NRC FORM 464 Part I
(6-1998)

U.S. NUCLEAR REGULATORY COMMISSION

RESPONSE TO FREEDOM OF INFORMATION ACT (FOIA) / PRIVACY ACT (PA) REQUEST

FOIA/PA	RESPONSE NUMBER
2001-0040	1

RESPONSE TYPE ☑ FINAL ☐ PARTIAL

REQUESTER: James V. Vassello

DATE: NOV 13 2000

PART I. – INFORMATION RELEASED

- ☐ No additional agency records subject to the request have been located.
- ☐ Requested records are available through another public distribution program. See Comments section.
- ☐ APPENDICES: Agency records subject to the request that are identified in the listed appendices are already available for public inspection and copying at the NRC Public Document Room.
- ☑ APPENDICES: A — Agency records subject to the request that are identified in the listed appendices are being made available for public inspection and copying at the NRC Public Document Room.
- ☐ Enclosed is information on how you may obtain access to and the charges for copying records located at the NRC Public Document Room, 2120 L Street, NW, Washington, DC.
- ☐ APPENDICES: Agency records subject to the request are enclosed.
- ☐ Records subject to the request that contain information originated by or of interest to another Federal agency have been referred to that agency (see comments section) for a disclosure determination and direct response to you.
- ☐ We are continuing to process your request.
- ☐ See Comments.

PART I.A – FEES

AMOUNT *: $ 41.80

* See comments for details

- ☑ You will be billed by NRC for the amount listed.
- ☐ You will receive a refund for the amount listed.
- ☐ None. Minimum fee threshold not met.
- ☐ Fees waived.

PART I.B – INFORMATION NOT LOCATED OR WITHHELD FROM DISCLOSURE

- ☐ No agency records subject to the request have been located.
- ☐ Certain information in the requested records is being withheld from disclosure pursuant to the exemptions described in and for the reasons stated in Part II.
- ☐ This determination may be appealed within 30 days by writing to the FOIA/PA Officer, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001. Clearly state on the envelope and in the letter that it is a "FOIA/PA Appeal."

PART I.C COMMENTS (Use attached Comments continuation page if required)

As indicated in our telephone conversation of 11/9/00, the fees for processing your request are as follows:

$ 39.00 (1 hr. professional search @ $39/hr.)
2.80 (14 pages @ $0.10/page)
$ 41.80 TOTAL

SIGNATURE: FREEDOM OF INFORMATION ACT AND PRIVACY ACT OFFICER
Carol Ann Reed

Re: FOIA/PA 00-000

APPENDIX A
RECORDS BEING RELEASED IN THEIR ENTIRETY
(If copyrighted identify with *)

NO.	DATE	DESCRIPTION/(PAGE COUNT)
1.	12/15/1966	Revised Draft: III. Technical Safety Guide, Reactor Containment Leakage Testing and Surveillance Requirements of the "Safety Standards, Criteria, and Guides for the Design, Location, Construction, and Operation of Reactors," (14 pages)

TID-24085
(~~no mf~~)
(keep)

SAFETY STANDARDS, CRITERIA, AND GUIDES FOR THE DESIGN, LOCATION, CONSTRUCTION, AND OPERATION OF REACTORS

MASTER

III. TECHNICAL SAFETY GUIDE

Reactor Containment Leakage Testing and Surveillance Requirements

Revised Draft - December 15, 1966

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This draft Guide is made available to the Division of Reactor Licensing for interim guidance in developing leakage rate testing and surveillance of reactor containment vessels.

U. S. ATOMIC ENERGY COMMISSION
DIVISION OF SAFETY STANDARDS
WASHINGTON, D.C.

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7.5.1

5.1 REACTOR CONTAINMENT LEAKAGE TESTING AND SURVEILLANCE REQUIREMENTS

1.0 CONTAINMENT TESTING AND SURVEILLANCE

In recognition of the need to provide evidence, during service, of the capability of a containment system to perform its intended safety function, a program of testing and surveillance is developed.*

Because the leakage rate of containment system is a practical measure of its readiness to fulfill the containment function, the integrated leakage rate test is considered a principal and essential test (designated as a Class A test).

To justify the infrequent conduct of these Class A tests, a series of periodic surveillance tests (designated Class B and C tests) are suggested to monitor the principal sources of leakage development (penetrations and isolation valves) during the service interval between integrated leakage rate tests. These tests enable a suitable program of maintenance and repair to be developed to control leakages within acceptable limits.

For those engineered safeguards systems which are relied upon to control or mitigate containment leakages under post-accident conditions, a series of systems tests (designated Class D test) are suggested. These tests are intended to verify the capability of the systems to function (when needed) without loss of containment leak-tight integrity.

The test program suggests the performance initially of a preoperational leakage rate test (Class A test) at two pressure levels—one, at the calculated maximum peak accident pressure, and the other, at reduced pressure. These two tests measure the representative leakage characteristics of the containment system. Subsequently, at periodic intervals, Class A tests may then be conducted at a single test pressure—the reduced test pressure.

The reduced test pressure leakage rate test (Class A test) is justified by the conduct of the more frequent surveillance tests (Class B and C tests) at a test pressure equal to the maximum calculated peak accident pressure. These Class B and C tests provide the means to maintain the containment's leakage characteristics essentially as initially determined at the time of the preoperational Class A test.

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*This testing and surveillance program has evolved from a survey of containment leakage characteristics and reported testing experiences.

A retest schedule is suggested which recognizes that the containment leakage potential and its consequences depend upon the magnitude of the containment calculated peak accident pressure and the design basis accident leakage rate as influenced by siting criteria. More frequent testing is considered necessary where low leakage rates are specified because test experiences have shown the difficulty in maintaining such limits.

The retest schedule program provides for a graduated increase in the interval between tests for the first three Class A tests. During this period, the adequacy of the test program can be evaluated by the observed leakage behavior of the containment system. The test frequency then seeks a level which is governed by the leakage measurements of the successive tests. Any leakage measurements which yield results in excess of allowable test limits will indicate the existence of deteriorative service conditions or inadequate maintenance programs during the test interval. On the other hand, leakage measurements within limits will attest to the adequacy of the test program. The test schedule reflects this flexible approach of allowing the observed leakage behavior of the containment system during service to dictate the test frequency.

The allowable test and operational leakage limits (to be specified in the license) establish the acceptance criteria for Class A tests. These limits are determined by adjusting the design basis accident leakage rate to reflect the differences between calculated accident and test conditions. A further adjustment is made to account for testing at pressures other than the calculated peak pressure of the design basis accident. Following each Class A test, and before resumption of plant operation, the containment leakage rate is intentionally decreased, by repairs if necessary, to provide a margin for any leakage increase which the containment system may experience in service. The margin is proportionally adjusted as the interval between Class A test is extended by the test frequency schedule.

1.1 PURPOSE

These minimum test requirements are intended to verify periodically the leak-tight integrity of the containment system, and to establish the acceptance requirements of each test. The purpose of the tests is to assure that leakage of the containment system is held within allowable test limits and that the periodic surveillance tests assure proper maintenance and repair.

2.0 TEST CLASSIFICATIONS

Four classes of tests are to be performed during the service life of the containment system, namely:

Class A Tests - overall integrated leakage rate measurements of the containment system under the "as is" service condition, at the time of the test.

Class B Tests - local leak detection tests of containment components which penetrate, or seal the boundary of the containment system.

Class C Tests - individual local operability and leakage tests of containment isolation valves.

Class D Tests - individual operability tests under Class A test conditions of those engineered safeguard systems which influence containment leakage under post-accident conditions.

3.0 CLASS A TEST REQUIREMENTS

3.1 Pretest Requirements - All Class A tests, other than the initial pre-operational test, are to be performed without any preliminary leak-detection surveys and leak repairs except to meet the requirements of Section 12.0. Major leak repairs are permissible provided the measured reduction in leakage thus attained is added to the Class A test result.

All systems which, under post-accident conditions, become an extension of the containment boundary are to be vented to the containment atmosphere prior to the conduct of a Class A test.

Closure of the containment isolation valves is to be accomplished by the normal mode of actuation and without any preliminary exercises or adjustments. Correction of closure malfunction is permissible provided the reduction in leakage effected by the repairs is included in the Class A test result.

3.2 Test Methods - Tests employing either the absolute pressure-temperature method or the reference vessel system in accord with the ANS-7.6 Standard* (or other method of demonstrated equivalency) are acceptable. The method chosen for the initial test will normally be required for the periodic retests.

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*ANS-7.6 Proposed Standard for Leakage Rate Testing of Containment Structures for Nuclear Reactors, October 31, 1966.

The test duration is to be determined by the time required to yield meaningful results. The minimum test duration is to be not less than 24 hours unless test experiences of at least 2 prior Class A tests provide evidence of the adequacy of shorter test duration. The test accuracy is to be verified by a supplementary means to demonstrate the validity of measurements. An acceptable means is suggested by ANS-7.6 Standard.

3.3 Initial Leakage Rate Tests - After completion of containment construction and installation of all systems penetrating the containment boundary, the initial preoperational integrated leakage rate tests are to be conducted at two pressure levels in the order specified:

a. At 100% maximum containment operating pressure, P_p (corresponds with the maximum peak pressure calculated for the design basis accident analyses).

b. At pressure P_t, not less than 50% maximum containment operating pressure P_p.

The leakage characteristics yielded by measurements L_{pm} and L_{tm}, establish, by the method outlined in Fig. 1, the maximum allowable test leakage rate L_t, and the allowable operational leakage rate L_{to} to be specified in the license, for subsequent leakage rate tests.

3.4 Allowable Operational Leakage Rate - The allowable operational leakage rate L_{to} establishes the limit to be met before placing the containment into service and before resumption of plant operation following each Class A test.

As an acceptance criterion, the measured leakage rate L_m initial test or L_m for retests is to equal or be less than L_{to} (see Fig. 1). Repairs and retests are to be performed, if necessary, until the acceptance criterion is met.

3.5 Periodic Leakage Rate Tests - Subsequent integrated leakage rate tests are to be conducted at a single test pressure P_t of Section 3.4(b) and both of the following acceptance criteria are to be met.

3.51 As an acceptance criterion, which governs retest schedule only, the measured leakage rate L_m is not to exceed the maximum allowable test leakage rate L_t as determined under Section 3.3. If the measured leakage rate L_m exceeds L_t, a revision of the retest schedule revision as required by Section 7.12 is to apply.

If L_m exceeds L_t at the 1 year test interval, the margin between L_t and L_{to} limits established by Section 3.3 shall be increased by the difference between L_t and L_m.

3.52 As an acceptance criterion to be met, before resumption of plant operation, the leakage rate, either as measured or following repairs and retests, is not to exceed the allowable operational leakage rate L_{to} as determined in Section 3.4

If repairs are necessary to meet the acceptance criterion, the integrated leakage rate test need not be repeated provided local measured reductions in leakages achieved by repairs, reduce the overall measured integrated leakage rate to a value not in excess of the allowable operational leakage rate L_{to}.

4.0 CLASS B TEST REQUIREMENTS

4.1 Class B tests are to be performed to detect or measure local leakages originating at the following containment components:

a. Containment penetrations whose design incorporate resilient seals, gaskets, or sealant compounds; piping penetrations fitted with expansion bellows;

b. Air lock door seals, including operating mechanisms and penetrations with resilient seals which are part of the containment boundary in the air lock structure.

c. Equipment and access doors with resilient seals or gaskets (seal welded doors are excluded); containment steel-to-concrete junction flexible seals.

d. Components other than a, b, or c, which develop leaks in service and require repairs to meet the acceptance criterion of any Class A test.

Acceptable alternate means of performing Class B tests include:

a. Examination of the pneumatically pressurized test chamber (provided for this purpose) of components by the soap bubble or the halide leak detector.

b. Measurement of the rate of pressure loss of the pneumatically pressurized test chamber of the containment component.

c. Surveillance of leakage by a permanently installed system having provisions for individual or group pressurization of containment penetrations or seals, and measurement of pressure loss (or flow of air through leak paths).

d. Other methods of demonstrated equivalency to a, b, or c.

4.2 Test Pressure - All Class B tests are to be performed by local pneumatic pressurization of the containment components, either individually or in groups, at a pressure not less than 100% maximum containment operating pressure P_p.

4.3 Acceptance Criterion - Repairs and retests are required when the leakage rate of all Section 4.1 containment components tested yields an average leakage rate per 24 hours per component in excess of 0.1% of L_p. Repairs of lesser leaks are optional.

4.4 Alternate Tests - Containment systems in which all of the components as defined under Section 4.1 are not fitted with means to enable Class B testing are to be subjected instead to the performance of a Class A test in accord with Section 3.5 at intervals specified under Section 7.22 except that the test pressure is to correspond with Section 4.2.

5.0 CLASS C TEST REQUIREMENTS

5.1 Class C tests are to be performed to verify operability and leak-tightness of those isolation valves on lines which penetrate the containment boundary and perform a containment function, i.e.,

a. Valves which communicate directly with the outside atmosphere (includes vacuum relief valves).

b. Valves which, in the event of valve leakage or valve malfunction upon isolation signal, may extend the containment boundary beyond that included during the conduct of Class A tests.

c. Valves which, under post-accident containment isolated conditions, are not expected to be maintained continually at system fluid pressures equal to or greater than the containment maximum operating pressure P_p.

5.2 Valve Operability Tests - Valve operability tests are to be conducted prior to leakage tests to demonstrate proper closure of normally open valves (or opening and closing of normally closed valves) upon isolation signal. Where complete valve motion (complete closure or opening) is impractical during plant operation, partial exercising of the valve is acceptable.

Valve malfunctions are to be corrected and reported with each Class A test report.

5.3 Valve Leakage Tests - Isolation valve leakage tests are to be performed by local pressurization (or other equivalent means) at a pressure not less than 100% maximum containment operating pressure P_p, and by employing any of the test methods applicable to Class B tests to detect leaks. Where valve seal-water systems are provided, the operation of the system is an acceptable alternate test.

5.31 Acceptance Criterion - Repairs and retests are required whenever the leakage rate of any valve tested yields an equivalent leakage rate per 24 hours in excess of 1% of L_p. Repairs of lesser leaks are optional.

6.0 CLASS D TEST REQUIREMENTS

6.1 Class D tests are to be performed to demonstrate the system operability (in accordance with design specifications) of those engineered safeguards systems (e.g., containment spray, containment air cooling, etc.) which, under post-accident conditions, are relied upon to limit or reduce directly or indirectly the consequent leakage from the containment.

The mode of operation of each system may be modified to the extent necessary or practical to enable operational testing of the system or its components, Such tests are to be conducted initially in conjunction with the preoperational leakage rate test, under the pneumatically pressurized condition of Section 3.3 a. Subsequent tests may be performed at normal ambient conditions.

System malfunctions are to be corrected and reported with the Class A test results.

7.0 CONTAINMENT PERIODIC RETEST SCHEDULE

7.1 Class A Retest Schedule

7.11 After the initial preoperational leakage rate test, consecutive intervals between tests are not to exceed the schedule of the table in Figure 2 for the applicable classification provided the acceptance criterion of Section 3.51 (first sentence) is met.

7.12 In the event the measured leakage rate of any Class A test (including leakage rate reductions effected by leaks repaired either directly prior to or during the test) exceeds the maximum allowable test leakage rate, L_t, the test schedule for successive tests returns to the beginning of the sequence of intervals of the applicable classification shown in the table of Fig. 2.

7.2 Class B Retest Schedule

7.21 At least two Class B tests (except for air locks) at approximately equally spaced intervals are to be performed during the interval between any scheduled Class A test, but no Class B test interval is to increase beyond 1 year. Air locks are to be tested at 4 month intervals irrespective of the Class B test schedule except when air locks are not opened during this interval, in which case, tests are to be performed after each opening, but no interval is to increase beyond 1 year.

7.22 If Class B tests are not practical (e.g., containment vessels not fitted with component test provisions), Class A tests are to be performed at intervals not greater than 1 year for the containment service lifetime (or until such time when modifications are made to enable Class B testing).

7.3 Class C Retest Schedule

7.31 Valve operability and leakage tests of isolation valves defined by Section 5.1 a, are to coincide with the schedule of Class B tests.

7.32 Valve operability and leakage tests of isolation valves defined by Section 5.1 b and c are to be performed during a scheduled Class A test or during other plant shutdowns to achieve at least one test per year.

7.4 Class D Retest Schedule

7.41 Class D tests are to be conducted during each scheduled Class A test or other plant shutdowns to achieve at least one test per year.

7.5 Test Interval Allowance - Class A test schedules may be varied by not more than 6 months to coincide with scheduled or unscheduled plant shutdown periods.

7.6 Permissible Periods for Testing

7.61 The performance of Class A tests is to be limited to periods when the plant facility is nonoperational and secured in the shutdown condition under administrative control and safety procedures defined in the license.

7.62 Prior to pressurization for and during the performance of any Class A test, the containment atmosphere temperature is to be maintained such that the lowest service metal temperature of pressure retaining components is at least 30°F above the maximum value of the ductile brittle transition temperature (NDTT) of the containment's constructional steels.

8.0 CONTAINMENT MODIFICATIONS

Any major modification or replacement of components of the containment system performed after the initial preoperational leakage rate test is to be followed by either a Class A test, or a Class B test to meet the acceptance criteria of Section 3.51 and Section 4.3 repsectively. Modifications or replacements performed directly prior to the conduct of a Class A test need not require a separate test.

9.0 CONTINUOUS LEAKAGE MONITORING SYSTEM

9.1 A continuous leakage monitoring system is acceptable as a supplemental means (but not in lieu of Class A tests) to measure or detect changes in containment leakage rates provided the average pressure P_m is not less than 10% of P_t.

9.2 The operation of a continuous leakage monitoring system may serve to monitor the containment leak-tight integrity during plant operation to avoid exceeding leakage limits which, if undetected, may lead to a reduction in Class A test intervals as required by Section 7.12.

9.3 The leakage rate measurements L_{mm} of the monitoring system, when compared with the leakage rate L_{tm} of the initial Class A test, establish the allowable operational leakage rate L_s (see Fig. 1) for subsequent operation of the monitoring system. The value, L_s, is to be reverified with each subsequent Class A test performed by comparison of L_{tm} measurement taken directly before the Class A test with the measured leakage rate L_m, and revised if necessary.

Each subsequent measured leakage rate L_{mm} derived from operation over a period sufficient to yield meaningful results may not exceed the allowable test leakage rate L_s. In the event this limit is exceeded, Class B tests and corrective repairs are required until the subsequent measured leakage rate L_{mm} meets the acceptance criteria.

10.0 MULTIPLE VESSEL CONTAINMENTS

Multiple interconnected containment vessels are considered as a single containment in the performance of Class A tests.

11.0 MULTIPLE BARRIER CONTAINMENTS

Containment systems with several leakage barriers are to be subjected to Class A tests to verify separately that the measured leakage rate is not in excess of allowable test leakage rate specified for each barrier.

12.0 ANNUAL INSPECTION

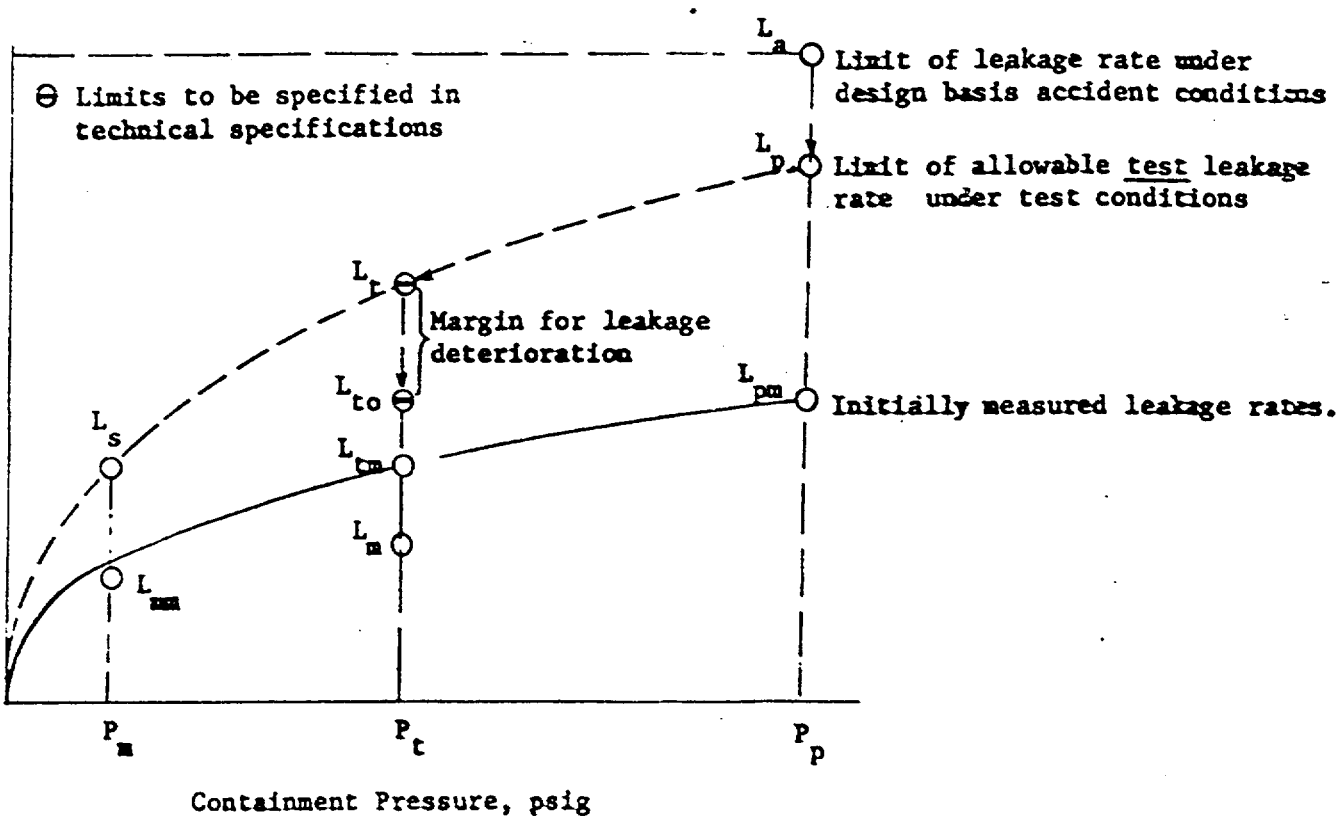
A detailed visual examination of the accessible interior and exterior of the containment structure and its components is to be performed annually and prior to any Class A test, to uncover any evidence of deterioration which may affect either the containment's structural integrity or leak-tightness.

The discovery of any significant deterioration must be accompanied by corrective actions in accord with acceptable procedures, nondestructive tests and inspection, and local testing where practical, prior to the conduct of any Class A test. Such repairs are to be reported as part of Class A test results.

13.0 REPORT OF TEST RESULTS

Each Class A test is to be the subject of a summary technical report, which includes a schematic arrangement of the leakage measurement system, the instrumentation employed, the test procedure, test results in graphical form, and the analysis and interpretation of leakage rate results in meeting the allowable leakage rates specified in the license. Summaries of Class B, C, and D test results as may be specified under the respective sections are to be included in the same report.

Fig. 1 - Determination of Allowable Leakage Rate Limits Applicable to Containment Testing



The leakage rate limits are established from the following relations:

1. Maximum allowable leakage rate at pressure P_p.

$$L_p = L_a (R_p T_p / R_a T_a)^{1/2}$$

2. Allowable test leakage rate L_t at pressure P_t, the lesser of

$$L_p (L_{tm} / L_{pm}) \quad \text{and} \quad L_p (P_t / P_p)^{1/2}$$

3. Allowable operational leakage rate L_{to} at pressure P_t

$$L_{to} = L_t (1 - A_L) \qquad \text{from Table 1 select } A_L$$

4. Allowable test leakage rate L_s of monitoring system (if provided) at pressure P_m

$$L_s = L_t (L_{mm} / Lm)$$

Notations and Definitions

P_d	containment vessel design pressure.
P_p	maximum containment operating pressure (calculated peak pressure) which may be imposed upon containment vessel as determined from the safety analyses of design basis accidents.
P_t	containment vessel test pressure selected to measure the integrated leakage rate for successive tests.
P_m	average containment atmosphere pressure maintained during the operation of a continuous leakage monitoring system
L_a	design basis accident leakage rate at pressure P_p, applied in the safety analyses to evaluate the consequences of containment leakage, under the calculated design basis accidents conditions in accord with the site exposure guidelines set forth in 10 CFR 100.
L_p	maximum allowable leakage rate at peak pressure P_p, under the test conditions of the containment air atmosphere
L_t	maximum allowable <u>test</u> leakage rate at pressure P_t defining the limit governing retest schedule requirements.
L_{to}	allowable <u>operational</u> leakage rate at pressure P_t, defining the limit for both initial measurement L_{tm} and subsequent measurements L_m, at the outset of plant operation following a Class A test.
L_{pm}, L_{tm}	the initial measured leakage rates at pressure P_p and P_t respectively.
L_m	measured leakage rate of any subsequent integrated leakage rate test at pressure P_t.
L_{mm}	measured leakage rate derived from operation of continuous leakage monitoring system at pressure P_m (ave).
L_s	allowable operational leakage rate defining the acceptable limit of leakage rate measurements yielded by continuous leakage monitoring system with respect to leak repair requirements.
T_a, T_p	absolute temperature °R coincident with pressure P_p under accident and test conditions respectively.
R_a, R_p	equivalent gas constant of the containment atmosphere mixture or composition under accident and test conditions respectively.
A_L	Leakage deterioration allowance factor applied to obtain L_{to} limit (see Table 1) for the appropriate retest schedule classification.

Fig. 2 - Containment Retest Schedule Classification
(Class A tests - Integrated Leakage Rate)

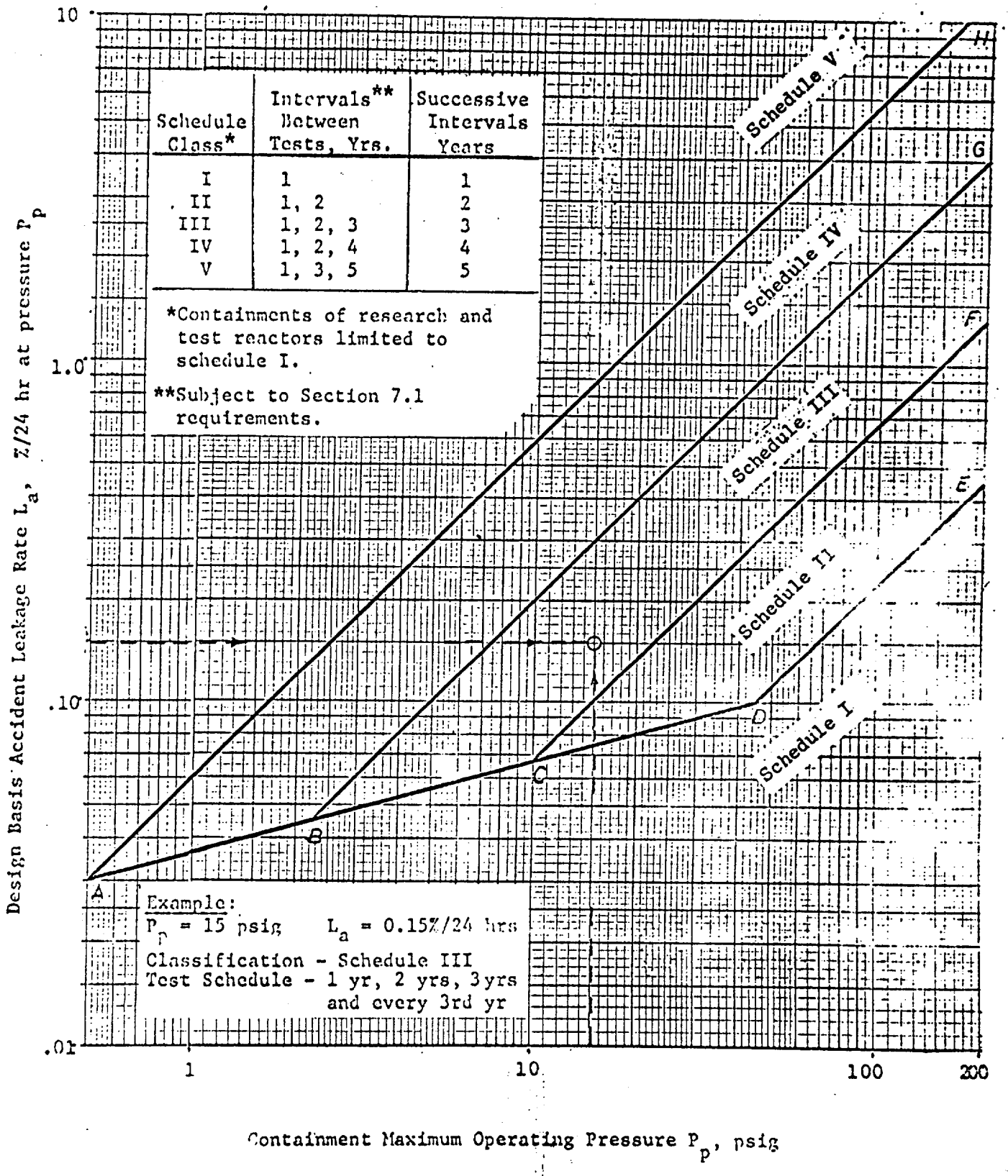


Table 1 — Leakage Deterioration Allowance, Factor A_L

Retest Schedule Classification	Preoperational Test	1 year Interval	2 year Interval	3 year Interval	4 year Interval	5 year Interval
I	0.10	0.10		-	-	-
II	0.10	0.20	0.20	-	-	-
III	0.10	0.20	0.30	0.30	-	-
IV	0.10	0.20	0.40	-	0.40	-
V	0.10	0.30	-	0.50	-	0.50