



JUL 29 2016

L-2016-152  
10 CFR 50.73

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 50-389  
Reportable Event: 2016-001  
Date of Event: June 2, 2016  
Inadequate Legacy Evaluation for Containment High Range Radiation Monitor  
Nonconformance with Design Accuracy Requirements Resulted in Latent Inoperability  
and Operation Prohibited by Technical Specifications

The Licensee Event Report 2016-001 is being submitted pursuant to the requirements of 10 CFR 50.73 to provide notification of the subject event.

Respectfully,

*F. V. W. A. for Christopher Constanzo*

Christopher R. Constanzo  
Site Vice President  
St. Lucie Plant

CRC/KWF  
Attachment

IEZZ  
NRR



**LICENSEE EVENT REPORT (LER)**  
(See Page 2 for required number of digits/characters for each block)

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA, Privacy and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to Infocollect.Resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

<b>1. FACILITY NAME</b> St. Lucie Unit 1	<b>2. DOCKET NUMBER</b> 05000335	<b>3. PAGE</b> 1 OF 4
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**4. TITLE**  
Inadequate Legacy Evaluation for Containment High Range Radiation Monitor Nonconformance with Design Accuracy Requirements Resulted in Latent Inoperability and Operation Prohibited by Technical Specifications

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
6	2	2016	2016	001	00	7	29	2016	St. Lucie Unit 2	05000389
									FACILITY NAME	DOCKET NUMBER
										05000

**9. OPERATING MODE** 1

**11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)**

<input type="checkbox"/> 20.2201(b)	<input type="checkbox"/> 20.2203(a)(3)(i)	<input type="checkbox"/> 50.73(a)(2)(i)(C)	<input type="checkbox"/> 50.73(a)(2)(vii)
<input type="checkbox"/> 20.2201(d)	<input type="checkbox"/> 20.2203(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)
<input type="checkbox"/> 20.2203(a)(1)	<input type="checkbox"/> 20.2203(a)(4)	<input type="checkbox"/> 50.73(a)(2)(ii)(B)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)
<input type="checkbox"/> 20.2203(a)(2)(i)	<input type="checkbox"/> 50.36(c)(1)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(ix)(A)
<input type="checkbox"/> 20.2203(a)(2)(ii)	<input type="checkbox"/> 50.36(c)(1)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(iv)(A)	<input type="checkbox"/> 50.73(a)(2)(x)
<input type="checkbox"/> 20.2203(a)(2)(iii)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(v)(A)	<input type="checkbox"/> 73.71(a)(4)
<input type="checkbox"/> 20.2203(a)(2)(iv)	<input type="checkbox"/> 50.46(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(v)(B)	<input type="checkbox"/> 73.71(a)(5)
<input type="checkbox"/> 20.2203(a)(2)(v)	<input type="checkbox"/> 50.73(a)(2)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(v)(C)	<input type="checkbox"/> OTHER
<input type="checkbox"/> 20.2203(a)(2)(vi)	<input checked="" type="checkbox"/> 50.73(a)(2)(i)(B)	<input type="checkbox"/> 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A

**12. LICENSEE CONTACT FOR THIS LER**

LICENSEE CONTACT K. W. Frehafer, Licensing Engineer	TELEPHONE NUMBER (Include Area Code) (772) 467-7748
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**13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT**

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
B	IL	CBL1		YES					

**14. SUPPLEMENTAL REPORT EXPECTED**  YES (If yes, complete 15. EXPECTED SUBMISSION DATE)  NO

**15. EXPECTED SUBMISSION DATE**

MONTH	DAY	YEAR

**ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)**

On June 2, 2016, St. Lucie Units 1 and 2 were in Mode 1 at 100% power. At 1500 hours FPL declared the containment high range radiation monitors (CHRRMs) inoperable on both Units. FPL determined that the resolution of the NRC Information Notice (IN) 97-45 industry Operating Experience (OE) concerning CHRRMs cabling was less than adequate. The assumed CHRRMs design accuracy could not be assured during some postulated design basis accidents due to the errors introduced by thermal induced currents and water intrusion/cable blistering within the associated detectors' cabling, resulting in inoperable CHRRMs. The Technical Specifications (TSs) require pre-planned alternate means for containment radiation monitoring for inoperable CHRRMs; these requirements were not implemented until June 2016. FPL also submitted a TS 6.9.2 Special Report for two channels of inoperable CHRRMs.

This legacy event was caused by the inadequate evaluation and improper tracking of actions required to fully close the nonconformance identified in the 1997 Information Notice. CHRRMs are used for information, they are not used to control radioactive releases or mitigate accidents. Their inoperability had no significant impact on the health and safety of the public.

FPL plans to replace the CHRRMs cabling susceptible to the phenomenon identified in NRC Information Notice 97-45 and its supplement 1.



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Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA, Privacy and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to [Infocollects.Resource@nrc.gov](mailto:Infocollects.Resource@nrc.gov), and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

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**NARRATIVE**

**Description of the Event**

On June 2, 2016, St. Lucie Units 1 and 2 were in Mode 1 at 100% power. As discussed in the NRC design basis inspection report 05000335/2016010 and 05000389/2016010, FPL's 1997 evaluation of previous containment high range radiation monitor (CHRRM) [EIS:IL:RM] industry Operating Experience (OE) had incorrectly evaluated the impact of thermally induced currents (TIC) and moisture intrusion/cable blistering on Rockbestos/Raychem coaxial cable [EIS:IL:CBL1] and their effect on CHRRMs operability. At 1500 hours, FPL declared the CHRRMs inoperable and entered the appropriate action statements for each Unit. The limiting condition for operation (LCO) for Technical Specification (TS) 3.3.3.1, Action b, Table 3.3-6, Action 15 (Unit 1) and Action 27 (Unit 2), are essentially the same and state that:

"With the number of channels OPERABLE [OPERABLE Channels – Unit 2] less than required by the Minimum Channels OPERABLE requirement, either restore the inoperable Channel(s) to OPERABLE status within 72 hours, or:

- 1) Initiate the preplanned alternate method of monitoring the appropriate parameter(s), and
- 2) Prepare and submit a Special Report to the Commission pursuant to Specification 6.9.2 within 14 days following the event outlining the action taken, the cause of the inoperability and the plans and schedule for restoring the system to OPERABLE status."

On June 4, 2016 the preplanned alternate methods for monitoring containment radiation levels were implemented in accordance with operator night orders and enhancements made to plant procedure EPG-08, "Monitoring Plant Equipment Important to the Radiological Emergency Plan," Attachment 2, "Alternate Monitoring Method with the CHRRM Channels Inoperable."

The CHRRMs are used as one of several diverse methods for evaluating emergency action levels (EALs) for the Loss of Fuel Clad Barrier and for the Potential Loss of Primary Containment Barrier in the St. Lucie Emergency Plan (EPlan). Unit differences necessitate different strategies for the Loss of Fuel Clad Barrier EAL determined by CHRRMs indication. These preplanned alternate methods use:

- the containment isolation radiation monitors (Unit 1), or
- the diverse indications as defined in the EAL table to evaluate the loss of the fuel clad barrier (Unit 2) (e.g. core exit thermocouples, Dose Equivalent I-131, loss of the core heat removal safety function and entry into emergency operating procedure EOP-15)

The Potential Loss of Primary Containment Barrier EAL determined by CHRRMs indication will be provided in part by the use of the post-LOCA radiation monitors with outside containment radiation levels that correlate to the radiation levels inside containment.

Two inoperable CHRRMs require that the NRC be notified of this condition in accordance with TS 6.9.2. FPL submitted the special report on July 16, 2016, in FPL letter L-2016-127.

**Cause of the Event**

In 1997 and 1998, NRC Information Notice (IN) 97-45 and its supplement 1 notified the industry that the CHRRMs were subject to erratic behavior and possible failure because the expected post-accident environmental conditions within containment could adversely affect the cabling system. FPL's initial disposition of the issue considered the CHRRMs operable due to the short time period the effects lasted, the bounded containment LOCA temperature profiles, and the consideration of the diverse means available for accomplishing post-accident dose assessment, core damage assessment, and emergency plan (EPlan) actions. FPL intended

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to close out the potential cabling noncompliance issue as recommended by the Nuclear Utility Group on Equipment Qualification (NUGEQ). However, this intent was not effectively followed through by FPL and the associated tracking action was inappropriately closed by utility personnel. Failure to appropriately track actions to restore compliance is considered a 1997 legacy issue; the corrective action program (CAP) requirements for operability/functionality have been significantly enhanced in the intervening years. FPL plans to replace the subject cabling with alternates resistant to the effects noted in the IN.

**Analysis of the Event**

This event is reportable under 10 CFR 50.73(a)(2)(i)(B) as "Any operation or condition which was prohibited by the plant's Technical Specifications..." The CHRRMs are designed for accuracy within a factor of 2 over the entire range for post-accident monitoring. However, this design requirement would not have been met during postulated design basis accidents (DBAs). From 1997 until June 2016, this noncompliance resulted in inoperable CHRRMs without the implementation of the required TS pre-planned alternate containment radiation monitoring methods.

The Rockbestos/Raychem coaxial cabling used with the CHHRM detectors in containment is susceptible to the TIC phenomenon that can introduce transient signal errors in excess of the system's design factor of 2 accuracy requirement during short duration large temperature transients, such as those anticipated following a design basis main steam line break (MSLB) inside containment or loss of coolant accident (LOCA). These transient signal errors are directly proportional to the rate of temperature change (positive and negative) and are only functionally significant in the initial seconds to minutes of a DBA. The TIC error induced during the initial temperature ramp of some DBAs was calculated to be in excess of 6000 Rem/hr, and quickly decayed to near zero within the first 100 seconds. As the containment cools down post-DBA, the error response will transition to a negative bias. For St. Lucie, the negative bias is expected to be less than -60 Rem/hr at 500 seconds to -8.5 Rem/hr at 3500 seconds.

Cable moisture intrusion/blistering and other phenomenon described in IN 97-45 are driven in part from the temperature peak inside containment, and could lead to a permanent signal bias or cable failure.

FPL performed an extent of condition by reviewing the other radiation monitors at St. Lucie for susceptibility to the effects noted in the IN, and no other components relied for long-term post-accident monitoring were identified.

**Safety Significance**

There are no automatic functions provided by CHRRMs on either Unit other than annunciation. The CHRRMs are one of the methods utilized in the St. Lucie Emergency Plan to determine EAL entry conditions, dose assessment, and core damage assessment.

Although the postulated TIC signal error in the first 100 seconds post-DBA results in indicated radiation levels inside containment meeting the EPlan EALs for both the Loss of Fuel Clad and the Potential Loss of Containment, that early in the event there would be no confirmatory evidence to support escalation of the emergency classification beyond the Alert Level. Based on emergency procedure sequence and licensed Operator training for event diagnosis and response, it is considered highly improbable that Operations would declare a Site Area Emergency based solely on the application of the initial containment radiation spike within the Fission Product Barrier EALs.

During the postulated post-DBA containment cooldown, the magnitude of the negative bias introduced by the TIC would be overcome by the actual radiation levels in containment, should fuel damage occur. After approximately one hour, the magnitude of the negative bias is insignificant as compared with any substantive accident dose. In addition, during a DBA with fuel damage, diverse indication for entry into higher EALs which are proceduralized and trained upon would result in licensed operators and members of the Emergency Response Organization to make the correct emergency declaration.

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Moisture intrusion/cable blistering is a concern during the higher peak temperatures inside containment associated with DBAs. FPL originally concluded that this was not a concern because of the assumption that the phenomenon would only occur at the higher temperatures associated with MSLLB. However, the lower temperatures associated with LOCAs do not preclude this degradation mechanism and could result in a long-term erroneous signal bias.

Regardless, the diverse indications as defined in the EAL tables to evaluate the loss of the fuel clad barrier are also available and provide information on the health of the fuel clad barrier. These pre-existing diverse indication independent from CHRRMs include the core exit thermocouples, dose equivalent I-131, loss of the core heat removal safety function, and entry into the emergency operating procedure Safety Function Status Checks.

In addition to directing EPlan EAL entry conditions as described above, the CHRRMs also support Emergency Preparedness dose and core damage assessment capabilities. However, dose and core damage assessment continue to be functional without reliance on CHRRMs as the pre-existing procedures and training for members of the Emergency Response Organization and Operations provide diverse means (i.e., core exit thermocouples, reactor vessel water level monitoring system, reactor coolant system activity, and safety function status checks) for obtaining the required information.

Even though the CHRRMs were inoperable during of the time period of concern, diverse indication provides similar information. Therefore this event had no significant impact on the health and safety of the public.

**Corrective Actions**

1. Alternate pre-planned means for monitoring containment radiation levels were implemented on June 4, 2016.
2. The 14-day TS Special Report for two inoperable CHRRMs channels was submitted on June 16, 2016.

The licensee planned actions listed below have been entered into the site corrective action program. Any changes to the actions will be managed under the corrective action program:

3. FPL is conducting constructability reviews inside containment for cable replacement during the next refueling outages.
4. Based on the constructability reviews and material availability, an implementation schedule will be developed and the more robust coaxial cable design will be installed within the next two refueling outages for each unit.

**Failed Component(s)**

Unit 1: Cable; Manufacturer: Rockestos; Model: RSS-6-104/LD

Unit 2: Cable; Manufacturer: Raychem; Model: Flamtrol (XLPE)

**Similar Events**

None.