Progress Energy

Crystal River Nuclear Plant
Docket No. 50-302
Operating License No. DPR-72

Ref: 10 CFR 50.54(f)

August 8, 2003
3F0803-03

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

Subject: Crystal River Unit 3 – 60 Day Response to NRC Bulletin 2003-01, "Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized-Water Reactors"

Reference: NRC to PEF letter, dated June 9, 2003, NRC Bulletin 2003-01, "Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized-Water Reactors"

Dear Sir:

The referenced NRC Bulletin 2003-01 was issued to inform licensees of the potential for additional adverse effects due to debris blockage of the flow paths necessary for the Emergency Core Cooling System (ECCS), Containment Spray System (CSS) recirculation, and containment drainage. These additional adverse effects were based on the NRC-sponsored research that identified the potential susceptibility of pressurized-water reactor (PWR) recirculation sump screens to debris blockage in the event of a high energy line break (HELB) that would require ECCS and CSS operation in the recirculation mode.

Bulletin 2003-01 requires individual PWR licensees to submit information within 60 days that fulfills either:

Option 1. State that the ECCS and CSS recirculation functions have been analyzed with respect to the potentially adverse post-accident debris blockage effects identified in this bulletin;

OR

Option 2. Describe any interim compensatory measures that have been implemented or that will be implemented to reduce the risk which may be associated with potentially degraded or nonconforming ECCS and CSS recirculation functions until an evaluation to determine compliance is complete.

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At CR3, the loss of sump recirculation ability due to entire screen blockage is beyond the current design basis and has not previously been considered, i.e., analyses that specifically include recent research regarding fiber and particulate combination effects on sump screens have not been performed. Therefore, in accordance with Bulletin 2003-01, Option 2, certain recirculation sump compensatory measures will be implemented to reduce the risk which may be associated with potentially degraded or non-conforming ECCS and CSS recirculation functions while evaluations proceed to confirm compliance.

Attachments A and B to this letter provide the CR3 information requested above for Option 2 of the Bulletin. Attachment C lists the regulatory commitments established in this submittal.

If you have any questions regarding this submittal, please contact Mr. Sid Powell, Supervisor, Licensing and Regulatory Programs at (352) 563-4883.

Sincerely,

Dale E. Young

Dale E. Young
Vice President
Crystal River Nuclear Plant

DEY/lvc

Attachments:

A. 60 Day Response to NRC Bulletin 2003-01, "Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized-Water Reactors"
B. CR3 Design Layout and Details
C. List of Regulatory Commitments

xc: NRR Project Manager
Regional Administrator, Region II
Senior Resident Inspector

STATE OF FLORIDA

COUNTY OF CITRUS

Dale E. Young states that he is the Vice President, Crystal River Nuclear Plant for Progress Energy Florida, Inc.; that he is authorized on the part of said company to sign and file with the Nuclear Regulatory Commission the information attached hereto; and that all such statements made and matters set forth therein are true and correct to the best of his knowledge, information, and belief.

Dale E Young

Dale E. Young
Vice President
Crystal River Nuclear Plant

The foregoing document was acknowledged before me this 8th day of August, 2003, by Dale E. Young.

Janet Schroeder

Signature of Notary Public
State of Florida

JANET SCHROEDER
MY COMMISSION # DD 128063
EXPIRES: June 20, 2006
Bonded Thru Notary Public Underwriters

(Print, type, or stamp Commissioned Name of Notary Public)

Personally Known ✓ -OR- Produced Identification ______

PROGRESS ENERGY FLORIDA, INC.

CRYSTAL RIVER UNIT 3

DOCKET NUMBER 50-302/LICENSE NUMBER DPR-72

ATTACHMENT A

60 Day Response for NRC Bulletin 2003-01, "Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized-Water Reactors"

NRC Bulletin 2003-01 Response

Bulletin 2003-01, "Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized-Water Reactors," requests that individual PWR (pressurized-water reactor) licensees submit information within 60 days that either:

Option 1: State that the ECCS and CSS recirculation functions have been analyzed with respect to the potentially adverse post-accident debris blockage effects identified in this bulletin, taking into account the recent research findings described in the Discussion section, and are in compliance with all existing applicable regulatory requirements;

OR

Option 2: Describe any interim compensatory measures that have been implemented or that will be implemented to reduce the risk which may be associated with potentially degraded or nonconforming ECCS and CSS recirculation functions until an evaluation to determine compliance is complete. If any of the interim compensatory measures listed in the Discussion section will not be implemented, provide a justification. Additionally, for any planned interim measures that will not be in place prior to your response to this bulletin, submit an implementation schedule and provide the basis for concluding that their implementation is not practical until a later date.

Since Crystal River Unit 3 (CR3) is not able to confirm compliance with 10 CFR 50.46(b)(5) and other existing applicable regulatory requirements (General Design Criteria) relative to the potentially adverse post-accident debris blockage effects identified in Bulletin 2003-01, Option 2 will be pursued. Therefore, certain recirculation sump compensatory measures will be implemented to reduce the risk (Reference 1) which may be associated with potentially degraded or nonconforming Emergency Core Cooling System (ECCS) and Containment Spray System (CSS) recirculation functions while evaluations proceed to determine compliance.

Loss of recirculation capability due to complete sump screen blockage is beyond the current design basis of CR3. Analyses that specifically include recent research (Reference 3) regarding fiber and particulate combination effects on sump screens have not been performed. Because some system components and piping inside the Reactor Building (RB) are insulated with mineral wool fiber, CR3 may be susceptible to differential pressure effects across the screen beyond those currently evaluated, and thus may be susceptible to adverse effects on Net Positive Suction Head (NPSH) for ECCS and Building Spray (BS) pumps and/or on structural loading of the sump screen during certain post-Loss-of Coolant Accident (LOCA) events requiring sump recirculation.

Summary Description of the Reactor Building Sump Design at Crystal River Unit 3

The CR3 RB sump, a recessed pit, is approximately 10 feet long x 9.5 feet wide x 10.5 feet deep and is located outside the secondary bio-shield wall below the lowest floor (95 feet datum elevation). The bottom of sump datum elevation is 84 feet-6 inches. The sump contains a vertical screen which is a 5-piece assembly of woven wire screen sections, each about 20 inches wide x 10 feet-5 inches tall, equating to a total screen area of approximately 86 square feet. Each section is individually supported along its perimeter by structural steel members. The woven wire screen has a square opening size of ¼ inch x ¼ inch (clear area). The sump trash rack is a 55 square foot horizontal section of standard floor grating (4 inch x 1-3/16 inch openings), located at the floor

level and is protected by a 4 inch high curb. The floor above the clean side of the sump is approximately 40 square feet of solid deck plate. Refer to Reference 7 and Attachment B for configuration details of the sump and for the RB basement floor layout, including sump location and post-LOCA recirculation pool flow paths.

The CR3 RB sump supports both trains of ECCS and BS during design basis events (LOCAs) that require long term containment pool recirculation cooling. Sump water level instrumentation is available on the clean side of the sump strainer. The sump is completely submerged in recirculation events with 2.5 to 7 feet of water cover [amount depends on Borated Water Storage Tank (BWST) depletion and hideout areas, Reference 5]. Therefore, the sump level indication during a design basis event would normally be off-scale high. The instrument error compensated maximum sump flow rate, after switchover to recirculation and with all ECCS equipment operating [two complete trains responding to a Large Break LOCA (LBLOCA)] is about 8700 gpm (Reference 4).

The 1970 CR3 sump design (Reference 7) pre-dates the initial issue of Regulatory Guide (RG) 1.82 (Reg. Guide, Reference 6). This provides some rationale why CR3 has only 1 sump (not 2), a horizontal trash rack (not vertical), and a design coolant velocity at the screen of 0.2 feet/second based on the full surface area of the screen structure (versus 50% of the area), which are some of the recommendations in the Reg. Guide and/or the proposed revision (Reference 2). However, CR3 design basis hydraulic analyses (Reference 4) demonstrate that sump screen blockage in excess of 50% of the screen area provides adequate Net Positive Suction Head (NPSH) availability for post-LOCA ECCS and BS pump performance.

Responses to Bulletin 2003-01 Compensatory Measures

The following sections discuss the interim compensatory measures that have been, or are planned to be implemented at CR3 (reference the six bullets listed on Page 7 of NRC Bulletin 2003-01). The discussions include measures already taken and anticipated dates for those supplementary measures planned:

1st Bullet: operator training on indications of and responses to sump clogging

CR3 is currently conducting licensed operator fundamentals training on indications available for recognition of containment sump screen blockage and appropriate response measures. This training will be complete by August 22, 2003, as the current session of operator re-qualification training runs through that date. The following training is being implemented:

- Classroom training has been incorporated into the current session of licensed operator re-qualification training. Specific training associated with containment sump blockage issues, including classroom simulator training, familiarizes the operators with symptoms of a pending loss of ECCS/BS recirculation capability and the steps necessary for subsequent recovery of margin. Specific Emergency Operating Procedure (EOP) step/action training will be conducted upon approval of the procedures and before implementation in the operating shifts (no later than September 5, 2003).

- Training for required Technical Support Center (TSC) personnel for the revisions being made to Emergency Management procedures EM-225 and EM-225E (References 16 and 17) will be completed by September 5, 2003.

- EOP and TSC procedure revisions will be issued for use no later than September 5, 2003, fully implementing these interim compensatory measures.

- As part of the training effort, the CR3 plant simulator has been upgraded to support sump screen blockage scenarios. The simulator now demonstrates the impact on ECCS or BS pump NPSH resulting from progressive sump screen clogging, including the beneficial effects of decreasing flow in accordance with the interim compensatory guidance described below. The classroom simulator provides direct visual representation of the indications that are available, the corrective actions that can be taken, and the restoration of pump performance and sump level that is a direct result of those actions.

The operator training lesson plan includes monitoring of the operating ECCS and BS pumps for indications of pump distress or loss of NPSH, such as erratic current or flow and includes monitoring the sump screen differential pressure by monitoring water level on the clean side of the screen. The training emphasizes the use of all available instrumentation to identify symptoms of containment sump blockage or degraded ECCS or BS pump performance. For example, decreasing sump level is a definitive indicator of containment sump screen blockage. General symptoms of pump distress (erratic current and/or flow) are used independently and/or in combination with sump level to determine if unacceptable amounts of sump blockage may be developing.

The Babcock and Wilcox Owners Group (BWOG) Technical Basis Document (TBD), which provides the basis for EOP instructions for B&W NSSS plants, is being revised to include recovery

strategies and guidance for addressing symptoms indicative of a clogged containment sump (ECCS) screen following recirculation initiation. Emergency Operating Procedure EOP-14 (Reference 15), Enclosure 19 is being revised to implement these recovery strategies.

Total loss of sump recirculation, due to complete sump clogging, is beyond the design basis of CR3. However, if it were to occur, emergency management personnel in the TSC, would be called on to provide guidance and recommendations using guidance provided by the Emergency Management Guidelines (EM-225 series). A more detailed discussion of the proposed procedure changes is provided below.

The following is a CR3-specific list of the instrumentation available to determine the potential of impending containment sump screen blockage:

- Containment flood level (depth of the containment pool above the sump, i.e., submergence depth)
- Containment sump level (decreasing level relative to flood plane level indicates screen differential pressure exceeding static driving head from the pool depth)
- Decay Heat [DH; low pressure injection (LPI) or low-head (Safety Injection, SI)] flow (fluctuations could indicate void development)
- Building Spray (BS; Containment Spray) flow (fluctuations could indicate void development)
- DH pump motor current (fluctuations could indicate void development)
- BS pump motor current (fluctuations could indicate void development)

Procedure revisions will provide guidance for the operators and TSC staff indicating that sump blockage may be occurring or has occurred. For example, the proposed revision to EOP-14, Enclosure 19 will require the crew to monitor for indications of sump screen blockage following transition to RB sump recirculation, whereas indications of RB sump screen blockage include any of the following:

- RB Sump Level decreasing on the following indicators:
  WD-301-LI
  WD-302-LI
- DHP (Decay Heat Pump) motor amps fluctuating
- LPI flow rate fluctuating
- BS pump motor amperage fluctuating
- BS flow rate fluctuating

EM-225, "Duties of the Technical Support Center (TSC) Accident Assessment Team," Enclosure 4 currently directs the Accident Assessment Team (AAT) to perform applicable actions in EM-225E, "Guidelines for Long Term Cooling," following transition to sump recirc3ulation. EM-225 is used by the AAT for recommending recovery actions for occurrences that are beyond the design basis. In addition to the existing guidance, EM-225 will provide additional guidance, similar to the following, if indications of sump screen blockage occur.

> ECCS pumps have been aligned to the RB sump and are now showing signs of sump screen blockage (flow oscillations, pump motor amperage fluctuations). Per EOP-14, Enclosure 19,

LPI flows should have been reduced to 1400 gpm per pump. A least one BSP should be secured and, if both trains of LPI are in service, High Pressure Injection (HPI) should be secured.

- Closely monitor ECCS pump parameters and incore temperatures
- Expedite Borated Water Storage Tank (BWST) refill operation from spent fuel pool using EM-225E.
- Expedite mixing of boric acid for Boric Acid Storage Tank (BAST) makeup per OP-403B, Boric Acid Production.
- Refer to EM-225E, Contingency Actions for RB Sump Screen Blockage, for specific guidance.

The following actions to restore sump recirculation are already included in the EOPs or will be included in the proposed revision. They are intended to provide operator response to erratic pump performance indication and/or sump level decreasing:

Due to the inability to accurately diagnose a Core Flood (CF) line break, CR3 operators are trained to continue operating both trains of LPI, if both are available. This is because termination of either train could result in stopping LPI flow from the train that is feeding the core, leaving the remaining operating train feeding the broken line. In this situation, if the wrong LPI train were shut down, only HPI flow on the order of 550 gpm would be available to the core. Therefore, dual LPI train operation is to be maintained. Because of the CF line break possibility, the EOPs do not direct shutdown of an LPI pump, but do direct further throttling, within design basis limitations.

- CR3 operators already throttle LPI and BS flows prior to switchover from the injection phase to the recirculation phase of LOCA recovery. LPI/BS flows are pre-set at 3000/1500 gpm per train when injecting from the BWST. Prior to transferring to the RB sump as a suction source, these flows are reduced to a nominal 2000/1200 gpm respectively, for ECCS/BS pump NPSH purposes. HPI flow is not typically throttled until hours into the recovery.
- If indications of ECCS pump distress occur or if decreasing sump level indication is observed, procedure revisions will instruct the operators to:

  - Verify correct ECCS pump suction flowpath exists
  - Further reduce LPI flow to 1400 gpm per train
  - Shutdown one train of BS if two trains of BS are in service and one RB cooler unit is operating
  - Shutdown the second train of BS if RB pressure and dose conditions permit
  - Shutdown all HPI flow if 2 trains of LPI are in operation > 1400 gpm

  HPI pump suctions are aligned to the LPI pump discharge lines (piggy-back) in the recirculation mode and therefore are not directly susceptible to NPSH from sump clogging. However, due to their energy development, the HPI pumps are extremely vulnerable to inadequate NPSH effects. If indications of LPI pump

distress occur, such as oscillating flowrate or motor amperage, the impact on the HPI pump could be significant. Therefore, if both trains of LPI are providing more than 1400 gpm ECCS flow, HPI pumps are shutdown. This action reduces flow through the screen and ensures HPI pump availability, if needed later.

- Subsequently, if indications of pump distress persist or return, additional guidance is being provided in the TSC procedures to consider the following actions:

  - Using of RB cooling units in lieu of RB spray for RB pressure control
  - Further reducing injection flow to match DH (flow versus time curves added)
  - Using HPI in piggy-back, instead of LPI, to achieve better flow instrument accuracy at lower flow rates
  - Re-aligning HPI to BWST to re-establish an injection path
  - Aligning HPI pump to MU (Makeup) tank and establish normal 'make-up' as an injection path
  - Transitioning to normal DH removal flow path, if possible
  - Performing sump screen backwash

    CR3 can back-flush the sump screen, using the Boron precipitation control 'dump-to-sump' process via the drop line, already detailed in EOP-14. The sump screen structure was reinforced in 1997 to permit the use of this process. The revision to EM-225E will provide guidance for its use if sump screen clogging continues to challenge core cooling capability.

Most of these actions require declaration of 10 CFR 50.54(x).

2nd Bullet: procedural modifications, if appropriate, that would delay the switchover to containment sump recirculation (e.g., shutting down redundant pumps that are core, and operating the CSS intermittently)

A. Procedure actions that delay the switchover to containment sump recirculation:

CR3 has evaluated potential pre-emptive measures that would effectively extend the BWST injection time and delay switchover to sump recirculation, and has concluded that additional measures, over those already taken, are not appropriate. Specifically, shutting down redundant pumps during the injection phase of LBLOCAs is not considered to be in the best interest of safety.

As described previously, both DH pumps are necessary to ensure full LPI flow (initially greater than 2685 gpm and greater than 1000 gpm after 10 minutes) is available to the core during injection for a CF line break. Shutdown of one ECCS train (DH/MU pump) could potentially result in only one HPI pump cooling the core, less than 600 gpm. The availability of only one HPI pump has been analyzed for this specific line break (single failure of one train), but it is not considered to be appropriate to intentionally reduce margin (increase in peak clad temperature) by shutting down the equipment designed for this size break (LPI). The inability to accurately diagnose break location and the lack of qualified LPI cross-tie line flow instrumentation, precludes shutting down either of the LPI pumps during the injection phase.

Also, both trains of RB spray are necessary to ensure RB design pressure is not challenged in the event where a single failure precludes proper transfer of Engineered Safeguards (ES) grade cooling water to the RB fan cooler assemblies. CR3 uses a common closed cycle cooling system (SW) for both ES trains of RB fan cooling. Normal RB cooling is a non-safety grade cooling loop. Transfer to the safety grade cooling system occurs on an ES signal, but a single failure of a transfer valve could make the RB fan cooling system ineffective. Proper transfer and operation must be confirmed prior to terminating the operation of one of the BS pumps. This action is detailed in the EOPs for consideration after switchover to the RB sump recirculation has occurred, but is considered overly burdensome on the operator to perform this diagnosis and action prior to switchover.

CR3 has also considered terminating HPI pumps during the injection phase of a LBLOCA, but EOP direction is not specific to LOCA break size. In the course of accident recovery, if it has been concluded that adequate LPI is feeding both CF nozzles (determined to be at least 1000 gpm per nozzle by analysis) then HPI could be terminated. Again, this diagnosis takes time and is not considered to be an appropriate action to take during the injection phase, unless the break size is small enough to provide sufficient time to do so. If inventory depletion is slow enough, the TSC could also direct this action prior to switchover.

Some measures already directed by the EOPs are effective in delaying switchover during small and medium sized break LOCAs. Actions are taken to throttle HPI flow for the purposes of maintaining minimum subcooling margin (SCM), for nil-ductility temperature (NDT) concerns, and for pressurized thermal shock (PTS) concerns. These EOP 'Rules,' are prescribed in EOP-13, and are emphasized in every operator's training.

Per BWOG recommendations for larger LOCAs that require ECCS injection flow and BS spray, pre-emptive operator actions to stop pumps or throttle flow solely for the purpose of delaying switchover to containment sump recirculation are not recommended until the impact of the changes can be evaluated on a generic basis for the following reasons:

- Operator actions to stop ECCS or CSS pumps or throttle flow may result in conditions that are either outside of the design basis safety analyses assumptions or violate the design basis safety analyses assumptions (single failure). This would result in the potential for creating conditions that would make the optimal recovery more challenging (e.g., stopping containment spray impacts containment fission product removal, containment sump pH and equipment environment qualification design basis requirements).

- These actions would be inconsistent with the overall BWOG TBD philosophy. The TBDs are symptom-based procedures that provide for the monitoring of plant parameters and prescribe actions based on the trend of those parameters. To avoid the risk of taking an incorrect action for an actual event, the BWOG TBDs do not prescribe contingency actions until symptoms that warrant those contingency actions are identified.

- These actions would be inconsistent with the current operator response using the BWOG TBDs that has been established through extensive operator training. The expected operator response is based on the optimal set of actions considering both design basis accidents and accidents outside the design basis. The BWOG TBD operator response is not limited to a specific accident progression in order to provide optimal guidance for a wide range of possible accidents.

- To be effective in delaying the switchover to containment sump recirculation, operator actions to stop ECCS or BS pumps must be taken in the early stage of an accident. This introduces a significant opportunity for operator errors based on other actions that may be required during this time frame.

As summarized above, these procedures currently exist and the licensed operators are thoroughly trained on their use. Any generic changes to the BWOG TBD guidance will be evaluated as part of an Owners Group program and incorporated into CR3 EOPs, as appropriate.

Additionally, guidance is being added to the EOPs to consider shutting down the second BS train, if a symptom of excessive sump blockage is evident and if event recovery conditions permit. This would necessitate the confirmation that RB fan cooling is adequate for controlling RB pressure and that RB pressure is low (less than 10 psig) and either decreasing or stable. This would also require confirmation that radiological dose from the recirculation fluid is low enough to dictate the action. CR3 alternative source term criteria rely on one BS train in operation for about 5 hours to maintain alternative source term assumptions. However, if ECCS equipment functions properly, fuel failure should not occur, and RB radiation levels may be low enough to permit shutdown of all BS. This level of diagnosis and reaction is considered too difficult to implement during BWST drawdown and, therefore, is intended to be implemented after switchover.

B. Procedure actions that delay BWST inventory depletion:

CR3 is not planning to implement procedure changes, i.e., increasing the initial BWST inventory, effectively delaying depletion of the BWST.

The CR3 BWST inventory is controlled by the Improved Technical Specifications (ITS). Surveillance Requirement (SR) 3.5.4.2 requires that BWST liquid volume be maintained between 415,200 gallons and 449,000 gallons. The BWST contains about 9400 gallons per foot of level, so there is a 3.5 foot permissible level fluctuation in the above range. Accounting for instrument uncertainty, the operating range reduces to about a 2 foot band, or about 18,800 gallons. At full ECCS flow (8700 gpm), maintaining the upper level limit would delay switchover less than 3 minutes. It would also translate into about a 3.5 inch increase of RB flood plane at roughly 80,000 gallons per foot of depth (10,700 sq ft of floor area, Reference 5) after injection.

Additionally, the switchover to the sump must be complete prior to reaching a BWST level of 5 feet-6 inches (plus measurement uncertainty, Reference 21) in order to preclude vortex formation, which prevents the potential air binding of the ECCS andBS pumps during maximum injection rates. The inventory remaining in the BWST serves as the initial volume for refill (3rd Bullet) or potential injection via HPI (lower vortex limits).

Based on this information, it is concluded that there is little advantage gained in delay time, or static head for NPSH improvement purposes, to administratively control the minimum BWST level at the ITS maximum level. Additionally, there is potentially only 4 inches of RB flood level margin available (Reference 5) for prevention of submergence of sensitive RG 1.97 instrumentation (located above plant datum elevation 102 inch). This leaves some room for the equivalent of about 3 feet of BWST level above the ITS limit, but as previously stated, very little benefit is provided by this amount of inventory. Therefore a change to increase the ITS limit will not be pursued.

3rd Bullet: ensuring that alternative water sources are available to refill the RWST (Refueling Water Storage Tank) or to otherwise provide inventory to inject into the reactor core and spray into the containment atmosphere

A. Alternate sources to refill the BWST [for potential Reactor Coolant System (RCS) injection or BS use]

CR3 is revising TSC guidance to immediately begin refilling the BWST upon completion of the ECCS/BS pump suction switchover to the RB sump. The Accident Assessment Team, upon staffing the TSC in a LOCA event, will quickly take the action prescribed in EM-225 to proceed into EM-225E. Guidance similar to the following will be added to the beginning of the 'Long Term Cooling Requirements' section:

- Refilling the BWST will provide additional ECCS inventory for RCS injection in the unlikely event that severe RB sump screen blockage occurs
- As soon as possible after ECCS Suction Transfer is complete, notify the Operational Support Center (OSC) to begin refilling the BWST from the Spent Fuel (SF) pool by performing Enclosures 11 and 12 of this procedure
- Notify OSC to commence Boric Acid production per OP-403B
- The most desired long term cooling mode of operation is to supply LPI injection through both injection lines. Review plant conditions for the safest method for achieving this alignment.

The guidance added to EM-225E provides instructions to the TSC staff for refilling the BWST from the SF pool and for replenishing the SF pool inventory used. This action does not consider the long term adverse effects due to lowering of the RB sump pH, so long term equipment corrosion effects, including those that affect post-accident hydrogen generation rate assumptions, will need to be considered and monitored. Additional actions to restore the sump fluid pH between 7.0 and 8.0 will be necessary, but these can be developed by the TSC, as significant time is available to develop and implement those plans. Hydrogen concentration monitoring is documented in the EOPs, therefore no additional monitoring instructions are necessary.

Use of the SF pool is believed to be the best method available for refilling the BWST, since it is a ready source of adequately borated water that can be quickly transferred to the BWST. It also eliminates the need to circulate and sample the water in the BWST prior to its use. There is some time required to fully implement these changes to the procedures, to provide training to the operating staff, and to issue the procedure revisions. The current operator requalification training session is scheduled to end by August 22, 2003. Therefore, full implementation including procedure issuance will be within two weeks of completing the training (September 5, 2003).

B. Alternate sources to inject into the RCS

In the case where recirculation flow reduction measures haven't completely eliminated sump screen blockage concerns, CR3 has determined that additional TSC guidance in EM-225E is appropriate to instruct the TSC staff to consider additional RCS injection source possibilities. The following guidance will be fully implemented after completion of the current training session, i.e., by September 5, 2003:

- The first choice would be to realign an HPI pump to the BWST and inject at a rate that is twice the predicted flow rate required to match the decay heat boil-off rate (Wvap), or at least 200 gpm if the predicted flow rate is lower than that. The flow is to be divided evenly among the available HPI nozzles. New guidance, as well as time-dependent injection rate curves, one for matching decay heat with liquid flow and one for matching decay heat boil-off, is planned for inclusion in EM-225E.

- If the BWST is not available, or if its inventory is nearing low level limits, the TSC staff will be instructed to consider aligning an HPI pump to the volume control [MakeUp (MU)] tank. This will involve use of the normal charging flow path, setting MU flow to exceed predicted decay heat requirements to match or exceed boil-off yet meeting HPI pump minimum flow requirements, and maintaining MU tank level via the RC Bleed Tanks or the Boric Acid Storage Tanks.

EM-225E will also contain RB sump screen blockage contingency actions, similar to the following actions:

- If ECCS suction must be realigned to the BWST, ECCS flow rates significantly greater than two times W_{VAP} are undesirable since they will accelerate BWST depletion.

- Because break location is unknown, ECCS flow > W_{VAP} must be injected through at least 2 nozzles.

- 200 gpm minimum HPI flow allows MU pump recirculation valves to remain closed.

- If ECCS pump suction flow from RB sump is interrupted due to sump blockage, or ECCS flow cannot be maintained at full flow (4 nozzles) from one HPI pump, then provide direction to the Control Room to reestablish ECCS injection flow from the BWST.

  - Align one HPI pump to BWST
  - Maintain ECCS total flow rate two times W_{VAP} or 200 gpm (whichever is greater)
  - Direct the Control Room to divide ECCS flow evenly between all available HPI nozzles
  - Closely monitor ECCS pump parameters and incore temperatures
  - When HPI flow from BWST has been established, calculate the time to BWST depletion based on initial BWST level and HPI flow rate

- Develop alternative methods for recovering the RB sump or continuing injection from alternate source.

  - Consider back washing the RB sump screen by performing a DH drop line dump to sump evolution per EOP-14, Enclosure 20
  - Consider cyclic operation of an LPI pump from RB sump. Direct pump operation on RB sump level indication. Ensure pump is stopped if indications of pump distress are observed.

- Consider aligning 1 HPI pump to MU tank. Maintain MU tank level by feeding from Reactor Coolant Bleed Tank (RCBTs) and BASTs.
- Consult with engineering personnel to determine minimum acceptable HPI flow rate. Maintain injection flow rate $\geq W_{VAP}$.
- If CFTs were isolated before being fully depleted, consider reopening CF isolation valves
- Consult with engineering personnel to determine if plant conditions will support a transition to normal Decay Heat Removal lineup
- Refer to the CR3 Severe Accident Guideline

If additional injection inventory is used, the impact of the additional water on RB structural integrity is negligible. The placement of another 450,000 gallon BWST volume (60,000 cubic feet) of water in containment is not expected to challenge the pressure rating of the 2 million cubic feet building structure (Reference 19), since most of the mass/energy release impact has been absorbed by this time in the event recovery (in addition, Reference 18 concludes approximately 60,000 cubic feet of free volume margin exists above the 2 million cubic feet assumed in CR3's containment and FSAR analyses).

It is recognized that certain post-accident monitoring instrumentation could be lost if additional water inventory is provided to the RB. Indication such as Pressurizer Level, RC Drain Tank Level and Pressure, Steam Generator Level, RB Temperature, RCS Pressure and Level, and Containment Isolation Valve position are among those that could become ineffective (Reference 20). Additionally, RB sump and RB flood plane level indications could peg high due to the higher water level. The impact of losing all or any of these instruments, by adding water to the RCS/RB beyond the normal BWST depletion volume, has been assessed. Maintaining adequate core cooling is considered to be a higher precedent than the preservation of these indicators in post-LOCA recovery. This is being emphasized in the current licensed operator re-qualification session.

4th Bullet: more aggressive containment cleaning and increased foreign material controls

A. Foreign material control/exclusion (FME)

The CR3 inspection procedure for the containment building is SP-324, "Containment Inspection" (Reference 11). SP-324 has been revised to require more detailed RB inspections. In summary, the RB has been divided into six (6) separate areas. During a refueling outage, each area will be inspected by a separate team. RB cleanup leads are assigned, typically SROs. These revisions are intended to enhance RB cleanliness and reduce foreign material loading in the RB following outage activities, thereby reducing the 'rush' to inspect and exit the RB during power startup iterations.

Additionally, SP-324 verifies prior to RB closure that drainage paths, such as Fuel Transfer Canal drain lines, floor drains, and D-ring wall penetrations are left in their design configuration (which ensures they are open and/or unobstructed), and that all items remaining inside the RB have been qualified and/or evaluated for RB sump impact (References 9 and 10). These approved items are specifically listed in SP-324 or an engineering evaluation is performed. The full implementation of this procedure revision will occur during the next refueling outage, which is currently scheduled for October 2003.

Examples of additional measures being taken to minimize foreign material in the RB include:

- Awareness training has been provided to the Maintenance organization on the importance of RB cleanliness towards the minimization of resident debris that could affect sump recirculation, and thus post-accident core cooling capabilities.

- AI-607, "Pre-job and Post-job Briefings," (Reference 13) will include a checklist item for RB housekeeping requirements (revision due prior to the next refueling outage). This step will be discussed with the work crews in pre-job briefs for work occurring inside the RB.

- Consideration of the use of double-loop tie wraps for temporarily strung cabling, hoses, etc. This type of tie wrap remains connected to the temporary items when snipped free from the support to which it was attached.

- Adhesive equipment labels for RB components have been replaced with ceramic and metallic labels, attached with stainless steel cable (Procedure AI-516, Reference 12). A Refueling Outage 13 (13R) outage crew will be looking for label upgrades that could have been missed, with plans to replace any if/when found.

- Exposed paper equipment safety tags have been eliminated during power operating modes (they are now encapsulated in Lexan enclosures) and tied off with stainless steel wire cable.

- Enforcement of the use of mats and/or tarps for work activities occurring over open floor grating to minimize spread of foreign material to lower building elevations.

B. Containment cleaning

In addition to the FME controls discussed above, a High Impact Team (HIT) has been assembled and devoted to RB housekeeping prior to, and during 13R. This team is responsible for assigning cleaning resources, as well as enforcing cleanliness standards in the RB and performing routine inspections. The intent is to maintain a high standard of cleanliness throughout the outage and to minimize RB cleaning and inspection activities at the end of the outage. As part of this effort, full time resources have been allocated to clean the RB for the outage duration and it is planned to clean all accessible areas, not just the task work areas, during the time available.

As stated above, awareness training has been provided to the Maintenance staff on this issue. Expectations and the purpose for heightened RB cleanliness have been clearly detailed. The implementation of this enhanced cleaning will occur during 13R, scheduled for October 2003, when access to the RB is available.

5th Bullet: ensuring containment drainage paths are unblocked

The primarily credited drainage path for post-LOCA recirculation fluid is the 7 feet high x 4 feet wide personnel access hallway/door through the 'A' D-ring wall on elevation 95 feet-7 ½ inches. This door includes a high-radiation gate made of standard cyclone fence mesh, and is the last item closed when exiting the D-rings for plant startup activities. It is a routine access area verified to be free of debris by SP-324. There are seven (7) other 12 inch x 12 inch openings, each one foot above the RB basement floor elevation, in the D-ring wall; four (4) in the south D-ring that are screened due to their close proximity to the RB sump and three (3) in the north D-ring that are clear (Reference 8). These openings are also inspected during SP-324. The orientation and location of these openings provides reasonable assurance that an adequate unobstructed coolant flow path will always exist from the RCS break to the RB sump, even should one or multiple of the openings become obstructed by debris. Only these eight penetrations have been identified in the D-rings below the flood plane elevation 101 feet-8 inches. Refer to Attachment B, sheet 2 for a schematic of the 95 foot floor elevation.

Verification of drainage path availability is performed for all floor drains and two (2) Fuel Transfer Canal (FTC) drains per SP-324. One FTC drain is screened and directly feeds the RB sump. The valves on the sump end of this drain are verified open by procedure. The other FTC drain feeds into the reactor vessel cavity. This drain is verified to have its blind flange, used during FTC fill, removed. These two inspections provide positive assurance that the deep end of the FTC does not hold excessive amounts of water and prevent its return to the RB sump. The floor drains throughout the RB are not credited for being open for water transfer, but they are screened, routed to the sump, and are inspected to be free of visible obstructions in SP-324. While these verifications are included in SP-324, additional human factoring of SP-324 will be completed prior to 13R to ensure verification of RB drainage paths are completed.

Engineered scaffolding frames and pre-approved maintenance storage boxes are permitted inside the RB during power operations. These items are documented in SP-324 or engineering evaluations, and are evaluated for post-accident conditions, including reviews for seismic stability, flood plane impact, zinc and aluminum limitations, and potential debris source term (free of tape, paint, rubber, wood, etc.). The storage boxes are placed at upper floor elevations (119 feet and 160 feet), which are above the flood plane and are not transportable (a minimum weight requirement prevents floatation). There are five (5) scaffolding frames left inside the RB for ALARA purposes. These frames are required each outage for hanging shielding (letdown line lead blanket support frames) and steam generator manway clean room frames. The tube-lock style scaffold framing foundation is the RB basement floor (elevation 95 foot). Since this scaffolding is erected by procedure, is seismically rugged, is a tubing frame construction, and has been fully evaluated by engineering, there is no impact on post-LOCA flow path or drainage availability to the RB sump (References 9 and 10).

Additionally, the five LERs listed on Page 5 of Bulletin 2003-01 were reviewed. Of these, those that reported deficiencies in the ability to ensure sufficient water inventory is available at the containment sump are most applicable to CR3. Examples of water retention areas not considered by the reporting sites included: the Fuel Transfer Canal, the Reactor Vessel Cavity, and those areas that could be restricted by blocked/clogged floor drains. CR3's flood plane and NPSH analyses (References 4 and 5) do account for the possibility to retain water in these and other areas and do

account for floor drain clogging, so no additional activities beyond those discussed herein are currently planned at CR3.

<u>6th Bullet</u>: **ensuring sump screens are free of adverse gaps and breaches**

CR3 verifies sump screen integrity on a Refueling Outage interval (ITS 3.5.2.7, 24 months), similar to that described in RG 1.82, Revision 0. Procedure SP-175, "Containment Flood Level and Flood Monitoring System Calibration," (Reference 14) Section 4.7, requires the ECCS System Engineer to inspect the RB sump each outage. An inspection will occur in 13R, scheduled for October, 2003. The checklist requires acceptability of the complete sump structure, the screen, all fasteners, minimal corrosion of all components, and no evidence of debris in or around the screen or ECCS suction piping. The inspection includes both sides of the screen. There is currently not a specific checklist item in the procedure for gaps and breaches. A procedure revision has been initiated to revise SP-175 to add a gap/breach inspection to the checklist. This procedure enhancement is expected to be complete prior to 13R, scheduled for October 2003, and should read similar to:

- Ensure there are no openings or gaps in, or around, the screen that exceed ¼ inch in width, including the solid deck plate above the screen. In other words the sump assembly cannot allow larger debris to short circuit the screen and enter the ECCS/BS suction piping.

The 13R inspection, subsequent to incorporating the proposed checklist revision, is expected to have the rigor intended by the Bulletin recommendation.

Furthermore, CR3 performed a detailed inspection of the sump assembly in 1997. The strainer was structurally reinforced to support reverse pipe jet flow used in 'dump to sump' boron precipitation control measures. During that time the screen and its supporting steel network were verified to be constructed per the design drawings and additional work was performed (welding, bolting) to be in full compliance with design requirements. At task completion, engineering inspected the strainer perimeter and the deck plate above to ensure no gaps exceeded ¼ inch width. Some gap shimming was performed around piping penetrations through the deck plate to maintain this dimensional requirement.

The following plant specific measure is planned to be implemented during the next Refueling Outage:

CR3 is planning comprehensive containment walkdowns for the purpose of defining the potential sump screen debris source term, similar to that described in NEI-02-01, Revision 1, "Condition Assessment Guidelines: Debris Sources Inside PWR Containments." The walkdowns are scheduled to occur during 13R, October, 2003. These walkdowns are part of the long range plan intended to bring GSI-191 concerns to a formal resolution at CR3.

References:

1. LA-UR-02-7562, "The Impact of Recovery From Debris-Induced Loss of ECCS Recirculation on PWR Core Damage Frequency," dated February 2003
2. Draft Regulatory Guide 1107 (DG-1107), "Water Sources for Long-Term Recirculation Cooling Following a Loss-of-Coolant Accident," dated February 2003
3. NUREG/CR-6808, "Knowledge Base for the Effect of Debris on Pressurized Water Reactor Emergency Core Cooling Sump Performance," dated February 2003.
4. CR3 Calculation M90-0021, Revision 12, "Building Spray and Decay Heat Pump $NPSH_{a/r}$."
5. CR3 Calculation M90-0023, Revision 7, "Reactor Building Flooding."
6. US Atomic Energy Commission Regulatory Guide 1.82, June 1974, "Sumps for Emergency Core Cooling and Containment Spray Systems"
7. CR3 Drawing S-521-038 Sheet 1, Revision 9, and Sheet 2, Revision 1, Reactor Building Sump Liner, Screen and Covers. Plan, Sections & Details
8. CR3 Drawing S-421-020, Revision 12, "Secondary Shield Wall, Stretch-out of Inside Face."
9. Engineering Evaluation EES-01-006, Revision 1, "Materials Stored and Installed in the RB at Power"
10. Request for Engineering Assistance REA 01-0559, "Documentation of Storage Boxes and Scaffolding Remaining in the RB after 12R During Operating Modes 1-4"
11. SP-324, Revision 47, "Containment Inspection"
12. AI-516, Revision 3, "Plant Labeling Guidelines"
13. AI-607, Revision 13, "Pre-Job and Post-Job Briefings"
14. SP-175, Revision 29, "Containment Sump Level and Flood Monitoring System Calibration"
15. EOP-14, Revision 9, "Emergency Operating Procedure Enclosures"
16. EM-225, Revision 13, "Duties of the Technical Support Center Accident Assessment Team"
17. EM-225E, Revision 5, "Guidelines for Long Term Cooling"
18. CR3 Calculation M98-0010, Revision 0, "CR-3 Containment Free Volume"
19. CR3 Calculation M97-0132, Revision 6, "CR-3 Containment Analyses"
20. CR3 Design Basis Document Tab 5/11, Revision 14, "Post Accident Monitoring Instrumentation"
21. CR3 Calculation M95-0005, Revision 6, "Minimum BWST Level Necessary to Prevent Vortexing During Drawdown"

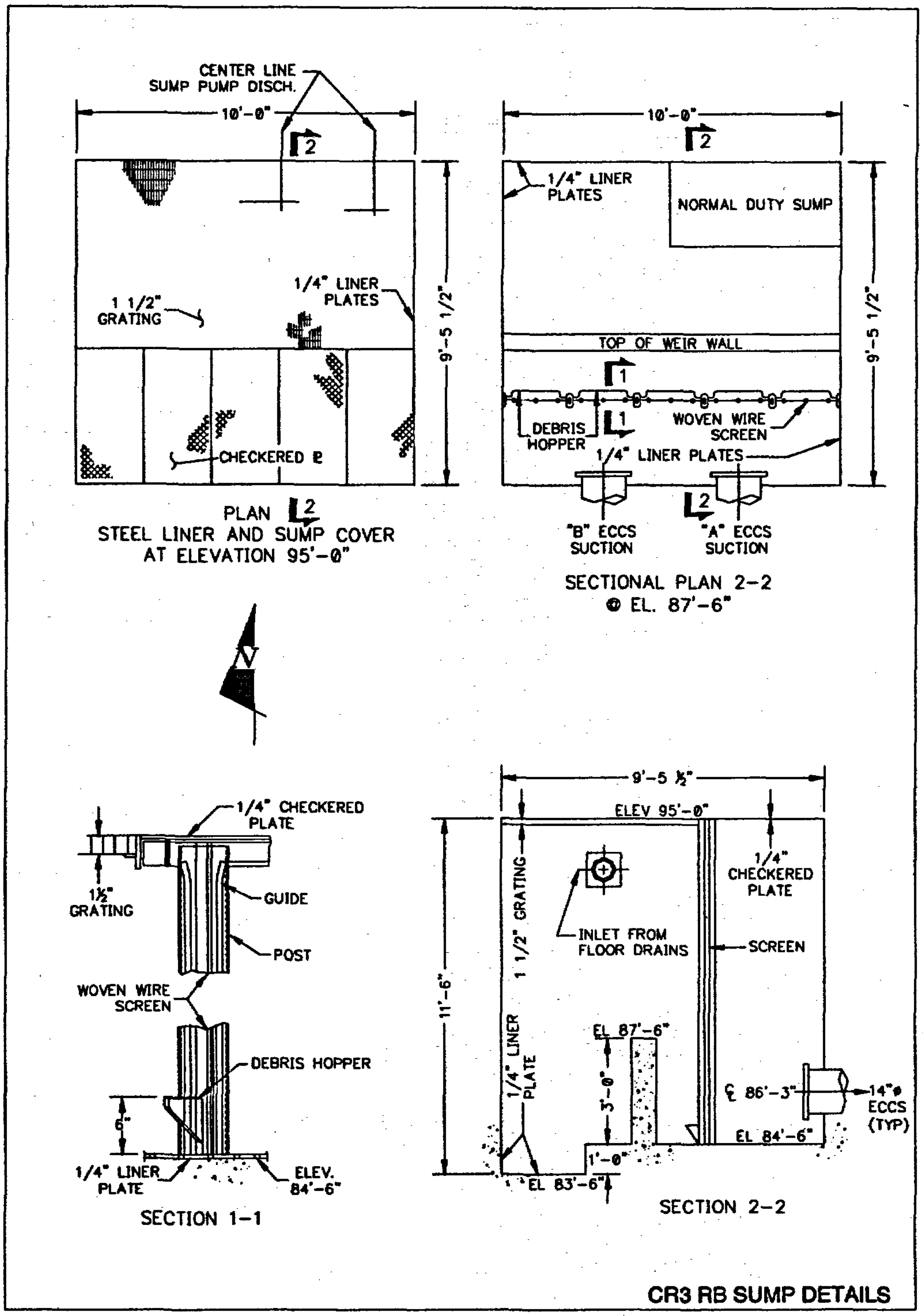
PROGRESS ENERGY FLORIDA, INC.

CRYSTAL RIVER UNIT 3

DOCKET NUMBER 50-302/LICENSE NUMBER DPR-72

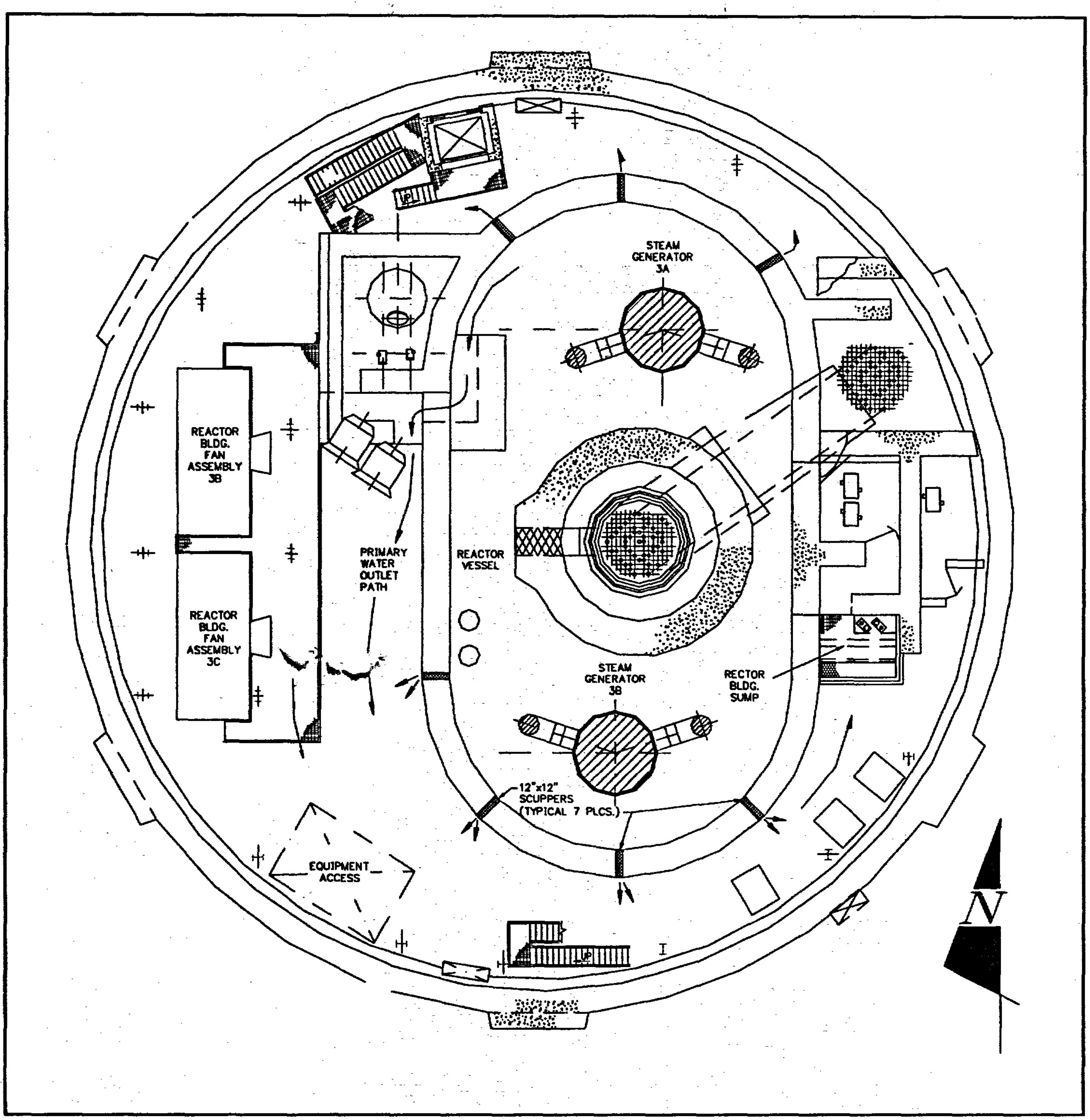
ATTACHMENT B

CR3 Design Layout and Details

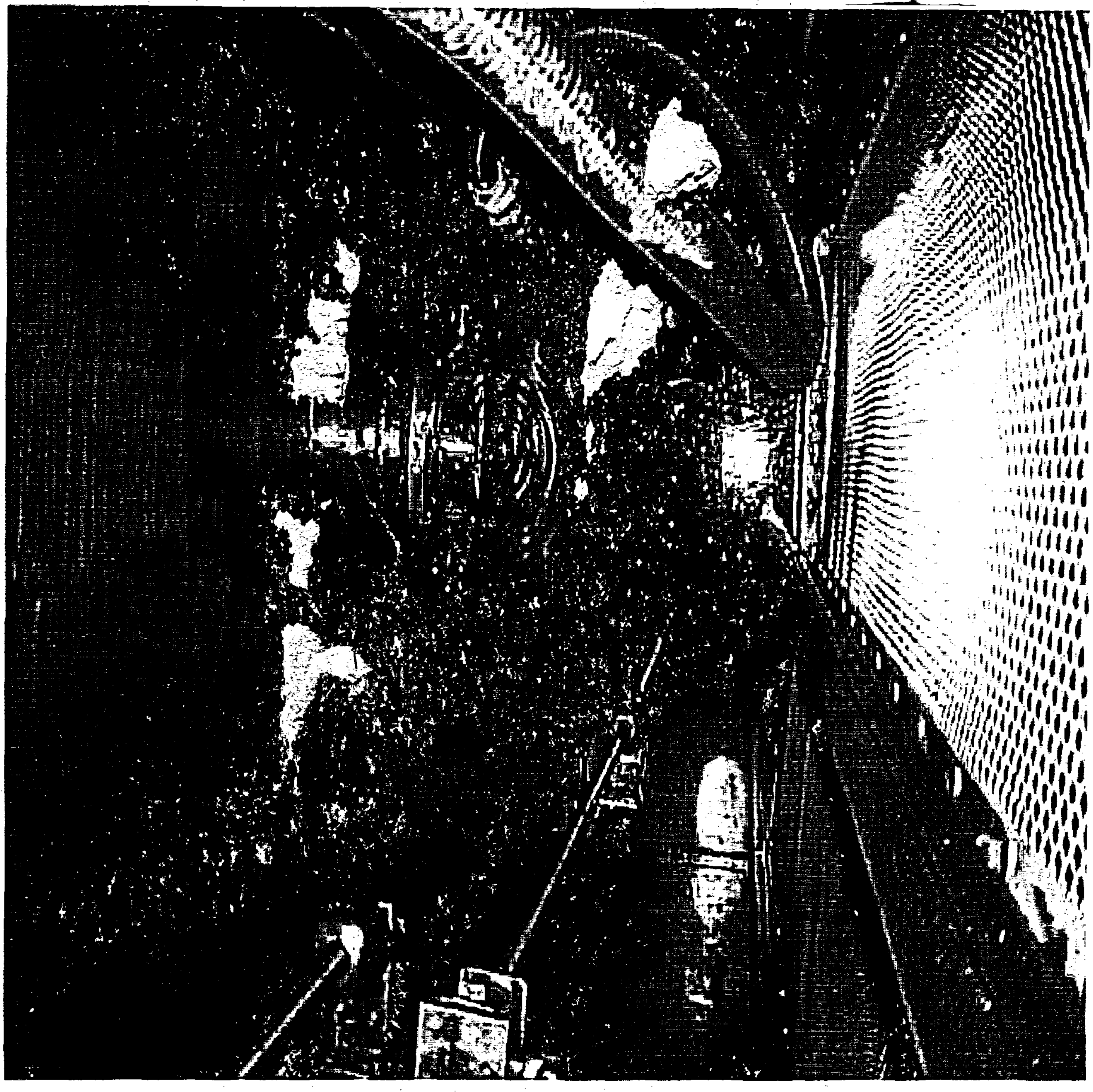


CR3 Reactor Building Sump Details

(Not to Scale)



CR3 Reactor Building basement Layout (Floor Elevation 95'-0")
(LOCA pool recirculation flow paths and RB sump location shown)



CR3 Sump Photograph Taken During Inspection Activities
(ECCS Suction Piping, Level Indicators, Screen Segment)

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ATTACHMENT C

List of Regulatory Commitments

List of Regulatory Commitments

The following table identifies those actions committed to by Progress Energy Florida, Inc. in this document. Any other actions discussed in the submittal represent intended or planned actions by Progress Energy Florida, Inc. They are described to the NRC for the NRC's information and are not regulatory commitments. Please notify the Supervisor, Licensing and Regulatory Programs, of any questions regarding this document or any associated regulatory commitments.

ID Number	Commitment	Commitment Date
3F0803-03	CR3 is currently conducting licensed operator training on indications available for recognition of containment sump screen blockage and appropriate response measures. The training will be complete by August 22, 2003.	August 22, 2003
3F0803-03	Training for required Technical Support Center (TSC) personnel for the revisions being made to Emergency Management procedures EM-225 and EM-225E will be completed by September 5, 2003.	September 5, 2003
3F0803-03	EOP and TSC procedure revisions will be issued for use no later than September 5, 2003, fully implementing the interim compensatory measures.	September 5, 2003
3F0803-03	The CR3 inspection procedure for the containment building is SP-324, "Containment Inspection." The full implementation of this procedure revision will occur during the next refueling outage, which is currently scheduled for October 2003.	October, 2003
3F0803-03	A High Impact Team (HIT) has been assembled and devoted to RB housekeeping during 13R.	October 2003
3F0803-03	While these verifications are included in SP-324, additional human factoring of SP-324 will be completed prior to 13R to ensure verification of RB drainage paths are completed.	September 30, 2003
3F0803-03	A procedure revision has been initiated to revise SP-175 to add a gap/breach inspection to the checklist. This procedure enhancement is expected to be complete prior to 13R, scheduled for October 2003.	October 2003
3F0803-03	AI-607 "Pre-job and Post-job Briefings" will include a checklist item for RB housekeeping requirements (revision due prior to the next refueling outage). This step will be discussed with the work crews in pre-job briefs for work occurring inside the RB.	October 2003