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RS-03-185

10 CFR 50.90

September 15, 2003

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

Clinton Power Station, Unit 1
Facility Operating License No. NPF-62
NRC Docket No. 50-461

Subject: Additional Information Supporting the Request for Amendment to Technical Specifications 3.6.5.1, "Drywell" and 5.5.13, "Primary Containment Leakage Rate Testing Program"

Reference: Letter from Keith R. Jury (AmerGen Energy Company, LLC) to U.S. NRC, "Request for Amendment to Technical Specifications 3.6.5.1, Drywell and 5.5.13, Primary Containment Leakage Rate Testing Program," dated January 29, 2003

In the above referenced letter, AmerGen Energy Company (AmerGen), LLC submitted a request for changes to the Facility Operating License No. NPF-62 and Appendix A to the Facility Operating License, Technical Specifications (TS), for Clinton Power Station (CPS), Unit 1. Specifically, the proposed change will revise TS 3.6.5.1, "Drywell," Surveillance requirement (SR) 3.6.5.1.3 to delay the performance of the next drywell bypass leakage test (DWBT) to no later than November 23, 2008. This request also revises TS 5.5.13, "Primary Containment Leakage Rate Testing Program," to remove an exception that is no longer applicable and to reflect a one-time deferral of the primary containment Type A integrated leak rate test (ILRT) to no later than November 23, 2008.

On May 15 and 27, 2003, the NRC requested additional information in support of their review of the referenced amendment request. Attachment 1 to this letter provides the requested information. Results of supporting sensitivity studies are provided as Attachments 2 and 3.

Should you have any questions related to this information, please contact Mr. Timothy A. Byam at (630) 657-2804.

A017

I declare under penalty of perjury that the foregoing is true and correct.

Respectfully,

9/15/03
Executed on

Keith R. Jury
Keith R. Jury
Director – Licensing and Regulatory Affairs
AmerGen Energy Company, LLC

Attachments:

1. Additional Information Supporting the Request for Amendment to Technical Specifications 3.6.5.1, "Drywell" and 5.5.13, "Primary Containment Leakage Rate Testing Program"
2. Impact of Undetected Steel Liner Corrosion on the Clinton ILRT and DWBT Extension Risk Assessment
3. Clinton ILRT and DWBT Interval Extension Sensitivity Case
4. Revised Table C.4-1,"Quantitative Results as a Function of ILRT and DWBT Interval"

ATTACHMENT 1

Additional Information Supporting the Request for Amendment to Technical Specifications 3.6.5.1, "Drywell" and 5.5.13, "Primary Containment Leakage Rate Testing Program"

As the inservice inspection (ISI) requirements mandated by 10 CFR 50.55a and the leak rate testing requirements of Option B of 10 CFR Part 50, Appendix J complement each other to ensure the leak-tight and structural integrity of the containment, the staff needs the following information to complete its review of the license amendment request:

Question 1

Since there is no description (or summarization) regarding the containment ISI program being implemented at the plant included in the submittal (reference), provide a description of the ISI methods that provide assurance that in the absence of a containment integrated leak rate testing (ILRT) for 15 to 20 years, the containment structural and leak-tight integrity will be maintained.

Response 1

Clinton Power Station (CPS) has implemented a Containment Inservice Inspection (CISI) Program. As described in Attachment 2 to Reference 1, CPS performs a comprehensive primary containment inspection to the requirements of American Society of Mechanical Engineers (ASME) Section XI, "Inservice Inspection," Subsections IWE, "Requirements for Class MC and Metallic Liners of Class CC Components of Light-Water Cooled Power Plants," and Subsection IWL, "Requirements of Class CC Concrete Components of Light-Water Cooled Power Plants." The CPS CISI Program began development in 1996 and the initial inspections were completed in September 2001. The components subject to Subsection IWE and IWL requirements are those that make up the containment structure and its leak-tight barrier (including integral attachments), and those that contribute to its structural integrity. Specifically included are Class MC pressure retaining components, including metallic shell and penetration liners of Class CC pressure retaining components, and their integral attachments. The ASME Code Inspection Plan was developed in accordance with the requirements of the 1992 Edition with the 1992 Addenda of the ASME Boiler and Pressure Vessel Code, Section XI, Division 1, Subsections IWE and IWL, as modified by NRC final rulemaking to 10 CFR 50.55a, "Codes and standards." published in the Federal Register on August 8, 1996.

The initial ISI inspections of the CPS Metal / Concrete Containment have been completed. Various indications were observed, documented, evaluated and determined to be acceptable. No areas of the containment liner surfaces require augmented examination. No loss of structural integrity of primary containment was observed.

There will be no change to the schedule for these inspections as a result of the extended ILRT interval.

Question 2

IWE-1240 requires licensees to identify the containment surface areas requiring augmented examinations. Provide the locations of the steel containment (or concrete containment liner) surfaces that have been identified as requiring augmented examination and a summary of the findings of the examinations performed.

Response 2

As noted above, CPS has completed the initial CISI Program inspections. All indications identified were documented, evaluated and determined to be acceptable. Therefore, CPS has no containment liner surfaces that require augmented examinations.

Question 3

For the examination of penetration seals and gaskets, and examination and testing of bolted connections associated with the primary containment pressure boundary (Examination Categories E-D and E-G), relief for the requirements of the code had been requested. As an alternative, it was proposed to examine them during the leak-rate testing of the primary containment. However, Option B of Appendix J for Type B and Type C testing (as per NEI 94-01 and RG 1.163), and the ILRT extension requested in this amendment for Type A testing provide flexibility in the scheduling of these inspections. Provide your schedule for examination and testing of seals, gaskets, and bolted connections that provide assurance regarding the integrity of the containment pressure boundary.

Response 3

CPS has implemented approved relief request CIP-6101 on the IWE-2500 requirement for VT-3 (i.e., visual) examination of seals and gaskets on airlocks, hatches, and other devices (i.e., bolted connections). In lieu of the VT3 examination, CPS tests these components in accordance with the CPS Primary Containment Leakage Rate Testing Program following the requirements of 10 CFR 50 Appendix J, Option B. Specifically, CPS procedurally requires a visual inspection of containment airlock doorseal gaskets prior to each doorseal test, performed on a 30-day interval. CPS has modified the containment airlock handwheel shaft seals with an improved seal design, which allows individual testing of all sealing surfaces. These seals are individually tested on a 6-month periodicity during the airlock lubrication and inspection preventive maintenance (PM) activity as ongoing condition monitoring to ensure modification effectiveness.

Containment airlock "barrel testing", or pressurization of the entire interior volume of the airlock, is performed on a 30-month frequency. During this test, all other bolted leakage pathways associated with the airlocks, such as the equalizing valves, are challenged. The barrel test connection flange is equipped with a double O-ring and test connection. The test connection flange is tested individually following reinstallation.

Equipment hatch gaskets are inspected by maintenance personnel each outage prior to hatch reinstallation and leakage rate testing. Bolted connections (i.e., blind flanges) and electrical penetrations receive Type B testing on a performance-based frequency in accordance with the Option B program. CPS has two containment penetrations sealed by blind flanges. These penetrations are 1MC-067, the ILRT test connection, and 1MC-

074, the Reactor Water Cleanup System decontamination flange penetration. Both penetrations are tested on a 120-month periodicity, in accordance with Option B requirements, as based on excellent as-found leakage performance.

CPS has 49 electrical penetrations. All penetrations are tested on a 120-month periodicity, in accordance with Option B requirements, as based on excellent as-found leakage performance.

Question 4

The stainless steel bellows have been found to be susceptible to trans-granular stress corrosion cracking, and the leakage through them are not readily detectable by the Type B testing (see Information Notice 92-20). If applicable, provide information regarding inspection and testing of the bellows, and how such behavior has been factored into the risk assessment.

Response 4

CPS has installed Modification FH-030 to the Inclined Fuel Transfer System containment penetration to address the issue of bellows ply separation and the ability to fully challenge the bellows with a Type B test. This modification was made to address the concerns raised by Information Notice 92-20, "Inadequate Local Leak Rate Testing." Modification FH-030 consists of a steel cylinder attached to the bellows and the fuel transfer tube with test connection valves allowing pressurization of the volume between the cylinder and the transfer tube and bellows. This modification allows CPS to fully challenge the bellows assembly with the Type B test. Since leakage through the bellows is readily detected through periodic Type B testing, it is not necessary to factor this type of failure in the CPS risk assessment. Because potential leakage through this path would be detected through Type B tests even without ILRT testing, and because Type B tests are already performed more often than ILRT tests, extending the ILRT interval does not impact the risk of an undetected bellows failure. Therefore, the bellows failure mechanism is not specifically addressed in the risk analysis. CPS has no other flexible bellows assemblies serving as the primary containment boundary.

Question 5

Inspections of some reinforced concrete and steel containment structures have found degradation on uninspectable (embedded) side of the drywell steel shell and steel liner of the primary containment. These degradations cannot be found by visual (i.e., VT-1 or VT-3) examinations unless they are through the thickness of the shell or liner, or 100 percent of the uninspectable surfaces are periodically examined by ultrasonic testing. Provide information addressing how potential leakage under high pressure during core damage accidents is factored into the risk assessment related to the extension of the ILRT.

Response 5

At CPS, the liner sections are completely welded together and anchored into the concrete. There is no air space between the liner and the concrete structure. The corrosion / oxidation effects associated with water being in contact with the liner and the concrete reinforcing bars are minimized due to the lack of available oxygen between the

concrete and the liner. Furthermore, the liner is intended to be a membrane and constitute a leak-proof boundary for the containment. The liner is nominally ¼" to ½" thick, depending on the location in the containment. The CISI Program includes required examination and testing of ASME Class MC and CC pressure retaining components at CPS. Visual inspections are performed for all accessible portions of the containment liner. Possible instances of liner damage or coating degradation are identified and evaluated for extent of condition. There have been few instances recorded in the industry of corrosion causing through-wall penetration of the containment liner. Furthermore, because concrete is poured against the containment liner even if through-liner corrosion should occur, rarely would this result in significant leakage from the containment. These factors have been addressed in a corrosion sensitivity study completed for CPS and provided in the response to Probabilistic Safety Assessment (PSA) Branch Question #4 below. This study also takes into consideration the possibility that the rate of through-wall corrosion could increase over time.

REQUEST FOR ADDITIONAL INFORMATION FROM THE PROBABILISTIC SAFETY ASSESSMENT BRANCH

Question 1

The January 29, 2003 submittal provides risk impacts for a change in test frequency from 1 test in 10 years to 1 test in 15 years. Please provide the corresponding risk results (for Δperson-rem, ΔLERF, and ΔCCFP) for (a) a change in ILRT test frequency for 3 tests in 10 years to 1 test in 15 years and (b) a combined change in ILRT and DWBT test frequency from 3 tests in 10 years to 1 test in 15 years.

Response 1

Attachment 5 to Reference 1 provided the CPS risk assessment to support the proposed extension of the ILRT interval. Table 4-1, "Quantitative Results as a Function of ILRT Interval," from Reference 1 documented the changes in risk metrics due to the ILRT extension alone going from 3 tests in 10 years to 1 test in 15 years. Based on the results provided in Table 4-1, CPS has calculated the requested risk results. The results of this calculation are provided in Table 1 below.

The changes in risk metrics for deferring both the ILRT and DWBT from 3 tests per 10 years to 1 test per 15 years were documented on Table C.4-1, "Quantitative Results as a Function of ILRT and DWBT Interval," in Attachment 5 to Reference 1 and are also provided in Table 1 below.

Table 1

CHANGES IN RISK METRICS DUE TO EXTENDING ILRT AND DWBT FROM 3 TESTS IN 10 YEARS TO 1 TEST IN 15 YEARS

Risk Metric	ILRT only	ILRT and DWBT
Δperson-rem	0.07	0.09
ΔLERF	2.24E-7	3.02E-7
ΔCCFP	0.8%	1.06%

It should be noted that the changes in LERF values from Table 1 were considered to be the changes in EPRI Category 3b even though this characterization is extremely conservative for a Mark III containment based upon the small, calculated radiological impact.

A typographical error in Table C.4-1 of Reference 1 has been identified. The EPRI Category 3b accident sequence frequency for the 3 tests in 10 years assessment is 5.9E-8/yr not 3.9E-8/yr. The corrected Table C.4-1 is provided for information as Attachment 4 to this letter.

Question 2

Provide the technical justification for the assumption in the risk analysis that no long-term station blackout scenarios contribute to LERF. If this justification is based on timing arguments, provide a timeline for a representative scenario that includes consideration of the time at which the various emergency action levels are declared, the decision to evacuate is made, and the evacuation is initiated and completed. If this justification is based on source term magnitude, provide the estimated source terms for a representative scenario, and the definition of LERF used for this determination. Consider the impact that increased drywell bypass leakage would have on the above assessments.

Response 2

Long-term Station Blackout (SBO) sequences have been eliminated from consideration as events that could contribute to LERF for purposes of this analysis. Thus, they do not contribute to the frequency of EPRI categories 3a and 3b. The CPS Risk Assessment to Support ILRT Interval Extension Request (Attachment 5 to Reference 1) eliminated the 3.0E-6 events per year of the SBO frequency based upon this argument. This corresponds to the CPS Revision 3 Probabilistic Risk Assessment (PRA) results that show a frequency of 3.0E-6 events per year for Loss of Offsite Power (LOOP) sequences in which the Reactor Core Isolation Cooling (RCIC) System initially was successful, but core damage occurs because of battery depletion after 4 hours. In these instances core damage and containment releases would happen late enough that they would not contribute to the LERF value.

CPS has used the MAAP computer code to model the sequence of events associated with the SBO scenario. A timeline for battery depletion SBO events is provided in Table 2 below. This run represents the accident progression for scenarios in which core

cooling is provided by RCIC alone for the first 4 hours after the event then subsequently fails because of battery depletion.

Table 2

BATTERY DEPLETION SBO EVENT TIMELINE

Event	Time After Plant Trip (hrs)
Loss of Offsite Power Initiating Event	0
Failure of emergency AC power (EDGs)	0
Failure of HPCS	0
RCIC Initiation (first time)	0.01
Battery Depletion	4
Loss of RCIC (no injection capability left)	4
Core Uncovery	4.8
Time to 2/3rds Core Height	5.1
Time until Max Core Temp>1800 F	5.7
Time until RPV breach	8.6

The CPS Emergency Action Levels (EALs) are specified in Exelon Training & Reference Manual EP-AA-1003, "Radiological Emergency Plan Annex for Clinton Station," Revision 3. SBO events in which battery depletion is likely to occur would be classified as a General Emergency under Emergency Action Level (EAL), MG1, "Prolonged (> 4 hrs.) loss of all Vital Bus AC power." This EAL identifies the following as the threshold value for declaring a General Emergency.

<u>EAL Threshold Value</u>

1. Loss of all AC power to Division I **and** II Vital Buses.
   AND
2. Any of the following:
   - Restoration of power to **either** Division I **or** Division II Vital Bus within **4 hours** is **NOT** likely.
     OR
   - Conditions are imminent that a loss of two fission product barriers **and** potential loss of the third will occur **prior** to restoration of AC power to the plant.

An SBO event in which AC power recovery is projected not to be recovered would be classified as a General Emergency based upon meeting the EAL threshold values identified in items 1 and 2 above. The timing for such a declaration is expected to be early enough that evacuation of the local population could be made in time to avoid large radiological exposure to the local population within 10 miles. Thus, the dominant SBO core melt progression sequences are considered not to be LERF events based upon their timing alone taking no credit for containment mitigation. Large radiological releases associated with the dominant SBO accident sequences would not happen before vessel breach because the containment remains intact and the releases are scrubbed.

Question 3

Provide an assessment of the impact on risk results (Δperson-rem, ΔLERF, and ΔCCFP) if long-term station blackouts were not removed from the residual core damage frequency when determining the Category 3a and 3b frequencies.

Response 3

As described in the response to Question 2 above, including long-term SBO scenarios in the EPRI Category 3a and 3b frequency calculations would not be appropriate to the analysis, nor is it consistent with the NEI ILRT risk assessment methodology. However, a sensitivity analysis has been performed in response to this RAI to determine the impact of the long-term SBO sequence on Category 3a and 3b. The results of this sensitivity analysis are provided in Table 3 below. Although this produces a slight increase in the Risk Metrics for this assessment the conclusions remain unchanged. The change in LERF frequency remains in the "Small" range as defined in Regulatory Guide (RG) 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis."

Additional Information Supporting the Request for Amendment to Technical Specifications 3.6.5.1, "Drywell" and 5.5.13, "Primary Containment Leakage Rate Testing Program"

Table 3
QUANTITATIVE RESULTS AS A FUNCTION OF ILRT AND DWBT INTERVAL
LONG TERM LOOP/STATION BLACKOUT INCLUDED FOR CALCULATION OF 3a AND 3b CATEGORIES

EPRI Category	Dose (Person-Rem Within 50 miles)	Quantitative Results as a Function of ILRT and DWBT Interval					
		Baseline (3-per-10 year)		Current (1-per-10 year)		Proposed (1-per-15 year)	
		Accident Frequency (per year)	Population Dose Rate (Person-Rem/Year Within 50 miles)	Accident Frequency (per year)	Population Dose Rate (Person-Rem/Year Within 50 miles)	Accident Frequency (per year)	Population Dose Rate (Person-Rem/Year Within 50 miles)
1	2.40E+03	4.68E-06	1.12E-02	2.68E-06	6.43E-03	1.12E-06	2.68E-03
2	5.10E+05	1.13E-07	5.76E-02	1.13E-07	5.76E-02	1.13E-07	5.76E-02
3a	2.40E+04	7.21E-07	1.73E-02	2.54E-06	6.09E-02	3.94E-06	9.47E-02
3b	8.40E+04	6.76E-08	5.68E-03	2.53E-07	2.13E-02	4.09E-07	3.44E-02
4	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7a	5.10E+05	2.63E-07	1.34E-01	2.63E-07	1.34E-01	2.63E-07	1.34E-01
7b	3.50E+05	4.70E-06	1.65	4.70E-06	1.65	4.70E-06	1.65
7c	3.70E+05	1.71E-05	6.33	1.71E-05	6.33	1.71E-05	6.33
7d	3.00E+05	9.20E-07	2.76E-01	9.20E-07	2.76E-01	9.20E-07	2.76E-01
8	5.10E+05	1.21E-07	6.17E-02	1.21E-07	6.17E-02	1.21E-07	6.17E-02
TOTALS:		2.87E-05	8.54	2.87E-05	8.60	2.87E-05	8.64
Increase in Dose Rate (1)					0.64%		0.50%
Increase in LERF (2)				1.86E-07		1.56E-07	
Increase in CCFP (%) (3)				0.67%		0.56%	

Question 4

Inspections of some reinforced and steel containments (e.g., North Anna, Brunswick, D. C. Cook, and Oyster Creek) have indicated degradation from the uninspectable (embedded) side of the steel shell and liner of primary containments. Please describe the uninspectable areas of the Clinton containment, and the programs used to monitor their condition. Provide a quantitative assessment of the impact on LERF due to age-related degradation in these areas, in support of the requested ILRT interval extension from 10 to 15 years.

Response 4

The CPS containment is reinforced concrete with an integral steel liner. The liner sections are completely welded together and anchored into the concrete. The concrete side of the liner is not accessible and cannot be directly inspected by visual means. There is no air space between the liner and the concrete structure. Therefore, before any significant leakage path through the containment liner can occur the flaw or defect must propagate through the containment liner. Because the large majority of the inside of the containment liner is fully exposed to the containment atmosphere and is accessible for inspection, there is a high likelihood that such through-wall defects would be detected through the visual examinations performed as part of the CISI Program. Accessible portions of the containment liner are required to be inspected on a once per fuel cycle frequency per CPS CISI Program. Portions of the inside of the containment liner that are not accessible include the liner below the suppression pool surface and portions of the liner that are obstructed from view by equipment (e.g. piping, cable trays, ductwork) and structural elements (e.g. intermediate concrete floors) next to the containment wall. However, it is estimated that 80% of the inside of the containment liner that is exposed to air is accessible for inspection. The portion of the liner below the suppression pool surface is demonstrated to be low leakage since it is capable of retaining suppression pool water. There are leak test channels at the containment liner seams in the suppression pool area to drain any water that leaks through the suppression pool liner. Therefore, leakage through the suppression pool liner is detectable.

The areas of the containment liner above the suppression pool surface that cannot be inspected are judged to be no more susceptible to degradation than those portions that are accessible. Corrosion identified in areas that are accessible for inspection could indicate that an investigation of similar areas that are not readily accessible may be required. Therefore, any widespread corrosion phenomena would be investigated and corrective action would be taken. This does not completely preclude the possibility of undetected localized corrosion occurring in areas that are not accessible, however, industry experience has shown a fairly low incidence rate for through-liner corrosion. Furthermore, localized breaches of the containment liner are not likely to lead to significant containment breaches since a leakage path through the reinforced concrete structure would also have to be present. A corrosion sensitivity study has been performed that estimates the impact on the ILRT risk assessment results based upon the above factors. This sensitivity case also takes into consideration that through-liner corrosion may become more likely over time as the containment ages. This sensitivity case is provided in ERIN Calculation P0467030001-2232, "Impact of Undetected Steel Liner Corrosion on the Clinton ILRT and DWBT Extension Risk Assessment," and has

been included as Attachment 2 to this letter. The conclusion of this sensitivity case is that the LERF contributions (including through-liner corrosion effects) are still in the "Small" range as defined in RG 1.174 and are therefore acceptable. Note the analysis performed in Attachment 2 is conservative with regard to the LERF metric because the scrubbing action provided by the CPS drywell and suppression pool would in most instances prevent a large release regardless of the size of the liner breach. Nevertheless, liner breach due to corrosion was assumed to lead to a large magnitude radionuclide release.

Question 5

The baseline drywell bypass (DWB) leakage rate for Category I sequences (DWL_c) is based on a limited set of data (results from 6 leakage tests), and the multipliers used to characterize more severe leakage (10 x DWL_c for Category 3a and 35 x DWL_c for Category 3b sequences) are arbitrarily taken from the ILRT methodology. Please provide a more complete set of DWB leakage rate data that includes all available DWB test results for the entire fleet of Mark III plants over their full operating history, and DWB test results for other BWR containment types that may be applicable. Justify that the DWB leakage rates ascribed to Category 1, 3a, and 3b sequences are representative of the full range of leakage rates that have been found. These comparisons should support a conclusion that the maximum leakage rates observed are within the value assigned to Category 3b, and that the majority of the leakage rate results are well represented by the value assigned to Category 1.

Response 5

Adapting the Nuclear Energy Institute (NEI) ILRT risk assessment approach for addressing the impacts of the drywell bypass leakage issue is believed to provide a reasonable approach for dealing with the drywell behavior. This is based upon the following considerations.

A. In the older BWR containment designs (i.e., Mark I and II), the drywell enclosure is also part of the containment enclosure. Therefore, the data used in the NEI approach is reflective of drywell failures. The body of plant experience used considered the older BWR containment designs. Therefore, the NEI data is reflective of typical BWR drywell failure mechanisms.

B. The CPS containment and drywell designs are similar in many of their construction details. A comparison of the containment and drywell design features is provided in Table 4. As this comparison shows, the basic designs are much the same and therefore, would be expected to have much the same leakage failure mechanisms.

ATTACHMENT 1

Additional Information Supporting the Request for Amendment to Technical Specifications 3.6.5.1, "Drywell" and 5.5.13, "Primary Containment Leakage Rate Testing Program"

Table 4

A Comparison of Clinton Power Station Containment and Drywell Structural Design Features

DESIGN FEATURE	CPS CONTAINMENT DESIGN	CPS DRYWELL DESIGN
Design Pressure	15 psig	30 psig
Construction	Reinforced concrete with carbon steel liner. Stainless steel in suppression pool area.	Reinforced concrete with steel plate covering internal surfaces of drywell cylinder and top slab. Stainless steel in suppression pool area. Drywell vents below suppression pool surface connect drywell and containment.
Liner Thickness	Nominally ¼" to ½"	Nominally ½"
Concrete Wall Thickness	3'-0" walls, 2'-6" dome, 9'-8" base mat	5'-0" walls, 6'-0" top slab, 9'-8" base mat
Equipment Hatch	Dished welded steel hatch bolted onto flange on hatch barrel. Flange connection is double gasketed.	Same as containment.
Personnel Airlocks	2 Personnel airlocks each with interlocked double doors. Constructed of welded steel. Doors have double gasketed flanges.	1 Personnel airlock (same as containment).
Piping Penetrations	Three types: Type 1 For high-energy lines, guard pipes enclose these lines to direct the energy into the drywell. Type 2 penetrations consist of a penetration sleeve anchored in the containment and extending to just inside the liner. Full penetration welds are used to weld the flued head to the process pipe. Type 3 penetrations consist of the sleeve anchored in the containment wall and extending just beyond the containment liner. Full penetration welds are used to attach the cover plate to the process pipe.	Same as containment.

Other Mechanical	Inclined Fuel Transfer Tube consists of a ¾" thick carbon steel rolled plate pipe sleeve of 40" inside diameter with a 36" standard flange on the containment side.	Drywell head (24.7 feet diameter elliptical dome with double seal) is bolted onto drywell head flange. Serves as boundary between drywell and upper containment pools during non-refueling periods.
Electrical Penetrations	Dual header plate type electrical penetrations are used.	Cables penetrating the drywell wall pass through penetrations that are filled with sealant.

The owners of the other Mark III containments were contacted to corroborate the expected behavior of Mark III drywell designs. A summary of the Mark III DWBT results is provided in Table 5 below. Several observations resulted from this inquiry.

A. Higher drywell leakage has been observed at some of these plants. It should be noted that CPS has historically had lower leakage than the Mark III average. For all plants, drywell leakage was observed to be well within the TS allowable bands for the respective site. As required by the TS surveillance requirement, the as left drywell leakage, prior to the first startup after performing a required drywell bypass leakage test, is required to be ≤ 10% of the drywell bypass leakage limit (i.e., design limit).

B. In no case were the actual leak rates at the other Mark III plants in excess of 10x or 35x the baseline leakage used at CPS. As noted in the sensitivity case presented for PSA Branch Question #6 below, leakage was assigned to the next higher group. For example, a leakage of 345 SCFM would have been assigned to the 10x group (i.e., greater than 300 SCFM but less than 3,000 SCFM group). The fact that there were no leakages greater than 3,000 SCFM is significant. It is only changes in drywell large leakage probability that impacts the delta-LERF risk metric.

C. There are approximately 28 completed drywell bypass tests that could be used in the data analysis. With this limited data set, it is difficult to use standard statistical methods to calculate meaningful conditional drywell large failure probabilities.

CPS experience provides a better state of knowledge about the expected CPS drywell behavior than can be gained from generic Mark III experience alone. At CPS, the drywell leakage is low enough that, to accommodate instrument air inflow into the drywell, the drywell must be vented on approximately a daily basis using the CPS hydrogen mixing compressors. Operation of air operated valves and existence of small instrument air system leaks into the drywell contribute to a pressurization of the drywell. As stated in Attachment 2 to Reference 1, the drywell is being vented approximately once per day when the drywell pressure approaches the upper TS limit of 1.0 psid. Venting is performed by using one of the hydrogen mixing compressors to remove air from the drywell to reduce drywell pressure. The need to vent the drywell on a regular basis provides AmerGen with an effective means for verifying drywell integrity. It has

been concluded that as long as the drywell continues to pressurize, regardless of the rate, an unacceptable leakage path does not exist and drywell integrity is assured. Any significant change in the frequency of drywell venting would result in investigation and correction of the cause.

Table 5

MARK III DRYWELL BYPASS TEST RESULT SUMMARY

Plant	Test Number	Leak Rate (SCFM)	Ratio to Design Limit (%)
CPS	1	273.0	0.63
	2	20.8	0.05
	3	19.0	0.04
	4	21.9	0.05
	5	18.0	0.04
	6	30.2	0.07
Plant 1	1	562	1.2
	2	602	1.3
	3	10	0.022
	4	345	0.75
	5	754	1.6
	6	421	0.91
Plant 2	1	611	1.75
	2	1621	4.63
	3	2599	7.43
	4	2315	6.61
	5	1568	4.48
	6	1500	4.29
	7	1631	4.66
	8	1591	4.55
	9	618	1.77
	10	869	2.48
Plant 3	1	124	0.2
	2	123	0.2
	3	797	1.4
	4	253	0.4
	5	2450	4.2
	6	111	0.2

Because CPS drywell venting occurs frequently, it provides an opportunity to observe adverse trends and provides a minimum amount of time for new failure mechanisms to build in. Therefore, the probability of increased drywell leakage and the spectrum of leakage sizes used in the original risk analysis is judged to be conservative relative to a realistic assessment of the probability of CPS drywell leakage and the spectrum of sizes

for potential leakage paths. Nonetheless, to address the NRC's request a sensitivity case has been provided in the response to Question 6 below that utilizes the Mark III data provided in Table 5.

Question 6

The probability values assigned to small (Category 3a) or large (Category 3b) DWB leakage are arbitrarily taken from the ILRT methodology. These values were derived from data from the containment ILRT program, which is fundamentally different than and not directly applicable to DWB testing. Using the expanded set of DWB leakage data developed in response to RAI 5, please develop DWB-specific probability values for these leakage categories. Describe and justify the probability distribution used to fit the data (e.g. chi-squared) and the confidence level associated with the probability values (e.g. 95th percentile). Update the risk-informed analysis, as appropriate, based on this information.

Response 6

Because CPS is required to vent the drywell approximately once per day to relieve drywell pressure buildup, AmerGen believes that the existing risk analysis provided in the Reference 1 is conservative. The need to vent demonstrates a level of drywell integrity that is better than the assumptions used in the original risk analysis provided in Reference 1. This is considerably better than the averages suggested by generic Mark III data.

However, an analysis was performed using the drywell bypass leak test results discussed in the response to Question 5 above and is provided in Attachment 3 to this letter. This analysis was performed as though the test data were representative of CPS. This analysis is summarized as follows:

A. Drywell leakage data suggest that there should be a much larger fraction of drywell leakages from the CPS analysis that would fall into the small category (i.e., greater than 300 SCFM but no larger than 3,000 SCFM) than was used in the original analysis. This is especially true when an upper bound estimate of the fraction of small leaks is used.

B. Drywell leakage data show no results in the large leakage category (i.e., from 3,000 SCFM to 10,500 SCFM or greater). Even though there were no observed instances of leakage in this category, the relatively small population of drywell test data produces a calculated upper bound rate of occurrence for the large category that is also larger than was used in the original analysis. The fact that there were no drywell test results in this large category is important because there would have to be large drywell leakage for there to be a change in Large Early Release Frequency.

C. The Chi squared 95th percentile upper bound value for the large leakage category was estimated to be approximately 0.11. The conservative upper bound approach resulted in the small leakage category being assigned a value of approximately 0.89. In essence, the very conservative upper bound statistics produce the result that the drywell leaks with certainty. The same values were used for all test intervals because the total leakage probability cannot exceed 1.0

and because of the CPS need to vent the drywell on an approximately daily basis provides a means for detecting new large leakage failure mechanisms.

D. The upper bound drywell leakage probabilities combined with the containment failure rates from the NEI approach were used to calculate changes in risk metrics in the same manner as was done for the original submittal. Even with these upper bound estimates of drywell leakage failure rate for the small and large categories, changes in risk metrics for the combined drywell and containment testing deferral remain acceptable. For example, the change in LERF results using these upper bound estimates still remains in the small range as defined in Regulatory Guide 1.174. This is because the drywell leakage is low enough to prevent large releases in most instances even when upper bound estimates of the drywell failure rate are used. The numeric results of this sensitivity study, representing the ILRT/DWBT frequency being reduced from 3/10 year frequency to 1/15 year frequency, are provided below.

Δ LERF	= 4.51E-7/year
Δ Dose Rate	= 0.09 Person-Rem
Δ CCDP	= 1.6%

<u>Question 7</u>

The deterministic calculations provided in Section C.3 address only LOCA events. Such events do not tend to be important contributors to core damage frequency and risk for BWR plants. In contrast, the frequency-dominant core damage sequences (e.g., station blackout, and transients) could be adversely impacted if the DWB leakage is sufficiently large. (Increased DWB leakage, even within the Technical Specification limits, could result in fission products bypassing the suppression pool during the later phases of the accident.) Please provide deterministic evaluations of the impact of increased DWB leakage on containment response and fission product releases to the environment for the frequency-dominant core damage sequences at Clinton. Based on these results, justify that the frequency dominant accident sequences/accident classes are appropriately treated within the DWB risk assessment methodology, i.e., the dominant sequences, in conjunction with small or large DWB leakage, are properly classified as LERF or non-LERF, and assigned appropriate population dose values.

<u>Response 7</u>

The deterministic analyses used in the DWBT evaluation were chosen to provide bounding consequential effects that can be used to characterize, in a conservative manner, all of the dominant severe accident sequences for CPS.

The approach to determining the impact of an extended DWBT interval was to, first, examine the impact on core damage frequency (CDF) and then on releases from the containment (i.e., LERF, person-rem, and Conditional Core Damage Probability (CCDP)). Because of their similar construction, testing, controls, and environment, it is reasonable to assume that the drywell behaves much like containment with regard to potential leakage and leak sizes. Therefore, the drywell bypass leakage cases to be analyzed, with their corresponding probabilities, are the same as for containment. The

analyzed cases included baseline leakage, 10x baseline leakage, and 35x baseline leakage. Based on the above, it was determined that the ILRT extension methodology could be applied for the balance of the DWBT interval extension analysis.

The core of the DWBT analysis is to assess combinations of drywell failure size and containment failure size cases. Three considerations are key to assessing these combinations.

1) Could CDF be increased due to a higher probability of containment rupture?
2) Is the source term increased because the drywell atmosphere that bypasses the suppression pool will not have the benefit of scrubbing of fission products in the suppression pool?
3) Are the effects on containment pressure due to bypass of the suppression pool significant in the assessment of CDF or post core damage containment survivability?

By choosing the range of LOCA analyses described in the risk assessment for extending both the ILRT and DWBT (Attachment 5 to Reference 1, Appendix C), AmerGen is able to determine if the proposed extension of the DWBT interval would have a significant effect on CDF due to increased frequency of containment failure. LOCA analyses were chosen because they provide the most significant potential for bypass, since they lead to the greatest possibility of containment overpressure failure. Therefore, they are bounding for all CPS dominant accident scenarios, including SBO. For these bounding scenarios, there is no significant change in containment rupture probability.

The MAAP analyses allow for categorizing the effects on radionuclide releases from combinations of drywell failure size and containment failure size. For these analyses, the amount of Cesium Iodide (CsI) released from containment for various failure sizes is used because the bounding scenarios for release of CsI to the containment are LOCA scenarios.

The results of various cases of drywell bypass size are then binned into the categories used for the ILRT analysis. Subsequent discussion in this RAI response explains further why LOCA scenarios are bounding for leakage and for releases.

Overview of Containment and the Drywell

The Mark III containment consists of two compartments, an outer wetwell and an inner drywell. The potential for drywell bypass could influence two aspects of the analysis related to bypass of the suppression pool.

A. Containment Pressurization

The bypass could provide a method by which RPV blow down is not suppressed in the suppression pool but rather bypasses the pool and results in direct pressurization of the wetwell air space.

B. Radionuclide Releases

The bypass could provide a mechanism by which the radionuclide releases may avoid scrubbing in the suppression pool and pass directly into the wetwell airspace where the unscrubbed fission products could be released through leakage or containment failure. This may occur late in sequences during RPV blowdown.

Accident Sequence Types

It is well recognized that the CPS severe accident contributors are dominated by sequences other than LOCAs. Based on Table 6, LOCA accident sequences appear to impose the most severe challenges on both containment pressurization (before RPV breach) and radionuclide release. Therefore, LOCA sequences were chosen as conservative surrogates to characterize both of these effects as the drywell bypass leakage is varied. These conservative results are then used to envelope the containment response and radionuclide release fractions for both LOCA and non-LOCA sequences.

Analysis Results

Both effects related to drywell bypass leakage (i.e., containment pressurization and radionuclide release) are conservatively modeled through the use of LOCA accident sequences. The following represents the primary effects that make the selection of LOCA sequences conservative:

Pressurization of Containment

Appendix C of Attachment 5 to Reference 1 discusses the CPS Updated Safety Analysis Report (USAR) results that indicate that the small break LOCA is most limiting from a containment pressurization perspective when drywell bypass leakage is present. The USAR results also indicate that extremely large bypass leakages are tolerable when the blowdown is much quicker as in a DBA LOCA and by extrapolation an RPV breach by debris. These USAR results were confirmed by comparing 2 inch LOCA events with DBA LOCA events for containment pressurization as summarized in Table C.3-1 of Attachment 5 to Reference 1. In summary, the initial blowdown at LOCA initiation has a very small impact on wetwell (i.e., containment) pressurization regardless of the LOCA size or the drywell bypass leakage area.

A. Before RPV Breach due to debris attack

- For LOCA events, the drywell is pressurized before core damage and the wetwell airspace pressurization occurs from the following.
  - a) Non-condensibles
  - b) Partial pressure changes due to water temperature increase
  - c) Steam not condensed in the pool

d) Steam that bypasses the pool through the drywell bypass flow area

- For transient events with the SRV tailpipes and vacuum breakers intact[(1)], the drywell is not directly pressurized by steam discharge. The decay heat and any blowdown flow are directed via the SRV tailpipes to the suppression pool. Drywell bypass plays no significant role in containment pressurization. Wetwell airspace pressurization occurs due to the following.

  a) Non-condensibles released from the RPV

  b) Partial pressure changes due to water temperature increase

  c) Steam not condensed in the pool

- Transient/Stuck Open Relief Valve (SORV) sequences with broken tailpipe. These can be viewed as LOCAs.

- The Interfacing System LOCA (ISLOCA) is not applicable to this evaluation. ISLOCAs are not treated separately in the ILRT/DWBT methodology since they result in direct bypass of the drywell and containment.

B. Following RPV Breach

The effect of RPV pressure at RPV breach causes somewhat different containment response as described in the following.

During a LOCA, the RPV pressure effect occurs early in the event (before core damage) when the blowdown is mostly steam. This is the worst time for bypass because the pool is most effective in reducing the containment pressurization due to steam. Therefore, the bypass size is most crucial for the LOCA case when determining consequential containment pressurization.

In the case of transients, the RPV pressure blowdown at RPV breach during core melt progression includes the release of non-condensibles. These non-condensibles will bypass the pool regardless of whether there is a drywell bypass leak area. Therefore, the LOCA calculation is again conservative in treating this.

The severe accident transient sequence with a high pressure at RPV breach is evaluated in the PRA using MAAP. Its characteristics are less severe than the LOCA sequences when the drywell bypass is included because the blowdown flow is so large that during the initial blowdown most fission products and steam are directed through the pool to be scrubbed.

The pressurization resulting from drywell bypass areas in the range considered appropriate for CPS is not a significant contributor to containment pressurization.

(1) Includes transients, SORVs and ATWS.

Additional Information Supporting the Request for Amendment to Technical Specifications 3.6.5.1, "Drywell" and 5.5.13, "Primary Containment Leakage Rate Testing Program"

Radionuclide Release Potential

A. Before RPV Breach

- For transients, there is no pathway for fission products that would be affected by the drywell bypass leakage.
- For LOCA events, the LOCA allows a direct release path from the RPV to the drywell and from the drywell to the wetwell air space through the drywell bypass flow area. This drywell bypass pathway does not benefit from the water scrubbing effect resulting from a release into the suppression pool. For this accident type, much of the CsI release occurs before the core melt progression breaches the RPV. Therefore, the CsI is mobile over the entire time of in-vessel core melt progression and it has a pathway to be transported to the wetwell airspace.

B. Following RPV Breach

The radionuclide release pathways following RPV breach are the same for LOCAs and transients, however, the forcing function and the radionuclide release timing and locations may be different.

The severe accident transient sequences with a high pressure at RPV breach are evaluated in the PRA using MAAP. The characteristics are less severe than the LOCA sequences when the drywell bypass is included because the blowdown flow is so large that during the initial blowdown most fission products and steam are directed through the pool to be scrubbed.

The principal additional effect of the SBO event on the core melt progression is the fission product behavior during the RPV blowdown at RPV breach with the RPV at high pressure. However, as already discussed, the fission products will be swept into the suppression pool during the blowdown and very little release to the wetwell airspace or environment will occur without scrubbing. This is demonstrated by the MAAP calculations for an SBO with maximum drywell bypass and containment leakage assumed.

The MAAP calculations show the CsI releases to the environment associated with an SBO are more than a factor of thirteen less than the LOCA calculations used to bound the radionuclide release estimates when compared for the worst case postulated bypass sizes ($35L_c$ and $35L_a$), where L_c is the baseline drywell bypass leakage and L_a is the allowable containment leakage.

Accident Type	CsI Release Fraction
LOCA	1.35E-3
SBO	9.4E-5

Conclusion

Table 6 summarizes the effects of different accident sequence types on both containment response and fission product release.

The use of the LOCA deterministic scenarios with assumed drywell bypass leakage provides bounding estimates of the containment pressurization and radionuclide release potential that allows conservative estimates to be calculated for both of these effects. The LOCA scenarios envelope the severe accident types including SBO sequences that affect the ILRT/DWBT frequency assessment.

These bounding deterministic estimates are then used to characterize the effects of all severe accident scenarios for the evaluation of drywell bypass including the potential for LERF. The threshold developed for LERF is generally characterized by greater than 10% CsI release. As can be seen from the CPS specific MAAP calculations, the CsI release fraction for Category 3b is very low, much lower than the threshold used for LERF. However, consistent with the EPRI ILRT methodology, Category 3b is still used as a surrogate measure of the LERF changes. This appears to be a substantial conservatism when characterizing the change in LERF associated with the ILRT and DWBT interval extensions.

Table 6

EFFECTS OF DRYWELL BYPASS LEAKAGE

Accident Types	Direct DW Pressurization Relative to Wetwell Air Space		Radionuclide Release Path	
	Before RPV Breach	After RPV Breach	Before RPV Breach	After RPV Breach
Transient	No	Yes	Scrubbed	Potential Bypass
SORV	No	Yes	Scrubbed	Potential Bypass
Transient/SORV Broken Tailpipe	Yes	Yes	Potential Bypass	Potential Bypass
LOCA	Yes	Yes	Potential Bypass	Potential Bypass
ATWS	No	Yes	Scrubbed	Potential Bypass
ISLOCA	No	Yes	Containment Completely Bypassed	Containment Completely Bypassed

<u>References</u>

1. Letter from Keith R. Jury (AmerGen Energy Company, LLC) to U.S. NRC, "Request for Amendment to Technical Specifications 3.6.5.1, Drywell and 5.5.13, Primary Containment Leakage Rate Testing Program," dated January 29, 2003

ATTACHMENT 2

IMPACT OF UNDETECTED STEEL LINER CORROSION ON THE CLINTON ILRT AND DWBT EXTENSION RISK ASSESSMENT

Clinton Power Station

IMPACT OF UNDETECTED STEEL LINER CORROSION ON THE CLINTON ILRT AND DWBT EXTENSION RISK ASSESSMENT

ERIN Calculation P0467030001-2232

Prepared by: Barbara J. Schlegel-Fehr Date: 8/5/03

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Approved by: [illegible] Date: 8/5/03

Accepted by: ______________ Date: ______________

Revisions:

Rev.	Description	Preparer/Date	Reviewer/Date	Approver/Date

Section 1
BACKGROUND

A previous analysis was performed to evaluate the risk impact of extending the Integrated Leak Rate Test (ILRT) and Drywell Bypass Test (DWBT) interval for the Clinton Power Station [1]. That analysis was performed using the recommended approach developed by NEI for performing assessments of one-time extensions for containment ILRT surveillance intervals [2]. Additional considerations were also made regarding the DWBT. The results of that analysis are summarized in Table 1, which is essentially a copy of Table C.4-1 from Reference 1.

The risk increase from extending the ILRT and DWBT interval from the original 3-in-10 year requirement to 1-in-15 years is quantified by the increase in LERF (the CDF is not impacted by the ILRT and DWBT interval). The NRC Regulatory Guide 1.174 [3] defines very small changes in risk as resulting in increases in LERF below 1.0E-7/yr. The Regulatory Guide also states that when the calculated increase in LERF is in the range of 1.0E-6/yr to 1.0E-7/yr, applications will be considered only if it can be reasonably shown that the total LERF is less than 1.0E-5/yr. For Clinton the increase in LERF from the 3-in-10 year interval to the 1-in-15 year interval was determined to be 3.00E-7/yr, which is above the very small change threshold. However, the total LERF from internal and external events was approximated as 8.39E-7/yr (from Reference 1), which is well below the 1.0E-5/yr acceptance criteria.

As can also be seen in Table 1, the dose increase was determined to be 9E-2 person-rem/yr, which is only 1.1% above the 3-in-10 year value of 8.54 person-rem/yr. The increase in the containment failure probability (CCFP) was determined to be about 1.0%, which is also judged to be insignificant.

Table 1

QUANTITATIVE RESULTS AS A FUNCTION OF ILRT AND DWBT INTERVAL

EPRI Category	Dose (Person-Rem Within 50 miles)	Baseline (3-per-10 year)		Current (1-per-10 year)		Proposed (1-per-15 year)	
		Accident Frequency (per year)	Population Dose Rate (Person-Rem/Year Within 50 miles)	Accident Frequency (per year)	Population Dose Rate (Person-Rem/Year Within 50 miles)	Accident Frequency (per year)	Population Dose Rate (Person-Rem/Year Within 50 miles)
1	2.4E+3	4.78E-6	1.15E-2	3.04E-6	7.3E-3	1.66E-6	3.98E-3
2	5.1E+5	1.13E-7	5.76E-2	1.13E-7	5.76E-2	1.13E-7	5.76E-2
3a	2.4E+4	6.29E-7	1.51E-2	2.21E-6	5.30E-2	3.45E-6	8.28E-2
3b	8.4E+4	5.90E-8[(5)]	5.02E-3	2.21E-7	1.93E-2	3.59E-7	3.15E-2
4	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5	n/a	n/a	n/a	n/a	n/a	n/a	n/a
6	n/a	n/a	n/a	n/a	n/a	n/a	n/a
7a	5.1E+5	2.63E-7	1.34E-1	2.63E-7	1.34E-1	2.63E-7	1.34E-1
7b	3.5E+5	4.7E-6	1.65	4.7E-6	1.65	4.7E-6	1.65
7c	3.7E+5	1.71E-5	6.33	1.71E-5	6.33	1.71E-5	6.33
7d	3.0E+5	9.2E-7	2.76E-1	9.2E-7	2.76E-1	9.2E-7	2.76E-1
8	5.1E+5	1.21E-7	6.17E-2	1.21E-7	6.17E-2	1.21E-7	6.17E-2
TOTALS:		2.87E-5[(4)]	8.54	2.87E-5[(4)]	8.59	2.87E-5[(4)]	8.63
Increase in Dose Rate[(1)]					0.58%		0.48%
Increase in LERF[(2)]				1.62E-7		1.4E-7	
Increase in CCFP(%)[(3)]				<1%		0.5%	

(1) The increase in dose rate (person-rem/year) is with respect to the results for the preceding ILRT and DWBT interval, as presented in the table. For example, the increase in dose rate for the proposed 1-per-15 ILRT and DWBT is calculated as: total dose rate for 1-per-15 year ILRT and DWBT, minus total dose rate for 1-per-10 year ILRT and DWBT. For each case, the dose rate increase is insignificant.

(2) The increase in Large Early Release Frequency (LERF) is with respect to the results for the preceding ILRT and DWBT interval, as presented in the table. The change in LERF is determined by the change in the accident frequency of EPRI Category 3b. For example, the increase in LERF for the proposed 1-per-15 ILRT and DWBT is calculated as: 3b frequency for 1-per-15 year ILRT and DWBT, 3.59E-7/yr, minus 3b frequency for 1-per-10 year ILRT and DWBT, 2.21E-7/yr, equals 1.4E-7/yr.

(3) The increase in the conditional containment failure probability (CCFP) is with respect to the results for the preceding ILRT and DWBT interval, as presented in the table. The CCFP is calculated as: $CCFP_{\%}$ = [1 – ((Category #1 Frequency + Category #3a Frequency) / CDF)] x 100%

(4) Due to the NEI methodology and round-off, the total frequency of all severe accidents is slightly higher than the CPS Rev 3 reported CDF (approximately 4%). This in turn leads to slightly higher population dose rate estimates for the baseline, the current, and the proposed ILRT and DWBT frequencies.

(5) The typographical error in the table in Reference 1 has been corrected; the correct value is 5.90E-8 vs. 3.90E-8.

Recently, the NRC issued a series of Requests for Additional Information (RAIs) in response to the one-time relief request for the ILRT and DWBT surveillance interval. The RAI related to the risk assessment is provided below.

Request for Additional Information No. 4:

Inspections of some reinforced and steel containments (e.g., North Anna, Brunswick, D. C. Cook, and Oyster Creek) have indicated degradation from the uninspectable (embedded) side of the steel shell and liner of primary containments. Please describe the uninspectable areas of the Clinton containment, and the programs used to monitor their condition. Provide a quantitative assessment of the impact on LERF due to age-related degradation in these areas, in support of the requested ILRT interval extension from 10 to 15 years.

The analysis that follows addresses the risk assessment portion of this RAI.

Section 2
STEEL LINER CORROSION ANALYSIS

The analysis utilizes the Calvert Cliffs liner corrosion analysis [4] to estimate the likelihood and risk-implications of degradation-induced leakage occurring undetected during the extended test interval. The Calvert Cliffs analysis was performed for a concrete cylinder and dome and a concrete basemat, each with a steel liner. The Clinton containment is a pressure-suppression BWR/Mark III type that includes a steel-lined reinforced concrete structure as the barrier to the environment.

The following approach is used to determine the change in likelihood, due to extending the ILRT and DWBT interval, of detecting corrosion of the containment steel liner. This likelihood is then used to determine the resulting change in risk. Consistent with the Calvert Cliffs analysis, the following issues are addressed:

- Differences between the containment basemat and the containment walls
- The historical steel liner flaw likelihood due to concealed corrosion
- The impact of aging
- The corrosion leakage dependency on containment pressure
- The likelihood that visual inspections will be effective at detecting a flaw

ASSUMPTIONS

A. Consistent with the Calvert analysis, a half failure is assumed for basemat concealed liner corrosion due to the lack of identified failures. Assuming 0.5 failures when 0 failures have occurred is a typical PRA approach. (See Table 2, Step 1.)

B. The two corrosion events used to estimate the liner flaw probability in the Calvert Cliffs analysis are assumed to be applicable to the Clinton containment analysis. These events, one at North Anna Unit 2 and one at Brunswick Unit 2, were initiated from the non-visible (backside) portion of the containment liner.

C. For consistency with the Calvert Cliffs analysis, the estimated historical flaw probability is calculated using a 5.5 year data period to reflect the years since September 1996 when 10 CFR 50.55a started requiring visual inspection. Additional

success data were not used to limit the aging impact of this corrosion issue, even though inspections were being performed prior to this date (and have been performed since the time frame of the Calvert Cliffs analysis), and there is no evidence that additional corrosion issues were identified. (See Table 2, Step 1.)

D. Consistent with the Calvert Cliffs analysis, the corrosion-induced steel liner flaw likelihood is assumed to double every five years. This is based solely on judgment and is included in this analysis to address the increased likelihood of corrosion as the steel liner ages. (See Table 2, Steps 2 and 3.) Sensitivity studies are included that address doubling this rate every ten years and every two years.

E. In the Calvert Cliffs analysis, the likelihood of the containment atmosphere reaching the outside atmosphere given that a liner flaw exists was estimated (based on an assessment of the containment fragility curve versus the ILRT test pressure) as 1.1% for the containment walls and dome region and 0.11% (1/10th the walls and dome value) for the basemat. For Clinton the containment failure probabilities are conservatively assumed to be 10% for the outer walls and 1% for the basemat. Sensitivity studies are included that increase and decrease the probabilities by an order of magnitude. (See Table 2, Step 4.)

F. In the Calvert Cliffs analysis it is noted that approximately 85% of the interior wall surface is accessible for visual inspections. The amount at Clinton is approximately 80%, which is very similar. Therefore, consistent with the Calvert analysis, a 5% visual inspection detection failure likelihood given the flaw is visible and a 5% likelihood of a non-detectable flaw are used. This results in a total undetected flaw probability of 10%, which is assumed in the base case analysis. (See Table 2, Step 5.) Sensitivity studies are included that evaluate a total detection failure likelihood of 5% and 15%, respectively. (See Table 4 for sensitivity studies.) Additionally, it should be noted that to date, all liner corrosion events have been detected through visual inspection and repaired.

G. Consistent with the Calvert analysis, all non-detectable containment failures are assumed to result in early releases. This approach avoids a detailed analysis of containment failure timing and operator recovery actions. This is a particularly conservative assumption for Clinton because it is unlikely that any releases would not be scrubbed in the Mark III containment pool.

H. The conservative approach utilized here (where all of the corrosion induced leakages result in release category 3b) is assumed to bound the impact from both the ILRT and DWBT interval extension without performing a separate analysis for each. This is considered reasonable since the original analysis showed that the DWBT impact would not considerably change the results of the analysis.

ANALYSIS

Table 2
STEEL LINER CORROSION BASE CASE

Step	Description	Containment Cylinder and Dome		Containment Basemat	
1	**Historical Steel Liner Flaw Likelihood** Failure Data: Containment location specific (consistent with Calvert Cliffs analysis).	Industry Applicable Events: 2 2/(70 * 5.5) = 5.2E-3 (Based on 70 units with liners over 5.5 years)		Industry Applicable Events: 0 (assume 0.5) 0.5/(70 * 5.5) = 1.3E-3 (Based on 70 units with liners over 5.5 years)	
2	**Age Adjusted Steel Liner Flaw Likelihood** During 15-year interval, assume failure rate doubles at the end of every five years (which equates to a 14.9% increase per year). The average over the 5th to 10th year period is set equal to the historical failure rate of Step 1 (consistent with Calvert Cliffs analysis). These assumptions are used to calculate the flaw likelihood for each year (for a 15 year period)	Year 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15	Flaw Likelihood 1.8E-03 2.1E-03 2.4E-03 2.7E-03 3.1E-03 3.6E-03 4.1E-03 4.7E-03 5.4E-03 6.2E-03 7.1E-03 8.2E-03 9.4E-03 1.1E-02 1.2E-02 1.4E-02	Year 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15	Flaw Likelihood 4.5E-04 5.1E-04 5.9E-04 6.8E-04 7.8E-04 8.9E-04 1.0E-03 1.2E-03 1.4E-03 1.6E-03 1.8E-03 2.1E-03 2.4E-03 2.7E-03 3.1E-03 3.6E-03
3	**Flaw Likelihood at 3, 10, and 15 years** This cumulative probability uses the age adjusted liner flaw likelihood of Step 2 (consistent with Calvert Cliffs analysis – See Table 6 of Reference [4]). For example, the 7.10E-03 (at 3 years) cumulative flaw likelihood is the sum of the year 1, year 2, and year 3 likelihoods of Step 2.	**7.12E-3 (at 3 years)** **4.14E-2 (at 10 years)** **9.66E-2 (at 15 years)** (Note that the Calvert Cliffs analysis presents the delta between 3 and 15 years of 8.7% to utilize in the estimation of the delta-LERF value. For this analysis the values are calculated based on the 3, 10, and 15 year intervals.)		**1.78E-3 (at 3 years)** **1.03E-2 (at 10 years)** **2.41E-2 (at 15 years)** (Note that the Calvert Cliffs analysis presents the delta between 3 and 15 years of 2.2% to utilize in the estimation of the delta-LERF value. For this analysis the values are calculated based on the 3, 10, and 15 year intervals.)	

Table 2

STEEL LINER CORROSION BASE CASE

Step	Description	Containment Cylinder and Dome	Containment Basemat
4	**Likelihood of Breach in Containment Given Steel Liner Flaw** The failure probability of the containment is assumed to be 10% (compared to 1.1% in the Calvert Cliffs analysis). The basemat failure probability is assumed to be a factor of ten less, 1%, (compared to 0.11% in the Calvert Cliffs analysis).	**10%**	**1%**
5	**Visual Inspection Detection Failure Likelihood** Utilize assumptions consistent with Calvert Cliffs analysis.	**10%** 5% failure to identify visual flaws plus 5% likelihood that the flaw is not visible (not through-cylinder but could be detected by ILRT). All events have been detected through visual inspection. 5% visible failure detection is a conservative assumption.	**100%** Assumed to be 100% consistent with the Calvert Cliffs analysis. This is very conservative for a Mark III containment because the suppression pool covers the entire basemat, and leakage would be detected by the pool detection system.
6	**Likelihood of Non-Detected Containment Leakage** (Steps 3 * 4 * 5)	**7.12E-5 (at 3 years)** 7.12E-3 * 10% * 10% **4.14E-4 (at 10 years)** 4.14E-2 * 10% * 10% **9.66E-4 (at 15 years)** 9.66E-2 * 10% * 10%	**1.78E-5 (at 3 years)** 1.78E-3 * 1% * 100% **1.03E-4 (at 10 years)** 1.03E-2 * 1% * 100% **2.41E-4 (at 15 years)** 2.41E-2 * 1% * 100%

Cumulative Likelihood of Non-Detected Containment Leakage Due to Corrosion

The total likelihood of the corrosion-induced, non-detected containment leakage is the sum in Step 6 for the containment walls and the containment basemat:

At 3 years: 7.12E-5 + 1.78E-5 = 8.90E-5

At 10 years: 4.14E-4 + 1.03E-4 = 5.17E-4

At 15 years: 9.66E-4 + 2.41E-4 = 1.21E-3

Table 3 summarizes the results of the revised ILRT and DWBT assessment including the potential impact from non-detected corrosion-induced containment leakage scenarios, with the assumption that all of these scenarios result in EPRI Class 3b (i.e., LERF). The impacts of including the potential for corrosion-induced leakages compared to the original analysis results [1] are noted in parentheses.

The factors calculated above are applied to those core damage accidents that ARE NOT already independently LERF or that could never result in LERF. For example, the 3-in-10 year base case is calculated as follows:

- Per Table 1, the EPRI Class 3b frequency is 5.90E-8/yr
- As discussed in Sections 3.1 and C.3.3 of Reference 1, the Clinton CDF associated with accidents that are not independently LERF or that could never result in LERF is [2.76E-5/yr – (3.0E-6/yr + 3.79E-6/yr + 1.21E-7/yr) = 2.07E-5. (As explained in Reference 1, the total CDF of 2.87E-5/yr is 4% greater than the value of 2.76E-5/yr used to calculate the initial 3b frequency due to the NEI methodology and round-off.)
- The increase in the base case Class 3b frequency due to the corrosion-induced concealed flaw issue is calculated as 2.07E-5/yr * 8.90E-5 = 1.84E-9/yr, where 8.90E-5 was previously shown to be the cumulative likelihood of non-detected containment leakage due to corrosion at 3 years.
- The base case 3b frequency including the corrosion-induced concealed flaw issue is then calculated as 5.90E-8/yr + 1.84E-9/yr = 6.09E-8/yr (taking into account round-off).

Table 3

CLINTON ILRT AND DWBT: BASE, 1 IN 10, AND 1 IN 15 YR EXTENSIONS (Including Age Adjusted Steel Liner Corrosion Likelihood) [1]

EPRI Category	Dose (Per-Rem)	Base Case 3 in 10 Years		Extend to 1 in 10 Years		Extend to 1 in 15 Years	
		Core Damage Frequency (/yr)	Dose Rate (person-Rem/yr)	Core Damage Frequency (/yr)	Dose Rate (person-Rem/yr)	Core Damage Frequency (/yr)	Dose Rate (person-Rem/yr)
1	2.4E+3	4.78E-6	1.15E-2	3.03E-6	7.26E-3	1.63E-6	3.92E-3
2	5.1E+5	1.13E-7	5.76E-2	1.13E-7	5.76E-2	1.13E-7	5.76E-2
3a	2.4E+4	6.29E-7	1.51E-2	2.21E-6	5.30E-2	3.45E-6	8.28E-2
3b	8.4E+4	6.09E-8	5.14E-3	2.32E-7	1.96E-2	3.84E-7	3.24E-2
7a	5.1E+5	2.63E-7	1.34E-1	2.63E-7	1.34E-1	2.63E-7	1.34E-1
7b	3.5E+5	4.70E-6	1.65	4.70E-6	1.65	4.70E-6	1.65
7c	3.7E+5	1.71E-5	6.33	1.71E-5	6.33	1.71E-5	6.33
7d	3.0E+5	9.20E-7	2.76E-1	9.20E-7	2.76E-1	9.20E-7	2.76E-1
8	5.1E+5	1.21E-7	6.17E-2	1.21E-7	6.17E-2	1.21E-7	6.17E-2
Total[2]		2.87E-5	8.54	2.87E-5	8.59	2.87E-5	8.63
Dose Rate from 3a and 3b (person-Rem/yr)			2.02E-2 (+1.6E-4)		7.26E-2 (+9.0E-4)		1.15E-1 (+2.1E-03)
Increase in Total Dose Rate (person-Rem/yr)		From 3 yr	---		4.82E-2 = 0.56% (+7.2E-4)		8.75E-2 = 1.02% (+1.91E-3)
		From 10 yr	---		---		3.92E-2 = 0.46% (+1.19E-3)
LERF from 3b (/yr)			6.09E-8 (+1.84E-9)		2.32E-7 (+1.07E-8)		3.84E-7 (+2.51E-8)
Increase in LERF (/yr)		From 3 yr	---		1.71E-7 (+8.87E-9)		3.23E-7 (+2.32E-8)
		From 10 yr	---		---		1.52E-7 (+1.44E-8)
CCFP %			81.15% (+0.006%)		81.75% (+0.047%)		82.28% (+0.090%)
Increase in CCFP		From 3 yr	---		0.60% (+0.04%)		1.13% (+0.09%)
		From 10 yr	---		---		0.53% (+0.04%)

(1) The numbers in parenthesis represent the incremental change (compared to Table 1) due to inclusion of the impact from the corrosion analysis.

(2) The sums of the values in the table do not always exactly equal the totals due to round-off.

Based on the results shown in Table 3, it can be seen that including corrosion effects in the ILRT and DWBT assessment would not alter the conclusions from the original analysis. The increase in LERF from the 3-in-10 year interval to the 1-in-15 year interval is 3.23E-7/year, compared with 3.00E-7/yr without corrosion effects. The dose increase is 8.75E-02 person-rem/yr, which is only 1.02% above the 3-in-10 year value of 8.54 person-rem/yr. The increase in the CCFP is determined to be insignificant (82.28% for the 1-in-15 year case versus 81.15% for the 3-in-10 year case). Additionally, since the increase in LERF is in the range of 1.0E-6/yr to 1.0E-7/yr,the total LERF from both internal and external events needs to be considered. However, since the base LERF from internal and external events was approximated as 8.39E-7/yr [1], the increase from the ILRT and DWBT interval extension would still result in a total LERF that is well below the 1.0E-5/yr acceptance criteria, which confirms that the proposed interval extension is acceptable from a risk basis.

Section 3
SENSITIVITY STUDIES

Sensitivity cases were also developed to gain an understanding of the sensitivity of this analysis to the various key parameters. The time for the flaw likelihood to double was adjusted from every five years to every two and every ten years. The failure probabilities for the drywell and wetwell walls and the basemat were increased and decreased in various cases by an order of magnitude. The total detection failure likelihood was adjusted from 10% to 15% and 5%. The results of the sensitivity cases are summarized in Table 4. For all but the highly conservative containment breach cases, the increase in LERF due to corrosion is less than 1.0E-7/yr. The total increase in LERF is within the range of 3.0E-7/yr and 1.0E-6/yr in each case.

Table 4

CLINTON STEEL LINER CORROSION SENSITIVITY CASES

Age (Step 3)	Containment Breach (Step 4)	Visual Inspection & Non-Visual Flaws (Step 5)	Increase in Class 3b Frequency (LERF) for ILRT and DWBT Extension From 3 in 10 to 1 in 15 years (/yr)	
			Total Increase	Increase Due to Corrosion
Base Case (Doubles every 5 yrs)	Base Case (10% Walls, 1% Basemat)	Base Case (10%)	3.23E-7	2.32E-8
Doubles every 2 yrs	Base	Base	3.51E-7	5.15E-8
Doubles every 10 yrs	Base	Base	3.19E-7	1.90E-8
Base	Base	15%	3.32E-7	3.25E-8
Base	Base	5%	3.14E-7	1.39E-8
Base	100% Walls, 10% Basemat	Base	5.32E-7	2.32E-7
Base	1% Walls, 0.1% Basemat	Base	3.02E-7	2.32E-9
Lower Bound				
Doubles every 10 yrs	1% Walls, 0.1% Basemat	5%	3.01E-7	1.14E-9
Upper Bound				
Doubles every 2 yrs	100% Walls, 10% Basemat	15%	1.02E-6	7.21E-7

Section 4
SUMMARY AND CONCLUSIONS

This analysis provides a quantitative assessment of the impact on risk of the potential for undetected steel liner corrosion due to an extension of the ILRT and DWBT interval. The increase in LERF due to extending the test interval from 3 in 10 years to 1 in 15 years is 3.23E-7/yr, of which 2.32E-8/yr is due to corrosion. This value is within the range of 1.0E-6/yr to 1.0E-7/yr. For risk changes with calculated delta-LERF values in this range, RG 1.174 then requires that the total LERF including internal and external events be shown to be less than 1.0E-5/yr. The total LERF from internal and external events including the potential impact from the corrosion is estimated as 9.04E-7/yr, which is well below the acceptance criteria of 1.0E-5/yr. This confirms that the proposed interval extension is acceptable from a risk basis. Additionally, a series of parametric sensitivity studies regarding the potential age-related corrosion effects on the steel liner indicate that even with very conservative assumptions, the conclusions from the original analysis would not change; that is, the ILRT and DWBT interval extension is judged to have a minimal impact on public risk and is therefore acceptable.

Section 5
REFERENCES

[1] *Clinton Power Station Risk Assessment to Support ILRT (Type A) Interval Extension Request*, prepared for Amergen by ERIN Engineering and Research, Inc., C46702024-4924, December 2002.

[2] *Interim Guidance for Performing Risk Impact Assessments In Support of One-Time Extensions for Containment Integrated Leakage Rate Test Intervals*, Developed for NEI by John M. Gisclon, EPRI Consultant, William Parkinson and Ken Canavan, Data Systems and Solutions, November 2001.

[3] An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis, Regulatory Guide 1.174, July 1998.

[4] *Response to Request for Additional Information Concerning the License Amendment Request for a One-Time Integrated Leakage Rate Test Extension*, Letter from Mr. C. H. Cruse (Calvert Cliffs Nuclear Power Plant) to NRC Document Control Desk, March 27, 2002.

Attachment 3

CLINTON ILRT AND DWBT INTERVAL EXTENSION SENSITIVITY CASE

CLINTON ILRT AND DWBT INTERVAL EXTENSION SENSITIVITY CASE

AUGUST 2003

CLINTON ILRT AND DWBT INTERVAL EXTENSION SENSITIVITY CASE

C457-03-0703-5454

Prepared by: E T Burns Date: August 28, 2003

Reviewed by: Anthony Wald Date: August 29, 2003

Approved by: [signature] Date: Sept 03, 2003

Revisions:

Rev.	Description	Preparer/Date	Reviewer/Date	Approver/Date

CLINTON ILRT AND DWBT INTERVAL EXTENSION SENSITIVITY CASE

Overview

The NRC requested a sensitivity case for the DWBT interval extension using the 95% confidence "Chi-square" upper bound based on only Mark III data to characterize the drywell leakage probability.

This sensitivity case was performed at the request of the NRC. Because only a limited set of data is available for Mark III plants, the statistical analysis of the small sample size could be misleading.

In addition, the sensitivity case is not considered representative of Clinton because Clinton has a daily check on the drywell integrity via the observed daily pressurization of the drywell due to the small air leakage inside the drywell. This indicates that the data from other Mark III plants may not be applicable.

DWBT Data Assessment

Informal data from Mark III plants for the DWBT results are used. The data used in this sensitivity case is provided as follows:

Mark III Plant	DWBT Leakages		Total Tests
	Sm	Lg	
Clinton	0	0	6
Plant 1	5	0	6
Plant 2	10	0	10
Plant 3	2	0	6
Total	17	0	28

The data is interpreted as follows[1] for the Clinton DWBT evaluation:

0 – 300 scfm	no "failure"
300 scfm – 3000 scfm	small failure (Category 3a)
>3000 scfm	large failure (Category 3b)

This characterization of failure is interpreted in terms of the Clinton ILRT/DWBT submittal. A "Chi-square" upper bound (95% confidence) value is used for the calculation of possible leakage based on Mark III DWBT data.

f = # failures
N = # tests

$$UB = \frac{X^2\,(0.05, 2f + 2)}{2N}$$

<u>Large Leak</u> (f = 0)

$$UB = \frac{X^2\,(0.05, 2(0) + 2)}{2(28)} = \frac{X^2\,(0.05, 2)}{56} = \frac{5.991}{56} = 0.107$$

<u>Small Leak</u> (f = 17)

$$UB = \frac{X^2\,(0.05, 2(17) + 2)}{2(28)} = \frac{X^2\,(0.05, 36)}{56} = \frac{50.96}{56} = 0.910$$

(1) CPS Threshold (L_c) = 300 scfm

Small Leak Upper Bound ~ 10 L_c = 3,000 scfm
Large Leak characterized as 10 L_c to 35 L_c = (10,500 scfm = 35 L_c)

The small and large leakage categories cannot both be simultaneously at their upper bound probabilities, because the total probability would exceed 1. To address this inconsistency, the Large Leakage probability will be retained, and the Small Leakage probability will be assigned such that the total leakage probability does not exceed 1. This maximizes the calculated LERF under these assumed boundary conditions.

$$Ps = 1.0 - 0.107 = 0.893$$

The no leakage category will be assigned a value of zero, because the upper bound statistics produce the very conservative result that the drywell will leak with certainty.

The result of the 95% upper bound "Chi-square" evaluation of the Mark III data is shown in Table 1. As can be seen, the drywell bypass probability using the "Chi-square" 95% upper bound results in an increase in the large bypass probability of approximately a factor of 40.0.

Another feature of the results in Table 1 merits explanation. Using the Chi-squared upper bound values causes the drywell leakage probabilities to no longer vary with test frequency. This occurs because, as noted above, use of the Chi-squared results causes the "no leakage" category to have a probability of zero. The probability of being in the "no leakage" category cannot, then, decrease with decreasing test frequency. As a result, the total leakage probability cannot increase with decreasing test frequency. Furthermore, the ratio of large leak probability has been assumed to be constant. This is because the development of additional large leakage mechanisms would very likely be identified by changes in the drywell venting frequency. So, the probabilities of EPRI Categories 3a and 3b for the drywell in this sensitivity study are insensitive to test frequency. These results come from use of the bounding Chi-squared value. However, the combined impact of drywell failure probabilities and containment failure probabilities does still vary with test frequency. As described in the paragraph concerning Results, below, use of even this highly conservative drywell leakage probability yields containment performance measures that are within acceptable bounds.

Table 1

DRYWELL BYPASS PROBABILITY BY EPRI CATEGORY

	EPRI Category	ILRT/DWBT Submittal	NRC Requested Sensitivity Case		
		3/10 yr	3/10 yr	1/10 yr	1/15 yr
1	No Leak (L_c)	~1	~0[1]	~0[1]	~0[1]
3a	Small Leak (10 L_c)	2.70E-2	0.893	0.893	0.893
3b	Large Leak (35 L_c)	2.70E-3	0.107	0.107	0.107

(1) The upper bound statistics used produce a conservative result that the drywell leaks with certainty. The leakage probabilities are left at the same values for all three cases because the total leakage probability cannot exceed 1. The proportion of large versus small leakage probabilities is also assumed to remain constant, because the development of a new large leakage mechanism would most likely be detected by changes in the CPS drywell "burping" frequency.

Process

The calculations for the combined ILRT and DWBT interval extension are reperformed with the ILRT interval extension characterized as in the main report and the DWBT characterized with the "Chi-square" upper bound data.

The tables from Appendix C of the Clinton ILRT Risk Assessment have been revised here to reflect the use of the "Chi-square" 95% confidence bound probabilities for the DWBT using the Mark III-only data. This calculation follows the directions from Appendix C with this one exception.

Results

The results of the analysis are the following when the ILRT/DWBT frequency is reduced from 3/10 year frequency to 1/15 year:

Δ LERF = 4.51E-7/yr

Δ Dose Rate = .09 Person Rem

Δ CCDP = 1.6%

These results can be compared with the results of the ILRT/DWBT evaluation using the NEI methodology. Table 2 shows this comparison. The Δ LERF increases by 50%. The other risk measures are essentially unchanged.

Table 2

COMPARISON OF SENSITIVITY CASE AND NEI METHOD:

CHANGES IN RISK METRICS ASSOCIATED WITH REDUCING THE FREQUENCY OF ILRT/DWBT FROM 3/10 YEARS TO 1/15 YEARS

	Δ Person Rem	Δ CCFP	Δ LERF
NRC Sensitivity Case	0.09	1.6%	4.51E-7
NEI ILRT/DWBT Method	0.09	<1.5%	3.02E-7

The Δ LERF for these comparisons results form changes in the so-called Class 3b of the NEI structure for ILRT evaluations. The Δ LERF is calculated to remain in Region II of the RG 1.174 acceptance guidelines even if the frequency of the ILRT/DWBT is changed from 3/10 years to 1/15 years. However, it is noted that the radionuclide release (e.g., CsI release fraction) calculated for category 3b is significantly below the release fraction, which has been attributed to LERF releases. [C-25] Therefore, the NEI/EPRI characterization of Category 3b as a LERF contributor is considered extremely conservative for a Mark III.

Attachments

Subsequent pages contain tables for this bounding analysis, which correspond to those in Appendix C of the submittal. (Note that Table C.3-2 is unchanged from the submittal.) Following those tables are further details of the results comparison.

List of Tables

Table C.3-2

SUMMARY OF POPULATION DOSE AS A FUNCTION OF THE COMBINATIONS OF DW AND WW LEAKAGE

Case	DW Bypass Leakage(10)	WW Leakage(11)	Person Rem(8)	Factional CsI Release	Equivalent EPRI Category	LERF Characterization
AA'(1)	1 DWL_C	1 La	2.4E+3(1)	1.7E-5(2)	1	Non-LERF
AB'(1)	1 DWL_C	10 La	2.4E+4(1)	NA	3a	Non-LERF
AC'(1)	1 DWL_C	35 La	8.4E+4(1)	2.3E-4(2)	3b(9)	LERF
BA'	10 DWL_C	1 La	3.9E+3(4)	2.1E-5(3)	1	Non-LERF
BB'	10 DWL_C	10 La	3.9E+4(5)	NA	3a	Non-LERF
BC'	10 DWL_C	35 La	1.4E+5(6)	NA	3b(9)	LERF
CA'	35 DWL_C	1 La	1.0E+4(4)	3.9E-5(2)	3a	Non-LERF
CB'	35 DWL_C	10 La	1.0E+5(7)	NA	3b(9)	LERF
CC'	35 DWL_C	35 La	4.9E+5(4)	1.35E-3(2)	3b(9)	LERF

NA = Not available from the MAAP cases performed to model the Leakage cases.

Notes to Table C.3-2

(1) These are the cases developed in the ILRT submittal (see the Main Report) assuming a 1/15 year ILRT interval. The Person Rem are assigned using the EPRI methodology.

The EPRI accident classes are assigned according to the methodology developed by EPRI as are the LERF characterization.

(2) Based on deterministic thermal hydraulic calculations on a Clinton-specific basis.

(3) CsI release based on an assumed linear relationship of the CsI release to the DW leakage rate.

(4) Derived using the calculated CsI release fraction and the calculated relationship between Clinton CsI fractional release and the person-rem dose. (See Attachment C-2.)

From this relationship, the person rem associated with different leakage cases is estimated as follows:

CsI Fraction Release (x)	*Person Rem (y)*
3.9E-5	1.0E+4
1.3E-3	4.9E+5
2.1E-5	3.9E+3

(5) Calculated according to EPRI method (10 times Case BA' which is 1 La WW leakage).

(6) Calculated according to EPRI method (35 times Case BA' which is 1 La WW leakage).

(7) Calculated according to EPRI method (10 times Case CA' which is 1 La WW leakage).

(8) Person rem is adjusted for CPS power, leakage rate, and population.

(9) It is important to note that the CsI release for Category 3b is substantially below that typically assigned to LERF. However, to be consistent with the NEI guidelines, the Category 3b is treated here as a LERF contributor. This appears to be severely conservative when characterizing the change in LERF associated with the ILRT and DWBT interval extensions.

(10) DW leakage is based on multiples of a conservative estimate of the DW leakage from the "as found" DWBT results and subsequent trending information (DWL_c).

(11) WW leakage is based on multiples of the Tech Spec Leakage (La). This is consistent with the NEI methodology and operating experience.

Table C.3-3a

SUMMARY OF THE CONDITIONAL PROBABILITY OF OCCURRENCE
FOR THE VARIOUS POSTULATED LEAKAGE CASES
(DRYWELL BYPASS LEAKAGE PROBABILITY SET BY 95% "CHI-SQUARE" ESTIMATION)
(Case No. 1: ILRT and DWBT Frequencies at 3/10 Years)

1	*2*	*3*	*4*	*5*	*6*	*7*
			PROBABILITY OF CASE			
Leakage Combinations	DW Bypass Leakage[(1)]	WW Leakage[(2)]	DW	WW	Combined	EPRI Class
AA'	1 DWL_c	1 La	0	1.0	0	1
AB'	1 DWL_c	10 La	0	2.7E-2	0	3a
AC'	1 DWL_c	35 La	0	2.7E-3	0	3b
BA'	10 DWL_c	1 La	0.893	~ 1.0	0.89	1
BB'	10 DWL_c	10 La	0.893	2.7E-2	2.4E-2	3a
BC'	10 DWL_c	35 La	0.893	2.7E-3	2.4E-3	3b
CA'	35 DWL_c	1 La	0.107	~ 1.0	0.11	3a
CB'	35 DWL_c	10 La	0.107	2.7E-2	2.9E-3	3b
CC'	35 DWL_c	35 La	0.107	2.7E-3	2.9E-4	3b

---

(1) DW leakage is based on multiples of a conservative estimate of the DW leakage from the "as found" DWBT results and subsequent trending information (DWLc).

(2) WW leakage is based on multiples of the Tech Spec Leakage (La). This is consistent with the NEI methodology and operating experience.

Table C.3-3b

SUMMARY OF CLINTON REVISED BASELINE RELEASE FREQUENCIES AS A FUNCTION OF EPRI CATEGORY
(DRYWELL BYPASS LEAKAGE PROBABILITY SET BY 95% "CHI-SQUARE" ESTIMATION)
(Case No. 1 ILRT and DWBT Frequency = 3/10 yrs)

EPRI Category	Category Description	Frequency Estimation Methodology	Frequency (1/yr)
1	No Containment Failure: Accident sequences in which the containment remains intact and is initially isolated. Only affected by ILRT leak testing frequency due to the incorporation of categories 3a and 3b.	Per NEI Interim Guidance: [Total Clinton "OK" release category frequency] – [Frequency EPRI Categories 3a and 3b] [5.47E-6/yr] – [2.77E-6/yr + 1.16E-7/yr] = 2.45E-6/yr	2.58E-6
2	Containment Isolation System Failure: Accident sequences in which the containment isolation system function fails during the accident progression (e.g., due to failures-to-close of large containment isolation valves initiated by support system failures, or random or common cause failures). Not affected by ILRT leak testing frequency.	[Clinton containment isolation failure probability] X [(Total CDF) – (CDF of Class II + CDF of Class IV +CDF of Class V)] [4.99E-3] X [(2.76E-5/yr) – (3.79E-6/yr +9.9E-7/yr + 1.21E-7/yr)] = 1.13E-7/yr	1.13E-7
3a	Small Pre-Existing Failures: Accident sequences in which the containment is failed due to a pre-existing small leak in the containment structure or liner that would be identifiable only from an ILRT (and thus affected by ILRT testing frequency).	Per NEI Interim Guidance: DW leakage = 1DWL$_c$(4) = 0 for 1DWLc [Clinton CDF for accidents not involving containment failure/bypass] x [0](3) [(2.76E-5/yr) – (3.0E-6/yr + 3.79E-6 /yr + 1.21E-7/yr)]x [0](3) = 0 Other Contributors(5) In addition, the following incremental effect associated with the combination of DW and WW leakage is included: [(2.76E-5/yr) – (3.0E-6/yr + 3.79E-6 /yr + 1.21E-7/yr)] * (2.4E-2 +0.11)(2) = 2.07E-5/yr *0.134=2.77E-6	2.77E-6

Table C.3-3b

SUMMARY OF CLINTON REVISED BASELINE RELEASE FREQUENCIES AS A FUNCTION OF EPRI CATEGORY (DRYWELL BYPASS LEAKAGE PROBABILITY SET BY 95% "CHI-SQUARE" ESTIMATION) (Case No. 1 ILRT and DWBT Frequency = 3/10 yrs)

EPRI Category	Category Description	Frequency Estimation Methodology	Frequency (1/yr)
3b	Large Pre-Existing Failures: Accident sequences in which the containment is failed due to a pre-existing large leak in the containment structure or liner that would be identifiable only from an ILRT (and thus affected by ILRT testing frequency).	Per NEI Interim Guidance: (DW Leakage = 1 DWLc)(4) = 0 always leak [Clinton CDF for accidents not involving containment failure/bypass] x [0](3) [(2.76E-5/yr) – (3.0E-6/yr + 3.79E-6/yr + 1.21E-7/yr)] x [0](3) = 0 Other Contributors(5) In addition, the frequency incremental effect associated with the combination of DW and WW leakage is included: [(2.76E-5/yr) – (3.0E-6/yr + 3.79E-6/yr + 1.21E-7/yr)] * (2.4E-3 + 2.9E-3 + 2.9E-4)(2) = 2.07E-5/yr * 5.6E-3 = 1.16E-7/yr	1.16E-7
4	Type B Failures: Accident sequences in which the containment is failed due to a pre-existing failure-to-seal of Type B components that would not be identifiable from a ILRT (and thus not affected by ILRT testing frequency).	Per NEI Interim Guidance: N/A (not affected by ILRT frequency)	N/A
5	Type C Failures: Accident sequences in which the containment is failed due to a pre-existing failure-to-seal of Type C components that would not be identifiable from a ILRT (and thus not affected by ILRT testing frequency).	Per NEI Interim Guidance: N/A (not affected by ILRT frequency)	N/A

Table C.3-3b

SUMMARY OF CLINTON REVISED BASELINE RELEASE FREQUENCIES AS A FUNCTION OF EPRI CATEGORY
(DRYWELL BYPASS LEAKAGE PROBABILITY SET BY 95% "CHI-SQUARE" ESTIMATION)
(Case No. 1 ILRT and DWBT Frequency = 3/10 yrs)

EPRI Category	Category Description	Frequency Estimation Methodology	Frequency (1/yr)
6	Other Containment Isolation System Failure: Accident sequences in which the containment isolation system function fails due to "other" pre-existing failure modes not identifiable by leak rate tests (e.g., pathways left open or valves that did not properly seal following test or maintenance activities). Not affected by ILRT leak testing frequency.	Per NEI Interim Guidance: N/A (not affected by ILRT frequency)	N/A
7a	Containment Failure Due to Accident (a): CD, vessel breach, Early CF, Early SP Bypass, CS Not Available Vessel breach occurs and both the containment and the drywell have failed either before or at the time of vessel breach. The containment sprays do not operate before or at the time of vessel breach.	Total Clinton release mode frequency for: C9 ε C10 2.62E-7 C11 ε C12 1.82E-9 E1 ε E2 ε	2.64E-7
7b	Containment Failure Due to Accident (b): CD, vessel breach, Early CF, Early SP Bypass, CS Available Vessel breach occurs and both the containment and the drywell fail either before or at the time of vessel breach. In this bin, however, the containment sprays operate before or at the time of vessel breach.	Total Clinton release mode frequency for: C1 7.78E-8 C2 1.80E-7 C6 3.51E-6 C8 9.41E-7	4.71E-6
7c	Containment Failure Due to Accident (c): CD, vessel breach, Early CF, No SP Bypass Vessel breach occurs and the containment fails either before or at the time of vessel breach. The drywell does not fail and, therefore, all of the radionuclide releases pass through the suppression pool. Because the pool has not been bypassed, the availability of the sprays is not very important and, thus, the CS characteristic has been dropped.	Total Clinton release mode frequency for: B1 1.13E-6 B2 8.16E-6 A1 7.81E-6	1.71E-5

Table C.3-3b

SUMMARY OF CLINTON REVISED BASELINE RELEASE FREQUENCIES AS A FUNCTION OF EPRI CATEGORY
(DRYWELL BYPASS LEAKAGE PROBABILITY SET BY 95% "CHI-SQUARE" ESTIMATION)
(Case No. 1 ILRT and DWBT Frequency = 3/10 yrs)

EPRI Category	Category Description	Frequency Estimation Methodology	Frequency (1/yr)
7d	Containment Failure Due to Accident (d): CD, vessel breach, Late CF Vessel breach occurs, however, the containment does not fail until the late time period. If the containment did not fail early, it is unlikely that the drywell will fail early. Thus, the suppression pool bypass characteristic and the containment spray characteristic have been dropped.	Total Clinton release mode frequency for: D5 9.91E-9 D6 9.07E-7	9.17E-7
8	Containment Bypass Accidents: Accident sequences in which the containment is bypassed. Such accidents are initiated by LOCAs outside containment (i.e., Break Outside Containment LOCA, or Interfacing Systems LOCA). Not affected by ILRT leak testing frequency.	[Total Clinton Containment Bypass release frequency]	1.21E-7
		TOTAL:	2.87E-5[(1)]

(1) Accurate to within a few percent of the total CDF (2.76E-5/yr). [18] Differences due to roundoff and EPRI calculational approach.

(2) The derivation of the conditional probability of a Category 3a and 3b release given an otherwise isolated accident sequence is derived in Table C.3-3a.

(3) As derived in Section 3.4.1, the following conditional probabilities have been derived as part of the NEI/EPRI ILRT methodology for containment compared with the sensitivity case:

	NEI METHOD		DWBT SENSITIVITY		
Test Frequency	10 La	35 La	10 Lc	35Lc	1 Lc
3/10 yr	2.7E-2	2.7E-3	0.89	0.11	~0
1/10 yr	9.0E-2	9.0E-3	0.89	0.11	~0
1/15 yr	0.135	0.0135	0.89	0.11	~0

For the NEI method, these same values are applied to both containment and DW leakage where DW leakage is characterized as multiples of DWL_c.

For the DWBT sensitivity case, drywell bypass leakage probability set by 95% "Chi-square" estimation using Mark III data only.

(4) Probability of DW Leakage = $1DWL_c$ is zero from Table C.3-3a.

(5) Other contributors associated with extension of both ILRT and DWBT intervals.

Table C.3-3c

CLINTON DOSE RATE ESTIMATES AS A FUNCTION OF EPRI CATEGORY
FOR POPULATION WITHIN 50-MILES
(DRYWELL BYPASS LEAKAGE PROBABILITY SET BY 95% "CHI-SQUARE" ESTIMATION)
(Case No 1: 3/10 year DWBT and ILRT)

EPRI Category	Category Description	Person-Rem Within 50 miles[6]	Category Frequency (per year)[7]	Dose Rate (Person-Rem/yr)
1	No Containment Failure[1]	2.4E+3	2.58E-6	6.19E-3
2	Containment Isolation System Failure[2]	5.1E+5	1.13E-7	5.76E-2
3a	Small Pre-Existing Failures[3]	2.4E+4	2.77E-6	6.65E-2
3b	Large Pre-Existing Failures[3]	8.4E+4[9]	1.16E-7[9]	9.74E-3[9]
4	Type B Failures (LLRT)	n/a	n/a	N/a
5	Type C Failures (LLRT)	n/a	n/a	N/a
6	Other Containment Isolation System Failure	n/a	n/a	N/a
7a	Containment Failure Due to Severe Accident (a)[4]	5.1E+5	2.63E-7	1.35E-1
7b	Containment Failure Due to Severe Accident (b)[4]	3.5E+5	4.71E-6	1.65
7c	Containment Failure Due to Severe Accident (c)[4]	3.7E+5	1.71E-5	6.33
7d	Containment Failure Due to Severe Accident (d)[4]	3.0E+5	9.17E-7	2.75E-1
8	Containment Bypass Accidents[5]	5.1E+5	1.21E-7	6.17E-2
	Total		2.87E-5[8]	8.59

Notes to Table C.3-3c

(1) The population dose associated with the Technical Specification Leakage is based on scaling the population data, the power level, and allowable Technical Specification leakage compared to the NUREG/CR-4551 reference plant. The release for this EPRI category is assigned from APB#7 from Table 3-4 of the main report.

(2) EPRI Category #2 (Containment Isolation failures) may include drywell isolation failures. Therefore, the release associated with this category is assigned to be equivalent to the release associated with APB#1 from Table 3-4 of the main report.

(3) Dose estimates for #3a and #3b, per the NEI Interim Guidance, are calculated as 10xCategory 1 dose and 35xCategory 1 dose, respectively.

(4) Dose estimate for 7a, 7b, 7c, and 7d are taken from APB # 1, 2, 4, and 5, respectively. (See main Report.)

(5) EPRI Category #8 sequences involve containment bypass failures; as a result, the person-rem dose is not based on normal containment leakage. The releases for this category are assumed to result in a direct path to the environment, and as such, are assigned to be equivalent to the highest release category from NUREG/CR-4551. APB#1 from Table 3-4 is therefore used of the main report.

(6) Table C.3-2.

(7) Table C.3-3b.

(8) Within a few percent of total CDF of 2.76E-5/yr [18]. Slight differences are due to the EPRI calculational approach and round off. The use of slightly higher frequencies in Table C.3-6 is conservative for assessing the risk metric of dose rate.

(9) Large pre-existing failure estimates of the population dose are based on using the extrapolated person rem for Case CC' (Table C.3-2) in the calculation of those contributors with 35 DWLc and 35 La and adding these results to the other large pre-existing failures.

Table C.3-4a

SUMMARY OF THE CONDITIONAL PROBABILITY OF OCCURRENCE
FOR THE VARIOUS POSTULATED LEAKAGE CASES
(DRYWELL BYPASS LEAKAGE PROBABILITY SET BY 95% "CHI-SQUARE" ESTIMATION)
(Case No. 2: ILRT and DWBT Frequencies at 1/10 Years)

Leakage Combinations	DW Bypass Leakage[(1)]	WW Leakage[(2)]	*PROBABILITY OF CASE*			EPRI Category
			DW	WW	Combined	
AA'	1 DWL_c	1 La	0	1.0	0	1
AB'	1 DWL_c	10 La	0	9.0E-2	0	3a
AC'	1 DWL_c	35 La	0	9.0E-3	0	3b
BA'	10 DWL_c	1 La	0.893	~ 1.0	0.89	1
BB'	10 DWL_c	10 La	0.893	9.0E-2	8.0E-2	3a
BC'	10 DWL_c	35 La	0.893	9.0E-3	8.0E-3	3b
CA'	35 DWL_c	1 La	0.107	~ 1.0	0.11	3a
CB'	35 DWL_c	10 La	0.107	9.0E-2	9.6E-3	3b
CC'	35 DWL_c	35 La	0.107	9.0E-3	9.6E-4	3b

(1) DW leakage is based on multiples of a conservative estimate of the DW leakage from the "as found" DWBT results and subsequent trending information (DWLc).

(2) WW leakage is based on multiples of the Tech Spec Leakage (La). This is consistent with the NEI methodology and operating experience.

Table C.3-4b

SUMMARY OF CLINTON RELEASE FREQUENCIES AS A FUNCTION OF EPRI CATEGORY (DRYWELL BYPASS LEAKAGE PROBABILITY SET BY 95% "CHI-SQUARE" ESTIMATION)

(Case No. 2: ILRT and DWBT Frequency = 1/10 yrs)

EPRI Category	Category Description	Frequency Estimation Methodology	Frequency (1/yr)
1	<u>No Containment Failure</u>: Accident sequences in which the containment remains intact and is initially isolated. Only affected by ILRT leak testing frequency due to the incorporation of categories 3a and 3b.	Per NEI Interim Guidance: [Total Clinton "OK" release category frequency] – [Frequency EPRI Categories 3a and 3b] [5.47E-6/yr] – [3.93E-6/yr + 3.84E-7/yr] = 9.56E-7/yr	1.16E-6
2	<u>Containment Isolation System Failure</u>: Accident sequences in which the containment isolation system function fails during the accident progression (e.g., due to failures-to-close of large containment isolation valves initiated by support system failures, or random or common cause failures). Not affected by ILRT leak testing frequency.	[Clinton containment isolation failure probability] x [(Total CDF) – (CDF of Class II + CDF of Class IV +CDF of Class V)] [4.99E-3] X [(2.76E-5/yr) – (3.79E-6/yr +9.9E-7/yr + 1.21E-7/yr)] = 1.13E-7/yr	1.13E-7
3a	<u>Small Pre-Existing Failures</u>: Accident sequences in which the containment is failed due to a pre-existing small leak in the containment structure or liner that would be identifiable only from an ILRT (and thus affected by ILRT testing frequency).	Per NEI Interim Guidance: <u>(DW Leakage = 1 DWL_c)</u>(4) = 0 for 1DWLc case [Clinton CDF for accidents not involving containment failure/bypass] x [0](3) [(2.76E-5/yr) – (3.0E-6/yr + 3.79E-6 /yr + 1.21E-7/yr)] x [0](3) = 0 <u>Other Contributors</u>(5) In addition, the following incremental effect associated with the combination of DW and WW leakage is included: [(2.76E-5/yr) – (3.0E-6/yr + 3.79E-6 /yr + 1.21E-7/yr)] * (8.0E-2 + 0.11)(2) = 2.07E-5/yr * 0.19 = 3.93E-6/yr	3.93E-6

Table C.3-4b

SUMMARY OF CLINTON RELEASE FREQUENCIES AS A FUNCTION OF EPRI CATEGORY
(DRYWELL BYPASS LEAKAGE PROBABILITY SET BY 95% "CHI-SQUARE" ESTIMATION)
(Case No. 2: ILRT and DWBT Frequency = 1/10 yrs)

EPRI Category	Category Description	Frequency Estimation Methodology	Frequency (1/yr)
3b	Large Pre-Existing Failures: Accident sequences in which the containment is failed due to a pre-existing large leak in the containment structure or liner that would be identifiable only from an ILRT (and thus affected by ILRT testing frequency).	Per NEI Interim Guidance: (DW Leakage = 1 DWL_a)[4] = 0 [Clinton CDF for accidents not involving containment failure/bypass] x [0][3] [(2.76E-5/yr) – (3.0E-6/yr + 3.79E-6/yr + 1.21E-7/yr)] x [0][3] = 0 Other Contributors[5] In addition, the frequency incremental effect associated with the combination of DW and WW leakage is included: [(2.76E-5/yr) – (3.0E-6/yr + 3.79E-6/yr + 1.21E-7/yr)] * (8.0E-3 + 9.6E-3 + 9.6E-4)[2] = 2.07E-5/yr * 1.9E-2 = 3.84E-7	3.84E-7
4	Type B Failures: Accident sequences in which the containment is failed due to a pre-existing failure-to-seal of Type B components that would not be identifiable from a ILRT (and thus not affected by ILRT testing frequency).	Per NEI Interim Guidance: N/A (not affected by ILRT frequency)	N/A
5	Type C Failures: Accident sequences in which the containment is failed due to a pre-existing failure-to-seal of Type C components that would not be identifiable from a ILRT (and thus not affected by ILRT testing frequency).	Per NEI Interim Guidance: N/A (not affected by ILRT frequency)	N/A

Table C.3-4b

SUMMARY OF CLINTON RELEASE FREQUENCIES AS A FUNCTION OF EPRI CATEGORY
(DRYWELL BYPASS LEAKAGE PROBABILITY SET BY 95% "CHI-SQUARE" ESTIMATION)
(Case No. 2: ILRT and DWBT Frequency = 1/10 yrs)

EPRI Category	Category Description	Frequency Estimation Methodology	Frequency (1/yr)
6	Other Containment Isolation System Failure: Accident sequences in which the containment isolation system function fails due to "other" pre-existing failure modes not identifiable by leak rate tests (e.g., pathways left open or valves that did not properly seal following test or maintenance activities). Not affected by ILRT leak testing frequency.	Per NEI Interim Guidance: N/A (not affected by ILRT frequency)	N/A
7a	Containment Failure Due to Accident (a): CD, vessel breach, Early CF, Early SP Bypass, CS Not Available Vessel breach occurs and both the containment and the drywell have failed either before or at the time of vessel breach. The containment sprays do not operate before or at the time of vessel breach.	Total Clinton release mode frequency for: C9 ε C10 2.62E-7 C11 ε C12 1.82E-9 E1 ε E2 ε	2.64E-7
7b	Containment Failure Due to Accident (b): CD, vessel breach, Early CF, Early SP Bypass, CS Available Vessel breach occurs and both the containment and the drywell fail either before or at the time of vessel breach. In this bin, however, the containment sprays operate before or at the time of vessel breach.	Total Clinton release mode frequency for: C1 7.78E-8 C2 1.80E-7 C6 3.51E-6 C8 9.41E-7	4.71E-6
7c	Containment Failure Due to Accident (c): CD, vessel breach, Early CF, No SP Bypass Vessel breach occurs and the containment fails either before or at the time of vessel breach. The drywell does not fail and, therefore, all of the radionuclide releases pass through the suppression pool. Because the pool has not been bypassed, the availability of the sprays is not very important and, thus, the CS characteristic has been dropped.	Total Clinton release mode frequency for: B1 1.13E-6 B2 8.16E-6 A1 7.81E-6	1.71E-6

Table C.3-4b

SUMMARY OF CLINTON RELEASE FREQUENCIES AS A FUNCTION OF EPRI CATEGORY (DRYWELL BYPASS LEAKAGE PROBABILITY SET BY 95% "CHI-SQUARE" ESTIMATION)

(Case No. 2: ILRT and DWBT Frequency = 1/10 yrs)

EPRI Category	Category Description	Frequency Estimation Methodology	Frequency (1/yr)
7d	Containment Failure Due to Accident (d): CD, vessel breach, Late CF Vessel breach occurs, however, the containment does not fail until the late time period. If the containment did not fail early, it is unlikely that the drywell will fail early. Thus, the suppression pool bypass characteristic and the containment spray characteristic have been dropped.	Total Clinton release mode frequency for: D5 9.91E-9 D6 9.07E-7	9.17E-7
8	Containment Bypass Accidents: Accident sequences in which the containment is bypassed. Such accidents are initiated by LOCAs outside containment (i.e., Break Outside Containment LOCA, or Interfacing Systems LOCA). Not affected by ILRT leak testing frequency.	[Total Clinton Containment Bypass release frequency]	1.21E-7
		TOTAL:	2.87E-5[(1)]

(1) Accurate to within a few percent of the total CDF (2.76E-5/yr). [18] Differences due to roundoff and EPRI calculational approach.

(2) The derivation of the conditional probability of a Category 3a and 3b release given an otherwise isolated accident sequence is derived in Table C.3-4a.

(3) As derived in Section 3.4.1, the following conditional probabilities have been derived as part of the NEI/EPRI ILRT methodology for containment compared with values for the sensitivity case:

Test Frequency	NEI METHOD		DWBT SENSITIVITY		
	10 La	35 La	10 Lc	35Lc	1 Lc
3/10 yr	2.7E-2	2.7E-3	0.89	0.11	~0
1/10 yr	9.0E-2	9.0E-3	0.89	0.11	~0
1/15 yr	0.135	0.0135	0.89	0.11	~0

For the NEI method, these same values are applied to both containment and DW leakage where DW leakage is characterized as multiples of DWL_c.

For the DWBT sensitivity case, drywell bypass leakage probability set by 95% "Chi-square" estimation using Mark III data only.

(4) Probability of DW Leakage = 1DWL_c is zero from Table C.3-4a.

(5) Other contributors associated with extension of both ILRT and DWBT intervals.

Table C.3-4c

CLINTON DOSE RATE ESTIMATES AS A FUNCTION OF EPRI CATEGORY FOR POPULATION WITHIN 50-MILES

(DRYWELL BYPASS LEAKAGE PROBABILITY SET BY 95% "CHI-SQUARE" ESTIMATION)
(Case No 2: ILRT and DWBT With Frequency of 1/10 year)

EPRI Category	Category Description	Person-Rem Within 50 miles(6)	Category Frequency (per year)(7)	Dose Rate (Person-Rem/yr)
1	No Containment Failure(1)	2.4E+3	1.16E-6	2.78E-3
2	Containment Isolation System Failure(2)	5.1E+5	1.13E-7	5.76E-2
3a	Small Pre-Existing Failures(3)	2.4E+4	3.93E-6	9.43E-2
3b	Large Pre-Existing Failures(3)	8.4E+4(9)	3.84E-7(9)	3.23E-2(9)
4	Type B Failures (LLRT)	n/a	n/a	N/a
5	Type C Failures (LLRT)	n/a	n/a	N/a
6	Other Containment Isolation System Failure	n/a	n/a	N/a
7a	Containment Failure Due to Severe Accident (a)(4)	5.1E+5	2.63E-7	1.35E-1
7b	Containment Failure Due to Severe Accident (b) (4)	3.5E+5	4.71E-6	1.65
7c	Containment Failure Due to Severe Accident (c) (4)	3.7E+5	1.71E-5	6.33
7d	Containment Failure Due to Severe Accident (d) (4)	3.0E+5	9.17E-7	2.75E-1
8	Containment Bypass Accidents(5)	5.1E+5	1.21E-7	6.17E-2
	Total		2.87E-5(8)	8.63

Notes to Table C.3-4c

(1) The population dose associated with the Technical Specification Leakage is based on scaling the population data, the power level, and allowable Technical Specification leakage compared to the NUREG/CR-4551 reference plant. The release for this EPRI category is assigned from APB#7 from Table 3-4 of the main report.

(2) EPRI Category #2 (Containment Isolation failures) may include drywell isolation failures. Therefore, the release associated with this category is assigned to be equivalent to the release associated with APB#1 from Table 3-4 of the main report.

(3) Dose estimates for #3a and #3b, per the NEI Interim Guidance, are calculated as 10xCategory 1 dose and 35xCategory 1 dose, respectively.

(4) Dose estimate for 7a, 7b, 7c, and 7d are taken from APB # 1, 2, 4, and 5, respectively. (See main Report.)

(5) EPRI Category #8 sequences involve containment bypass failures; as a result, the person-rem dose is not based on normal containment leakage. The releases for this category are assumed to result in a direct path to the environment, and as such, are assigned to be equivalent to the highest release category from NUREG/CR-4551. APB#1 from Table 3-4 is therefore used of the main report.

(6) Table C.3-2.

(7) Table C.3-4b.

(8) Within a few percent of total CDF of 2.76E-5/yr [18]. Slight differences are due to the EPRI calculational approach and round off. The use of slightly higher frequencies in Table C.3-6 is conservative for assessing the risk metric of dose rate.

(9) Large pre-existing failure estimates of the population dose are based on using the extrapolated person rem for Case CC' (Table C.3-2) in the calculation of those contributors with 35 DWLc and 35 La and adding these results to the other large pre-existing failures.

Table C.3-5a

SUMMARY OF THE CONDITIONAL PROBABILITY OF OCCURRENCE FOR THE VARIOUS POSTULATED LEAKAGE CASES

(DRYWELL BYPASS LEAKAGE PROBABILITY SET BY 95% "CHI-SQUARE" ESTIMATION)
(Case No. 3: ILRT and DWBT Frequencies of 1/15 yr)

Leakage Combinations	DW Bypass Leakage	WW Leakage	*PROBABILITY OF CASE*			EPRI Category
			DW[2]	WW[1]	Combined	
A	1 DWL_c	1 La	0	1.0	0	1
B	1 DWL_C	10 La	0	.135	0	3a
C	1 DWL_C	35 La	0	.0135	0	3b
D	10 DWL_C	1 La	0.893	~ 1.0	0.89	1
E	10 DWL_C	10 La	0.893	0.135	0.12	3a
F	10 DWL_C	35 La	0.893	0.0135	1.2E-2	3b
G	35 DWL_C	1 La	0.107	~ 1.0	0.11	3a
H	35 DWL_C	10 La	0.107	0.135	1.4E-2	3b
I	35 DWL_C	35 La	0.107	0.0135	1.4E-3	3b

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[1] The WW leakage cases for the DWBT evaluation use the assessed probabilities characteristic of the 1 per 15 year ILRT frequency.

10 La = 0.135
35 La = 0.0135

[2] The DW leakage estimates are using the 1/15 year DWBT frequency.

Table C.3-5b

SUMMARY OF CLINTON RELEASE FREQUENCIES AS A FUNCTION OF EPRI CATEGORY (DRYWELL BYPASS LEAKAGE PROBABILITY SET BY 95% "CHI-SQUARE" ESTIMATION)

(Case No 3: ILRT and DWBT Frequencies of 1/15 yrs)

EPRI Category	Category Description	Frequency Estimation Methodology	Frequency (1/yr)
1	No Containment Failure: Accident sequences in which the containment remains intact and is initially isolated. Only affected by ILRT leak testing frequency due to the incorporation of categories 3a and 3b.	Per NEI Interim Guidance: [Total Clinton "OK" release category frequency] – [Frequency EPRI Categories 3a and 3b] [5.47E-6/yr] – [4.76E-6/yr + 5.67E-7/yr] = 1.43E-7/yr	1.43E-7
2	Containment Isolation System Failure: Accident sequences in which the containment isolation system function fails during the accident progression (e.g., due to failures-to-close of large containment isolation valves initiated by support system failures, or random or common cause failures). Not affected by ILRT leak testing frequency.	[Clinton containment isolation failure probability] X [(Total CDF) – (CDF of Class II + CDF of Class IV +CDF of Class V)] [4.99E-3] X [(2.76E-5/yr) – (3.79E-6/yr +9.9E-7/yr + 1.21E-7/yr)] = 1.13E-7/yr	1.13E-7
3a	Small Pre-Existing Failures: Accident sequences in which the containment is failed due to a pre-existing small leak in the containment structure or liner that would be identifiable only from an ILRT (and thus affected by ILRT testing frequency).	Per NEI Interim Guidance: = 0 1 DWLc case [(2.76E-5/yr) – (3.0E-6/yr + 3.79E-6 /yr + 1.21E-7/yr)] x [0][(3)] = 0 In addition, the following incremental effect associated with the combination of DW(2) and WW leakage is included: [(2.76E-5/yr) – (3.0E-6/yr + 3.79E-6 /yr + 1.21E-7/yr)] * (0.12 + 0.11)[(2)] = 2.07E-5/yr * 0.23 = 4.76E-6/yr	4.76E-6

Table C.3-5b

SUMMARY OF CLINTON RELEASE FREQUENCIES AS A FUNCTION OF EPRI CATEGORY
(DRYWELL BYPASS LEAKAGE PROBABILITY SET BY 95% "CHI-SQUARE" ESTIMATION)
(Case No 3: ILRT and DWBT Frequencies of 1/15 yrs)

EPRI Category	Category Description	Frequency Estimation Methodology	Frequency (1/yr)
3b	Large Pre-Existing Failures: Accident sequences in which the containment is failed due to a pre-existing large leak in the containment structure or liner that would be identifiable only from an ILRT (and thus affected by ILRT testing frequency).	Per NEI Interim Guidance: = 0 [(2.76E-5/yr) – (3.0E-6/yr + 3.79E-6/yr + 1.21E-7/yr)] x [0][3] = 0 In addition, the frequency incremental effect associated with the combination of DW(2) and WW leakage is included: [(2.76E-5/yr) – (3.0E-6/yr + 3.79E-6/yr + 1.21E-7/yr)] * (1.2E-2 + 1.4E-2 + 1.4E-3) [2] = 2.07E-5/yr * 2.74E-2 = 5.67E-7/yr	5.67E-7
4	Type B Failures: Accident sequences in which the containment is failed due to a pre-existing failure-to-seal of Type B components that would not be identifiable from a ILRT (and thus not affected by ILRT testing frequency).	Per NEI Interim Guidance: N/A (not affected by ILRT frequency)	N/A
5	Type C Failures: Accident sequences in which the containment is failed due to a pre-existing failure-to-seal of Type C components that would not be identifiable from a ILRT (and thus not affected by ILRT testing frequency).	Per NEI Interim Guidance: N/A (not affected by ILRT frequency)	N/A
6	Other Containment Isolation System Failure: Accident sequences in which the containment isolation system function fails due to "other" pre-existing failure modes not identifiable by leak rate tests (e.g., pathways left open or valves that did not properly seal following test or maintenance activities). Not affected by ILRT leak testing frequency.	Per NEI Interim Guidance: N/A (not affected by ILRT frequency)	N/A

Table C.3-5b

SUMMARY OF CLINTON RELEASE FREQUENCIES AS A FUNCTION OF EPRI CATEGORY
(DRYWELL BYPASS LEAKAGE PROBABILITY SET BY 95% "CHI-SQUARE" ESTIMATION)
(Case No 3: ILRT and DWBT Frequencies of 1/15 yrs)

EPRI Category	Category Description	Frequency Estimation Methodology	Frequency (1/yr)
7a	<u>Containment Failure Due to Accident (a):</u> CD, vessel breach, Early CF, Early SP Bypass, CS Not Available Vessel breach occurs and both the containment and the drywell have failed either before or at the time of vessel breach. The containment sprays do not operate before or at the time of vessel breach.	Total Clinton release mode frequency for: C9 ε C10 2.62E-7 C11 ε C12 1.82E-9 E1 ε E2 ε	2.64E-7
7b	<u>Containment Failure Due to Accident (b):</u> CD, vessel breach, Early CF, Early SP Bypass, CS Available Vessel breach occurs and both the containment and the drywell fail either before or at the time of vessel breach. In this bin, however, the containment sprays operate before or at the time of vessel breach.	Total Clinton release mode frequency for: C1 7.78E-8 C2 1.80E-7 C6 3.51E-6 C8 9.41E-7	4.71E-6
7c	<u>Containment Failure Due to Accident (c):</u> CD, vessel breach, Early CF, No SP Bypass Vessel breach occurs and the containment fails either before or at the time of vessel breach. The drywell does not fail and, therefore, all of the radionuclide releases pass through the suppression pool. Because the pool has not been bypassed, the availability of the sprays is not very important and, thus, the CS characteristic has been dropped.	Total Clinton release mode frequency for: B1 1.13E-6 B2 8.16E-6 A1 7.81E-6	1.71E-5
7d	<u>Containment Failure Due to Accident (d):</u> CD, vessel breach, Late CF Vessel breach occurs, however, the containment does not fail until the late time period. If the containment did not fail early, it is unlikely that the drywell will fail early. Thus, the suppression pool bypass characteristic and the containment spray characteristic have been dropped.	Total Clinton release mode frequency for: D5 9.91E-9 D6 9.07E-7	9.17E-7

Table C.3-5b

SUMMARY OF CLINTON RELEASE FREQUENCIES AS A FUNCTION OF EPRI CATEGORY
(DRYWELL BYPASS LEAKAGE PROBABILITY SET BY 95% "CHI-SQUARE" ESTIMATION)
(Case No 3: ILRT and DWBT Frequencies of 1/15 yrs)

EPRI Category	Category Description	Frequency Estimation Methodology	Frequency (1/yr)
8	Containment Bypass Accidents: Accident sequences in which the containment is bypassed. Such accidents are initiated by LOCAs outside containment (i.e., Break Outside Containment LOCA, or Interfacing Systems LOCA). Not affected by ILRT leak testing frequency.	[Total Clinton Containment Bypass release frequency]	1.21E-7
		TOTAL:	2.87E-5[(1)]

(1) Accurate to within a few percent of the total CDF (2.76E-5/yr). [18] Differences due to roundoff and EPRI calculational approach.

(2) Table C.3-5a provides the "combined" probability of the DW and WW leakage that needs to be accounted for in Categories 3a and 3b.

(3) As derived in Section 3.4.1, the following conditional probabilities have been derived as part of the NEI/EPRI ILRT methodology for containment compared with values for the sensitivity case:

Test Frequency	NEI METHOD		DWBT SENSITIVITY		
	10 La	35 La	10 Lc	35Lc	1 Lc
3/10 yr	2.7E-2	2.7E-3	0.89	0.11	~0
1/10 yr	9.0E-2	9.0E-3	0.89	0.11	~0
1/15 yr	0.135	0.0135	0.89	0.11	~0

For the NEI method, these same values are applied to both containment and DW leakage where DW leakage is characterized as multiples of DWL_c.

For the DWBT sensitivity case, drywell bypass leakage probability set by 95% "Chi-square" estimation using Mark III data only.

(4) Probability of DW Leakage = $1DWL_c$ is zero from Table C.3-5a.

(5) Other contributors associated with extension of both ILRT and DWBT intervals.

Table C.3-5c

CLINTON DOSE RATE ESTIMATES AS A FUNCTION OF EPRI CATEGORY FOR POPULATION WITHIN 50-MILES

(DRYWELL BYPASS LEAKAGE PROBABILITY SET BY 95% "CHI-SQUARE" ESTIMATION)

(Case No 3: DWBT and ILRT Frequency of 1/15 yrs))

EPRI Category	Category Description	Person-Rem Within 50 miles[6]	Category Frequency (per year)[7]	Dose Rate (Person-Rem/yr)
1	No Containment Failure[1]	2.4E+3	1.43E-7	3.43E-4
2	Containment Isolation System Failure[2]	5.1E+5	1.13E-7	5.76E-2
3a	Small Pre-Existing Failures[3]	2.4E+4	4.76E-6	1.14E-1
3b	Large Pre-Existing Failures[3]	8.4E+4[9]	5.67E-7[9]	4.76E-2[9]
4	Type B Failures (LLRT)	n/a	n/a	n/a
5	Type C Failures (LLRT)	n/a	n/a	n/a
6	Other Containment Isolation System Failure	n/a	n/a	n/a
7a	Containment Failure Due to Severe Accident (a)[4]	5.1E+5	2.64E-7	1.35E-1
7b	Containment Failure Due to Severe Accident (b)[4]	3.5E+5	4.71E-6	1.65
7c	Containment Failure Due to Severe Accident (c)[4]	3.7E+5	1.71E-5	6.33
7d	Containment Failure Due to Severe Accident (d)[4]	3.0E+5	9.17E-7	2.75E-1
8	Containment Bypass Accidents[5]	5.1E+5	1.21E-7	6.17E-2
	Total		2.87E-5[8]	8.68

Notes to Table C.3-5c

(1) The population dose associated with the Technical Specification Leakage is based on scaling the population data, the power level, and allowable Technical Specification leakage compared to the NUREG/CR-4551 reference plant. The release for this EPRI category is assigned from APB#7 from Table 3-4 of the main report.

(2) EPRI Category #2 (Containment Isolation failures) may include drywell isolation failures. Therefore, the release associated with this category is assigned to be equivalent to the release associated with APB#1 from Table 3-4 of the main report.

(3) Dose estimates for #3a and #3b, per the NEI Interim Guidance, are calculated as 10xCategory 1 dose and 35xCategory 1 dose, respectively.

(4) Dose estimate for 7a, 7b, 7c, and 7d are taken from APB # 1, 2, 4, and 5, respectively. (See main Report.)

(5) EPRI Category #8 sequences involve containment bypass failures; as a result, the person-rem dose is not based on normal containment leakage. The releases for this category are assumed to result in a direct path to the environment, and as such, are assigned to be equivalent to the highest release category from NUREG/CR-4551. APB#1 from Table 3-4 is therefore used of the main report.

(6) Table C.3-2.

(7) Table C.3-5b.

(8) Within a few percent of total CDF of 2.76E-5/yr [18]. Slight differences are due to the EPRI calculational approach and round off. The use of slightly higher frequencies in Table C.3-6 is conservative for assessing the risk metric of dose rate.

(9) Large pre-existing failure estimates of the population dose are based on using the extrapolated person rem for Case CC' (Table C.3-2) in the calculation of those contributors with 35 DWLc and 35 La and adding these results to the other large pre-existing failures.

Table C.4-1

QUANTITATIVE RESULTS AS A FUNCTION OF ILRT AND DWBT INTERVAL

(DRYWELL BYPASS LEAKAGE PROBABILITY SET BY 95% "CHI-SQUARE" ESTIMATION)

EPRI Category	Dose (Person-Rem Within 50 miles)	Quantitative Results as a Function of ILRT and DWBT Interval					
		Baseline (3-per-10 year)		Current (1-per-10 year)		Proposed (1-per-15 year)	
		Accident Frequency (per year)	Population Dose Rate (Person-Rem/Year Within 50 miles)	Accident Frequency (per year)	Population Dose Rate (Person-Rem/Year Within 50 miles)	Accident Frequency (per year)	Population Dose Rate (Person-Rem/Year Within 50 miles)
1	2.4 E+3	2.58E-6	6.19E-3	1.16E-6	2.78E-3	1.43E-7	3.43E-4
2	5.1E+5	1.13E-7	5.76E-2	1.13E-7	5.76E-2	1.13E-7	5.76E-2
3a	2.4E+4	2.77E-6	6.65E-2	3.93E-6	9.43E-2	4.76E-6	1.14E-1
3b	8.4E+4	1.16E-7	9.74E-3	3.84E-7	3.23E-2	5.67E-7	4.76E-2
4	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7a	5.1E+5	2.64E-7	1.35E-1	2.64E-7	1.35E-1	2.64E-7	1.35E-1
7b	3.5E+5	4.71E-6	1.65	4.71E-6	1.65	4.71E-6	1.65
7c	3.7E+5	1.71E-5	6.33	1.71E-5	6.33	1.71E-5	6.33
7d	3.0E+5	9.17E-7	2.75E-1	9.17E-7	2.75E-1	9.17E-7	2.75E-1
8	5.1E+5	1.21E-7	6.17E-2	1.21E-7	6.17E-2	1.21E-7	6.17E-2
TOTALS:		2.87E-5[(4)]	8.59	2.87E-5[(4)]	8.63	2.87E-5[(4)]	8.68
Increase in Dose Rate [(1)]					0.58%		0.35%
Increase in LERF [(2)]				2.68E-7		1.92E-7	
Increase in CCFP (%) [(3)]				1.0%		0.6%	

Notes to Table C.4-1:

(1) The increase in dose rate (person-rem/year) is with respect to the results for the preceding ILRT and DWBT interval, as presented in the table. For example, the increase in dose rate for the proposed 1-per-15 ILRT and DWBT is calculated as: total dose rate for 1-per-15 year ILRT and DWBT, minus total dose rate for 1-per-10 year ILRT and DWBT. For each case, the dose rate increase is insignificant.

(2) The increase in Large Early Release Frequency (LERF) is with respect to the results for the preceding ILRT and DWBT interval, as presented in the table. As discussed in Section C.3.4.4 of the report, the change in LERF is determined by the change in the accident frequency of EPRI Category 3b. For example, the increase in LERF for the proposed 1-per-15 ILRT and DWBT is calculated as: 3b frequency for 1-per-15 year ILRT and DWBT.

(3) The increase in the conditional containment failure probability (CCFP) is with respect to the results for the preceding ILRT and DWBT interval, as presented in the table. As discussed in Section C.3.4.5, the conditional containment failure probability (CCFP) is calculated as:

$$CCFP_{\%} = [1 - ((\text{Category \#1 Frequency} + \text{Category \#3a Frequency}) / \text{CDF})] \times 100\%$$

(4) Due to the NEI Methodology and round off, the total frequency of all severe accidents is slightly higher than the CPS Rev 3 reported CDF (approximately 4%). This in turn leads to slightly higher population dose rate estimates for the Baseline, the current, and the proposed ILRT frequencies.

SENSITIVITY CASE RESULTS

(DRYWELL BYPASS LEAKAGE PROBABILITY SET BY 95% "CHI-SQUARE" ESTIMATION)

This is a brief summary of the NRC requested sensitivity case results when the drywell leakage probability is derived using only the available DWBT results for Mark III plants and the 95% upper bound "Chi-square" distribution value.

Dose Rate Impacts

The change in dose rate as a function of the ILRT/DWBT frequency for drywell bypass leakage probability set by 95% "Chi-square" estimation can be summarized as follows:

"New" Test Frequency	"Base" Test Frequency	New Dose Rate	"Base" Dose Rate	Change in Dose Rate	% Change
1/10yr	3/10yr	8.63	8.59	0.04	0.47
1/15yr	1/10yr	8.68	8.63	0.05	0.58
1/15yr	3/10yr	8.68	8.59	0.09	1.00

LERF Impacts

The change in LERF (Category 3b) as a function of the ILRT/DWBT frequency for drywell bypass leakage probability set by 95% "Chi-square" estimation can be summarized as follows:

"New" Test Frequency	"Base" Test Frequency	New LERF	"Base" LERF	Change in LERF
1/10yr	3/10yr	3.84E-7	1.16E-7	2.68E-7
1/15yr	1/10yr	5.67E-7	3.84E-7	1.92E-7
1/15yr	3/10yr	5.67E-7	1.16E-7	4.51E-7

<u>CCFP Impacts</u>

The change in CCFP can be calculated by the following equation:

$CCFP_{\%}$ = [1 – (Intact Containment Frequency / Total CDF)] x 100%, or
= [1 – ((#1 Frequency + #3a Frequency) / CDF)] x 100%

For a DWBT and ILRT 3-year interval:

$CCFP_3$ = [1 – ((2.58E-6 + 2.77E-6) / 2.76E-5)] x 100%
= 80.6%

For the DWBT and ILRT 10-year interval:

$CCFP_{10}$ = [1 – ((1.16E-6 + 3.93E-6) / 2.76E-5)] x 100%
= 81.6%

For a DWBT and ILRT 15-year interval:

$CCFP_{15}$ = [1 – ((1.43E-7 + 4.76E-6) / 2.76E-5)] x 100%
= 82.2%

The change in CCFP as a function of the ILRT/DWBT frequency for drywell bypass leakage probability set by 95% "Chi-square" estimation can be summarized as follows:

"New" Test Frequency	"Base" Test Frequency	New CCFP	"Base" CCFP	Change in CCFP
1/10yr	3/10yr	81.6%	80.6%	1.0%
1/15yr	1/10yr	82.2%	81.6%	0.6%
1/15yr	3/10yr	82.2%	80.6%	1.6%

The change in the conditional containment failure probability when <u>both</u> ILRT and DWBT intervals are extended from 10 to 15 years is:

$\Delta CCFP = CCFP_{15}^{(1)} - CCFP_{10}^{(1)} = 0.6\%$

This change in CCFP of less than 1% is insignificant from a risk perspective.

Attachment 4

REVISED TABLE C.4-1

"QUANTITATIVE RESULTS AS A FUNCTION OF ILRT AND DWBT INTERVAL"

Table C.4-1

QUANTITATIVE RESULTS AS A FUNCTION OF ILRT AND DWBT INTERVAL

EPRI Category	Dose (Person-Rem Within 50 miles)	Quantitative Results as a Function of ILRT and DWBT Interval					
		Baseline (3-per-10 year)		Current (1-per-10 year)		Proposed (1-per-15 year)	
		Accident Frequency (per year)	*Population Dose Rate* (Person-Rem/Year Within 50 miles)	*Accident Frequency* (per year)	*Population Dose Rate* (Person-Rem/Year Within 50 miles)	*Accident Frequency* (per year)	*Population Dose Rate* (Person-Rem/Year Within 50 miles)
1	2.4 E+3	4.78E-6	1.15E-2	3.04E-6	7.3E-3	1.66E-6	3.98E-3
2	5.1E+5	1.13E-7	5.76E-2	1.13E-7	5.76E-2	1.13E-7	5.76E-2
3a	2.4E+4	6.29E-7	1.51E-2	2.21E-6	5.30E-2	3.45E-6	8.28E-2
3b	8.4E+4	5.90E-8	5.02E-3	2.21E-7	1.93E-2	3.59E-7	3.15E-2
4	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7a	5.1E+5	2.63E-7	1.34E-1	2.63E-7	1.34E-1	2.63E-7	1.34E-1
7b	3.5E+5	4.7E-6	1.65	4.7E-6	1.65	4.7E-6	1.65
7c	3.7E+5	1.71E-5	6.33	1.71E-5	6.33	1.71E-5	6.33
7d	3.0E+5	9.2E-7	2.76E-1	9.2E-7	2.76E-1	9.2E-7	2.76E-1
8	5.1E+5	1.21E-7	6.17E-2	1.21E-7	6.17E-2	1.21E-7	6.17E-2
TOTALS:		2.87E-5[4]	8.54	2.87E-5[4]	8.59	2.87E-5[4]	8.63
Increase in Dose Rate [1]					0.58%		0.48%
Increase in LERF [2]				1.62E-7		1.4E-7	
Increase in CCFP (%) [3]				< 1%		0.5%	