Mr. T. F. Plunkett
President - Nuclear Division
Florida Power and Light Company
P.O. Box 14000
Juno Beach, Florida 33408-0420

May 27, 1999

SUBJECT: SAFETY ASSESSMENT REGARDING CONTAINMENT RADIATION MONITOR SENSITIVITY AT ST. LUCIE PLANT, UNITS 1 AND 2 AND TURKEY POINT PLANT, UNITS 3 AND 4 (TAC NO. M40294)

Dear Mr. Plunkett:

As a result of general questions by U.S. Nuclear Regulatory Commission (NRC) inspectors regarding the design and licensing bases of St. Lucie and Turkey Point Plants and the staff interpretation of the guidance provided in Regulatory Guide 1.45, the staff has written the attached safety assessment. This safety assessment is being forwarded to you for your information. No specific reply or action is requested at this time. However, as discussed in the attachment, future generic actions may be taken by the NRC to address containment radiation monitoring issues.

If you have any questions regarding this matter, please contact Bill Gleaves at (301) 415-1479 for St. Lucie Plant, or Kahtan Jabbour at (301) 415-1496 for Turkey Point Plant.

Sincerely,

Original signed by:

Sheri R. Peterson, Chief, Section 2
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-335, 50-389
50-250, 50-251

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Enclosure: Safety Assessment

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

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Docket Nos. 50-335, 50-389
50-250, 50-251

Enclosures: 1) Safety Assessment
2) Task Interface Agreement 96-019
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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY ASSESSMENT BY PLANT SYSTEMS BRANCH DIVISION OF SYSTEMS SAFETY AND ANALYSIS OFFICE OF NUCLEAR REACTOR REGULATION REGION II CONCERNS (TIA 96-019) REGARDING THE CONTAINMENT RADIATION MONITORING SYSTEMS AT ST. LUCIE UNITS 1 AND 2 AND TURKEY POINT UNITS 3 AND 4 (TAC NOS. M97286, M97287, M97288, AND M97289)

1.0 INTRODUCTION

By memorandum dated November 12, 1996 (Enclosure 2), Region II requested the Office of Nuclear Reactor Regulation's (NRR's) assistance to assess alleged discrepancies between the sensitivities in the containment radiation monitoring system described in the Updated Final Safety Analysis Report (UFSAR) and Regulatory Guide (RG) 1.45, "Reactor Coolant Pressure Boundary Leakage Detection Systems," at St. Lucie Units 1 and 2, and Turkey Point Units 3 and 4. Specifically, Region II raised the following question:

> Does the staff consider the [containment radiation monitoring] system described in the UFSAR to be consistent with RG 1.45?

Because of the importance of early leak detection in the prevention of accidents, RG 1.45, in part, establishes the following key regulatory positions with regard to the design and sensitivity of the reactor coolant system (RCS) leakage detection system of which the containment radiation monitoring system is part:

C.3 At least three separate detection methods should be employed and two of these methods should be (1) sump level and flow monitoring and (2) airborne particulate radioactivity monitoring. The third method may be selected from the following:

a. monitoring of condensate flow rate from air coolers,
b. monitoring of airborne gaseous radioactivity.

C.5. The sensitivity and response time of each leakage detection system described in regulatory position C.3 that is employed for unidentified leakage, should be adequate to detect a leakage rate, or its equivalent, of 1 gpm in less than 1 hour.

C.6 The leakage detection systems should be capable of performing their functions following seismic events that do not require plant shutdown. The airborne particulate radioactivity monitoring system should remain functional when subjected to the safe shutdown earthquake (SSE).

RG 1.45 also provides the following guidance:

> In analyzing the sensitivity of leak detection systems using airborne particulate or gaseous radioactivity, a realistic primary coolant radioactivity concentration assumption should be used. The expected values used in the plant environmental report would be acceptable.

The U.S. Nuclear Regulatory Commission (NRC) Plant Systems Branch (SPLB) reviewed available documentation concerning the Region's request and their assessment is summarized below.

2.0 ASSESSMENT

2.1 St. Lucie

By letter dated November 20, 1987, the Combustion Engineering Owners Group (CEOG) submitted Topical Report CEN-367, "Leak-Before-Break Evaluation of Primary Loop Piping in Combustion Engineering Designed Nuclear Steam Supply Systems," for NRC staff review. CEOG proposed to eliminate the dynamic effects of postulated primary loop pipe ruptures from the design basis[1] for certain Combustion Engineering plants, which includes St. Lucie Units 1 and 2, using "leak-before-break" (LBB) technology. The NRC staff reviewed CEN-367 and found the report acceptable for referencing in license applications to the extent specified and under the limitations delineated in the report and associated NRC safety evaluation (Ref. 2). The safety evaluation defines the basis for acceptance of the report and states that when referencing this CEOG report as a technical basis for applying LBB to primary loop piping, the licensee must demonstrate that reactor coolant system (RCS) leakage detection systems installed at the specific facility are consistent with the guidance described in RG 1.45.

During the process of St. Lucie's license application review, the staff in the original Safety Evaluation Reports for Unit 1, dated November 1974, and for Unit 2, dated October 1981, stated that the RCS leakage detection systems for St. Lucie were in accordance with the guidance described in RG 1.45 and were, therefore, acceptable. In addition, the licensee stated in the Technical Specification (TS) Bases, Section 3/4.4.6.1, that these detection systems were consistent with the recommendations of RG 1.45.

Accordingly, by letter dated August 26, 1992 (Ref. 3), the licensee proposed to eliminate the dynamic effects associated with high energy pipe rupture in the RCS piping from the licensing and design bases of St. Lucie Units 1 and 2, by the application of LBB technology. In the submittal, the licensee stated that in preparation of the proposal, it had reviewed the design of the RCS leakage detection systems and reaffirmed the staff's original conclusion that the RCS leakage detection systems for St. Lucie were in accordance with the guidance described in RG 1.45. The staff reviewed the August 26, 1992, submittal and concluded that since both the St. Lucie units were bounded by the CEOG analyses and the RCS leakage detection systems

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[1] As permitted by General Design Criterion 4 (GDC)-4, Environmental and Dynamic Effects Design bases," of Appendix A to 10 CFR Part 50.

remained capable of detecting the specified leakage rate as described in RG 1.45, the dynamic effects associated with high energy pipe rupture in the RCS piping could be excluded from the licensing and design bases of St. Lucie (Ref. 4).

During an inspection of the St. Lucie Unit 1 containment radiation monitoring system in 1996, the NRC found discrepancies regarding the systems' sensitivity response time between the UFSAR and the guidance described in RG 1.45. St. Lucie Units 1 and 2 UFSARs both state that a 1 gpm reactor coolant boundary leak will cause a 10 percent deviation in the normal readings of various monitoring systems and the time for the containment radiation monitor to reach this deviation is 15.1 hours and 18.1 hours for the noble gas and particulate channels, respectively. Since these response times appeared to contradict the 1 hour response time documented in Regulatory Position C.5 of RG 1.45 and the above UFSAR statements, the inspector considered these discrepancies to be an Unresolved Item (URI).

Based on SPLB's review, the staff found that the sensitivity response times of the containment radiation monitoring system described in the St. Lucie Units 1 and 2 UFSARs are not consistent with the recommendations of Regulatory Position C.5 of RG 1.45. However, SPLB discussed the discrepancies with the NRC's Materials and Chemical Engineering Branch and determined that the licensee's UFSAR values of 15.1 and 18.1 hours for detecting 1 gpm of leakage are acceptable for utilization of LBB technology at St. Lucie pending completion of generic activities discussed in Section 3 of this assessment. Considering the planned generic activities, the fact that the containment sump monitors at St. Lucie Units 1 and 2 are capable of detecting leakage of 1 gpm within 1 hour and that the likelihood of a safe shutdown earthquake (SSE) occurring in 18 hours verses 1 hour is not a significant increase in risk, the staff concludes that the containment radiation monitors at St. Lucie Units 1 and 2 are sufficient to meet the intent of Regulatory Position C.5 of RG 1.45. The staff recommends that the inspection URI be closed and no further staff action be taken at this time. Once the generic activities are completed, further action may be warranted.

2.2 Turkey Point

During an inspection at Turkey Point Units 3 and 4 in 1996, the inspector reviewed the licensee's calculations used to determine the setpoints for the containment particulate and gaseous radiation monitors, R-11 and R-12, respectively. The inspector found that with the assumption of 1.0 percent failed fuel and a 1 gpm leak, the R-11 monitor would alarm within 1 hour and the R-12 monitor would alarm within 4 hours. The inspector questioned the acceptability of these particulate and gaseous radiation monitor setpoints with Regulatory Position C.5 of RG 1.45. Consequently, the inspector considered this issue as an URI.

The staff reviewed Westinghouse topical report, WCAP-9558 (Ref. 5), which was submitted to address asymmetric blowdown loads on the pressurized-water reactor (PWR) RCS that resulted from a limited number of discrete break locations. The report evaluated the limiting or bounding break locations. Subsequent to the review, the staff issued generic letter (GL) 84-04 (Ref. 6) to inform all PWR utilities of its conclusions. In GL 84-04, the staff stated that an acceptable technical basis had been provided so that the asymmetric blowdown loads resulting from double-ended pipe breaks in main coolant loop piping need not be considered as a design basis for the Westinghouse Owner's Group plants listed in WCAP-9558, which included Turkey Point Units 3

and 4, provided two conditions were satisfied. Only the following condition relates to the design and operation of RCS leakage detection systems:

> Leakage detection systems at the facility should be sufficient to provide adequate margin to detect the leakage from the postulated circumferential through wall flaw utilizing the guidance of RG 1.45 with the exemption that the seismic qualification of the airborne particulate radiation monitor is not necessary. At least one leakage detection system with a sensitivity capable of detecting 1 gpm in 4 hours[2] must be operable.

Furthermore, the staff stated that other PWR licensees or applicants could also request exemptions on the same basis from the requirements of GDC-4 with respect to asymmetric blowdown loads resulting from discrete breaks in the primary main coolant loop, if they could demonstrate the applicability of the modeling and conclusions contained in the referenced reports to their plants or could provide an equivalent fracture mechanics based demonstration of the integrity of the primary main coolant loop in their facilities. Licensees or applicants were required to justify such exemptions on a plant-by-plant basis. In GL 84-04, the staff also provided guidance on the information needed to support case-by-case exemption requests.

Subsequently, in a memorandum (Ref. 7) to R. Vollmer (NRC, Director, Division of Engineering), R. Mattson (NRC, Director, Division of Systems Integration) established the guidance regarding the acceptability of RCS leakage detection system sensitivity for PWRs which used LBB technology in the evaluation of asymmetric loss-of-coolant accident (LOCA) loads. The memorandum stated that since RG 1.45 was not published until May 1973, most of the operating PWRs (including Turkey Point Units 3 and 4) listed in WCAP-9558 which were affected by asymmetric LOCA loads were not reviewed against the guidance of RG 1.45. However, the sensitivity guidelines of RG 1.45 (capability to detect a leak of 1 gpm in 1 hour) seemed appropriate and the staff recommended their use with a suitable change to the detection time to account for the fact that a constant leak rate was being considered. Therefore, the NRC staff recommended the following variance from RG 1.45 for plants listed in WCAP-9558:

> At least one system for RCS leak detection should have the capability of detecting a one gpm (unidentified) leak in four hours during normal operating conditions for an exemption with respect to asymmetric loads.

In the licensee's response to GL 84-04, dated November 1, 1988 (Ref. 8) the licensee for Turkey Point stated that the requirements for RCS leakage detection systems as included in plant TS Section 3.1.3 satisfied the condition above. The staff reviewed the licensee's November 1, 1988, submittal and concurred (Ref. 9) that the leakage detection systems at Turkey Point Units 3 and 4 satisfied the above cited leak detection sensitivity requirements established in GL 84-04,

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[2] In WCAP-9558, specific leakage from main reactor coolant piping assumed for asymmetric LOCA loads was postulated to remain constant for a long time (days). Therefore, the staff accepted a 4 hour time period to be used as part of the sensitivity criterion.

and the dynamic effects of postulated primary loop pipe ruptures that could be eliminated from the design basis.

Accordingly, by letter dated February 2, 1995 (Ref. 10), the licensee proposed to eliminate the dynamic effects associated with high energy pipe rupture in the RCS piping from licensing and design bases of Turkey Point Units 3 and 4 by the application of LBB technology. The staff reviewed the licensee's February 2, 1995, submittal and concluded that Turkey Point Units 3 and 4 were bounded by the Westinghouse analyses and the RCS leakage detection systems satisfied the requirements in GL 84-04. Therefore, the staff found the licensee's request to utilize LBB methodology for RCS piping design bases acceptable.

Based on SPLB's review, the staff found that the containment radiation monitoring system described in the Turkey Point Units 3 and 4 UFSAR is not consistent with the recommendations of Regulatory Position C.5 of RG 1.45. However, Turkey Point Units 3 and 4 are not required to meet RG 1.45, but only the criteria of GL 84-04. Since the sensitivity requirements for the particulate and gaseous radiation monitors at Turkey Point Units 3 and 4 meet the criteria of GL 84-04, the staff concludes that they are acceptable for the purpose of supporting the facility's main coolant loop LBB analysis.

3.0 CONCLUSION

Based on the above discussion, SPLB concludes the following:

(a) The containment radiation monitoring system described in the St. Lucie Units 1 and 2 UFSAR is not consistent with the recommendations of Regulatory Position C.5 of RG 1.45. However, SPLB discussed the discrepancies with the Materials and Chemical Engineering Branch and determined that the licensee's UFSAR values of 15.1 and 18.1 hours for detecting 1 gpm of leakage are acceptable for utilization of LBB technology at St. Lucie pending completion of generic activities as discussed below. Considering the planned generic activities, the fact that the containment sump monitors at St. Lucie Units 1 and 2 are capable of detecting leakage of 1 gpm within 1 hour and that the likelihood of an SSE occurring in 18 hours verses 1 hour is not a significant increase in risk, the staff concludes that the containment radiation monitors at St. Lucie Units 1 and 2 are sufficient to meet the intent of Regulatory Position C.5 of RG 1.45. The staff recommends that the inspection URI be closed and no further staff action be taken at this time. Once the generic activities are completed, further action may be warranted.

(b) The containment radiation monitoring system described in the Turkey Point Units 3 and 4 UFSAR is not consistent with the recommendations of Regulatory Position C.5 of RG 1.45. However, Turkey Point Units 3 and 4 are not required to meet RG 1.45, but only the criteria of GL 84-04. Since the sensitivity requirements for the particulate and gaseous radiation monitors at Turkey Point Units 3 and 4 meet the criteria of GL 84-04, the staff concludes that they are acceptable.

During the review of the discrepancies at St. Lucie Units 1 and 2 and Turkey Point Units 3 and 4, the staff recognized that there are inconsistencies in the primary coolant radioactivity concentration assumptions for the sensitivity response times at various facilities. For example,

the percentage of failed fuel assumed was 1.0 percent at Turkey Point and 0.1 percent at St. Lucie. The outcome between these percentages can change the sensitivity response time by many hours, which could exceed the 1 gpm in 1-hour guidance documented in RG 1.45. Furthermore, in recent years, plants have exhibited better fuel performance and improved chemistry resulting in less primary coolant radioactivity concentrations than was assumed when plants were originally licensed. This reduced primary coolant radioactivity could also lead to additional difficulties in detecting leaks in the RCS by measurement of radioactivity levels.

The Office of Nuclear Regulatory Research (RES) is currently developing an RG for LBB to establish updated regulatory guidance on experience obtained over the past years in the application of LBB technology. Since LBB is related to RG 1.45, as discussed in Section 2.1, NRR staff is supporting RES's efforts in developing the LBB RG. Once the new RG is developed, RG 1.45 may be reviewed to determine if updates and clarifications are needed to reflect the updated guidance. RG 1.45 may also be reviewed to determine if any updates are needed to address inconsistencies in licensees' assumptions regarding primary coolant radioactivity concentrations and reduced primary coolant radioactivity levels. Once this is complete, generic action may be warranted to address the containment radiation monitoring system sensitivity response times.

If future issues arise between the response times of containment radiation monitoring systems at other plants and the current regulatory guidance, SPLB will evaluate these issues on a plant-specific basis.

Principle contributor: V. Ordaz

Date: May 27, 1999

REFERENCES:

1. Memorandum to F. Hebdon from E. Merschoff, "Task interface Agreement (TIA-019) Concerning Discrepancies Between the Containment Radiation Monitoring System Described in the Updated Final Safety Analysis Report (UFSAR) and Regulatory Guide 1.45 at St. Lucie Units 1 and 2, and Turkey Point Units 3 and 4," dated November 12, 1996.

2. Letter from J. Richardson to E. Sterling, "Acceptance for Referencing of Topical Report CEN-367, Leak-Before-Break Evaluation of Primary Coolant Loop Piping in Combustion Engineering Designed Nuclear Steam Supply Systems," dated October 30, 1990.

3. Letter from D. Sager to NRC, St. Lucie - Application of Leak-Before-Break Technology to Reactor Coolant System Piping," dated August 26, 1992.

4. Letter from J. Norris to J. Goldberg, "St. Lucie - Application of Leak-Before-Break Technology to Reactor Coolant System Piping," dated March 5, 1993.

5. Westinghouse Topical Report, WCAP-9558, Revision 2, "Mechanistic Fracture Evaluation of Reactor Coolant Pipe Containing a Postuiated Circumferential Through-Wall Crack," dated May 1981.

6. Generic Letter 84-04, "Safety Evaluation of Westinghouse Topical Report Dealing With Elimination of Postulated Pipe Breaks in PWR Primary Main Loops," dated February 1, 1984.

7. Memorandum to R. Vollmer from R. Mattson, "Guidance Regarding Sensitivity for Reactor Coolant Pressure Boundary Leakage Detection Methods for Evaluation of Asymmetric LOCA Loads," dated August 22, 1983.

8. Letter from W. Conway to G. Edison, "Application of Leak Before Break Technology to Primary Coolant System Piping," dated November 1, 1988.

9. Letter from G. Edison to W. Conway, "Turkey Point Units 3 and 4 Generic Letter 84-04, Asymmetric LOCA Loads, dated November 28, 1988.

10. Letter from T. Plunkett to NRC, "Turkey Point Units 3 and 4 Request to Utilize Leak-Before-Break Methodology for Reactor Coolant System Piping," dated February 2, 1995.