

FTS 624-0657  
OAK RIDGE NATIONAL LABORATORY  
OPERATED BY  
UNION CARBIDE CORPORATION  
NUCLEAR DIVISION



POST OFFICE BOX Y  
OAK RIDGE, TENNESSEE 37830

March 3, 1982

Mr. Hans Ashar  
Office of Standards Development  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555

Dear Hans:

Referencing our phone conversation of this morning, I would like to verify our interest in the program related to an evaluation of Appendix J of 10 CFR Part 50 on primary reactor containment leakage testing for water-cooled power reactors. Based on our recent involvement in the evaluation of Reg. Guides related to performance of greased prestressing tendons in nuclear power plant structures, and previous studies which we have conducted relative to reactor containments (see Attachment I), I feel as if we are well qualified to perform the evaluation. Personnel who were directly involved in the previous studies on testing of containment systems used with light-water-cooled power reactors are still members of our section at ORNL. In addition, a member of our group is presently directly involved in conducting leakage tests for the Fusion Energy Program. We also have available to us ORNL staff members who are experts in the areas of instrumentation techniques and statistical methods. I have also enclosed (Attachment II) a summary of activities which our group has been involved in over the past few years.

Sincerely,

D. J. Naus

DJN:ege

Enclosure

cc: F. J. Homan  
A. L. Lotts  
H. E. Trammell  
G. D. Whitman

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Attachment I

RELATIVE ORNL REPORTS

1. F. C. Zapp, Testing of Containment Systems Used with Light-Water-Cooled Power Reactors, ORNL-NSIC-26, Nuclear Safety Information Center (August 1968).
2. A Study of the Design and Construction Practices of Prestressed and Reinforced Concrete Containment Vessels, Final Report F-C2121, ORNL Subcontract 2997 (August 1969).
3. G. C. Robinson and T. R. Horton, "Leak Testing of Reactor Containment Systems," Nuclear Safety, 7(2):194 (Winter 1965-1966).
4. G. C. Robinson, "Containment-Vessel Leak-Rate Testing," Nuclear Safety, 6(1): 69-72 (Fall 1964).
5. G. C. Robinson, "Leak Tests of Containment Vessels," Nuclear Safety, 4(4): 85-87 (June 1963).

FY 1983 PROGRAM ASSUMPTION

PROGRAM: DET

TITLE: CONTAINMENT LEAK TESTING

FIN: B0489

CONTRACTOR: ORNL

SITE: OAK RIDGE

STATE: TENNESSEE

NRC TECHNICAL MONITOR: G. ARNDT

PRINCIPAL INVESTIGATOR: D. NAUS

OBJECTIVE:

EVALUATE THE PRACTICALITY OF THE CONTAINMENT LEAK TESTING PROGRAM, AND  
COMPATIBILITY OF REGULATORY REQUIREMENTS AND INDUSTRY TESTING STANDARDS.

BUDGET ACTIVITY:

FY 1983 PROGRAM ASSUMPTIONS:

OBLIG: \$50,000

COMPLETE UNFINISHED PORTIONS OF TASKS B,C, AND D (TASK A SHOULD BE COMPLETE), AS DEFINED IN THE FY 1982 STATEMENT OF WORK.

## 1982 PROGRAM BRIEF

PROGRAM: DET

TITLE: Containment Leak Rate Testing

CONT: FIN NO.: B0489  
CONTRACTOR: ORNL  
SITE: Oak Ridge

NRC TECHNICAL MONITOR: E. G. Arndt

PRINCIPAL INVESTIGATOR: D. Naus

## OBJECTIVE:

Evaluate the practicality of the containment leak testing program, and compatibility of regulatory requirements and industry testing standards.

## BUDGET ACTIVITY:

FY 1982 SCOPE:  
(10/01/81-09/30/82)

OBLIG: \$150,000

- A. Review existing containment leak rate testing regulatory requirements, and the programs conducted in compliance with these requirements, using field and licensing experience.
- B. Review the proposed Appendix J revision. Provide recommendations and bases for specific proposed Appendix J revisions, and comment on the remainder of the proposed revision as appropriate.
- C. Review ANSI/ANS 56.8-1981, "Containment System Leakage Testing Requirements", for compatibility with the proposed Appendix J revision.
- D. Provide a value-impact analysis for the entire proposed Appendix J revision, as prepared for public comment issue, addressing the value and impact on the licensees, the licensing process, and the public. Revise the value-impact analysis as necessary following the public comment period, reflecting any changes made for the final rule.

## REPORTS:

Monthly progress reports  
One draft report  
One final report

STATEMENT OF WORK

BACKGROUND

Appendix J to 10 CFR 50 was issued in 1973. Changes in testing procedures, questions on interpretation, and numerous plant-specific exemption requests have generated a need to update and streamline this rule. In addition, in 1981 a national standard was issued providing detailed recommendations on the test procedures and analyses. Some of the positions in the proposed revision should be reviewed in depth against the field and licensing experiences of the past decade. Observations and recommendations resulting from such a review would either validate the positions in the proposed revision, or would provide a basis for modifying such positions.

OBJECTIVE

Evaluate the practicality of the containment leak testing program, and compatibility of regulatory requirements and industry testing standards.

SCOPE

- A. Review existing containment leak rate testing regulatory requirements, and the programs conducted in compliance with these requirements, using field and licensing experience.
- B. Review the proposed Appendix J revision. Provide recommendations and bases for specific proposed Appendix J revisions, and comment on the remainder of the proposed revision as appropriate.
- C. Review ANSI/ANS 56.8-1981, "Containment System Leakage Testing Requirements", for compatibility with the proposed Appendix J revision.
- D. Provide a value-impact analysis for the entire proposed Appendix J revision, as prepared for public comment issue, addressing the value and impact on the licensees, the licensing process, and the public. Revise the value-impact analysis as necessary following the public comment period, reflecting any changes made for the final rule.

WORK DESCRIPTION

TASK A

Review the existing Appendix J test requirements, including:

- 1. Relevant licensing exemption requests and exemptions granted.
- 2. Relevant Licensee Event Reports (LERs).
- 3. (See also #9) A minimum of 3 Type A test reports, complete with field data.
- 4. ( " " " ) " " " " " B " " " " " "
- 5. ( " " " ) " " " " " C " " " " " "
- 6. ( " " " ) A minimum of 7 additional summary reports each for Type A, B, & C tests.
- 7. ( " " " ) If not previously done, witness at least one test each of Type A, B, and C tests.
- 8. Interview, directly if necessary, or via correspondence to the maximum practical extent, at least 5 licensees, 2 non-utility organizations that perform these tests under contract to utilities, and 3 architect-engineer firms that design containments and plant systems that are subjected to Type A, B, & C tests.

9. Interview directly representatives from the following NRC groups:  
NRR - Containment Systems Branch; IE - Division of Reactor Programs;  
RES - Mechanical/Structural Engineering Branch. At this time, selection  
of plants from which data is to be reviewed and tests witnessed will be  
discussed. Selections are subject to approval by NRC Technical Monitor.

Items 1 - 7 will provide data for evaluation, while items 8 & 9 will provide  
information on field and licensing experiences with the existing Appendix J.

Time allocated: Approximately 6 months.

#### TASK B

- \* With the background on the existing Appendix J gained from Task A, review  
the proposed revision to Appendix J.
- \* Provide comment on the proposed revision in general.
- \* In particular, provide recommendations, and supporting bases, for the  
following specific aspects of the proposed revision:

1. Containment Integrated Leak Rate Test (CILRT) pressure
2. CILRT frequency
3. CILRT duration
4. CILRT reporting requirements
5. Local leak testing
6. Verification testing
7. Test temperature for a) purge valves, b) MSIV's, or c) other  
containment isolation valves
8. Waiting period following valve closure before leak testing.

Further details are as follow:

#### 1. Containment Integrated Leak Rate Test (CILRT) Pressure

Containment tests have been conducted at the design basis accident pressure  
or at a reduced pressure. At issue is whether reduced pressure testing  
provides adequate assurance of containment integrity. Difficulties have been  
encountered in defining the correlation of results at peak pressure with  
results at reduced pressure. There is a need to resolve the pros and cons of  
testing at peak pressure or reduced pressure.

- 1.1 Review and analyze plant leak-rate data from Task A to identify the  
problems associated with low-pressure testing.
- 1.2 To the extent that the information is readily retrievable from the  
available literature, review the foreign experience and data, and provide  
conclusions regarding their experience and philosophy of low-pressure  
testing. This is to be considered as supplementary to the domestic  
testing experience.
- 1.3 Assess validity and methods for extrapolation of low-pressure test  
results to accident pressure.
- 1.4 Discuss the advantages and disadvantages of the high- and low-pressure  
tests and provide recommendations to NRC regarding changes to Appendix J.

## 2. CILRT Frequency

The frequency of performing containment integrated leak rate tests is based on the 10-year service period. Any delay in the licensing of a plant following the performance of the preoperational CILRT would extend the time interval for the first periodic CILRT. The time interval between successive CILRTs is subject to interpretation. Perhaps a CILRT should not have to be performed in conjunction with the 10-year inservice inspection outage. Under consideration is a frequency for performing CILRTs without reference to the 10-year service period.

2.1 Review the test experience and recommend acceptable test frequency with technical support.

2.2 Evaluate the impact on the test conclusions of the different methods of data analysis and test techniques.

## 3. CILRT Duration

Develop and provide a method of analysis and guidelines for determining acceptable duration of CILRT test.

## 4. CILRT Reporting Requirements

Provide recommendations on reporting requirements with respect to format and test results for integrated and local leak rate tests (V.B.).

## 5. Local Leak Testing

5.1 Examine the feasibility and practicality of conducting local leak rate (Types B & C) tests during plant operation.

5.2 Explore regulatory criteria and techniques to encourage continuous leak testing.

## 6. Verification Testing

Appendix J requires that a supplemental leak rate test be performed to verify the measurements of a containment leak rate. In one such test, the CILRT test is repeated after completion of the initial CILRT by introducing a known leak rate from the containment by direct leakage through an orifice to atmosphere. The new measurements of leakage from containment should not vary more than 25% from the initial test leakage rate for adequate verification. At issue is whether such a test is either directly or indirectly useful, and whether the criteria are adequate.

6.1 Reassess the acceptability of the supplemental CILRT verification test and test acceptance criteria.

## 7. Test Temperature

Most valves test more leak tight when hot than when cold. Evaluate the practicality of requiring a valve temperature test condition, and make appropriate suggestions.

## 8. Waiting Period

Soft-seated valves seal better after being pressed against the seat for a while. Evaluate the practicality of establishing a waiting period following valve closure before leak testing. Make appropriate recommendations.



Time allocated: Approximately 3 months past Task A.

#### TASK C

Review ANSI/ANS 56.8-1981. Considering it as a detailed adjunct to the regulation, containing test procedures and analytic methods as compared with test criteria in the regulation,

- (a) highlight conflicts between the two documents, and
- (b) note if any Appendix J contents belong instead in ANSI/ANS 56.8, or the reverse.

Time allocated: Approximately 2 months past Task A.

#### TASK D

1) Develop an initial value-impact statement for the proposed Appendix J revision, using guidance to be provided by the NRC. Following the public comment period, revise as necessary to reflect any changes made for the final rule.

Time allocated: Approximately 3 months past Task A for initial statement.  
Approximately 2 separate, additional months for final statement.

#### MEETINGS AND TRAVEL

Task A will require, for up to two contractor employees per trip, at least:

- 1 two-day meeting with NRC staff under Task A.
- 2 two-day site visits to witness tests under Task A, if not done prior to this contract.
- 1 one-day visit to a data source in connection with Task D.
- 1 two-day meeting with NRC staff to discuss Draft Report.

#### REPORTING REQUIREMENTS

The contractor will submit the following reports:

1. Monthly progress report
2. Draft Report
3. Final Report



### CONTRACT SCHEDULE

• 6 mo

(Review existing rule)

• 3 mo •

(Review Proposed rule)

2 mo.

(Review ANSI/ANS 56.8)

3 mo      2 mo

(Prepare value-impact statement)