7.11 Added stress from pulling tendons out of sleeves and grease after cutting

Description:

The procedure to remove the tendons from the sleeves that intersect the SGR opening is as follows (FM 7.11 Exhibit 3 is the Precision Surveillance Corporation (PSC) Field and Quality Control Procedure for Tendon Removal):

1- Degrease tendon sleeves;

2- Cut tendons using a flame torch (detensioning);

3- Pull tendons using a coiler machine (FM 7.11 Exhibit 4 describes the typical tendon coiler system used by PSC).

The force required to pull the tendons out of the sleeves can be high because:

1- The tendons and grease have been in place and pre-stressed for more than 30 years;

2- The grease has a high viscosity;

3- The degreasing operation is not thorough for the hoop tendons.

This can result in additional stresses in the concrete around the sleeves during the removal operation.

Data to be collected and Analyzed:

1. Tendon removal procedure (FM 7.11 Exhibit 1 is an excerpts of the Engineering Change package creating and repairing the opening in the containment building);

2. Description of the tendon coiler equipment (FM 7.11 Exhibit 4);

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3. Maximum pulling capacity of the coilers (FM 7.11 Exhibit 2 is an email exchange with PSC personnel to try and determine the pulling capacity of a PSC tendon coiler);

4. Coiler operation details (FM 7.11 Exhibit 5 is an email exchange with PSC personnel on the topic);

5. Comparison of the force of a tendon coiler with the typical forces involved in the post-tensioned system;

Verified Supporting Evidence:

a. None

Verified Refuting Evidence:

a. The maximum pulling capacity of the coilers is only 16,000 lbs (FM 7.11 Exhibit 2). See Discussion below regarding the forces typically involved in this containment;

b. Coiler operates at a slow pulling rate of 30ft / min (FM 7.11 Exhibit 5 is an email exchange with PSC personnel to try and determine the pulling rate of a PSC coiler);

Discussion:

As a comparison point, a SINGLE tendon wire 7mm in diameter, stressed at 70% of 240ksi Ultimate Tensile Strength, generates a force of 0.7 x PI x (3.5 / 25.4)^2 x 240,000 lbs ~ 10,000 lbs. And one tendon contains 163 such wires for a force per tendon around 1,600,000 lbs.

The forces at play in the post-tensioned containment, seen by the concrete in everyday operation, are much larger than the pulling capability of the PSC tendon coiler.

Conclusion:

The force from removing the tendons out of the sleeves did not generate the delamination.

PCHG-DESG **Engineering Change** **0000063016R163**

D.1 Installation Package

D1.1 This EC will create and repair an opening in the Reactor Building wall. This opening is necessary for the transport of the old and replacement OTSG during the Steam generator replacement outage. The following is an over view of the activities required to accomplish these activities:

Pre-Outage:

1. Mock-ups and associated training of craft for complex work activities required for the creation and restoration of the access Opening.
2. Staging tendon upper support frames onto the Reactor Building roof and attaching the tendon work platforms.
3. Partial degreasing of 30 vertical tendons in and around the Opening prior to Plant shutdown.
4. Installation of a temporary work platform (a.k.a. "chipping platform") as described in EC #63022.
5. Survey and layout the basic geometry of the Opening, and shallow saw cutting of the Opening.
6. Deleted
7. Tendon anchorage inspections per ASME Section XI, Subsection IWL.
8. Disable sump pumps SDP-3A and 3B and Install temporary sump pump(s) in the tendon gallery sump. Test the temporary pumps to ensure that they are operable and deliver at least 300gpm.
9. Saw cutting of the perimeter of the containment access opening.

Modes 5 and 6:

10. Tendon anchorage inspections per ASME Section XI, Subsection IWL.
11. Detensioning, removal and final degreasing of 10 vertical and 17 hoop tendon's from within the Opening (mode 5 or 6).
12. Hydrodemolition of the 42" thick concrete containment wall from within the Opening.
13. Radiological and environmental testing and disposal of the hydrodemolition effluent (wastewater and concrete rubble)
14. Cutting and removal of the steel reinforcement bars (rebar) within the Opening; drilling of pilot holes in liner plate for cut line layout.
15. Cutting and removal of tendon sheathing within the Opening.
16. Perform core boring in accordance with AI-480, ASTM C-42 and Attachment Z65.

Defueled Prior To Removal and reinstallation of the OTSG:

17. Cutting and removal of the steel liner plate at the Opening, about liner plate cut line.

Defueled After Removal and Reinstallation of the OTSG and removal of lifting and rigging equipment:

18. Tendon anchorage inspections per ASME Section XI, Subsection IWL (detensioned tendons-see #18)
19. Detensioning of Additional 20 Vertical and 18 Hoop Tendons Outside the Opening.
20. Reinstallation of the liner plate and associated weld examination.
21. Re-apply liner plate coating (can also be done in Mode 6).

During No Mode or Modes 5 and 6

22. Install three layers of reinforcing steel and tendon sheaths.
23. Install replacement tendons.
24. Install formwork.
25. Replace the removed concrete.
26. Tension/re-tension and re-grease tendons (Hoop tendons must be re-greased prior to entering Mode 4 since work is prohibited in the area between buttress numbers 1 and 3 with the plant at power due to the potential exposure of personnel to high pressure steam from the steam vents. Vertical tendons may be re-greased in any Mode but must be completed within 30 days after entering Mode 2) and perform IWE/IWL inspections of tendon anchorage.

During Refueling activities but Prior to Mode 4

27. Remove temporary pumps from the tendon gallery sump and re-energize sump pumps SDP-3A and 3B.
28. Perform ILRT, IWL and IWE inspection of the repaired containment opening and repaired liner plate.

D.1.2 Replacement activities of this EC are required to support SGRP and shall be coordinated with the following ECs and associated work orders.

EC 63022, Revision 0, Rigging and Handling
EC 70377, Revision 0, Temporary power interface

D.2 Installation Requirements

D.2.1 Prerequisites / Precautions

To ensure compliance with the Station Fire Protection Program all work related to this EC will be done in conformance to the following procedures:

1. All welding, cutting, or burning shall be per FIR-NGGC-0003, "Hot Work Permit".

2. Determination of fire loading shall be per FIR-NGGC-0004, "Determination of Combustible Loading and Equivalent Fire Severity".
3. All transient combustibles shall be controlled per AI-2200, "Guidelines for Handling, Use and Control of Transient Combustibles".
4. For administrative and technical guidance for the development and operation of the Fire Watch Program at CR-3 refer to AI-2210, "Fire Watch Program".
5. Pre-Fire Plan – Containment Building, AI-2205E
6. CP-137, Revision 20, Fire and HELB Barrier Breaches

- Ensure that all applicable environmental permits are obtained and in place before implementation of activities associated with this EC.
- Ensure that activities associated with this EC are in compliance with the applicable portions of EVC-CRNF-00003, "Use Crystal River Nuclear Plant Site-Specific Environmental Compliance Manual".
- Any hazardous waste that is produced by activities implemented per this EC shall be handled and shipped in accordance with Procedures EVC-SUBS-00016, EVC-SUBS-00008 and AI-1820,
- Any non-hazardous waste that is produced by activities implemented per this EC shall be handled and shipped in accordance with Procedure AI-1820
- All chemicals and other consumables shall be approved and properly labeled per CHE-NGGC-0045
- All lifting and rigging shall be performed in accordance with AI-650, "Rigging, Lifting, and Material Handling Program"
- All welding shall be performed per NGGM-PM-0003, Corporate Welding Manual.
- Standard inspection criteria for structural steel, welding, and bolting apply, per NUA-NGGC-1530 unless noted otherwise.
- Special care shall be taken to minimize damage to existing applied protective coatings. Care shall be taken during rigging, handling, unloading, and erecting structural steel and components. Any damage done to protective coating should be repaired in accordance with site procedure.
- Coatings must comply with FIR-NGGC-0004 and the requirements of MNT-NGGC-0009.

1. Mock-ups and Associated Training for Complex Work Activities Required for the Creation and Restoration of the Access Opening.

Several mock-ups that will simulate complex work activities associated with the creation and restoration of the access Opening will be required and are considered essential to the successful completion of the project.

These simulations aid in training the craft in executing these activities in a safe and expeditious manner. Mock-ups should incorporate any radiation protection/ALARA considerations deemed appropriate by RP. Mock-ups will be constructed as determined necessary to support construction activities. The following mock-ups and training categories are considered essential:

- Tendon detensioning and re-tensioning
- Tendon plasma cutting
- Tendon removal and re-installation
- Liner plate cutting and removal
- Repairing the liner plate
- Reinstallation and welding of liner plate
- Installation of the new tendon sheaths
- Mechanical splicing of the rebar
- Fusion welding of rebar splices
- Full size mock-up of the Opening for placement of concrete.
- Visual inspections per IWE/IWL for the liner plate, tendons and concrete (training must meet IWL-2300 and IWE-2300 requirements).

2. The following Prerequisites / limitations shall apply to the Tendon activities:

- The methodology and requirements for Calibration of all tools and equipment shall be evaluated, reviewed and approved by Progress Energy (CR3) Nuclear Assessment Section (NAS).
- Tendon Service Platforms (USF) cannot be installed prior to 60 days before the start of R16
- Each USF will be lifted to the containment roof, directly above the equipment hatch at AZ. 150 degrees and installed on the rail system (Refer to safe load path drawing #63016-SK-S001 contained in Attachment G01).
- Each work platform, suspended from an USF will be load tested to 125% of its rated load (Refer to Section E00 for test requirements).
- In the event of violent weather (as described below) all work platforms shall be lowered to the ground or the Intermediate Building roof and secured (Refer to plant procedure EM-220, Violent Weather for additional information:

    1. Tornado Watch: Alerts an area of the possibility of a tornado and usually lasts for 2 to 4 hours.
    2. Tornado Warning: Issued when a tornado has been sighted in the area.
    3. Whenever winds exceed 30 mph

4. Hurricane and Tropical Storm Watch and Warning (in accordance with the EM-220 Violent Weather Committee instructions)

- Storm drains in the tendon gallery shall be protected from grease spills. Plastic sheeting shall line the tendon gallery floor and walls as required to contain grease.
- Work cannot be performed in the area between buttress numbers 1 and 3 until in cold shutdown due to potential exposure of personnel to high pressure steam from the steam vents. Therefore work on the suspended service platforms at buttress numbers 2 and 3 cannot begin until the unit enters cold shutdown. These platforms must be lowered (remotely controlled during lowering) and stored on the intermediate building roof until Mode 5.
- Partial degreasing of 30 vertical tendons can begin no sooner than 60 days prior to the start of R16 refueling outage while the Unit is in any Mode.
- A hot work permit per FIR-NGGC-0003, "Hot Work Permit" must be obtained prior to plasma detensioning of the tendons to be removed.
- Tendon removal shall not begin prior to the plant entering Mode 5.
- Re-greasing of the tendons can be completed while the Unit is in any Mode, but is to be completed no more than 30 days after the Unit is in Mode 2. All waste grease shall be collected and disposed of in accordance with EVC-SUBS-00107.
- Disposal of the waste grease (after release by RP) must comply with the "Waste Vendor Program" corporate policy # EVC-SUBS-00107. All documentation generated as part of the disposal, e.g., manifests, disposal certificates, etc, must be provided to the CR3 waste coordinator.

3. The following Prerequisites / Precautions shall apply to the Hydrodemolition activities

- The hydrodemolition activities will require 2,000,000 gallons of clean water supplied to the hydrodemolition contractor with total suspended solids of less than 45ppm and must undergo laboratory analysis to baseline radio nuclides and other chemical parameters as determined by RP and the chemistry department.
- The details for water supply and disposal for concrete removal are outside the scope of this EC and will be included and approved per Work Order Task 1165094-Task-03. It is anticipated the water may be supplied over an extended period of time from the well fields located to the east of CR3, operated and maintained by the fossil group at Crystal River South (CRS). This water may be stored in one of the existing abandoned oil storage tanks (Cap.

8,000,000 gals). Shoring utilized to support the disposal chute may be stabilized by temporarily attaching bracing to the MSB purlins as required. A 1/2"diameter hole is permitted through the exterior wall, insulation, and purlin. Upon removal of the temporary bracing the hole in the exterior wall will be sealed with a suitable sealant. The debris chute and shoring will be removed as necessary upon notification to implement the EM-220 Violent Weather Plan.

- Station security shall be notified at least 24 hours prior to breaching the liner plate so that they may evaluate and implement compensatory measures.
- Ensure that a fire barrier breach permit is in place as required by CP-137, Revision 20, Fire and HELB Barrier Breaches.
- The containment coordinator is to be informed prior to starting the hydrodemolition machine. The coordinator must then inform all personnel in the immediate area of the opening that hydrodemolition activities are about to start and noise levels will increase dramatically (Pertains to OE from other plants during hydrodemolition).
- The hydrodemolition contractor's diesel trucks and power packs must be reviewed by the Nuclear Plant Construction (NPC) Environmental Specialist to ensure compliance with air permits. If necessary per the permit, this data will be provided to the CR3 Environmental Specialist.
- Functional testing of the hydrodemolition equipment is required prior to cold shutdown. This will require testing of all the high pressure lines, electrical and hydraulic lines and controls. Two sheets of 8' x 10' x 3/8" min. thick (or similar) steel plates will be placed on the chipping platform against the reactor building wall for the purpose of testing the high pressure water nozzles and associated equipment (Refer to Section E00).
- Operations must be made aware that any venting of radioactive material from the RB with the containment breached must be handled in accordance with the CR3 Offsite Dose Calculation Manual (ODCM).
- Communication with the Control Room is vital to ensure that radiological releases are not performed while personnel are working in elevated areas around the containment building.
- Verify the settling (percolation) ponds are available and in a physical condition/configuration to receive the approved discharge from the hydrodemolition activities. Note that approximately 500,000 gallons of condensate may be added to the settling ponds during plant cool down (in addition to the 2,000,000 gallons from hydrodemolition).
- The discharge water from the hydrodemolition activities to the settling ponds must meet the following requirements:
  - Sampled and released by RP/Chemistry
  - pH between 6.0 and 9.0 pH

· A "stop job" limit will be established at pH less than or equal to 2, or pH greater than or equal to 12.5.

· Laboratory samples for pH, Total Suspended Solids (TSS), and oil & grease may be collected at about 3 times during project (start, middle, end), and results placed in project file and plant file. There are no specific limits for TSS or oil and grease.

· Sump pumps SDP-3A and SDP-3B located in the tendon gallery must be turned off/disabled immediately prior to the start of hydrodemolition operations.

· Steps must be taken to verify that the temporary sump pump installed in the tendon gallery is correct for the operation and has a discharge volume of 300gpm. Temporary sump pumps are to be installed in the tendon gallery sump prior to the start of hydrodemolition.

· A safety net must be erected around the hydrodemolition equipment and the chipping platform to contain any debris resulting from hydrodemolition activities.

· The hydrodemolition contractor is to reduce the water pressure to a workable minimum pressure when removing the final 6"-9" thickness of concrete before exposing the liner plate.

· After the opening has been created in the containment wall and hydrodemolition is complete, remove the temporary sump pumps and re-energize sump pumps SDP-3A and SDP-3B.

· As a precaution, in case the liner plate is punctured prior to the plant being defueled, Belzona and thin sheets of steel plate (1/16" to 1/8" thick) shall be available (close to hand) with which to seal the puncture.

· 3.a The following and precautions shall apply to the core boring of the Reactor Building:

· Drill core bores in accordance with Plant Operating Manual AI-480 and ASTM C-42

1. The locations chosen for core bores shall be in good concrete with no visual cracking present.

The core shall be located at the approximate distance half way between the liner plate and the vertical tendons.

· If rebar or misc. steel is encountered, drill additional core at new location. Use drill stops for core boring.

·

4. The following limitations and precautions shall apply to the Liner Plate removal and reinstallation activities:

· The liner plate cannot be cut until the plant is defueled

· Liner plate coating cannot be removed or applied to the steel liner plate unless reviewed and approved by the ASME Code Section XI, IWE/IWL (ISI) Program Coordinator. Approval shall be documented by review and approval of the Work Order Task.

- All welding shall be performed per NGGM-PM-0003, Corporate Welding Manual.
- Station security shall be notified at least 24 hours prior to breaching the liner plate so that they may evaluate and implement compensatory measure.
- Notify Operations and RP and insure the following has been accomplished prior to commencing the liner plate cut:
  - Appropriate radiological postings installed outside the access Opening
  - Personnel monitoring and air monitoring equipment (radiological) installed and operational outside access Opening.
  - Satellite de-contamination facility established (Ref. RP Task Plan)
  - A 12" wide strip of paint on either side of the liner plate cut line has been removed.
  - Inside face of the liner plate must be decontaminated as practical.
  - Satellite de-contamination facility established
- Obtain a fire barrier breach permit per site procedure CP-137, Fire and HELB Barrier Breaches,
- Additional attachment welds on the metallic liner may be required to attach construction aids to the liner. These construction aids may include pads that will be permanently welded to the liner to support lifting rings and lugs.

D.2.2 Detail required sequencing of steps

This section will be broken up by major activity. The handoffs from one activity to another will be identified.

D.2.2.1 Tendon Degreasing, Detensioning, Removal, Reinstallation and Retensioning

Refer to PSC Manual "Post Tensioning System Field and Quality Control Procedure Manual" (Attachment Z23) for additional guidance in removal, inspection and reinstallation of tendons.

Note: The intent of all of the instructions contained in this document must be transferred to the work order instructions, clearly, accurately and in their entirety. However, CR3 procedures will always take precedence over the PSC F&Q Quality Control Procedures.

The methodology and requirements for Calibration of all tools and equipment shall be evaluated, reviewed and approved by Progress Energy (CR3) Nuclear Assessment Section (NAS).

1. Tendon Service Platform installation

   a. Install four Upper Support Frames (USF) supplied by Precision Surveillance Corporation (PSC) as directed by PSCs supervisory representative and in accordance with the information contained in the PSC design calculation contained in Attachment Z34. Note that all platform tie-down material/equipment will be supplied by PSC.
   b. Each USF shall be initially placed on the reactor building roof rails above the equipment hatch (approximate AZ 150), following the safe load path drawing (see attachment G01).
   c. Each of the four USFs will support a suspended work platform (2-8'x10' and 2-nominal10'x20' platforms). Each work platform is lifted over the equipment hatch shield structure at AZ 150 degrees, and attached to its respective USF with cables.
   d. After a work platform has been attached to its respective USF it will be proof load tested per the requirements of Section E00.
   e. The suspended work platforms come in two sizes. The 8' x 10' platforms (and USFs) will be moved and staged at buttresses 2 and 5 and the nominal 10' x 20' platform will be placed at buttresses 3 and 4 with the restrictions listed below in f.
   f. The USF and platform combination for buttress numbers 2, 3 and 5 will be rolled clockwise around the roof (from their initial position at approximate AZ 150 degrees) and must be lowered to their temporary storage location on top of the intermediate building roof. They cannot be staged at buttress numbers 2 or 3 until Mode 5. Note that the platform at buttress number 5 may be temporarily stored on the IB roof if required until Mode 5. The platform sequence is buttresses 5 first followed by buttress 2 and finally buttress 3.
   g. The USF and platform combination for Buttress number 4 shall be rolled counterclockwise from its initial position at AZ 150 degrees to the east side of buttress # 4. It may be staged at buttress #4 during any Mode.

2. Tendon Degreasing and Tendon Removal

a. Partially degrease the following vertical tendons prior to shutdown (Refer to drawing 421-347 for tendon location) :

i. 34V8 thru 34V17 (within the opening),

ii. 45V22 thru 45V24 and, 34V1 thru 34V7 (about buttress #4 and adjacent to the opening)

iii. 23V1 thru 23V3 and 34V18 thru 34V24 (about buttress #3 and adjacent to the opening)

b. After partially degreasing the vertical tendons, perform the required ASME Section XI, subsection IWL inspections of the tendon anchorage components either before the outage or during the outage dependent on labor needs, and the following requirements:

1. The following two vertical tendon anchorages (inside the opening) including the surrounding concrete require a detailed visual inspection per IWL prior to ram detensioning (Refer to Drawing 421-347 and Ref. 4.19 for location):

34V12 and 34V13

2. The anchorage components of the following 8 remaining vertical tendons that are being removed from the opening do not require IWL inspections, except for the concrete surrounding the tendon bearing plates that must be inspected to IWL requirements prior to detensioning:

34V8 thru 34V11 and 34V14 thru 34V17

The anchorage components of hoop tendons that are being removed do not require IWL inspections, except for the concrete surrounding the tendon bearing plates that must be inspected to IWL requirements. However, craft personnel are to look at the tendon assembly after cleaning and prior to cutting the buttonheads for removal and note any obvious deficiencies that may question the integrity of the tendon assembly. Any questionable deficiencies should be referred to the IWE/ IWL Responsible Engineer.

c. Two vertical adjacent tendons (, 34V12 and 34V13) (Refer to drawing 421-347 for location) may be removed from within the opening after the reactor has shutdown (after entering Mode 5) and prior to the start of concrete hydrodemolition of the 42" thick containment wall and saved for possible re-use.

These two tendons will be detensioned with a hydraulic ram, the buttonheads removed with a hand grinder, coiled and then saved as

a contingency to ensure that replacement vertical tendons of sufficient length are available in the event that a new replacement tendon is identified as being too short. If it is determined that one or more of these three original tendons must be reused, then the tendon(s) will be sent to PSC for restoration.
Note that Tendon 34V13 may be plasma cut directly above the bottom anchor head.

One wire will be removed from each of the two tendons, its length measured as accurately as possible, recorded, and this information sent to engineering for evaluation.

d.

e. With the plant in Mode 5 or 6 the following tendons can be removed:
i. 8 vertical tendons 34V8 thru 34V11 and 34V14 thru 34V17 (Ref. to drawing 421-347 for location).
ii. 17 hoop tendons 42H27 thru 42H34 and 53H27 thru 53H35 - (Ref. drawing 421-347 for locations)
iii. After the hoop and vertical tendons have been removed from within the opening, the open tendon sheaths shall be degreased to the extent practical.

f. The remaining 8 vertical tendons to be removed from within the opening (34V8 thru 34V11 and 34V14 thru 34V17) will be destructively detensioned by plasma cutting the buttonheads at the lower anchorage in the tendon gallery. The tendon is then coiled–up at the upper anchorage (RB roof) and banded, removed from the coiler, wrapped in plastic and lifted to the ground by the mobile crane.

g. Hoop tendons to be removed from within the opening will be destructively detensioned by plasma cutting the buttonheads at the smaller work platforms located at buttress numbers 2 and 5. The tendon is then coiled–up at either buttress number 3 or 4 and banded, removed from the coiler, wrapped in plastic and lifted to the ground by the mobile crane.

h. After a tendon is removed, attach a temporary protective bearing plate cover to the bearing plate, over the open tendon sheath void (hoops only) to prevent further debris from entering the tendon sheaths. Alternatively the grease cap can be replaced using the old gaskets.

i. Tendon removal activities are completed

3. Tendon Detensioning around the access opening

a. After the old steam generators have been transported out and the new steam generators into containment, and the Horizontal Transfer Structure is no longer required to support lifting the steam generators, the following tendons shall be detensioned:
i. 45V22 thru 45V24 and, 34V1 thru 34V7 (about buttress #4 and adjacent to the opening)

ii. 23V1 thru 23V3 and 34V18 thru 34V24 (about buttress #3 and adjacent to the opening)
iii. 42H22 thru 42H26 and, 53 H23 thru 53H26 (below the opening)
iv. 42H35 thru 42H39 and 53H36 thru 53H39 (above to the opening)

b. Detensioning shall be accomplished in accordance with PSC procedures

c. Complete the required ASME Section XI, Subsection IWL inspections of all the detensioned tendon anchorage components and surrounding concrete prior to detensioning.

4. Tendon reinstallation (No Mode or Mode 5 or 6)

a. Tendon reinstallation can commence once the liner plate has been installed and the 2 layers of reinforcing steel has been installed in the containment opening.
b. Install vertical tendon sheaths (See Drawing 421-350 and 351)
c. Install Horizontal tendon sheaths (See Drawing 421-350 and 351)
d. Install tendon sheath support brackets (See Drawing 421-350)
e. As hoop and vertical tendons sheaths are installed the tendon sheaths shall be cleaned, to the extent practical, to remove any debris.
f. With the sheaths and support brackets installed, INSERT vertical and hoop Tendons into tendon sheaths. The following tendons will be re-inserted:

- Vertical tendons 34V8 thru 34V17 (Refer to drawing 421-347 for location)
- Hoop tendons 42H27 thru 42H34 and 53H27 thru 53H35 - (Ref. drawing 421-347 for locations)

g. Vertical tendons are uncoiled into the open tendon sheaths at the RB roof while pulling from the tendon gallery. Buttonhead the tendons in the tendon gallery.
h. Hoop tendons are uncoiled into the open tendon sheaths at buttress numbers 3 and 4 while pulling from either buttress numbers 2 or 5 with a tugger. Buttonhead the tendons at buttress 2 and 5.
i. STOP installing tendons at the start of concrete placement and HOLD until concrete has reached a compressive strength of 3000 psi.
j. Complete tendon installation into tendon sheath

5. Tendon retensioning (No Mode or Mode 5 or 6)

a. See Drawing 421-352 for tendon retensioning sequencing
b. With the tendon reinstallation completed and once the replacement concrete has reached a compressive strength of 5000 psi the following tendons can be retensioned :

i. 45V22 thru 45V24 and, 34V1 thru 34V7 (about buttress #4 and adjacent to the opening)

ii. 23V1 thru 23V3 and 34V18 thru 34V24 (about buttress #3 and adjacent to the opening)
iii. 42H22 thru 42H26 and, 53 H23 thru 53H26 (below the opening)
iv. 42H35 thru 42H39 and 53H36 thru 53H39 (above to the opening)

c. Once the replacement concrete has reached a compressive strength of 6000 psi the following tendons in the opening can be tensioned:
i. Vertical tendons 34V8 thru 34V17
ii. 17 hoop tendons 42H27 thru 42H34 and 53H27 thru 53H35

Tendons will be tensioned/retensioned to 70% GUTS (Guaranteed Ultimate Tensile Strength), *+4%, -0%*

D.2.2.2 Hydrodemolition

Refer to Mac & Mac Hydrodemolition Work Instructions (Attachment Z24) for additional guidance in hydrodemolition activities.

1. Pre-outage activities

a. Install field routed water supply and discharge piping
b. Water supplied to the hydrodemolition contractor should have total suspended solids of less than 45ppm and must undergo laboratory analysis to baseline radio nuclides and other chemical parameters as determined by RP and the chemistry department.
c. EC 63022 will install a chipping platform over the equipment hatch
d. With the installation of the chipping platform the following hydrodemolition activities can commence including pre-operational testing of the equipment as described in Section D.2.1-3.
e. Layout the containment opening (Ref Drawing 421-348 and 349)
f. Make a concrete saw cut, with a maximum depth of ½" around the perimeter (along the scribe lines) of the Opening to preclude spalling and to provide a neat, straight edge to pour the replacement concrete up against.
g. Install the hydrodemolition equipment including
i. Water supply and pumping system
ii. Water collection and discharge system
iii. Hydrodemolition Support Frame bolted to the chipping platform (Ref. sketch G05R0
iv. Provide two support plates bolted with hilti bolts on the outside surface of the containment wall. This plate is provided to secure the vertical members of the hydro-demolition support frame during disassembly of the support frame. The support plate is shown in Page 3 of Attachment G 05.

From: Brian Giometti
To: Portmann, Rick; Christopher Cox
Subject: RE: CR3 Root Cause Team Questions
Date: Tuesday, December 15, 2009 8:24:18 AM

Rick-

I would estimate the maximum force the vertical coiler can pull around 16,000 lb. The horizontals are less.

This is based upon our testing at the shop as well as the fact that the 1st vertical tendon was not able to be broken free from the grease with the coiler. When the crane was used, the operator's computer read 17,000 lb.

Let me know if you need any further clarification.

Brian

From: Portmann, Rick [mailto:Rick.Portmann@pgnmail.com]
Sent: Tuesday, December 15, 2009 6:24 AM
To: Christopher Cox; Brian Giometti
Subject: CR3 Root Cause Team Questions

Christopher / Brian – There were a few more questions that came up last night from the root cause team. I'm not sure where this one question comes up in the scheme of things, but your assistance is appreciated. See below. Thanks, Rick Outage Cell: 352-464-7846

What is the maximum force of the tendon coiler used at CR3?

Precision Surveillance Corporation

PROGRESS ENERGY FLORIDA, INC.
CRYSTAL RIVER NUCLEAR UNIT 3
STEAM GENERATOR REPLACEMENT PROJECT

PRECISION SURVEILLANCE CORPORATION
FIELD AND QUALITY CONTROL PROCEDURE

TENDON REMOVAL

Prepared by	*LEVEL II Q.C.* Title	*08/29/08* Date
Approved by	*PROJECT MANAGER, P.E.* Title	*08/29/08* Date
Approved by	*PRESIDENT* Title	*08/29/08* Date

1.0 PURPOSE

1.1 This procedure will establish the requirements for the removal of tendons from tendon voids at Crystal River Unit 3 for the vertical and horizontal tendon work during the Steam Generator Replacement Project.

2.0 SCOPE

2.1 The tendons to be removed from the tendon voids shall be as specified in the Owner Work Package. Vertical Tendons shall be removed from the top, horizontal tendons shall be removed from the buttress as per the Owner Work Package.

3.0 RESPONSIBILITY

3.1 Owner Field Construction Personnel shall be responsible for the physical activities associated with this procedure.

4.0 QUALIFICATIONS

4.1 Owner Field Construction Personnel shall be fit by skill, training and/or experience to perform these duties.

5.0 EQUIPMENT

5.1 Tendon Field Coiler.

5.2 Cleaning waffle, splice chucks and cables.

5.3 Miscellaneous Tools, wrenches, ratchets, sockets, shackles, come-alongs, banders and banding materials, etc.

5.4 Plastic bags, plastic sheeting (Visqueen), rags, buckets or drums for waste grease.

6.0 PRECAUTIONS

6.1 As in other heavy construction, care should be exercised while working from scaffolds, platforms, ladders, high or restricted access locations. Respect for the safety and well-being of the other trades and personnel in the area must be observed, especially during hoisting operations. The area in the tendon gallery where a tendon is being removed from the void is to be roped off and personnel are to be kept away from that area during tendon removal.

CAUTION: DO NOT STAND UNDER LOADS WHILE STATIONARY OR DURING HOISTING.

DO NOT PERMIT OTHERS TO STAND UNDER LOADS.

DO NOT THROW OR DROP OBJECTS.

STAY AWAY FROM THE AREA IN THE TENDON GALLERY WHILE A TENDON IS BEING REMOVED

6.2 Use care when coiling the tendon, it tends to be quite springy and can cause injury if not properly restrained.

6.3 Waste grease from the voids could be a slipping safety hazard, during all operations it should be cleaned up and placed in waste drums.

7.0 QUALITY CONTROL DOCUMENTATION AND HOLD POINTS

7.1 There are no Quality Control Documentation (QCD) points or HOLD POINTS in this procedure.

□0 PREREQUISITES

8.1 Prior to implementing this procedure the field anchor head cut off operations on the tendon must have been performed as per PSC Procedure F&Q 8.0. If shims have not been removed from under a anchor head they are to be removed, kept in matched pairs and protected from the elements by covering with plastic or placing in a temporary storage container until sent to storage.

□0 PROCEDURE

9.1 TENDON REMOVAL

9.1.1 Remove tendon end protection from each end of the tendon.

9.1.2 On the cut end of the horizontal tendon attach a minimum 5/16 inch cable with a void cleaning waffle to one of the cut wires using a wire/cable chuck. This cable will be pulled into the tendon void as the tendon is removed and may be left in the void for later use or removed. The cleaning waffle will remove all excess grease from the void.

9.1.3 The trumplet will have excess grease removed after tendon removal with manual degreasing devices.

9.1.4 For vertical tendon attach 5/16 inch cable only to cut end to facilitate cleaning at a latter date. If used, secure cable to top bearing plate. Alternatively, a cable can be dropped down the void for cleaning after tendon removal at Owner Field Construction Personnel discretion.

9.1.5 Expand the coiler hub and attach the cable from the field coiler to the tendon end anchor head plate, bolt and apply a light tension on the cable with the coiler.

9.1.6 Coil the tendon on the coiler, using extra care as the anchor head enters the coiler. Place two bands on the tendon anchor head after the first revolution. After, band the tendon coils in the coiler for every new loop of the tendon as it is coiled (stagger the placement of the banding). The closer to the end of the tendon the more banding of the coils are needed in the coiler.

9.1.7 Detach the waffle cleaner or 5/16 inch cable, if present, from the wire at the cut end of the tendon and secure the cable.

9.1.8 Reverse the operation of the coiler and retract the hub to loosen the pulling cable and detach the pulling cable from the tendon end.

9.1.9 Hoist the tendon out of the uncoiler, wrap in plastic and lower it to the ground for storage and subsequent scraping.

9.1.10 If the tendon voids are to be cleaned at this time refer to PSC Procedure F&Q 11.0, if not protect the void end as per Section 9.2 of this Procedure.

9.2 VOID END PROTECTION

9.2.1 After the tendon is removed from the void, the tendon void end may be covered with plywood or by attaching a temporary bearing plate cover to the bearing plate, or the grease cap may be replaced using the old gaskets to provide the voids protection from the elements.

10.0 DOCUMENTATION

10.1 There is no documentation required by this procedure.

11.0 QUALITY CONTROL

11.1 There is no quality control inspection or documentation required by this procedure.

12.0 NOTIFICATION

12.1 Owner Site Shift Superintendent or Field Engineer shall be notified if any areas of rust, water coating, damage or other types of deterioration are found on tendon wires.

13.0 ATTACHMENTS

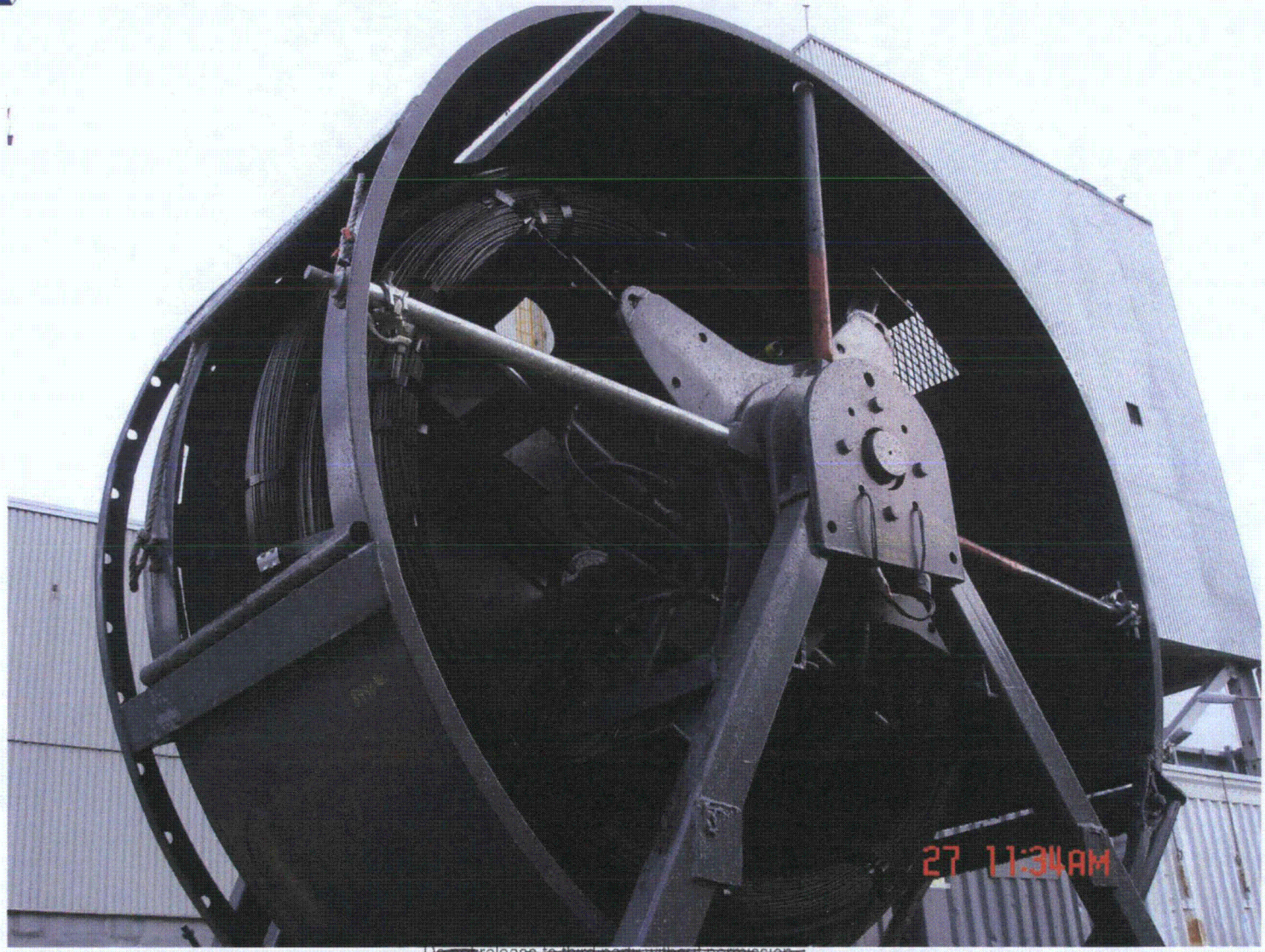
13.1 None.

7.11 PSC Tendon Coiler

The following are photographs of the PSC tendon coiler as used at CR3.

May identify additional perspective on this issue as RCA related efforts proceeds

7.11 PSC Tendon coiler



7.11 PSC Tendon coiler

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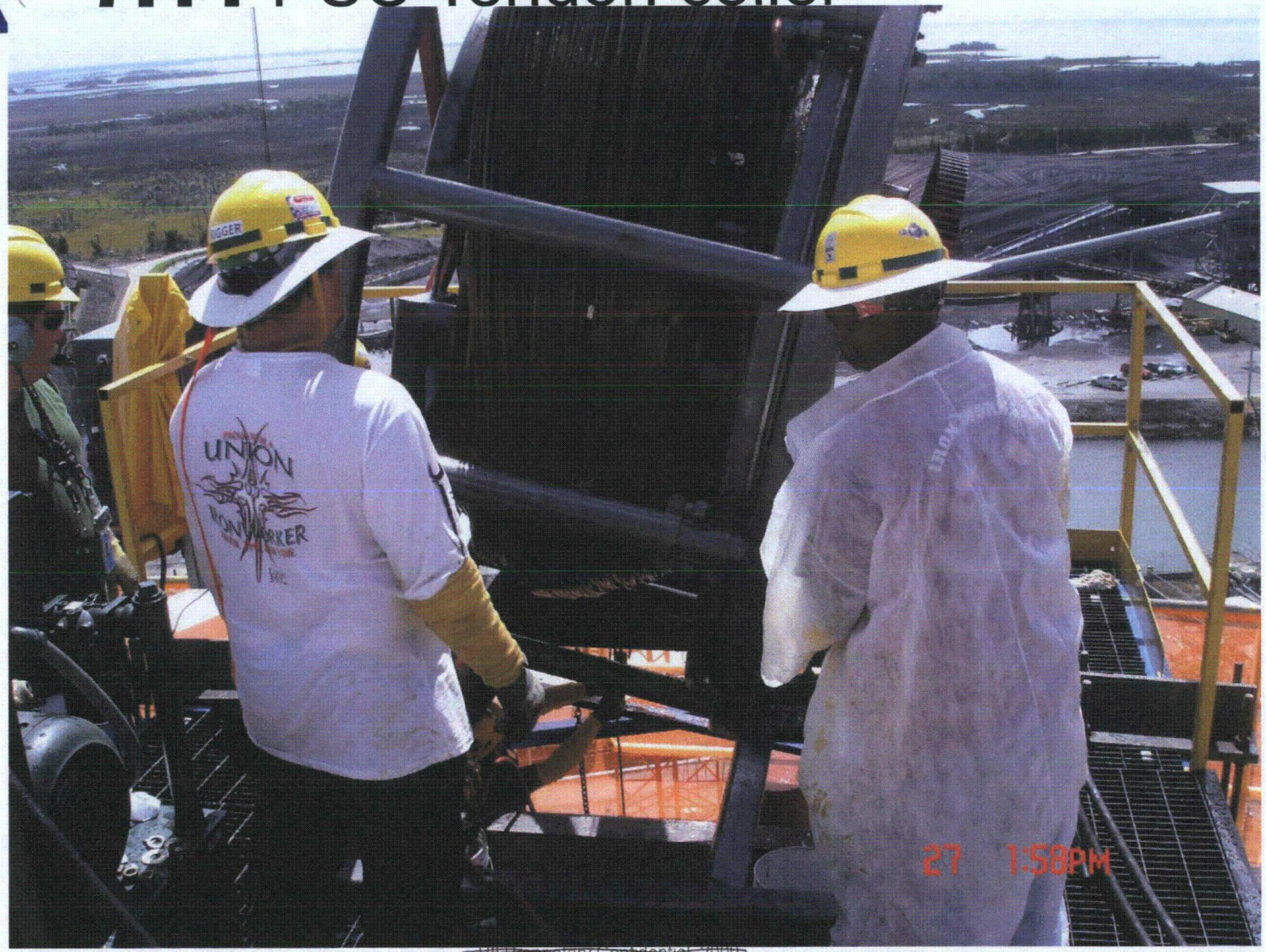

7.11 PSC Tendon coiler

7.11 PSC Tendon coiler

FM 7.11 Exhibit 5

From: "Holliday, John" <John.Holliday@pgnmail.com>
To: "'patrickberbon@yahoo.com'" <patrickberbon@yahoo.com>

From: Paul Smith [mailto:PSmith@psctendon.com]
Sent: Monday, January 04, 2010 8:26 AM
To: Holliday, John
Subject: RE: RCA question about PSC coiler

John,

Please find below a response to the questions:

1. Hoop tendon length is approximately 155 feet so weight should be approximately 4500lbs.
2. Vertical weight is about right.
3. Max pulling force is 16,000lb when you start pulling but quickly drops.
4. Coiler is designed and built by PSC for PSC and has no operation manual.
5. Estimated coiling rate is more like 30 ft per minute during continuous operation. Coiler stops to allow banding each revolution.

Paul

From: Holliday, John [mailto:John.Holliday@pgnmail.com]
Sent: Sunday, January 03, 2010 9:25 AM
To: Paul Smith
Subject: FW: RCA question about PSC coiler

Paul,
Could you please review and provide responses to the questions below that I received from the Root Cause Team. Thanks.

Regards,
John Holliday

From: Patrick Berbon [mailto:patrickberbon@yahoo.com]

Cc: Portmann, Rick; Williams, Charles R.; Dave Brevig
Subject: RCA question about PSC coiler

Hi John,

We have some more questions on the PSC tendon coiler used at CR3.

- Can you confirm the approximate weight of a hoop tendon is: 9.72 in2 x 130 ft x 0.28 lb/in3 = 4,250 lbs?

- Can you confirm the approximate weight of a vertical tendon is: 9.72 in2 x 192 ft x 0.28 lb/in3 = 6,270 lbs?

- We have an email from Brian Giometti at PSC indicating the maximum pulling force for the coiler is around 16,000 lbs. Can you confirm that?

- Do you have an operation's manual for the coiler? Can we get a copy?

- What is an estimate of the coiling rate? Does 1ft/min make sense?

I appreciate your time.

Patrick Berbon, PII Team