operability assurance program outlined in MEB Branch Technical Position MEB-2, Pump and Valve Operability Assurance Program. (Also see SRP Section 3.9.3.) The design basis for the valves and actuators should include the buildup of containment pressure for the LOCA break spectrum, and the purge line and vent line flows as a function of time up to and during valve closure.

   b. The number of purge and vent lines that may be used should be limited to one purge line and one vent line.

   c. The size of the purge and vent lines should not exceed about eight inches in diameter unless detailed justification for larger line sizes is provided.

d. The containment isolation provisions for the purge system lines should meet the standards appropriate to engineered safety features; i.e., quality, redundancy, testability and other appropriate criteria.

e. Instrumentation and control systems provided to isolate the purge system lines should be independent and actuated by diverse parameters; e.g., containment pressure, safety injection actuation, and containment radiation level. If energy is required to close the valves, at least two diverse sources of energy shall be provided, either of which can affect the isolation function.

f. Purge system isolation valve closure times, including instrumentation delays, should not exceed five seconds.

g. Provisions should be made to ensure that isolation valve closure will not be prevented by debris which could potentially become entrained in the escaping air and steam.

2. The purge system should not be relied on for temperature and humidity control within the containment.

3. Provisions should be made to minimize the need for purging of the containment by providing containment atmosphere cleanup systems within the containment.

4. Provisions should be made for testing the availability of the isolation function and the leakage rate of the isolation valves, individually, during reactor operation.

5. The following analyses should be performed to justify the containment purge system design:

a. An analysis of the radiological consequences of a loss-of-coolant accident. The analysis should be done for a spectrum of break sizes, and the instrumentation and setpoints that will actuate the vent and purge valves closed should be identified. The source term used in the radiological calculations should be based on a calculation under the terms of Appendix K to determine the extent of fuel failure and the concomitant release of fission products, and the fission product activity in the primary coolant. A pre-existing iodine spike should be considered in determining primary coolant activity. The volume of containment in which fission products are mixed should be justified, and the fission products from the above sources should be assumed to be released through the open purge valves during the maximum interval required for valve closure. The radiological consequences should be within 10 CFR 100 guideline values.

b. An analysis which demonstrates the acceptability of the provisions made to protect structures and safety-related equipment; e.g., fans, filters and ductwork, located beyond the purge system isolation valves against loss of function from the environment created by the escaping air and steam.

c. An analysis of the reduction in the containment pressure resulting from the partial loss of containment atmosphere during the accident for ECCS backpressure determination.

d. The allowable leak rates of the purge and vent isolation valves should be specified for the spectrum of design basis pressures and flows against which the valves must close.

CONTAINMENT VENTILATION SYSTEM (OPTIONAL*)

LIMITING CONDITION FOR OPERATION

3.6.1.8 The containment purge supply and exhaust isolation valves shall be closed.

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTION:

With one containment purge supply and/or one exhaust isolation valve open, close the open valve(s) within one hour or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

SURVEILLANCE REQUIREMENTS

4.6.1.8 The containment purge supply and exhaust isolation valves shall be determined closed at least once per 31 days.

3/4.6.1.8 CONTAINMENT VENTILATION SYSTEM

The containment purge supply and exhaust isolation valves are required to be closed during plant operation since these valves have not been demonstrated capable of closing during a (LOCA or steam line break accident). Maintaining these valves closed during plant operations ensures that excessive quantities of radioactive materials will not be released via the containment purge system.