



GE Nuclear Energy

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Supplemental Reload Licensing Report  
for  
Brunswick Steam Electric Plant Unit 1  
Reload 10 Cycle 11

Approved

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## **Important Notice Regarding**

### **Contents of This Report**

#### **Please Read Carefully**

This report was prepared by General Electric Company (GE) solely for Carolina Power and Light Company (CP&L) for CP&L's use in defining operating limits for the Brunswick Steam Electric Plant Unit 1. The information contained in this report is believed by GE to be an accurate and true representation of the facts known or obtained or provided to GE at the time this report was prepared.

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## Acknowledgement

The engineering and reload licensing analyses, which form the technical basis of this Supplemental Reload Licensing Report, were performed by M.R. Morris. The Supplemental Reload Licensing Report was prepared by M.R. Morris. This document has been verified by W.E. Russell.

The basis for this report is *General Electric Standard Application for Reactor Fuel*, NEDE-24011-P-A-11, November 1995; and the U.S. Supplement, NEDE-24011-P-A-11-US November 1995.

## 1. Plant-unique Items

Appendix A: Analysis Conditions  
Appendix B: Main Steamline Isolation Valve Out of Service (MSIVOOS)  
Appendix C: Decrease in Core Coolant Temperature Events  
Appendix D: Feedwater Temperature Reduction (FWTR)  
Appendix E: Maximum Extended Operating Domain

## 2. Reload Fuel Bundles

| Fuel Type                                  | Cycle Loaded | Number |
|--|--------------|--------|
| <u>Irradiated:</u>                         |              |        |
| GE8B-P8DQB339-11GZ-80M-4WR-150-T (GE8x8EB) | 7            | 16     |
| GE8B-P8DQB323-10GZ-80M-4WR-150-T (GE8x8EB) | 7            | 4      |
| GE10-P8HXB322-11GZ-70M-150-T (GE8x8NB-3)   | 8            | 40     |
| GE10-P8HXB324-12GZ-70M-150-T (GE8x8NB-3)   | 8            | 20     |
| GE10-P8HXB320-11GZ-100M-150-T (GE8x8NB-3)  | 9            | 68     |
| GE10-P8HXB322-11GZ-70M-150-T (GE8x8NB-3)   | 9            | 56     |
| GE10-P8HXB346-12GZ-100M-150-T (GE8x8NB-3)  | 10           | 156    |
| <u>New:</u>                                |              |        |
| GE13-P9DTB380-11G5.0A-100T-146-T (GE13)    | 11           | 68     |
| GE13-P9DTB380-10G5.0A-100T-146-T (GE13)    | 11           | 132    |
| Total                                      |              | 560    |

## 3. Reference Core Loading Pattern

|   |                                 |
|---|---------------------------------|
| Nominal previous cycle core average exposure at end of cycle:                                   | 27290 MWd/MT<br>( 24757 MWd/ST) |
| Minimum previous cycle core average exposure at end of cycle from cold shutdown considerations: | 27045 MWd/MT<br>( 24535 MWd/ST) |
| Assumed reload cycle core average exposure at beginning of cycle:                               | 14678 MWd/MT<br>( 13316 MWd/ST) |
| Assumed reload cycle core average exposure at end of cycle:                                     | 27520 MWd/MT<br>( 24966 MWd/ST) |
| Reference core loading pattern:   | Figure 1                        |

## 4. Calculated Core Effective Multiplication and Control System Worth – No Voids, 20°C

|  |       |
|--|-------|
| Beginning of Cycle, $k_{\text{effective}}$                                       |       |
| Uncontrolled   | 1.108 |
| Fully controlled   | 0.965 |
| Strongest control rod out  | 0.986 |
| R, Maximum increase in cold core reactivity with exposure into cycle, $\Delta k$ | 0.000 |

## 5. Standby Liquid Control System Shutdown Capability

|                |  |
|----------------|--|
| Boron<br>(ppm) | Shutdown Margin ( $\Delta k$ )<br>(20°C, Xenon Free) |
| 660            | 0.036  |

6. Reload Unique GETAB Anticipated Operational Occurrences (AOO) Analysis  
Initial Condition Parameters

| Exposure: BOC11 to EOC11–2205 MWd/MT with Increased Core Flow (ICF) |                 |        |       |          |                    |                          |              |
|---|-----------------|--------|-------|----------|--------------------|--------------------------|--------------|
|   | Peaking Factors |        |       |          |                    |                          |              |
| Fuel Design   | Local           | Radial | Axial | R-Factor | Bundle Power (MWt) | Bundle Flow (1000 lb/hr) | Initial MCPR |
| GE8x8NB–3   | 1.20            | 1.57   | 1.40  | 1.000    | 6.988              | 111.1                    | 1.25         |
| GE13  | 1.45            | 1.46   | 1.26  | 1.020    | 6.514              | 107.5                    | 1.37         |

| Exposure: EOC11–2205 MWd/MT to EOC11 with ICF |                 |        |       |          |                    |                          |              |
|---|-----------------|--------|-------|----------|--------------------|--------------------------|--------------|
|   | Peaking Factors |        |       |          |                    |                          |              |
| Fuel Design                                   | Local           | Radial | Axial | R-Factor | Bundle Power (MWt) | Bundle Flow (1000 lb/hr) | Initial MCPR |
| GE8x8NB–3                                     | 1.20            | 1.52   | 1.40  | 1.000    | 6.773              | 112.7                    | 1.29         |
| GE13  | 1.45            | 1.48   | 1.16  | 1.020    | 6.582              | 106.9                    | 1.38         |

| Exposure: EOC11–2205 MWd/MT to EOC11 with Maximum Extended Load Line Limit (MELLL) |                 |        |       |          |                    |                          |              |
|--|-----------------|--------|-------|----------|--------------------|--------------------------|--------------|
|  | Peaking Factors |        |       |          |                    |                          |              |
| Fuel Design  | Local           | Radial | Axial | R-Factor | Bundle Power (MWt) | Bundle Flow (1000 lb/hr) | Initial MCPR |
| GE8x8NB–3  | 1.20            | 1.47   | 1.40  | 1.000    | 6.544              | 86.8                     | 1.23         |
| GE13   | 1.45            | 1.35   | 1.32  | 1.020    | 6.007              | 85.3                     | 1.35         |

| Exposure: EOC11-2205 MWd/MT to EOC11 with ICF and FWTR |       |        |       |          |                    |                          |              |
|--|-------|--------|-------|----------|--------------------|--------------------------|--------------|
| Peaking Factors  |       |        |       |          |                    |                          |              |
| Fuel Design  | Local | Radial | Axial | R-Factor | Bundle Power (MWt) | Bundle Flow (1000 lb/hr) | Initial MCPR |
| GE8x8NB-3  | 1.20  | 1.59   | 1.40  | 1.000    | 7.069              | 110.4                    | 1.26         |
| GE13   | 1.45  | 1.48   | 1.21  | 1.020    | 6.600              | 107.0                    | 1.36         |

| Exposure: EOC11-2205 MWd/MT to EOC11 with MSIVOOS and ICF |       |        |       |          |                    |                          |              |
|---|-------|--------|-------|----------|--------------------|--------------------------|--------------|
| Peaking Factors   |       |        |       |          |                    |                          |              |
| Fuel Design   | Local | Radial | Axial | R-Factor | Bundle Power (MWt) | Bundle Flow (1000 lb/hr) | Initial MCPR |
| GE8x8NB-3   | 1.20  | 1.54   | 1.40  | 1.000    | 6.867              | 112.0                    | 1.27         |
| GE13  | 1.45  | 1.48   | 1.16  | 1.020    | 6.594              | 106.8                    | 1.37         |

## 7. Selected Margin Improvement Options

|                            |                                 |
|----------------------------|---------------------------------|
| Recirculation pump trip:   | No                              |
| Thermal power monitor:     | Yes                             |
| Improved scram time:       | Yes (ODYN Option B)             |
| Measured scram time:       | No                              |
| Exposure dependent limits: | Yes                             |
| Exposure points analyzed:  | 2 (EOC11-2205 MWd/MT and EOC11) |

## 8. Operating Flexibility Options

|  |                    |
|--|--------------------|
| Single-loop operation:   | Yes                |
| Load line limit:   | Yes                |
| Extended load line limit:                                      | Yes                |
| Maximum extended load line limit:                              | Yes                |
| Increased core flow throughout cycle:                          | Yes                |
| Flow point analyzed:   | 104.3 %            |
| Increased core flow at EOC:                                    | Yes                |
| Feedwater temperature reduction throughout cycle:              | Yes                |
| Temperature reduction:   | 110.3°F            |
| Final feedwater temperature reduction:                         | Yes                |
| ARTS Program:  | Yes                |
| Maximum extended operating domain:                             | Yes                |
| Turbine bypass system OOS:                                     | No                 |
| Safety/relief valves OOS:<br>(credit taken for 9 of 11 valves) | Yes                |
| ADS OOS:   | Yes (2 valves OOS) |
| EOC RPT OOS:   | No                 |
| Main steam isolation valves OOS:                               | Yes                |

## 9. Core-wide AOO Analysis Results

Methods used: GEMINI; GEXL-PLUS

| Exposure range: BOC11 to EOC11-2205 MWd/MT with ICF |                |               |                          |      |      |
|---|----------------|---------------|--------------------------|------|------|
|   |                |               | Uncorrected $\Delta$ CPR |      |      |
| Event   | Flux<br>(%NBR) | Q/A<br>(%NBR) | GE8x8NB-3                | GE13 | Fig. |
|   | —              | —             |                          |      | —    |
| Load Reject w/o Bypass                              | 377            | 118           | 0.15                     | 0.27 | 2    |
| Turbine Trip w/o Bypass                             | 384            | 117           | 0.15                     | 0.27 | 3    |



| Exposure range: EOC11–2205 MWd/MT to EOC11 with ICF |                |               |                          |      |      |
|---|----------------|---------------|--------------------------|------|------|
|   |                |               | Uncorrected $\Delta$ CPR |      |      |
| Event   | Flux<br>(%NBR) | Q/A<br>(%NBR) | GE8x8NB–3                | GE13 | Fig. |
|   | –              | –             |                          |      | –    |
| Load Reject w/o Bypass                              | 344            | 117           | 0.19                     | 0.28 | 4    |
| Turbine Trip w/o Bypass                             | 471            | 121           | 0.19                     | 0.27 | 5    |

| Exposure range: EOC11–2205 MWd/MT to EOC11 with MELL |                |               |                          |      |      |
|--|----------------|---------------|--------------------------|------|------|
|  |                |               | Uncorrected $\Delta$ CPR |      |      |
| Event  | Flux<br>(%NBR) | Q/A<br>(%NBR) | GE8x8NB–3                | GE13 | Fig. |
|  | –              | –             |                          |      | –    |
| Load Reject w/o Bypass                               | 310            | 117           | 0.12                     | 0.24 | 6    |
|  | –              | –             |                          |      | –    |

| Exposure range: EOC11–2205 MWd/MT to EOC11 with ICF and FWTR |                |               |                          |      |      |
|--|----------------|---------------|--------------------------|------|------|
|  |                |               | Uncorrected $\Delta$ CPR |      |      |
| Event  | Flux<br>(%NBR) | Q/A<br>(%NBR) | GE8x8NB–3                | GE13 | Fig. |
| FW Controller Failure  | 245            | 117           | 0.17                     | 0.23 | 7    |
| Load Reject w/o Bypass                                       | 323            | 116           | 0.16                     | 0.26 | 8    |
|  | –              | –             |                          |      | –    |

| Exposure range: EOC11–2205 MWd/MT to EOC11 with MSIVOOS and ICF |                |               |                          |      |      |
|---|----------------|---------------|--------------------------|------|------|
|   |                |               | Uncorrected $\Delta$ CPR |      |      |
| Event   | Flux<br>(%NBR) | Q/A<br>(%NBR) | GE8x8NB–3                | GE13 | Fig. |
|   | –              | –             |                          |      | –    |
| Load Reject w/o Bypass  | 328            | 116           | 0.17                     | 0.28 | 9    |
| Turbine Trip w/o Bypass   | 315            | 115           | 0.17                     | 0.26 | 10   |

## 10. Local Rod Withdrawal Error (With Limiting Instrument Failure) AOO Summary

The rod withdrawal error event in the maximum extended operating domain was originally analyzed in the GE BWR Licensing Report, *Maximum Extended Operating Domain Analysis for Brunswick Steam Electric Plant*, NEDC–31654P, dated February 1989. The MCPR limit for rod withdrawal error is bounded by the operating limit MCPRs presented in Section 11 of this report for RBM setpoints shown in Tables 10–5(a) or 10–5(b) of NEDC–31654P.



## 11. Cycle MCPR Values<sup>1 2</sup>

In agreement with commitments to the NRC (letter from M.A. Smith to Document Control Desk, 10CFR Part 21, Reportable Condition, Safety Limit MCPR Evaluation, May 24, 1996) a cycle-specific Safety Limit MCPR calculation was performed, and has been reported in both the Safety Limit MCPR and the Operating Limit MCPR shown below. This cycle specific SLMCPR was determined using the analysis basis documented in GESTAR with the following exceptions:

1. The actual core loading was analyzed.
2. The actual bundle parameters (e.g., local peaking) were used.
3. The full cycle exposure range was analyzed.

Safety limit: 1.10

Single loop operation safety limit: 1.12

### Non-pressurization events:

| Exposure Range: BOC11 to EOC11   |           |      |
|----------------------------------|-----------|------|
|                                  | GE8x8NB-3 | GE13 |
| Fuel Loading Error (misoriented) | 1.28      | 1.27 |
| Fuel Loading Error (mislocated)  | 1.29      | 1.29 |
| LFWH                             | 1.22      | 1.22 |

### Pressurization events:

| Exposure range: BOC11 to EOC11-2205 MWd/MT with ICF <sup>3</sup> |           |      |           |      |
|--|-----------|------|-----------|------|
| Exposure point: EOC11-2205 MWd/MT                                |           |      |           |      |
|  | Option A  |      | Option B  |      |
|  | GE8x8NB-3 | GE13 | GE8x8NB-3 | GE13 |
|  |           |      |           |      |
| Load Reject w/o Bypass   | 1.35      | 1.42 | 1.28      | 1.37 |
| Turbine Trip w/o Bypass  | 1.35      | 1.42 | 1.28      | 1.37 |

1. The GE8x8NB-3 fuel type MCPR values bound the GE8x8EB MCPR values for all events.

2. The operating limit MCPR for two loop operation (TLO) bounds the operating limit MCPR for single loop operation (SLO), therefore, the operating limit MCPR need not be changed for SLO.

3. The ICF Operating Limits for the exposure range of BOC11 to EOC11-2205 MWd/MT bound the Operating Limits for the following domains; MELL, ICF and FWTR, MSIVOOS and ICF.

| Exposure range: EOC11–2205 MWd/MT to EOC11 with ICF<br>Exposure point: EOC11 |               |      |               |      |
|--|---------------|------|---------------|------|
|  | Option A      |      | Option B      |      |
|  | GE8x8NB–<br>3 | GE13 | GE8x8NB–<br>3 | GE13 |
| Load Reject w/o Bypass   | 1.35          | 1.48 | 1.31          | 1.40 |
| Turbine Trip w/o Bypass  | 1.35          | 1.47 | 1.31          | 1.39 |

| Exposure range: EOC11–2205 MWd/MT to EOC11 with MELL |               |      |               |      |
|--|---------------|------|---------------|------|
| Exposure point: EOC11                                |               |      |               |      |
|  | Option A      |      | Option B      |      |
|  | GE8x8NB–<br>3 | GE13 | GE8x8NB–<br>3 | GE13 |
| Load Reject w/o Bypass                               | 1.28          | 1.44 | 1.24          | 1.36 |

| Exposure range: EOC11–2205 MWd/MT to EOC11 with ICF and FWTR<br>Exposure point: EOC11 |               |      |               |      |
|---|---------------|------|---------------|------|
|   | Option A      |      | Option B      |      |
|   | GE8x8NB–<br>3 | GE13 | GE8x8NB–<br>3 | GE13 |
| FW Controller Failure   | 1.31          | 1.43 | 1.28          | 1.35 |
| Load Reject w/o Bypass  | 1.31          | 1.46 | 1.27          | 1.38 |

| Exposure range: EOC11–2205 MWd/MT to EOC11 with MSIVOOS and ICF<br>Exposure point: EOC11 |               |      |               |      |
|--|---------------|------|---------------|------|
|  | Option A      |      | Option B      |      |
|  | GE8x8NB–<br>3 | GE13 | GE8x8NB–<br>3 | GE13 |
| Load Reject w/o Bypass   | 1.33          | 1.47 | 1.29          | 1.39 |
| Turbine Trip w/o Bypass  | 1.33          | 1.46 | 1.29          | 1.38 |

## 12. Overpressurization Analysis Summary

| Event                     | P <sub>sl</sub><br>(psig) | P <sub>v</sub><br>(psig) | Plant<br>Response |
|---------------------------|---------------------------|--------------------------|-------------------|
| MSIV Closure (Flux Scram) | 1291                      | 1322                     | Figure 11         |

### 13. Loading Error Results<sup>4</sup>

Variable water gap misoriented bundle analysis: Yes

| Misoriented Fuel Bundle | $\Delta$ CPR |
|-------------------------|--------------|
| GE8x8NB-3               | 0.18         |
| GE13                    | 0.17         |

### 14. Control Rod Drop Analysis Results

This is a banked position withdrawal sequence plant, therefore, the control rod drop accident analysis is not required. NRC approval is documented in NEDE-24011-P-A-US.

### 15. Stability Analysis Results

GE SIL-380 recommendations and GE interim corrective actions have been included in the Brunswick Steam Electric Plant Unit 1 operating procedures. Regions of restricted operation defined in Attachment 1 to NRC Bulletin No. 88-07, Supplement 1, *Power Oscillations in Boiling Water Reactors (BWRs)*, are applicable to Brunswick 1.

### 16. Loss-of-Coolant Accident Results

#### LOCA method used: SAFER/GESTR-LOCA

The GE8x8EB LOCA analysis results presented in Sections 5 and 6 of *Brunswick Steam Electric Plant Units 1 and 2 SAFER/GESTAR-LOCA Loss-of-Coolant Accident Analysis*, NEDC-31624P, Revision 2, July 1990, conservatively bound the LOCA analysis of the GE8x8NB-3 fuel types. This analysis yielded a licensing basis peak clad temperature of 1533°F, a peak local oxidation fraction of <0.30%, and a core-wide metal-water reaction of 0.046%.

An additional LOCA analysis was performed for the GE13 fuel type. The results, presented in *Brunswick Steam Electric Plant Units 1 and 2 SAFER/GESTAR-LOCA Loss-of-Coolant Accident Analysis: Application to GE13 Fuel*, NEDC-31624P, Supplement 3, Rev. 0, January 1996, show a licensing basis peak clad temperature of 1535°F. The peak local oxidation fraction and core-wide metal-water reaction were shown to be bounded by results from the GE8x8EB LOCA analysis.

The most and the least limiting MAPLHGRs for the new GE13 fuel designs are as follows:

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4. Includes a 0.02 penalty due to variable water gap R-factor uncertainty.

## 16. Loss-of-Coolant Accident Results (cont)

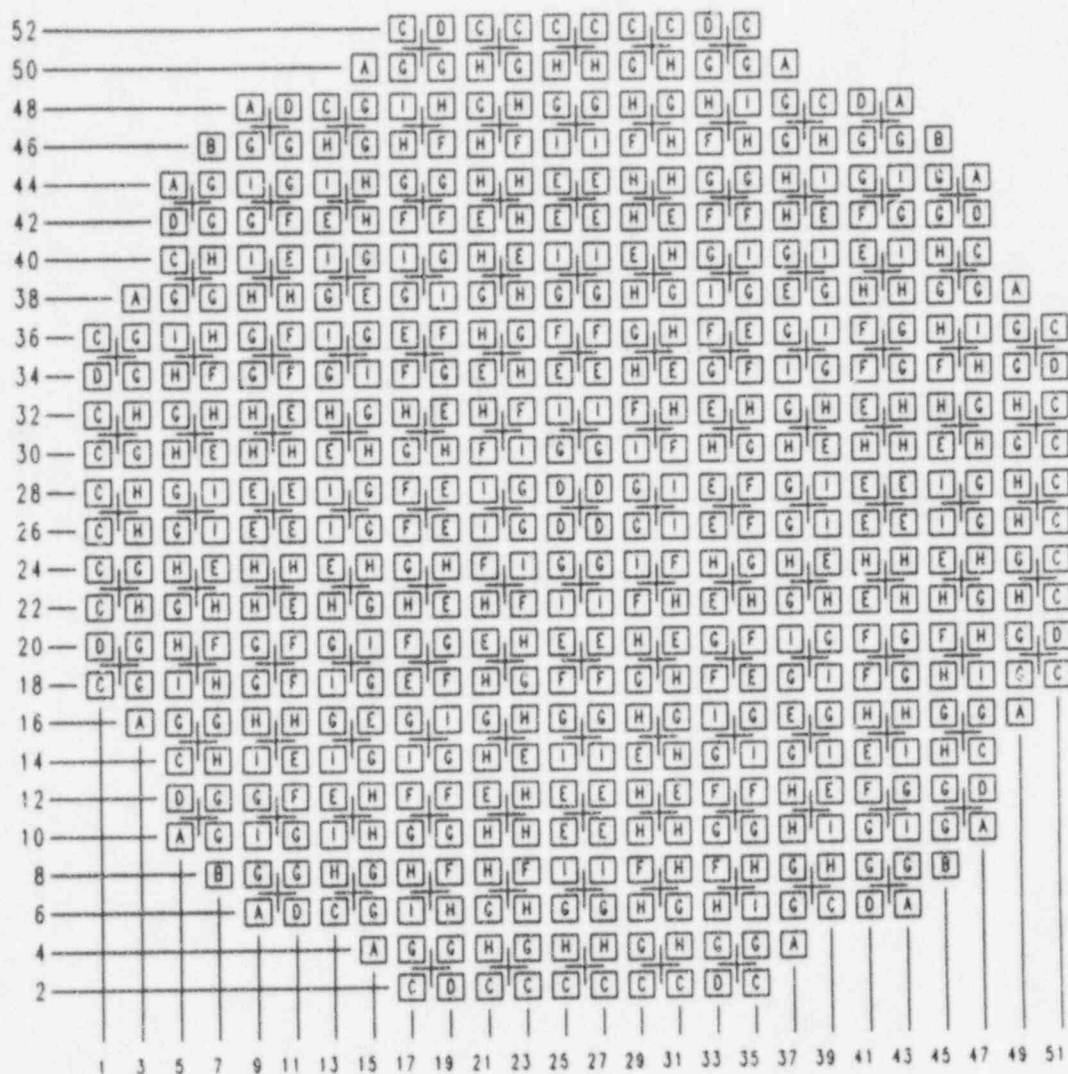
Bundle Type: GE13-P9DTB380-10G5.0A-100T-146-T

| Average Planar Exposure |          | MAPLHGR(kW/ft) |                |
|-------------------------|----------|----------------|----------------|
| (GWd/ST)                | (GWd/MT) | Most Limiting  | Least Limiting |
| 0.00                    | 0.00     | 11.17          | 11.29          |
| 0.20                    | 0.22     | 11.20          | 11.32          |
| 1.00                    | 1.10     | 11.32          | 11.42          |
| 2.00                    | 2.20     | 11.49          | 11.56          |
| 3.00                    | 3.31     | 11.68          | 11.72          |
| 4.00                    | 4.41     | 11.88          | 11.89          |
| 5.00                    | 5.51     | 12.03          | 12.06          |
| 6.00                    | 6.61     | 12.14          | 12.22          |
| 7.00                    | 7.72     | 12.25          | 12.38          |
| 8.00                    | 8.82     | 12.36          | 12.55          |
| 9.00                    | 9.92     | 12.47          | 12.73          |
| 10.00                   | 11.02    | 12.59          | 12.87          |
| 12.50                   | 13.78    | 12.65          | 12.73          |
| 15.00                   | 16.53    | 12.39          | 12.49          |
| 17.50                   | 19.29    | 12.03          | 12.12          |
| 20.00                   | 22.05    | 11.67          | 11.75          |
| 25.00                   | 27.56    | 10.94          | 11.04          |
| 30.00                   | 33.07    | 10.22          | 10.37          |
| 35.00                   | 38.58    | 9.52           | 9.67           |
| 40.00                   | 44.09    | 8.83           | 8.98           |
| 45.00                   | 49.60    | 8.15           | 8.32           |
| 50.00                   | 55.12    | 7.48           | 7.67           |
| 55.00                   | 60.63    | 6.80           | 7.02           |
| 57.66                   | 63.56    | 6.43           | 6.66           |
| 57.99                   | 63.93    | —              | 6.61           |

## 16. Loss-of-Coolant Accident Results (cont)

Bundle Type: GE13-P9DTB380-11G5.0A-100T-146-T

| Average Planar Exposure |          | MAPLHGR(kW/ft) |                |
|-------------------------|----------|----------------|----------------|
| (GWd/ST)                | (GWd/MT) | Most Limiting  | Least Limiting |
| 0.00                    | 0.00     | 10.94          | 11.09          |
| 0.20                    | 0.22     | 10.99          | 11.13          |
| 1.00                    | 1.10     | 11.11          | 11.23          |
| 2.00                    | 2.20     | 11.29          | 11.38          |
| 3.00                    | 3.31     | 11.49          | 11.55          |
| 4.00                    | 4.41     | 11.70          | 11.73          |
| 5.00                    | 5.51     | 11.90          | 11.93          |
| 6.00                    | 6.61     | 12.07          | 12.13          |
| 7.00                    | 7.72     | 12.24          | 12.27          |
| 8.00                    | 8.82     | 12.38          | 12.43          |
| 9.00                    | 9.92     | 12.50          | 12.62          |
| 10.00                   | 11.02    | 12.61          | 12.81          |
| 12.50                   | 13.78    | 12.66          | 12.72          |
| 15.00                   | 16.53    | 12.39          | 12.49          |
| 17.50                   | 19.29    | 12.03          | 12.12          |
| 20.00                   | 22.05    | 11.66          | 11.75          |
| 25.00                   | 27.56    | 10.93          | 11.04          |
| 30.00                   | 33.07    | 10.21          | 10.37          |
| 35.00                   | 38.58    | 9.51           | 9.65           |
| 40.00                   | 44.09    | 8.82           | 8.97           |
| 45.00                   | 49.60    | 8.15           | 8.31           |
| 50.00                   | 55.12    | 7.48           | 7.66           |
| 55.00                   | 60.63    | 6.80           | 7.01           |
| 57.77                   | 63.68    | 6.41           | 6.63           |
| 57.93                   | 63.85    | —              | 6.61           |



| Fuel Type                          |           |                                    |            |
|------------------------------------|-----------|------------------------------------|------------|
| A=GE8B-P8DQB339-11GZ-80M-4WR-150-T | (Cycle 7) | F=GE10-P8HXB322-11GZ-70M-150-T     | (Cycle 9)  |
| B=GE8B-P8DQB323-10GZ-80M-4WR-150-T | (Cycle 7) | G=GE10-P8HXB346-12GZ-100M-150-T    | (Cycle 10) |
| C=GE10-P8HXB322-11GZ-70M-150-T     | (Cycle 8) | H=GE13-P9DTB380-10G5.0A-100T-146-T | (Cycle 11) |
| D=GE10-P8HXB324-12GZ-70M-150-T     | (Cycle 8) | I=GE13-P9DTB380-11G5.0A-100T-146-T | (Cycle 11) |
| E=GE10-P8HXB320-11GZ-100M-150-T    | (Cycle 9) |                                    |            |

Figure 1 Reference Core Loading Pattern



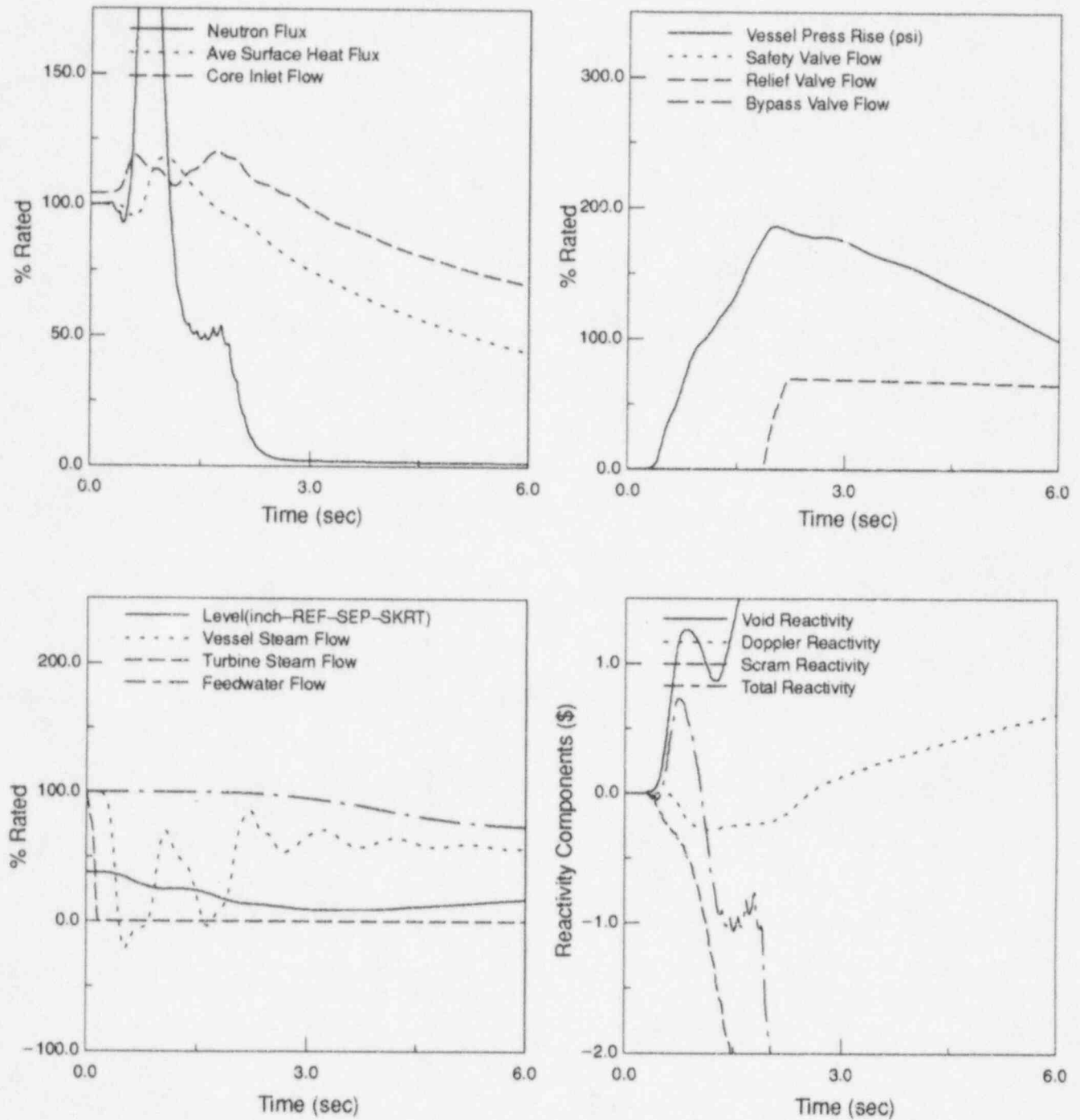


Figure 2 Plant Response to Load Reject w/o Bypass (BOC11 to EOC11-2205 MWd/MT with ICF)



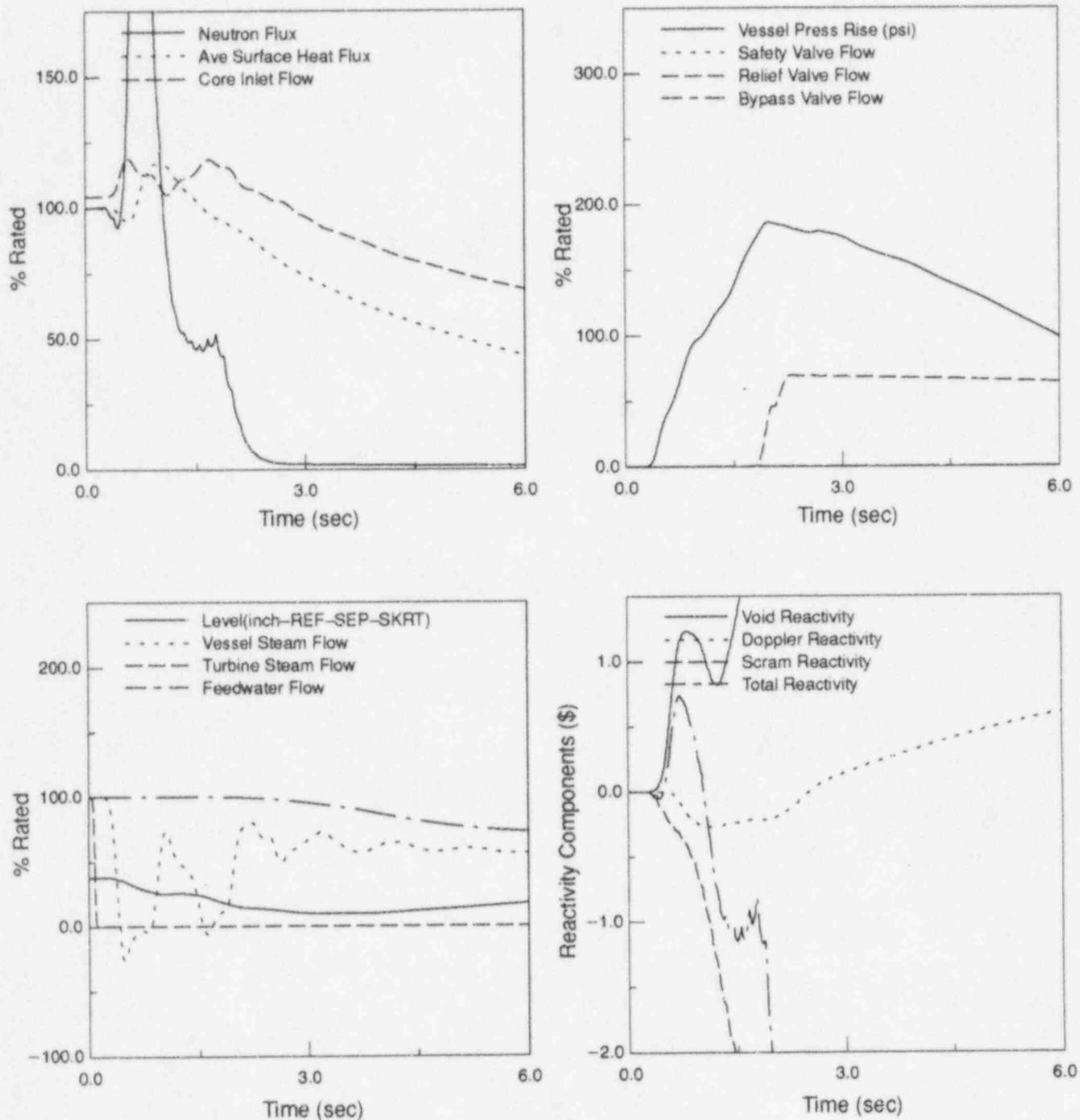


Figure 3 Plant Response to Turbine Trip w/o Bypass (BOC11 to EOC11-2205 MWd/MT with ICF)

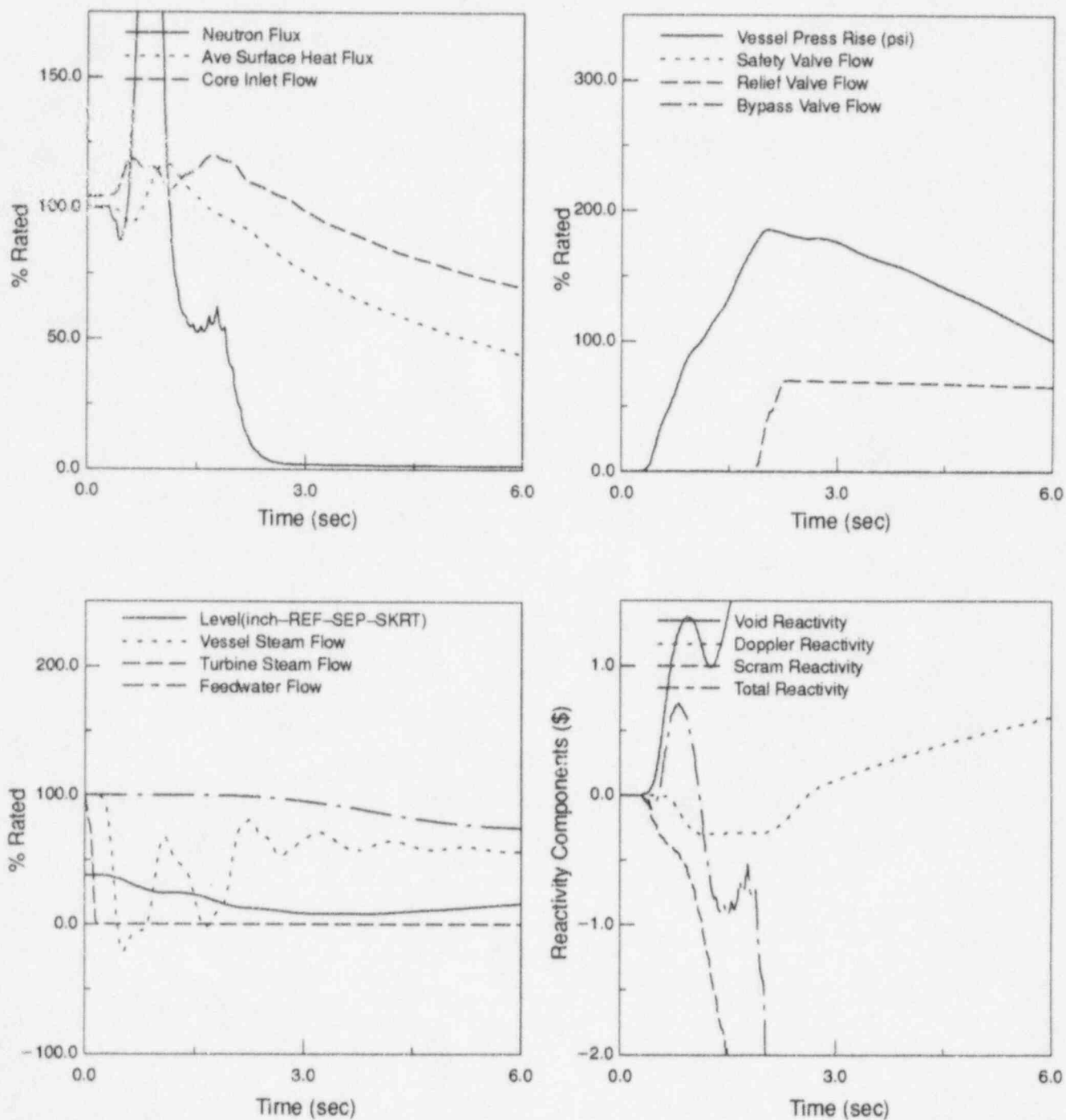


Figure 4 Plant Response to Load Reject w/o Bypass (EOC11-2205 MWd/MT to EOC11 with ICF)

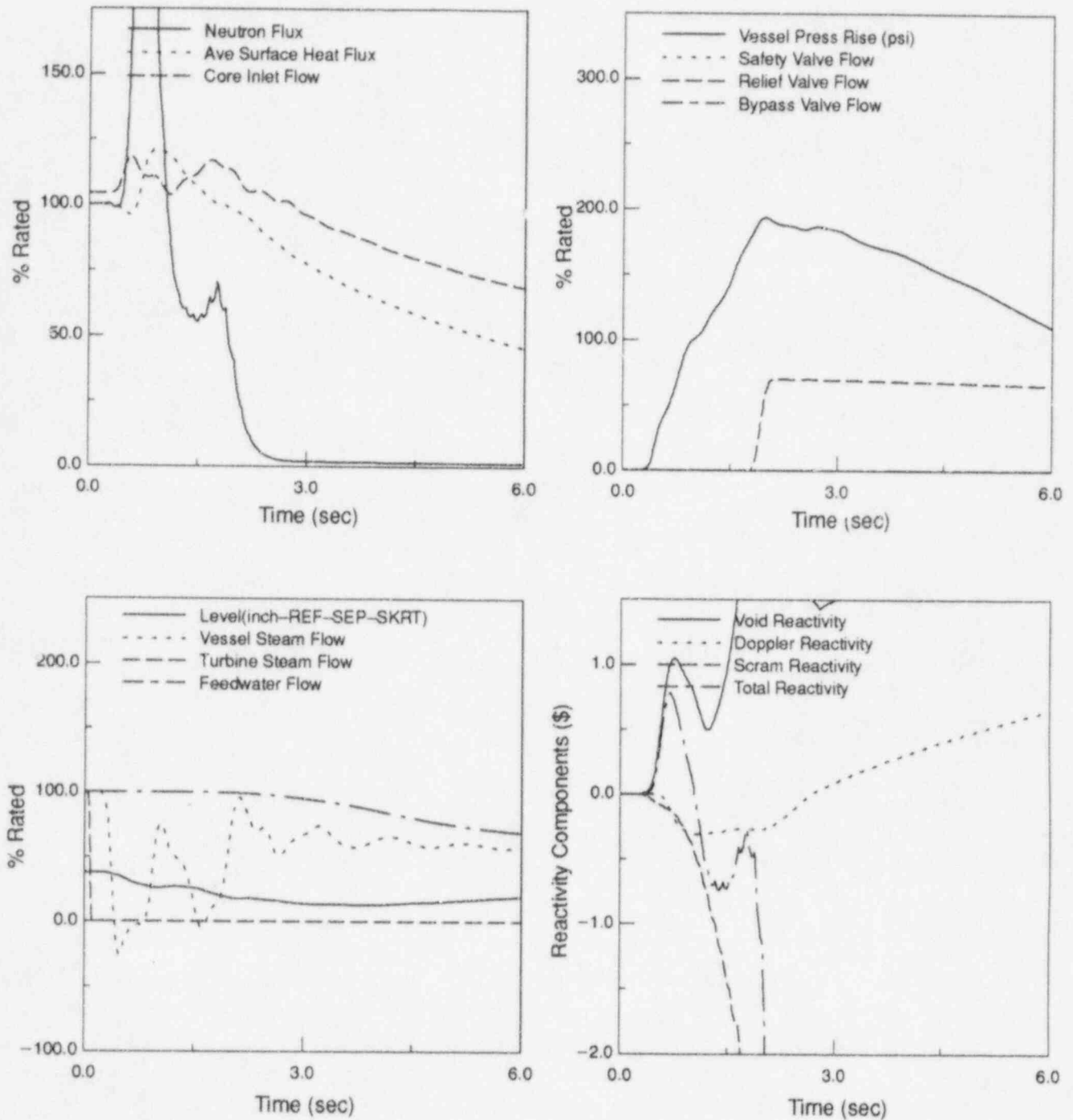


Figure 5 Plant Response to Turbine Trip w/o Bypass (EOC11-2205 MWd/MT to EOC11 with ICF)

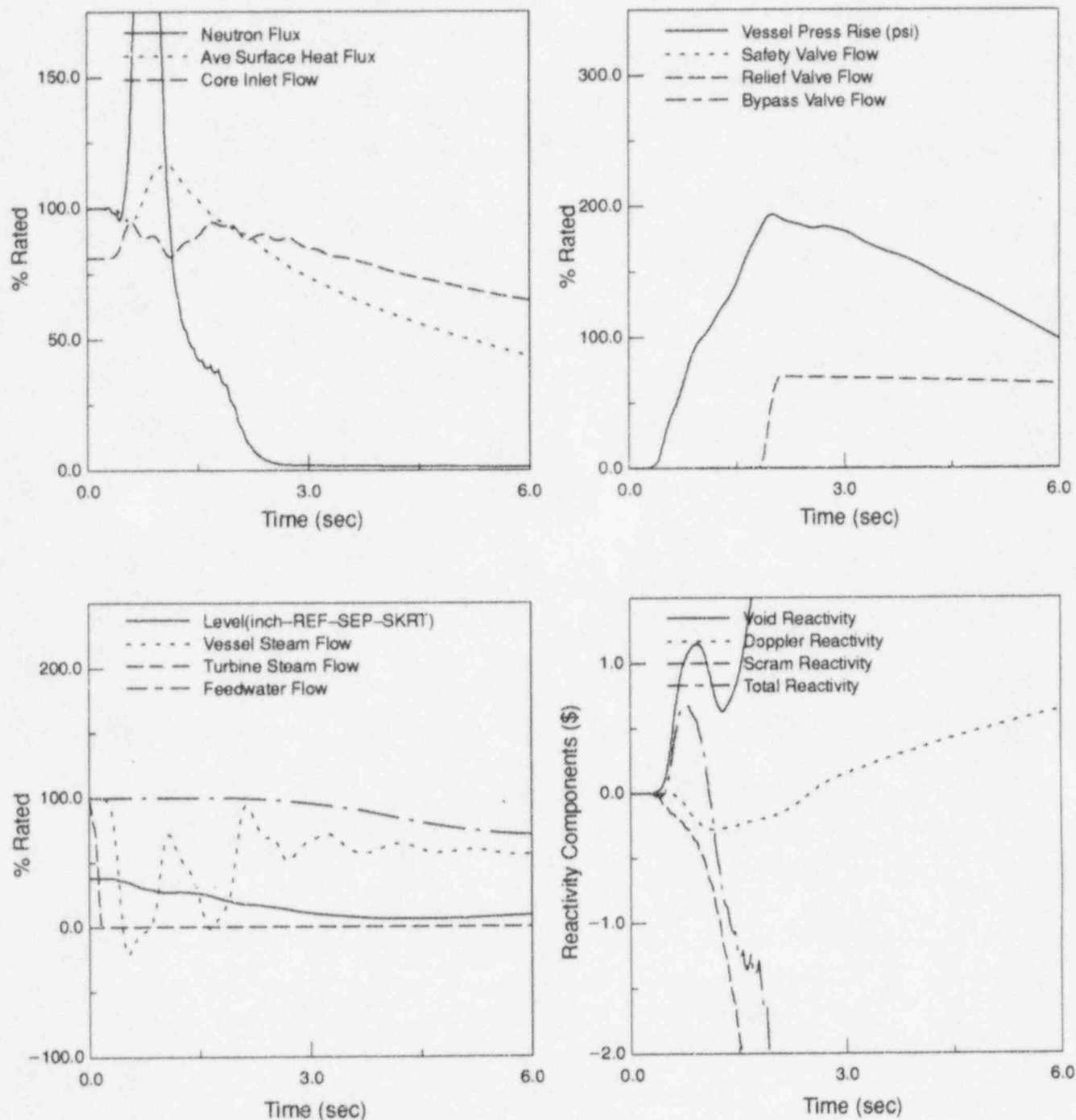


Figure 6 Plant Response to Load Reject w/o Bypass (EOC11-2205 MWd/MT to EOC11 with MELLL)

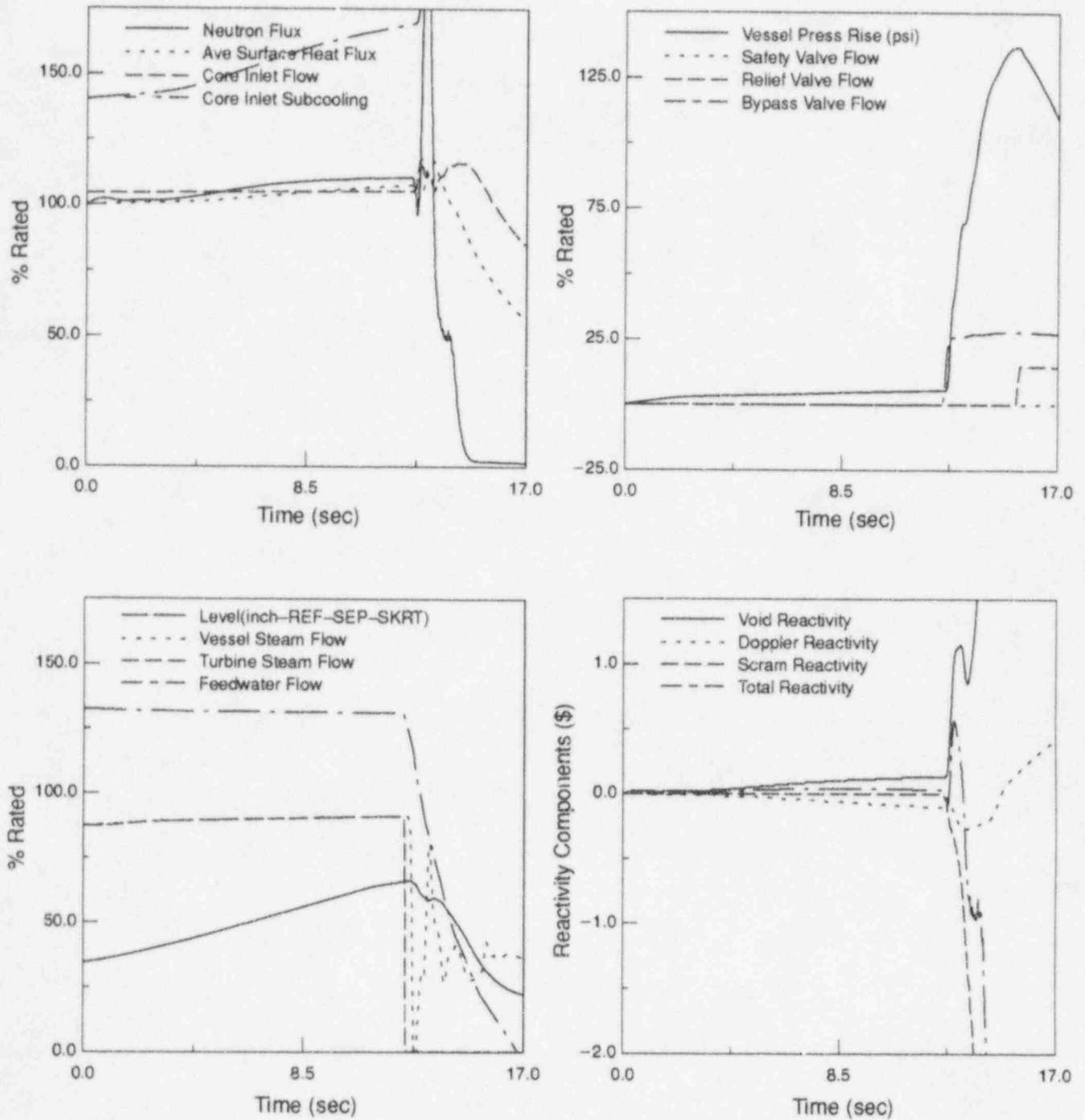


Figure 7 Plant Response to FW Controller Failure (EOC11-2205 MWd/MT to EOC11 with ICF and FWTR)

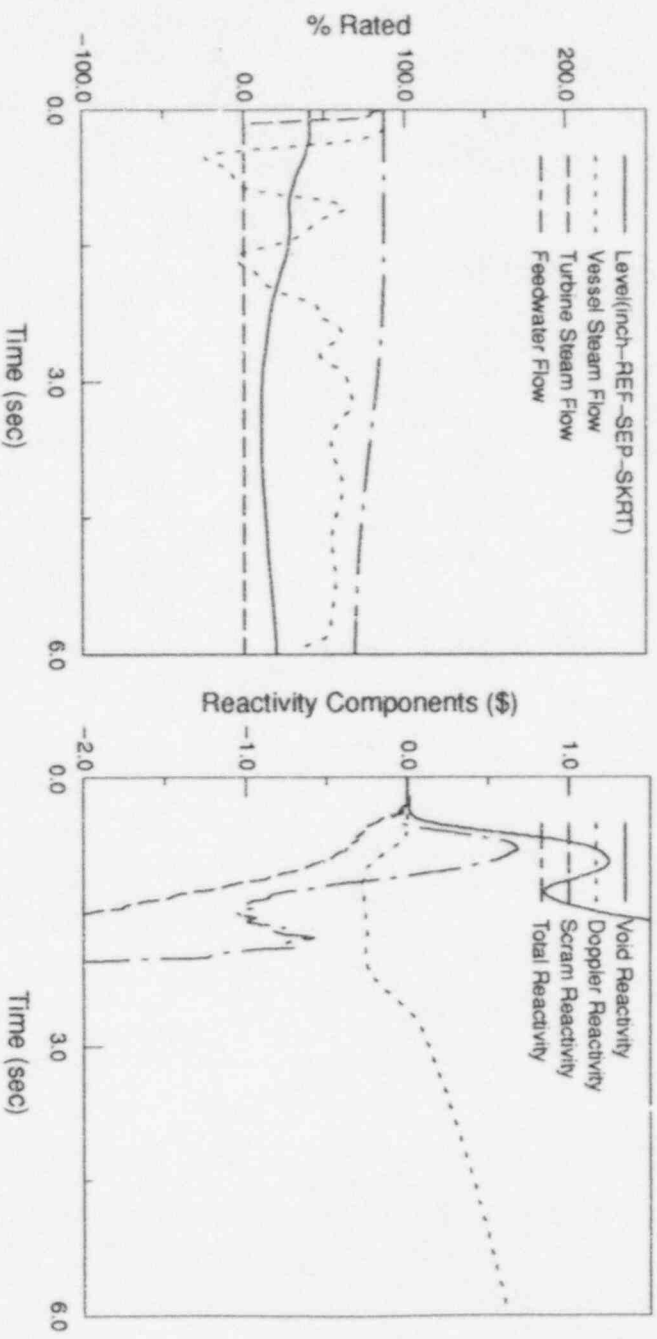
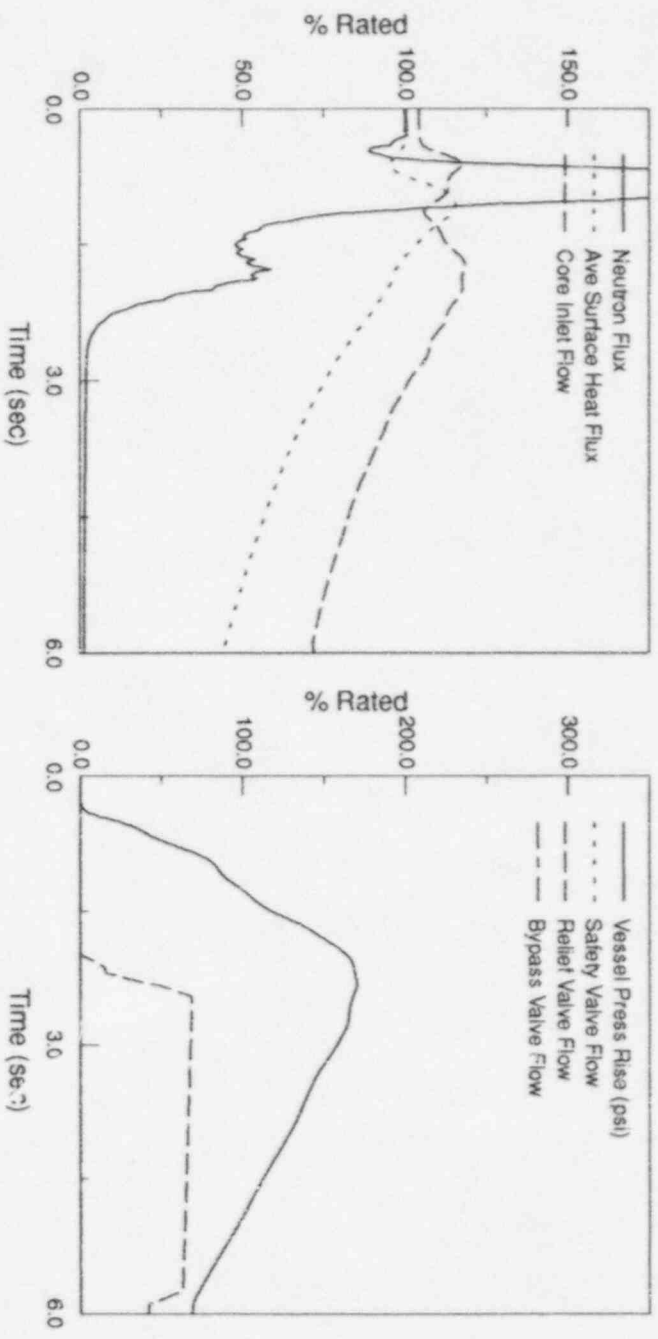


Figure 8 Plant Response to Load Reject w/o Bypass (EOC11-2205 MWd/MT to EOC11 with ICF and FWTR)

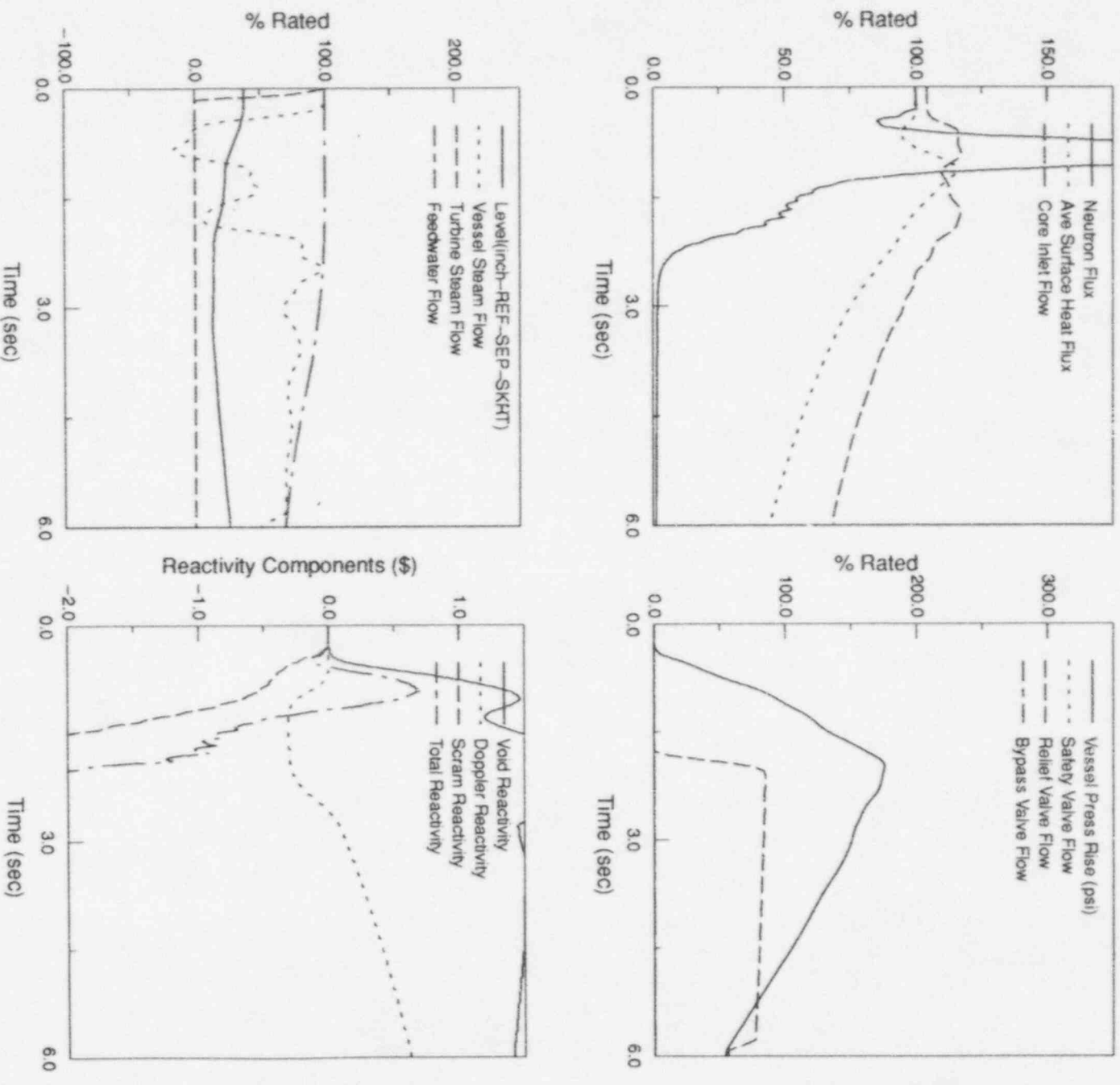


Figure 9 Plant Response to Load Reject (w/o Bypass (EOCII-2205 MWd/MT to EOCII with MSIVOOS and ICF)



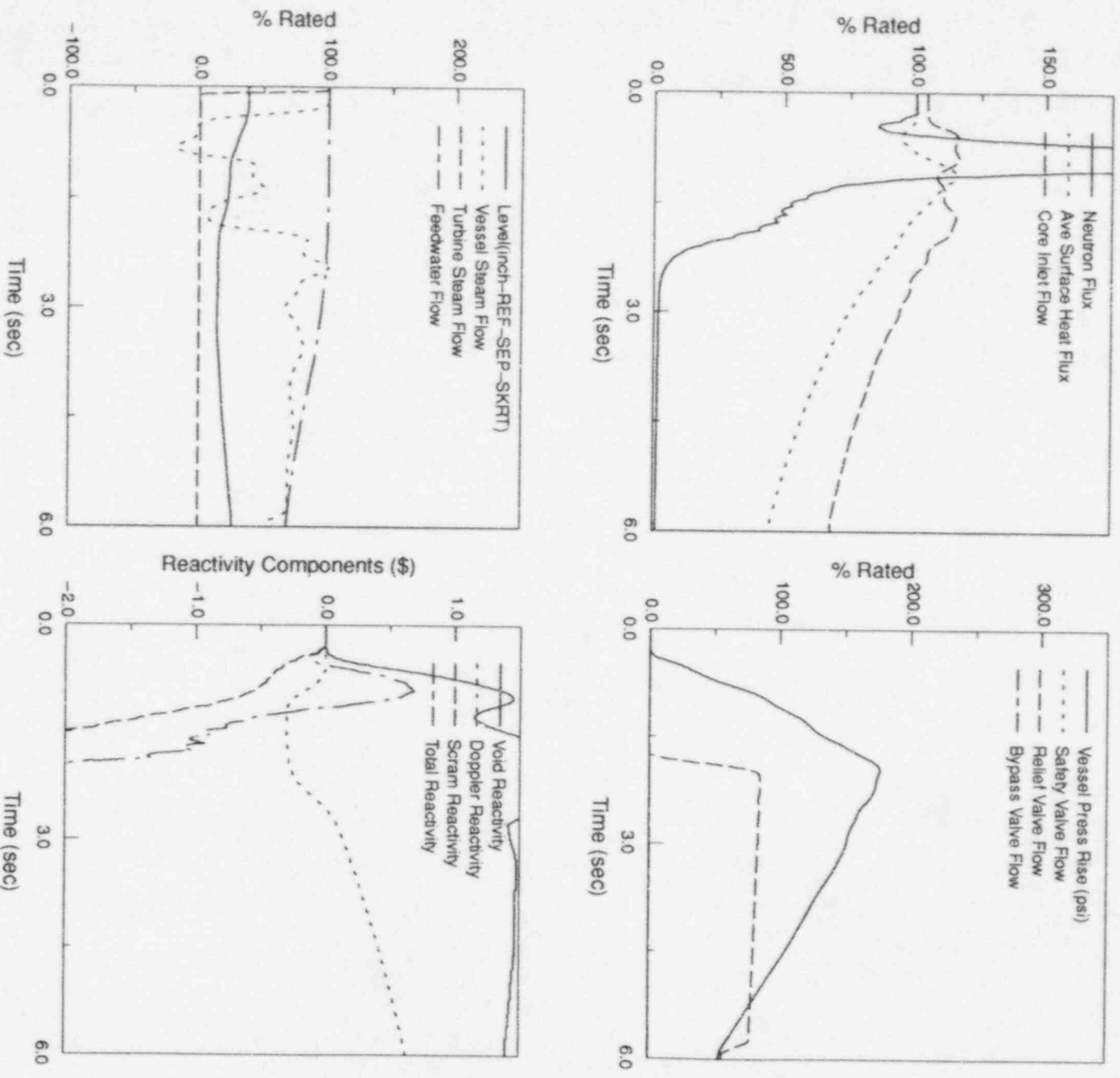


Figure 10 Plant Response to Turbine Trip w/o Bypass (EOCII-2205 MWd/MT to EOCII with MSIVOOS and ICF)

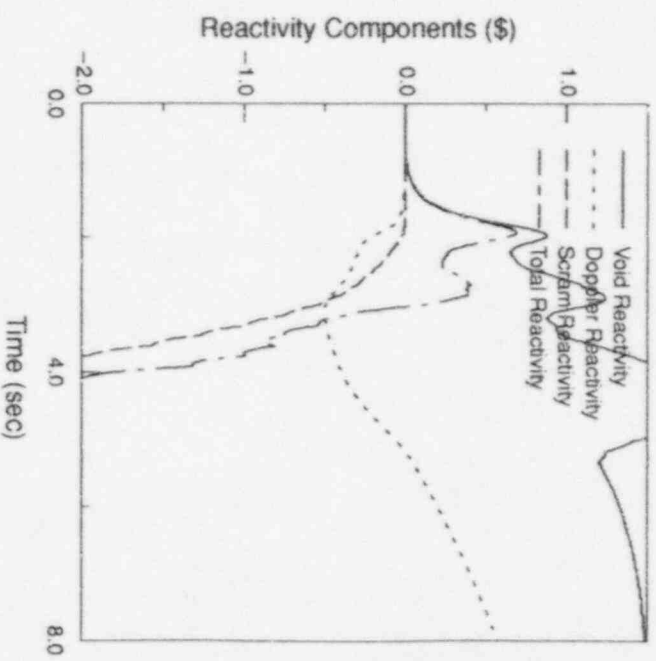
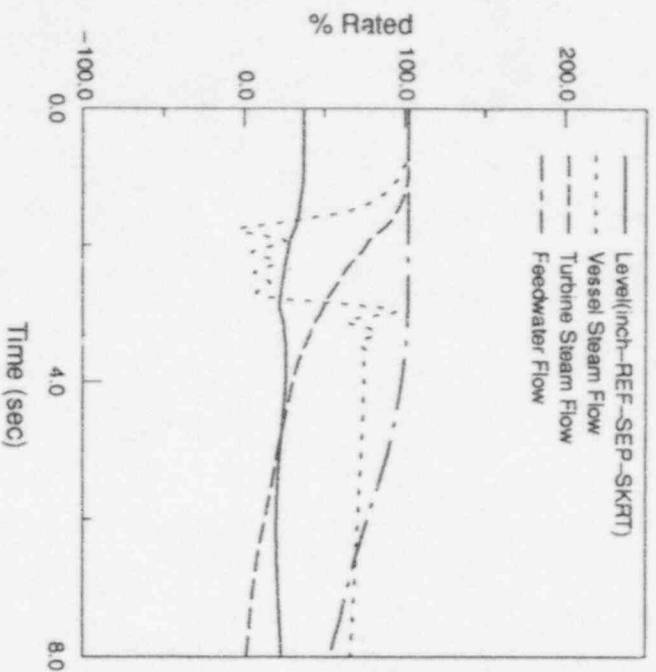
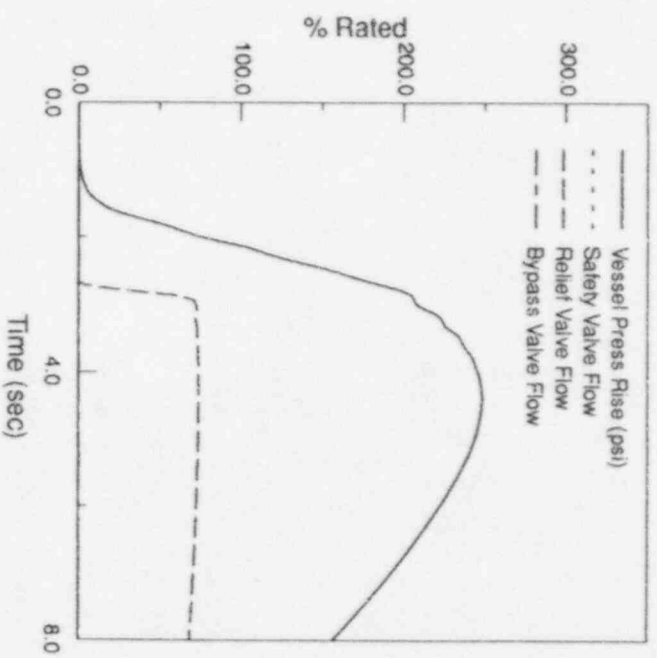
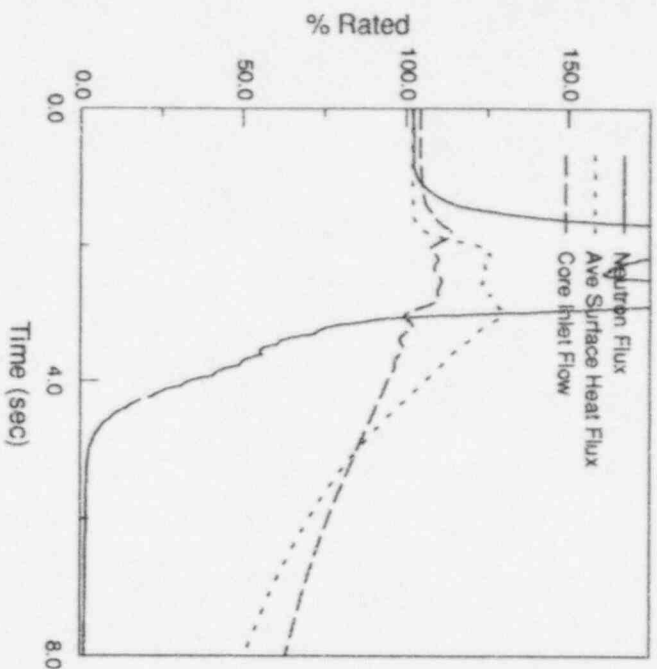


Figure 11 Plant Response to MSIV Closure (Flux Scram)

## Appendix A Analysis Conditions

This is the first reload core for Brunswick Unit 1 which will operate at an uprated power of 105% (2558 MWt). To reflect actual plant parameters accurately, the values shown in Table A-1 were used for this cycle.

**Table A-1**

| Parameter                               | Analysis Value       |                      |                      |                      |
|---|----------------------|----------------------|----------------------|----------------------|
|   | ICF                  | MELLL                | ICF and FWTR         | MSIVOOS and ICF      |
| Thermal power, MWt                      | 2558.0               | 2558.0               | 2558.0               | 2558.0               |
| Core flow, Mlb/hr                       | 80.3                 | 62.4                 | 80.3                 | 80.3                 |
| Reactor pressure, psia                  | 1060.8               | 1056.5               | 1059.5               | 1060.8               |
| Inlet enthalpy, BTU/lb                  | 530.7                | 524.6                | 519.4                | 530.7                |
| Non-fuel power fraction                 | 0.037                | 0.037                | 0.037                | 0.037                |
| Steam flow analysis, Mlb/hr             | 11.09                | 11.07                | 9.67                 | 11.09                |
| Dome pressure, psig                     | 1030.0               | 1030.0               | 1030.0               | 1045.0               |
| Turbine pressure, psig                  | 969.0                | 969.3                | 984.1                | 941.6                |
| No. of Safety/Relief Valves             | 9                    | 9                    | 9                    | 11                   |
| Relief mode lowest setpoint, psig       | 1164.0               | 1164.0               | 1164.0               | 1164.0               |
| Recirculation pump power source         | on-site <sup>5</sup> | on-site <sup>5</sup> | on-site <sup>5</sup> | on-site <sup>5</sup> |
| Turbine control valve mode of operation | Partial arc          | Partial arc          | Partial arc          | Partial arc          |

5. Bounds operation with off-site power source for reload licensing events for Cycle 11.

## Appendix B

### Main Steamline Isolation Valve Out of Service

Reference B-1 provided a basis for operation of Brunswick Steam Electric Plant (BSEP) with one Main Steamline Isolation Valve Out of Service (MSIVOOS) (three steamline operation) and all S/RVs in service. For this mode of operation in BSEP Unit 1 throughout Cycle 11, the MCPR limits presented in Section 11 of this report are bounding and should be applied when operating in the MSIVOOS mode at any time during the cycle. The peak steamline and peak vessel pressures for the limiting overpressurization event (MSIV closure with flux scram) were not calculated for the MSIVOOS mode of operation. In this mode of operation it is required that all S/RVs be operational versus the assumed 2 S/RVs OOS for the events evaluated during normal plant operation. Previous cycles analyses have shown that the MSIV closure with flux scram, evaluated in the MSIVOOS mode, has resulted in the peak vessel pressure being reduced by more than 25 psi, when compared to the same case evaluated with all (four) steamlines operational.

#### Reference

B-1. *Main Steamline Isolation Valve Out of Service for the Brunswick Steam Electric Plant*, EAS-117-0987, GE Nuclear Energy, April 1988.

## **Appendix C**

### **Decrease in Core Coolant Temperature Events**

The Loss of Feedwater Heater (LFWH) event and the HPCI inadvertent start-up event are the only cold water injection AOOs checked on a cycle-by-cycle basis. A Cycle 11 analysis showed a LFWH  $\Delta$ CPR of 0.12. The HPCI event was shown to be bounded by the LFWH event for Cycle 11.

## Appendix D Feedwater Temperature Reduction (FWTR)

Reference D-1 provides the basis for operation of the Brunswick Steam Electric Plant with FWTR. The MCPR limits presented in Section 11 of this report are bounding and should be applied when operating with FWTR. Previous analysis has shown the FWCF event is most severe at ICF and FWTR.

### Reference

D-1. *Feedwater Temperature Reduction with Maximum Extended Load Line Limit and Increased Core Flow for Brunswick Steam Electric Plant Units 1 and 2*, NEDC-32457P, Revision 1, December 1995.

## Appendix E

### Maximum Extended Operating Domain

Reference E-1 provided a basis for operation of the Brunswick Steam Electric Plant in the Maximum Extended Operating Domain (MEOD). The reload licensing analysis performed for Cycle 11 and documented herein is consistent with and provide the cycle-specific update to the reference E-1 analysis. Application of the GEXL-PLUS correlation to the reload fuel has been confirmed as required in reference E-1. The applicability of GE13 was addressed and found acceptable.

#### Reference

E-1. *Maximum Extended Operating Domain Analysis for Brunswick Steam Electric Plant*, NEDC-31654P, GE Nuclear Energy (Proprietary), February 1989.



ENCLOSURE 4

BRUNSWICK STEAM ELECTRIC PLANT, UNIT NO. 1  
DOCKET NO. 50-325/LICENSE NO. DPR-71  
TRANSMITTAL OF CORE OPERATING LIMITS REPORT,  
SUPPLEMENTAL RELOAD LICENSING REPORT, AND  
LOSS-OF-COOLANT-ACCIDENT ANALYSIS REPORT

AFFIDAVIT FROM GENERAL ELECTRIC NUCLEAR ENERGY  
REGARDING WITHHOLDING FROM PUBLIC DISCLOSURE  
IN ACCORDANCE WITH 10 CFR 2.790



## Affidavit

**I, Ralph J. Reda**, being duly sworn, depose and state as follows:

- (1) I am Manager, Fuels and Facility Licensing, General Electric Company ("GE") and have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been authorized to apply for its withholding.
- (2) The information sought to be withheld is contained in the document, NEDC-31624P, Supplement 1, Revision 3, *Loss-of-Coolant Accident Analysis Report for BRUNSWICK STEAM ELECTRIC PLANT UNIT 1, Reload 10 Cycle 11*, May 1996.
- (3) In making this application for withholding of proprietary information of which it is the owner, GE relies upon the exemption from disclosure set forth in the Freedom of Information Act ("FOIA"), 5 USC Sec. 552(b)(4), and the Trade Secrets Act, 18 USC Sec. 1905, and NRC regulations 10 CFR 9.17(a)(4), 2.790(a)(4), and 2.790(d)(1) for "trade secrets and commercial or financial information obtained from a person and privileged or confidential" (Exemption 4). The material for which exemption from disclosure is here sought is all "confidential commercial information," and some portions also qualify under the narrower definition of "trade secret," within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975F2d871 (DC Cir. 1992), and Public Citizen Health Research Group v. FDA, 704F2d1280 (DC Cir. 1983).
- (4) Some examples of categories of information which fit into the definition of proprietary information are:
  - a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by General Electric's competitors without license from General Electric constitutes a competitive economic advantage over other companies;
  - b. Information which, if used by a competitor, would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product;
  - c. Information which reveals cost or price information, production capacities, budget levels, or commercial strategies of General Electric, its customers, or its suppliers;
  - d. Information which reveals aspects of past, present, or future General Electric customer-funded development plans and programs, of potential commercial value to General Electric;
  - e. Information which discloses patentable subject matter for which it may be desirable to obtain patent protection.

The information sought to be withheld is considered to be proprietary for the reasons set forth in both paragraphs (4)a. and (4)b., above.

- (5) The information sought to be withheld is being submitted to NRC in confidence. The information is of a sort customarily held in confidence by GE, and is in fact so held. Its initial designation as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in (6) and (7) following. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by GE, no public disclosure has been made, and it is not available in public sources. All disclosures to third parties including any required transmittals to NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary agreements which provide for maintenance of the information in confidence.
- (6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge. Access to such documents within GE is limited on a "need to know" basis.
- (7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist or other equivalent authority, by the manager of the cognizant marketing function (or his delegate), and by the Legal Operation, for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside GE are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary agreements.
- (8) The information identified in paragraph (2) is classified as proprietary because it would provide other parties, including competitors, with information related to detailed results of analytical models, methods and processes, including computer codes, which GE has developed, requested NRC approval of, and applied to perform evaluations of the BWR. The development of the evaluation process along with the interpretation and application of the analytical results is derived from the extensive experience database that constitutes a major GE asset.
- (9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GE's competitive position and foreclose or reduce the availability of profit-making opportunities. The fuel design is part of GE's comprehensive BWR safety and technology base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and analytical methodology and includes development of the expertise to determine and apply the appropriate evaluation process. In addition, the technology base includes the value derived from providing analyses done with NRC-approved methods.

The research, development, engineering, analytical, and NRC review costs comprise a substantial investment of time and money by GE.

The precise value of the expertise to devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial.

GE's competitive advantage will be lost if its competitors are able to use the results of the GE experience to normalize or verify their own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

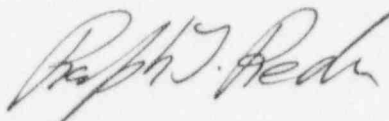
The value of this information to GE would be lost if the information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive GE of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing these very valuable analytical tools.

State of North Carolina    )  
County of New Hanover    ) SS:

Ralph J. Reda, being duly sworn, deposes and says:

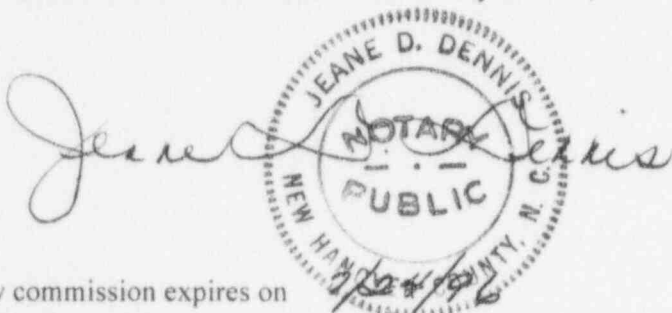
That he has read the foregoing affidavit and the matters stated therein are true and correct to the best of his knowledge, information, and belief.

Executed at Wilmington, North Carolina, this 20 day of June, 1996.



Ralph J. Reda  
General Electric Company

Subscribed and sworn before me this 20 day of June, 1996



My commission expires on  
Notary Public, State of North Carolina