NUCLEAR ENERGY BUSINESS GROUP • GENERAL ELECTRIC COMPANY
SAN JOSE, CALIFORNIA 95125

GENERAL ELECTRIC

APPLICABLE TO:

PUBLICATION NO. NEDO-21662-2

T.I.E. NO.

TITLE LOCA ANALYSIS REPORT FOR JAMES A. FITZPATRICK NUCLEAR POWER PLANT (LEAD PLANT)

ISSUE DATE July 1977

ERRATA And ADDENDA SHEET

NO. 3

DATE August 1981

NOTE: Correct all copies of the applicable publication as specified below.

ITEM	REFERENCES (SECTION, PAGE PARAGRAPH, LINE)	INSTRUCTIONS (CORRECTIONS AND ADDITIONS)
01	Page v/vi	Replace with new page v/vi.
02	Page 3-1/3-2	Replace with new page 3-1/3-2.
03	Page 4-3	Replace with new page 4-3.
04	Page 4-8	Replace with new page 4-8.
05	Page 4-9	Add new page 4-9.
06	Page 4-10	Add new page 4-10.
07	Page 4-11/4-12	Add new page 4-11/4-12.

LIST OF TABLES

Table	Title	Page
1	BWR/4 With LPCI Modification (Important LOCA/ECCS Parameters)	2-3
2	Significant Input Parameters to the Loss-of-Coolant Accident	3-1
3	Summary of Break Spectrum Results	4-5
4	LOCA Analysis Figure Summary - Lead Plant	4-6
5A	MAPLHGR Versus Average Planar Exposure	4-7
5B	MAPLHGR Versus Average Planar Exposure	4-7
5C	MAPLHGR Versus Average Planar Exposure	4-8
5D	MAPLHGR Versus Average Planar Exposure	4-8
5E	MAPLHGR Versus Average Planar Exposure	4-9
5F	MAPLHGR Versus Average Planar Exposure	4-9
5G	MAPLHGR Versus Average Planar Exposure	4-10
5H	MAPLHGR Versus Average Planar Exposure	4-10
5I	MAPLHGR Versus Average Planar Exposure	4-11
5J	MAPLHGR Versus Average Planar Exposure	4-11
6	Single Failure Evaluation (Plants With LPCI Modification)	6-7

3. INPUT TO ANALYSIS

A list of the significant plant input parameters to the LOCA analysis is presented in Table 2.

Table 2

SIGNIFICANT INPUT PARAMETERS TO THE LOSS-OF-COOLANT ACCIDENT ANALYSIS

Plant Parameters:

Core Thermal Power	2531 MWt, which corresponds to 105% of rated steam flow
Vessel Steam Output	10.96×10^6 lbm/h, which corresponds to 105% of rated steam flow
Vessel Steam Dome Pressure	1055 psia
Recirculation Line Break Area for Large Breaks - Discharge	(DBA) 2.37 ft^2, 1.89 ft^2, 1.0 ft^2
- Suction	4.14 ft^2
Recirculation Line Break Area for Small Breaks - Discharge	1.0 ft^2, 0.9 ft^2, 0.15 ft^2
- Suction	0.07 ft^2
Number of Drilled Bundles	All

Fuel Parameters:

	Fuel Type	Fuel Bundle Geometry	Peak Technical Specification Linear Heat Generation Rate (kW/ft)	Design Axial Peaking Factor	Initial Minimum Critical Power Ratio*
A.	Initial - Type 2	7x7	18.5	1.5	1.2
B.	Initial - Type 3	7x7	18.5	1.5	1.2
C.	8D274H	8x8	13.4	1.4	1.2
D.	8D274L	8x8	13.4	1.4	1.2
E.	8DRB265L	8x8	13.4	1.4	1.2
F.	8DRB283	8x8	13.4	1.4	1.2
G.	P8DRB265L	8x8	13.4	1.4	1.2
H.	P8DRB283	8x8	13.4	1.4	1.2
I.	P8DRB284H	8x8	13.4	1.4	1.2
J.	P8DRB299	8x8	13.4	1.4	1.2

*To account for the 2% uncertainty in bundle power required by Appendix K, the SCAT calculation is performed with an MCPR of 1.18 (i.e., 1.2 divided by 1.02) for a bundle with an initial MCPR of 1.20.

4.5 RESULTS OF THE CHASTE ANALYSIS

This code is used, with suitable inputs from the other codes, to calculate the fuel cladding heatup rate, peak cladding temperature, peak local cladding oxidation, and core-wide metal-water reaction for large breaks. The detailed fuel model in CHASTE considers transient gap conductance, clad swelling and rupture, and metal-water reaction. The empirical core spray heat transfer and channel wetting correlations are built into CHASTE, which solves the transient heat transfer equations for the entire LOCA transient at a single axial plane in a single fuel assembly. Iterative applications of CHASTE determine the maximum permissible planar power where required to satisfy the requirements of 10CFR50.46 acceptance criteria.

The CHASTE results presented are:

- Peak Cladding Temperature versus time
- Peak Cladding Temperature versus Break Area
- Peak Cladding Temperature and Peak Local Oxidation versus Planar Average Exposure for the most limiting break size
- Maximum Average Planar Heat Generation Rate (MAPLHGR) versus Planar Average Exposure for the most limiting break size
- Rod Perforation Time and Temperature
- Hot Rod Location

A summary of the analytical results is given in Table 3. Table 4 lists the figures provided for this analysis. The MAPLHGR values for each fuel type in the FitzPatrick core are presented in Tables 5A through 5J.]

4.6 METHODS

In the following sections, it will be useful to refer to the methods used to analyze DBA, large breaks, and small breaks. For jet-pump reactors, these are defined as follows:

a. DBA Methods. LAMB/SCAT/SAFE/DBA-REFLOOD/CHASTE. Break size: DBA.

b. Large Break Methods (LBM). LAMB/SCAT/SAFE/non-DBA REFLOOD/CHASTE. Break sizes: $1.0\ ft^2 \leq A < DBA$.

c. Small Break Methods (SBM). SAFE/non-DBA REFLOOD. Heat transfer coefficients: nucleate boiling prior to core uncovery, 25 Btu/hr-ft^2-°F after recovery, core spray when appropriate. Peak cladding temperature and peak local oxidation are calculated in non-DBA-REFLOOD. Break sizes: $A \leq 1.0\ ft^2$.

Table 5A

MAPLHGR VERSUS AVERAGE PLANAR EXPOSURE

Plant: FitzPatrick

Fuel Type: Initial Core Type 2

Average Planar Exposure (MWd/t)	MAPLHGR (kW/ft)	PCT (°F)	Oxidation Fraction
200	14.9	2198	0.032
1000	14.9	2196	0.031
5000	14.9	2198	0.030
10000	14.6	2199	0.031
15000	14.1	2197	0.075
20000	13.9	2197	0.075
25000	13.8	2198	0.071
30000	13.3	2189	0.075
35000	12.4	2065	0.050
40000	11.1	1870	0.025

Table 5B

MAPLHGR VERSUS AVERAGE PLANAR EXPOSURE

Plant: FitzPatrick

Fuel Type: Initial Core Type 3

Average Planar Exposure (MWd/t)	MAPLHGR (kW/ft)	PCT (°F)	Oxidation Fraction
200	14.7	2197	0.032
1000	14.8	2197	0.032
5000	15.0	2197	0.032
10000	14.6	2198	0.030
15000	14.1	2199	0.077
20000	13.9	2196	0.077
25000	13.7	2199	0.079
30000	13.1	2198	0.050
35000	11.8	2111	0.068
40000	10.5	1933	0.035

Table 5C

MAPLHGR VERSUS AVERAGE PLANAR EXPOSURE

Plant: FitzPatrick   Fuel Type: 8D274H

Average Planar Exposure (MWd/t)	MAPLHGR (kW/ft)	PCT (°F)	Oxidation Fraction
200	11.2	2063	0.020
1000	11.2	2060	0.020
5000	11.8	2125	0.024
10000	12.1	2152	0.026
15000	12.2	2181	0.028
20000	12.1	2180	0.029
25000	11.6	2134	0.025
30000	10.9	2041	0.018
35000	9.9	1914	0.012
40000	9.3	1830	0.008

Table 5D

MAPLHGR VERSUS AVERAGE PLANAR EXPOSURE

Plant: FitzPatrick   Fuel Type: 8D274L

Average Planar Exposure (MWd/t)	MAPLHGR (kW/ft)	PCT (°F)	Oxidation Fraction
200	11.2	2070	0.020
1000	11.3	2070	0.020
5000	11.9	2143	0.025
10000	12.1	2149	0.025
15000	12.2	2179	0.028
20000	12.1	2179	0.028
25000	11.6	2133	0.025
30000	10.9	2039	0.018
35000	10.0	1914	0.012
40000	9.3	1829	0.008

Table 5E

MAPLHGR VERSUS AVERAGE PLANAR EXPOSURE

Plant: FitzPatrick

Fuel Type: 8DRB265L

Average Planar Exposure (MWd/t)	MAPLHGR (kW/ft)	PCT (°F)	Oxidation Fraction
200	11.5	2158	0.030
1000	11.6	2159	0.030
5000	12.0	2200	0.033
10000	12.1	2198	0.032
15000	12.0	2200	0.033
20000	11.9	2197	0.033
25000	11.3	2125	0.026
30000	10.7	2046	0.020
35000	10.1	1959	0.015
40000	9.4	1871	0.011

Table 5F

MAPLHGR VERSUS AVERAGE PLANAR EXPOSURE

Plant: FitzPatrick

Fuel Type: 8DRB283

Average Planar Exposure (MWd/t)	MAPLHGR (kW/ft)	PCT (°F)	Oxidation Fraction
200	11.3	2138	0.028
1000	11.4	2133	0.028
5000	11.9	2193	0.033
10000	12.1	2199	0.033
15000	12.0	2198	0.033
20000	11.8	2195	0.033
25000	11.3	2135	0.027
30000	11.1	2102	0.025
35000	10.5	2021	0.018
40000	9.8	1938	0.014

Table 5G

MAPLHGR VERSUS AVERAGE PLANAR EXPOSURE

Plant: FitzPatrick

Fuel Type: P8DRB265L

Average Planar Exposure (MWd/t)	MAPLHGR (kW/ft)	PCT (°F)	Oxidation Fraction
200	11.5	2140	0.028
1000	11.6	2147	0.028
5000	12.1	2190	0.031
10000	12.2	2188	0.031
15000	12.2	2195	0.032
20000	12.0	2179	0.030
25000	11.3	2088	0.023
30000	10.7	2004	0.017
35000	10.1	1904	0.012
40000	9.4	1810	0.008

Table 5H

MAPLHGR VERSUS AVERAGE PLANAR EXPOSURE

Plant: FitzPatrick

Fuel Type: P8DRB283

Average Planar Exposure (MWd/t)	MAPLHGR (kW/ft)	PCT (°F)	Oxidation Fraction
200	11.3	2122	0.027
1000	11.4	2123	0.027
5000	11.9	2174	0.030
10000	12.1	2183	0.031
15000	12.1	2193	0.032
20000	11.9	2172	0.030
25000	11.3	2099	0.024
30000	11.1	2046	0.020
35000	10.5	1963	0.029
40000	9.8	1851	0.010

Table 5I

MAPLHGR VERSUS AVERAGE PLANAR EXPOSURE

Plant: FitzPatrick

Fuel Type: P8DRB284H

Average Planar Exposure (MWd/t)	MAPLHGR (kW/ft)	PCT (°F)	Oxidation Fraction
200	11.3	2116	0.026
1000	11.3	2117	0.026
5000	11.7	2152	0.029
10000	12.1	2185	0.031
15000	12.0	2186	0.031
20000	11.6	2142	0.027
25000	10.9	2046	0.020
30000	10.2	1945	0.014
35000	9.6	1852	0.010
40000	9.0	1768	0.007

Table 5J

MAPLHGR VERSUS AVERAGE PLANAR EXPOSURE

Plant: FitzPatrick

Fuel Type: P8DRB299

Average Planar Exposure (MWd/t)	MAPLHGR (kW/ft)	PCT (°F)	Oxidation Fraction
200	10.9	2068	0.022
1000	11.0	2072	0.023
5000	11.5	2111	0.025
10000	12.2	2191	0.031
15000	12.2	2198	0.032
20000	12.1	2195	0.032
25000	11.6	2139	0.027
30000	10.9	2029	0.019
35000	10.3	1955	0.023
40000	9.6	1836	0.009