FPL Energy
Seabrook Station

FPL Energy Seabrook Station
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September 29, 2005

SBK-L-05197
Docket No. 50-443

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

Seabrook Station
License Amendment Request 05-06
"Application for Amendment to Technical Specification 6.15 for a Six Month Extension to the Containment Integrated Leak Rate Test Interval"

FPL Energy Seabrook, LLC (FPL Energy Seabrook) has enclosed herein License Amendment Request (LAR) 05-06. License Amendment Request 05-06 is submitted pursuant to the requirements of 10 CFR 50.90 and 10 CFR 50.4.

This LAR proposes a change to Seabrook Station Technical Specification 6.15, Containment Leakage Rate Testing Program, to permit a one time, six month extension to the currently approved 15-year test interval for the containment integrated leak rate test (ILRT). FPL Energy Seabrook performed the last ILRT on October 30, 1992 and TS 6.15 currently requires that the next test be performed no later than October 29, 2007. This change proposes to extend the completion date for the next ILRT to April 29, 2008.

As discussed in the enclosed LAR, the proposed change does not involve a significant hazard consideration pursuant to 10 CFR 50.92. A copy of this letter and the enclosed LAR has been forwarded to the New Hampshire State Liaison Officer pursuant to 10 CFR 50.91(b). FPL Energy Seabrook has determined that LAR 05-06 meets the criteria of 10 CFR 51.22(c)(9) for a categorical exclusion from the requirements for an Environmental Impact Statement. The Station Operation Review Committee and the Company Nuclear Review Board have reviewed this LAR.

FPL Energy Seabrook requests NRC Staff review and approval of LAR 05-06 with issuance of a license amendment by September 30, 2006 and implementation of the amendment within 90 days.

A017

Should you have any questions regarding this letter, please contact Mr. James M. Peschel, Regulatory Programs Manager, at (603) 773-7194.

Very truly yours,

FPL Energy Seabrook, LLC.

Gene St. Pierre

Gene St. Pierre
Site Vice President

Enclosures:

Notarized Affidavit
Licensee's Evaluation of the Proposed Change

Attachments:

1. Proposed Technical Specification Change (mark-up)
2. Proposed Technical Specification page (re-type)
3. Evaluation of the Risk Impact of Extending the Frequency of the Containment Integrated Leak Rate Testing from 10 to 25 Years

cc: S. J. Collins, NRC Region I Administrator
V. Nerses, NRC Project Manager, Project Directorate I-2
G.T. Dentel, NRC Senior Resident Inspector

Mr. Bruce G. Cheney, ENP, Director, Division of Emergency Services
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FPL Energy
Seabrook Station

AFFIDAVIT

<u>**SEABROOK STATION UNIT 1**</u>

Facility Operating License NPF-86
<u>**Docket No. 50-443**</u>

License Amendment Request 05-06
"<u>Application for Amendment to Technical Specification 6.15 for a Six Month Extension to the Containment Integrated Leak Rate Test Interval</u>"

The following information is enclosed in support of this License Amendment Request:

- **Enclosure - Licensee's Evaluation of the Proposed Change**
- **Attachment 1 - Proposed Technical Specification Change (mark-up)**
- **Attachment 2 - Proposed Technical Specification Page (re-type)**
- **Attachment 3 - Evaluation of Risk Impact of Extending the Frequency of Containment Integrated Leak Rate Testing from 10 to 25 Years**

I, Gene F. St. Pierre, Site Vice President of FPL Energy Seabrook, LLC hereby affirm that the information and statements contained within this License Amendment Request are based on facts and circumstances which are true and accurate to the best of my knowledge and belief.

Sworn and Subscribed before me this 29th day of September, 2005

Victoria Susan Robertson
Notary Public

VICTORIA SUSAN ROBERTSON
MY COMMISSION EXPIRES JAN. 15, 2008
NOTARY PUBLIC NEW HAMPSHIRE

Gene St. Pierre
Gene St. Pierre
Site Vice President

LICENSEE'S EVALUATION

Subject: License Amendment Request 05-06, Application for Amendment to Technical Specification 6.15 for a Six Month Extension to the Containment Integrated Leak Rate Test Interval

1.0 DESCRIPTION

This proposed amendment will revise Seabrook Station Technical Specification (TS) 6.15, Containment Leakage Rate Testing Program, to permit a one time, six month extension to the currently approved 15-year test interval for the containment integrated leak rate test (ILRT). FPL Energy Seabrook performed the last ILRT on October 30, 1992 and TS 6.15 currently requires that the next test be performed no later than October 29, 2007. This change proposes to extend the completion date for the next ILRT to April 29, 2008. Extending the completion date prevents a premature plant shutdown to perform the test and provides time to plan for the ILRT in refueling outage 12 in the spring of 2008.

2.0 PROPOSED CHANGE

TS 6.15 currently includes the following:

> "....This program shall be in accordance with the guidelines contained in Regulatory Guide 1.163, "Performance-Based Containment Leak Test Program, dated September 1995, as modified by the following exception:
>
> > a. NEI 94-01-1995, Section 9.2-3: The first ILRT performed after October 30, 1992 shall be performed no later than October 29, 2007."

This proposed change modifies TS 6.15 to the following:

> > a. NEI-94-01-1995, Section 9.2-3: The first ILRT performed after October 30, 1992 shall be performed no later than *April 29, 2008.*

3.0 BACKGROUND

The testing requirements of 10 CFR Part 50, Appendix J provide assurance that the primary containment, including those systems and components that penetrate the primary containment, do not exceed the leakage rate assumed in the plant analyses. The main purpose of the reactor containment system is to mitigate the consequences of potential accidents by minimizing the release of radionuclides to the environment to assure the health and safety of the public. Appendix J specifies containment leakage testing requirements, which include an ILRT (also known as a Type A test). The ILRT measures the overall leakage rate of the primary containment.

10 CFR 50 Appendix J was revised in 1995 to allow use of Option B, Performance Based Requirements. Regulatory Guide (RG) 1.163 (Reference 1) concludes that NEI 94-01, Revision 0, Industry Guideline for Implementing Performance-Based Option of 10 CFR Part 50, Appendix J, (Reference 2) provides methods acceptable to the NRC staff for complying with the provisions of Option B. Also, NEI 94-01 permits an extended ILRT test interval of 10 years based on two consecutive successful tests. In 1997, Seabrook Station implemented performance based testing in accordance with Option B and RG 1.163 and established a ten-year frequency for ILRTs. Successful ILRTs were completed on November 22, 1989 and October 30, 1992, and the pre-operational ILRT was performed on March 19, 1986.

In April 2002, the NRC approved Amendment 82 (Reference 3) following North Atlantic Energy Service Corporation's (FPL Energy Seabrook's predecessor) request for a one time, five-year extension to the 10-year ILRT interval. The evaluation of this change determined that the risk associated with the ILRT extension was small and that the ability of the in-service inspection program to detect containment degradation was unlikely to be affected. As a result, the due date for the next ILRT was extended to October 29, 2007.

This LAR proposes a one-time extension of the interval for the containment ILRT from 15 years to 15.5 years. Extending the ILRT due date from October 29, 2007 to April 29, 2008, would prevent a premature plant shutdown and provide time to plan and incorporate the containment ILRT in refueling outage 12 in the spring of 2008. Refueling outage 12 is currently scheduled for April 2008, just five months after the current ILRT due date of October 29, 2007. Without the requested extension, FPL Energy Seabrook would be required to end Cycle 12 five months earlier than planned. Including the ILRT in refueling outage 11, which is scheduled for the fall of 2006 (13 months prior to the ILRT due date) significantly impacts not only the planning for the outage but also the overall length of the outage. The large number of containment projects included in the scope of refueling outage 11 (steam generator inspections, reactor top head inspection, reactor vessel interior inspection - split pin, ultrasonic fuel cleaning, and containment sump modifications) would complicate the performance of the ILRT.

4.0 TECHNICAL ANALYSIS

The proposed change to extend the ILRT surveillance interval by six months is justified based on the results of previous ILRTs and local leak rate testing, containment inspection programs, and a risk evaluation.

Previous ILRT and Local Leak Rate Test (LLRT) Results

Previous ILRT testing confirmed that the Seabrook Station containment structure leakage is acceptable, with considerable margin, with respect to the TS acceptance criterion of 0.15% of primary containment air weight per day (1.0 La). The test results and methods used to determine containment leakage are shown below.

Test Date	Mass Point Method Leakage Rate** (%/day)	Total Time Method Leakage Rate*** (%/day)	Test Duration (Hours)	TS 6.15 Acceptance Criteria (%/day)
October 30, 1992	0.070	0.106	12	0.150
November 22, 1989	0.059	*	24	0.150
March 19, 1986	0.058	*	24	0.150

* The Total Time Analysis Method was not utilized during this test.

** The Mass Point Analysis Method is described Section 5.5.3 of ANSI/ANS-56.8-1994 "Containment System Leakage Testing Requirements."

*** The Total Time Analysis Method, described in Bechtel Topical Report (BN-TOP-1), Revision 1, dated November 1972, "Testing Criteria for Integrated Leakage Rate Testing of Primary Containment Structures for Nuclear Power Plants" was used for this test because the test duration was less than 24 hours

FPL Energy Seabrook has a comprehensive LLRT [Type B and C] program in place to meet the requirements of Option B of Appendix J. The Type B program tests electrical penetrations, the fuel transfer tube (bellows and flange), equipment hatch (flange o-ring and airlock), personnel air lock, two mechanical spare penetrations with flanged closures (o-rings), hydrogen analyzer trains, and two ventilation penetrations with flanged enclosures. The Type C program tests 39 penetrations.

A review of historical LLRT data below indicates that LLRT test results have been consistently maintained significantly below the maximum allowable combined leakage rate of 0.60 L_a for all penetrations and valves subject to Type B and C tests. In addition, FPL Energy Seabrook conservatively maintains an administrative leakage limit for each Type B and C tested containment penetration less than or equal to 0.05 L_a (37 scfh) and a limit of 0.01 L_a (7.4 scfh) for the containment on-line purge penetrations. The following summary shows the combined totals of all of the LLRTs at various times through out the past 20 years:

Year	Maximum Pathway Leakage*	Minimum Pathway Leakage*
2005	0.080 L_a	0.036 L_a
2004	0.081 L_a	0.026 L_a
2003	0.078 L_a	0.024 L_a
2002	0.079 L_a	0.030 L_a
2001	0.079 L_a	0.063 L_a

Year	Maximum Pathway Leakage*	Minimum Pathway Leakage*
2000	0.081 L_a	0.066 L_a
1999	0.094 L_a	0.073 L_a
1997	0.124 L_a	0.034 L_a
1995	0.126 L_a	0.054 L_a
1994	0.095 L_a	0.036 L_a
1992	0.110 L_a	0.036 L_a
1989	0.152 L_a	0.059 L_a
1986	0.146 L_a	0.099 L_a

The Maximum and Minimum Pathway Leakage calculation methods are defined in Section 2 of ANSI/ANS-56.8-1994 "Containment System Leakage Testing Requirements."

Containment Inspection Programs

RG 1.163, position C.3, specifies performing visual examinations of the accessible interior and exterior surfaces of the containment system for structural problems prior to initiating an ILRT and during two other outages before the next Type A test, if the interval for the Type A test has been extended to ten years, in order to allow for early uncovering of evidence of structural deterioration. These visual examinations were completed prior to the 1986, 1989 and 1992 ILRTs with no significant defects noted. Additional visual examinations were conducted during 1995, 1999, 2002 and 2005 with no significant containment liner defects noted. In addition, FPL Energy Seabrook conducts a periodic visual inspection of the concrete containment enclosure building every other refueling outage to ensure its integrity as required by the TS 3.6.5.3, Containment Enclosure Building Structural Integrity. The secondary containment structure shields the primary containment structure from the effects of weather, thereby providing additional assurance of its integrity. The visual inspections of the primary containment and the containment enclosure building are performed in accordance with the Containment Leakage Rate Testing Program every other refueling outage.

FPL Energy Seabrook has established a program as required by 10 CFR 50.65 "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," for monitoring the condition of structures within the scope of the rule, which includes the primary containment building. Baseline structural inspections were conducted at Seabrook Station in 1996. Additional inspections were performed in 1999 and 2002. No gross imperfections to structural steel or concrete were recorded during either inspection. This Maintenance Rule inspection is performed on a five-year frequency and will not be revised by the extension of the ILRT frequency.

FPL Energy Seabrook has developed a containment inservice inspection program as required by 10 CFR 50.55a(g)(6)(ii)(B). The containment inservice inspection program was developed pursuant to the requirements of Subsections IWE and IWL, of Section XI, of the 1995 Edition (including the 1996 Addenda) of the American Society of Mechanical Engineer's (ASME) Boiler and Pressure Vessel Code (Code). 10 CFR 50.55a(g)(6)(ii)(B) required an expedited examination of the accessible portions of primary containment liner, penetrations, selected pressure retaining bolted connections, the moisture barrier at the liner to containment floor junction and outer concrete surfaces. The inspections were conducted during refueling outages 7 and 10 and met the applicable requirements of the ASME Code. This inspection is performed every 40 months. The concrete inspections are performed on a 5-year frequency. The concrete inspection was conducted in 2000 and is scheduled to be performed later this year. In addition, during each refueling outage the design engineering group performs an inspection of the containment liner at all accessible elevations to ensure equipment meets the appropriate separation criterion from the containment liner.

In addition to the inspections discussed above, periodic functional ISI inspections are performed on ASME piping to ensure the weld structural integrity. These inspections comply with the requirements of the 1995 Edition, 1996 Addenda of the ASME Section XI, Article IWA-5000, System Pressure Tests, and inspect the ASME piping and welds through containment penetrations.

Risk Impact

Included in Attachment 3 is a Seabrook Station site specific risk evaluation for extending the ILRT frequency to 25 years. Following is the conclusion from the evaluation:

> A change in the ILRT frequency from 1-in-10 years to 1-in-25 years will have an extremely small change in population dose consequences (0.33%). Also, the change in LERF (3.34E-8/yr) is well below the Reg Guide 1.174 1E-7 guideline for very small changes.

This finding is consistent with NUREG-1493, Section 10.1.2:

> Reducing the frequency of Type A tests (ILRTs) from the current three per 10 years to one per 20 years was found to lead to an imperceptible increase in risk. The estimated increase in risk is very small because ILRTs identify only a few potential containment leakage paths that cannot be identified by Type B and C testing, and the leaks that have been found by Type A tests have been only marginally above existing requirements.

5.0 REGULATORY SAFETY ANALYSIS

5.1 No Significant Hazards Consideration

In accordance with 10 CFR 50.92, FPL Energy Seabrook has concluded that the proposed changes do not involve a significant hazards consideration (SHC). The basis for the conclusion that the proposed changes do not involve a SHC is as follows:

1. *The proposed changes do not involve a significant increase in the probability or consequences of an accident previously evaluated.*

The probability or consequences of accidents previously evaluated in the UFSAR are unaffected by this proposed change. There is no change to any equipment response or accident mitigation scenario, and this change results in no additional challenges to fission product barrier integrity. The proposed change does not alter the design, configuration, operation, or function of any plant system, structure, or component. As a result, the outcomes of previously evaluated accidents are unaffected. The proposed extension to the containment integrated leak rate test (ILRT) interval does not involve a significant increase in consequences because, as discussed in NUREG 1493, Performance Based Containment Leak Rate Test Program, Type B and C tests identify the vast majority (greater than 95 percent) of all potential leakage paths. Further, ILRTs identify only a few potential leakage paths that cannot be identified through Type B and C testing, and leaks found by Type A testing have been only marginally greater than existing requirements. In addition, periodic inspections ensure that any significant containment degradation will not go undetected. Therefore, the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. *The proposed changes do not create the possibility of a new or different kind of accident from any previously evaluated.*

No new accident scenarios, failure mechanisms, or limiting single failures are introduced as a result of the proposed change. The proposed change does not challenge the performance or integrity of any safety-related system. The proposed change neither installs or removes any plant equipment, nor alters the design, physical configuration, or mode of operation of any plant structure, system, or component. No physical changes are being made to the plant, so no new accident causal mechanisms are being introduced. The proposed change only changes the frequency of performing the ILRT; however, the test implementation and acceptance criteria are unchanged. Therefore, the proposed change does not create the possibility of a new or different kind of accident from any previously evaluated.

3. *The proposed changes do not involve a significant reduction in the margin of safety.*

The margin of safety associated with the acceptance criteria of any accident is unchanged. The proposed change will have no affect on the availability, operability, or performance of the safety-related systems and components. The proposed change does not alter the design, configuration, operation, or function of any plant system, structure, or component. The ability of any operable structure, system, or component to perform its designated safety function is unaffected by this change. NUREG 1493 concluded that reducing the frequency of ILRTs to 20 years resulted in an imperceptible increase in risk. Also, inspections of containment, required by the ASME code and the maintenance rule, ensure that containment will not degrade in a manner that is only detectable by Type A (ILRT) testing. Therefore, the margin of safety as defined in the TS is not reduced and the proposed change does not involve a significant reduction in a margin of safety.

Based on the above, FPL Energy Seabrook concludes that the proposed amendment presents no significant hazards consideration under the standards set forth in 10 CFR 50.92 (c), and accordingly, a finding of "no significant hazards consideration" is justified.

5.2 Applicable Regulatory Requirements / Criteria

5.2.1 Regulations

The regulatory basis for TS 6.15, Containment Leakage Rate Testing Program, exists in 10 CFR 50, Appendix J, Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors. Appendix J stipulates that one of the conditions required of all operating licenses for light-water-cooled power reactors as specified in 10 CFR 50.54(o) is that primary reactor containments meet the leakage-rate test requirements in either Option A or B of Appendix J. These test requirements ensure that (a) leakage through these containments or systems and components penetrating these containments does not exceed allowable leakage rates specified in the Technical Specifications and (b) integrity of the containment structure is maintained during its service life

10 CFR 50, Appendix A (Reference 4), General Design Criterion 16, "Containment design" requires that reactor containment and associated systems shall be provided to establish an essentially leak-tight barrier against the uncontrolled release of radioactivity to the environment and to assure that the containment design conditions important to safety are not exceeded for as long as postulated accident conditions require.

10 CFR 50.55a, Codes and Standards (Reference 5), mandates that systems and components of boiling and pressurized water-cooled nuclear power reactors must meet the requirements of the ASME Boiler and Pressure Vessel Code specified in paragraphs (b), (c), (d), (e), (f), and (g) of Part 50.55a.

5.2.2 Design Bases – UFSAR (Reference 6)

The containment design bases are established by the requirement that the system safely withstand the consequences of postulated accidents in conjunction with simultaneous occurrences of adverse environmental conditions. The containment structure and the containment enclosure, together with the exhaust system, are designed so that the offsite doses from radioactivity released under accident conditions are less than the limits set forth in 10 CFR 100.

The reactor containment structure, the containment penetrations and the containment isolation barriers are designed to permit periodic Type A integrated leakage rate testing. The reactor containment and its leakage limiting barriers are also designed to permit periodic inspection of important areas such as penetrations. The Type A test schedule and reporting requirements will be in accordance with the Containment Leakage Rate Testing Program. The structural integrity of the containment vessel and of the containment enclosure building shall be determined in accordance with the Containment Leakage Rate Testing program.

The TS leakage limits provide assurance that the limits specified in 10 CFR 100 will not be exceeded under accident conditions. Complying with the limits contained in the Containment Leakage Rate Testing Program ensures that the containment structure will function as an effective barrier against the release of fission products. Extending the ILRT interval by six months does not impact the ability of the containment to satisfy its design bases function.

5.2.3 Analysis

FPL Energy Seabrook performed a risk impact assessment for extending the ILRT frequency to 25 years (Attachment 3) in support of this proposed change. The proposed ILRT interval extension does not impact core damage risk or the reliability of the containment isolation valves to close on demand. Extending the ILRT presents an extremely small, 0.33%, increase in total population dose. The change in large early release frequency (LERF) is also very small. RG 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," (Reference 7) provides guidance for determining the risk impact of plant specific changes. RG 1.174 defines very small changes in the risk-acceptance guidelines as increases in LERF less than 10^{-7} per reactor year. The increase in LERF from extending the ILRT interval from 15 to 25 years is 3.34×10^{-8} per reactor year. This change is well below the RG 1.174 guideline and bounds the proposed extension to 15.5 years.

The Seabrook Station containment is a large reinforced concrete structure. The containment pressure boundary consists of the steel liner, containment access penetrations, and process piping and electrical penetrations. The integrity of the penetrations is verified through Type B and Type C local leak rate tests (LLRT) as required by 10 CFR 50, Appendix J and the overall integrity of the containment structure is verified through an ILRT. The leak rate testing requirements of Option B of 10 CFR 50, Appendix J, and the containment in-service inspection (ISI) requirements mandated by 10 CFR 50.55a complement each other in ensuring the leak-tightness and structural integrity of the containment.

FPL Energy Seabrook has a comprehensive containment ISI program developed pursuant to the requirements of Subsections IWE and IWL of Section XI of the 1995 Edition (including the 1996 Addenda) of the American Society of Mechanical Engineer's Boiler and Pressure Vessel Code. This program examines the accessible pressure-retaining surfaces to periodically monitor the condition of the containment building. Historical inspections of containment performed under this program have not identified any suspect areas.

Extending the ILRT frequency is not likely to impact the ability to detect age related containment liner degradation. Degradation of the liner would likely not be detected by the ILRT unless through-wall failures existed.

5.2.3 Conclusion

Extending the ILRT frequency would result in an increase in risk; however, the increase is small. The increase in LERF from the proposed extension is acceptable under the criteria in RG 1.174. An ILRT extension is not likely to affect the detection of degradation of the containment.

In conclusion, based on the considerations discussed previously, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

6.0 ENVIRONMENTAL CONSIDERATION

The proposed amendment would change a surveillance requirement. However, the proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22 (c) (9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement of environmental assessment need be prepared in connection with the proposed amendment.

7.0 REFERENCES

1. Appendix J to Part 50--Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors
2. NEI 94-01, *Industry Guideline for Implementing Performance Based Option of 10 CFR 50, Appendix J*, Revision 0.
3. Amendment No. 82, Seabrook Station Unit No. 1 – Issuance of Amendment Re: One-time Extension of Containment Type A Leak Test Interval (TAC No. MB2573)
4. Appendix A to Part 50--General Design Criteria for Nuclear Power Plants, *Criterion 16--Containment design*.
5. 10 CFR 50.55a, Codes and Standards
6. Seabrook Station UFSAR, Section 6.2, Containment Systems
7. Regulatory Guide 1.174, *An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant Specific Changes to the Licensing Basis*, Revision 1, November 2002.

Attachment 1

Proposed Technical Specification Change (mark-up)

Refer to the attached markup of the proposed change to the Technical Specifications. The attached markup reflects the currently issued revision of the Technical Specifications listed below. Pending Technical Specifications or Technical Specification changes issued subsequent to this submittal are not reflected in the enclosed markup.

The following Technical Specifications are included in the attached markup:

Technical Specification	Title	Page
TS 6.15	Containment Leakage Rate Testing Program	6-22

6.14.1 (Continued)

4) An evaluation of the change, which shows the predicted releases of radioactive materials in liquid and gaseous effluents and/or quantity of solid waste that differ from those previously predicted in the License application and amendments thereto;

5) An evaluation of the change, which shows the expected maximum exposures to a MEMBER OF THE PUBLIC in the UNRESTRICTED AREA and to the general population that differ from those previously estimated in the License application and amendments thereto;

6) A comparison of the predicted releases of radioactive materials, in liquid and gaseous effluents and in solid waste, to the actual releases for the period prior to when the change is to be made;

7) An estimate of the exposure to plant operating personnel as a result of the change; and

8) Documentation of the fact that the change was reviewed and found acceptable by the SORC.

b. Shall become effective upon review and acceptance by the SORC.

6.15 <u>CONTAINMENT LEAKAGE RATE TESTING PROGRAM</u>

A program shall be established to implement the leakage rate testing of the containment as required by 10 CFR 50.54(o) and 10 CFR 50, Appendix J, Option B, as modified by approved exemptions. This program shall be in accordance with the guidelines contained in Regulatory Guide 1.163, "Performance-Based Containment Leak Test Program, dated September 1995," as modified by the following exception:

a. NEI 94-01-1995, Section 9.2-3: The first ILRT performed after October 30, 1992 shall be performed no later than ~~October 29, 2007~~. April 29, 2008

The peak calculated containment internal pressure for the design basis loss of coolant accident, P_a, is 49.6 psig.

The maximum allowable containment leakage rate, L_a, at P_a, shall be 0.15% of primary containment air weight per day.

The provisions of SR 4.0.2 do not apply to the test frequencies specified in the Containment Leakage Rate Testing Program.

Attachment 2

Proposed Technical Specification Page (re-type)

Refer to the attached retype of the proposed change to the Technical Specifications. The attached retype reflects the currently issued version of the Technical Specifications. Pending Technical Specification changes or Technical Specification changes issued subsequent to this submittal are not reflected in the enclosed retype. The enclosed retype should be checked for continuity with Technical Specifications prior to issuance.

The following Technical Specifications are included in the attached retype:

Technical Specification	Title	Page
TS 6.15	Containment Leakage Rate Testing Program	6-22

6.14.1 (Continued)

4) An evaluation of the change, which shows the predicted releases of radioactive materials in liquid and gaseous effluents and/or quantity of solid waste that differ from those previously predicted in the License application and amendments thereto;

5) An evaluation of the change, which shows the expected maximum exposures to a MEMBER OF THE PUBLIC in the UNRESTRICTED AREA and to the general population that differ from those previously estimated in the License application and amendments thereto;

6) A comparison of the predicted releases of radioactive materials, in liquid and gaseous effluents and in solid waste, to the actual releases for the period prior to when the change is to be made;

7) An estimate of the exposure to plant operating personnel as a result of the change; and

8) Documentation of the fact that the change was reviewed and found acceptable by the SORC.

b. Shall become effective upon review and acceptance by the SORC.

6.15 CONTAINMENT LEAKAGE RATE TESTING PROGRAM

A program shall be established to implement the leakage rate testing of the containment as required by 10 CFR 50.54(o) and 10 CFR 50, Appendix J, Option B, as modified by approved exemptions. This program shall be in accordance with the guidelines contained in Regulatory Guide 1.163, "Performance-Based Containment Leak Test Program, dated September 1995," as modified by the following exception:

a. NEI 94-01-1995, Section 9.2-3: The first ILRT performed after October 30, 1992 shall be performed no later than April 29, 2008.

The peak calculated containment internal pressure for the design basis loss of coolant accident, P_a, is 49.6 psig.

The maximum allowable containment leakage rate, L_a, at P_a, shall be 0.15% of primary containment air weight per day.

The provisions of SR 4.0.2 do not apply to the test frequencies specified in the Containment Leakage Rate Testing Program.

Attachment 3

Risk Impact of Extending the Frequency of Containment Integrated Leak Rate Testing
From 10 Years to 25 Years

Risk Impact of Extending the Frequency of Containment Integrated Leak Rate Testing from 10 Years to 25 Years

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1.0 Purpose

This evaluation addresses the impact on plant risk of extending Type A containment integrated leak rate testing (ILRT) from a 10-year interval to a 25-year interval.

Attachment A documents a sensitivity analysis, in a standard format, to support the ILRT Technical Specification change.

2.0 Background

Three types of tests are used to assure containment leak-tight integrity:

- Type A, or integrated leak rate testing (ILRT), and
- Type B and C, or local leak rate testing (LLRT).

Local leak rate testing is performed on one penetration at a time and the impact on the overall leakage is the sum of individual penetrations' leakage. Integrated leak rate testing, on the other hand, is a global check of the containment isolation capability, conducted by pressurizing the containment to the peak DBA pressure (49.6 psig) and measuring the integrated impact of all leakage. The focus of this evaluation is on the frequency of ILRTs.

Technical Specification 6.15 sets the maximum allowed leakage (L_a)at 0.15% containment free volume by weight, per day at the peak DBA pressure. From EX1803.001, the procedural requirements for ILRT are an as-found value less than $1.0L_a$ and an as-left value of less than $0.75L_a$. The first three ILRTs performed at Seabrook Station have all been below $0.75L_a$.

Previous changes to the Appendix J of 10CFR Part 50 have allowed relaxation in the frequency of ILRT and LLRT testing, based on the performance of previous tests. Good performance of the Seabrook Unit 1 containment has allowed extension of the frequency for ILRT from 3 times in 10 years to once-in-10 years. This evaluation addresses the risk impact of further extending this frequency to once-in-25 years.

3.0 Evaluation

An extension to the ILRT frequency can impact risk by affecting the reliability of containment isolation due to unidentified leakage. It does not affect the Level 1 (core damage) risk and also does not impact the reliability of containment isolation valves failing to close on demand. Extending ILRT does increase the potential for unidentified containment leakage.

In general terms, ILRT-identified leakage can be grouped into three classes of containment isolation failure:

- Minor Containment Leakage (MCL) - leakage slightly above the TS leakage limit (L_a). This leakage is modeled as $2L_a$, i.e. two times allowable leakage.
- Small Containment Leakage (SCL) - significantly above the TS leakage limit but below the size that would qualify as large, early release (LERF). This leakage is modeled as $10L_a$, i.e. an order of magnitude above allowable leakage.

- Large Containment Leakage (LCL) - leakage that would qualify as LERF. This leakage is modeled as equivalent to the opening of the containment online purge line (8-inch nominal).

Risk can be decomposed into the *frequency* of unidentified leakage and the *consequences* of containment leakage. Extending ILRT has the potential to impact the *frequency* of containment leakage, but doesn't impact the *conditional consequences*. Thus, this evaluation first considers the impact on the frequency of leakage due to changing the ILRT interval to 25 years. Second, the consequences of minor, small, and large leakage are evaluated. Finally, the change in risk is calculated based on multiplying the change in frequency times the conditional consequences.

Note: the failure being evaluated is *not* failure of ILRT -- i.e., failure of the test to identify real leakage -- but failure of containment isolation that ILRT could uniquely identify. Due to the integral nature of the test, it is unlikely that leakage could be hidden from the test unless it was related to the isolation that is done to protect equipment and instrumentation. Failure of ILRT is not addressed quantitatively in this evaluation. This is conservative with regard to extending ILRT testing frequency because it would reduce the value of an ILRT.

3.1 Frequency

The accident sequences of interest are those core damage sequences with offsite releases through unidentified containment leakage -- leakage that could be identified through ILRT. These are core damage sequences where the containment is intact except for unidentified leakage - i.e., not gross containment failure, containment bypass, failure of active containment isolation, etc. Since the unidentified leak does not impact the likelihood or outcome of the core damage accident, the sequence frequency can be written as:

FREQ = Freq(Core damage with containment intact) x Prob(ILRT leak)

Where:

Freq(Core damage with containment intact) = Freq(release category S5) = 1.79E-5/yr (from Reference 1: SSPSS-2004 Table 2.4-1), and

Prob(ILRT leak) = Prob(Unidentified containment leak detectable via ILRT). This probability is estimated in the following sections, for three different leakage sizes.

3.1.1 Minor Containment Leakage (MCL)

<u>Baseline Probability</u>

The probability of Minor Containment Leakage detectable from ILRT can be estimated from generic industry data. Section 4.1 of NUREG-1493 (Reference 2) discusses the results of approximately 180 ILRTs throughout the industry during the period 6/87 to 4/93. Of those 180 tests, 42 were classified as failures but only 5 were found by ILRT which LLRT could not and did not detect. The generic containment leakage probability of leakage that ILRT alone could identify:

PROB(MCL-ILRT1) = 5/180 = 0.0278

NUREG-1493 also states that:

"Of note in the ILRT failures observed that were not detected by Type B and C testing, the actual leakage rates were very small, only marginally in excess of current leak-tightness requirements."

The leakage definition used for MCL ($2L_a$) is conservative compared to the above industry experience.

NUMARC conducted a similar survey of 144 ILRTs (also documented in NUREG-1493). This survey found 23 ILRT-related isolation failures but only 4 failures that ILRT alone could detect (code A1 and A3). This results in an identical failure rate (4/144 = 0.0278) as from the NUREG data. The 4 failures were all steam generator in-leakage, with as-found leakage of $0.88L_a$ to $1.3L_a$. At Seabrook, the integrity of secondary side leakage paths is verified by either a pressurization test of the SGs with the primary system depressurized or on-line with the plant systems examined when pressurized. Thus, the likelihood of SG manway gasket leakage is even more remote than indicated by generic data. No credit is taken for this Seabrook inspection.

In addition, 2 events in the NUMARC survey involved Type B & C leakage that was not discovered by LLRT (code A2). These events represent the failure of LLRT that ILRT could discover. These two events also involved leakage below $2L_a$. The probability of containment leakage identified by ILRT that LLRT failed to discover:

PROB(MCL-ILRT2) = 2/144 = 0.0139

Of the other 17 failure events in the NUMARC database, the leakages were less than $2L_a$ except for two events -- one less than $3L_a$ and a second approaching $10L_a$. However, these involved exceedances due to additions from LLRT-identified leakage or testing errors. These events did not involve direct ILRT-identified failures.

These two probabilities can be summed to give an overall probability of containment leakage that was not detected by means other than ILRT. Thus, the probability of a minor containment leak that could be detected by ILRT:

PROB(MCL-ILRT) = 0.0278 + 0.0139 = 0.0417

These probabilities are based on industry events that involved small leakage, bounded by $2L_a$ -- consistent with the leakage definition of MCL.

Adjusted Probabilities

To evaluate the impact of the change in ILRT frequency on the probability of containment leakage, the failure probabilities calculated above need to be converted to a *failure rate per time*.

These failure events are associated with processes that can be seen as randomly generating leakage that could be detected by ILRT. For example, the SG secondary manway leakage could be present following the SG sludge lancing that occurs each refueling outage. Also, the Type B & C leakage not identified by LLRT could happen in any outage where the penetration seal is opened and reclosed. Thus, the processes that generate leakage can be thought of as a random process with a failure rate of λ_{ILRT}.

For minor containment leakage, the NUREG and NUMARC data are based on plant experience from 1993 and earlier, when the ILRT Technical Specifications required Type A testing 3 times in 10 years. Thus, the probability calculated above should be identified as:

PROB(MCL-ILRT, 3-in-10-year) = 0.0417

Then, if we assume a constant probability (0.0417) over this time, the failure rate per hr:

$\lambda_{ILRT,MCL}$ = 0.0417 / (10yr x 8760hr/yr / 3) = 1.43E-6/hr

Now, for a 10-year interval (the current requirement) and assuming a constant failure rate, the average failure probability is:

PROB(MCL-ILRT, 1-in-10-year) = 1.43E-6/hr x 10yr x 8760hr/yr = 0.125, or a factor of 3 increase (consistent with the factor of 3 increase in duration between ILRTs).

For a further increase to 25 years:

PROB(MCL-ILRT, 1-in-25-year) = 1.43E-6/hr x 25yr x 8760hr/yr = 0.313, a factor of 7.5 increase over the initial 3 tests in 10 years, or a factor of 2.5 increase over the once-in-10 year requirement.

3.1.2 Small Containment Leakage (SCL)

The NRC and NUMARC databases have no leakage events detected by ILRT (alone) that were above *minor* in size. Using the NUREG-1493 data with the evidence of 0 SCL failures, the χ^2 distribution can be used to provide a conservative estimate of the failure probability.

The containment failure process can be modeled as a binomial distribution. Then the 95% upper confidence limits can be approximated as:

$P_U(95\%) = \chi^2(\nu=2f+2;\ 0.95)\ /\ 2N,$

where f represents the number of SCLs, N represents the number of ILRTs in the database, ν represents the number of degrees of freedom, and $\chi^2(\nu;0.95)$ represents the chi-square probability with ν degrees of freedom at the 95% confidence level (Reference 3: NUREG/CR-2300, Section 5.5.1.3).

f = 0

N = 180

$\nu = 2$

$\chi^2(\nu=2;0.95) = 5.99$ (from Table C in Reference 6).

Thus, an upper limit on the probability of a small containment leakage that could be detected only by ILRT:

PROB(SCL-ILRT-95%) = 5.99 / (2*180) = 0.0166

A similar process can be used to calculate a 50% confidence upper limit probability:

$\chi^2(\nu=2;0.50) = 1.39$

PROB(SCL-ILRT-50%) = 1.39 / (2*180) = 0.00386

These values can be compared with the small pre-existing leakage basic event probability currently used in the Seabrook PRA (SSPSS-2004):

ZZ.CIS.PRE.EXIST = 3.74E-3, or a factor of 4 smaller than the 95% chi-square estimate but consistent with the 50% confidence value.

This basic event, documented in PLG-0631, Section 3.2.3.2 (Ref. 7), is based on a review of containment isolation data from NUREG/CR-4220. This data is pre-1985 and includes leakage that could be detected by LLRT as well as ILRT. It is expected that this probability is conservative since the reliability of containment isolation has likely improved over the decades and since this includes LLRT- as well as ILRT-identified leakage.

For this analysis, the conservative 95% confidence value will be used for the 3-in-10 year case. As discussed in Section 3.1.1, increasing the interval between ILRTs to 10 years and to 25 years increases the failure probability by factors of 3 and 7.5, respectively. Thus,

PROB(SCL-ILRT, 3-in-10-year) = 0.0166

PROB(SCL-ILRT, 1-in-10-year) = 0.0166 x 3.0 = 0.0498

PROB(SCL-ILRT, 1-in-25-year) = 0.0166 x 7.5 = 0.125

3.1.3 Large Containment Leakage (LCL)

One would expect the probability of LCL to be much lower than SCL since it would require a defect that would likely be detected by other means - visual, leakage from other systems, etc. The Seabrook PRA has a value for large pre-existing leakage:

ZZ.CIL.PRE.EXIST = 9.34E-5, or a factor of 40 smaller than the small pre-existing leak probability above.

It is reasonable to assume the LCL probability would be at least an order of magnitude less than the SCL probability. Since the SCL probability is based on a conservative estimate, the factor of 40 will be used to estimate a probability for LCL:

PROB(LCL-ILRT) = 0.0166 / 40 = 4.15E-4

The probabilities for extended frequencies are modified as discussed in the previous section:

PROB(LCL-ILRT, 3-in-10-year) = 4.15E-4

PROB(LCL-ILRT, 1-in-10-year) = 4.15E-4 x 3.0 = 1.25E-3

PROB(LCL-ILRT, 1-in-25-year) = 4.15E-4 x 7.5 = 3.11E-3

3.1.4 Frequency Results

The following summarizes the probabilities for different ILRT frequencies:

	Probability of Unidentified Containment Leakage		
ILRT Frequency	**MCL**	**SCL**	**LCL**
3 per 10 years	0.0417	1.66E-2	4.15E-4
1 per 10 years	0.125	4.98E-2	1.25E-3
1 per 25 years	0.313	1.25E-1	3.11E-3

As discussed above, the frequency of core damage with intact containment, release category S5, is 1.79e-05. Thus, the frequency of core damage with unidentified leakage is:

	Frequency of Core Damage with Unidentified Containment Leakage		
ILRT Frequency	MCL	SCL	LCL
3 per 10 years	7.46E-07	2.97E-07	7.43E-09
1 per 10 years	2.24E-06	8.91E-07	2.24E-08
1 per 25 years	5.60E-06	2.24E-06	5.57E-08

Note, the frequency of LCL is approximately a factor of 100 below MCL. While this was coincidental, it is consistent with the data and experience that large containment leakage would be rare in comparison to minor leakage.

3.2 Consequence

The consequences for the three leakage sizes are derived from the Base Case Level 3 consequence model.

3.2.1 Base Case Model

Table 1 provides a summary of the Base Case risk results for the best estimate source term and consequence assumptions (from Reference 4: SSPSS 2004, Section 15.3). This table presents the seven release category groups that have been used in the Seabrook PRA to bin the impact of containment performance - early vs late failure; large vs small leakage; structural failure vs isolation failure vs bypass failure.

The mean frequency values are based on specific release categories from SSPSS-2004. Note, the sum of the release category frequencies is equal to the Core Damage Frequency total (2.99E-5/yr) for Modes 1-3, full scope.

The Level 3 consequence analysis is based on Seabrook-specific site parameters, using the CRACIT computer code. Using a combination of realistic source term, median consequence modeling (S1) and conservative source term, median consequence (S7), there are early fatalities projected on a conditional consequence basis.

The absolute risk values are the product of frequency times consequence. The absolute early fatality risk is 4.3E-06/yr. The total expected offsite exposure risk, the sum of the absolute risk from each release category, is 30.6 man-rem per year.

3.2.2 ILRT Sensitivities

Table 2 provides consequence and risk results for the three ILRT frequency cases - 3 in 10 years, 1 in 10 years, and 1 in 25 years. Each case includes the three containment leakage sizes - minor (MCL), small (SCL), and large (LCL).

The consequence model for the MCL size is based on the following:

- MCL = 2 x L_a (as discussed in Section 3.1),
- Seabrook value for L_a = 0.15% per day (based on TS 6.15),
- IntactS5 leakage = 0.10% per day (based on PLG-0432 assumption).

Thus, MCL / IntactS5 = (2 x 0.15%) / (0.10%) = 3, or MCL = 3 x intactS5. That is, the leakage from MCL is three times the intact containment category rather than two time, based on the calculation for "IntactS5" which used a leakage of 0.1%, rather than 0.15% (L_a).

Similarly, SCL / IntactS5 = (10 x 0.15%) / (.10%) = 15, or SCL = 15 x intactS5.

Based on Section 4.2 of EPRI TR-104285 (Reference 5), it is reasonable to assume a direct correlation of the population doses with release magnitudes for low fission product releases. Thus, for MCL and SCL, we assume the Conditional Consequences are directly proportional to the size of leak - factors of 3 and 15 larger than IntactS5.

As shown in Table 2, the LCL is modeled after release category "lerfS6." The large containment leakage size is modeled as equivalent to the opening of the containment online purge line, consistent with the definition of release category "lerfS6."

From Table 2, the consequence results for population dose can be summarized as follows:

ILRT Frequency	ILRT-Related Pop. Dose	Adjusted Total Pop. Dose	Percent of Adjusted Total	Change from 3 per 10 yr	Change from 1 per 10 yr
3 per 10 years	0.025	30.6	0.08%	--	--
1 per 10 years	0.075	30.7	0.25%	0.33%	--
1 per 25 years	0.188	30.8	0.60%	0.65%	0.33%
BaseLine Total	--	30.6	--	--	--
	man-rem/yr	man-rem/yr			

Note, the BaseLine Total does not include an explicit contribution for ILRT-related consequences. As a result, an adjusted total population dose is calculated by adding the ILRT-related dose to the BaseLine total dose. In all cases, the ILRT-related dose is a very small percent of the total dose. Thus, the change in total population dose from extending the ILRT frequency is also very small. The change from the current frequency is only 0.33%. The cumulative change (from 3-in-10 yr to 1-in-25 yr) is only 0.65% increase.

3.2.3 Conservative Source Term / Consequence Sensitivity

Table 3 provides similar results using conservative source term and high consequence assumptions. With conservative assumptions, the conditional consequences are significantly greater. The integrated risk results for the Conservative BaseLine case:

Early fatality risk = 7.44E-05/yr

Total man-rem risk = 73.0 man-rem / yr

Table 4 provides consequence and risk results for the three ILRT frequency cases - 3 in 10 years, 1 in 10 years, and 1 in 25 years - using the Conservative BaseLine model. The results for population dose are summarized below:

ILRT Frequency	ILRT-Related Pop. Dose	Adjusted Total Pop. Dose	Percent of Adjusted Total	Change from 3 per 10 yr	Change from 1 per 10 yr
3 per 10 years	0.347	73.3	0.47%	--	--
1 per 10 years	1.04	74.0	1.41%	.95%	--
1 per 25 years	2.59	75.5	3.43%	3.00%	2.03%
BaseLine Total	--	19.0	--	--	--
	man-rem/yr	man-rem/yr			

Thus, for population dose, even with conservative consequence assumptions, the conclusion is still strong - that a change in ILRT frequency up to 1-in-25 year makes a small change in overall population dose risk.

3.2.4 Large Early Release Frequency

The large early release frequency (LERF) is impacted only by Large Containment Leakage (LCL). The change in ILRT-related LERF, from Table 2, is as follows:

ILRT Frequency	ILRT-Related LERF (LCL)	Change from 3 per 10 yr	Change from 1 per 10 yr
3 per 10 years	7.43E-09	--	--
1 per 10 years	2.23E-08	1.49E-08	--
1 per 25 years	5.57E-08	4.83E-08	3.34E-08
BaseLine LERF Total	--	--	--

Thus, the ΔLERF from current 1-in-10 year to 1-in-25 year frequency is 3.34E-08/yr. The cumulative ΔLERF (from 3-in-10 year to 1-in-25 year) is 4.83E-08/yr. These ΔLERF values are both below the Reg Guide 1.174 guideline of 1E-7 for "Very Small Changes".

3.3 Qualitative Risk Considerations

Section 3.1 and 3.2 estimated a small potential increase in risk based on extending the frequency of ILRT. There are other considerations that are difficult to quantify but provide some potential for risk reduction with extending the ILRT frequency:

- Shortened outages. The ILRTs at Seabrook Station have taken 4 to 5 days of critical path time during refueling outages. Fewer ILRTs means shorter outages and less outage risk.
- Reduced potential for damaged equipment not discovered. Due to the internal pressure in the containment during the test, equipment has been damaged in past tests. While this is primarily a maintenance cleanup and repair issue, it does have the potential for damage that is not detected following the test.
- Reduced personnel exposure - preparation for and recovery from an ILRT requires a significant number of activities within the containment.
- Reduced time when the containment is inaccessible. If a shutdown sequence occurred, local action in containment would not be possible for an extended period of

time. For example, locally gagging an RHR relief valve that opened inadvertently would not be possible during the ILRT.

4.0 Safety Significance

This evaluation addresses extending the frequency of the ILRT to once in 25 years. Any significant hazards will be evaluated as part of the license amendment. This evaluation provides a portion of the supporting evidence that may be used for a license amendment. Any required 10CFR50.59 screening or evaluation will be performed as part of the license amendment request (LAR).

5.0 Conclusion

A change in the ILRT frequency from 1-in-10 years to 1-in-25 years will have an extremely small change in population dose consequences (0.33%). Also, the change in LERF (3.34E-8/yr) is well below the Reg Guide 1.174 1E-7 guideline for very small changes.

This finding is consistent the findings of NUREG-1493, Section 10.1.2:

> Reducing the frequency of Type A tests (ILRTs) from the current three per 10 years to one per 20 years was found to lead to an imperceptible increase in risk. The estimated increase in risk is very small because ILRTs identify only a few potential containment leakage paths that cannot be identified by Type B and C testing, and the leaks that have been found by Type A tests have been only marginally above existing requirements.

6.0 References

1. SSPSS-2004, "Seabrook Station Probabilistic Safety Study, 2004 Update," December 2004.
2. NUREG-1493, "Performance-Based Containment Leak-Test Program," September 1995.
3. NUREG/CR-2300, "PRA Procedures Guide," January 1983.
4. PLG-0631, "Probabilistic Risk Assessment of 40% Power operation at the Seabrook Station", November 1988.
5. EPRI-104285, "Risk Impact Assessment of Revised Containment Leak Rate Testing Intervals," August 1994.
6. Statistical Data Analysis Handbook, Francis J. Wall, McGraw-Hill, 1986.

TABLE 1 Risk Summary for Best Estimate Source Term/Consequence Modeling - Base Case *

Release Category Group	Description	Release Categories [a]	Frequency (per yr) [b]	Conditional Consequences [c] Early Fatalities	Total Cancers	Total Man-Rem	Absolute Risk (Freq x Conseq) Early Fatality Risk	Total Cancer Risk	Total Man-Rem Risk
S1	Early containment failure	lerfS1A	1.30E-11	52.0	6463	2.70E+07	6.76E-10	8.40E-08	3.51E-04
S2	Early small containment leakage, late overpressure failure	serfS2A, serfS2B, serfS2R, serfS7S, serfS7V	8.12E-07	0.0	524	2.60E+06	0.00E+00	4.25E-04	2.11E+00
S3	Early intact, late overpressurization failure basemat melt-through	lateS3A, lateS3B, lateS4 (d)	1.11E-05	0.0	474	2.40E+06	0.00E+00	5.26E-03	2.66E+01
S5	Intact containment (TS Leakage)	intactS5	1.79E-05	0.0	0.3	1.30E+03	0.00E+00	5.37E-06	2.33E-02
S6	Containment isolation failure	lerfS6	2.53E-09	0.0	448	2.20E+06	0.00E+00	1.13E-06	5.57E-03
S7	Containment bypassed	lerfS7I, lerfS7S, lerfS7V	1.00E-07	43.0	3743	1.80E+07	4.30E-06	3.74E-04	1.80E+00
TOTAL			***2.99E-05***				***4.30E-06***	***6.07E-03***	***3.06E+01***

Notes:

* Hand calculations in these tables may not exactly match the spreadsheet calculation because values displayed are rounded to three digits.

(a) Release Categories are from SSPSS-2004 Section 14.6. Note that "lerf" = large, early release frequency, "serf" = small, early release frequency, "late" = large, late release frequency, and "intact" = TS leakage frequency.

(b) The Frequency values are from the SSPSS-2004 Table 2.4-1, based on the Release Category designators in the previous column. Note that the frequency for "serfS7" is included in Group S2 frequency since this is the closest group with regard to consequences.

(c) Conditional Consequences come from SSPSS 2004, Tables 15.3-1, 3, 5. These values are for 10-mile evacuation with realistic source term and median consequence modeling.

(d) Category S4, basemat melt-through is combined with S3 since the consequences are similar.

TABLE 2 Risk Summary for Best Estimate Source Term/Consequence Modeling - ILRT Sensitivities

ILRT Release Category	Description	Release Categories	Frequency (per yr)	*Conditional Consequences* Early Fatalities	Total Cancers	Total Man-Rem	*Absolute Risk (Freq x Conseq)* Early Fatality Risk	Total Cancer Risk	Total Man-Rem Risk
3 ILRTs per 10 Years									
MCL	Minor Containment Leakage (2La)	3 x intactS5	7.46E-07	0.0	0.9	3.90E+03	0.00E+00	6.72E-07	2.91E-03
SCL	Small Containment Leakage (10La)	15 x intactS5	2.97E-07	0.0	4.5	1.95E+04	0.00E+00	1.34E-06	5.79E-03
LCL	Large Containment Leakage	lerfS6	7.43E-09	0.0	448	2.20E+06	0.00E+00	3.33E-06	1.63E-02
						Subtotal (MCL, SCL, LCL) =	0.00E+00	5.34E-06	2.50E-02
						Baseline Total (from Table 1) =	4.30E-06	6.07E-03	3.06E+01
						Adjusted Total (Subtotal + Baseline Total) =	***4.30E-06***	***6.07E-03***	***3.06E+01***
						Percentage of Total =	0.00%	0.09%	0.08%
1 ILRT per 10 Years									
MCL	Minor Containment Leakage (2La)	3 x intactS5	2.24E-06	0.0	0.9	3.90E+03	0.00E+00	2.01E-06	8.73E-03
SCL	Small Containment Leakage (10La)	15 x intactS5	8.91E-07	0.0	4.5	1.95E+04	0.00E+00	4.01E-06	1.74E-02
LCL	Large Containment Leakage	lerfS6	2.23E-08	0.0	448	2.20E+06	0.00E+00	9.98E-06	4.90E-02
						Subtotal (MCL, SCL, LCL) =	0.00E+00	1.60E-05	7.51E-02
						Baseline Total (from Table 1) =	4.30E-06	6.07E-03	3.06E+01
						Adjusted Total (Subtotal + Baseline Total) =	***4.30E-06***	***6.08E-03***	***3.07E+01***
						Percentage of Total =	0.00%	0.26%	0.25%
1 ILRT per 25 Years									
MCL	Minor Containment Leakage (2La)	3 x intactS5	5.60E-06	0.0	0.9	3.90E+03	0.00E+00	5.04E-06	2.19E-02
SCL	Small Containment Leakage (10La)	15 x intactS5	2.23E-06	0.0	4.5	1.95E+04	0.00E+00	1.00E-05	4.35E-02
LCL	Large Containment Leakage	lerfS6	5.57E-08	0.0	448	2.20E+06	0.00E+00	2.50E-05	1.23E-01
						Subtotal (MCL, SCL, LCL) =	0.00E+00	4.00E-05	1.88E-01
						Baseline Total (from Table 1) =	4.30E-06	6.07E-03	3.06E+01
						Adjusted Total (Subtotal + Baseline Total) =	***4.30E-06***	***6.11E-03***	***3.08E+01***
						Percentage of Total =	0.00%	0.66%	0.61%

TABLE 3 Risk Summary for Conservative Source Term/Consequence Modeling - Conservative Base Case*

				Conditional Consequences (c)			Absolute Risk (Freq x Conseq)		
Release Category Group	Description	Release Categories (a)	Frequency (per yr) (b)	Early Fatalities	Total Cancers	Total Man-Rem	Early Fatality Risk	Total Cancer Risk	Total Man-Rem Risk
S1	Early containment failure	lerfS1A	1.30E-11	843.0	13060	9.90E+06	1.10E-08	1.70E-07	1.29E-04
S2	Early small containment leakage, late overpressure failure	serfS2A, serfS2B, serfS2R, serfS7S, serfS7V	8.12E-07	1.0	16770	3.30E+07	8.12E-07	1.36E-02	2.68E+01
S3	Early intact, late overpressurization failure basemat melt-through	lateS3A, lateS3B, lateS4 (d)	1.11E-05	0.0	1924	3.90E+06	0.00E+00	2.14E-02	4.33E+01
S5	Intact containment (TS Leakage)	intactS5	1.79E-05	0.0	1.6	3.00E+03	0.00E+00	2.86E-05	5.37E-02
S6	Containment isolation failure	lerfS6	2.53E-09	629.0	23290	4.40E+07	1.59E-06	5.89E-05	1.11E-01
S7	Containment bypassed	lerfS7I, lerfS7S, lerfS7V	1.00E-07	720.0	14360	2.70E+07	7.20E-05	1.44E-03	2.70E+00
TOTAL			*2.99E-05*				*7.44E-05*	*3.65E-02*	*7.30E+01*

Notes:

* Hand calculations in these tables may not exactly match the spreadsheet calculation because values displayed are rounded to three digits.

(a) Release Categories are from SSPSS-2004 Section 14.6. Note that "lerf" = large, early release frequency, "serf" = small, early release frequency, "late" = large, late release frequency, and "intact" = TS leakage frequency.

(b) The Frequency values are from the SSPSS-2004 Table 2.4-1, based on the Release Category designators in the previous column. Note that the frequency for "serfS7" is included in Group S2 frequency since this is the closest group with regard to consequences.

(c) Conditional Consequences come from SSPSS 2004, Tables 15.3-1, 3, 5. These values are for 10-mile evacuation with conservative source term and high consequence modeling.

(d) Category S4, basemat melt-through is combined with S3 since the consequences are similar.

TABLE 4 Risk Summary for Conservative Source Term/Consequence Modeling - ILRT Sensitivities

ILRT Release Category	Description	Release Categories	Frequency (per yr)	*Conditional Consequences* Early Fatalities	Total Cancers	Total Man-Rem	*Absolute Risk (Freq x Conseq)* Early Fatality Risk	Total Cancer Risk	Total Man-Rem Risk
3 ILRTs per 10 Years									
MCL	Minor Containment Leakage (2La)	3 x intactS5	7.46E-07	0.0	4.8	9.00E+03	0.00E+00	3.58E-06	6.72E-03
SCL	Small Containment Leakage (10La)	15 x intactS5	2.97E-07	0.0	24	4.50E+04	0.00E+00	7.13E-06	1.34E-02
LCL	Large Containment Leakage	lerfS6	7.43E-09	9.2	23290	4.40E+07	6.83E-08	1.73E-04	3.27E-01
						Subtotal (MCL, SCL, LCL) =	6.83E-08	1.84E-04	3.47E-01
						Baseline Total (from Table 3) =	7.44E-05	3.65E-02	7.30E+01
						Adjusted Total (Subtotal + Baseline Total) =	***7.45E-05***	***3.67E-02***	***7.33E+01***
						Percentage of Total =	0.09%	0.50%	0.47%
1 ILRT per 10 Years									
MCL	Minor Containment Leakage (2La)	3 x intactS5	2.24E-06	0.0	0.3	9.00E+03	0.00E+00	6.71E-07	2.01E-02
SCL	Small Containment Leakage (10La)	15 x intactS5	8.91E-07	0.0	1.5	4.50E+04	0.00E+00	1.34E-06	4.01E-02
LCL	Large Containment Leakage	lerfS6	2.23E-08	9.2	5972.7	4.40E+07	2.05E-07	1.33E-04	9.81E-01
						Subtotal (MCL, SCL, LCL) =	2.05E-07	1.35E-04	1.04E+00
						Baseline Total (from Table 3) =	7.44E-05	3.65E-02	7.30E+01
						Adjusted Total (Subtotal + Baseline Total) =	***7.46E-05***	***3.66E-02***	***7.40E+01***
						Percentage of Total =	0.27%	0.37%	1.41%
1 ILRT per 25 Years									
MCL	Minor Containment Leakage (2La)	3 x intactS5	5.60E-06	0.0	0.3	9.00E+03	0.00E+00	1.68E-06	5.04E-02
SCL	Small Containment Leakage (10La)	15 x intactS5	2.23E-06	0.0	1.5	4.50E+04	0.00E+00	3.34E-06	1.00E-01
LCL	Large Containment Leakage	lerfS6	5.57E-08	9.2	5972.7	4.40E+07	5.13E-07	3.33E-04	2.45E+00
						Subtotal (MCL, SCL, LCL) =	5.13E-07	3.38E-04	2.60E+00
						Baseline Total (from Table 3) =	7.44E-05	3.65E-02	7.30E+01
						Adjusted Total (Subtotal + Baseline Total) =	***7.49E-05***	***3.68E-02***	***7.56E+01***
						Percentage of Total =	0.68%	0.92%	3.44%

Attachment A Sensitivity Case

A.1 Introduction

This Sensitivity case addresses the impact on plant risk of extending Type A containment integrated leak rate testing (ILRT) from a 10-year interval to 25-year interval.

A.2 Evaluation

This Sensitivity case is documented in the spreadsheets presented as Tables A-1, A-2, and A-3. Table A-1 provides the sensitivity calculation for a test interval of 3-in-10 years. The definition of release "class" used in these tables is related to Release Category Groups used in Tables 1 to 4 of the Base case evaluation. The values for frequency and dose for most of the classes are taken directly from Table 1 (as indicated by italic terms in Table A-1) . The other values are discussed below.

Frequency

The Sensitivity case uses just two ILRT-failure classes (3a and 3b) while the Base case evaluation uses three - minor (MCL), small (SCL), and large (LCL).

The frequency values for Class 3a and Class 3b are calculated as a fraction of CDF Total. In the Sensitivity case for small leakage, the Class 3a fraction (0.064) is calculated using some of the same data used in the Baseline model (Section 3.1.1), 4 small failures in 144 tests. The Sensitivity case uses an upper bound estimate (95^{th} percentile of a χ^2 distribution) rather than a best estimate value used in Section 3.1.1 for *Minor* leakage (0.0417). For *Small* leakage, the Baseline model (Section 3.1.2) uses 95^{th} percentile of a χ^2 distribution with zero out of 180 tests to obtain a smaller value (0.0166).

In the Sensitivity for large leakage, the Class 3b fraction (0.021) is based on an upper bound estimate (95^{th} percentile of a χ^2 distribution) based on zero events in 144 events. The Baseline model for *Large* leakage uses a value (4.15E-4) as documented in Section 3.1.3.

Consequence

The dose values for Class 3a and Class 3b are calculated as a factor of the intact containment dose (Class 1) -- $10L_a$ for Class 3a and $35L_a$ for Class 3b. For the related release categories in the Baseline model:

Dose(Minor Containment Leakage) = $2L_a$

Dose(Small Containment Leakage) = $10L_a$

Dose(Large Containment Leakage) = Dose(Release Category S6)

Thus, the Small category matches up with the Class 3a. There is not an equivalent to Minor category in the Sensitivity evaluation. The Large category dose from S6 (2.2E6 man-rem) can be compared with the Class 3b dose, $35L_a$ (4.55E4 man-rem) - a factor of 48 higher.

To summarize the comparison between the Baseline model and Sensitivity model:

Leakage Size	Baseline Evaluation			Sensitivity Evaluation			Fractional Change	
	ID	FREQ Fraction of Intact	DOSE man-rem	ID	FREQ Fraction of CDF	DOSE man-rem	FREQ Fraction	DOSE man-rem
Minor	MCL	0.0417	3.90E3	n/a	n/a	n/a	n/a	n/a
Small	SCL	0.0166	1.95E4	Class 3a	0.064	1.30E4	3.9	0.67
Large	LCL	0.000415	2.20E6	Class 3b	0.021	4.55E4	50	0.02

Thus, the Base case is conservative in comparison to the Sensitivity case for *dose* but the Sensitivity is conservative with respect to *frequency*. The net result is that they can be considered equivalent within the range of uncertainty of the analysis. Note that the frequency fraction is used slightly differently between the two evaluations.

Impact of Testing Interval Change

The Base case evaluation uses factors of 3 (for 1 in 10 year) and 7.5 (for 1 in 25 year). These factors were based on the increase in time between tests assuming a linear increase in failure probability:

(3 tests/10 yr) / (1 test/10yr) = 3.0

(3 tests/10 yr) / (1 test/25yr) = 7.5

The Sensitivity evaluation uses increase factors in the frequencies of Class 3a and Class 3b of 1.1 (for 1 in 10 year) and 1.225 (for 1 in 25 year) over the baseline (3 in 10 year). These use the additional data provided in NUREG-1493 that ILRTs only detect about 3% of leaks. Thus,

3 x 3% = 0.09 ~0.1, or 10% increase

7.5 x 3% = 0.225, or 22.5% increase

A.3 Conclusion

Results

The table below provides a summary of the results, comparing once with 3-in-10 year results and a second with 1-in-10 year results. The person-rem results can be compared with the Base case results in Section 3.2.2. The Sensitivity case shows smaller percentage change.

The Base case did not include a Conditional Containment Failure Probability (CCFP) calculation, but the Sensitivity case shows very small change.

Class 3b results are provided since it is assumed that Class 3b release is a LERF and it is the only LERF contributor that would change with change in testing interval. The ΔLERF are comparable but slightly higher than the Base case results.

RESULTS	3-In-10 Year	1-In-10 Year	1-In-25 Year

Person-Rem per Year	30.6305	30.6355	30.6418
ΔPerson-Rem / Yr (from Baseline)		0.0050 (0.02%)	0.0113 (0.04%)
ΔPerson-Rem / Yr (from 1 in 10 Yr)			0.0063 (0.02%)
CCFP	0.4223	0.4224	0.4271
ΔCCFP (from Baseline)		0.0021 (0.5%)	0.0048 (1.1%)
ΔCCFP (from 1 in 10 Yr)			0.0027 (0.6%)
Class 3b Frequency	6.28E-07	6.91E-07	7.69E-07
ΔLERF (from Baseline)		6.3E-08	1.41E-07
ΔLERF (from 1 in 10 Yr)			7.8E-08

Comments on the Sensitivity Case

The Sensitivity case has several "issues" that limit its value as a best estimate risk tool. First, Class 3a (small leakage) frequency is based on actual failures (4 in 144) but the data indicates that all of the actual failures were less than $2L_a$ leakage. But the Sensitivity assumed a leakage of 10 La, mixing the data of minor leakage with small leakage (that the Base case model attempted to keep straight). In addition, the failure fraction for Class 3a is based on a 95^{th} percentile upper bound calculation, which is NOT appropriate for best estimate results.

Second, Class 3b (large leakage) frequency is also based on a 95^{th} percentile upper bound, using the evidence of zero events. The resulting fraction for Class 3b is only about 3 times less than Class 3a (small leakage). This doesn't seem to comport with reasonable judgment; the likelihood of a large leakage would be expected to be much lower than the type of minor leakage that has been detected. Large leakage is extremely unlikely to occur and, if it did occur, it is likely that large leakage would be detected from other plant indications. The Base case model makes an attempt at estimating the frequency of large leakage and provides another, existing value for comparison.

Third, the Sensitivity case uses a factor of 35 L_a, which corresponds to a leakage rate of 35 x 0.15% = 5% per day. However, NUREG-1493 (page 5-10) indicates that for a 3.6-inch diameter opening, the critical flow would be 200% per day. The Seabrook PRA uses 3-inch diameter as the cutoff between large and small containment failure. The value used in the Sensitivity case for Class 3b is way below what would be considered a LERF type release. Thus, the results for LERF in the Sensitivity case, which use the change in Class 3b, are extremely conservative. In reality, the Sensitivity case does not even evaluate a real LERF sequence.

Finally, the impact of changing testing intervals includes a factor of 3% in the Sensitivity case, based on limited discovery of leakage by ILRT. But discoverability is already in the estimation of the frequency of small and large leakage - it is specifically "failure of containment isolation that ILRT could uniquely identified" (from Section 3.0).

As a result of these issues, it is difficult to reach a meaningful conclusion from the Sensitivity case. In addition, the uncertainties, which are present in such an evaluation which relies on zero failures, would overwhelm the small changes that the numbers indicate.

TABLE A-1 Mean Consequence Measures for 3-in-10 Year Test Interval - Sensitivity *

Class	Description	Frequency (per Rx-yr)	Person-Rem	Person-Rem per year
1	No Containment Failure	1.54E-05	1.30E+03	2.00E-02
2	Large Cont. Isolation Failure (failure to close)	2.53E-09	2.20E+06	5.57E-03
3a	Small Isolation Failure (Type A test)	1.91E-06	1.30E+04	2.49E-02
3b	Large Isolation Failure (Type A test)	6.28E-07	4.55E+04	2.86E-02
6	Other Isolation Failures (dependent Failures)	0.00E+00	4.55E+04	0.00E+00
7a	Severe Accident Phenomena (Early-Large)	1.30E-11	2.70E+07	3.51E-04
7b	Severe Accident Phenomena (Early-Small, Late-Large) **	8.12E-07	2.60E+06	2.11E+00
7c	Severe Accident Phenomena (Late-Large)	1.11E-05	2.40E+06	2.66E+01
8	Containment Bypassed (SGTR)	1.00E-07	1.80E+07	1.80E+00
CDFTotal		2.99E-05		30.6305

Class 1 frequency = IntactCDF-Class3a-Class3b-Class6 =	1.54E-05
Class 2 frequency = *Freq[S6]* =	2.53E-09
Class 3a frequency = 0.064*CDFTotal =	1.91E-06
Class 3b frequency = 0.021*CDFTotal =	6.28E-07
Class 6 frequency = n/a	0.00E+00
Class 7a frequency = *Freq[S1]* =	1.30E-11
Class 7b frequency = *Freq[S2]* =	8.12E-07
Class 7c frequency = *Freq[S3]* + *Freq[S6]*=	1.11E-05
Class 8 frequency = *Freq[S7]* =	1.00E-07

Class 1 dose = *Dose[S5]* =	1.30E+03
Class 2 dose = *Dose[S6]* =	2.20E+06
Class 3a dose = 10La x Class 1 dose = 10 x *Dose[S5]* =	1.30E+04
Class 3b dose = 35La x Class 1 dose = 35 x *Dose[S5]* =	4.55E+04
Class 6 dose = 35La x Class 1 dose = 35 x *Dose[S5]* =	4.55E+04
Class 7a dose = *Dose[S1]* =	2.70E+07
Class 7b dose = *Dose[S2]* =	2.60E+06
Class 7c dose = *Dose[S3]* =	2.40E+06
Class 8 dose = *Dose[S7]* =	1.80E+07

CCFP = 1 - (Class 1 + Class 3a)/CDFTotal = $\boxed{0.4223}$

Notes:

* Frequency and Dose values come from the release categories in Table 1. The italic terms indicate the link to Table 1 release categories.

** Class 7b = Release category [S2] -- this release category includes both severe accident phenomena and containment isolation failure that result in a small containment opening, too small to prevent long term pressurization and failure.

TABLE A-2 Mean Consequence Measures for 10 Year Test Interval - Sensitivity

Class	Description	Frequency (per Rx-yr)	Person-Rem	Person-Rem per year
1	No Containment Failure	1.51E-05	1.30E+03	1.96E-02
2	Large Cont. Isolation Failure (failure to close)	2.53E-09	2.20E+06	5.57E-03
3a	Small Isolation Failure (Type A test)	2.10E-06	1.30E+04	2.74E-02
3b	Large Isolation Failure (Type A test)	6.91E-07	4.55E+04	3.14E-02
6	Other Isolation Failures (dependent Failures)	0.00E+00	4.55E+04	0.00E+00
7a	Severe Accident Phenomena (Early-Large)	1.30E-11	2.70E+07	3.51E-04
7b	Severe Accident Phenomena (Early-Small, Late-Large)	8.12E-07	2.60E+06	2.11E+00
7c	Severe Accident Phenomena (Late-Large)	1.11E-05	2.40E+06	2.66E+01
8	Containment Bypassed (SGTR)	1.00E-07	1.80E+07	1.80E+00
CDFTotal		2.99E-05		30.6355

Class 1 frequency = IntactCDF-Class3a-Class3b-Class6 =	1.51E-05
Class 3a frequency = 0.064*CDFTotal*1.1	2.10E-06
Class 3b frequency = 0.021*CDFTotal*1.1	6.91E-07

CCFP = 1 - (Class 1 + Class 3a)/CDFTotal = 0.4244

Other frequencies from Table A-1

TABLE A-3 Mean Consequence Measures for 25 Year Test Interval - Sensitivity

Class	Description	Frequency (per Rx-yr)	Person-Rem	Person-Rem per year
1	No Containment Failure	1.48E-05	1.30E+03	1.92E-02
2	Large Cont. Isolation Failure (failure to close)	2.53E-09	2.20E+06	5.57E-03
3a	Small Isolation Failure (Type A test)	2.34E-06	1.30E+04	3.05E-02
3b	Large Isolation Failure (Type A test)	7.69E-07	4.55E+04	3.50E-02
6	Other Isolation Failures (dependent Failures)	0.00E+00	4.55E+04	0.00E+00
7a	Severe Accident Phenomena (Early-Large)	1.30E-11	2.70E+07	3.51E-04
7b	Severe Accident Phenomena (Early-Small, Late-Large)	8.12E-07	2.60E+06	2.11E+00
7c	Severe Accident Phenomena (Late-Large)	1.11E-05	2.40E+06	2.66E+01
8	Containment Bypassed (SGTR)	1.00E-07	1.80E+07	1.80E+00
CDFTotal		2.99E-05		30.6418

Class 1 frequency = IntactCDF-Class3a-Class3b-Class6 =	1.48E-05
Class 3a frequency = 0.064*CDFTotal*1.225	2.34E-06
Class 3b frequency = 0.021*CDFTotal*1.225	7.69E-07

Other frequencies from Table A-1

CCFP = 1 - (Class 1 + Class 3a)/CDFTotal = 0.4271