**Progress Energy**

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

Ref: 10 CFR 50.54(f)

December 10, 2007
3F1207-02

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

Subject: Crystal River Unit 3 - Request for Extension of Completion Date for Corrective Actions and Modifications Required by Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized Water Reactors"

References:

1. NRC Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors," dated September 13, 2004
2. CR-3 to NRC letter, "Response to Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors," dated August 30, 2005

Dear Sir:

By letter dated August 30, 2005, Florida Power Corporation (FPC), doing business as Progress Energy Florida Inc., Crystal River Unit 3 (CR-3) submitted a response to Generic Letter (GL) 2004–02. In this letter, FPC described the overall strategy for GSI-191 resolution and Generic Letter 2004-02 activities and stated that CR-3 would be in compliance with the regulatory requirements in the Generic Letter by December 31, 2007. CR-3 served as a pilot plant for this initiative and worked closely with the Nuclear Regulatory Commission (NRC) and the industry in addressing this GL and remains fully committed to resolving the issue in a timely manner. CR-3 provided the majority of its analytical and physical design information relative to GL 2004–02 for NRC Staff review as part of the pilot plant effort.

CR-3 has completed extensive physical and program-related modifications to improve sump performance. These modifications include installation of an 1139 $ft^2$ strainer, modified sump trash rack, debris interceptors and flow distributor, improvements to containment cleanliness procedures and development of methods to backflush debris from the sump strainer. During the most recent Refueling Outage 15 (Fall 2007), CR-3 took further aggressive measures to address the GL by reducing aluminum in containment, eliminating fibrous insulation on the pressurizer, removing degraded coatings and modifying reactor building floor drain strainers.

With this submittal, CR-3 respectfully requests that the date to complete all corrective actions and modifications associated with GL 2004-02 be extended to restart from Refueling Outage 16, scheduled to begin September 26, 2009. The basis for this proposed extension is in Attachment 1. During Refueling Outage 16, the CR-3 steam generators and their insulation will be removed and new steam generators will be installed with reflective metal insulation. The steam generator insulation replacement is the last planned physical corrective action associated with GL 2004-02.

Progress Energy Florida, Inc.
Crystal River Nuclear Plant
15760 W. Powerline Street
Crystal River, FL 34428

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NRR

CR-3 is currently performing downstream effects evaluations. These evaluations will be completed prior to February 29, 2008. The results of these evaluations will be included in the Supplemental Response to the GL in accordance with the NRC to NEI letter dated November 30, 2007, Supplemental Licensee Responses to Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors."

This letter contains regulatory commitments as shown in Attachment 2.

CR-3 staff is available to meet with the NRC to discuss any of the information in this letter.

If there are any questions regarding this submittal, please contact Mr. Dennis Herrin, Acting Supervisor, Licensing and Regulatory Programs at (352) 563-4633.

Sincerely,

Jon A. Franke
Director Site Operations
Crystal River Nuclear Plant

JAF/seb

Attachments:
1. Basis for Proposed Extension Request
2. Regulatory Commitments

xc: NRC Project Manager
NRC Regional Office
NRC Resident Inspector

**STATE OF FLORIDA**

**COUNTY OF CITRUS**

Jon A. Franke states that he is the Director Site Operations, Crystal River Nuclear Plant for Florida Power Corporation, doing business as 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.

Jon A. Franke
Director Site Operations
Crystal River Nuclear Plant

The foregoing document was acknowledged before me this 10 day of December, 2007, by Jon A. Franke.

Signature of Notary Public
State of Florida

CAROLYN E. PORTMANN
Notary Public - State of Florida
My Commission Expires Mar 1, 2010
Commission # DD 524380
Bonded By National Notary Assn.

(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**

**Request for Extension of Completion Date for Corrective Actions and Modifications Required by Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors"**

**Attachment 1**

**Basis for Proposed Extension Request**

# Basis for Proposed Extension Request

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## 1.0 Background

Generic Letter (GL) 2004-02 required that addressees provide by September 1, 2005, a description of and implementation schedule for all corrective actions, including any plant modifications, that were identified while responding to the GL. The GL requested that all licensees complete actions related to the GL by December 31, 2007, or provide justification for continued operation until the actions are completed. Florida Power Corporation, Crystal River Unit 3 (CR-3) provided its response by letter dated August 30, 2005. In this letter, CR-3 stated that confirmation of compliance with the regulatory requirements listed in GL 2004-02 would occur when all necessary activities are complete, which would be prior to December 31, 2007.

CR-3 conducted an evaluation of recirculation sump performance earlier than the schedule requested by GL 2004-02 and volunteered to be a pilot plant for an NRC staff audit. CR-3 supplied documentation related to its proposed analyses and planned changes, and from April 5, 2005 through June 16, 2005, the NRC staff conducted a pilot audit of the CR-3 implementation plant-specific evaluations responsive to GL 2004-02.

The majority of the CR-3 hardware modifications were installed during Refueling Outage (RFO) 14 in Fall 2005. These modifications include increasing the surface area of the sump screen from 86 $ft^2$ to 1139 $ft^2$ and installing a flow distributor and debris interceptor. A more comprehensive list of physical modifications is included in Section 4.3 and Table 1 of this Attachment. Mitigative measures have also been taken which include operator training on indications of sump strainer blockage, aggressive containment cleanliness initiatives, foreign material exclusion measures, and the establishment of multiple and diverse means to backflush the sump screen should blockage occur.

During RFO 15 in Fall 2007, CR-3 took further aggressive measures to address the GL by reducing aluminum in containment, eliminating a significant portion of fibrous insulation on the pressurizer, removing degraded coatings and modifying floor drain strainers to minimize debris transport to the sump.

During RFO 16, scheduled for Fall 2009, CR-3 will be replacing both steam generators (SGs). This modification will remove the majority of remaining fibrous insulation material and replace it with reflective metal insulation (RMI).

## 2.0 Reason for Requested Extension

CR-3 installed new sump screens during RFO 14 in Fall 2005. Since that time, industry testing associated with chemical effects have resulted in further evaluations and the need for additional mitigating actions. CR-3 has remained committed to performing site-specific testing to validate the extensive physical modifications installed in response to GL 2004-02. Preliminary results of plant-specific testing performed November 12-30, 2007 confirmed that the current screen configuration is of adequate size to demonstrate acceptable sump performance with the debris and chemical loadings for all postulated line breaks following steam generator replacement in RFO 16 with significant margin.

However, preliminary results of plant-specific testing could not demonstrate acceptable sump performance with current debris and chemical loading for all postulated pipe break sizes. Acceptable sump performance was demonstrated for 100% of postulated line breaks smaller than 2", 97% of postulated pipe line breaks between 2" and 6" and 51% of postulated pipeline breaks greater than 6".

A major factor of acceptable sump performance is limited head loss. The head loss challenges shown in preliminary testing of the CR-3 current configuration can be attributed to fiber insulation. This fiber insulation produces both post-LOCA debris and chemical load. The majority of fiber insulation remaining in containment is on the SGs. Mitigating the insulation on the SGs prior to RFO 16, would involve significant radiological dose and personnel safety hazards. Mitigation consists of removing contaminated fibrous insulation and replacing it with reflective metal insulation (RMI). This sequence of removal and installation will be performed in a high radiation area and will require extensive use of scaffolding. The typical dose rate in the general area of the SGs is 110 mrem/hr and 155 mrem/hr on contact at the bottom of the SGs. Work in the area will most likely require respiratory protection which will increase stay times. Fitting of new RMI insulation to the existing SGs will also require several iterations to ensure proper field fit-up with interferences. This will further increase stay times and exacerbate the dose consequences. Safety hazards are magnified as the replacement activities will require handling bulky/heavy material while on scaffolding in a high stress environment.

During RFO 16, both SGs will be replaced which simplifies fibrous insulation removal. The new SGs will also not contribute any dose to the work area in which RMI installation will take place significantly reducing the dose received by personnel. In addition, completing the work in RFO 16, results in personnel exposure to the high radiation area being limited to a one time effort and not the repeated task, that would occur by removing and fitting new insulation a second time.

Mitigating the fibrous insulation on the current SGs prior to RFO 16 will incur significant personnel dose that can be eliminated by operating in the current configuration until RFO 16. CR-3 believes it is prudent to plan removal of the SG insulation during the scheduled SG replacement in RFO 16. The scheduled start of RFO 16 is currently September 26, 2009, 21 months after the December 31, 2007 date specified in GL 2004-02 for completion of all corrective actions and modifications. An extension of the December 31, 2007 date is therefore requested.

CR-3 is also currently performing downstream effects evaluations as prescribed in WCAP-16406-P and WCAP 16793-NP. These evaluations will be completed prior to February 29, 2008. The results of these evaluations will be included in the Supplemental Response to the GL in accordance with the NRC to NEI letter dated November 30, 2007, Supplemental Licensee Responses to Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors."

## 3.0 Justification for Requested Extension

A Justification for Continued Operation from the NRC's April 2001, NRR Director's Quarterly Status Report was included in the Summary of the July 26-27, 2001, Meeting with Nuclear Energy Institute and Industry on ECCS Strainer Blockage in PWRs, dated August 14, 2001. In this Justification, the following considerations were noted which apply to CR-3. These considerations will remain valid during the requested extension period.

- The CR-3 containment is compartmentalized which makes the transport of debris to the sump screens difficult.
- CR-3 does not need to switchover to recirculation from the sump during a bounding large break Loss of Coolant Accident (LOCA) until 20-30 minutes after the accident initiation, allowing time for much of the debris to settle in other places in containment.
- The probability of the initiating event (i.e., large break LOCA) is extremely low.
- CR-3 has received leak-before-break (LBB) credit on the largest Reactor Coolant System (RCS) primary coolant piping. It demonstrates that LBB qualified piping is of sufficient toughness that it will most likely leak (even under safe shutdown earthquake conditions) rather than rupture.

## 4.0 Compliance with SECY-06-0078 Criteria

SECY-06-0078, "Status of Resolution of GSI-191, Assessment of [Effect of] Debris Accumulation on PWR (Pressurized-Water Reactor) Sump Performance," dated March 31, 2006, includes criteria for evaluating the delay of final hardware changes related to the resolution of GSI-191. There are two specified criteria for extensions of several months and one additional criterion for extensions of more than several months.

### 4.1 SECY-06-0078 Criterion 1

*The licensee has a plant-specific technical/experimental plan with milestones and schedule to address outstanding technical issues with enough margin to account for uncertainties.*

Generic Letter (GL) 2004-02, Question 2(b) requested a description of and implementation schedule for all corrective actions, including plant modifications, that were identified while responding to the generic letter. In the CR-3 response to GL 2004-02, dated August 30, 2005, CR-3 submitted a thorough description of these corrective actions with their expected date of implementation. An updated status of these activities is shown in Table 1 of this Attachment.

In a letter dated February 9, 2006 (Reference 1), the NRC requested additional information regarding the CR-3 GL 2004-02 response. This request for additional information (RAI) was followed by letters dated January 4, 2007 (Reference 2) and November 30, 2007 (Reference 3) which extended the due date of the RAI Response to

February 29, 2008. CR-3 will respond to the RAI in accordance with the November 30, 2007 correspondence.

### 4.2 SECY-06-0078 Criterion 2

*The licensee identifies mitigative measures to be put in place prior to December 31, 2007, and adequately describes how these mitigative measures will minimize the risk of degraded ECCS (Emergency Core Cooling System) and CSS (Containment Spray System) functions during the extension period.*

The following mitigative measures have already been taken to minimize the risk of degraded ECCS and CSS functions during the extension period:

1) Licensed Operator training has been conducted on indications available for recognition of containment sump screen blockage and appropriate response measures. The operator training lesson plan includes monitoring of the operating ECCS and Building Spray (BS) pumps for indications of pump distress or loss of Net Positive Suction Head (NPSH), such as erratic motor current or pump flow and includes monitoring the sump screen differential pressure. The training emphasizes the use of all available instrumentation to identify symptoms of containment sump blockage or degraded ECCS or BS pump performance. The plant simulator was also upgraded to include sump screen blockage scenarios.

2) Multiple and diverse sources to refill the Borated Water Storage Tank (BWST) inventory to inject into the RCS have been established. CR-3 has revised Emergency Procedure series EM-225 to begin refilling the BWST as soon as possible following completion of the ECCS/BS pump suction switchover to the RB sump. Refilling the BWST will provide additional ECCS inventory for RCS injection and/or backflushing in the unlikely event that severe RB sump screen blockage occurs.

3) Aggressive containment cleaning and increased foreign material controls have been established. Surveillance Procedure, SP-324, "Containment Inspection" has been revised to require more detailed RB inspections following an outage. This includes separate areas of the RB being inspected by teams typically led by Senior Reactor Operators.

4) Training has been provided to the Maintenance organization on the importance of RB cleanliness towards the minimization of latent debris that could affect sump recirculation, and thus post-accident core cooling capabilities, including enforcement of the use of mats and/or tarps for work activities occurring over open floor grating to minimize the spread of foreign material to lower building elevations. In addition, a checklist item to discuss housekeeping requirements for work inside the RB has been added to Administrative Instruction, AI-607, "Pre-job and Post-job Briefings."

5) Verification of drainage path availability is performed for all RB floor drains and the two (2) Fuel Transfer Canal (FTC) drains per SP-324. This procedure provides instructions to inspect the RB after online activities such as a maintenance outage,

quarterly inspections and limited maintenance jobs which require entry into containment. This procedure contains instructions to ensure no latent debris is present which can be carried to the RB sump.

6) CR-3 verifies the integrity of the RB sump on a refueling outage interval of 24 months with the performance of Surveillance Procedure SP-175A, "Reactor Building Emergency Sump Inspection and Cleaning." The procedure requires 100% inspection of each sump strainer top-hat, surrounding interstitial spaces (space between top-hats and vertically down center of top-hats) and above and below the screen structure, including inspection for the integrity of all fasteners, minimal corrosion of all components, and no evidence of debris in or around the sump or ECCS suction piping prior to declaring the sump operable following a refueling outage.

7) Engineering Change screening criteria includes questions that require the engineer to determine if the change will create or alter the potential sources of debris which could interfere with ECCS suction from the RB sump and if the change will result in the addition of materials in containment that could affect post-accident chemical precipitate formation, such as aluminum or aluminum containing materials. This aids in preventing the introduction of materials into containment that are potentially detrimental to ECCS recirculation.

8) To address the possibility of high sump screen differential pressure and sump screen blockage, diverse contingency actions including backflush of sump screens and stop/start of sump suction are written into Operating Manual EM-225E, "Guidelines for Long Term Cooling." The actions in this procedure are cued by indications of RB sump strainer blockage in Emergency Operating Procedures (EOPs). Indications of possible blockage include fluctuating flow rate and/or pump motor amps, as well as increasing differential pressure indications across the sump screen. None of the methods to address sump screen blockage interrupt flow to the core.

The sources of inventory for backflush capability are diverse. The sources provide a reverse flow to the sump strainer which causes debris to slough off and create clean strainer surface area. Preliminary results of backflush procedures performed during CR-3 sump strainer head loss testing demonstrate the effectiveness of the procedures as a valid defense in depth strategy for mitigating the effects of sump strainer blockage.

The system piping configurations at CR3 allow for various methods of backflushing the sump screens if excessive sump blockage is indicated or predicted. The Borated Water Storage Tank (BWST) provides a source of water that can easily be aligned to provide gravity flow to the sump via operator actions performed within the control room (i.e., remotely operated valves with main control board controls). Another backflush method that can be performed from within the control room utilizes the decay heat drop line to align reverse Reactor Coolant System (RCS) flow to the sump strainer. These methods of backflush are currently included in Operating Manual EM-225E, "Guidelines for Long Term Cooling."

The spent fuel pool is also capable of providing a source of backflush water to the RB sump strainer. This is performed through interconnections with the Decay Heat (DH) system. This flow can be provided via gravity, or by the motive force of a spent fuel pump. Use of the spent fuel system for backflushing requires access to the Auxiliary Building for manual valve alignment. These two additional methods of backflush, utilizing gravity and a spent fuel pump, will be added to Operating Manual EM-225E, "Guidelines for Long Term Cooling" as a means of adding further diversity to the backflush options. These additions to EM-225E, will be effective by December 31, 2007, prior to the requested extension period.

The choice of which backflush method to use will be based on plant conditions and equipment availability, as well as dose rates in the Auxiliary Building. However, due to the diversity of the methods and water sources, backflushing is considered a viable defense in depth strategy for coping with potential sump blockage.

## 4.3 SECY-06-0078 Criterion 3

*For proposed extensions beyond several months, a licensee's request will more likely be accepted if the proposed mitigative measures include temporary physical improvements to the ECCS sump or materials inside containment to better ensure a high level of ECCS sump performance.*

The following extensive hardware modifications and material programs have been permanently implemented to decrease the probability of ECCS sump blockage.

1) Sump Strainer: A complex geometry top hat style strainer with an effective surface area of 1139 $ft^2$ has been installed. The plate thickness is 14 gauge and the perforations are 1/8 inch in diameter. This perforation size was selected to preclude blockage of downstream piping components of which the minimum identified opening (throttle valve, orifice, spray nozzle, etc.) is 3/16 inch.

2) Strainer trash rack: The containment sump trash rack has approximately 100 $ft^2$ of horizontal and 15 $ft^2$ (25 lineal feet) of vertical surface areas. The trash rack surface area is capable of large debris capture, while the vertical sections preclude the possibility of a large piece of debris (insulation panel, plastic sheet, etc.) from completely obstructing the flow to the strainer below and starving the ECCS and BS pump suction.

3) Curbing and compartmentalization: These curbs are not credited for debris capture, but they enhance the ability to capture or trap denser debris, minimizing transport to the sump. The compartmentalization and layout of CR-3's RB basement floor induces a convoluted/tortuous path for debris-laden coolant flow. In addition to trapping sinking debris inside the D-rings, the RCS Drain Tank room, the Incore Trench, and the hallway outside the north D-ring, large floating debris will tend to be retained inside the D-ring/RCS Drain Tank room due to the 2 foot minimum water level depth being higher in elevation than any of the unconfined exit paths (the D-ring personnel exit has a cyclone fence gate).

4) Flow distributor: A flow distributor optimizes the post-LOCA containment pool flow characteristics and induces settling of debris. The flow distributor minimizes localized flow streaming and reduces recirculation flow turbulence. The net effect is that the fluid is slowed to create a nearly homogenous flow pattern, minimizing the bulk stream velocity and turbulence.

5) Debris Interceptor: A 15 inch high stainless steel debris interceptor of perforated plate with 3/16" holes is installed across the entire width of the floor between the D–ring wall and the containment liner. The interceptor serves to trap debris that has settled and could be sliding or tumbling along the floor in the recirculation stream. The interceptor is capable of trapping at least 95 cubic feet of debris. This is considered to be especially important during the potential sheeting action of the water along the containment floor as the containment initially fills with water (prior to switchover to sump recirculation).

6) Fuel Transfer Canal Trash Rack: A trash rack is located in the refueling canal over the 6" diameter northwest end drain. This ensures that debris does not plug the drain, causing additional holdup volume of reactor building spray inventory within the refueling canal.

7) Scupper covers: The four 1-foot by 1-foot scuppers closest to the sump that permit flow through the D-ring walls have been fitted with perforated covers. These covers force larger debris items (greater than 3/16 inch in size) through a lengthy and tortuous path before reaching the sump, thereby increasing the likelihood for entrapment or settling prior to reaching the sump.

8) Auxiliary Pressurizer Spray Valve: The auxiliary pressurizer spray line throttle valve was identified as being susceptible to blockage by debris bypassing the sump strainer. Hydraulic analyses were performed to eliminate the need to throttle this valve, and operating procedures were revised accordingly.

9) Floor Drain Screens: 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. Floor drains have been fitted with screens that limit the size and quantity of debris that could migrate to the RB sump through the floor drain system during a LOCA. These screens were designed to maintain a consistency with the perforated plate on the debris interceptor and scupper covers and they are made of perforated plate having 3/16 inch holes.

10) RB Sump Level Instrumentation: A Rosemount differential pressure (dP) cell provides post-accident sump level indication for the plant operator at the Main Control Board and also provides the capability for Accident Assessment Teams to trend the effects of debris accumulation on the sump strainer by monitoring the differential pressure across the strainer via the plant computer. This feature provides the Control Room, Emergency Operations Facility (EOF) and Technical Support Center (TSC) Accident Assessment Teams a means to determine if sump strainer debris accumulation is occurring and permit proactive measures, such as flow throttling or

strainer backflushing, to be taken to ensure pump NPSH margin is maintained. The Regulatory Guide 1.97 Sump Level Indicator, a ball float style device, remains as a back-up.

11) Pressurizer and SG Blowdown Piping Insulation Removal: Nukon insulation on the Pressurizer top head has been replaced with RMI and the majority of Mineral Wool insulation on the Steam Generator Blowdown piping has been removed in RFO 15. This reduces the overall amount of fibrous debris that can be transported to the RB sump.

12) Pressurizer Alloy 600/82/182 Welds: The current industry issue regarding Primary Water Stress Corrosion Cracking associated with pressurizer Alloy 600/82/182 dissimilar metal welds has been addressed with mitigation techniques applied to dissimilar metal welds (DMWs) on pressurizer instrument and relief nozzles, the pressurizer thermowell, the pressurizer surge line nozzle and the pressurizer spray nozzle safe end DMW. The CR-3 pressurizer is fully mitigated for Alloy 600/82/182 welds which minimizes the possibility of a break at these locations.

13) Cyclone Separators: CR-3 replaced the cyclone separators on the Building Spray and Decay Heat pumps during two ECCS on-line outages in 2007. The original separators used throttle valves for balancing. Due to blockage concerns with the throttle valves, replacement cyclone separators were installed that eliminate the need for the valves. Testing performed at Wyle Labs demonstrated the ability of the cyclone separators to operate in debris-laden fluid without blockage.

14) Aluminum Reduction in Containment: During RFO 15, fourteen existing aluminum scaffold storage box lids were removed from containment and replaced with stainless steel. This reduction in aluminum decreases the potential for chemical precipitant formation, and increases the current design margin of the existing hydrogen control methodology. In addition, aggressive action was taken in RFO 15 to eliminate aluminum valve handwheels and level switches during the "C" Reactor Coolant Pump motor replacement.

15) Degraded Coatings in Containment: Significant efforts were conducted to remove degraded coatings and recoat areas of structural steel to reduce the degraded and unqualified coatings contribution to the RB sump debris blockage analysis. A significant surface area of Service Level 1 coatings were removed from the Secondary Shield Wall (D-Rings) and other areas of degraded coatings on concrete surfaces. During RFO 15, all degraded coatings in Service Level II areas were also assessed and many mitigated while digital photos were taken of any questionable areas so that future assessments can determine trends in CR-3 coatings conditions.

## 5.0 Risk Assessment

A risk estimate was performed to assess the impact of extending the time for meeting GL 2004-02 requirements for CR-3 until September 26, 2009. This estimate utilized an engineering evaluation (Engineering Disposition 68737) to determine break sizes and locations for which satisfactory performance of the screen was demonstrated.

Engineering Disposition (ED) 68737 describes LOCAs that have the potential to generate enough debris to cause sump blockage. The ED has estimated the percentage of piping in containment that could generate a LOCA that creates unacceptable debris. This estimate considers piping location, break size, and break geometry. Small break LOCAs, equivalent to pipe size of 2" internal diameter and smaller, do not prevent the satisfactory operation of the ECCS sump with current debris and chemical loading. Certain medium and large break LOCAs are considered to have the potential to generate enough debris to cause sump blockage with the current debris and chemical loading. There are 3% of medium LOCA breaks, equivalent to a pipe internal diameter of 2" to 6", that are also considered to have the potential to impact satisfactory performance of the ECCS sump. There are 49% of large break LOCAs, equivalent to pipe internal diameter of 6" and greater, which have the potential to impact satisfactory performance of the ECCS sump.

Using NUREG/CR-5750 for frequencies of medium and large break LOCAs with sump clogging events leading directly to core damage, the annual increase in core damage frequency (CDF) due to operation in the current configuration can be estimated. The CDF is calculated by multiplying LOCA frequencies by the conditional probability of the breaks causing enough debris to create unacceptable performance of the sump. From NUREG/CR-5750, the annual frequency for a medium break LOCA is 4E-5 and the annual frequency for a large break LOCA is 5E-6. Therefore, the annual increase in CDF is estimated to be 3.7E-6.

$\Delta CDF = (3\%)(4E\text{-}5)+(49\%)(5E\text{-}6) = 3.7E\text{-}6$

This ΔCDF is considered small and falls into Region II of the Acceptance Guidelines for CDF in Regulatory Guide (RG) 1.174. These guidelines state that when the increase in CDF is between 1E-6 and 1E-5 per year, an application will be considered only if it can be reasonably shown that the total CDF is less than 1E-4 per year. The current "PSA Model of Record" as described in CR-3 calculation P02-0001 Revision 3, provides a base CDF of 4.99E-6 per year. The total CDF for CR-3 considering the ΔCDF for the GL 2004-02 extension is 8.7E-6. This is calculated by adding the ΔCDF (3.7E-6) and the base CDF (4.99E-6). Therefore, the CDF results remain very low and this risk-assessment is considered acceptable for this application.

Large Early Release Frequency (LERF) can be approximated by using a ratio of LERF to CDF for large LOCA sequence with failure of recirculation from the current Probabilistic Risk Assessment (PRA) model. When this ratio is applied to the estimated ΔCDF, an order of magnitude estimate for ΔLERF can be derived. Using this method in which $LERF_{AX}$ is the contribution to LERF due to large break LOCA recirculation failures and

$CDF_{AX}$ is the contribution to CDF for Large Break LOCA recirculation failures, ΔLERF is calculated below:

$\Delta LERF = \Delta CDF * (LERF_{AX}/CDF_{AX}) = 3.7E\text{-}6\ (6.2E\text{-}11 / 1.4E\text{-}7)$
$\Delta LERF = 1.6E\text{-}9$ per year

ΔLERF is less than 1E-7 per year. This is very small and falls into Region III of the Acceptance Guidelines for LERF in RG 1.174.

External events have negligible impact on the emergency sump evaluation. Piping inside containment is well protected from most external events with the exception of seismic and fire events. The frequency of seismic events that could induce a pipe failure for the reactor coolant system (RCS) in the Crystal River area is negligible. Fire events resulting in a large or medium LOCA are not considered credible and therefore have a negligible contribution.

## 6.0 Conclusion

An extension of the CR-3 due date for completing all corrective actions and modifications required by GL 2004-02 until restart from RFO 16, scheduled to begin September 26, 2009 to coincide with the planned SG outage, is warranted because of the following:

- There is a low probability of the initiating event (Large and medium break LOCAs) during the period prior to RFO 16. The period of extension results in PRA calculated increases of CDF and LERF that are small or very small as described by Regulatory Guide 1.174.
- CR-3 has completed significant actions, including extensive analyses, and has implemented physical improvements (including a larger sump screen) to better ensure a high level of sump performance.
- CR-3 has implemented mitigative measures to minimize the risk of degraded ECCS functions during the extension period.
- CR-3 has a plant-specific plan, with milestones and schedule, to address outstanding technical issues with enough margin to account for uncertainties.
- CR-3 has proceduralized multiple and diverse methods of backflushing the sump strainers as defense in depth for mitigation of strainer blockage.
- The current issue regarding Primary Water Stress Corrosion Cracking associated with pressurizer Alloy 600/82/182 dissimilar metal welds has been addressed with mitigation techniques applied to all DMWs on the pressurizer. The pressurizer has been fully mitigated to address Alloy 600/82/182 PWSCC concerns.
- Mitigating the SG insulation in conjunction with SG replacement will result in exceptionally lower radiological doses to plant personnel.

## 7.0 References

1. NRC to CR-3 Letter, Crystal River Nuclear Plant – Unit 3, Request for Additional Information Re: Response to Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors," received February 9, 2006 (TAC NO. MC4678)

2. NRC Letter, "Alternative Approach for Responding to the Nuclear Regulatory Commission Request for Additional Information Letter Re: Generic Letter 2004-02," dated January 4, 2007

3. NRC Letter to NEI, Supplemental Licensee Responses to Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized Water Reactors, dated November 30, 2007

4. WCAP-16408-P, "Evaluation of Downstream Sump Debris Effects in Support of GSI-191," March 2005.

5. WCAP–16568-P, "Jet Impingement Testing to Determine the Zone of Influence (ZOI) for DBA-Qualified/Acceptable Coatings," June 2006.

6. WCAP-16793-NP, "Evaluation of Long-Term Cooling Considering Particulate, Fibrous and Chemical Debris in the Recirculating Fluid," May 2007.

**Table 1**

**Summary of Actions Related to the Requirements of GL 2004-02**

| Corrective Action Description | Current Completion Date |
|---|---|
| Install 1139 $ft^2$ sump strainer | Complete |
| Install Strainer Trash Rack - precludes possibility of large debris completely obstructing flow to the strainer. | Complete |
| Install Flow Distributor - optimizes flow field characteristics and settling of debris. | Complete |
| Install Debris Interceptor - traps debris settled along the RB floor. | Complete |
| Install Fuel Transfer Canal Trash Rack – precludes possibility of debris obstructing transfer canal drain. | Complete |
| Install Scupper Covers – forces large debris through a torturous path inducing entrapment and settling. | Complete |
| Install Floor Drain Screens – minimizes direct transfer of debris to the sump. | Complete |
| Install RB Sump Level Instrumentation – enhanced instrumentation provides capability for Accident Assessment Teams to trend the effects of debris accumulation on the sump strainer. | Complete |
| Cyclone Separator Testing – demonstrate that cyclone separators will not clog due to operation with debris-laden fluid. | Complete |
| Replace Cyclone Separators – eliminates the need for throttle valves susceptible to blockage. | Complete |
| Pressurizer Head Insulation Removal – reduces overall fiber load in containment. | Complete |
| Remove SG Blowdown Piping Insulation – reduces overall fiber load in containment. | Complete |
| Mitigate Pressurizer Alloy 600/82/182 Welds – addresses issue of Primary Water Stress Corrosion Cracking associated with dissimilar metal welds. | Complete |
| Validate assumption of coating Zone of Influence (ZOI) design input of 4 pipe diameters (WCAP – 16568 - P) | Complete |

**Table 1**

**Summary of Actions Related to the Requirements of GL 2004-02 (Continued)**

| Corrective Action Description | Current Completion Date |
|---|---|
| Operator training on indications of sump screen blockage. | Complete |
| Establish multiple and diverse methods of refilling the BWST. | Complete |
| Implement procedures for aggressive containment cleanliness. | Complete |
| Implement procedures for increased foreign materials controls. | Complete |
| Implement procedures for verification of drainage path availability for floor drains and fuel transfer canal drains. | Complete |
| Implement RB sump inspection procedures | Complete |
| Add screening to Engineering Change procedure for potential addition of debris source to containment that may interfere with ECCS suction capabilities. | Complete |
| Proceduralize multiple and diverse methods to backflush the RB sump screens. | Complete |
| Perform debris and chemical effects headloss testing for post-SG replacement debris loads | Complete |
| Evaluate effects of operation with debris and chemical laden fluid on downstream components including reactor vessel and fuel. | February 29, 2008 |
| Install replacement SGs with RMI | Upon restart from RFO 16 which is scheduled to begin September 26, 2009 |

PROGRESS ENERGY FLORIDA, INC.

CRYSTAL RIVER - UNIT 3

DOCKET NUMBER 50 - 302 / LICENSE NUMBER DPR - 72

**Request for Extension of Completion Date for Corrective Actions and Modifications Required by Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors"**

Attachment 2

Regulatory Commitments

## Regulatory Commitments

The following table identifies those actions committed to by Florida Power Corporation (FPC) in this document. Any other statements in this submittal are provided for information purposes and are not considered to be regulatory commitments. Please direct questions regarding these commitments to Mr. Dennis Herrin, Acting Supervisor, Licensing & Regulatory Programs at (352) 563-4633.

| Regulatory Commitments | Due date/event |
|---|---|
| Crystal River Unit 3 will proceduralize additional sump backflush methods utilizing Spent Fuel Pool inventory as defense in depth strategies for mitigating sump screen blockage. | December 31, 2007 |
| Perform Downstream Effects Evaluations as prescribed in WCAP-16406-P and WCAP-16793-NP. | February 29, 2008 |
| Crystal River Unit 3 will be in compliance with the regulatory requirements of Generic Letter 2004-02. | Upon restart from RFO 16 which is scheduled to begin September 26, 2009 |