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AUTH.NAME AUTHOR AFFILIATION
STALL,J.A. Florida Power & Light Co.
RECIP.NAME RECIPIENT AFFILIATION
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SUBJECT: Forwards initial response to NRC GL 98-04, "Potential for Degradation of ECCS & CSS After LOCA Because of Construction & Protective Coating Deficiencies & Foreign Matl in Containment."

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Florida Power & Light Company, 6351 S. Ocean Drive, Jensen Beach, FL 34957

FPL

November 4, 1998

L-98-277
10 CFR 50.4
10 CFR 50. 54 (f)

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D. C. 20555

RE: St. Lucie Units 1 and 2
Docket Nos. 50-335 and 389
Generic Letter 98-04 Initial Response

The Florida Power and Light Company (FPL) initial response to Generic Letter (GL) 98-02, *Potential for Degradation of the Emergency Core Cooling System and the Containment Spray System After a Loss-Of-Coolant Accident Because of Construction and Protective Coating Deficiencies and Foreign Material in Containment*, for St. Lucie Units 1 and 2 is attached.

The NRC issued this generic letter to alert licensees to the problems associated with the material condition of Service Level 1 protective coatings inside the containment and to request information to be used to evaluate licensee programs for ensuring that Service Level 1 protective coatings inside containment do not detach from their substrate during a DB LOCA and interfere with the operation of the emergency core cooling system (ECCS) and the safety-related containment spray system (CSS). The NRC intends to use this information to assess whether current regulatory requirements are being correctly implemented and whether they should be revised.

The attached information is provided pursuant to the requirements of Section 182a of the Atomic Energy Act of 1954, as amended, and 10 CFR 50.54(f). Please contact us if there are any questions regarding this submittal.

Very truly yours,

J. A. Stall
Vice President
St. Lucie Plant

JAS/GRM

Attachment 130059

cc: Regional Administrator, Region II, USNRC
Senior Resident Inspector, USNRC, St. Lucie Plant

STATE OF FLORIDA)

) ss.

COUNTY OF ST. LUCIE)

J. A. Stall being first duly sworn, deposes and says:

That he is Vice President, St. Lucie Plant, for the Nuclear Division of Florida Power & Light Company, the Licensee herein;

That he has executed the foregoing document; that the statements made in this document are true and correct to the best of his knowledge, information and belief, and that he is authorized to execute the document on behalf of said Licensee.

J. A. Stall

STATE OF FLORIDA

COUNTY OF St. Lucie

Sworn to and subscribed before me

this 4 day of November, 19 98
by J. A. Stall, who is personally known to me.

Name of Notary Public - State of Florida

GEORGE R. MADDEN
MY COMMISSION # CC 562026
EXPIRES: June 17, 2000
Bonded Thru Notary Public Underwriters

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

St. Lucie Units 1 And 2
NRC Generic Letter 98-04 – 120 Day Response

Introduction

The NRC issued Generic Letter (GL) 98-04 to address issues which have generic implications regarding the impact of potential coating debris on the operation of safety related systems, structures, and components (SSC) during and after a postulated design basis LOCA. Detachment of the protective coatings from the substrate may make the emergency core cooling system (ECCS) unable to satisfy the requirement of 10 CFR 50.46(b)(5) to provide long-term cooling. Such detachment of coatings may also make the safety related containment spray system (CSS) unable to satisfy the plant-specific licensing basis of controlling containment pressure, temperature, and radioactivity releases following a LOCA. The generic letter requests information to evaluate licensee programs for ensuring that Service Level 1 protective coatings inside containment do not detach from their substrate during a design basis LOCA and interfere with the operation of the ECCS and the CSS. This attachment provides the FPL response to the information requested in Generic Letter 98-04 for St. Lucie Units 1 and 2.

NRC Request (1)

(1) A summary description of the plant-specific program or programs implemented to ensure that Service Level 1 protective coatings used inside the containment are procured, applied and maintained in compliance with applicable regulatory requirements and the plant-specific licensing basis for the facility. Include a discussion of how the plant-specific program meets the applicable criteria of 10 CFR Part 50, Appendix B, as well as information regarding any applicable standards, plant-specific procedures, or other guidance used for: (a) controlling the procurement of coatings and paints used at the facility, (b) the qualification testing of protective coatings, and (c) surface preparation, application, surveillance, and maintenance activities for protective coatings. Maintenance activities involve reworking degraded coatings, removing degraded coatings to sound coatings, correctly preparing the surfaces, applying new coatings, and verifying the quality of the coatings.

FPL Response (1)

FPL has conducted a review of plant-specific programs with regard to NRC GL 98-04, *Potential for Degradation of the Emergency Core Cooling System and the Containment Spray System after a Loss-Of-Coolant Accident Because of Construction and Protective Coating Deficiencies and Foreign Material in Containment.* The following is the summary description of the Service Level 1 protective coatings used inside the containment of St. Lucie Units 1 and 2.

FPL has implemented controls for the surface preparation, procurement, application, surveillance, and maintenance activities for Service Level 1 protective coatings used inside the containment in a manner that is consistent with the regulatory requirements applicable to St. Lucie Units 1 and 2. The requirements of 10 CFR 50 Appendix B are implemented through specification of appropriate technical and quality requirements for the Service Level 1 coatings program, which is considered a "Special Process" and is controlled in accordance with the requirements of ANSI N45.2-1977, *Quality Assurance Program Requirements for Nuclear Facilities*. This program addresses both new coatings and ongoing maintenance activities.

The Unit 1 Updated Final Safety Analysis Report (UFSAR) states that all Service Level 1 coatings are laboratory tested to withstand the Design Basis Accident (DBA) conditions in order to demonstrate that coating failure and the associated potential consequences (i.e., build-up of coating material debris at the containment sump screens, adversely impacting the flow of water through the sump) cannot occur. The DBA conditions to which Service Level 1 coatings could potentially be subjected include (but are not limited to) ionizing radiation, high temperature/pressure, and impingement from jets/sprays.

The Unit 2 UFSAR states that the significant coating quantities in Service Level 1 areas conform to the intent of ANSI N512-1974, *Protective Coatings (Paints) for the Nuclear Industry,* and ANSI N101.2-1972, *Protective Coatings (Paints) for Light Water Nuclear Reactor Containment Facilities*. Significant surface areas of concrete, masonry, and steel receive protective coatings successfully tested under DBA conditions. Quality assurance during manufacturing, storage, application, and inspection of field applied coatings meets the intent of ANSI N101.4-1972, *Quality Assurance for Protective Coatings Applied to Nuclear Facilities,* in conjunction with the general QA requirements of ANSI N45.2. This provides the assurance (and documentation) that the work associated with Service Level 1 protective coatings is accomplished under controlled conditions in accordance with applicable codes, standards, specifications, and criteria, using qualified personnel and procedures.

The current Service Level 1 coating specification provides the technical requirements for protective coating work that is performed inside the St. Lucie Units 1 and 2 containment buildings. The coating specification provides necessary technical information and controls to ensure that the new coatings (a) are of a high quality, (b) meet licensing requirements, (c) minimize the potential for transport of paint debris to the containment sump under post-LOCA conditions, (d) provide corrosion protection, and (e) provide a suitable surface which will facilitate radioactive decontamination. The specification covers procurement, storage, removal of degraded coatings, surface preparation, application, inspection, applicator's certification, quality assurance documentation, condition assessment, and other related coating activities. The codes and standards used to develop the current specification are ANSI N101.2, ANSI N101.4, ANSI N45.2.2-1978, *Packaging, Shipping, Receiving, Storage, and Handling of Items for Nuclear Power Plants*, ANSI N45.2.6-1978, *Qualifications of Inspection, Examination, and Testing Personnel for Nuclear Power Plants*, and 10 CFR 50 Appendix B. Adequate assurance that the applicable requirements for procurement, application, inspection, and maintenance are implemented is provided by procedures and programmatic controls, approved under the FPL

Quality Assurance program. Following are the highlights of the current Service Level 1 coating program at St. Lucie Units 1 and 2.

(a) Procurement of Service Level 1 coating material

The Service Level 1 coating specification identifies specific coating systems which are approved for use inside the St. Lucie containments; these systems have been laboratory tested to withstand the worst case DBA conditions. Service Level 1 coatings used for new applications or repair/replacement activities are specified to be purchased to procurement quality level PC-1 (Nuclear Safety Related), and are procured from vendors with quality assurance programs meeting the applicable requirements of 10 CFR Part 50 Appendix B. The applicable technical and quality requirements that the vendors are required to meet are specified by FPL in procurement documents. Acceptance activities are conducted in accordance with procedures that are consistent with the requirements of ANSI N45.2, ANSI N45.2.2, and ANSI N45.2.6 requirements (e.g., receipt inspection, source surveillance, etc.). This specification of required technical and quality requirements combined with appropriate acceptance activities provides adequate assurance that the coatings received meet the requirements of the procurement documents.

(b) Qualification testing of coating

The current Service Level 1 coating systems used for new applications or for repair/replacement activities have been tested under conditions which envelope the DBA conditions postulated for St. Lucie Units 1 and 2. These tests were performed to envelope St. Lucie Units 1 and 2 unit specific conditions following the guidelines of ANSI N101.2. The test results demonstrate that the current Service Level 1 coating systems will remain intact during the worst case DBA conditions postulated for both St. Lucie Units 1 and 2. Limited amounts of coatings inside containment do not meet the design basis requirements; these are classified as unqualified coatings. In accordance with the requirements of the Service Level 1 coating specification, logs of unqualified coatings in each unit are maintained by the Engineering Department and documented in a controlled calculation. Engineering performs an inspection to document the condition of the coatings at the end of each refueling outage, updates the logs as required, and reviews the data prior to re-start to ensure that the quantities of unqualified coatings are below the maximum acceptable limit. The maximum acceptable amount of unqualified coatings considered containment recirculation flow, debris transport, and acceptable sump blockage. This basis is documented in controlled calculations. A continuing effort to minimize the amount of unqualified coatings is a high priority objective of the program.

(c) Surface preparation, application, surveillance, and maintenance activities

Surface preparation, application, inspection, surveillance, maintenance activities, and documentation associated with Service Level 1 coatings at St. Lucie Units 1 and 2 are performed in accordance with detailed instructions provided in the Service Level 1 coating

specification. This specification meets the intent of ANSI N101.2, ANSI N101.4, ANSI N45.2.2, ANSI N45.2.6, and 10 CFR 50 Appendix B. Service Level 1 coating work performed by FPL is performed in accordance with the requirements of the FPL Quality Assurance program. Service Level 1 coating work performed by a contractor organization is performed in accordance with the requirements of either the FPL Quality Assurance Program or the contractor Quality Assurance Program approved by the FPL Quality Assurance Department.

FPL periodically conducts visual inspections and condition assessments of Service Level 1 coatings inside the St. Lucie Unit 1 and 2 containment buildings. These inspections are part of the containment closeout inspections mandated by the Service Level 1 coating specification, and are performed during every refueling outage. Inspection results are documented and evaluated prior to unit re-start. As localized areas of degraded or unqualified coatings are identified, a list is prepared to schedule and prioritize repair/replacement activities as necessary. The periodic visual inspections and condition assessments, and the resulting repair/replacement activities, ensure that the quantity of Service Level 1 coatings which may be susceptible to detachment from the substrate during a LOCA event is minimized. The inspection/assessment program provides long term material condition data which is used to establish strategic maintenance planning.

NRC Request (2)

(2) Information demonstrating compliance with item (i) or item (ii):

(i) For plants with licensing-basis requirements for tracking the amount of unqualified coatings inside the containment and for assessing the impact of potential coating debris on the operation of safety-related SSCs during a postulated design basis LOCA, the following information shall be provided to demonstrate compliance:

(a) The date and findings of the last assessment of coatings, and the planned date of the next assessment of coatings.

(b) The limit for the amount of unqualified protective coatings allowed in the containment and how this limit is determined. Discuss any conservatism in the method used to determine this limit.

(c) If a commercial-grade dedication program is being used at your facility for dedicating commercial-grade coatings for Service Level 1 applications inside the containment, discuss how the program adequately qualifies such a coating for Service Level 1 service. Identify which standards or other guidance are currently being used to dedicate containment coatings at your facility; or,

(ii) For plants without the above licensing-basis requirements, information shall be provided to demonstrate compliance with the requirements of 10 CFR 50.46(b)(5), "Long-term cooling" and the functional capability of the safety-related CSS as set forth in your licensing basis. If a licensee can demonstrate this compliance without quantifying the amount of unqualified coatings, this is acceptable. The following information shall be provided:

(a) If commercial-grade coatings are being used at your facility for Service Level 1 applications, and such coatings are not dedicated or controlled under your Appendix B Quality Assurance Program, provide the regulatory and safety basis for not controlling these coatings in accordance with such a program. Additionally, explain why the facility's licensing basis does not require such a program.

FPL Response (2)

St. Lucie Units 1 and 2 do not have requirements for tracking the amount of unqualified coatings inside the containment and for assessing the impact of potential coating debris on the operation of safety related SSCs during a postulated design basis LOCA. Therefore, item (ii) of NRC Request (2) is applicable for St. Lucie Units 1 and 2.

The following description taken from the UFSAR and related NRC correspondence describe the requirements for St. Lucie Units 1 and 2 relative to conformance with 10 CFR 50.46(b)(5), "Long Term Cooling," specifically with regard to the ability to provide extended decay heat removal (including related assumptions for debris that could block containment emergency sump screens).

(a) Unit 1

The emergency core cooling system (ECCS) (referred to in the UFSAR as the safety injection system (SIS)) is designed to provide core cooling for all postulated pipe breaks in the reactor coolant system up to and including a double ended break in the largest reactor coolant pipe. After the initial injection of makeup inventory from the refueling water tank and other sources, cooling is accomplished by recirculation of borated water from the containment sump through the shutdown heat exchangers and back to the reactor core. The cooling must prevent significant alteration of core geometry, preclude fuel melting, limit the cladding metal-water reaction, and remove the energy generated in the core for an extended period of time following a LOCA. These functions must be accomplished assuming the failure of a single active component during the injection mode, or the single failure of an active or passive component during the recirculation mode. All components of the system which must operate following a LOCA are designed to operate in the environment to which they would be exposed in the event of a LOCA. All components of the system are designed to withstand the forces of the design basis earthquake.

- During normal plant operation, the ECCS (safety injection system) is not in operation (i.e., in a standby mode). Safety injection is automatically initiated upon a safety injection actuation signal (SIAS). The safety injection system transfers automatically from the injection mode to the recirculation mode of operation on receipt of the recirculation actuation signal (RAS); this is produced by a low level signal from the refueling water tank. On receipt of the RAS, the containment sump isolation valves are opened and the refueling water tank outlet valves are closed. This results in a transfer of the safety injection and spray pump suction from the tank to the containment sump.

The containment heat removal system consists of the containment spray system (CSS) and the containment cooling system and is designed to:

- prevent the containment pressure from exceeding its design value following a LOCA, assuming a single active or passive failure

- withstand the design basis earthquake loads without loss of function

- withstand post-accident environmental conditions without loss of function

The CSS consists of two independent and redundant subsystems. The heat removal capacity of either of the two subsystems is adequate to keep the containment pressure and temperature below design values and to bring the containment pressure below 10 psig within 24 hours after any size break in the reactor coolant system piping up to and including a double-ended break of the largest reactor pipe, assuming unobstructed discharge from both ends.

The recirculation mode for the CSS is automatically initiated by the RAS after low level set point is reached in the refueling water tank. During the RAS mode of operation, suction for the spray pumps is from the containment sump.

A double barrier is specified to be provided for the containment sump to prevent debris from entering the sump. The cubicle containing the reactor drain tank and the inlets to the recirculation lines is screened at openings in the sides and at the top to give ½-inch clear openings (with the exception of the sump ladder access, which has ¼-inch openings). The suction of each recirculation line is encased in a firmly fixed finer mesh screen capable of filtering ¼-inch particles. The pumps which use the containment sumps for suction during the recirculation phase of the LOCA have the capability of passing particles ¼-inch and smaller without any detrimental effect on pump capability. CSS nozzles are the non-clog type and have openings of 3/8-inch.

The spray water is channeled to the containment sump through a number of flow paths. The minimum water level expected in the containment following a LOCA is elevation 25.3 feet. The water level could reach elevation 27.3 feet if the entire usable volume of the

refueling water tank is sprayed and injected into the containment. The grating at the top of the sump is at elevation 23.0 feet.

The vortex formation analysis documented in the UFSAR assumes 100% blockage of the horizontal screen and 80% blockage of the vertical screen covering the sump suction line entrance. At the time Unit 1 was licensed, no distinction was drawn between the various potential sources of post-LOCA debris; the ECCS and CSS were intended to function, even with debris partially obstructing the sumps (from whatever source derived). The analyses submitted as part of the licensing process for St. Lucie Unit 1 demonstrate, however, that, even with this blockage, the ECCS and CSS will continue to provide sufficient cooling flow as to fulfill the long-term cooling functions required to conform with 10 CFR 50.46(b)(5).

In the *Safety Evaluation of the St. Lucie Plant Unit 1*[1], the NRC has concluded that the CSS design is acceptable relative to the intent of Regulatory Guide 1.1.

As documented in *Supplement No. 2 to the Safety Evaluation of the St. Lucie Plant Unit 1*[2], the NRC has evaluated the adequacy of the ECCS based on the final acceptance criteria given in 10 CFR 50.46, and has determined that the ECCS performance is acceptable.

(b) Unit 2

The ECCS is the SIS. It is designed to provide continuous long-term core cooling in the event of a LOCA; following the injection phase, this cooling is accomplished through recirculation of borated water from the containment sump through the shutdown heat exchangers and back to the reactor core. The SIS prevents significant degradation of core geometry, precludes fuel melting, limits the cladding metal-water reaction, removes the energy generated in the core, and assists in maintaining the core subcritical during the extended period of time following a LOCA. The ECCS (SIS) accomplishes these functional requirements by the use of redundant active and passive injection subsystems. These functions must be accomplished assuming the failure of a single active component during the injection mode, or the single active or limited leakage passive failure of a component during the recirculation mode. Components of the system which must operate following a LOCA are designed to operate in the environment to which they would be exposed for the time they are required to operate. The SIS is designed to Category I requirements.

The automatic actuation by the safety injection actuation signal (SIAS) initiates operation of the SIS in the event of low reactor coolant system pressure or high containment

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1 U. S. Atomic Energy Commission, *Safety Evaluation of the St. Lucie Plant Unit 1, November 8, 1974, Washington, D.C., section 6.3.*

2 U. S. Atomic Energy Commission, *Supplement 2 to the Safety Evaluation of the St. Lucie Plant Unit 1, March 1, 1976, Washington, D.C., Section 6.3.7.*

pressure. SIAS can be initiated manually from the control room. The injection mode utilizes water from the refueling water tank. The recirculation mode is initiated automatically by a RAS on low refueling water tank level; this permits continuous flow of water to the core.

The containment heat removal system consists of the Containment Cooling System and CSS. These systems are provided to remove heat from the containment, thereby reducing the containment pressure and temperature, and maintaining them at acceptably low levels following an accident. The components of the system are designed to operate under post accident conditions for extended periods. The CSS consists of two independent and redundant trains.

When a low level in the refueling water tank is reached, the RAS is initiated which closes the RWT isolation valves and opens the containment sump isolation valves. During recirculation, spray flow drawn from the sump is cooled by the shutdown heat exchanger before returning to the containment through the spray nozzles.

The containment sump is a large reservoir, designed in accordance with the Regulatory Guide 1.82[3], which provides for long term continuous recirculation. The sump encloses the redundant sections of the ECCS and CSS which are separated by approximately 15-feet. The sump is located at the lowest floor elevation in the containment (exclusive of the reactor cavity sump) and is shielded by two filtering devices (an outer trash rack and fine mesh screens). Piping that penetrates the screens is provided with boots connecting the pipe and screen; with these design provisions, fluid is filtered by the fine mesh screens prior to reaching the safeguards system suction lines. The screens are 18 gauge wire with an open area of 0.0081 square inches (or equivalent). The screen mesh size was selected to avoid entrapment of particles in the fuel assembly spacer grids.

Drains from the various regions of the containment are directed to the sump via vent openings in the secondary shield wall. These vent openings have coarse grating acting as trash racks that prevent debris laden water from impinging on the screens that enclose the sump.

In addition, a vertical sump divider screen is provided in the sump to separate the redundant suction lines. The mesh for the divider screen is sized to avoid entrapment of particles greater than 0.135-inches in diameter in the HPSI discharge throttle valves. This will also prevent clogging of the CSS nozzles, which have an inside diameter of 0.375-inches.

The coolant velocity through the screens, as documented in the UFSAR, is approximately 0.2 feet/second. This is based on the assumption that the vertical screens are 50% blocked

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3 USNRC, Regulatory Guide 1.82, *Sumps for Emergency Core Cooling and Containment Spray Systems*, June 1974, Revision 0

and the horizontal screens are 100% blocked. The UFSAR states that insulation is the primary source of post-accident debris inside containment; however, it is concluded in the UFSAR that the insulation will not obstruct the flow through the sump screens. The ECCS and CSS were intended to function, even with debris partially obstructing the sumps (from whatever source derived). The analyses submitted for St. Lucie Unit 2 demonstrate that, even with the extent of blockage assumed, the ECCS and CSS will continue to provide sufficient cooling flow to fulfill the long-term cooling functions required to conform with 10 CFR 50.46(b)(5).

In the *Safety Evaluation Report related to the operation of St. Lucie Plant Unit No. 2*[4] (SER), the NRC concluded that the design of St. Lucie Unit 2 provides reasonable assurance that the post-LOCA recirculation of reactor coolant will not be impaired by debris, and is therefore acceptable.

In NUREG 0843 Supplement No. 3[5] for St. Lucie Unit 2, the NRC reviewed the test report for the containment sump, and concluded that, for up to 50% blockage of the sump screen, sump performance is not degraded. Based on this, the NRC concluded that the St. Lucie Unit 2 emergency containment sump design is acceptable.

For Unit 1, the sump screen blockage assumption does not distinguish among the source terms for the LOCA-generated debris. For Unit 2, the UFSAR states that (a) insulation is the primary source of post-LOCA debris, and (b) the insulation will not obstruct the flow through the sump screens; the ECCS and CSS were intended to function, even with debris partially obstructing the sumps (from whatever source). The analysis for coating failure alone during a LOCA, and testing of coating failure conducted to date, does not contradict the St. Lucie 1 and 2 determination that the ECCS flow following a LOCA will be adequate to maintain the core temperature at an acceptably low value and to remove decay heat for the extended period of time required by the long-lived radioactivity remaining in the core following a DBA. Accordingly, a separate demonstration of the regulatory and safety basis for safety system performance is not required.

To minimize the potential of debris clogging on the sump screens, and to maintain the integrity of the containment sump screens, the following programs are in place at St. Lucie Units 1 and 2.

(a) Sump Inspection Program

The sump screens in the containment are inspected during every refueling outage to confirm that the screens will perform their intended function. This is done by inspecting the sump screens for the following.

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4 USNRC, *Safety Evaluation Report related to the operation of St. Lucie Plant Unit No. 2, NUREG 0843, October 1981, Washington, D.C. Section 6.3.*

5 USNRC, *Safety Evaluation Report related to the operation of St. Lucie Plant Unit No. 2, NUREG 0843 Supplement 3, April 1983, Washington, D.C., Section 6.3.3.*

- General condition (structural integrity; screen corrosion; missing or incorrectly sized screens; unintended openings in screens; damaged, loose, or missing subcomponents; penetration anomalies).

- Maintenance of design configuration.

- Debris in the vicinity of the screens.

(b) Containment Closeout Inspections Foreign Material Exclusion (FME)

The containment is thoroughly inspected for loose debris during every refueling outage prior to start-up. All debris is collected and removed from containment prior to start-up as required by plant procedures. This ensures that the containment sump area is clean, and that all items that could wash into the sump and damage the screens have been removed.

(c) Unqualified Coating Control

In accordance with the requirements of the Service Level 1 coating specification, logs of unqualified coatings in each unit are maintained by the FPL and documented in a controlled calculation. FPL performs an inspection to document the condition of the coatings at the end of each refueling outage, updates the logs as required, and reviews the data prior to re-start to ensure that the quantities of unqualified coatings are below the acceptable limit. The acceptable amount of unqualified coatings is based on consideration of containment re-circulation flow, debris transport, and acceptable sump blockage. This basis is documented in controlled calculations. In addition, an assessment is performed of the in-place coatings prior to restart to ensure that they would not adversely affect the ECCS during a DBA.

FPL does not employ commercial grade dedication for Service Level 1 coatings inside containment at St. Lucie Units 1 and 2. Service Level 1 coatings are procured safety related from vendors which maintain 10 CFR 50 Appendix B quality assurance programs.