

James A. FitzPatrick
Nuclear Power Plant
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Michael J. Colomb
Site Executive Officer

September 8, 1998
JAFP-98-0287

United States Nuclear Regulatory Commission
Attn: Document Control Desk
Mail Station P1-137
Washington, D.C. 20555

Subject: **Docket No. 50-333**
LICENSEE EVENT REPORT: LER-98-009

Error in Exclusion Region of Power-Flow Map

Dear Sir:

This report is submitted in accordance with 10 CFR 50.73(a)(2)(i)(B).

There are no commitments contained in this report.

Questions concerning this report may be addressed to Mr. Robert Steigerwald at (315) 349-6209.

Very truly yours,

A handwritten signature in black ink, appearing to read 'Michael J. Colomb'.

MICHAEL J. COLOMB

MJC:RS:las
Enclosure

cc: USNRC, Region 1
USNRC, Project Directorate
USNRC Resident Inspector
INPO Records Center

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Estimated burden per response to comply with this mandatory information collection request: 50 hrs. Reported lessons learned are incorporated into the licensing process and fed back to industry. Forward comments regarding burden estimate to the Records Management Branch (T-6 F33), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, and to the Paperwork Reduction Project (3150-0104), Office of Management and Budget, Washington, DC 20503. If 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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TITLE (4)

Error in Exclusion Region of Power-Flow Map

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
08	07	98	98	009	00	09	08	98	N/A	05000
									N/A	05000

OPERATING MODE (9) N

POWER LEVEL (10) 0

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)

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

LICENSEE CONTACT FOR THIS LER (12)

NAME

Mr. Robert Steigerwald, Sr. Licensing Engineer

TELEPHONE NUMBER (Include Area Code)

(315) 349-6209

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX

SUPPLEMENTAL REPORT EXPECTED (14)

YES (If yes, complete EXPECTED SUBMISSION DATE).

NO

EXPECTED SUBMISSION DATE (15)

MONTH DAY YEAR

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On August 7, 1998, with the reactor shutdown, it was discovered that the stability Option 1-D Exclusion Region of the power-flow map defined in the Core Operating Limits Report (COLR) was incorrect and non-conservative. A conservative bounding Exclusion Region was provided by the fuel vendor and incorporated into the Cycle 13 COLR to allow the plant to restart. The Exclusion Region, after the correction, has a larger area than that previously provided for the Cycle 13 COLR. With the error, it was possible that the plant could have been placed in a condition not allowed by the Technical Specifications (TS). The TS require the Exclusion Region to be exited immediately by either inserting control rods and/or increasing reactor recirculation flow. This is being reported under 10 CFR 50.73.(a)(2)(i)(B), "Any operation or condition prohibited by the plant's Technical Specifications", since the condition could have existed and the required operator action would not have been taken. The safety significance was determined to be minimal since a review of plant operating history determined that the plant had not operated in the corrected Exclusion Region. Corrective actions include revisions to the vendor's procedure that is used to produce the Option 1-D Exclusion Region, obtaining a bounding assessment of the Cycle 13 Exclusion Region from the vendor, and updating of the COLR based on the bounding Cycle 13 Exclusion Region prior to the plant restart. The vendor also performed an extent of condition review to determine if it affected any other Option 1-D plant.

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Event Description:

On August 7, 1998, with the reactor shutdown, it was discovered that the Exclusion Region of the power-flow map defined in the Core Operating Limits Report (COLR) was incorrect and non-conservative. NYPA reactor engineering personnel demonstrated a questioning attitude in the process of reviewing calculations for the next fuel cycle performed by its fuel vendor, General Electric (GE). Based on the reactor engineers' knowledge of the changes to the core being made for Cycle 14, it had been expected that the Exclusion Region would become smaller or at least stay the same as that of the current Cycle (Cycle 13). However, the Exclusion Region calculated for Cycle 14 was larger. In response to the NYPA reactor engineers' questions, GE informed NYPA that an error in the Cycle 13 Exclusion Region calculation had been discovered. The effect of the error was that the Exclusion Region in use since the beginning of Cycle 13 (December 1996) was incorrect and non-conservative. The Exclusion Region should have been larger, that is, it should have covered a larger portion of the power-flow map than it actually did cover. With the error, it was possible that the plant could have been placed in a condition outside that allowed by the TS. The plant could have operated with less margin to an instability event than allowed under the terms of the Option I-D solution approved for FitzPatrick in Tech Spec amendment 236. Review of plant operating history determined that the plant had not operated in an area of the power-flow map which would have been prohibited by the corrected Exclusion Region.

GE's review revealed that the Cycle 13 Exclusion Region was incorrect and should have been larger than that previously provided to NYPA. An error was made in the input to a computer code used to determine the high flow reactor power-flow state-point used to define the Exclusion Region boundary. A second, less significant change was made in the power-flow conditions of the low flow state-point used to define the Exclusion Region consistent with GE's new procedure. The original FitzPatrick Cycle 13 Exclusion Region had been calculated before GE had formalized the Option 1-D Exclusion Region generation process in a procedure. GE's new procedure provides detailed guidance that should eliminate the types of errors made in the FitzPatrick Cycle 13 work.

Cause:

GE performed an internal review to determine the cause. GE determined the cause of the error to be a lack of an explicit procedure on how to perform the analysis. The analyst entered computer code data for the calculation in the wrong order. This led to a wrong interpolation by the computer code. GE Technical Design Procedure TDP-0097 had been written and issued after the error occurred in the FitzPatrick Cycle 13 analysis. The new procedure specifies explicitly the steps for entering the computer code data, including the order in which the data is to be entered.

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Analysis:

NYPA reactor engineering personnel demonstrated a questioning attitude in the process of reviewing calculations performed by its fuel vendor, General Electric, for the next cycle. An Exclusion Region had been calculated for Cycle 14 that was larger than that in current use for Cycle 13. Based on knowledge of the changes to the core being made for Cycle 14, it had been expected that the Exclusion Region would become smaller or at least stay the same as in Cycle 13. GE was asked to explain these results. GE's review revealed that the Cycle 13 Exclusion Region was incorrect and should have been larger than the one provided in the information to NYPA.

When NYPA was notified of the error in the Exclusion Region the plant was in cold shutdown and preparing to startup. GE provided a bounding Exclusion Region that compensated for the errors in the original calculation, and NYPA revised the COLR incorporating this new bounding Exclusion Region. A 10 CFR 50.59 Nuclear Safety Evaluation (NSE) supported the COLR revision, but since the Exclusion Region appears in various procedures which were not revised at the same time, the NSE also restricted operation to powers below which the revised Exclusion Region could not be entered. This NSE provided the technical justification for changes to those procedures containing the Exclusion Region. Once these procedure changes were completed the NSE was re-revised to lift the power restrictions, and normal plant startup continued to rated conditions.

On August 9, subsequent to the completion of COLR and procedure changes, GE completed and provided a final calculation of the Cycle 13 Exclusion Region according to their new procedure. Comparison of the final version to the bounding Exclusion Region, which had become the new operating basis, showed that the operating basis was conservative and no further changes were made to the COLR or plant procedures. So the plant plans to operate under the conservative and bounding Exclusion Region for the remainder of Cycle 13.

The Option 1-D Stability Solution was approved for FitzPatrick in TS amendment 236. It requires establishment of a restricted area in the upper left quadrant of the power-flow map. There are two levels of restriction; first the Exclusion Region, and second the Buffer Zone. Planned entry into the Exclusion Region is prohibited, and immediate exit is required when the region is entered.

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Analysis: (cont'd.)

Operating records were checked to determine whether the revised Exclusion Region had been entered at any time during Cycle 13. No entry of the final corrected Exclusion Region was found to have occurred. On several occasions during startups, shutdowns, and during transitions between two-loop and single-loop operation the Buffer Zone as originally defined was entered. Since the region boundaries were not properly defined there were occasions when the corrected Buffer Zone was entered without automatic or manual initiation of the Stability Monitor, SOLOMON. On the occasions when SOLOMON did actuate after detection of entry into the Buffer Zone, or when run prior to Buffer Zone entry to determine operability, calculated results showed acceptable decay ratios (A measure of core power-flow stability). If the plant had operated in the extended portion of the corrected Exclusion Area it would have reduced the margin to an instability event. The safety significance of this occurrence was determined to be minimal since operation of the plant never entered the newly defined Exclusion Region.

There are two parts to the Option 1-D solution. First, the Exclusion Region and Buffer Zone formulation that, when properly administered, prevents the plant from entering the power-flow conditions where it may be susceptible to power-flow oscillations. Second, the Detect and Suppress analysis that demonstrates the capability of the Flow-Biased APRM Scram trip to initiate a scram during a postulated power-flow oscillation prior to violating the Minimum Critical Power Ratio (MCPR) Safety Limit. The error discovered in the Exclusion Region calls into question the proper administration of the restricted area of the power-flow map, but there were no errors found in the Detect and Suppress analysis. Therefore, had the plant experienced an instability event, the APRM Scram trip would still have prevented a Safety Limit violation. Furthermore, operator training and procedure guidance both provide tools for the operator to recognize the presence of an instability event. Upon recognition of such an event the operator is directed to manually scram the plant.

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Corrective Actions:

1. GE provided a revised Exclusion Region using a conservatively bounding calculation to allow the plant to restart.
2. The COLR and procedures were revised based on the bounding Exclusion Region provided by GE.
3. Plant operating history was reviewed to determine if the corrected Exclusion Region was entered during previous Cycle 13 operations. It was determined that the new Exclusion Region was not entered.
4. GE wrote and issued a procedure subsequent to the original error that contains sufficient detail to ensure correct data entry.
5. GE performed an extent of condition review to determine if other Option 1-D plants were affected.
6. GE is performing a Potentially Reportable Condition review to determine if the deviation in the Option 1-D stability regions could have resulted in a substantial safety hazard or violation of a safety limit. Scheduled to be completed Oct 24, 1998.

Additional Information:

Previous Similar Events: None