Nuclear Operating Company

South Texas Project Electric Generating Station P.O. Box 289 Wadsworth, Texas 77483

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U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
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South Texas Project
Units 1 and 2
Docket Nos. STN 50-498, STN 50-499
Response to Request for Additional Information – South Texas Project
Containment Integrated Leakage Rate Test Interval Extension

The South Texas Project submits the attached information in response to the NRC request for additional information regarding our proposed one-time extension of the interval between containment integrated leakage rate tests from 10 years to 15 years. The extension is to be applicable to both Unit 1 and Unit 2. Approval is requested to support the next Unit 2 refueling outage, which is currently scheduled to begin in October 2002.

If there are any questions, please contact either Mr. P. L. Walker at (361) 972-8392 or me at (361) 972-8757.

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

Executed on 6/25/02.

J. J. Sheppard
Vice President and
Assistant to the President and CEO

PLW
Attachment: Response to Request for Additional Information –
Containment Integrated Leakage Rate Test Interval Extension

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South Texas Project
Units 1 and 2
Response to Request for Additional Information -
Containment Integrated Leakage Rate Test Interval Extension

Question (1)

RG 1.174 states that when the calculated increase in LERF is in the range of 1E-07 to 1E-06, proposed changes will be considered if the total LERF is less than 1E-05.

In order to process the current request we would need the licensee to provide an estimate of total LERF. The total LERF estimate should include external events as well as internal events. RG 1.174 references NUREG/CR-6595 to assist licensees in making such estimates in case they have not done so as part of their IPEEE.

An alternative approach would be to argue that the proposed change is less than 1E-07 per reactor year which is the risk acceptance guideline for a very small change as defined in RG 1.174. The licensee estimated the change in LERF by calculating the increase in the Class 3B frequency. The licensee conservatively used the CDF in estimating the Class 3B frequency. Some plant specific accident classes leading to core damage are likely to include individual sequences that either may already (independently) cause a LERF or could never cause a LERF, and thus are not associated with a postulated large Type A containment leakage path. These contributors can be removed from Class 3B in the evaluation of LERF. This most likely will result in the cumulative increase in LERF dropping below 1E-07.

Response (1)

The STP PRA is a complete Level 2 PRA that includes external events. Using the calculational technique recommended by the NRC staff, the extended ILRT interval will result in a Large Early Release Frequency of 7.3E-7. This value represents the sum of the change in LERF due to the extension and the Class 8 frequency [Large Early Release Frequency including Containment Bypass, which is not affected by ILRT testing frequency] from the PRA. The total LERF is less than 1E-05 and therefore satisfies the requirements of RG 1.174.

Question (2)

We wish to raise a concern that has been discussed in a guidance letter from NEI dated November 30, 2001. The concern is potential degradation of the side of the containment liner, which is not accessible. Calvert Cliffs recently provided information (ADAMS Accession No. ML020920100) in support of a similar request to address this issue. STP may want to consider Calvert Cliffs' response when amending their submittal.

Response (2)

Identifying Visible Degradation

Several plants have identified through-wall defects in their containment liner due to corrosion of the backside of the liner. These defects were identified in areas where the protective coating had blistered. The through-wall defects resulted from foreign material in the concrete that was in contact with the liner. This interfered with the concrete's alkalinity in inhibiting corrosion of the steel.

Examinations pursuant to the requirements of Subsection IWE of ASME Section XI and the plant protective coatings program ensure continued integrity of the South Texas Project containment liner. Under Subsection IWE, inservice inspection examinations are performed that require visual examination of essentially 100% of the accessible surface area of the containment liner once per ISI period (three in 10 years). This exam is performed and documented by qualified individuals per Subsection IWE during the outage and/or before an ILRT. The exam is performed either directly or remotely, depending upon the accessibility to the various areas. This exam has been performed once on Unit 1 and once on Unit 2 under IWE. Prior to IWE, the containment structure was inspected each period. There have been no recordable indications of liner plate degradation. Augmented inspections have not been required.

Coating condition assessments conducted as part of the structures monitoring program provide additional assurance that containment liner flaws are identified. The structures monitoring program covers the baseline inspection and subsequent inspections that are conducted at intervals not exceeding five years. Visual inspection of coatings in containment is intended to characterize the condition of the coating systems. Additional inspections may be performed depending on inspection results. In some cases, a complete inspection is not possible due to inaccessibility. For these cases, the coating systems are characterized based on an inspection of coating systems that are reasonably accessible or based on a representative sample. If localized areas of degraded coatings are identified, those areas are evaluated and scheduled for repair/replacement, as necessary. Some areas are not available for inspection because of having been embedded in concrete.

Visual inspections following the 1996 change in the ASME Code are believed to be more effective in detecting liner flaws. In addition, the flaws that are of concern for LERF are considerably larger than those of concern for successfully passing the ILRT.

Identifying Non-Visible Degradation

Containment liner surface area totals 143,910 ft^2. Of this, 20,359 ft^2 is embedded in concrete and is inaccessible for inspection. The embedded liner represents approximately 14% of the total.

Additional discussion is provided in response to Question (6).

Question (3)

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-tightness and structural integrity of the containment. 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.

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 (3)

A detailed description of the ISI methods and criteria used to ensure that the containment structural and leak-tight integrity are maintained is provided in Attachment 2.

There have been no augmented inspections of the concrete containment steel liner. The liner is inspected in accordance with ASME Subsection IWE, as specified in 10CFR50.55a(a)(2)(ix). Augmented inspections are required if containment surface areas are likely to experience accelerated degradation and aging as described in IWE-1240. The South Texas Project has not experienced such containment conditions that would require augmented inspections.

Question (4)

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 leakrate 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 (4)

Relief Request RR-ENG-IWE-01 (NOC-AE-000653) (October 7, 1999)

> This relief request proposed an alternative to the examination requirements for category E-D, seals and gaskets, in which Appendix J Type B testing would be performed in place of VT-3 visual examinations.

Relief Request RR-ENG-IWE-05 (NOC-AE-00000535) (June 6, 2000)

> This relief request proposed an alternative to the examination requirements for category E-G, pressure retaining bolting, in which bolt torque or tension tests should not be required if the bolted connections had not been disassembled and reassembled during the inspection interval. Appendix J, Type B testing and VT-1 visual examination once each inspection interval are adequate to demonstrate that the bolting design function is met.

The NRC staff concluded that the alternatives are authorized pursuant to 10CFR50.55a(a)(3)(ii) for the first 10-year inspection intervals for Units 1 and 2. Type B and Type C pneumatic tests to measure leakage rates must be conducted periodically at intervals based on the safety significance and historical performance of each boundary and isolation valve. The sequence of periods following September 9, 2001 will comply with IWE-2412, Inspection Program B. The minimum and maximum examination percentage to be completed for the applicable examination categories is determined by Table IWE-2412-1 (and 10CFR50.55a for the first inspection period), and is summarized below:

Period	Start Date	End Date	Min.	Max.
1	9/9/98	9/8/01	16%	34%
2	9/9/01	9/8/05	50%	67%
3	9/9/05	9/8/08	100%	100%

Following completion of the expedited first inspection period, the inspection interval may be extended or decreased by as much as one year in accordance with IWA-2430(d) and IWE-2412(b). In addition, if the units are continuously shutdown for six months or more, the inspection interval during which the outage occurred may be extended for an equivalent amount of time in accordance with IWA-2430(e) for that unit.

Question (5)

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 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 (5)

This issue is not applicable to the South Texas Project.

The issue of leakage testing containment penetration bellows addressed in Information Notice 92-20 stems from the Quad Cities Station experience which led them to conclude that it is not possible to perform a valid Type B LLRT on this type of bellows assembly. The LLRT was performed by pressurizing the volume between the two plies of the bellows through a test connection. The leakage rate could not be accurately measured because the two plies of the bellows were in contact with each other, restricting the flow of the test medium to the crack locations. Any two-ply bellows of similar construction may be susceptible to this problem.

The South Texas Project has only one bellowed penetration, which is for the fuel transfer tube. Unlike the configuration of the bellows at Quad Cities, this bellows is single-ply.

Question (6)

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 (6)

The following approach was used to determine the change in likelihood, due to extending the ILRT interval, of detecting liner corrosion. This likelihood was then used to determine the resulting change in risk. The following issues are addressed:

- Differences between the containment basemat and the containment cylinder and dome;
- The historical liner flaw likelihood due to concealed corrosion;
- The impact of aging;
- The liner corrosion leakage dependency on Containment pressure; and
- The likelihood that visual inspection will be effective at detecting a flaw.

The assessment used the following assumptions:

- Basemat concealed liner corrosion due to the lack of identified failures is a half failure. (Table 1, Step 1)
- The success data are limited to those taken since September 1996 when visual inspection was required under 10CFR50.55a. Additional success data were not used to limit the impact of corrosion on aging even though inspections were performed prior to this date and there is no evidence that liner corrosion issues were identified. (Table 1, Step 1)

- The likelihood of a liner flaw is assumed to double every five years. This is included to address the increased likelihood of corrosion due to aging.
- The likelihood of releasing containment atmosphere to the outside given a liner flaw is a function of pressure inside containment. Anchored points of 0.1% at 20 psia and 100% at 150 psia were selected, with intermediate failure likelihood determined through logarithmic interpolation.
- The likelihood of leakage escape due to crack formation in the basemat region is considered to be 10 times less likely than for the containment cylinder and dome regions. (Table 1, Step 4)
- The likelihood of visual inspection detection failure is 5% given that the flaw is visible. The total detection failure likelihood is 10%.
- All non-detectable containment over-pressurization leakage events are assumed to be large early releases.

This assessment for the liner corrosion base case is summarized in Table 1.

The likelihood of the corrosion-induced, non-detected containment leakage is the product of:

- Increase in flaw likelihood between 3 and 15 years (Step 3);
- Likelihood of breach in containment given a liner flaw (Step 4); and
- Likelihood of visual inspection detection failure (Step 5).

The total likelihood of corrosion-induced, non-detected containment leakage is the sum of the above for the containment cylinder and dome, and for the containment basemat.

$$\text{Total Likelihood} = 0.0096\% + 0.0024\%$$
$$= 0.012\%$$

The sum of all Containment release categories for the South Texas Project, including "containment intact" but excluding the Large Early Release Frequency, is estimated at 1.08E-7 per year. This is based on the current Level 2 PRA model, STP_1999. The total core damage frequency is 1.17E-5 per year. If all non-detectable containment leakage events are considered to be LERF, then the increase in LERF associated with liner corrosion is:

$$\text{Increase in LERF (ILRT from 3 years to 15 years)} = 0.012\% * 1.08\text{E-}05$$
$$= 1.3\text{E-}09 \text{ per year}$$

Sensitivity of this analysis to liner corrosion is such that potential increase in LERF is not significant.

CONCLUSION

Considering increased frequency of visual inspections and the benefit of improved visual inspections under the 1996 inspection criteria, the increase in risk is expected to be less than 1.0E-07 for LERF. Changes less than 1E-7 are considered small per Regulatory Guide 1.174. Therefore, the increase in risk associated with a one-time extension of the ILRT interval from 10 to 15 years is acceptable.

TABLE 1

LINER CORROSION BASE CASE

Step	Description	Containment Cylinder and Dome 86 %		Containment Basemat 14 %	
1	**Historical Liner Flaw Likelihood** **Failure Data:** **Success Data:** Based on results from periodic visual inspections of containment surfaces for 70 steel-lined Containments over a 5.5-year period.	Events: 2 2/(70*5.5) = **5.2E-03**		Events: 0 0.5/(70*5.5) = **1.3E-03** (Assuming a half failure)	
2	**Age-Adjusted Liner Flaw Likelihood**	**Year**	**Failure Rate**	**Year**	**Failure Rate**
	During a 15-year interval, the assumed failure rate doubles every five years (14.9% increase per year). The average for years 5 through 10 was set to the historical failure rate.	1 avg 5-10 15	2.1E-03 5.2E-03 1.4E-02	1 avg 5-10 15	5.0E-04 1.3E-03 3.5E-03
		15-year avg = 6.27E-03		**15-year avg = 1.57E-03**	
3	**Increase in Flaw Likelihood Between 3 and 15 Years** Uses aged adjusted liner flaw likelihood (Step 2), assuming failure rate doubles every five years.	**8.7 %**		**2.2 %**	
4	**Likelihood of Breach in Containment Given Liner Flaw**	**Pressure (psia)**	**Likelihood of Breach**	**Pressure (psia)**	**Likelihood of Breach**
	The upper end pressure is consistent with the South Texas Project Level 2 PRA analysis. The likelihood for the lower end is assumed to be 0.1%. Intermediate failure likelihoods are determined through logarithmic interpolation. The likelihood for the basemat is assumed to be one-tenth of that for the cylinder/dome analysis. (Note 1)	20 58.9 (ILRT) 100 120 150	0.1% ≈1.1% 7.02% 20.3% 100	20 58.9 (ILRT) 100 120 150	.01% ≈0.11% 0.7% 2.0% 10%

5	**Visual Inspection Detection Failure Likelihood**	**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)	**100%** Basemat cannot be visually inspected.
6	**Likelihood of Non-Detected Containment Leakage** Product of results from steps 3, 4, and 5	**0.0096%** 8.7%*1.1%*10%	**0.0024%** 2.2%*0.11%*100%

Note 1: From the STP IPE, the median failure pressure for hoop failure is 162.8 psig with a β_c (standard deviation for a log-normal distribution) of 0.14. The median failure pressure for liner tear is 112.8 psig with a β_c of 0.2. These values are similar to the values presented in the Calvert Cliffs submittal.

South Texas Project

Units 1 and 2
Reactor Containment ISI Methods

Acceptance Criteria

Acceptance criteria of IWE-3000, 1992 Edition with the 1992 Addenda of ASME Section XI, are utilized for flaw acceptance. Examinations that detect flaws or evidence of degradation that require evaluation in accordance with the requirements of IWE-3100 may be supplemented by other examination methods and techniques to determine the character of the flaw or degradation. Visual examinations that detect surface flaws or areas that are suspect (as defined by Engineering) are supplemented by either surface or volumetric examination. Engineering evaluations performed in accordance with IWE-3122.4 are subject to review by enforcement and regulatory authorities. A summary of the flaw evaluation information (e.g., flaw description and disposition) shall be submitted with the ISI examination reports.

When conditions exist in accessible areas that could indicate the presence of or result in degradation to an inaccessible area, then 10CFR50.55a(b)(2)(x)(A) requires an evaluation be performed to determine the acceptability of the inaccessible area. The inaccessible area evaluation shall include the following information, which shall be transmitted and retained with the ISI Summary Report required by ASME Section XI, IWA-6000:

- A description of the type and estimated extent of degradation, and the conditions that led to the degradation;
- An evaluation of each area, and the result of the evaluation; and
- A description of necessary corrective actions.

Qualification of NDE Personnel

Personnel performing NDE shall be qualified and certified in accordance with IWA-2300 of the 1992 Edition including the 1992 Addenda of ASME Section XI.

NDE Examinations

Non-destructive examination is performed in accordance with NDE Procedures or approved contractor/vendor procedures.

Technical procedures developed by other departments or outside organizations (e.g., contractor, consultants, NDE vendors, etc.) shall be approved by appropriate personnel as determined by the manager of the responsible department prior to use.

The General Visual examination of Examination Category E-A, Item Number E1.11, is performed by, or under the direction of, a Registered Professional Engineer or other individual, knowledgeable in the requirements for design, inservice inspection, and testing of Class MC components. The examination shall be performed either directly or remotely, by an examiner trained in the visual method with visual acuity sufficient to detect evidence of degradation that may affect either the containment structural integrity or leak tightness.

If ultrasonic thickness measurements are required, they are taken in accordance with Examination Category E-C, using an ultrasonic thickness measurement method in accordance with ASME Section V, T-544 per IWE-2500(c)(2). The location of the minimum wall thickness is marked or recorded to allow periodic reexamination of that location in accordance with Table IWE-2500-1.

When the visual examinations of IWE-2500 are performed remotely, 10CFR50.55a(b)(2)(x)(B) allows the maximum direct examination distance specified in Table IWA-2210-1 to be extended and the minimum illumination requirements specified in Table IWA-2210-1 to be decreased, provided the conditions or indications for which the visual examination is performed can be detected at the chosen distance and illumination.

When containment vessel or liner is painted or coated to protect surfaces from corrosion, pre-service and inservice examinations are performed without removal of the painting or coating.

Components Subject to Examination

The ASME Class MC-equivalent components subject to examination (IWE) are:

- Steel containment liner
- Structural stiffeners, including attachment welds
- Metal liner anchorage
- Penetrations, bellows and reinforcement
- Personnel and equipment access hatches
- Fuel transfer tube
- Bolted connections (pressure retaining)
- Seals, gaskets, and moisture barriers
- Attachment welds between structural attachments and the containment liner pressure-retaining boundary, including the weld metal and base metal for ½ in. beyond the edge of the weld.

Components are scheduled for examination in accordance with ASME Section XI, Table IWE-2412-1 and Table IWE-2500-1.

The rules of IWE-1220 have been used to exempt components from examination. Components exempt from examination are listed below:

- Vessels, parts, and appurtenances that are outside the boundaries of the containment as defined in the Design Specifications;
- Embedded or inaccessible portions of containment vessels, parts, and appurtenances that met the requirements of the original Construction Code;
- Portions of containment vessels, parts, and appurtenances that become embedded or inaccessible as a result of vessel repair or replacement if the conditions of IWE-1232 and IWE-5220 are met;
- Piping, pumps, and valves that are part of the containment system, or which penetrate or are attached to the containment vessel. These components are examined in accordance with the rules of IWB or IWC. The requirements of IWE-1231 are met to maintain accessibility for Class CC liner and MC components for the life of the plant. Inaccessible surface areas are defined in IWE-1232.

Condition Reports and Work Orders

If potential nonconforming conditions are identified or if any acceptance criteria are not met during the performance of scheduled CISI (IWE) examinations, the non-conforming condition is documented per the applicable NDE procedure and a Condition Report (CR) initiated as needed

If required, a work package is prepared and the work accomplished fully documented in, and reconciled with, the approved Work Package prior to returning the system, equipment or component to service.

Additional Examinations and Successive Examinations

The provisions of 10CFR50.55a(b)(2)(x)(D) may be used as an alternative to the requirements of IWE-2430 for evaluation of indications and selection of additional components subject to examination. For flaws or areas of degradation exceeding the acceptance standards of Table IWE-3410-1, an evaluation is performed to determine whether additional component examinations are required. The evaluation identifies the number and type of additional examinations to ensure detection of similar degradation in similar components. The following information is provided in the ISI Summary Report as required by ASME Section XI IWA-6000.

- A description of each flaw or area including the extent of degradation and the conditions that led to the degradation;
- The acceptability of each flaw or area and the need for additional examinations to verify that similar degradation does not exist in similar components; and
- A description of necessary corrective actions.

Successive inspections are required in accordance with IWE-2420. When component examination results require evaluation of flaws, areas of degradation, or repairs in accordance with IWE-3000, and the component is found to be acceptable for continued service, the areas containing such flaws, degradation, or repairs shall be reexamined during the next inspection period in accordance with Examination Category E-C. When the reexaminations reveal that the flaws, areas of degradation, or repairs remain essentially unchanged for three consecutive inspection periods, the areas containing such flaws, degradation, or repairs no longer require augmented examination in accordance with Examination Category E-C.

Configuration Changes/Plant Modification

If a plant modification or Design Change Package (DCP) impacts the IWE examination plan, the plan shall be revised to incorporate the change. PSI examination shall be performed, as applicable, on modified components or components added to the examination plan.

Records and Reports

Records and reports are in accordance with IWA-6000.

Computerized Data Base and Examination Plan

A computerized data base system is utilized for status and Section XI credit of completed CISI examinations. The database is used to identify components requiring examination during a specific refueling outage.

The database includes, as a minimum, the following:

- Examination Area and Identification
- ASME Section XI Category and Item Number
- Examination Method
- Examination Results