1750 UNITED STATES 0374
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

Docket No. 50-298

August 5, 1975

Nebraska Public Power District
ATTN: Mr. J. M. Pilant, Manager
Licensing and Quality Assurance
Post Office Box 499
Columbus, Nebraska 68601

Re: Cooper Nuclear Station

Gentlemen:

10 CFR Part 50, Appendix J, "Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors," was published February 14, 1973. Since many nuclear plants had either received an operating license or their containments had reached advanced stages of design or construction at that time, some plants may not now be in full compliance with the requirements of this regulation.

You are requested to determine if you are conducting containment leakage testing in full compliance with Appendix J. This determination should include the identification of any design features that do not permit conformance with its requirements or existing technical specification requirements which are in conflict with Appendix J, (i.e. less restrictive than). It should be understood that while a containment leakage testing program may be in compliance with the technical specifications for your facility, the program may not be in conformance with Appendix J.

If you are not in full compliance, you should identify your planned actions and schedule to attain conformance to the Regulation. Possible courses of action include design modifications, amendments to the technical specifications, and requests for exemption pursuant to 10 CFR Part 50, Section 50.12.

Please submit the results of your study to us as soon as possible but no later than 30 days from receipt of this letter.

This request for generic information was approved by GAO under a blanket clearance number B-180225 (R0072); this clearance expires July 31, 1977.

Sincerely,

Karl R. Goller, Assistant Director
for Operating Reactors
Division of Reactor Licensing

Enclosure:
Appendix J

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cc w/enclosure:
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Title 10—Atomic Energy

CHAPTER I—ATOMIC ENERGY COMMISSION

PART 50—LICENSING OF PRODUCTION AND UTILIZATION FACILITIES

Reactor Containment Leakage Testing for Water-Cooled Power Reactors

On August 27, 1971, the Atomic Energy Commission published in the FEDERAL REGISTER (36 FR 17053) a proposed amendment to its regulations in 10 CFR Part 50 which would specify the minimum containment leakage test requirements for water-cooled power reactors.

Interested parties were invited to submit written comments and suggestions for consideration in connection with the proposed amendment within 60 days after publication in the FEDERAL REGISTER. Upon consideration of the comments received, and other factors involved, the Commission has adopted the proposed amendment, with certain modifications in the form set forth below.

Significant differences from the amendment published for comment are: (1) Modification of procedures governing containment inspection and leak detection surveys, as a prerequisite to conducting formal leakage tests, and clarification of the basis for reporting present leakage values to the Commission, (2) establishment of criteria for deferring certain safety-related systems from regularly scheduled Type A containment leakage tests, (3) incorporation by reference of the recently-issued American National Standard for leakage rate testing of containment structures for nuclear reactors into the regulation, (4) inclusion of nitrogen gas as a suitable testing medium for testing the leaktightness of valves, and (5) inclusion of water-leakage test and acceptance criteria for containment isolation valves which are sealed against containment atmosphere outleakage during a design basis accident condition by means of a seal-water system. In addition, editorial and format changes were made.

With regard to item (1) above, the rule set forth below requires the licensee to identify specifically those components whose initial poor leak-tightness performance precluded completion of a Type A containment leakage test and to report this information to the Commission. The proposed rule would not have required the reporting of such information unless attempts to reduce the leakage rate of poor leak-tight components failed to meet minimum leak-tightness acceptance criteria. Thus, components which required frequent adjustments or repair in order to meet allowable leakage limits will be identified and the specific reductions in leakage rate values resulting from such adjustments, will be reported to the Commission. The identification of such components will provide the AEC with a sounder basis for judging whether or not containment leakage rates could have been exceeded in the unlikely event a design basis accident were to occur. In addition, such identification may provide insight into the frequency and kinds of adjustments being made to components to meet the minimum acceptable leakage limits and a basis for either establishing a more frequent containment leakage test schedule or modifying or replacing components.

With regard to item (2) above, the rule set forth below specifies criteria by which the licensee may for certain safety-related systems temporarily dispense with drainage and venting to containment atmosphere during Type A containment leakage tests. The proposed rule had specified that all systems which would connect directly with the containment atmosphere and would become an extension of the containment boundary should be vented to containment. Strict compliance with this rule would have required removing certain safety-related systems from service for the duration of the test and would limit the performance of the overall integrated containment leakage tests to those times when there would be no fuel in the reactor. This procedure is considered to be unnecessarily conservative.

The inclusion of all safety-related systems in the overall integrated containment leakage test can be accomplished while the reactor is fueled, and in a state of potential criticality, by maintaining the minimum number of safety-related systems in an operable state until all systems are tested. Another option is to periodically test the containment isolation valves in these safety-related systems in accordance with the rule set forth below. This would also assure that the requisite level of plant safety will be provided during the containment leakage test program without compromising the requirements for including all systems which penetrate the containment boundary in the leakage test.

The proposed rule required the use of test methods described in proposed American Nuclear Society Standard ANS 7.60 by referencing a portion of the proposed standard. On March 16, 1972, the American National Standards Institute approved ANS 7.60 and officially issued it for use as ANSI N45.4-1972, American National Standard, "Leakage Rate Testing of Containment Structures for Nuclear Reactors." The standard has been reviewed for compatibility with the proposed rule and it was concluded that incorporation of the requirements of ANSI

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from testing the containment with components and systems in the state as close as practical to that which would exist under design basis accident conditions (e.g., vented, drained, flooded or pressurized).

G. "Acceptance criteria" means the standard against which test results are to be compared for establishing the functional acceptability of the containment as a leakage limiting boundary.

III. LEAKAGE TESTING REQUIREMENTS

A program consisting of a schedule for conducting Type A, B, and C tests shall be developed for leak testing the primary reactor containment and related systems and components penetrating primary containment pressure boundary.

Upon completion of construction of the primary reactor containment, including installation of all portions of mechanical, fluid, electrical, and instrumentation systems penetrating the primary reactor containment pressure boundary, and prior to any reactor operating period, preoperational and periodic leakage rate tests, as applicable, shall be conducted in accordance with the following:

A. *Type A test*—1. *Pretest requirements.* (a) Containment inspection in accordance with V.A. shall be performed as a prerequisite to the performance of Type A tests. During the period between the initiation of the containment inspection and the performance of the Type A test, no repairs or adjustments shall be made so that the containment can be tested in as close to the "as is" condition as practical. During the period between the completion of one Type A test and the initiation of the containment inspection for the subsequent Type A test, repairs or adjustments shall be made to components whose leakage exceeds that specified in the technical specification as soon as practical after identification. If during a Type A test, including the supplemental test specified in III.A.3.(b), potentially excessive leakage paths are identified which will interfere with satisfactory completion of the test, or which result in the Type A test not meeting the acceptance criteria III.A.4.(b) or III.A.5.(b), the Type A test shall be terminated and the leakage through such paths shall be measured using local leakage testing methods. Repairs and/or adjustments to equipment shall be made and a Type A test performed. The corrective action taken and the change in leakage rate determined from the tests and overall integrated leakage determined from the local leak and Type A tests shall be included in the report submitted to the Commission as specified in V.B.

(b) Closure of containment isolation valves for the Type A test shall be accomplished by normal operation and without any preliminary exercising or adjustments (e.g., no tightening of valve after closure by valve motor). Repairs of maloperating or leaking valves shall be made as necessary. Information on any valve closure malfunction or valve leakage that requires corrective action before the test, shall be included in the report submitted to the Commission as specified in V.B.

(c) The containment test conditions shall stabilize for a period of about 4 hours prior to the start of a leakage rate test.

(d) Those portions of the fluid systems that are part of the reactor coolant pressure boundary and are open directly to the containment atmosphere under post-accident conditions and become an extension of the boundary of the containment shall be opened or vented to the containment atmosphere prior to and during the test. Portions of closed systems inside containment that penetrate containment and rupture as a result of a loss of coolant accident shall be vented to the containment atmosphere. All vented systems shall be drained of water or other fluids to the extent necessary to assure exposure of the system containment isolation valves to containment air test pressure and to assure they will be subjected to the post-accident differential pressure. Systems that are required to maintain the plant in a safe condition during the test shall be operable in their normal mode, and need not be vented. Systems that are normally filled with water and operating under post-accident conditions, such as the containment heat removal system, need not be vented. However, the containment isolation valves in the systems defined in III.A.1.(d) shall be tested in accordance with III.C. The measured leakage rate from these tests shall be reported to the Commission.

2. *Conduct of tests.* Preoperational leakage rate tests at either reduced or at peak pressure, shall be conducted at the intervals specified in III.D.

3. *Test methods.* (a) All Type A tests shall be conducted in accordance with the provisions of the American National Standard N45.4–1972, Leakage Rate Testing of Containment Structures for Nuclear Reactors, March 16, 1972.[1] The method chosen for the initial test shall normally be used for the periodic tests.

(b) The accuracy of any Type A test shall be verified by a supplemental test. An acceptable method is described in Appendix C of ANSI N45.4–1972. The supplemental test method selected shall be conducted for sufficient duration to establish accurately the change in leakage rate between the Type A and supplemental test. Results from this supplemental test are acceptable provided the difference between the supplemental test data and the Type A test data is within 0.25 La (or 0.25 Lt). If results are not within 0.25 La (or 0.25 Lt), the reason shall be determined, corrective action taken, and a successful supplemental test performed.

(c) Test leakage rates shall be calculated using absolute values corrected for instrument error.

4. *Preoperational leakage rate tests.* (a) *Test pressure*—(1) *Reduced pressure tests.* (i) An initial test shall be performed at a pressure Pt, not less than 0.50 Pa to measure a leakage rate Ltm.

(ii) A second test shall be performed at pressure Pa to measure a leakage rate Lam.

(iii) The leakage characteristics yielded by measurements Ltm and Lam shall establish the maximum allowable test leakage rate Lt of not more than La (Ltm/Lam). In the event Ltm/Lam is greater than 0.7, Lt shall be specified as equal to La (Pt/Pa)[1/2].

(2) *Peak pressure tests.* A test shall be performed at pressure Pa to measure the leakage rate Lam.

(b) *Acceptance criteria*—(1) *Reduced pressure tests.* The leakage rate Ltm shall be less than 0.75 Lt.

(2) *Peak pressure tests.* The leakage rate Lam shall be less than 0.75 La and not greater than Ld.

5. *Periodic leakage rate tests*—(a) *Test pressure.* (1) *Reduced pressure tests* shall be conducted at Pt.

(2) Peak pressure tests shall be conducted at Pa.

(b) *Acceptance criteria*—(1) *Reduced pressure tests.* The leakage rate Ltm shall be less than 0.75 Lt. If local leakage measurements are taken to effect repairs in order to meet the acceptance criteria, these measurements shall be taken at a test pressure Pt.

(2) Peak pressure tests shall be conducted [illegible]. Ltm shall be less than 0.75 La. If local leakage measurements are taken to effect repairs in order to meet the acceptance criteria, these measurements shall be taken at a test pressure Pa.

6. *Additional Requirements.* (a) If any periodic Type A test fails to meet the applicable acceptance criteria in III.A.5.(b), the test schedule applicable to subsequent Type A tests will be reviewed and approved by the Commission.

(b) If two consecutive periodic Type A tests fail to meet the applicable acceptance criteria in III.A.5.(b), notwithstanding the periodic retest schedule of III.D., a Type A test shall be performed at each plant shutdown for refueling or approximately every 18 months, whichever occurs first, until two consecutive Type A tests meet the acceptance criteria in III.A.5.(b), after which time the retest schedule specified in III.D. may be resumed.

B. *Type B tests*

1. *Test methods.* Acceptable means of performing preoperational and periodic Type B tests include:

(a) Examination by halide leak-detection method (or by other equivalent test methods such as mass spectrometer) of a test chamber, pressurized with air, nitrogen, or pneumatic fluid specified in the technical specifications or associated bases and constructed as part of individual containment penetrations.

(b) Measurement of the rate of pressure loss of the test chamber of the containment penetration pressurized with air, nitrogen or pneumatic fluid specified in the technical specifications or associated bases.

(c) Leakage surveillance by means of a permanently installed system with provisions for continuous or intermittent pressurization of individual or groups of containment penetrations and measurement of rate of pressure loss of air, nitrogen, or pneumatic fluid specified in the technical specifications or associated bases through the leak paths.

2. *Test Pressure.* All preoperational and periodic Type B tests shall be performed by local pneumatic pressurization of the containment penetrations, either individually or in groups, at a pressure not less than Pa.

3. *Acceptance criteria.* (Also see Type C tests.) (a) The combined leakage rate of all penetrations and valves subject to Type B and C tests shall be less than 0.60 La, with the exception of the valves specified in III.C.3.

(b) Leakage measurements obtained through component leakage surveillance systems (e.g., continuous pressurization of individual containment components) that maintain a pressure not less than Pa at individual test chambers of containment penetrations during normal reactor operation are acceptable in lieu of Type B tests.

C. *Test C tests*

1. *Test method.* Type C tests shall be performed by local pressurization. The pressure shall be applied in the same direction as that when the valve would be required to perform its safety function, unless it can be determined that the results from the tests for a pressure applied in a different direction will provide equivalent or more conservative results. The test methods in III.B.1 may be substituted where appropriate. Each valve to be tested shall be closed by normal operation and without any preliminary exercising or adjustments (e.g., no tightening of valve after closure by valve motor).

[1] ANSI N45.4–1972 Leakage Rate Testing of Containment Structures for Nuclear Reactors (dated Mar. 16, 1972). Copies may be obtained from the American Nuclear Society, 244 East Ogden Avenue, Hinsdale, Ill. 60521. A copy is available for inspection at the Commission's Public Document Room, 1717 H Street NW., Washington, DC. The incorporation by reference was approved by the Director of the Federal Register on October 20, 1972.

N45.4–1972 by reference would enhance uniformity of containment leak testing. Accordingly, the rule set forth below now specifies that the Type A containment leakage tests shall be conducted in accordance with the provisions of ANSI N45.4–1972.

The proposed rule limited the leakage testing medium for reactor containment isolation valves to air, which is widely used in the containment leakage testing program. However, the use of nitrogen gas for valve leakage testing is also technically satisfactory. Accordingly, the rule set forth below specifies that either air or nitrogen may be used as the testing medium in the conduct of the valve leakage tests.

The rule set forth below expands upon the requirements contained in the proposed rule for testing valves, sealed with water from a seal-water system, by including minimum water test pressure and test acceptance criteria.

The proposed rule required that the valves be subjected to a seal-water system operability test to establish that the valves could be satisfactorily pressurized with seal-water. There was no requirement to measure the rate at which water leaked past the valve. It had been assumed that the seal-water inventory would be adequate to seal the valves against outleakage of containment atmosphere during the design basis accident condition. However, the lack of a specific water inventory criterion against which actual valve leakage rates would be measured, could result in an inadequate supply of seal-water for valve sealing with attendant loss of the containment isolation function. Accordingly, a provision has been incorporated into the rule set forth below which requires that the valve leakage rate shall not exceed the seal-water inventory, on the assumption that the seal-water system will be pressurized for 30 days at 110 percent of the calculated peak containment internal pressure related to the design basis accident. With the inclusion of this requirement, the requirements for conducting only a seal-water system operability test were eliminated.

Containment is provided for water-cooled power reactors to prevent uncontrolled releases of radioactive materials to the environment, if the barriers provided by the fuel cladding and reactor coolant pressure boundary should be breached. Testing the reactor containment for leakage helps to assure that:

(a) Leakage of the primary reactor containment and associated systems is held within allowable leakage rate limits as specified in the technical specifications or associated bases of the license;

(b) Periodic surveillance is performed to assure proper maintenance and leak repair during the life of the containment; and

(c) The containment will continue to perform its function throughout the life of the plant.

The amendment which follows provides uniform requirements for containment leakage testing. It specifies the minimum requirements for periodic verification by tests of the leak-tight integrity of the primary reactor containment and associated systems for water-cooled power reactors, and the acceptance criteria for such tests.

Pursuant to the Atomic Energy Act of 1954, as amended, and sections 552 and 553 of title 5 of the United States Code, the following amendment to Title 10, Chapter I, Code of Federal Regulations, Part 50, is published as a document subject to codification to be effective on March 16, 1973.

1. A new paragraph (o) is added to § 50.54 to read as follows:

§ 50.54 Conditions of licenses.

* * * * *

(o) Primary reactor containments for water cooled power reactors shall be subject to the requirements set forth in Appendix J.

2. A new Appendix J is added to read as follows:

APPENDIX J

PRIMARY REACTOR CONTAINMENT LEAKAGE TESTING FOR WATER-COOLED POWER REACTORS

I. INTRODUCTION

One of the conditions of all operating licenses for water-cooled power reactors as specified in § 50.54(o) is that primary reactor containments shall meet the containment leakage test requirements set forth in this appendix. These test requirements provide for preoperational and periodic verification by tests of the leak-tight integrity of the primary reactor containment, and systems and components which penetrate containment of water-cooled power reactors, and establish the acceptance criteria for such tests. The purposes of the tests are to assure that (a) leakage through these primary reactor containments and systems and components penetrating primary containment shall not exceed allowable leakage rate values as specified in the technical specifications or associated bases; and (b) periodic surveillance of reactor containment penetrations and isolation valves is performed so that proper maintenance and repairs are made during the service life of the containment, and systems and components penetrating primary containment. These test requirements may also be used for guidance in establishing appropriate containment leakage test requirements in technical specifications or associated bases for other types of nuclear power reactors.

II. EXPLANATION OF TERMS

A. "Primary reactor containment" means the structure or vessel that encloses the components of the reactor coolant pressure boundary, as defined in § 50.2(v), and serves as an essentially leak-tight barrier against the uncontrolled release of radioactivity to the environment.

B. "Containment isolation valve" means any valve which is relied upon to perform a containment isolation function.

C. "Reactor containment leakage test program" includes the performance of Type A, Type B, and Type C tests, described in II.F, II.G, and II.H, respectively.

D. "Leakage rate" for test purposes is that leakage which occurs in a unit of time, stated as a percentage of weight of the original content of containment air at the leakage rate test pressure that escapes to the outside atmosphere during a 24-hour test period.

E. "Overall integrated leakage rate" means that leakage rate which obtains from a summation of leakage through all potential leakage paths including containment welds, valves, fittings, and components which penetrate containment.

F. "Type A Tests" means tests intended to measure the primary reactor containment overall integrated leakage rate (1) after the containment has been completed and is ready for operation, and (2) at periodic intervals thereafter.

G. "Type B Tests" means tests intended to detect local leaks and to measure leakage across each pressure-containing or leakage-limiting boundary for the following primary reactor containment penetrations:

1. Containment penetrations whose design incorporates resilient seals, gaskets, or sealant compounds, piping penetrations fitted with expansion bellows, and electrical penetrations fitted with flexible metal seal assemblies.

2. Air lock door seals, including door operating mechanism penetrations which are part of the containment pressure boundary.

3. Doors with resilient seals or gaskets except for seal-welded doors.

4. Components other than those listed in II.G.1, II.G.2, or II.G.3 which must meet the acceptance criteria in III.B.3.

H. "Type C Tests" means tests intended to measure containment isolation valve leakage rates. The containment isolation valves included are those that:

1. Provide a direct connection between the inside and outside atmospheres of the primary reactor containment under normal operation, such as purge and ventilation, vacuum relief, and instrument valves;

2. Are required to close automatically upon receipt of a containment isolation signal in response to controls intended to effect containment isolation;

3. Are required to operate intermittently under postaccident conditions; and

4. Are in main steam and feedwater piping and other systems which penetrate containment of direct-cycle boiling water power reactors.

I. P_a (p.s.i.g.) means the calculated peak containment internal pressure related to the design basis accident and specified either in the technical specification or associated bases.

J. P_t (p.s.i.g.) means the containment vessel reduced test pressure selected to measure the integrated leakage rate during periodic Type A tests.

K. L_a (percent/24 hours) means the maximum allowable leakage rate at pressure P_a as specified for preoperational tests in the technical specifications or associated bases, and as specified for periodic tests in the operating license.

L. L_d (percent/24 hours) means the design leakage rate at pressure, P_a, as specified in the technical specifications or associated bases.

M. L_t (percent/24 hours) means the maximum allowable [illegible] at pressure P_t derived from the preoperational test data as specified in III.A.4(a)([illegible]).

N. L_{am}, L_{tm} (percent/24 hours) means the total measured containment leakage rates at pressure P_a and P_t, respectively, obtained

Test pressure. (a) Valves, unless [illegible] with fluid (e.g., water, [illegible]) [illegible] shall be [illegible] at a pressure of Pa.

(b) Valves, which are sealed with fluid from a seal system shall be [illegible] with that fluid to a pressure not less than 1.10 Pa.

[illegible] Acceptance criterion. The combined leakage rate for all penetrations and valves subject to Type B and C tests shall be less than 0.60 La. Leakage from containment isolation valves that are sealed with fluid from a seal system may be excluded when determining the combined leakage rate: Provided, That:

(a) Such valves have been demonstrated to have fluid leakage rates that do not exceed those specified in the technical specifications or associated bases, and

(b) The installed isolation valve seal-water system fluid inventory is sufficient to assure the sealing function for at least 30 days at a pressure of 1.10 Pa.

D. Periodic retest schedule—1. Type A test. (a) After the preoperational leakage rate tests, a set of three Type A tests shall be performed, at approximately equal intervals during each 10-year service period. The third test of each set shall be conducted when the plant is shutdown for the 10-year plant inservice inspections.[illegible]

(b) Permissible periods for testing. The performance of Type A tests shall be limited to periods when the plant facility is nonoperational [illegible]

[illegible]

IV. [illegible]

A. Containment modification. [illegible]

[illegible]

A. Containment inspection. [illegible]

V. [illegible]

[illegible]

B. Report of test results. [illegible]

[illegible]

(Secs. 103, 104, 161(i), 182, 68 Stat. [illegible]; 42 U.S.C. [illegible])

Dated at Germantown, Md., this [illegible] day of February [illegible].

For the Atomic Energy Commission.

[illegible],
Secretary of the Commission.

[illegible]

[illegible]