2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:08 A

Request Number: 1

Individual Contacted: Sid Powell

Date Contacted: 10/15/2009

Requestor/Inspector: Anthony Masters

Category: Question

Request: There is an area on the containment dome on the south, approximately half way between the walking platform and the peak of the dome that is depressed. There appears to be a grout covering that is seriously deteriorated. Is this evidence of repeat delamination damage?

References:

Response Assigned to: Craig Miller

Date Due to Inspector: 10/16/2009

Response:

I was up on the dome earlier this evening to examine the entire dome structure since I also have a Pri 3 investigation upcoming regarding the condition of the concrete on the dome (reference AR 357670). Although it had been a number of years since my last visit up there, the overall condition of the dome is pretty much exactly the same as it has been in my past trips as part of tendon surveillance. I believe that when they made the re-pours of the dome due to the original delamination, the final surface did not end up being a smooth arcing curvature and had several localized uneven areas. The one in question is exactly that.

Furthermore, as part of our ongoing Condition Monitoring of Structures effort (EGR-NGGC-0351), I will be returning to the dome this evening (10/16/2009) with Dayna Mendez to obtain digital photographs of the area to insert into our data base on this subject so that we have a reference point for future inspections.

Misc Notes:

Response By: Joe Lese

Reviewed By:

Date Response Provided: 10/16/2009

Status: Closed

Date Closed:

P/84

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20-Jan-10 11:21:09 A

Request Number: 2

Individual Contacted: Sid Powell

Date Contacted: 10/16/2009

Requestor/Inspector: Anthony Masters

Category: Information Request

Request: The Inspector has requested a procedure that was used for tensioning the tendons originally.

References:

Response Assigned to: Sid Powell

Date Due to Inspector: 10/16/2009

Response:

Prescon Field Installation Manual.tif was placed in folder L:\Shared\2009 NRC SPECIAL INSPECTION TEAM Q-A\POWELL Q-A\Request 2, Original Tendon Tensioning Procedure

Misc Notes:

Response By:

Reviewed By:

Date Response Provided:

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 3

Individual Contacted: Paul Fagan

Date Contacted: 10/16/2009

Requestor/Inspector: George Thomas

Category: Information Request

Request: George Thomas of the NRC requested a copy of our EC 74801 on the core bores. I printed a copy and delivered to Mr. Thomas at 0900. This is a preliminary copy since the EC has not been issued yet.

References:

Response Assigned to: Glenn Pugh

Date Due to Inspector: 10/16/2009

Response:

An approved (issued) copy of Revision 1 of the EC 74801 was printed and hand carried to George Thomas on 10/28/09.

Misc Notes: See question #19 for continued submittal of NDE and Core Bore Plan changes.

Response By: Glenn Pugh

Reviewed By: Charles Williams

Date Response Provided: 10/28/2009

Status: Closed

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 4

Individual Contacted: Sid Powell

Date Contacted: 10/16/2009

Requestor/Inspector: George Thomas

Category: Information Request

Request: Please provide the concrete mix design and associated material test data for concrete use in original construction of the containment wall. Also provide original test data of production concrete used in the original construction of the containment wall.

References: Calculation S00-0047

Response Assigned to: Sid Powell

Date Due to Inspector: 10/17/2009

Response:

The RB exterior shell consisted of around 105 separate concrete pours. Attachment B of calculation S00-0047 shows a listing of these pours by elevation and buttress zone. It also lists the mix design for each pour. For example, the SGR containment opening is between buttress 3 and 4 and between Elevations 180' and 220'. Per the pour list in the calculation the corresponding pour numbers are 685RB, 695RB, 700RB, 712RB, and 722RB. The construction microfiche listing then gives a corresponding microfiche card number for each of these pours. For example the records for pour number 685RB are on card 1P08022. A typical microfiche card will contain several pages of information including the mix design, batch tickets (truck slips), the date of the pour, curing data, and other relevant data. CR3 Document Services are attempting to scan these cards for use by the NRC and Root Cause team. At this time, there are some examples of the pour cards at L:\Shared\Containment Root Cause Files\Requested by NRC. A copy of calculation S00-0047 is also included at this location. Document Services is attempting to scan the pours between buttresses 3 and 4 (all elevations) first. If a different location is required, please let Glenn Pugh

C. G. Pugh 10/17/09

Misc Notes:

Response By: Glenn Pugh

Reviewed By:

Date Response Provided: 10/16/2009

Status: Closed

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 5

Individual Contacted: Sid Powell

Date Contacted: 10/16/2009

Requestor/Inspector: George Thomas

Category: Information Request

Request: With regard to the SGR Construction Opening, please provide stress plots of the SGR Opening and surrounding areas for the Dead load + Prestress load combination for the following cases: (i) prior to tendon detensioning and removal (ii) after tendon removal; (iii) with SGR opening and (iv) After restoration of opening and tendon retensioning.

References:

Response Assigned to: Sid Powell

Date Due to Inspector: 10/17/2009

Response:

George asked if we could provide stress plots for the analysis at the SGR opening for the Dead Load + Pressure Load combination at the 4 stages of the SGR project. Unfortunately we did not run computer stress analyses for the various load combinations. Each load element (dead load, pressure, liner plate thermal, thermal gradient, etc.) were individually evaluated. Additionally each were run at unit values, as to support the various amplificatior factors applied to the design basis evaluations. The results of these analyses were then extracted from the structural analysis package and processed, as necessary, to address the load combinations for various building conditions throughout the outage. Unfortunately, the program used does not have the ability to develop stress plots.

Misc Notes: Response inadequate. By this question, the NRC is seeking information to understand the structural behavior and response of the Containment Wall under real loads (i.e., Dead + applicable Prestress Load) in and around the SGR construction opening area for the configurations prior to, during and following creation of the SGR construction opening. Provide the pertinent information in an easily reviewable form. This information may be provided with pending response to Question 28.

Response By: Dan Jopling

Reviewed By:

Date Response Provided: 10/20/2009

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 6

Individual Contacted: Sid Powell

Date Contacted: 10/16/2009

Requestor/Inspector: Dan Naus

Category: Question

Request: Were the vertical and hoop tendons in the SGR opening area subject to lift-off measurements before detensioning and removal. If so provide lift off measurements. Were the removed tendons inspected/examined and if so what were the findings.

References:

Response Assigned to: Sid Powell

Date Due to Inspector: 10/16/2009

Response:

No lift off measurements were made for the tendons that were removed from the opening.

IWL examinations were performed on the concrete and bearing plates for the removed tendons. tendon end examinations were performed on the two longest tendons that were non-destructively removed. One wire each was removed and examined for the two longest tendons.

Misc Notes: Does CR3 plan on performing tension testing (i.e., ultimate strength, yield strength and elongation) on a wire sample from one or more of the removed hoop tendons that exhibited higher than anticipated loss of prestressing force (i.e., hoop tendons that did not meet the 95% predicted value criteria in IWL)? This information may be provided with pending response to Question 22.

Response By: Sid Powell

Reviewed By:

Date Response Provided: 10/16/2009

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 7

Individual Contacted: Garry Miller

Date Contacted: 10/22/2009

Requestor/Inspector: Dan Naus

Category: Information Request

Request: Provide de-tensioning sequence in R16 for the construction opening. Provide procedure? Did anyone hear anything?

Follow up request: Documents related to the dome delamination seem to indicate that a loud noise or boom was heard on December 4, 1974, however, no noticeable damage was observed during a subsequent visual inspection. Did anyone hear a loud noise or boom during the detensioning procedure related to the SGR contruction opening?

References:

Response Assigned to: Charles Williams

Date Due to Inspector: 10/26/2009

Response:

R16 Tendon Detensiong sequence.pdf: {E-mail from the SGR Tendon Field Engineer on the detensioning sequence.}

Containment Opening - Tendon Removal Timeline.xlsx: {Spreadsheet containing some interview questions and responses as well as some plant shutdown/mode times and tendon detensioning sequence information.}

Z3R5 PSC Field and Quality Control Manual1.pdf: {PSC Procedures [ALL], F&Q 8.0, 8.1, and 10.0 specifically address Tendon Detensioning/Removal, Plasma Tendon Detension, and Tendon Removal}

Follow up Response: Interviews were performed with craft and supervisory personnel associated with detensioning and hydroblasting. None indicated any abnormal noises occurring during these evolutions. Some were asked specifically if any loud noises were heard and no one identified any abnormal loud noises. Additionally, seismic monitoring data was obtained and reviewed for indication of movement. WO 1654188-01 shows no evidence of movement. Note: One direction was invalidated due to disturbance that occurred during data retrieval. The other two directions showed no movement. See Seismic Data - PT-379.pdf file at L:\Shared\2009 NRC SPECIAL INSPECTION TEAM Q-A\WILLIAMS Q-A\Request 7, Q1 Response Info - Portmann

Misc Notes:

Response By: Rick Portmann / Charles Williams

Reviewed By:

Date Response Provided: 11/2/2009

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 8

Individual Contacted: Garry Miller

Date Contacted: 10/22/2009

Requestor/Inspector: Dan Naus

Category: Information Request

Request: Any information on significant repairs (concrete related) between buttress 3 and 4 from original construction to today.

References:

Response Assigned to: Charles Williams

Date Due to Inspector: 10/26/2009

Response:

Performed a search of the document control system, both the SEEK system and historical QA records. Looked for any Work Orders, NCRs, Correspondence, or other documents using the keywords “concrete repair” and “concrete crack.” There were several “hits” on these key words. The majority of these “hits” were screened away by reviewing the title of the document. Any “hits” where the title was not clear were reviewed individually. The results were several AR’s and Work Orders to repair damaged or cracked concrete on the RB containment. However, none of the items reviewed were in the area of concern. Document search summaries are here: L:\Shared\CR3 Containment\NRC SIT Team Questions & Info\Request 8, Q2 Response Info- Pugh

In addition, conversations were held with several people in maintenance and engineering, including one person that was employed in the early 1970’s. No one could remember making any repairs on the RB shell concrete in the area of interest. No modifications could be identified. Conclude that the concrete between buttress 3 and 4 is original construction.

Misc Notes:

Response By: Glenn Pugh

Reviewed By: Chales Williams

Date Response Provided: 10/28/2009

Status: Closed

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 9

Individual Contacted: Garry Miller

Date Contacted: 10/22/2009

Requestor/Inspector: Dan Naus

Category: Question

Request: Was there any analysis of why re-tensioning was required in past tendon surveillance activities (done at that time of surveillance testing)?

Follow up request: Since lower than expected lift-off loads have been obtained in the recent 3 tendon surveillanceds for a significant number of horizontal tendons, describe your plan, if any, to dtermine, evaluate and eliminate the cause(s) of the condition not meeting the IWL acceptance by examination criteria.

Follow up request: Is the cause of the larger than anticipated losses of prestressing force in several hoop tendons being addressed as part fo the root cause assessment?

References:

Response Assigned to: Charles Williams

Date Due to Inspector: 10/26/2009

Response:

There was no analysis performed during past surveillance testing years in which tendons were re-tensioned.

Additional information in response to the above question: See License Request No. 24 – NRC SIT Question# 18 folder, under sub-folder: "IWL - Tendon Surveillance History" for information, discussions and actions taken related to tendon lift-off testing and re-tensioning.

Misc Notes:

Response By: Rick Portmann

Reviewed By:

Date Response Provided: 11/2/2009

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 10

Individual Contacted: Garry Miller

Date Contacted: 10/22/2009

Requestor/Inspector: Dan Naus

Category: Question

Request: When CTL is using IR and IE, can they determine relative concrete quality of locations tested as part of CTL NDE procedures?

References:

Response Assigned to: Paul Fagan

Date Due to Inspector: 10/26/2009

Response:

In general, the Impulse Response (IR) test results is influenced by concrete quality and existence of defects at the test point. The aspects in concrete influencing IR results include presence of delamination, cracking, significant void or honeycomb and change in concrete properties. The most significant factor is the presence of delamination which effectively reduces the thickness of wall or slab responding to the impact. Considerable difference in quality of concrete is typically reflected in the test results. For example, a core removed from panel RBCN-0014-N (Core #13) where a higher mobility value was obtained by NDT, had less coarse aggregate in the concrete, which changed density and modulus in that localized area, no delamination was noted in these areas with subsequent boroscope examinations.

Misc Notes:

Response By: Paul Fagan

Reviewed By:

Date Response Provided: 11/12/2009

Status: Closed

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 11

Individual Contacted: Garry Miller **Date Contacted:** 10/22/2009

Requestor/Inspector: Louis Lake **Category:** Question

Request: Does the PGN Testing Procedure identify how CTL calibrates their equipment, qualification of personnel, and equipment set-up (i.e., frequencies)? Provide Testing Procedure to NRC.

References:

Response Assigned to: Paul Fagan **Date Due to Inspector:** 10/26/2009

Response:

This question pertains to PGN procedure PT-407T, Reactor Building Concrete Examination and Testing, Revision 2.
The question is split into three areas with specific procedure steps stated to address each area.
Area 1 – Calibration
Step 3.2 Responsibilities
Step 3.2.1
The Condition Assessment Consultant is responsible for:
Provide equipment list and associated calibration documentation
Step 3.3 Limits & Precautions
Step 3.3.2
The equipment utilized to perform the NDT was calibrated in the field during trial use by CTLGroup. This method of validating the test process and equipment for a specific application is standard practice for concrete condition assessments utilizing NDT.
Step 5.3 Reports
Step 5.3.1
An equipment list with calibration documentation will be provided for the NDT used. The NDT process calibration/validation document will be included in the report.
Enclosure 7
For a critical structure of this scale, more correlation data is desired in order to finalize a more comprehensive calibration.
Enclosure 8
Individual equipment packages have been established to track specific calibrated equipment in order to link individual NDT locations with a calibrated equipment package. The Exterior Containment Inspection Log requires an Equipment Package Number to be recorded for each NDT location. The Equipment Package Number is traceable to a permanent plant record documenting the calibration records for the equipment.

Area 2 – Qualification
Step 3.2 Responsibilities
Step 3.2.1
The Condition Assessment Consultant, CTLGroup, shall be responsible for assuring that all individuals under his supervision are properly trained in the use of this procedure and associated equipment.
Step 3.2.1
The Condition Assessment Consultant is responsible for:
Provide personnel qualification records for lead Engineer
Step 3.5.2 Initial Conditions
ENSURE that all personnel are familiar with the operating manuals of the equipment to be used during the inspection.

Step 5.3 Reports
Step 5.3.1
The report will include personnel qualification records of lead engineers who performed the NDT.
Area 3 – Equipment set-up
Step 3.2 Responsibilities
Step 3.2.1
The Condition Assessment Consultant is responsible for:
Provide calibration/validation documentation to substantiate the NDT methods to be used and to support the dedication of the software (SMASH) being used to evaluate the NDT data.
Step 3.3 Limits & Precautions
Step 3.3.2
The equipment utilized to perform the NDT was calibrated in the field during trial use by CTLGroup. This method of validating the test process and equipment for a specific application is standard practice for concrete condition assessments utilizing NDT.
Enclosure 5, page 1
TURN ON the computer to start setup process.
Enclosure 6, page 1
TURN ON the computer to start setup process.

Misc Notes:

Response By: Paul Fagan

Reviewed By:

Date Response Provided: 11/12/2009

Status: Closed

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 12

Individual Contacted: Garry Miller **Date Contacted:** 10/22/2009

Requestor/Inspector: Dan Naus **Category:** Question

Request: Once the construction opening is refilled with concrete, how and for how long will the concrete be allowed to cure, and what is decision process for start of post-tensioning the structure?

Follow up request: In light of the apparent much more extensive repair area affected by delamination, how will the concrete curing and decision process for start of post-tensioning be affected?

References:

Response Assigned to: Don Dyksterhouse **Date Due to Inspector:** 10/26/2009

Response:

Response located in L:\Shared\2009 NRC SPECIAL INSPECTION TEAM Q-A\DYKSTERHOUSE Q-A

- Concrete will be cured for 7 days from the time of placement (Ref. 1).
- After forms are stripped a curing compound is applied (Ref. 1)
- Forms may be removed after 3 days, or sooner if the concrete has achieved a compressive strength of 3000 ps as demonstrated through strength testing (Ref. 1)
- Tendon retensioning starts with the verticals at buttress #3 and #4 (23V1 thru 23V3, 45V22 thru 45V24) after th concrete reaches a compressive strength of 5000 psi, followed by the remaining verticals outside the opening (34V18 thru 34V24, 34V1 thru 34V7) in parallel with the hoop tendons above and below the opening (42H22 thru 42H26, 53H23 thru 53H26, 42H35 thru 42H39 and 53H36 thru 53H39). After the concrete reaches 6000 psi the tendons within the opening are retensioned (34V8 thru 34V17 and 42H27 thru 42H34 and 53H27 thru 53H35). Tendon retensioning sequence is shown in detail on drawing 421-352 (Ref. 2).

The following is extracted from Ref. 3, page 86 and provides concrete mix strength information that may support removing the formwork earlier:

The use of autogenous curing containers is not planned during the containment opening concrete placement. Although autogenous containers would better represent the curing environment before formwork removal, their use involves additional resources and storage space. Therefore, standard curing methods will be used during actual concrete placement at the opening. To better understand what the difference in compressive strengths would be between the two methods, S&ME was tasked with testing a batch of concrete (concrete proportions based on results of Phase II testing i.e. Option 1A) and determining the difference in compressive strength between the two curing methods at 1, 2, 3, 5 and 28 days.

Attachment Z55R3 contains the S&ME test methodology and test results. Test results for compressive strength are reproduced below:

Age, days	Autogenous Containers	Alternative Proposed Curing	Autogenous/Alt
1	5,620 psi	4,760 psi	18% increase
2	6,450	5,930	9% increase
3	6,590	6,320	4% increase
5	6,860	6,830	0%
28	8,050	8,480	5% decrease

The results clearly indicate that the autogenous cured cylinders have higher early age strength which is as expected. The heat of hydration is (to some extent, over and above the standard cylinders) trapped inside the containers resulting in a harder concrete. These results would indicate that formwork could be removed as early as one day after completion of concrete placement.

Per Ref. 1:

Specified Concrete Strength: 6000 psi at 5 days, 7000 psi at 28 days
Slump: 6" to 9"
Air Entrainment: 0% to 3.5% maximum
Concrete Unit Wt: 145 pcf minimum

References:
1. Specification CR3-C-0003, Rev. 0, Specification for Concrete Work for Restoration of the SGR Opening in the Containment Shell.
2. Drawing 421-352, Rev. 0, RB Temporary Access Opening for SGR – Restoration – Sheet 1 of 1
3. EC 63016, Rev. 26, Containment Opening

Misc Notes:

Response By:

Reviewed By: **Date Response Provided:**

Status: Open **Date Closed:**

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Request Number: 13

Individual Contacted: Garry Miller

Date Contacted: 10/22/2009

Requestor/Inspector: George Thomas

Category: Question

Request: Before additional tendons are de-tensioned, will there be as-found lift off measurements taken for these tendons.

References:

Response Assigned to: Charles Williams

Date Due to Inspector: 10/26/2009

Response:

Planning and scheduling are currently in progress to obtain lift-off measurements of some of the tendons which are going to be detensioned. The root cause team has requested lift-off data on vertical tendons 34V3 thru 34V7 & 34V18 thru 34V22 and horizontal tendons 42H22 thru 42H26 & 42H35 thru 42H39.

See lift-off data provided in Request 6 response.

Misc Notes:

Response By: Rick Portmann

Reviewed By:

Date Response Provided: 11/4/2009

Status: Closed

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 14

Individual Contacted: Garry Miller

Date Contacted: 10/22/2009

Requestor/Inspector: Dan Naus

Category: Question

Request: For the original structural integrity test, were there any strain gauges in the SGR opening area or near it?

References:

Response Assigned to: Charles Williams

Date Due to Inspector: 10/26/2009

Response:

Section 5.3.2 of the Dome Repair report included with Letter 3F1276-10 outlines where the strain gauges were attached.

In addition to the final report, Attachment 1 to Supplement number 2 (transmitted via letter 3F1076-05) contained a detailed listing of strain gages for the SIT. The construction opening is centered on azimuth 150o (between buttresses 3 and 4) from Elevations 180' to 210'. The listing in Attachment 1, does not show any gages in this area. The closest would be at azimuths 90o and 200o at Elevation 204' (gages 13, and 15).

The SIT report (GAI Report 1930, dated 12/7/76) contains radial displacements for these gages (See Appendix B, Page B-5 of the GAI report).

Documents for this response are located here: L:\Shared\CR3 Containment\NRC SIT Team Questions & Info\Request 14, Q8 Response Info- Pugh

Misc Notes:

Response By: Glen Pugh

Reviewed By: Charles Williams

Date Response Provided: 10/28/2009

Status: Closed

Date Closed:

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20-Jan-10 11:21:09 A

Request Number: 15

Individual Contacted: Garry Miller

Date Contacted: 10/22/2009

Requestor/Inspector: Louis Lake

Category: Question

Request: When the 1976 roof delamination issue occurred, was there any evaluation of the rest of containment, including a "notch sensitivity" review? Refer to the FPC Final Report Page # 110.
a) was the concrete different in the containment versus the dome?

References:

Response Assigned to: Charles Williams

Date Due to Inspector: 10/26/2009

Response:

Misc Notes:

Response By:

Reviewed By:

Date Response Provided:

Status: Open

Date Closed:

20-Jan-10 11:21:09 A

Request Number: 16

Individual Contacted: Garry Miller **Date Contacted:** 10/22/2009

Requestor/Inspector: Louis Lake **Category:** Information Request

Request: Discuss the planned NDE method, its reliability, industry experience, and other pertinent information.
B) Discuss supplementary verification plans to ensure results are reliable.

References:

Response Assigned to: Paul Fagan **Date Due to Inspector:** 10/26/2009

Response:

A) Impulse Response (IR) test was chosen as the primary NDT technique to evaluate the extent of delamination. The IR method uses a low strain impact from a hammer equipped with a load cell to send a stress wave through the element under test. The response to the input stress is measured using a velocity transducer (geophone). Both the hammer and the geophone are linked to a portable field computer for data acquisition and storage. Time records for both the hammer force and the geophone velocity response are transformed into the frequency domain using the Fast Fourier Transform (FFT) algorithm.
Average Mobility is the key parameter that the dynamic IR test produces. It is defined as the structural surface velocity responding to the impact divided by the force input [(m/s)/N]. The mean mobility value over the 0.1-1 kHz range is directly related to the modulus, density and the effective thickness of the element. In general, presence of significant voiding or an internally delaminated or un-bonded layer will result in an increased average mobility value. On the other hand, a sound concrete element without distress will produce a relatively low average mobility value. The test results can be analyzed and presented in the form of contour plots. The suspect areas can be identified through a scaled color scheme.
Comparing to another well-known NDT method Impact-Echo (IE) test, the IR test uses a compressive stress impact approximately 100 times that of the IE test. This greater stress input means that the plate responds to the IR hammer impact in a bending mode over a very much lower frequency range (0-1 kHz for plate structures), as opposed to the reflective mode of the IE test which normally requires a frequency range of approximately 5 to 30 kHz, The influence of reinforcement and tendons in the structure has generally less impact than it would for IE test, while delamination at relatively shallow depth, if any, will dominate the signal response in IR testing. It makes it ideal to evaluate the presence of delamination without having to layout locations of tendon and reinforcing bars prior to the testing in a time critical project. However, the IR test cannot detect with high certainty the absolute depth of delamination; rather it's on a comparative basis. The width or size of crack cannot be determined in the IR testing.
The IR test method has been used to evaluate concrete structure condition in the past 20 years. The test method is in the process of being standardized by ASTM. CTLGroup has extensive experiences in utilizing this method to characterize defects in concrete. IR test has been used in evaluating concrete structures in both nuclear and fossil power plants. CTL Group experience for nuclear related structures has been compiled (see attached).
B) According to the Progress Energy procedure PT-407T, Rev. 2, concrete core samples are removed in areas with high mobility values (greater than 1.0) to confirm the presence of delamination. Core samples are also removed in areas where mobility value is in the "Gray" (between 0.4 and 1.0) range to verify the condition, unless the slightly elevated values can be dispositioned through evaluation. Many cores have been removed based on the IR test results along the boundary of delamination in the section where steam generator opening is located. At this time, the approximate 20 cores so far removed indicated the IR results have been accurate in characterizing the extent of delamination in the steam generator opening area. Also according to the test procedure, a population of core samples is also removed from areas where low mobility values (less than 0.4) are obtained to confirm the sound concrete condition. Based on the core samples removed, the IR results have been accurate to detect a delamination in the concrete.

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Misc Notes:

Response By:	Paul Fagan		
Reviewed By:		**Date Response Provided:**	11/12/2009
Status:	Closed	**Date Closed:**	

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 17

Individual Contacted: Garry Miller

Date Contacted: 10/22/2009

Requestor/Inspector: George Thomas

Category: Question

Request: For petrographic analysis, who are the labs and what are their credentials?

Follow up Request: Provide information on the qualification of the petrographers from CTL and Photometrics who are performing/supervising petrographic examination work for CR3.

References:

Response Assigned to: Paul Fagan

Date Due to Inspector: 10/26/2009

Response:

Two labs have performed petrographic analyses in accordance with ASTM C 856: MACTEC Engineering & Consulting and CTL Group. MACTEC performed petrographic analysis under their Appendix B program, while CTL performed an informational "comparison" analysis as an additional, independent data point. The resume and qualification package of the Mactec individual who performed the analysis for CR3 is attached, as well as the CTL analyst's resume and petrography literature from the CTL website. A third laboratory, PhotoMetrics, is also performing material analysis, although not per the ASTM standard. The material examinations being performed by Dr.Mostafa at the PhotoMetrics laboratory involve methods intended to examine similar conditions and attributes evaluated under petrographic examinations, but using tools and techniques more frequently used in material science, e.g., scanning electron microscope (SEM) and micro-hardness examinations that are more thorough. Information from the PhotoMetrics website is attached.

Misc Notes:

Response By: Craig Miller

Reviewed By:

Date Response Provided: 11/18/2009

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 18

Individual Contacted: Garry Miller

Date Contacted: 10/22/2009

Requestor/Inspector: George Thomas

Category: Question

Request: How are core samples being processed and sent to the labs for petrography?
A) How will you determine that the results are consistent between the labs?

Follow up Request: Please expand your response on the quesiton of determining consistency of results between the labs. This may be provided with response to new quesiton __ below.

References:

Response Assigned to: Paul Fagan

Date Due to Inspector: 10/26/2009

Response:

Each of the cores used for petrographic analysis was obtained with a 4" diamond core bore bit, sealed in aluminum foil and plastic, wrapped in bubble wrap, and packaged in wooden crates. The packages were shipped via Fedex for overnight delivery. Chain of Custody forms are used to track each core. Cores #5 and #7 were sent to MACTEC for analysis. MACTEC cut core #5 longitudinally and sent half to CTL. Core #6 was sent to PhotoMetrics using the same process.
The labs are each performing independent analyses. The primary goal of the analyses was to estimate the relative age of the cracked surface. Each lab was given this objective when the work was authorized. Final reports will be issued with results.

Misc Notes:

Response By: Craig Miller

Reviewed By:

Date Response Provided: 11/18/2009

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 19

Individual Contacted: Garry Miller

Date Contacted: 10/22/2009

Requestor/Inspector: George Thomas

Category: Question

Request: What is the sampling plan for NDE and core samples,

References:

Response Assigned to: Paul Fagan

Date Due to Inspector: 10/26/2009

Response:

The nondestructive testing (NDT) and core bores are being executed based on the requirements specified by the Root Cause Team in support of the root cause analysis, design basis evaluation, and repair requirements. NDT is performed on the exposed surfaces of the containment in each of the six bays, where a bay is defined as the area between each of the six buttresses. NDT is also planned to be performed on the dome surface and is in progress on the containment walls accessible from within adjoining buildings such as the Auxiliary Building, Intermediate Building, and the Fuel Transfer Building.

Exposed Surfaces

Exposed surfaces accessed via work platforms, scaffolding, ladders, and roofs of adjoining buildings are included in the condition assessment of structure. A small percentage of the overall surface area of exposed surfaces has physical constraints that make access impractical.

Adjoining Building Surfaces

Surfaces within adjoining buildings are accessed via permanent platforms, scaffolding, and ladders included in the condition assessment of the structure. A large percentage of the accessible surfaces are included in the plan; however, physical constraints exist in each of the three adjoining buildings that limit access. Examples are 1) areas with wall attachments that limit access to the concrete surface, 2) locked high radiation areas, and 3) contaminated areas.

Core Bores

The location and number of core bores is defined by the on-going NDT results and input from the Root Cause Team. Core bores are taken to provide samples for concrete testing. Cores in both solid and delaminated areas characterized by NDT are used to confirm the test results. Core bores have been drilled around the perimeter of the delamination in the bay between buttresses 3 and 4 to confirm the boundary of the delamination characterized by NDT.

Misc Notes:

Response By: Paul Fagan

Reviewed By:

Date Response Provided: 11/12/2009

Status: Closed

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 20

Individual Contacted: Garry Miller

Date Contacted: 10/22/2009

Requestor/Inspector: George Thomas

Category: Question

Request: What are your examination plans for below grade?

References:

Response Assigned to: Paul Fagan

Date Due to Inspector: 10/26/2009

Response:

The containment exterior concrete surfaces not exposed to the elements are accessed from within the Auxiliary, Intermediate, and Fuel Transfer Buildings. The containment wall rests on the foundation mat. The top surface of the foundation mat is at EL. 93'-0" (ref. drawing 421-004). No portion of the containment wall is inaccessible due to concrete being in contact with backfill (below grade). Surfaces within adjoining buildings are accessed via permanent platforms, scaffolding, and ladders are included in the condition assessment of the structure. A large percentage of the accessible surfaces are included in this assessment; however, physical constraints exist in each of the three adjoining buildings that limit access. Examples are 1) areas with wall attachments that limit access to the concrete surface, 2) locked high radiation areas, and 3) contaminated areas.

Misc Notes:

Response By: Paul Fagan

Reviewed By:

Date Response Provided: 11/12/2009

Status: Closed

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number:	21		
Individual Contacted:	Garry Miller	**Date Contacted:**	10/22/2009
Requestor/Inspector:	George Thomas	**Category:**	Information Request

Request: Provide interview observations from personnel involved with hydro-demolition and detensioning/cutting of tendons (when their comments note something of interest).

Provide information from additional interviews of personnel when they become available. Also, include interviews conducted by PII.

References:

Response Assigned to: Charles Williams **Date Due to Inspector:** 10/26/2009

Response:

Response located in L:\Shared\2009 NRC SPECIAL INSPECTION TEAM Q-A\WILLIAMS Q-A\Request 21, Q15 Response Info - Portmann

Misc Notes:

Response By:	Charles Williams		
Reviewed By:		**Date Response Provided:**	
Status:	Open	**Date Closed:**	

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number:	22		
Individual Contacted:	Garry Miller	**Date Contacted:**	10/22/2009
Requestor/Inspector:	George Thomas	**Category:**	Question

Request: Have removed tendons been inspected and were there any significant findings?

Does CR3 plan on performing tension testing (i.e., ultimate strength, yield strength and elongation) on a wire sample from one or more of the removed hoop tendons that exhibited higher than anticipated loss of prestressing force (i.e., hoop tendons that did not meet the 95% predicted value criteria in IWL)?

References:

Response Assigned to:	Charles Williams	**Date Due to Inspector:**	10/26/2009

Response:

There was no requested/required inspections performed of the removed tendons. Various questions were asked of the SGR Tendon Field Engineer and PSC Lead Individual, responses documented in the enclosed.
{Containment Opening - Tendon Removal Timeline.xlsx}
{10 28 interview Cliff Peters Gary Goetsch.pdf}
{Interview with Gary Goetsch.pdf}

Misc Notes:

Response By:	Rick Portmann		
Reviewed By:		**Date Response Provided:**	11/2/2009
Status:	Closed	**Date Closed:**	

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 23

Individual Contacted: Garry Miller

Date Contacted: 10/22/2009

Requestor/Inspector: George Thomas

Category: Question

Request: When were observations of surface feature changes and water leakage noted below the construction opening?

At what location of the SGR opening area did hydro-demolition begin and what was the sequence of progression for the creation of the opening?

Provide a copy of NCR 358724 that identified voids in the RB concrete in the area of hydro-demolition.

References:

Response Assigned to: Charles Williams

Date Due to Inspector: 10/26/2009

Response:

The below is the timeline of events as noted in the Outage Autolog system (relevant Autolog pages attached) :
10/1/2009 4:28:59 AM Begin hydro-demolition
10/1/2009 1:15:08 PM Hydro-demolition to first layer of rebar is complete, begin cutting rebar
10/2/2009 3:55:53 AM Restart hydro-demolition
10/2/2009 5:15:30 AM Stream of water identified exiting RB wall from below/to the right of the transfer opening. Hydro-demolition suspended.
10/2/2009 6:41:11 AM Voiding identified in RB wall
10/7/2009 12:52:15 PM 2 ft x 4 ft loose concrete below the containment opening.

Copy of NCR 358724 also provided in L:\Shared\2009 NRC SPECIAL INSPECTION TEAM Q-A\WILLIAMS Q-A\Request 23, Q17 Response Info - Miller

Misc Notes:

Response By: Charles Williams

Reviewed By:

Date Response Provided: 11/18/2009

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number:	24		
Individual Contacted:	Garry Miller	**Date Contacted:**	10/22/2009
Requestor/Inspector:	George Thomas	**Category:**	Question

Request: What were results of the last three IWE/IWL surveillance reports (provide actual complete reports)?
Provide inspection procedures and including qualification of personnel information?

References:

Response Assigned to:	Charles Williams	**Date Due to Inspector:**	10/26/2009

Response:

Response located in L:\Shared\2009 NRC SPECIAL INSPECTION TEAM Q-A\WILLIAMS Q-A\Request 24, Q18 Response Info-Portmann

Misc Notes:

Response By:	Charles Williams		
Reviewed By:		**Date Response Provided:**	
Status:	Closed	**Date Closed:**	

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 25

Individual Contacted: Garry Miller

Date Contacted: 10/22/2009

Requestor/Inspector: George Thomas

Category: Information Request

Request: Provide results of current visual inspections.

References:

Response Assigned to: Paul Fagan

Date Due to Inspector: 10/26/2009

Response:

In response to your E-Mail Clarification on 11/30/09 for information regarding "all IWL examinations, being performed during this (R16) outage, "to let you know there were no scheduled As-Found IWL examinations for this outage as they are performed every 5 years and were performed last in outage R15 (2007) [that information has been provided to you under NRC Folder "WILLIAMS Q-A" file "Request 24, Q18 Response Info-Portmann"]. The only IWL examinations scheduled are the As-Left Pre-Service IWL exams to be performed prior to, during, and following the ILRT on the repair/replacement area which is yet to be completed.
However as a result of the containment crack we did an augmented IWL scope between buttresses 3-4 to compare to the R15 information as part of the root cause investigation. I have included these reports, reference file RO-16 IWL Exam Reports.pdf enclosed in the NRC folder "FAGAN Q-A" file "Request 25, Q19 Response Info".
The SGR-QC also performed visual inspections of the tendon ends, bearing plates and surrounding concrete for those tendons affected by the containment opening Engineering Change (EC). These inspections were not required IAW IWL .

Rev. 1: The SGR-QC examination reports (File: Tendon Bearing Plate and Concrete Inspections.pdf) has been provided in this NRC folder.

Misc Notes:

Response By: Rick Portmann

Reviewed By:

Date Response Provided: 11/30/2009

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 26

Individual Contacted: Garry Miller

Date Contacted: 10/22/2009

Requestor/Inspector: Louis Lake

Category: Question

Request: Will PGN be doing the overall IWL inspection this R16 outage concurrent with ILRT?

References:

Response Assigned to: Paul Fagan

Date Due to Inspector: 10/26/2009

Response:

The IWL Inspections required by ASME Section XI are required every 5 years. CR3 last performed this inspection in R15 (2007). During R16 the ASME Section XI Repair / Replacement requirements require that a Pre-Service ISI VT examination be performed on the containment opening repair area prior to, during and following the ILRT. In support of the containment root cause it has been requested that an Augmented IWL Visual Examination be performed on the containment between Buttresses 3 and 4. This Augmented area includes the tendon gallery and the vertical face of containment only.

Misc Notes:

Response By: Rick Portmann

Reviewed By:

Date Response Provided: 11/4/2009

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 27

Individual Contacted: Garry Miller **Date Contacted:** 10/22/2009

Requestor/Inspector: George Thomas **Category:** Question

Request: What was technical analysis for decision to detension only specific tendons? Provide the analysis?

References:

Response Assigned to: Charles Williams **Date Due to Inspector:** 10/26/2009

Response:

Summary:
1. The requirement to restore the concrete prestress within and around the steam generator opening to approximately the levels that existed prior to construction so that the original design margins could be maintained. This resulted in the need to de-tension 30 vertical tendons and 35 horizontal tendons.
2. The requirement to use the containment shell to move steam generators in and out of containment. This analysis was based on de-tensioning only the 10 vertical tendons and the 17 horizontal tendons within the steam generator opening. The remaining tendons adjacent to the opening were required to meet design loading conditions. The controlling load case was loss of decay heat removal accident in combination with the applicable loads from the polar crane.

White paper

The purpose of this white paper is to document the engineering processes and subsequent decisions made in identifying which tendons to detension in and around the CR3 temporary access opening in support of Steam Generators Removal (SGR) activities.

Sargent & Lundy (S&L) created Finite Element Models (FEMs) of the containment shell that are summarized in Ref. 1, Section 6.0. These FEMs were created using the GTSTRUDL program through the generation of a 3-D model of the containment which includes the containment shell, dome, basemat, representative soil springs and the equipment hatch. Similar to the design basis analysis, the models utilize thin shell elements that take into account bending and membrane action in the shell. Linear soil springs were also modeled similar to the design basis analysis to simulate the support provided by the rock foundation.

A significant goal of the SGR project team was to restore the prestress within and around the access opening to the design basis level prior to SGR and thus maintain the original design margins. S&L performed preliminary studies utilizing these FEMs to determine the optimum number of vertical and hoop tendons to detension outside the opening. These preliminary studies indicated that restoration of the prestress within the access opening was not possible unless the axial stiffness of the concrete sections within the access opening are nearly the same as or higher than the axial stiffness of the existing concrete sections around the opening. Ref. 2, Section 4.1 evaluated the mechanical properties of the new concrete in the opening and the existing concrete around the opening, including the effects of concrete creep (the time dependent increase in strain in the hardened concrete when subjected to sustained load, i.e. prestress). This evaluation was based on the requirements of ACI 209R-92, Prediction of Creep, Shrinkage, and Temperature Effects in Concrete Structures, and was partially developed by Professor Domingo Carreira, Chairman of the sub-committee that prepared ACI 209R-92. This evaluation resulted in the requirement to add two layers of #11 at 11" centers to approximately equalize the stiffness of the concrete sections within the access opening with the axial stiffness of the existing concrete sections around the opening.

As part of the design evolution process, several detensioning alternatives were considered. This was necessary to meet the design constraint of keeping the number of tendons that have to be detensioned during the SGR outage construction to a minimum to minimize the duration of construction yet at the same time ensure that when the tendons are retentioned after the SGR opening has been plugged, the prestress within and around the access opening is restored to approximately the levels that existed prior to SGR construction thus maintaining the original design margins.

Determination of Prestress Reduction Level

The analysis in Reference 2 to determine the number of hoop and vertical tendons to detension was performed using the following FEM models:

FEM Model A:

- Original design basis prestress. Tendon forces are based on original lock-off stress (0.7xFu) and losses at end of outage and EOL.
- Access opening has not been created yet and is not in model.
- Creep adjusted E is based on age of concrete when initially loaded and load duration to end of outage and EOI i.e. E = 2681.62 ksi (for both end of outage and EOL)
- Element forces and stresses analyzed at end of SGR outage and EOL

FEM Model B:

- Same as Model #A except access opening is included in model.
- Tendon forces are based on original lock-off stress (0.7xFu) and losses at end of outage and EOL.
- Creep adjusted E is based on age of concrete when initially loaded and load duration to end of outage and EOI i.e. E = 2681.62 ksi (for both end of outage and EOL)
- Reduced prestress in containment shell from de-tensioning 30 vertical and 35 hoop tendons is derived from tw main load cases:

B1. All vertical and hoop tendons included in load case (as in Model A).

B2. Only the 30 vertical and 35 hoop tendons included in second load case

B3. Final reduced prestress = B1-B2

FEM Model C:

- This model reflects re-tensioning of the tendons at the end of the SGR outage. Young's modulus is the same fo the new patch concrete and existing concrete, E= 3767.168 ksi (reflects the stiffening of the concrete section within the opening by adding rebar (#11s at 11" c/c vertical and horizontal, both faces).
- Include 30 vertical tendons and 35 hoop tendons. Tendon forces are based on re-tensioning to 0.7 Fu minus tendon losses to end of life (EOL).

By adding the results from Models B and C (at end of SGR outage and EOL) and comparing to the design basis results for vertical and hoop prestress from Model A , it can be determined if the prestress in and around the access and hatch area can be restored to pre-outage levels. The calculation (Ref. 2) determined that the prestress levels in and around the opening after re-tensioning would be at levels similar to those before the SGR outage.

Note: After Ref. 2 was issued it was decided by S&L and Progress Energy that since the creep adjusted Young's Modulus (E) of the new and old concrete have been equalized (by adding #11 rebar's to the access opening), that for all future analysis a reduced E value = 2500 ksi (Original design basis calculations were performed using a reduced Young's Modulus E=2500 ksi) would be used for both short and long term loads (Refer to Ref. 1, Section 6.0, Task 2 and Ref. 2, Attachment 5, pages 7 and 8 for further discussion concerning the use of E=2500 ksi).

Shell Analysis with Reduced Prestress for Activities Occurring During SGR

Based on the results of Ref. 2, i.e. detension a total of 35 hoops (17 in the opening and 9 above and 9 below the access opening) and 30 vertical tendons (10 within the access opening and 10 on either side of the access opening), S&L evaluated the containment shell (Ref.3) for activities occurring during the SGR as follows:

1. Modes 5 and 6 with the access opening created and the exposed liner plate in-place. The maximum number o tendons that may be detensioned should be such that no overstressing of the concrete shell or liner plate occurs for all accident load cases/combinations, including a LODHR accident.
2. Defueled (No Mode) with the access opening created in the concrete shell and liner plate for all construction loads resulting from rigging the steam generators (SGs) into and out of containment and for moving the auxiliary crane on the hatch transfer system (HTS). The maximum number of tendons that may be detensioned should be such that no overstressing of the concrete shell occurs.

Preliminary studies performed by S&L in the development of this calculation (Ref. 3) initially considered all 30 vertical and 35 hoop tendons detensioned prior to creating the opening, however, these preliminary studies revealed that the containment shell was grossly overstressed in this configuration when evaluated for loads resulting from moving the old SGs out and the new SGs into containment (these preliminary studies are not available). S&L determined that the maximum number of tendons that could be detensioned while lifting the SGs on the HTS is 10 vertical and 17 hoop tendons within the access opening. The remaining 20 vertical and 18 hoop tendons outside and adjacent to the access opening must remain fully tensioned until all lifting activities involving the SGs on the HTS are completed. The remaining 20 vertical and 18 hoop tendons outside and adjacent to the access opening may then be detensioned. This conclusion resulted in the containment shell having two stages of prestress:

Stage 1 Prestress - Reduced prestress based on de-tensioning 17 hoop and 10 vertical tendons within the opening. Applicable during Modes 5 and 6 descending and No Mode while the SGs are being moved on the HTS

Stage 2 Prestress – Reduced prestress based on de-tensioning 17 hoop and 10 vertical tendons within the opening and de-tensioning an additional 9 hoops above and below the opening (total of 35 hoops de-tensioned) and 10 additional vertical tendons on either side of the opening (total of 30 verticals de-tensioned). Applicable after all lifts involving the SGs on the HTS are completed thru Modes 6 and 5 ascending (Refueling).

The containment shell was evaluated in Ref. 3 for Stage 1 prestress, SGR opening with concrete removed but the liner plate intact and loads applicable during Modes 5 and 6 descending. Ref. 3 also evaluated the containment shell for Stage 1 prestress, SGR opening with concrete and liner plate removed, reactor defueled, and applicable loads for moving the SGs in and out of the containment. Ref. 5 evaluated the containment shell for Stage 2 prestress during Modes 6 and 5 ascending, prior to restoration of the opening, during which time a LODHR accident is the controlling load case in combination with the applicable loads from the polar crane. These Ref. 3 and 5 evaluations show that containment shell stresses for Stage 1 and Stage 2 prestress and the applicable loadings during the SGR construction sequence are within code allowables. The containment shell with all detensioned tendons retentioned, SGR opening plugged with concrete, and the liner plate opening welded back was evaluated for design basis loading (Ref.4) to show that the containment concrete and liner plate stresses are within code allowable and the as repaired containment has approximately the same design margins as the as-found containment prior to the SGR construction.

Prestress	MODE	Concrete	Liner	Fuel	HTS	Polar Crn	DB Loads	Ref
Stage 1	5 and 6	Cut	Uncut	Old	No	Yes (*)	Yes (**)	3
Stage 1	No Mode	Cut	Cut	None	Yes	?	No	3
Stage 2	5 and 6	Cut	Restored	New	No	Yes	No	5
All	All	Plugged	Restored	New	No	Yes	Yes	4

(*) Dead weight of polar crane only
(**) Included design basis load combinations but substituted accident pressure and temperature resulting from a LODHR accident for LOCA pressure and temperature.

Restored Condition Analysis
The evaluations in Ref. 4 were performed using the following Finite Element Method (FEM) models:
FEM Model A:
- Original design basis prestress. Tendon forces are based on original lock-off stress (0.7xFu) and losses at end of outage and end of life (EOL).
- Access opening has not been created yet and is not in the model.
- E=2500 ksi for concrete (same as design basis calculations).
- Element forces and stresses analyzed at end of SGR outage and EOL

FEM Model B:
- Same as Model A except access opening is included in the model.
- Tendon forces are based on original lock-off stress (0.7xFu) and losses at end of outage and EOL.

- E=2500 ksi for concrete (same as design basis calculations)
- Reduced prestress in containment shell from de-tensioning 30 vertical and 35 hoop tendons is derived from tw main load cases:

B1. All vertical and hoop tendons included in load case (as in Model A).
B2. Only the 30 vertical and 35 hoop tendons included in second load case
B3. Final reduced prestress = B1-B2

- Dead load of wet concrete within the opening is included

FEM Model C:

- This model reflects re-tensioning of the tendons at the end of the SGR outage. Young's modulus (E=2500 ksi) is the same for the new patch concrete and existing concrete (reflects the stiffening of the concrete section within the opening by adding rebar (#11s at 11" c/c vertical and horizontal, both faces).
- Include 30 vertical tendons and 35 hoop tendons. Tendon forces are based on re-tensioning to 0.7 Fu minus tendon losses to end of life (EOL)

By adding the results from Models B and C (at end of SGR outage and EOL) and comparing to the design basis results for vertical and hoop prestress from Model A , it can be determined if the prestress in and around the access opening and hatch area can be restored to pre-outage levels. The calculation determined that the prestress levels in and around the opening after re-tensioning would be at levels approximately the same as those before the SGR outage for a majority of the elements. Pre-outage prestress levels could not be restored to certain elements in and around the access opening. For these elements detailed stress evaluations were performed that demonstrated they met all applicable design basis allowable stresses.

References:

1. Calculation S06-0002, Revision 1, Containment Shell Analysis for Steam Generator Replacement – Design Criteria.
2. Calculation S06-0004, Revision 0, Containment Shell Analysis for Steam Generator Replacement – Propertie of New Concrete for Access Opening and Number of Hoop and Vertical Tendons to be De-tensioned.
3. Calculation S06-0005, Revision 1, Containment Shell Analysis for Steam Generator Replacement – Shell Evaluation during Replacement Activities.
4. Calculation S06-0006, Revision 1, "Containment Shell Analysis for Steam Generator Replacement - Evaluatio of Restored Shell"
5. Calculation S09-0025, Revision 0, Containment Shell Analysis for Steam Generator Replacement – Evaluatio for Refueling prior to Restoration of Access Opening.

Misc Notes:

Response By: Don Dyksterhouse

Reviewed By:

Date Response Provided:

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 28

Individual Contacted: Garry Miller

Date Contacted: 10/22/2009

Requestor/Inspector: George Thomas

Category: Question

Request:
What were forces acting on SGR opening area and adjacent areas:
A) Prior to tendon de-tensioning and concrete removal?
B) After de-tensioning and tendon removal?
C) After detention and concrete removal?

By this question, the NRC is seeking information to understand the structural behavior and response of the Containment Wall under real loads (i.e., Dead + applicable Prestress Load) in and around the SGR construction opening area for the configurations prior to, during and following creation of the SGR construction opening. Provide the pertinent information in an easily reviewable form.

References:

Response Assigned to: Don Dyksterhouse

Date Due to Inspector: 10/26/2009

Response:

Refer to Calculation S09-0048 stress plots. These plots are for dead load + vertical and hoop prestress as requested by George Thomas.
References:
1. Calculation S09-0048, Revision 1, Stress Plots for SGR Containment Analysis

Misc Notes:

Response By: Don Dyksterhouse

Reviewed By:

Date Response Provided:

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 29

Individual Contacted: Garry Miller

Date Contacted: 10/22/2009

Requestor/Inspector: George Thomas

Category: Question

Request: How were the forces acting on the buttress analyzed when the horizontal tendons were released and the forces became unbalanced?

References:

Response Assigned to: Don Dyksterhouse

Date Due to Inspector: 10/26/2009

Response:

The unbalanced force(s) and moments from detensioning hoop tendons were evaluated for Buttress numbers 2, 3, 4 and 5 (Ref. 1, Pages 90 thru 95) and these forces and moments were applied to the appropriate nodes along the centerline of each buttress. Note that the forces and moments shown on pages 90 thru 95 of Ref. 1 are in the direction of the tensioned tendon. When these tendons are detensioned the signs reverse (Ref. 1, Attachment 2, load cases 6 and 10 and load combinations 102 and 104). The unbalanced forces are derived from the original lock-off stress – tendon losses at the time of the steam generator replacement outage (Ref. 2, Section 4.2.1.2).
References:
1. Calculation S06-0005, Revision 1, Containment Shell Analysis for SGR – Shell Evaluation During Replaceme Activities.
2. Calculation S06-0004, Revision 0, Containment Shell Analysis for SGR –Properties of new Concrete for Access Opening and Number of Hoop and Vertical Tendons to be Detensioned.

Misc Notes:

Response By: Don Dyksterhouse

Reviewed By:

Date Response Provided:

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 30

Individual Contacted: Garry Miller

Date Contacted: 10/22/2009

Requestor/Inspector: George Thomas

Category: 10/22/09

Request: Where is PII based, and provide a description of their credentials?
A) What is their root cause approach?

Provide PII's failure mode chart referred to in item (5) under the title, "Unique Qualification" of the response.

Identify the root cause failure analysis report for the MOX facility referred to in Item (6) under the title "Unique Qualification" of the response, if submitted to the NRC, or provide a copy of the report.

References:

Response Assigned to: Charles Williams

Date Due to Inspector: 10/26/2009

Response:

PII location, background, qualification and methods were reviewed with George Thomas. A hard copy of the response was provided and discussed on 10/28/09. Electronic copy of this file is in L:\Shared\2009 NRC SPECIAL INSPECTION TEAM Q-A\WILLIAMS Q-A\Request 30, Q24 Response Info - Williams

Misc Notes:

Response By: Charles Williams

Reviewed By:

Date Response Provided: 10/28/2009

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 31

Individual Contacted: Garry Miller

Date Contacted: 10/22/2009

Requestor/Inspector: George Thomas

Category: Question

Request: What are the various root causes and fault tree scenarios being considered?

Provide a list of root cause failure modes being considered under each of the 9 broad categories (i.e., break down each of the 9 categories into the approximately 79 failure modes being evaluated for CR3 containment).

References:

Response Assigned to: Charles Williams

Date Due to Inspector: 10/26/2009

Response:

A listing of potential causes categories and examples were reviewed with George Thomas. A hard copy response was provided and discussed with George Thomas on 10/28/09. Electronic copy of this file is in L:\Shared\2009 NRC SPECIAL INSPECTION TEAM Q-A\WILLIAMS Q-A\Request 31, Q25 Response Info - Williams

Misc Notes:

Response By: Charles Williams

Reviewed By:

Date Response Provided: 10/28/2009

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 32

Individual Contacted: Garry Miller

Date Contacted: 10/22/2009

Requestor/Inspector: George Thomas

Category: Question

Request: When and what will be the deliverable for the NRC to review, i.e., schedule for root cause, NDE, results of core bore samples, and design basis analysis?

Provide a response to part of the original question "What deliverables related to root cause analysis, extent of condition (NDE/core bores), design basis analysis and repair options would be provided to the NRC for review?"

Provide weekly updates to the schedule.

References:

Response Assigned to: Charles Williams

Date Due to Inspector: 10/26/2009

Response:

I asked George Thomas for a clarification of this request on 10/28/09. He said he would like a copy of the current schedule for activities for the Root Cause, Condition Assessment, Design Basis and Repair teams. A hard copy was provided on 10/29/09. Electronic copy of this file is in L:\Shared\2009 NRC SPECIAL INSPECTION TEAM Q-A\WILLIAMS Q-A\Request 32, Q26 Response Info - Williams

Misc Notes:

Response By: Charles Williams

Reviewed By:

Date Response Provided: 10/28/2009

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 33

Individual Contacted: Garry Miller

Date Contacted: 10/22/2009

Requestor/Inspector: George Thomas

Category: Information Request

Request: Provide copy of PGN's and PII's Root Cause Analysis procedure.

Include a statement on PII's root cause analysis procedure or if they would be working to PE's procedure.

References:

Response Assigned to: Charles Williams

Date Due to Inspector: 10/26/2009

Response:

A hard copy of the PGN root cause procedure CAP-NGGC-0205 was provided to George Thomas on 10/28/09. PII does not have a written procedure. The PII Root Cause process was discussed with George Thomas as part of response to Request 30. Electronic copy of this file is in L:\Shared\2009 NRC SPECIAL INSPECTION TEAM Q-A\WILLIAMS Q-A\Request 33, Q27 Response Info - Williams

Misc Notes:

Response By: Charles Williams

Reviewed By:

Date Response Provided: 10/28/2009

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 34

Individual Contacted: Garry Miller

Date Contacted: 10/22/2009

Requestor/Inspector: George Thomas

Category: Question

Request: Who is the contractor doing Design Basis Analysis? How does this relate to Root Cause analysis efforts?

References:

Response Assigned to: Don Dyksterhouse

Date Due to Inspector: 10/26/2009

Response:

The selected vendor to perform Design Basis Analysis is MPR Associates, Inc. Alexandria, Virginia. Computer Aided Engineering (CAE) Associates, Middlebury, Connecticut, is supporting MPR in the development of the 3-D finite element model.

The Root Cause Analysis team efforts are being supported by Performance Improvement International, PII, Oceanside, California and has independent technical capabilities to support the Root Cause Analysis team. The root cause(s) identified by the Root Cause Analysis team will be evaluated by the Design Basis Analysis team for impact on the design analysis and on the design basis.

Misc Notes:

Response By: Don Dyksterhouse

Reviewed By:

Date Response Provided:

Status: Closed

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 35

Individual Contacted: Garry Miller

Date Contacted: 10/22/2009

Requestor/Inspector: Robert Carrian

Category: Question

Request: Are you changing the design or licensing basis? Will a License Amendment or 10CFR50.59 type analyses be required?
A) Are you changing the ACI 318-63 code of record?

References:

Response Assigned to: Don Dyksterhouse

Date Due to Inspector: 10/26/2009

Response:

Misc Notes:

Response By:

Reviewed By:

Date Response Provided:

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number:	36		
Individual Contacted:	Garry Miller	**Date Contacted:**	10/22/2009
Requestor/Inspector:	Robert Carrian	**Category:**	Question

Request: Will there be a past-operability analysis completed?

References:

Response Assigned to:	Don Dyksterhouse	**Date Due to Inspector:**	10/26/2009

Response:

Misc Notes:

Response By:			
Reviewed By:		**Date Response Provided:**	
Status:	Open	**Date Closed:**	

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 37

Individual Contacted: Garry Miller

Date Contacted: 10/22/2009

Requestor/Inspector: George Thomas

Category: Question

Request: What type of analysis and codes (by names) is expected to be used in the design basis analysis?

References:

Response Assigned to: Don Dyksterhouse

Date Due to Inspector: 10/26/2009

Response:

The analysis computer code that will be used for the design basis analyses is ANSYS Version 11.0 SP1.

Misc Notes:

Response By: Don Dyksterhouse

Reviewed By:

Date Response Provided:

Status: Closed

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 38

Individual Contacted: Garry Miller

Date Contacted: 10/22/2009

Requestor/Inspector: Anthony Masters

Category: Information Request

Request: Provide procedures and drawings for tendon installation and stressing in original construction (containment walls and dome), and also after the 1976 dome repair.

References:

Response Assigned to: Don Dyksterhouse

Date Due to Inspector: 10/26/2009

Response:

Design drawings for both original design and post-dome repair are included in the CR3 Document Control System. Generally the drawing series that start with 421-001 is the original plant design drawings. The series that starts with 421-300 contains the dome repair drawings. Specifications for concrete and reinforcement are included in the shared drive. Drawing copies are included in the drive where available. Several of the 421-300 series of drawings are available only on aperture cards. A drawing list is in the Excel file.

L:\Shared\CR3 Containment\ROOT CAUSE ANALYSIS Files\(1) Concrete Design\Concrete Design Drawings

Misc Notes:

Response By: Glenn Pugh

Reviewed By: Charles Williams

Date Response Provided: 10/28/2009

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 39

Individual Contacted: Garry Miller

Date Contacted: 10/22/2009

Requestor/Inspector: Louis Lake

Category: Question

Request: Were there any changes to the dome made in 1976 (additional new anchors and/or radial rebars)?

References:

Response Assigned to: Don Dyksterhouse

Date Due to Inspector: 10/26/2009

Response:

The referenced report and drawings indicate radial #6 reinforcing bars were added and # 11 bars were used to replace damaged # 8 circumferential bars. There were approximately 1,850 radial #6 reinforcing bars added. If any #8 circumferential bars were damaged during concrete removal and the entire hoop was to be replaced, a #11 bar was used in place of the #8 bar. If any #8 circumferential bars were damaged during concrete removal and only a portion of the bar was exposed, a new # 8 bar was cadwelded to the embed bar.

References:

Final Report - Reactor Building Dome Delamination Report, December 10, 1976

SC-421-341, Reactor Building – Concrete Dome Repair Dome Reinforcement North Half – Top Reinforcement

SC-421-342, Reactor Building – Concrete Dome Repair Dome Reinforcement South Half – Top Reinforcement

SC-421-343, Reactor Building – Concrete Dome Repair Dome Reinforcement North Half – Bottom Reinforcemen

SC-421-344, Reactor Building – Concrete Dome Repair Dome Reinforcement South Half – Bottom Reinforcement

SC-421-345, Reactor Building – Concrete Dome Repair Dome Reinforcement Sections & Details

Misc Notes:

Response By: Don Dyksterhouse

Reviewed By:

Date Response Provided: 11/13/2009

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 40

Individual Contacted: Garry Miller

Date Contacted: 10/22/2009

Requestor/Inspector: Anthony Masters

Category: Question

Request: What is the cause of the low spot on the dome?
A) Email from Lese said it was same as previous inspections since 1976. Can this be confirmed from the final documentation and photographs in 1976?

References:

Response Assigned to: Don Dyksterhouse

Date Due to Inspector: 10/26/2009

Response:

The construction microfiche database contains a listing of microfiche for the dome repair project. The cards range in number from 2C01024 to 2C02089. A search of the database titles showed several microfiche cards (2C02064 and 2C02065) containing nonconformance's and corrective actions for the repair project. A review of these microfiche records did not reveal any information on a low spot. A check of the pour cards also did not mention a low spot or other problem.

However, to help in answering this question a conversation was held with Mr. Earnest Gallion about this repair. Mr. Gallion was an employee at the time of the dome repair. He reported that the concrete finishers used at the time of the repair where not as experienced as could be. There were several low spots and other imperfections that existed from the initial concrete pours. These are not considered detrimental to the qualification of the dome. Would also consider that these existing since the repair project.

This confirms statements by Mr. Joe Lese.

A copy of the Construction Microfiche log is included here: L:\Shared\CR3 Containment\ROOT CAUSE ANALYSIS Files\(2) Concrete Construction\Construction MicroFiche Index.pdf

Misc Notes: Related to question #1

Response By: Glenn Pugh

Reviewed By: Charles Williams

Date Response Provided: 10/28/2009

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 41

Individual Contacted: Garry Miller

Date Contacted: 10/22/2009

Requestor/Inspector: Anthony Masters

Category: Question

Request: NCR 360269 mentions SGR expected flexible tendon sheaths? What was the basis for them expecting a thin wall sheath?

References:

Response Assigned to: Charles Williams

Date Due to Inspector: 10/26/2009

Response:

Enclosed in this folder in response to the above question:
FW_ NRC Question - D Jopling Response.pdf

Misc Notes:

Response By: Rick Portmann

Reviewed By:

Date Response Provided: 11/2/2009

Status: Closed

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 42

Individual Contacted: Garry Miller

Date Contacted: 10/22/2009

Requestor/Inspector: Anthony Masters

Category: Question

Request: Were radial tension stresses due to the hoop tendons considered in the original design?

References:

Response Assigned to: Don Dyksterhouse

Date Due to Inspector: 10/26/2009

Response:

Cannot readily determine from the old Gilbert Calculations what the direct answer is to the request. It appears that the tendon design is based on limiting the concrete tensile stress to 212 psi. This limit bounds the tensile stresses in meridional, and hoop directions. See Book 2, Section 1.01.7, pages 1.01.7/6 and 1.01.7/7 for a brief memorandum outlining the critical loading of the cylindrical RB wall. The tendon pre-stress is designed to limit the tensile stresses in the concrete for the load combinations. However, it does not appear that the calculations considered the tensile stresses in the concrete outside the tendon's influence.

Copies of calculation pages are included at following drive location:

L:\Shared\2009 NRC SPECIAL INSPECTION TEAM Q-A\WILLIAMS Q-A\Request 42, Q36 Response Info- Pugh

Misc Notes: Consideration is on-going by George/Anthony

Response By: Glenn Pugh

Reviewed By: Charles Williams

Date Response Provided: 10/28/2009

Status: Closed

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 43

Individual Contacted: Dennis Herrin

Date Contacted: 11/2/2009

Requestor/Inspector: Anthony Masters

Category: Information Request

Request: Please provide Drawings: SC-400-007, 008, 009, and 015; and S-425-011 and S-425-012
Specifications: SP-5566, 5569, 5583, 5618, 5648, and 5909
Reports: VT-3C Report VT-07-106 and VT-3C Report VT-07-111
Calculations: S-07-0019 and S-07-0033

References:

Response Assigned to: Don Dyksterhouse

Date Due to Inspector: 11/2/2009

Response:

Enclosed in this folder in response to the above question: All requested information provided except for SP-5566, SP-5583. 11/3/09 Update. The last 2 spec's requested have been included in the file.

Misc Notes:

Response By: Rick Portmann

Reviewed By:

Date Response Provided:

Status: Closed

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 44

Individual Contacted: Dennis Herrin

Date Contacted: 11/3/2009

Requestor/Inspector: Anthony Masters

Category: Information Request

Request: In continuing evaluation of the IWL inspection and maintenance program:

If possible, I would like to speak with Mr. Bernard Komara and Mr. Marc LeBlanc as they were listed as the inspectors on two previous inspection reports that I have reviewed.

References:

Response Assigned to: Don Dyksterhouse

Date Due to Inspector:

Response:

Mr. Marc LeBlanc (NIC Contractor Inspector) was here in refuel 15 (2007) and to my knowledge is not here for refuel 16. Mr. Bernard Komara (NIC Contractor Inspector)has returned to CR3 for refuel 16 and is working for the site QC Organization. The Supervisor for Mr. Komara is Jeff Bennett.. Please contact Jeff (x-3323) for Bernie's availability.

Misc Notes: Evaluation of containment liner bulges still in progress.

Response By: Rick Portmann

Reviewed By:

Date Response Provided: 11/9/2009

Status: Closed

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 45

Individual Contacted: Dennis Herrin

Date Contacted: 11/3/2009

Requestor/Inspector: Anthony Masters

Category: Information Request

Request: In continuing evaluation of the IWL inspection and maintenance program:

SP-182, Rev. 16 (Dated 5/22/09) Reactor Building Structural Integrity Tendon Surveillance Program, indicates compliance with the 1992 addenda of the 1992 Edition of ASME Section XI, Subsection IWL, while the document titled ASME Section XI/ASME OM Code Program, Interval 4: Containment Inspection Program (2nd CISI) Revision 3 (Dated 5/6/09) indicates the 2001 Edition through the 2003 Addenda. Please clarify.

References:

Response Assigned to: Don Dyksterhouse

Date Due to Inspector:

Response:

The last performance of the Tendon Surveillance under SP-182 was in 2007. The ASME Section XI code of record during that time was the 1992 addenda of the 1992 Edition of ASME Section XI, Subsection IWL. In accordance with 10CFR50.55a, licensees are required to update their ISI Programs to meet the requirements of ASME Section XI once every 10 years or inspection interval. The 3rd inspection interval was completed on August 13, 2008 and the new interval (4th) began on August 14, 2008. For the 4th interval , the 2001 Edition through the 2003 Addenda is the code of record. The SP-182 will be revised to reflect the new code edition prior to its next required 5 year tendon surveillance.

Misc Notes:

Response By: Rick Portmann

Reviewed By:

Date Response Provided: 11/9/2009

Status: Closed

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 46

Individual Contacted: Dennis Herrin

Date Contacted: 11/3/2009

Requestor/Inspector: Anthony Masters

Category: Information Request

Request: In continuing evaluation of the IWL inspection and maintenance program:

SP-182, Rev. 16 (Dated 5/22/09) Reactor Building Structural Integrity Tendon Surveillance Program, has some concrete inspection activites associated with it as part of the tendon survelliances. Are the documented and reported in separate documentation or are the VT-1C and VT-3C examinations credited for this (i.e. VT-07-111 and VT-07-289)? If not, I would like to review the additional documentation.

References:

Response Assigned to: Don Dyksterhouse

Date Due to Inspector:

Response:

The visual examinations for the tendon surveillances are documented separately from the IWL concrete examinations. The last two tendon surveillances and the last two IWL examination reports have been supplied. See the Request #24, NRC SIT Question #18 folder for these examination reports.

Misc Notes:

Response By: Rick Portmann

Reviewed By:

Date Response Provided: 11/9/2009

Status: Closed

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 47

Individual Contacted: Dennis Herrin

Date Contacted: 11/3/2009

Requestor/Inspector: Anthony Masters

Category: Information Request

Request: In continuing evaluation of the IWL inspection and maintenance program:

SP-182, Rev. 16 (Dated 5/22/09) Reactor Building Structural Integrity Tendon Surveillance Program,, Section 3.5.3.1 specifies requirements for calibration for all measuring devices. I would like to review a sample of those records also.

References:

Response Assigned to: Don Dyksterhouse

Date Due to Inspector:

Response:

The tendon surveillance reports have the calibration records for the tendon testing equipment. The last two tendon surveillances reports have been supplied. See the Request #24, NRC SIT Question #18 folder for these examination reports.

Misc Notes:

Response By: Rick Portmann

Reviewed By:

Date Response Provided: 11/9/2009

Status: Closed

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 48

Individual Contacted: Dennis Herrin

Date Contacted: 11/3/2009

Requestor/Inspector: Anthony Masters

Category: Question

Request: In continuing evaluation of the IWL inspection and maintenance program:

SP-182, Rev. 16 (Dated 5/22/09) Reactor Building Structural Integrity Tendon Surveillance Program, Section 3.6 specifies acceptance criteria. Section 3.6.2 states that "abnormal conditions determined as the result of a visual inspection of the exterior concrete surface of the containment shall be recorded and documented, and investigated by Engineering for possible degradation of the structure."
Also, "Cracks found in concrete adjacent to the tendons (within 2 feet of the bearing plate) having widths greater than 0.010 inch shall be recorded and reported to Engineering for evaluation and resolution. Any crack widths greater than 0.050 inch shall be cause for investigation by Engineering to determine the cause and if there is any abnormal degradation of the structural integrity of the containment."
Photographs VT-07-289-8 and VT-07-289-11, which are associated with VT-1C Report VT-07-289, appear to show cracks within 2 feet of the bearing plate. Have these been documented and evaluated?

References:

Response Assigned to: Don Dyksterhouse

Date Due to Inspector:

Response:

The SP-182 criteria specified applies to the anchorage and bearing plate inspections performed for the tendon surveillances. The reports discussed are from the ASME Section XI IWL examinations performed. The recording and acceptance criteria may differ as the performance requirements come from separate requirements. These particular indications described on R15 IWL Report VT-07-289 were included in NCR 256010 for evaluation.

Misc Notes:

Response By: Rick Portmann

Reviewed By:

Date Response Provided: 11/9/2009

Status: Closed

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 49

Individual Contacted: Dennis Herrin

Date Contacted: 11/3/2009

Requestor/Inspector: Anthony Masters

Category: Question

Request: In continuing evaluation of the IWL inspection and maintenance program:

SP-182, Rev. 16 (Dated 5/22/09) Reactor Building Structural Integrity Tendon Surveillance Program, Section 3.7.1 recommends equipment for implementation of this inspection and 3.7.1.12 lists "optical comparators with 0.005 inch accuracy for measuring crack widths in concrete." Is this being used? VT-07-111 and VT-07-289 do not have it listed in the inspection equipment area on the reports. These reports list a 6"scale and measuring tape. Is 0.005 inch accuracy (or the 0.010 inch as acceptance criteria section 3.6.2 states) possible with these?

References:

Response Assigned to: Don Dyksterhouse

Date Due to Inspector:

Response:

The inspection reports referenced were performed as part of the IWL Examinations. The controlling procedures are NDEP-0620 and NAP-02. The SP-182 surveillance procedure referenced is used in conjunction with the Tendon examinations (not the IWL Examinations). The accuracy stated comes from the PSC Procedures and equipment utilized for the Tendon Examinations. An example of the certification record for one of the past surveillances can be found on pages 77-78 of the 6th surveillance report {WR 341602_ 6th-Surv.pdf}. Copies of the certifications have been enclosed in this file. This report can be found:
L:\Shared\2009 NRC SPECIAL INSPECTION TEAM Q-A\WILLIAMS Q-A\Request 24, Q18 Response Info-Portmann\IWL - Tendon Surveillance History

Misc Notes:

Response By: Rick Portmann

Reviewed By:

Date Response Provided: 11/12/2009

Status: Closed

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 50

Individual Contacted: Dennis Herrin

Date Contacted: 11/3/2009

Requestor/Inspector: Anthony Masters

Category: Question

Request: In continuing evaluation of the IWL inspection and maintenance program:

SP-182, Rev. 16 (Dated 5/22/09) Reactor Building Structural Integrity Tendon Surveillance Program, Section 3.7.2.11 states as an prerequisite to "verify that stressing jacks, pressure gauges, comparators, and all other measuring devices have been calibrated per Step 3.5.3.1..." Are the measuring devices used calibrated per Step. 3.5.3.1?

References:

Response Assigned to: Don Dyksterhouse

Date Due to Inspector:

Response:

Measuring devices are calibrated per Step 3.5.3.1 of SP-182. An example of the certification records for one of the past surveillances can be found on pages 58-82 in the 6th surveillance report {WR 341602_ 6th-Surv.pdf}. This report can be found:
L:\Shared\2009 NRC SPECIAL INSPECTION TEAM Q-A\WILLIAMS Q-A\Request 24, Q18 Response Info-Portmann\IWL - Tendon Surveillance History

Misc Notes:

Response By: Rick Portmann

Reviewed By:

Date Response Provided: 11/12/2009

Status: Closed

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 51

Individual Contacted: Dennis Herrin

Date Contacted: 11/3/2009

Requestor/Inspector: Anthony Masters

Category: Question

Request: In continuing evaluation of the IWL inspection and maintenance program:

SP-182, Rev. 16 (Dated 5/22/09) Reactor Building Structural Integrity Tendon Surveillance Program, Enclosure 1 lists tendons in the 5th and 7th surveillance as 46H21, 46H28, etc...; however, Enclosure 11 indicates that they are numbered as 64H21, 64H28, etc... I believe these are in fact the same tendons, but should the numbers not be consistent?

References:

Response Assigned to: Don Dyksterhouse

Date Due to Inspector:

Response:

These are the same tendons. The first two digits of the horizontal tendon identification refer to the tendon series on the containment buttresses it spans (ie. Between buttresses 4 and 6 [46Hxx] is the same as between buttresses 6 and 4[64Hxx]). Over the years CR3 has not been consistent in the use of one versus the other. A spreadsheet has been provided showing the tendon identifications used over prior surveillances. [Note: the spreadsheet is not a controlled document, just an aid for review of previous surveillance documentation.]

Enclosed in the Request# 51 folder:
Spreadsheet: Tendon Identification History (#51).xls

Misc Notes:

Response By: Rick Portmann

Reviewed By:

Date Response Provided: 11/9/2009

Status: Closed

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 52

Individual Contacted: Dennis Herrin **Date Contacted:** 11/3/2009

Requestor/Inspector: Anthony Masters **Category:** Question

Request: In continuing evaluation of the IWL inspection and maintenance program:

SP-182, Rev. 16 (Dated 5/22/09) Reactor Building Structural Integrity Tendon Surveillance Program, Enclosure 5 is titled "Reduced Force Dome Tendons" and lists 18 tendons. What is meant by this term "reduced force"? When, how, and why did they become reduced? D 125 is shown on this list and is also listed as tested in the 3rd Surveillance. Please clarify.

References:

Response Assigned to: Don Dyksterhouse **Date Due to Inspector:**

Response:

Following the investigation and evaluation of the 1976 Dome delamination event the dome tendons were re-stressed to predetermined values, of which approximately every 8th tendon was stressed at a value much, much lower than the remaining tendons (Approx. 646 KIPS vs. 1635 KIPS). These tendons are exempt from tendon lift off, and wire removal testing.
During the random selection process if one of these exempt tendons (or in general a tendon that is inaccessible or due to interferences cannot be safely tested per the IWL code) happens to be selected for testing, then a substitute tendon located as close as possible to the exempt tendon gets selected for examination and testing. Although still classified as exempt, the original exempt tendon is still subject to the examination tendon anchorage, free water and corrosion protection medium examination requirements if possible.
A review of the 3rd Surveillance tendon lift-off data shows that tendon D123 was tested. No test data was found for D125.

Misc Notes:

Response By: Rick Portmann

Reviewed By: **Date Response Provided:** 11/18/2009

Status: Closed **Date Closed:**

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 53

Individual Contacted: Dennis Herrin

Date Contacted: 11/4/2009

Requestor/Inspector: Anthony Masters

Category: Question

Request: In continuing evaluation of the IWL inspection and maintenance program:

SP-182, Rev. 16 (Dated 5/22/09) Reactor Building Structural Integrity Tendon Surveillance Program, Enclosure 11 lists original lift-off values. Are the values for the dome in this listing before or after the repair?

References:

Response Assigned to: Don Dyksterhouse

Date Due to Inspector:

Response:

The values listed in SP-182, Enclosure 11 are following the 1976 delamination event repair of the Dome.

Misc Notes:

Response By: Rick Portmann

Reviewed By:

Date Response Provided: 11/9/2009

Status: Closed

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 54

Individual Contacted: Dennis Herrin

Date Contacted: 11/4/2009

Requestor/Inspector: Anthony Masters

Category: Information Request

Request: In continuing evaluation of the IWL inspection and maintenance program:

I have reviewed some inspection reports for the IWL inspections for the shell, but would like to review some reports and evaluations for inspections on the dome.

References:

Response Assigned to: Don Dyksterhouse

Date Due to Inspector:

Response:

The last two IWL examination reports for 2001 (R12 and 2007 (R15) have been supplied and include examination of the dome. See the Request #24, NRC SIT Question #18 folder for these examination reports.

Misc Notes:

Response By: Rick Portmann

Reviewed By:

Date Response Provided: 11/9/2009

Status: Closed

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 55

Individual Contacted: Dennis Herrin **Date Contacted:** 11/4/2009

Requestor/Inspector: Anthony Masters **Category:** Question

Request: In continuing evaluation of the IWL inspection and maintenance program:

VT-07-111 and VT-07-289 documents some cracks and spalls and measured depths. How were the depths obtained for the cracks and spalls?

References:

Response Assigned to: Don Dyksterhouse **Date Due to Inspector:**

Response:

Direct Visual Examination was conducted on RBCN-0015 during R15 using the suspended work platform, a man lift (around the equipment hatch), and a step ladder (lower elevations not accessible by suspended work platform or man lift).
Using the procedure and criteria provided in the Engineering letter as threshold for recording, the VT-3C was performed and any areas of distress identified were further evaluated during a VT-1C. The VT-3C also considered areas of distress not previously identified, as well as changes to previously identified areas of distress During the VT-1C, previously existing areas of distress were compared with previous data and further characterized to document changes to previous data recorded. Areas of distress not previously identified were characterized and recorded. In all cases, size and depth were dimensioned and recorded with a tape measure and 6" scale. A short length of 3/32" bare wire welding rod was used for tight spots where the 6" scale would not fit. Technique used with the bare wire was to insert into the opening, and measure maximum depth against the 6" scale.

Misc Notes:

Response By: Rick Portmann

Reviewed By: **Date Response Provided:** 11/18/2009

Status: Closed **Date Closed:**

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 56

Individual Contacted: Dennis Herrin

Date Contacted: 11/4/2009

Requestor/Inspector: Anthony Masters

Category: Question

Request: In continuing evaluation of the IWL inspection and maintenance program:

VT-07-111 and 289, Item #11 indicates that spalls were due to some embedded cables near boxes (shown in photographs VT-07-289-6 and VT-07-289-15). What were these cables?

References:

Response Assigned to: Don Dyksterhouse

Date Due to Inspector:

Response:

It is believed that these cables and boxes are abandoned remnants from the testing equipment utilized during the original Structural Integrity Test in 1976. (stress & strain gages etc.)

Misc Notes:

Response By: Rick Portmann

Reviewed By:

Date Response Provided: 11/9/2009

Status: Closed

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 57

Individual Contacted: Dennis Herrin

Date Contacted: 11/4/2009

Requestor/Inspector: Anthony Masters

Category: Question

Request: In continuing evaluation of the IWL inspection and maintenance program:

The names and dates on theVT-1C and VT-3C reports are identical. Are both inspections/reports done on the same day by the same staff?

References:

Response Assigned to: Don Dyksterhouse

Date Due to Inspector:

Response:

Yes, the VT examiners know that certain indications found during a VT-3 examination require an additional, closer VT-1 examination and may elect to perform both examinations in series since they are already at the area.

Misc Notes:

Response By:

Reviewed By:

Date Response Provided:

Status: Closed

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 58

Individual Contacted: Dennis Herrin

Date Contacted: 11/4/2009

Requestor/Inspector: Anthony Masters

Category: Question

Request: In continuing evaluation of the IWL inspection and maintenance program:

FSAR, Section 5.2, Section 5.2.5.2.1.1.h.5 states: 5. The surveillance was performed 1, 3, and 5 years after the initial containment structural integrity test and is performed every 5 years thereafter. A report of each inspection will be recorded and significant deterioration or abnormal behavior reported to the Commission.
Are significant deterioration or abnormal behaviors being reported to the Commission?

References:

Response Assigned to: Don Dyksterhouse

Date Due to Inspector:

Response:

Yes - Significant deterioration or abnormal behaviors are being reported to the Commission. SP-182 (Para's 5.3.2 and 5.3.4) and the Improved Technical Specifications (5.7.2 Special Reports) describe the reporting requirements.

Misc Notes:

Response By: Rick Portmann

Reviewed By:

Date Response Provided: 11/12/2009

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 59

Individual Contacted: Dennis Herrin

Date Contacted: 11/4/2009

Requestor/Inspector: Anthony Masters

Category: Information Request

Request: In continuing evaluation of the IWL inspection and maintenance program:

I would like to review SP-180 and understand the basis surrounding the use and discontinuance for inspections of the dome repairs.

References:

Response Assigned to: Don Dyksterhouse

Date Due to Inspector:

Response:

A copy of SP-180 for inspection of the dome was provided to George Thomas on November 18, 2009. The document was obtained from microfiche and is not available electronically. Also note that the procedure was developed and implemented prior to the development of the IWL program.

Misc Notes:

Response By:

Reviewed By:

Date Response Provided:

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 60

Individual Contacted: Dennis Herrin

Date Contacted: 11/4/2009

Requestor/Inspector: Louis Lake

Category: Question

Request: What are the repair options being considered as a fix to the CR3 containment delamination issue?

References:

Response Assigned to: Sammy Radford

Date Due to Inspector: 11/6/2009

Response:

There were two options that had being considered.

1. Remove the delaminated concrete that is between is between Buttress #3 and Buttress #4 and install addition rebar ties. The wall will be reformed and replaced with new concrete. This was the method used to repair the delaminated dome section during construction and the method we will be using .
2. The next option we considered was to install anchors into the solid concrete portion of the wall on a spacing to be determined and anchor the delaminated section and solid section together. Then we will be pressuring grouting the delamination using a cementitious grout and epoxy grout to bond the two layer.We will be using some NDT to ensure we have filled all the voids between the two layers. This option was eliminated due to problems identified with the use of the grout with the potential of the debris blocking flow paths of the grout and size of some of the crack areas.

Misc Notes:

Response By: Sammy Radford

Reviewed By:

Date Response Provided: 11/18/2009

Status: Closed

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 61

Individual Contacted: Dennis Herrin

Date Contacted: 11/4/2009

Requestor/Inspector: Louis Lake

Category: Question

Request: What post modification testing of the CR3 containment is being planned to be performed following repair of the delaminated condition in order to demonstrate structural and leak-tight integrity?

References:

Response Assigned to: Sammy Radford

Date Due to Inspector: 11/6/2009

Response:

We are looking at the requirements for post mod testing. At the present time we plan to use the ILRT as the post mod testing.

Misc Notes:

Response By: Sammy Radford

Reviewed By:

Date Response Provided: 11/18/2009

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 62

Individual Contacted: Charles Williams

Date Contacted: 11/18/2009

Requestor/Inspector: George Thomas

Category: Information Request

Request: Provide strain gage data and map.

References:

Response Assigned to: Paul Fagan

Date Due to Inspector: 11/18/2009

Response:

Strain gage and displacement data provided on 11/18/09. Electronic copies available on L:\Shared\2009 NRC SPECIAL INSPECTION TEAM Q-A\FAGAN Q-A\Request 62 - Worthington - Williams

Misc Notes:

Response By: Worthington

Reviewed By: Charles Williams

Date Response Provided: 11/18/2009

Status: Closed

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 63

Individual Contacted: Garry Miller

Date Contacted: 12/2/2009

Requestor/Inspector: Anthony Masters

Category:

Request: Provide survey data results for the dome [repeated survey surveilance test], internal diameter of containment and survey data results for external buttresses.

References:

Response Assigned to: Paul Fagan

Date Due to Inspector:

Response:

Misc Notes:

Response By:

Reviewed By:

Date Response Provided:

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 64

Individual Contacted: Garry Miller

Date Contacted: 12/2/2009

Requestor/Inspector: Dan Naus / George Thomas

Category:

Request: Provide evaluation of crack identified in AR 368389 [core number 54 below the equipment hatch].

References:

Response Assigned to: Paul Fagan

Date Due to Inspector:

Response:

Misc Notes:

Response By:

Reviewed By:

Date Response Provided:

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 65

Individual Contacted: Garry Miller

Date Contacted: 12/2/2009

Requestor/Inspector: Robert Carrian

Category:

Request: Provide credentials of MPR Associates and CAE , specifically with regard to concrete containment structural analysis and design for nuclear plants.

References:

Response Assigned to: Don Dykstehouse

Date Due to Inspector:

Response:

The following data are excerpts from the MPR Associates response to a request for proposal RFP JO09-011. The responses are listed if the experience involved reinforced concrete analysis at a nuclear power plant if either MPR Associates or CAE were involved in the projects listed.

1. Development of the 3-D model for Three Mile Island nuclear power plant.
2. Original analysis of Crystal River containment dome delamination report.
3. Structural analysis of the reinforced concrete Fuel Handling Building at Salem Nuclear Plant.
4. Development of models for structural analysis of concrete containment buildings at Turkey Point and Oconee nuclear power plant.

MPR Associates has supported the nuclear industry since 1964.
CAE has supported the nuclear industry since 1993.

Misc Notes:

Response By:

Reviewed By:

Date Response Provided:

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 66

Individual Contacted: Garry Miller

Date Contacted: 12/2/2009

Requestor/Inspector: George Thomas

Category:

Request: Please confirm that the condition assessment, design basis analysis, root cause analysis, and repair option analysis efforts, currently ongoing for CR3, account for the following: SGR construction sequence (initial tendon detensioning, concrete removal, additional tendon detensioning, concrete placement, repair, tendon retensioning) loading and stiffness, based on the extent of condition of the affected areas, and is properly considered to account for the stress redistribution in the containment wall within the opening and its adjacent areas.

References:

Response Assigned to: Don Dyksterhouse

Date Due to Inspector:

Response:

Misc Notes:

Response By:

Reviewed By:

Date Response Provided:

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 67

Individual Contacted: Garry Miller

Date Contacted: 12/2/2009

Requestor/Inspector: George Thomas

Category:

Request: Refer to Slide #59 of the 11/20 public meeting presentation. This is with regard to how the liner is modeled for the Design Basis Analysis. Based on your current design basis in the FSAR and Containment Design Basis document 1/1, the liner serves as a leak-tight membrane during operating and accident conditions, and not as a structural element resisting design basis loads. However, in your current FEA model developed for the delamination issue, the liner seems to be included as a structural load-carrying member.

Explain and justify how the way the liner is modeled in the ANSYS model are consistent with your current design basis?

How will the liner be evaluated against design basis acceptance criteria?

How will you evaluate the effects on the liner during detensioning, repair, and retensioning?

References:

Response Assigned to: Don Dyksterhouse

Date Due to Inspector:

Response:

Misc Notes:

Response By:

Reviewed By:

Date Response Provided:

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 68

Individual Contacted: Garry Miller

Date Contacted: 12/2/2009

Requestor/Inspector: George Thomas

Category:

Request: Refer to Slide #75 of the 11/20 public meeting presentation. Slide states: "Run comparison to original design building elastic design results."

Explain how you plan to evaluate your analysis results for design basis loads and load combinations against acceptance criteria in accordance with the code of record, i.e., ACI 318-63, in the FSAR. How would you process your analysis results to perform code checks for stresses, strains, displacements or other applicable design basis acceptance criteria for concrete, rebar, liner and prestressing tendons? How is reinforcement being accounted for in your design basis evaluation?

The slide only inidicates evaluation for controlling factored load combinations. Are there not service or other load combinations in the design basis with a different set of acceptance criteria that needs to be documented? How would your calculation document the design basis of the modified containment following repair of the delaminated condition?

How will stresses in the concrete and rebar be determined from the ANSYS analysis? Provide your approach to performing the finite element analysis and design checks in support of the Design Basis Analysis considering the various interim configurations associated with the creation and restoration SGR construction opening, the delaminated condition and the associated repair?

References:

Response Assigned to: Don Dyksterhouse

Date Due to Inspector:

Response:

Misc Notes:

Response By:

Reviewed By:

Date Response Provided:

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 69

Individual Contacted: Garry Miller

Date Contacted: 12/2/2009

Requestor/Inspector: George Thomas

Category:

Request: Refer to Slide #74 - "Planned Analysis Steps" of the 11/20 public meeting presentation. Footnote (1) against "Delamination states "Analysis will consider time of delamination and specific concrete properties."

Since the final root cause analysis results will not be known until later, do you plan on running two different cases with regard to timing of delamination at this time? Specifically, with regard to making a decision on the number of tendons that will be required to be detensioned prior to repair and retensioned following repair.

Regarding the bullet that states: "SAVE path dependent model for starting point to Run 5 controlling design cases." As you go through the planned analysis steps, explain how your analysis model or ANSYS software is capable of starting the next analysis step using the deformed configuration of the previous step as the initial conditions for the next analysis step?

Are you planning to use the same concrete mix design as for the SGR construction opening in implementing repair of the delaminated area? How are properties of the new concrete being incorporated into your analysis?

References:

Response Assigned to: Don Dyksterhouse

Date Due to Inspector:

Response:

Misc Notes:

Response By:

Reviewed By:

Date Response Provided:

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 70

Individual Contacted: Garry Miller

Date Contacted: 12/2/2009

Requestor/Inspector: George Thomas

Category:

Request: With reference to 11/20 public meeting presentation, Slide 65 - shows approximation in Equipment Hatch modeling; and Slide 34 - shows that the delaminated conditions extends to above the EQ hatch area; slide 35 shows hoop tendons that wrap around EQ hatch. Further, there are also removed vertical tendons that wrap around EQ hatch. If your detensioning/retensioning scheme involves tendon elements that influence forces in the EQ hatch area, how do you plan to address it in your design basis model? Describe any plans to refine your model around the EQ hatch area.

References:

Response Assigned to: Don Dyksterhouse

Date Due to Inspector:

Response:

Misc Notes:

Response By:

Reviewed By:

Date Response Provided:

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:09 A

Request Number: 71

Individual Contacted: Garry Miller

Date Contacted: 12/2/2009

Requestor/Inspector: George Thomas

Category:

Request: Refer to slide 58 of the 11/20 public meeting presentation - describes a 180 degree symmetric model.

Please confirm whether, for your analysis, the explicitly developed 180 degree model is extruded to 360 degrees for your runs or not.

Please confirm if there are any unsymmetric containment features that may not be adequately represented in a symmetric model but may affect the response of the affected area.

References:

Response Assigned to: Don Dyksterhouse

Date Due to Inspector:

Response:

Misc Notes:

Response By:

Reviewed By:

Date Response Provided:

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

Request Number: 72

Individual Contacted: Garry Miller

Date Contacted: 12/2/2009

Requestor/Inspector: George Thomas

Category:

Request: Refer to Slide 74 (and 76) of the 11/20 public meeting presentation. The first three planned analysis steps are: (i) Dead Load + Tendons; (ii) Remove Hoop + Vertical Tendons in SGR opening; and (iii) Remove SGR opening. Provide stress and deformation plots for the area in and around the vicinity of the SGR opening (between Buttresses 3 & 4 from above the EQ hatch to below the ring girder) for each of the above configurations fo rthe Dead + Prestress load combination.

References:

Response Assigned to: Don Dyksterhouse

Date Due to Inspector:

Response:

Misc Notes:

Response By:

Reviewed By:

Date Response Provided:

Status: Open

Date Closed:

20-Jan-10 11:21:09 A

Request Number: 73

Individual Contacted: Garry Miller

Date Contacted: 12/2/2009

Requestor/Inspector: George Thomas

Category:

Request: Refer to Slide 81 of the 11/20 public meeting presentation with regard to Post Repair Testing.

Provide the name and credentials /qualifications of the designated Responsible Engineer, in accordance with ASME Section XI, Subsection IWL, for repair/replacement of the CR3 containment structure related to the SGR project and the Containment Delamination project. Provide the date the individual was designated as the Responsible Engineer.

Second bullet on the slide states: "Concrete exterior will be visually examined prior to pressurization and following depressurization." Third bullet states: "Evaluating other additional instrumentation based on the final repair that is implemented, and as driven by: root cause analysis." For the major containment repair/replacement activity involved at CR3, describe how the post-repair system pressure testing would meet the requirements of IWL-5000, and specifically provide verification of the containment structural integrity under accident pressure and corresponding structural behavior as predicted by the design basis analysis.

The response is incomplete/inadequate as indicated below. Provide a complete response to address these concerns. Also, confirm whether or not the design basis accident pressure and/or the containment design pressure was affected by the extended power uprate being implemented during/following the RF16 Outage.

1. The information provided with regard to qualifications and credentials of the designated IWL Responsible Engineer for the SGR Project, does not indicate nor provide evidence of basic qualifications required by IWL-2320 for an individual to be designated the Responsible Engineer. Provide evidence (such as PE registration) and information of required qualifications stated in the first paragraph of IWL-2320 (ASME Section IX, 2001 Edition with 2003 Addenda) for the designated Responsible Engineer. Also, include a resume with educational qualifications and experience of the individual.

2. There was no response provided with regard to the designated Responsible Engineer for the Containment Delamination Project, the person's qualifications and credentials and date of designation. Provide the requested information for the designated Responsible Engineer for the Containment Delamination Project.

3. For the major repair of the extensively delaminated condition of the CR-3 containment involving new design/construction features, the response provided with regard to examinations during the containment pressure test does not meet the requirements and intent of IWL-5250. Just performing visual examination of the repaired concrete surfaces prior/during/after the test, without performing structural response measurements and additional examinations, will not demonstrate the quality and adequacy of the repair (i.e. the repaired containment has not delaminated again) nor will it provide a verification of structural response/behavior as expected and predicted by the design basis analysis. Further, there will not be data available to compare to a previous benchmark test (such as original SIT) to fully demonstrate structural integrity of the repaired containment.

References:

2009 NRC Special Inspection - RB Concrete Separation

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Response Assigned to: Charles Williams **Date Due to Inspector:**

Response:

(1)Provide the name and credentials /qualifications of the designated Responsible Engineer, in accordance with ASME Section XI, Subsection IWL, for repair/replacement of the CR3 containment structure related to the SGR project and the Containment Delamination project.
(2)Provide the date the individual was designated as the Responsible Engineer.

Second bullet on the slide states: "Concrete exterior will be visually examined prior to pressurization and following depressurization." Third bullet states: "Evaluating other additional instrumentation based on the final repair that is implemented, and as driven by: root cause analysis." For the major containment repair/replacement activity involved at CR3, (3)describe how the post-repair system pressure testing would meet the requirements of IWL-5000, and specifically provide verification of the containment structural integrity under accident pressure and corresponding structural behavior as predicted by the design basis analysis.
Enclosed in this folder in response to the above question:
(1) The designated Responsible Engineer for the SGR Opening Project is John Holiday. Enclosed in this response folder is a copy of John's completed Progress Energy COMMON ESP TRAINING GUIDE (ESG0090N) - CONTAINMENT INSPECTION RESPONSIBLE ENGINEER TRAINING GUIDE. [See enclosed pdf: ESG0076N-Holliday.pdf]

(2) The effective date of John's designation as the SGR RE was the date on his training guide completion approval 7-14-09.
(3) See the excerpt below from the "Containment IWL Repair Plan" contained in the SGR Opening EC 63016, attachment Z58R26 for the IWL-5000 Pressure Test information. It is anticipated that this information will be moved from EC 63016 (SG Replacement Opening Project) to EC 75221 (Containment Repair Project) .
15.0 PRESSURE TESTING AND PRESERVICE EXAMINATION

15.1 A reactor building pressure test will be performed after de-tensioned and replaced tendons have been re-tensioned. The test will be conducted as specified in EC 63016 (Reference 19.28), which incorporates the applicable requirements of ASME Section XI, Article IWL-5000
(Reference 19.2). The IWL Responsible Engineer will authorize performance of the test.

15.2 The pressure test will be conducted at the design basis accident pressure, Pa = 54.2 psig (calculated peak containment DBA pressure), as specified in Reference 19.2, prior to returning reactor building to service.

15.3 The surface of all containment concrete placed during repair/replacement activities will be visually examined in accordance with the requirements developed in EC 63016 (Reference 19.28), which incorporates the requirements of ASME Section XI, Article IWL-5250 (Reference 19.2). The examinations will be done (1) prior to the start of pressurization, (2) at test pressure, and (3) following completion of depressurization. In addition, concrete surrounding the bearing plates of all new and detensioned / re-tensioned tendons will be examined per ASME Section XI, Subsection IWL Section 2524.1(Reference 19.2) following the completion of depressurization. The preservice examination required by IWL-2230 will be conducted in accordance with procedure EGR-NGGC-0015 (Reference 19.23) following completion of depressurization2

2 A single examination can satisfy the requirements of both IWL-5250 and IWL-2230..

If the results of the post-test and preservice examinations do not meet the acceptance standards developed by the IWL Responsible Engineer in accordance with IWL-3110, corrective action will be taken as required by IWL-3113 and IWL-5260.

Misc Notes:

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Response By:			
Reviewed By:		**Date Response Provided:**	
Status:	Open	**Date Closed:**	

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:10 A

Request Number: 74

Individual Contacted: Garry Miller

Date Contacted: 12/2/2009

Requestor/Inspector: Anthony Masters

Category:

Request: Refer to photos on Slide 14 of the 11/20 public meeting presentation.

Explain the gap between the liner and the concrete? Have you verified how far it goes?

It is our understanding that there is bulging in the containment liner with air voiding between liner and concrete at several locations all around between approximate EL 180 and 225 ft; and that it was dispositioned as construction/fabrication errors that existed prior to concrete pour. If this existed prior to original concrete pour, explain how there is voiding between the liner and concrete. What was the acceptance criteria used to evaluate this? Provide the engineering evaluation for accepting the bulging as-is and explain how this evaluation is consistent with CR3 current design basis.

References:

Response Assigned to: Paul Fagan

Date Due to Inspector:

Response:

Misc Notes:

Response By:

Reviewed By:

Date Response Provided:

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:10 A

Request Number: 75

Individual Contacted: Garry Miller

Date Contacted: 12/2/2009

Requestor/Inspector: George Thomas

Category:

Request: Describe your plans [PII] for finite element simulation of the delamination to confirm the root cause(s)?

References:

Response Assigned to: Charles Willaims

Date Due to Inspector:

Response:

Multiple finite element analyses are being performed to confirm the root cause. These include the use of the computer code Merlin to perform a 2-D simulation of a vertical cross section of the wall, and Abaqus to perform 3-D simulations. The models include the various parameters considered in the root cause analysis, including concrete strength, creep, thermal gradients, and fracture energy. This subject was also discussed between PII and the NRC SIT on 1/7/10

Misc Notes:

Response By: Craig Miller

Reviewed By:

Date Response Provided: 1/8/2010

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:10 A

Request Number: 76

Individual Contacted: Garry Miller

Date Contacted: 12/2/2009

Requestor/Inspector: Robert Carrian

Category:

Request: Refer to the Refuting evidence for failure mode 2.8 "Inadequate Support of Tendons during Pouring." There are photographs of the SGR opening area that show that the as-found hoop tendon sheathing are all not centered on a vertical line.

What was the design location of the tendon sheathing?

Was the installation of the tendon sheathing out-of-tolerance in the as-found condition (Tendon installation specification must have had a tolerance for tendon sheathing installation)?

References:

Response Assigned to: Charles Williams

Date Due to Inspector:

Response:

Misc Notes:

Response By:

Reviewed By:

Date Response Provided:

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:10 A

Request Number: 77

Individual Contacted: Garry Miller

Date Contacted: 12/2/2009

Requestor/Inspector: George Thomas

Category:

Request: Confirm whether "the lack of bond between the smooth tendon sheathing and the concrete" is included as a possible failure mode in the root cause investigation.

References:

Response Assigned to: Charles Williams

Date Due to Inspector:

Response:

The lack of bond between the smooth tendon sheathing and the concrete is not identified as a specific failure mode, but it is included as a condition in failure mode 6.4, "Added Stress from Differences Between Rigid and Flexible Sleeves". The finite element analyses also recognize this condition, and take no credit for any tensile load carrying strength at the sleeve-to-concrete interface.

Misc Notes:

Response By: Craig Miller

Reviewed By:

Date Response Provided: 1/8/2010

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:10 A

Request Number: 78

Individual Contacted: Garry Miller

Date Contacted: 12/2/2009

Requestor/Inspector: Anthony Masters

Category:

Request: Considering the delamination and subsequent repair of the CR3 dome during original construction, what non-destructive examination, core boring and/or other appropriate testing was extended to the dome during the current investigation of the containment wall delamination issue to confirm that the 1976 dome repairs remaind good? Provide results of the examinations performed on the dome. Also, explain how the results for these examinations would help address/resolve the concerns raised in the previous Requests #1 and #40 with regard to the low spot or depressed area on the dome.

References:

Response Assigned to: Paul Fagan

Date Due to Inspector:

Response:

Misc Notes:

Response By:

Reviewed By:

Date Response Provided:

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:10 A

Request Number: 79

Individual Contacted: Garry Miller

Date Contacted: 12/2/2009

Requestor/Inspector: Dan Naus / George Thomas

Category:

Request: Explain how your condition assessment performed in accordance with Procedure PT-407T (NDE testing, core bore sampling, boroscopic examination etc.) provides a reasonable assurance of a comprehensive and accurate determination of the extent of delaminated condition of the containment.

References:

Response Assigned to: Paul Fagan

Date Due to Inspector:

Response:

Misc Notes:

Response By:

Reviewed By:

Date Response Provided:

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:10 A

Request Number: 80

Individual Contacted: Garry Miller

Date Contacted: 12/2/2009

Requestor/Inspector: Dan Naus

Category:

Request: Provide information of the total number of core samples that were sent for petrographic examination for the containment delamination issue. Indicate the labs to which each sample was sent. How did you determine/ensure consistency of the examination and results between the labs? How did you establish that a reasonable number os samples were sent for petrographic examination?

References:

Response Assigned to: Charles Williams

Date Due to Inspector:

Response:

There have been a total of seven core samples that received some form of petrographic examination. The core identification numbers and test labs are:

1. Core 5 MACTEC (1/2 of Core 5 tested at MACTEC)
2. Core 5 CTL (1/2 of Core 5 tested at CTL)
3. Core 6 Photometrics
4. Core 7 MACTEC
5. Core 18 Photometrics
6. Core 19 Photometrics
7. Core 87 MACTEC

MACTEC and CTL performed petrographic examinations in accordance with ASTM C 856. Photometrics evaluated similar conditions and attributes as those evaluated under the ASTM standard, but used tools and techniques more frequently used in material science, e.g., scanning electron microscope (SEM) and micro-hardness examinations that are more thorough. Progress Energy did not provide any directions that would influence how a particular test or examination was performed, other than convey the main objective of the particular examination (i.e., determine age of the break). The purpose of using multiple labs was to obtain independent results; therefore there was no explicit effort to ensure consistency in the examination techniques or results.

Note that not all samples were examined for fracture age determination. For example, Core 87 was taken from the containment dome (area repaired in 1976). The purpose of the petrographic examination on this sample was to compare the aggregate from the dome to the aggregate from the wall.

The number of samples that received petrographic examinations is believed to be adequate based on the consistent results obtained from the various labs and the diversity of the sample locations.

Misc Notes:

Response By: Craig Miller

Reviewed By:

Date Response Provided: 12/7/2009

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:10 A

Request Number: 81

Individual Contacted: Garry Miller

Date Contacted: 12/2/2009

Requestor/Inspector: Dan Naus

Category:

Request: According to MacTec petrographic report dated November 11, 2009, limited observations were to be performed on sample 21270A (Core #2) which was used as a control sample. However, there is no discussion of how it was used. Also, it does not appear that any results from these observations were reported. What examinations were performed on this sample, what were the results and where is it documented?

References:

Response Assigned to: Charles Williams

Date Due to Inspector:

Response:

Per discussion with the MACTEC petrographer, the lab did do some limited observations on Core 2, but I did not see anything particularly useful in their analysis. It was originally intended to use the fracture surface of Core 2 as the "control sample" since the fracture was made during the core removal process. However, the lab created a fresh fracture surface in a portion of Core 5 instead for the "fresh vs. existing" comparison. Therefore, Core 2 was essentially unused in the examination.

Misc Notes:

Response By: Craig Miller

Reviewed By:

Date Response Provided: 12/7/2009

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:10 A

Request Number: 82

Individual Contacted: Garry Miller

Date Contacted: 12/2/2009

Requestor/Inspector: Dan Naus

Category:

Request: According to MacTec petrographic report dated November 11, 2009 from MacTec, one-half of sample 21270 (Core #2) was sent to CTL for petrographic examination. In the CTL report dated November 2, 2009 there does not appear to be any reference to this sample. Were petrographic examinations performed on this sample, and if so, what are the results and where is it documented?

References:

Response Assigned to: Charles Williams

Date Due to Inspector:

Response:

The MACTEC report does say that half of core #2 was sent to CTL, but it does not specify what tests are to be performed on it. CTL has this half of Core #2, but has not done any testing on it at this time. This sample was taken from an area that did not contain delamination. There are currently no plans to perform any tests on this sample.

Misc Notes:

Response By: Craig Miller

Reviewed By:

Date Response Provided: 12/7/2009

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:10 A

Request Number:	83		
Individual Contacted:	Garry Miller	**Date Contacted:**	12/2/2009
Requestor/Inspector:	Dan Naus / George Thomas	**Category:**	

Request: Describe what confirmatory NDE would be performed, after detensioning of additional tendons, in the areas that did not show any delamination in order to verify that the delamination has not propagated any further due to additional detensioning.

References:

Response Assigned to: Paul Fagan **Date Due to Inspector:**

Response:

Misc Notes:

Response By:			
Reviewed By:		**Date Response Provided:**	
Status:	Open	**Date Closed:**	

Request Number: 84

Individual Contacted: Charles Williams

Date Contacted: 1/12/2010

Requestor/Inspector: George Thomas

Category:

Request: With reference to the evidence sheets that refuted the root cause failure mode 8.4 - Inadequate Concrete Structure Monitoring/Maintenance (IWL), the SIT has the following observations:

1. The scope and description of this failure mode is unclear and not accurate. The monitoring of the concrete structure under the Containment ISI Program in accordance with ASME Section XI, Subsection IWL, infact includes examination of concrete surfaces and the unbonded post-tensioning system (tendon surveillance) of the Class CC containment. Program referenced does not seem accurate.

2.The inadequacy of a CISI program in accordance with ASME Section XI, Subsection IWL is an issue of regulatory and procedural compliance. It is not by itself a failure mode. The program may help detect early signs of a degradation or potential failure mode or a failure mode after it has occurred. The implemnetaion of the program may be inadequate if early signs of degradation identified during inservice inspection were not perperly addressed and the degradation progressed into failure. Clarify what failure mode is being addressed by FM 8.4 represent?

3. The "Data to be collected" is incomplete/inadequate since (i) it does not look at past IWL inspection results of the concrete surfaces; (ii) it does not look at past IWL tendon surveillance resports. Documents referenced are not accurate.

4.The refuting and supporting evidence is incomplete/inadequte because: (i) Exhibit 2 is in fact results of visual examination of concrete surfaces between buttresses 3 and 4 performed during RF 16 after the delamination was discovered, and not "conducted a few days prior to beginning the SGR hole cut activities (FM 8.4 Exhibit 2...) as stated in the evidence sheet. None of the reports from past IWL inspections of the concrete surfaces were reviewed as evidence. (ii) The CR-3 containment has had a history of a significant numebr of hoop tendons, including some that go through the SGR Openign, not meeting the IWL acceptance by examination criteria during the recent three surveillances (I.e. Surveillances 6, 7 & 8). This could provide supporting evidence for the delamination root cuase. None of the tendon surveillance reports from past surveillance were reviewed as evidence.

5. Further, the results of tendon surveillances 6, 7 & 8 were accepted by engineering evaluation. The cause (could be physical or calculation of predicted forces or both) of the lift-off forces of a large numberof hoop tendons sampled (including extended sampling) not meeting the IWL acceptance by examination criteria was not adequately addressed and eliminated/corrected in the CR-3 tendon surveillance program. Is the cause fo the larger than anticipated losses of prestressing force in several hoop tendons being addressed as part of the root cause assessment and, if so, where is it addressed?

References:

Response Assigned to: Charles Williams

Date Due to Inspector:

Response:

Misc Notes:

Response By:

Reviewed By:

Date Response Provided:

Status: Open

Date Closed:

2009 NRC Special Inspection - RB Concrete Separation

20-Jan-10 11:21:10 A

Request Number:	85
Individual Contacted:	Charles Williams
Date Contacted:	1/12/2010
Requestor/Inspector:	George Thomas
Category:	
Request:	The description and exhibit photographs indicate presence of a secondary delamination near the liner. What is the location and extent of the secondary delamination? Is it being investigated in the root cause analysis?
References:	

Response Assigned to:	Charles Williams
Date Due to Inspector:	
Response:	
Misc Notes:	

Response By:	
Reviewed By:	
Date Response Provided:	
Status:	
Date Closed:	