Douglas R. Gipson
Executive Vice President, Power Generation
and Chief Nuclear Officer

111 E 1st St., Monroe, MI 48161-2199
Tel: 734.384.2650 Fax: 734.384.2654

Detroit Edison
A DTE Energy Company

10CFR50.90
10CFR50.67

July 8, 2003
NRC-03-0053

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington D C 20555-0001

References: 1) Fermi 2
NRC Docket No. 50-341
NRC License No. NPF-43

2) Detroit Edison Letter to NRC, "Proposed License Amendment for the Implementation of Alternative Radiological Source Term Methodology," NRC-03-0007, dated February 13, 2003

Subject: Response to NRC Request for Additional Information Regarding the Implementation of Alternative Source Term

In Reference 2, Detroit Edison requested NRC approval of a proposed license amendment that modifies the Technical Specifications (TS) based on a re-evaluation of the Loss of Coolant Accident (LOCA) radiological dose consequences using the Alternative Source Term (AST) methodology. The NRC staff requested additional information to help complete their review of the proposed amendment. The requested additional information was discussed in telephone conversations between Detroit Edison personnel and the NRC staff on May 27, 2003 and July 1, 2003.

Detroit Edison's response to the NRC request is provided in Enclosure 1. Enclosures 2 and 3 provide copies of the requested PAVAN and ARCON96 computer programs' input data, respectively. Enclosure 4 provides copies of the requested RADTRAD computer program input and nuclide information files for LOCA.

A001

Should you have any questions or require additional information, please contact Mr. Norman K. Peterson of my staff at (734) 586-4258.

Sincerely,

Enclosures

cc: H. K. Chernoff
M. A. Ring
J. F. Stang, Jr.
NRC Resident Office
Regional Administrator, Region III
Supervisor, Electric Operators,
Michigan Public Service Commission

I, Douglas R. Gipson, do hereby affirm that the foregoing statements are based on facts and circumstances which are true and accurate to the best of my knowledge and belief.

Douglas R. Gipson
Executive Vice President, Power Generation &
Chief Nuclear Officer

On this 8th day of July, 2003 before me personally appeared Douglas R. Gipson, being first duly sworn and says that he executed the foregoing as his free act and deed.

SHARON K. BUCKLEY
NOTARY PUBLIC MONROE CO., MI
MY COMMISSION EXPIRES Sep 22, 2004

Notary Public

ENCLOSURE 1 TO
NRC-03-0053

FERMI 2 NRC DOCKET NO. 50-341
OPERATING LICENSE NO. NPF-43

RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION
REGARDING THE IMPLEMENTATION OF ALTERNATIVE SOURCE TERM

Response to NRC Request for Additional Information
Regarding the Implementation of Alternative Source Term

Detroit Edison's response is provided after each NRC request below:

1. Detroit Edison re-calculated atmospheric relative concentrations (χ/Q) for offsite and control room receptors for this amendment request. Please provide the following information regarding the determination of these values:

1.1 Please provide the information, including the joint frequency data file, that was input into the PAVAN code to generate χ/Q values. An electronic copy or a paper copy of the PAVAN input file(s) would be an acceptable approach to providing these data.

Response:

Enclosure 2 provides the PAVAN Code input data used to determine Exclusion Area Boundary (EAB) and the Low Population Zone (LPZ) atmospheric relative concentration (χ/Q) values. The joint frequency distribution that is used in the PAVAN input was developed based on meteorological data for the same five-year interval (1995-1999), previously submitted with Detroit Edison letter, NRC-01-0036.

1.2 Please provide the information, less the meteorological data files, that was input into the ARCON96 code to generate χ/Q values for the control room. The staff has access to Fermi 2 meteorological data in the ARCON96 format for the years 1995 through 1999. These data were submitted in support of a previous amendment request. Detroit Edison previously docketed ARCON96 input/output printouts for Fermi 2 in letter NRC-01-0036. If the input data on these printouts are still valid, please so indicate or provide updated printouts. Add data for any release point-receptor combinations not previously submitted.

Response:

Enclosure 3 provides the ARCON96 Code input data used to generate χ/Q values for the control room. Release points considered are the Reactor Building Heating, Ventilation and Air Conditioning (RBHVAC) stack, the Standby Gas Treatment System (SGTS) stack and the Turbine Building TBHVAC stack. Additionally, an Outage Building release point is considered in the Fuel Handling Accident (FHA)

analysis of non-recently irradiated fuel. χ/Q values are calculated for both the north and south control room intake locations, as applicable. The control room χ/Q values used to perform the FHA analyses described in letter NRC-01-0036 remain valid; however, the ARCON96 runs were subsequently updated for minor changes in the specification of the calm wind speed and the surface roughness term. Enclosure 3 also includes an explanation of the manner in which each input file was applied to the AST dose calculations.

1.3 Table 11 of the present submittal tabulates the control room χ/Q values for the LOCA SGTS and MSIV leakage paths and for the FHA. Which χ/Q values were used for assessing the ground level secondary containment bypass leakage dose?

<u>Response:</u>

Most secondary containment bypass pathways terminate in the Turbine Building; therefore, the corresponding releases would be through the more favorable TBHVAC stack. However, the SGTS release point was conservatively used to envelop all credible potential pathways. The TBHVAC stack pathway was only credited for the MSIV leakage, which was analyzed separately from the secondary containment bypass leakage.

1.4 Footnote 3 to Table 11 of the present submittal identifies that the LOCA χ/Q values include a factor of 4 reduction for the control room dual inlet design, referencing SRP 6.4 as the basis for this reduction. Please provide the following information:

1.4.1 The Fermi 2 intake selection is manual based upon radiation monitor alarms. What is the expected delay time for the operator to respond to the radiation monitor alarm under accident response conditions and initiate transfer to the "cleaner" intake? How is this delay time reflected in the value of the χ/Q value?

<u>Response:</u>

As discussed in UFSAR Section 7.3.5, automatic control room normal intake isolation occurs due to detection of potential breach of the primary reactor pressure boundary as indicated by low reactor water level, high drywell pressure, or high radiation level monitored by the fuel pool ventilation exhaust or the reactor building ventilation exhaust. Along with

the automatic normal intake isolation, the filtered emergency makeup of outside air is automatically initiated to pressurize the control room.

Initially, both the north and south emergency intakes are opened. The system samples both intakes for radiation levels during the first five minutes. After that, if an intake has high radiation levels, it is isolated and the one with lower radiation levels remains open. The operators then would assume manual control of the selection process, using the radiation monitors to determine which inlet has lower radiation levels.

The associated control system is single failure proof for assuring control room pressurization, but not for selecting the "cleaner" intake. Therefore, only manual control is credited in the analysis and the factor of 4 is used rather than the allowed factor of 10 for a fully automatic system, as described in Regulatory Guide (RG) 1.194.

Given the early system initiation by "LOCA signals" and automatic operation supplemented by manual operator action, RG 1.194 factor of 4 reduction is considered amply conservative and is consistent with the current Fermi 2 licensing basis.

1.4.2 The reduction factor is valid only if both intakes have comparable flow rates. Do the dual intakes at Fermi have comparable flows?

Response:

Each one of the north and south intakes is designed to provide adequate flow for control room pressurization. The flow in each emergency intake path is automatically modulated to maintain the required control room pressurization; therefore, since the required pressurization flow is a function of control room ex-filtration flow, it is concluded that both intakes have comparable flows.

This pressurization capability is also maintained when both intakes are open. Flows in the intake paths may be different when both trains are open, since the ducts associated with the north intake are longer and the automatic flow modulation signal sent to the modulating dampers in each intake is identical. However, radiation monitoring instruments are located as close as practical to the north and south intake points, such that radiation levels would be readily detected, and proper operator action would be taken to select a "cleaner" intake.

2. The text on Page 13 of Enclosure 1 of the submittal indicates that Fermi 2 procedures will be reviewed and revised as necessary to include directions for operators to manually *initiate* the SLC system on detection of symptoms indicating core damage. The staff notes that there are steps in the generic BWROG ERGs that direct the operator to *terminate* boron injection. For example, in the tree for RC/Q, the continuing action block contains a direction "If while executing these steps: it has been determined that the reactor will remain shutdown under all conditions without boron, terminate boron injection...." Similarly, SAGs RC/F-2, RC/F-3 also have steps calling for termination of all boron injection. Please describe how Detroit Edison intends to resolve the conflicting requirements.

Response:

The use of Standby Liquid Control (SLC) System to control the pH level in the suppression pool and maintain it at or above 7 post LOCA is a new function that will be introduced into the Fermi 2 emergency procedures with the implementation of this license amendment. Current procedures direct operators to initiate or terminate SLC injection based on the system need to control other functions such as reactivity control or RPV water level. Operators will follow the steps in the appropriate "leg" of the emergency procedure based on plant conditions. Therefore, with the introduction of new steps for the added SLC system function, procedures will be revised to clearly direct operators to maintain SLC injection when it is required for suppression pool water pH control.

3. Page 14 of Enclosure 1 of the submittal provides text that states "...an initial 8 hours of holdup inside the main steam lines may be credited...." The text suggests that the steam line volume and MSIV leakrate are used to establish this delay. This implies that a delay to fill the steam line is being taken:

3.1 Table 6 on Page 27 of Enclosure 1 does not tabulate this assumption. Nor is the assumption identified in Enclosure 2 as an alternative to the guidance in RG 1.183. Please explain how this holdup is modeled in the LOCA analysis. Is this modeled as a delay in the onset of the release?

Response:

The delay to fill the steam lines is determined based on the shortest steam line volume divided by the fully expanded 100 SCFH flow. No credit is taken for the additional delay that would be applicable to the next shortest line, or for the 50

SCFH flow and longer length of the third shortest steam line. This is modeled as a delay in the onset of the release.

3.2 Please explain why this delay assumption is consistent with the assumption of a well-mixed volume (Item 6.3, Page 20 of Enclosure 2).

Response:

The statement regarding a well-mixed volume assumption was in error. The analysis used the plug flow assumption as implemented using the Brockmann-Bixler feature in RADTRAD. This model is considered the most applicable assumption to the steam line configuration, where contained fluid temperatures are assumed to be controlled by pipe wall temperatures. The use of outside containment pressures in the determination of delay time for the entire steam pipe length is another conservatism. The approach has been previously approved by NRC in other AST applications such as for the Brunswick Nuclear Power Plant.

4. Section 3.2 of Enclosure 1 addresses the re-analysis of the FHA. This section states that the FHA analyzed in this submittal includes both types of fuel (i.e., GE14 and GE11). However, the text also states that the GE11 fuel may not meet Footnote 11 of RG 1.183. This was previously identified in Detroit Edison's letters dated December 29, 2000, and May 2, 2001 which addressed a proposed license amendment, which the staff approved. Those letters establish a protocol in which the decay time for GE14 fuel would be calculated using the AST and TEDE; and that the RG 1.25 analyses would be used for GE11 fuel that didn't meet Footnote 11. Section 3.2 states that the present submittal has no effect on these provisions.

4.1 The staff can find the proposed continuation of this dichotomy acceptable under the guidance of Section 1.3.2 of RG 1.183. However, since the present amendment request has requested a full implementation of the AST, this protocol could not be continued past the next revision of the GE11 (RG 1.25) analyses. At that time, the staff would expect that the GE11 analysis would be updated to incorporate AST and TEDE pursuant to the guidance in Section 1.3.4 of RG 1.183. Please confirm your understanding of these provisions.

Response:

As discussed in the conference call between Detroit Edison and NRC staff on July 1, 2003, the intent of Detroit Edison's license amendment in letter NRC-03-0007

is to request NRC approval of the proposed TS changes based on the re-evaluation of the Loss of Coolant Accident (LOCA) using AST.

Detroit Edison acknowledges that the submittal contains references to a full scope AST implementation in certain parts of the enclosures; however, this was largely due to the lack of clear understanding of the differences between full and selective implementation of AST. After re-examining these differences, Detroit Edison concludes that the references to full implementation are inappropriate. Therefore, Detroit Edison hereby clarifies that the license amendment application under review is not requesting a full scope implementation of the AST. The request is for a selective implementation of AST as it applies to the LOCA analysis only. No licensing bases changes are being sought regarding the FHA analyses or any other radiological accident analysis.

Section 1.2.2 of RG 1.183 states that "selective implementation is a modification of the facility design basis that (1) is based on one or more of the characteristics of the AST or (2) entails re-evaluation of a limited subset of the design basis radiological analyses." Detroit Edison submittal entails a re-evaluation of the LOCA DBA only. Section 1.3.2 of the RG also states that "a selective implementation of an AST and any associated facility modification based on the AST should evaluate all the radiological and nonradiological impacts of the proposed actions as they apply to the particular implementation." Based on this guidance, Detroit Edison determined that the only accident affected by the proposed TS changes is the LOCA. A discussion was included in the submittal that evaluated the impact of the proposed changes on other Design Basis Accidents (DBAs). The evaluation concluded that other DBAs are not affected by the changes proposed in the license amendment request. Therefore, the submittal meets the RG guidance for requesting a selective implementation of AST.

In addition to the LOCA re-evaluation using AST, the license amendment request included an update of the Fuel Handling Accident (FHA) analysis which had been previously approved in License Amendment No. 144. The update reflected the use of core source term input data consistent with the one used in the LOCA AST analysis and recalculated offsite atmospheric relative concentration factors (χ/Q's). Additionally, two separate analyses were performed for the GE11 fuel. One analysis assumes all the GE11 fuel in the reactor core meets the burnup limitations in RG 1.183 and is analyzed in accordance with the RG. The other analysis assumes that some of the GE11 fuel in the core exceeds the burnup limits in RG 1.183 and the FHA is analyzed in accordance with RG 1.25. The FHA analyses used the same methodology approved in Amendment No. 144. As indicated in the submittal, the re-evaluation of LOCA under AST was not intended to affect previously approved AST licensing bases.

Regarding the use of RG 1.25 methodology for FHA analysis involving fuel with burnup exceeding the limits in Footnote 11 of RG 1.183 as approved in License Amendment No. 144, it should be noted that the results of the analysis demonstrate a very high level of conservatism compared to AST. However, RG 1.25 was used because it is the only approved approach for addressing non-LOCA events involving high burnup fuel. Detroit Edison is actively working with other BWRs on the development of generic fission gas release evaluation for high burnup fuel during non-LOCA events. It is intended that the final product would be submitted for NRC review and approval. Once this evaluation is approved, non-LOCA events involving high burnup fuel may be evaluated in accordance with AST similar to other lower burnup fuel.

4.2 Tables 7 and 8 of Enclosure 1 provide the analysis inputs and assumptions for the FHA. Table 8 includes core damage and fuel decay period values for GE11 fuel commingled with the AST assumptions. Please confirm that the GE11 analyses did not use the fission product gap or fuel pool iodine DF assumptions shown in Table 8.

Response:

Analyses involving fuel that meets the limitations in RG 1.183, Footnote 11, were performed using the AST assumptions described in Table 8 of letter NRC-03-0007. The 1.7 radial peaking factor was applied in the analysis of GE14 fuel only. For the GE11 fuel, a 1.5 radial peaking factor was applied; consistent with the methodology presented in letter NRC-01-0036.

GE14 fuel is expected to always meet the RG 1.183 footnote burnup limits; hence, it is only evaluated using the AST assumptions. Analyses involving GE11 fuel verified to meet the RG 1.183 footnote limitations were performed in accordance with the AST assumptions listed in Table 8, except as noted above. GE11 fuel that does not meet the footnote limitations was analyzed using the Regulatory Guide 1.25 based methodology as described in Fermi 2 letter NRC-01-0036.

5. Please explain the basis for the 7.2 second SGT filter actuation assumption provided in Item 4.2 of Enclosure 2. This assumption was not tabulated in Table 8 of Enclosure 1. Was this assumption used in the analyses? If so, does this basis remain conservative for all potential decay periods? Fuel types?

Response:

Section 15.7.4 of the Fermi 2 UFSAR describes the basis for the expected SGT filter actuation timing of 4.3 seconds. However, because of RADTRAD limitations, the available degree of timing precision is 0.001 hours or 3.6 seconds. Therefore, the delay was rounded up to the next higher value (0.002 hours or 7.2 seconds) to ensure conservative results.

Credit for SGTS filtration is only taken in the analysis of recently irradiated fuel at 24 hours post shutdown. This applies to both the GE11 and the GE14 fuel types.

6. For each main steam pipe segment for which you are applying the Brockman-Bixler model, please provide the time dependent values for the following parameters:

6a. Gas pressure
6b. Gas temperature
6c. Pipe volume
6d. Pipe inner surface area

Response:

Table 1 below summarizes the main steam piping take-off for the four steam lines. The piping that was considered in the analysis is from the reactor vessel nozzles to the third steam line isolation valves. This is the safety related and seismically qualified piping that currently provides the pressure control boundary for the MSIV Leakage Control System.

Both the total and horizontal-only lengths of piping are included in Table 1; however, only horizontal lengths are considered in evaluating piping deposition. The total length of the shortest steam line is used as the basis for transit delay for all main steam lines.

Steam piping temperature derivations are shown in Attachment 1 below. As noted in the Attachment, only heat removal by conduction is considered. This maximizes piping temperatures; therefore, it is conservative for purposes of piping deposition credit.

Steam-air mix pressures are based on a simplified stepwise model of containment pressure versus time. Enclosure 4 provides a printout of the RADTRAD (non-default) files associated with MSIV leakage modeling, as well as those for primary containment leakage and Emergency Core Cooling System (ECCS) leakage.

7. In applications of MSL deposition credit that have been accepted to date, the licensee has identified a single failure of one of the MSIVs consistent with Paragraph 5.1.2 of RG 1.183. Your application does not appear to comply with this regulatory position. Please explain how your modeling considers single failure, or provide a justification of why you believe that single failure considerations do not apply.

Response:

The total MSIV leakage is conservatively modeled through three of the four main steam lines. Each of the three main steam lines is modeled as a separate release path. Each line was treated as a single segment, consistent with RADTRAD modeling guidance. When applied in this manner, only one of the isolation valves is required to control flow to the analyzed basis value. Therefore, single failure is inherently considered.

Table 1 - Main Steam Piping Summary

24.1	Main Steam 26 inch pipe ID
21.564	Main Steam 24 inch pipe ID

TOTAL MS PIPING

A	B	C	D	
1689.808	1869.458	1834.585	1691.683	26 inch piping, etc from vessel nozzle to discharge middle of reducing elbow (inches)
888	983	965	889	26 inch piping inside surface area (sq. ft.)
446	494	484	447	26 inch piping inside volume (cu. ft.)
2005.875	1486.938	2134.563	1993.5	24 inch piping, etc from middle of reducing elbow to discharge of 3rd MSIV (inches)
944	700	1004	938	24 inch piping inside surface area (sq. ft.)
424	314	451	421	24 inch piping inside volume (cu. ft.)
1832	1682	1969	1827	Total inside surface area (sq. ft.)
870	808	935	868	Total inside volume (cu. ft.)

HORIZONTAL MS PIPING ONLY

A	B	C	D	
935.7475	1095.15	1060.278	937.6225	26 inch piping, etc from vessel nozzle to discharge middle of reducing elbow (inches)
492	576	557	493	26 inch piping inside surface area (sq. ft.)
247	289	280	248	26 inch piping inside volume (cu. ft.)
1500.375	982.5625	1629.063	1487.125	24 inch piping, etc from middle of reducing elbow to discharge of 3rd MSIV (inches)
706	462	766	700	24 inch piping inside surface area (sq. ft.)
317	208	344	314	24 inch piping inside volume (cu. ft.)
1198	1038	1324	1193	Total inside surface area (sq. ft.)
564	497	624	562	Total inside volume (cu. ft.)
50	100	0	100	**Assumed Flow split (scfh)**
17.40	8.08		8.68	**Delay (hrs), for conservatism, 8 hours is used for all steam lines.**

Attachment 1 - Assessment of Steam Line Temperatures for Piping Deposition Credit Analysis

Main steam line wall temperatures following a LOCA have not been calculated specifically for Fermi. A generic cooldown analysis developed by GE and reported in August 1990 Cline Report (Reference 1) is used. Cooling is considered independent of leakage flow. Only conduction is considered. The function to the right is from Reference 1 and fits the figure below (from Reference 2) and is used for Fermi:

$$T(^{\circ}K) = 299.7 + 265.6 * e^{04.428*10^{-6}t}$$

where

t *time*, sec.

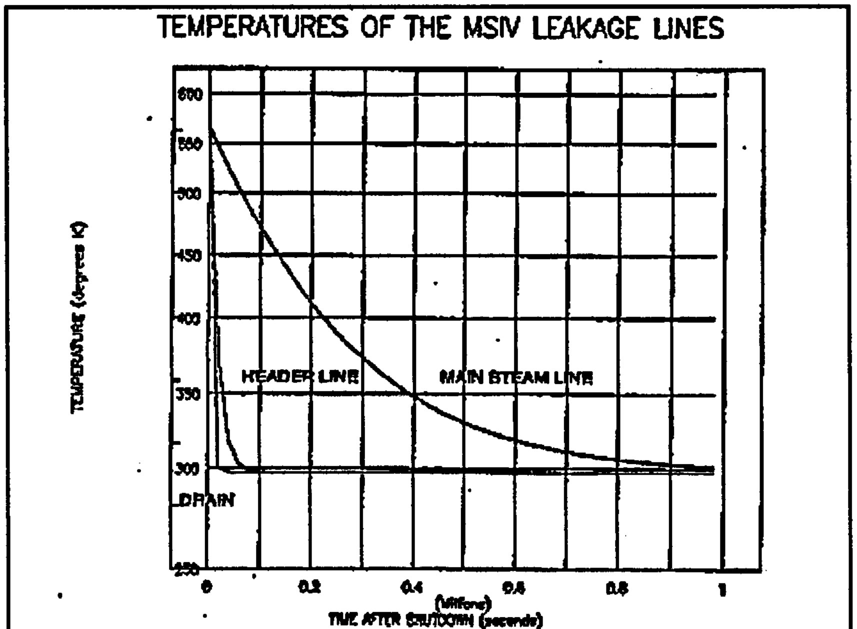

FIGURE 7. Temperature of the MSIV Leakage Pathway Piping as a Function of Time after Shutdown. The Rate of Cooling is Nearly Independent of the Flow Rate at the Low Rates Considered in the Present Analysis.

Time (hrs)	Temperature °K	Temperature °F	Value Used °F
0	565.3	557.9	558
1	561.1	550.3	|
2	557.0	542.9	|
3	552.9	535.5	|
4	548.9	528.3	|
5	545.0	521.2	|
6	541.1	514.3	|
7	537.3	507.4	\\|/
8	533.5	500.6	500
9	529.8	494.0	|
10	526.2	487.4	|
11	522.6	481.0	|
12	519.1	474.6	|
13	515.6	468.4	|
14	512.2	462.2	|
15	508.8	456.2	\\|/
16	505.5	450.2	450
17	502.3	444.4	|
18	499.0	438.6	|
19	495.9	432.9	|
20	492.8	427.4	|
21	489.7	421.9	|
22	486.7	416.5	|
23	483.8	411.1	\\|/
24	480.9	405.9	410
48	423.3	302.2	300
72	384.0	231.5	250
96	357.2	183.3	200

Reference 1: Cline, J.E. "MSIV Leakage - Iodine Transport Analysis," SAIC, August 20, 1990
Reference 2: Cline, J.E. "MSIV Leakage Iodine Transport Analysis," Prepared for USNRC under contract NRC-03-87-029, Task Order 74, March 26, 1991

ENCLOSURE 2 TO
NRC-03-0053

FERMI 2 NRC DOCKET NO. 50-341
OPERATING LICENSE NO. NPF-43

RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION REGARDING THE IMPLEMENTATION OF ALTERNATIVE SOURCE

PAVAN Code Input Data (Request No. 1.1)

```
      1  1111

Fermi
10.0 meters          10-60 meters

7 Wind Speed Categories
      7    0
2300. 47.2 10.0 10.0
      0    3    3    12   26   16   17
      2.   3.   4.   4.   3.   2.   3.   1.   2.   3.   3.   1.   3.   3.   3.   1.
      29.  53.  88.  98.  86. 141. 123.  39.  63.  10.  23.  86. 139. 189. 131.  62.
      61.  42.  97. 112. 187. 115.  95.  53.  51.  59.  78.  81. 131. 243. 154. 127.
      27.  16.  12.  21.  64.  11.   2.   0.   2.  18.  15.  12.  21.  33.  14.  15.
      10.   3.   3.   3.   4.   1.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.
      0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.
      6.   5.   3.   3.   3.   7.   2.   3.   6.   2.   3.   6.   7.   4.   4.   4.
      37.  32.  62.  31.  45.  83. 105.  55.  82.  30.  52. 107. 103. 151.  88.  97.
      53.  41.  68.  43.  67.  76.  76.  49.  64.  78.  81.  78.  62.  60.  40.  67.
      11.  14.   6.  12.  29.   6.   6.   0.   3.  11.  25.  12.  11.   9.   3.   6.
      1.   2.   0.   3.   3.   0.   0.   0.   0.   2.   0.   2.   0.   1.   0.   0.
      0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.
      7.   6.   6.  10.   3.   7.  10.   7.   4.  17.  10.  17.  29.  22.  18.  16.
      75.  69.  98.  56.  71. 149. 187. 112. 146. 115. 137. 161. 182. 154. 132. 125.
      85.  59. 110.  97. 102. 107. 115.  82.  95. 123. 177.  99.  68.  98.  60. 108.
      31.  28.  25.  20.  38.  16.  15.   5.   4.  37.  52.  19.  14.  16.   5.  11.
      1.   7.   0.   3.   4.   0.   0.   0.   0.   3.   7.   1.   0.   0.   1.   0.
      0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.
      88.  74.  48.  36.  46.  38.  56.  51.  80.  53. 126. 229. 223. 164. 165. 100.
      277. 347. 558. 321. 343. 562. 501. 461. 484. 424. 728. 742. 762. 611. 521. 574.
      321. 234. 658. 449. 435. 395. 430. 364. 399. 667. 802. 412. 325. 282. 217. 317.
      69. 104. 115.  88. 136.  36.  81.  35.  37. 162. 282.  61.  39.  29.  10.  35.
      3.  20.   2.   3.  11.   1.   5.   1.   1.  14.  29.   2.   0.   0.   0.   0.
      0.   0.   0.   1.   0.   0.   0.   0.   0.   0.   5.   0.   0.   0.   0.   0.
      126.  78.  53.  39.  42.  56.  51.  62. 143. 123. 294. 361. 338. 341. 298. 154.
      220. 153. 149. 120. 176. 292. 241. 283. 462. 495. 676. 426. 287. 379. 317. 358.
      66.  40.  47.  40.  87. 145. 167. 197. 276. 503. 210.  36.  34.  40.   9.  32.
      4.   0.   2.   3.   9.   5.  12.  27.  19. 114.  42.   1.   1.   1.   2.   4.
      0.   0.   0.   0.   0.   0.   0.   4.   2.   5.   5.   1.   0.   0.   0.   0.
      0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.
      64.  24.   9.  10.  17.  18.  21.  25.  60.  83. 135. 184. 233. 348. 184. 137.
      72.   8.   2.  13.  25.  70.  99.  74.  82. 146.  84.  53.  40. 114.  86. 119.
      1.   0.   0.   2.  15.  44.  45.  72.  71. 104.   4.   1.   0.   0.   0.   3.
      0.   0.   0.   0.   1.   3.   3.  10.  10.  13.   0.   0.   0.   0.   0.   0.
      0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.
      0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.
      31.   6.   8.   5.  10.   8.  27.  15.  16.  37.  25.  85. 166. 237. 153. 119.
      26.   0.   1.   1.   6.  39.  51.  20.  20.  56.  12.  15.  14.  36.  11.  76.
      0.   0.   0.   0.  10.  23.  26.  27.  10.  12.   0.   0.   0.   0.   0.   0.
      0.   0.   0.   0.   0.   1.   5.   6.   2.   0.   0.   0.   0.   0.   0.   0.
      0.   0.   0.   0.   0.   0.   2.   1.   0.   0.   0.   0.   0.   0.   0.   0.
      0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.
      101.0.750 3.50 7.50 12.5 18.5 24.0 55.0
      915. 915. 915. 915. 915. 915. 915. 915. 915. 915. 915. 915. 915. 915. 915. 915.
4827.4827.4827.4827.4827.4827.4827.4827.4827.4827.4827.4827.4827.4827.4827.4827.
      1.   1.   1.   1.   1.   1.   1.   1.   1.   1.   1.   1.   1.   1.   1.   1.
      1.   1.   1.   1.   1.   1.   1.   1.   1.   1.   1.   1.   1.   1.   1.   1.
```

1. PAVAN Model Options

The PAVAN model user options are as follows:

Option No.	Description	Utilized for Fermi Calculation?
1	Calculate σ_y and σ_z based on desert diffusion.	No
2	X/Q values include evaluation for no building wake.	No
3	ENVLOP calculations printed which describe upper envelope curve.	No
4	Print points used in upper envelope curve and calculation.	Yes
5 null		
6	Joint frequency distribution in % frequency format.	No
7	Print X/Q calculation details	Yes
8	Distribute calm winds observations into first wind speed category.	Yes
9	Use site-specific terrain adjustment factors for the annual average calculations.	Yes*
10	Option 10 is applied, which together with application of Option 9 dictates that site-specific terrain factors are used.	Yes*

* No terrain correction was needed, therefore these factors were set to 1.0 for each downwind direction and distance.

2. Source Data

A ground-level release was assumed, and per PAVAN model requirements, is indicated by placing a 10.0 in row 6, columns 11-15 of the input file indicating that meteorological data taken at the 10 m tower level are utilized. A height of 47.2 m and a cross-sectional area of 2300 m^2 is assumed for the Reactor Building.

3. Wind Speed Categories

Seven (7) wind speed categories are defined according to Safety Guide 23, with the first category identified as calm. The higher of the starting speeds of the wind vane and anemometer (i.e. 0.75 mph) was used as the threshold for calm winds, per Regulatory Guide 1.145, Section 1.1. A midpoint was also assumed between each of the category nos. 2-6 as to be inclusive of all wind speeds. The wind speed categories have therefore been defined as follows.

Category No.	Speed Interval (mph)
1 (Calm)	0 to <0.75
2	>=0.75 to <3.5
3	>=3.5 to <7.5
4	>=7.5 to < 12.5
5	>=12.5 to <18.5
6	>=18.5 < 24
7	>= 24

4. Fermi Meteorological Tower Data

5 years (1995-1999) of 10 meter meteorological tower data, as previously provided by Detroit Edison in support of Amendment 144, was utilized.

ENCLOSURE 3 TO
NRC-03-0053

FERMI 2 NRC DOCKET NO. 50-341
OPERATING LICENSE NO. NPF-43

RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION REGARDING THE IMPLEMENTATION OF ALTERNATIVE SOURCE

ARCON96 Code Input Data (Request No. 1.2)

SGTS Stack to South Intake (LOCA)

```
5
W:\ARCON96\WORKING\F1995.MET
W:\ARCON96\WORKING\F1996.MET
W:\ARCON96\WORKING\F1997.MET
W:\ARCON96\WORKING\F1998.MET
W:\ARCON96\WORKING\F1999.MET
10.00
60.00
2
2
54.25
2300.00
0.00
0.00
0.00
2  90
39.35
29.40
0.00
SGVtoS.log
SGVtoS.CFD
.1
0.33
4.00
1   2   4   8  12  24  96 168 360 720
1   2   4   8  11  22  87 152 324 648
0.00     0.00
n
```

Release Point	Receptor: CR Intake	Notes
SGTS Stack (LOCA)	South	The south control room intake is most favorable with respect to releases via the SGTS Stack. Hence, LOCA scenarios, which credited the operation of the CREF and the reduction factor associated with the dual-inlet configuration, are based on this source-receptor combination. Only the missile proof portion of the south control room emergency intake is credited for LOCA.

SGTS Stack to North Intake (LOCA)

```
5
W:\ARCON96\WORKING\F1995.MET
W:\ARCON96\WORKING\F1996.MET
W:\ARCON96\WORKING\F1997.MET
W:\ARCON96\WORKING\F1998.MET
W:\ARCON96\WORKING\F1999.MET
10.00
60.00
2
2
54.25
2300.00
0.00
0.00
0.00
245  90
17.19
18.44
0.00
SGVtoN.log
SGVtoN.CFD
.1
0.33
4.00
1   2   4   8  12  24  96 168 360 720
1   2   4   8  11  22  87 152 324 648
0.00     0.00
n
```

Release Point	Receptor: CR Intake	Notes
SGTS Stack (LOCA)	North	An SGTS Stack release to the north control room intake is limiting for accidents that do not credit the CREF; hence, this combination was considered the most likely limiting combination in the evaluation of the FHA involving recently irradiated fuel where operation of the SGTS is assumed.

TBHVAC Stack to South Intake (LOCA)

```
5
W:\ARCON96\WORKING\F1995.MET
W:\ARCON96\WORKING\F1996.MET
W:\ARCON96\WORKING\F1997.MET
W:\ARCON96\WORKING\F1998.MET
W:\ARCON96\WORKING\F1999.MET
    10.00
    60.00
  2
  2
    44.50
  5100.00
     0.00
     0.00
     0.00
  69  90
    64.23
    29.42
     0.00
TBVtoS.log
TBVtoS.cfd
 .1
     0.33
     4.00
   1   2   4   8  12  24  96 168 360 720
   1   2   4   8  11  22  87 152 324 648
     0.00      0.00
n
```

Release Point	Receptor: CR Intake	Notes
TB-HVAC Stack (LOCA)	South	The south control room intake is most favorable with respect to releases via the TB-HVAC Stack; hence, analyses of the post-LOCA MSIV release, which credit the operation of the CREF and the reduction factor associated with the dual-inlet configuration, are based on this source-receptor combination. Only the missile proof portion of the south control room emergency intake is credited for LOCA.

TBHVAC Stack to North Intake (LOCA)

```
5
W:\ARCON96\WORKING\F1995.MET
W:\ARCON96\WORKING\F1996.MET
W:\ARCON96\WORKING\F1997.MET
W:\ARCON96\WORKING\F1998.MET
W:\ARCON96\WORKING\F1999.MET
10.00
60.00
2
2
44.50
5100.00
0.00
0.00
0.0
119  90
52.78
18.44
0.00
TBVtoN.log
TBVtoN.cfd
.1
0.33
4.00
1   2   4   8   12   24   96 168 360 720
1   2   4   8   11   22   87 152 324 648
0.00      0.00
n
```

Release Point	Receptor: CR Intake	Notes
TB-HVAC Stack (LOCA)	North	The TB-HVAC Stack to north control room intake combination is not used in any of the accident analyses. It was evaluated to determine which was the most favorable of the control room intake locations with respect to this source.

RBHVAC Stack to South Intake (LOCA)

```
 5
W:\ARCON96\WORKING\F1995.MET
W:\ARCON96\WORKING\F1996.MET
W:\ARCON96\WORKING\F1997.MET
W:\ARCON96\WORKING\F1998.MET
W:\ARCON96\WORKING\F1999.MET
    10.00
    60.00
   2
   2
    54.25
  2300.00
     0.00
     0.00
     0.00
 301  90
    11.60
    29.42
     0.00
RBVSouth.log
RBVSouth.CFD
 .1
     0.33
     4.00
   1   2   4   8  12  24  96 168 360 720
   1   2   4   8  11  22  87 152 324 648
     0.00     0.00
n
```

Release Point	Receptor: CR Intake	Notes
RBHVAC Stack (LOCA)	South	The RB-HVAC to north and south (missile-proof only) control room intake combinations are not used in any of the accident dose calculations.

RBHVAC Stack to North Intake (LOCA)

```
5
W:\ARCON96\WORKING\F1995.MET
W:\ARCON96\WORKING\F1996.MET
W:\ARCON96\WORKING\F1997.MET
W:\ARCON96\WORKING\F1998.MET
W:\ARCON96\WORKING\F1999.MET
      10.00
      60.00
      2
      2
      54.25
      2300.00
      0.00
      0.00
      0.00
      214  90
      48.80
      18.44
      0.00
RBVNorth.log
RBVNorth.CFD
      .1
      0.33
      4.00
      1   2   4   8   12   24   96 168 360 720
      1   2   4   8   11   22   87 152 324 648
      0.00     0.00
n
```

Release Point	Receptor: CR Intake	Notes
RB-HVAC Stack (LOCA)	North	The RB-HVAC to north and south (missile-proof only) control room intake combinations are not used in any of the accident dose calculations.

SGTS Stack to South Intake (FHA)

```
5
W:\ARCON96\WORKING\F1995.MET
W:\ARCON96\WORKING\F1996.MET
W:\ARCON96\WORKING\F1997.MET
W:\ARCON96\WORKING\F1998.MET
W:\ARCON96\WORKING\F1999.MET
    10.00
    60.00
   2
   2
    54.25
  2300.00
     0.00
     0.00
     0.00
   2  90
    39.35
    18.60
     0.00
SGVtoSFHA.log
SGVtoSFHA.CFD
 .1
     0.33
     4.00
   1   2   4   8  12  24  96 168 360 720
   1   2   4   8  11  22  87 152 324 648
     0.00     0.00
n
```

Release Point	Receptor: CR Intake	Notes
SGTS Stack (FHA)	South	The SGTS to south control room (FHA) intake is not limiting since the SGTS stack is located closer to the north emergency air intake. Since none of the licensing basis FHA analyses credit the operation of the CREF or credit its dual-inlet configuration, this combination is not used in the analysis of any of the FHA scenarios.

SGTS Stack to North Intake (FHA)

Release Point	Receptor: CR Intake	Notes
SGTS Stack (FHA)	North	Calculation is same as SGTS to North control room intake described above for DBA LOCA. SGTS Stack to north control room intake is limiting for accidents that do not credit the CREF; hence, this source was selected in the evaluation of the FHA involving recently irradiated fuel for which SGTS operation is assumed. In addition, the FHA analyses take no credit for the ability to select the non-limiting intake during the post-accident response to the FHA.

RBHVAC Stack to South Intake (FHA)

```
5
W:\ARCON96\WORKING\F1995.MET
W:\ARCON96\WORKING\F1996.MET
W:\ARCON96\WORKING\F1997.MET
W:\ARCON96\WORKING\F1998.MET
W:\ARCON96\WORKING\F1999.MET
    10.00
    60.00
   2
   2
    54.25
  2300.00
     0.00
     0.00
     0.00
 301  90
    11.60
    18.60
     0.00
RBVSouthFHA.log
RBVSouthFHA.CFD
 .1
     0.33
     4.00
   1   2   4   8  12  24  96 168 360 720
   1   2   4   8  11  22  87 152 324 648
     0.00      0.00
n
```

Release Point	Receptor: CR Intake	Notes
RB-HVAC (FHA)	South	RB-HVAC to south control room (FHA) intake supports the evaluation of a FHA involving recently irradiated fuel during the initial release prior to RB-HVAC isolation of the refuel floor. Following this isolation, the release is assumed to occur via the SGTS to the north control room intake. Operation of the CREF and, hence, dual intake credit is not assumed in the analysis of any FHA. In addition, the FHA analyses take no credit for the ability to select the non-limiting intake during the post-accident response to the FHA.

RBHVAC Stack to North Intake (FHA)

Release Point	Receptor: CR Intake	Notes
RB-HVAC (FHA)	North	Calculation is same as RB-HVAC to north control room intake described above for DBA LOCA. The RB-HVAC to north control room intake (FHA) combination is not limiting and is not used in any of the accident dose calculations.

Outage Building (DWEEB) to South Intake (FHA)

```
5
W:\ARCON96\DC6086\F1995.MET
W:\ARCON96\DC6086\F1996.MET
W:\ARCON96\DC6086\F1997.MET
W:\ARCON96\DC6086\F1998.MET
W:\ARCON96\DC6086\F1999.MET
    10.00
    60.00
   2
   1
     0.00
  2300.00
     0.00
     0.00
     0.00
 261  90
    34.70
     0.00
     0.00
DWEEBtoSouthGrnd.log
DWEEBtoSouthGrnd.CFD
 .1
     0.33
     4.00
   1   2   4   8  12  24  96 168 360 720
   1   2   4   8  11  22  87 152 324 648
     0.00      0.00
n
```

Release Point	Receptor: CR Intake	Notes
Outage Bldg (FHA)	South	The Outage Building or "DWEEB" to south control room (FHA) intake was selected as a bounding source-receptor combination for the evaluation of the FHA involving non-recently irradiated fuel.

Outage Building (DWEEB) to North Intake (FHA)

Release Point	Receptor: CR Intake	Notes
Outage Bldg (FHA)	North	The FHA analyses take no credit for the ability to select the non-limiting intake during the initial response to the FHA; hence, the non-limiting Outage Building to North control room intake combination was not explicitly evaluated.

ENCLOSURE 4 TO
NRC-03-0053

FERMI 2 NRC DOCKET NO. 50-341
OPERATING LICENSE NO. NPF-43

RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION REGARDING THE IMPLEMENTATION OF ALTERNATIVE SOURCE

RADTRAD Files (Request No. 6)

```
Radtrad 3.02 1/5/2000

 MSIV Only, with delay, 900 cfm CR unfiltered intake
 Nuclide Inventory File:
 c:\program files\u s nuclear regulatory commission\radtrad\defaults\fermiast-
loca.nif
 Plant Power Level:
  3.4990E+03
 Compartments:
   5
 Compartment 1:
 Containment
   3
  2.9463E+05
   0
   0
   0
   1
   0
 Compartment 2:
 Reactor Building
   3
  1.0000E+00
   0
   0
   0
   0
   0
 Compartment 3:
 Environment
   2
  0.0000E+00
   0
   0
   0
   0
   0
 Compartment 4:
 Control Room
   1
  5.6960E+04
   0
   0
   1
   0
   0
 Compartment 5:
 Hold
   3
  1.0000E+00
   0
   0
   0
   0
   0
 Pathways:
   7
 Pathway 1:
 Containment to Hold
   1
   5
```

```
   4
 Pathway 2:
 Filtered Environment to Control Room
   3
   4
   2
 Pathway 3:
 Control Room to  Environment
   4
   3
   2
 Pathway 4:
 Unfiltered Environment to Control Room
   3
   4
   2
 Pathway 5:
 MS Line B Containment to  Environment
   1
   3
   1
 Pathway 6:
 MS Line D Containment to  Environment
   1
   3
   1
 Pathway 7:
 MS Line A  Containment to  Environment
   1
   3
   1
 End of Plant Model File
 Scenario Description Name:

 Plant Model Filename:

 Source Term:
   1
   1   1.0000E+00
 c:\program files\u s nuclear regulatory
commission\radtrad\defaults\fgr11&12.inp
 c:\program files\u s nuclear regulatory
commission\radtrad\defaults\bwr_dba.rft
   0.0000E+00
   1
   9.5000E-01   4.8500E-02   1.5000E-03   1.0000E+00
 Overlying Pool:
   0
   0.0000E+00
   0
   0
   0
   0
 Compartments:
   5
 Compartment 1:
   0
   1
   0
   0
   0
```

```
  0
  0
  3
  3
  1.0000E+01
  0
Compartment 2:
  0
  1
  0
  0
  0
  0
  0
  0
  0
Compartment 3:
  0
  1
  0
  0
  0
  0
  0
  0
  0
Compartment 4:
  0
  1
  0
  0
  0
  0
  1
  2.7045E+02
  2
  0.0000E+00   9.5000E+01   9.5000E+01   9.5000E+01
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
Compartment 5:
  0
  1
  0
  0
  0
  0
  0
  0
  0
Pathways:
  7
Pathway 1:
  0
  0
  0
  0
  0
  0
  0
  0
```

```
  0
  0
  1
  3
  0.0000E+00   5.0000E-01
  2.4000E+01   2.5000E-01
  7.2000E+02   0.0000E+00
  0
Pathway 2:
  0
  0
  0
  0
  0
  1
  2
  0.0000E+00   4.0570E+02   9.9750E+01   9.9750E+01   9.9750E+01
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 3:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   6.0850E+02   9.9000E+01   9.9000E+01   9.9000E+01
  5.0000E-01   6.0850E+02   9.9000E+01   9.9000E+01   9.9000E+01
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 4:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   2.0280E+02   0.0000E+00   0.0000E+00   0.0000E+00
  5.0000E-01   2.0280E+02   0.0000E+00   0.0000E+00   0.0000E+00
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 5:
  0
  0
```

2
8

1.0380E+03	4.9700E+02	0.0000E+00	
0.0000E+00	6.2000E-07	1.3600E+00	5.5800E+02
8.0000E+00	6.2000E-01	1.3300E+00	5.0000E+02
1.6000E+01	6.2000E-01	1.2500E+00	4.5000E+02
2.4000E+01	3.1000E-01	1.1800E+00	4.1000E+02
4.8000E+01	3.1000E-01	1.1400E+00	3.0000E+02
7.2000E+01	3.1000E-01	1.1300E+00	2.5000E+02
9.6000E+01	3.1000E-01	1.0100E+00	2.0000E+02
7.2000E+02	0.0000E+00	1.0100E+00	2.0000E+02

2
2
0
0
0
0
0
0
0

Pathway 6:

0
0
2
8

1.1930E+03	5.6200E+02	0.0000E+00	
0.0000E+00	6.2000E-07	1.3600E+00	5.5800E+02
8.0000E+00	6.2000E-01	1.3300E+00	5.0000E+02
1.6000E+01	6.2000E-01	1.2500E+00	4.5000E+02
2.4000E+01	3.1000E-01	1.1800E+00	4.1000E+02
4.8000E+01	3.1000E-01	1.1400E+00	3.0000E+02
7.2000E+01	3.1000E-01	1.1300E+00	2.5000E+02
9.6000E+01	3.1000E-01	1.0100E+00	2.0000E+02
7.2000E+02	0.0000E+00	1.0100E+00	2.0000E+02

2
2
0
0
0
0
0
0
0

Pathway 7:

0
0
2
8

1.1980E+03	5.6400E+02	0.0000E+00	
0.0000E+00	3.1000E-07	1.3600E+00	5.5800E+02
8.0000E+00	3.1000E-01	1.3300E+00	5.0000E+02
1.6000E+01	3.1000E-01	1.2500E+00	4.5000E+02
2.4000E+01	1.5500E-01	1.1800E+00	4.1000E+02
4.8000E+01	1.5500E-01	1.1400E+00	3.0000E+02
7.2000E+01	1.5500E-01	1.1300E+00	2.5000E+02
9.6000E+01	1.5500E-01	1.0100E+00	2.0000E+02
7.2000E+02	0.0000E+00	1.0100E+00	2.0000E+02

2
2
0
0

```
  0
  0
  0
  0
  0
Dose Locations:
  3
Location 1:
EAB
  3
  1
  3
  0.0000E+00   0.0000E+00
  1.1000E+00   2.0900E-04
  3.1000E+00   0.0000E+00
  1
  4
  0.0000E+00   3.4700E-04
  8.0000E+00   1.7500E-04
  2.4000E+01   2.3200E-04
  7.1200E+02   0.0000E+00
  0
Location 2:
LPZ
  3
  1
  7
  0.0000E+00   2.1700E-05
  4.0000E+00   1.4500E-05
  8.0000E+00   2.1700E-05
  1.2000E+01   1.4500E-05
  2.4000E+01   6.0200E-06
  9.6000E+01   1.7100E-06
  7.2000E+02   0.0000E+00
  1
  4
  0.0000E+00   3.4700E-04
  8.0000E+00   1.7500E-04
  2.4000E+01   2.3200E-04
  7.2000E+02   0.0000E+00
  0
Location 3:
Control Room
  4
  0
  1
  2
  0.0000E+00   3.4700E-04
  7.2000E+02   0.0000E+00
  1
  4
  0.0000E+00   1.0000E+00
  2.4000E+01   6.0000E-01
  9.6000E+01   4.0000E-01
  7.2000E+02   0.0000E+00
Effective Volume Location:
  1
  9
  0.0000E+00   2.3300E-04
  1.1000E+00   3.1000E-04
  3.1000E+00   2.3300E-04
```

```
  4.0000E+00   9.9300E-05
  8.0000E+00   2.3300E-04
  1.2000E+01   9.9300E-05
  2.4000E+01   7.0800E-05
  9.6000E+01   5.4800E-05
  7.2000E+02   0.0000E+00
 Simulation Parameters:
  3
  0.0000E+00   0.0000E+00
  8.0000E+00   2.5000E-01
  1.6000E+01   0.0000E+00
 Output Filename:
 H:\NUC\DETEDIS\PROCESS\AST\LOCA\Attachment F\MSIV Only with delay PEAK -
smallCR-with 3 MS H-Lines 900 CR unfiltered.o0
  1
  2
  1
  0
  1
 End of Scenario File
```

Radtrad 3.02 1/5/2000

PC Leak, 15 minute SC bypass, 900 cfm CR bypass

Nuclide Inventory File:

c:\program files\u s nuclear regulatory commission\radtrad\defaults\fermiast-loca.nif
Plant Power Level:
3.4990E+03
Compartments:
5
Compartment 1:
Containment
3
2.9463E+05
0
0
0
1
0
Compartment 2:
Reactor Building
3
1.0000E+00
0
0
0
0
0
Compartment 3:
Environment
2
0.0000E+00
0
0
0
0
0
Compartment 4:
Control Room
1
5.6960E+04
0
0
1
0
0
Compartment 5:
Hold
3
1.0000E+00
0
0
0
0
0
Pathways:
9
Pathway 1:
Containment to Reactor Building

```
   1
   2
   4
 Pathway 2:
 Filtered Environment to Control Room
   3
   4
   2
 Pathway 3:
 Control Room to  Environment
   4
   3
   2
 Pathway 4:
 Unfiltered Environment to Control Room
   3
   4
   2
 Pathway 5:
 MS Line B Containment to  Hold
   1
   5
   1
 Pathway 6:
 MS Line D Containment to  Hold
   1
   5
   1
 Pathway 7:
 MS Line A  Containment to  Hold
   1
   5
   1
 Pathway 8:
 Containment to  Environment
   1
   3
   4
 Pathway 9:
 Reactor Building to  Environment
   2
   3
   2
 End of Plant Model File
 Scenario Description Name:

 Plant Model Filename:

 Source Term:
   1
   1   1.0000E+00
 c:\program files\u s nuclear regulatory
commission\radtrad\defaults\fgr11&12.inp
 c:\program files\u s nuclear regulatory
commission\radtrad\defaults\bwr_dba.rft
   0.0000E+00
   1
   9.5000E-01   4.8500E-02   1.5000E-03   1.0000E+00
 Overlying Pool:
   0
   0.0000E+00
```

```
  0
  0
  0
  0
Compartments:
  5
Compartment 1:
  0
  1
  0
  0
  0
  0
  0
  3
  3
  1.0000E+01
  0
Compartment 2:
  0
  1
  0
  0
  0
  0
  0
  0
  0
Compartment 3:
  0
  1
  0
  0
  0
  0
  0
  0
  0
Compartment 4:
  0
  1
  0
  0
  0
  0
  1
  2.7045E+02
  1
  0.0000E+00   9.5000E+01   9.5000E+01   9.5000E+01
  0
  0
Compartment 5:
  0
  1
  0
  0
  0
  0
  0
  0
  0
```

```
Pathways:
  9
Pathway 1:
  0
  0
  0
  0
  0
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   4.7500E-01
  2.4000E+01   2.3750E-01
  7.2000E+02   0.0000E+00
  0
Pathway 2:
  0
  0
  0
  0
  0
  1
  2
  0.0000E+00   4.0570E+02   9.9750E+01   9.9750E+01   9.9750E+01
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 3:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   6.0850E+02   9.9000E+01   9.9000E+01   9.9000E+01
  5.0000E-01   6.0850E+02   9.9000E+01   9.9000E+01   9.9000E+01
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 4:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   2.0280E+02   0.0000E+00   0.0000E+00   0.0000E+00
```

```
  5.0000E-01   2.0280E+02   0.0000E+00   0.0000E+00   0.0000E+00
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 5:
  0
  0
  2
  3
  1.0380E+03   4.9700E+02   0.0000E+00
  0.0000E+00   6.2000E-01   1.5000E+00   5.5000E+02
  2.4000E+01   3.1000E-01   1.5000E+00   2.0000E+02
  7.2000E+02   0.0000E+00   0.0000E+00   3.2000E+01
  2
  2
  0
  0
  0
  0
  0
  0
  0
Pathway 6:
  0
  0
  2
  3
  1.1930E+03   5.6200E+02   0.0000E+00
  0.0000E+00   6.2000E-01   1.5000E+00   5.5000E+02
  2.4000E+01   3.1000E-01   1.5000E+00   2.0000E+02
  7.2000E+02   0.0000E+00   0.0000E+00   3.2000E+01
  2
  2
  0
  0
  0
  0
  0
  0
  0
Pathway 7:
  0
  0
  2
  3
  1.1980E+03   5.6400E+02   0.0000E+00
  0.0000E+00   3.1000E-01   1.5000E+00   5.5000E+02
  2.4000E+01   1.5500E-01   1.5000E+00   2.0000E+02
  7.2000E+02   0.0000E+00   0.0000E+00   3.2000E+01
  2
  2
  0
  0
  0
  0
  0
  0
```

```
  0
Pathway 8:
  0
  0
  0
  0
  0
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   2.5000E-02
  2.4000E+01   1.2500E-02
  7.2000E+02   0.0000E+00
  0
Pathway 9:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   1.0000E+05   0.0000E+00   0.0000E+00   0.0000E+00
  2.5000E-01   1.0000E+05   9.9000E+01   9.9000E+01   9.9000E+01
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Dose Locations:
  3
Location 1:
EAB
  3
  1
  3
  0.0000E+00   0.0000E+00
  1.1000E+00   2.0900E-04
  3.1000E+00   0.0000E+00
  1
  4
  0.0000E+00   3.4700E-04
  8.0000E+00   1.7500E-04
  2.4000E+01   2.3200E-04
  7.2000E+02   0.0000E+00
  0
Location 2:
LPZ
  3
  1
  7
  0.0000E+00   2.1700E-05
  4.0000E+00   1.4500E-05
  8.0000E+00   2.1700E-05
  1.2000E+01   1.4500E-05
```

```
   2.4000E+01   6.0200E-06
   9.6000E+01   1.7100E-06
   7.2000E+02   0.0000E+00
   1
   4
   0.0000E+00   3.4700E-04
   8.0000E+00   1.7500E-04
   2.4000E+01   2.3200E-04
   7.2000E+02   0.0000E+00
   0
 Location 3:
 Control Room
   4
   0
   1
   2
   0.0000E+00   3.4700E-04
   7.2000E+02   0.0000E+00
   1
   4
   0.0000E+00   1.0000E+00
   2.4000E+01   6.0000E-01
   9.6000E+01   4.0000E-01
   7.2000E+02   0.0000E+00
 Effective Volume Location:
   1
   9
   0.0000E+00   4.5300E-04
   1.1000E+00   6.1800E-04
   3.1000E+00   4.5300E-04
   4.0000E+00   1.8800E-04
   8.0000E+00   4.5300E-04
   1.2000E+01   1.8800E-04
   2.4000E+01   1.2600E-04
   9.6000E+01   8.7000E-05
   7.2000E+02   0.0000E+00
 Simulation Parameters:
   2
   0.0000E+00   1.0000E-01
   1.2000E+01   0.0000E+00
 Output Filename:
 H:\NUC\DETEDIS\PROCESS\AST\LOCA\Attachment F\PC LEAK -PEAK-Only 5% bypass -
smallCR-with 3 MS H-Lines 900 CR unfiltered.o0
   1
   2
   1
   0
   1
 End of Scenario File
```

```
Radtrad 3.02 1/5/2000

ECCS PEAK w reduced flashing, 15 min SC bypass, 900 cfm unfiltered CR intake
Nuclide Inventory File:
c:\program files\u s nuclear regulatory commission\radtrad\defaults\fermiast-
eccs.nif
Plant Power Level:
 3.4990E+03
Compartments:
  4
Compartment 1:
ECCS FLUID
  3
 9.4920E+05
  0
  0
  0
  0
  0
Compartment 2:
Reactor Building
  3
 1.0000E+00
  0
  0
  0
  0
  0
Compartment 3:
Environment
  2
 0.0000E+00
  0
  0
  0
  0
  0
Compartment 4:
Control Room
  1
 5.6960E+04
  0
  0
  1
  0
  0
Pathways:
  5
Pathway 1:
ECCS FLUID to Reactor Building
  1
  2
  2
Pathway 2:
Reactor Building to Environment
  2
  3
  2
Pathway 3:
Environment to Control Room
  3
```

```
   4
   2
 Pathway 4:
 Control Room to  Environment
   4
   3
   2
 Pathway 5:
 Unfiltered Environment to Control Room
   3
   4
   2
 End of Plant Model File
 Scenario Description Name:

 Plant Model Filename:

 Source Term:
   1
   1   1.0000E+00
 c:\program files\u s nuclear regulatory
commission\radtrad\defaults\fgr11&12.inp
 c:\program files\u s nuclear regulatory
commission\radtrad\defaults\bwr_dba.rft
   0.0000E+00
   1
   9.5000E-01   4.8500E-02   1.5000E-03   1.0000E+00
 Overlying Pool:
   0
   0.0000E+00
   0
   0
   0
   0
 Compartments:
   4
 Compartment 1:
   0
   1
   0
   0
   0
   0
   0
   0
   0
 Compartment 2:
   0
   1
   0
   0
   0
   0
   0
   0
   0
 Compartment 3:
   0
   1
   0
   0
```

```
  0
  0
  0
  0
  0
Compartment 4:
  0
  1
  0
  0
  0
  0
  1
  2.7045E+02
  1
  0.0000E+00   9.5000E+01   9.5000E+01   9.5000E+01
  0
  0
Pathways:
  5
Pathway 1:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   5.0000E+00   9.8000E+01   9.8000E+01   9.8000E+01
  2.4000E+01   5.0000E+00   9.8000E+01   9.8000E+01   9.8000E+01
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 2:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   1.0000E+05   0.0000E+00   0.0000E+00   0.0000E+00
  2.5000E-01   1.0000E+05   9.9000E+01   9.9000E+01   9.9000E+01
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 3:
  0
  0
  0
  0
  0
  1
```

```
  2
  0.0000E+00   4.0570E+02   9.9750E+01   9.9750E+01   9.9750E+01
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 4:
  0
  0
  0
  0
  0
  1
  2
  0.0000E+00   6.0850E+02   9.9000E+01   9.9000E+01   9.9000E+01
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 5:
  0
  0
  0
  0
  0
  1
  2
  0.0000E+00   2.0280E+02   0.0000E+00   0.0000E+00   0.0000E+00
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Dose Locations:
  3
Location 1:
EAB
  3
  1
  3
  0.0000E+00   0.0000E+00
  1.1000E+00   2.0900E-04
  3.1000E+00   0.0000E+00
  1
  4
  0.0000E+00   3.4700E-04
  8.0000E+00   1.7500E-04
  2.4000E+01   2.3200E-04
  7.2000E+02   0.0000E+00
  0
Location 2:
LPZ
  3
```

```
   1
   7
   0.0000E+00   2.1700E-05
   4.0000E+00   1.4500E-05
   8.0000E+00   2.1700E-05
   1.2000E+01   1.4500E-05
   2.4000E+01   6.0200E-06
   9.6000E+01   1.7100E-06
   7.2000E+02   0.0000E+00
   1
   4
   0.0000E+00   3.4700E-04
   8.0000E+00   1.7500E-04
   2.4000E+01   2.3200E-04
   7.2000E+02   0.0000E+00
   0
 Location 3:
 Control Room
   4
   0
   1
   2
   0.0000E+00   3.4700E-04
   7.2000E+02   0.0000E+00
   1
   4
   0.0000E+00   1.0000E+00
   2.4000E+01   6.0000E-01
   9.6000E+01   4.0000E-01
   7.2000E+02   0.0000E+00
 Effective Volume Location:
   1
   9
   0.0000E+00   4.5300E-04
   1.1000E+00   6.1800E-04
   3.1000E+00   4.5300E-04
   4.0000E+00   1.8800E-04
   8.0000E+00   4.5300E-04
   1.2000E+01   1.8800E-04
   2.4000E+01   1.2600E-04
   9.6000E+01   8.7000E-05
   7.2000E+02   0.0000E+00
 Simulation Parameters:
   1
   0.0000E+00   0.0000E+00
 Output Filename:
 H:\NUC\DETEDIS\PROCESS\AST\LOCA\Attachment F\ECCS PEAK-900ufil 15min drawdown
reduced flash.o0
   1
   2
   1
   0
   1
 End of Scenario File
```

FERMIAST-LOCA.nif

```
Nuclide Inventory Name:  Source Terms per DC-6120, Rev. 0

FERMI AST LOCA - 35 GWD/MTU 4.58 MW bundle - in Ci/MW
Power Level:
 0.1000E+01
Nuclides:
 60
Nuclide 001:
Co-58
  7
 0.6117120000E+07
 0.5800E+02
 0.1529E+03
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 002:
Co-60
  7
 0.1663401096E+09
 0.6000E+02
 0.1830E+03
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 003:
Kr-85
  1
 0.3382974720E+09
 0.8500E+02
 0.3736E+03
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 004:
Kr-85m
  1
 0.1612800000E+05
 0.8500E+02
 0.6693E+04
Kr-85     0.2100E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 005:
Kr-87
  1
 0.4578000000E+04
 0.8700E+02
 0.1343E+05
Rb-87     0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 006:
Kr-88
  1
 0.1022400000E+05
 0.8800E+02
 0.1863E+05
Rb-88     0.1000E+01
```

```
none      0.0000E+00
none      0.0000E+00
Nuclide 007:
Rb-86
  3
 0.1612224000E+07
 0.8600E+02
 0.4767E+02
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 008:
Sr-89
  5
 0.4363200000E+07
 0.8900E+02
 0.2609E+05
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 009:
Sr-90
  5
 0.9189573120E+09
 0.9000E+02
 0.3295E+04
Y-90      0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 010:
Sr-91
  5
 0.3420000000E+05
 0.9100E+02
 0.3263E+05
Y-91m     0.5800E+00
Y-91      0.4200E+00
none      0.0000E+00
Nuclide 011:
Sr-92
  5
 0.9756000000E+04
 0.9200E+02
 0.3463E+05
Y-92      0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 012:
Y-90
  9
 0.2304000000E+06
 0.9000E+02
 0.3405E+04
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 013:
Y-91
  9
 0.5055264000E+07
 0.9100E+02
```

```
 0.3387E+05
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 014:
Y-92
  9
 0.1274400000E+05
 0.9200E+02
 0.3497E+05
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 015:
Y-93
  9
 0.3636000000E+05
 0.9300E+02
 0.2656E+05
Zr-93     0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 016:
Zr-95
  9
 0.5527872000E+07
 0.9500E+02
 0.4575E+05
Nb-95m    0.7000E-02
Nb-95     0.9900E+00
none      0.0000E+00
Nuclide 017:
Zr-97
  9
 0.6084000000E+05
 0.9700E+02
 0.4322E+05
Nb-97m    0.9500E+00
Nb-97     0.5300E-01
none      0.0000E+00
Nuclide 018:
Nb-95
  9
 0.3036960000E+07
 0.9500E+02
 0.4609E+05
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 019:
Mo-99
  7
 0.2376000000E+06
 0.9900E+02
 0.4988E+05
Tc-99m    0.8800E+00
Tc-99     0.1200E+00
none      0.0000E+00
Nuclide 020:
Tc-99m
  7
```

```
 0.2167200000E+05
 0.9900E+02
 0.4428E+05
Tc-99    0.1000E+01
none     0.0000E+00
none     0.0000E+00
Nuclide 021:
Ru-103
  7
 0.3393792000E+07
 0.1030E+03
 0.4183E+05
Rh-103m  0.1000E+01
none     0.0000E+00
none     0.0000E+00
Nuclide 022:
Ru-105
  7
 0.1598400000E+05
 0.1050E+03
 0.2826E+05
Rh-105   0.1000E+01
none     0.0000E+00
none     0.0000E+00
Nuclide 023:
Ru-106
  7
 0.3181248000E+08
 0.1060E+03
 0.1558E+05
Rh-106   0.1000E+01
none     0.0000E+00
none     0.0000E+00
Nuclide 024:
Rh-105
  7
 0.1272960000E+06
 0.1050E+03
 0.2624E+05
none     0.0000E+00
none     0.0000E+00
none     0.0000E+00
Nuclide 025:
Sb-127
  4
 0.3326400000E+06
 0.1270E+03
 0.2278E+04
Te-127m  0.1800E+00
Te-127   0.8200E+00
none     0.0000E+00
Nuclide 026:
Sb-129
  4
 0.1555200000E+05
 0.1290E+03
 0.8507E+04
Te-129m  0.2200E+00
Te-129   0.7700E+00
none     0.0000E+00
Nuclide 027:
```

```
Te-127
  4
 0.3366000000E+05
 0.1270E+03
 0.2244E+04
none     0.0000E+00
none     0.0000E+00
none     0.0000E+00
Nuclide 028:
Te-127m
  4
 0.9417600000E+07
 0.1270E+03
 0.3799E+03
Te-127   0.9800E+00
none     0.0000E+00
none     0.0000E+00
Nuclide 029:
Te-129
  4
 0.4176000000E+04
 0.1290E+03
 0.8084E+04
I-129    0.1000E+01
none     0.0000E+00
none     0.0000E+00
Nuclide 030:
Te-129m
  4
 0.2903040000E+07
 0.1290E+03
 0.1639E+04
Te-129   0.6500E+00
I-129    0.3500E+00
none     0.0000E+00
Nuclide 031:
Te-131m
  4
 0.1080000000E+06
 0.1310E+03
 0.5246E+04
Te-131   0.2200E+00
I-131    0.7800E+00
none     0.0000E+00
Nuclide 032:
Te-132
  4
 0.2815200000E+06
 0.1320E+03
 0.3823E+05
I-132    0.1000E+01
none     0.0000E+00
none     0.0000E+00
Nuclide 033:
I-131
  2
 0.6946560000E+06
 0.1310E+03
 0.2657E+05
Xe-131m  0.1100E-01
none     0.0000E+00
```

```
none      0.0000E+00
Nuclide 034:
I-132
  2
 0.8280000000E+04
 0.1320E+03
 0.3901E+05
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 035:
I-133
  2
 0.7488000000E+05
 0.1330E+03
 0.5500E+05
Xe-133m   0.2900E-01
Xe-133    0.9700E+00
none      0.0000E+00
Nuclide 036:
I-134
  2
 0.3156000000E+04
 0.1340E+03
 0.6078E+05
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 037:
I-135
  2
 0.2379600000E+05
 0.1350E+03
 0.5235E+05
Xe-135m   0.1500E+00
Xe-135    0.8500E+00
none      0.0000E+00
Nuclide 038:
Xe-133
  1
 0.4531680000E+06
 0.1330E+03
 0.5412E+05
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 039:
Xe-135
  1
 0.3272400000E+05
 0.1350E+03
 0.1451E+05
Cs-135    0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 040:
Cs-134
  3
 0.6507177120E+08
 0.1340E+03
 0.4793E+04
```

```
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 041:
Cs-136
  3
 0.1131840000E+07
 0.1360E+03
 0.1463E+04
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 042:
Cs-137
  3
 0.9467280000E+09
 0.1370E+03
 0.4270E+04
Ba-137m   0.9500E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 043:
Ba-139
  6
 0.4962000000E+04
 0.1390E+03
 0.4843E+05
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 044:
Ba-140
  6
 0.1100736000E+07
 0.1400E+03
 0.4877E+05
La-140    0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 045:
La-140
  9
 0.1449792000E+06
 0.1400E+03
 0.5079E+05
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 046:
La-141
  9
 0.1414800000E+05
 0.1410E+03
 0.4422E+05
Ce-141    0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 047:
La-142
  9
 0.5550000000E+04
```

```
 0.1420E+03
 0.4320E+05
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 048:
Ce-141
  8
 0.2808086400E+07
 0.1410E+03
 0.4477E+05
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 049:
Ce-143
  8
 0.1188000000E+06
 0.1430E+03
 0.4142E+05
Pr-143    0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 050:
Ce-144
  8
 0.2456352000E+08
 0.1440E+03
 0.3790E+05
Pr-144m   0.1800E-01
Pr-144    0.9800E+00
none      0.0000E+00
Nuclide 051:
Pr-143
  9
 0.1171584000E+07
 0.1430E+03
 0.4041E+05
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 052:
Nd-147
  9
 0.9486720000E+06
 0.1470E+03
 0.1800E+05
Pm-147    0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 053:
Np-239
  8
 0.2034720000E+06
 0.2390E+03
 0.6634E+06
Pu-239    0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 054:
Pu-238
```

```
  8
 0.2768863824E+10
 0.2380E+03
 0.2561E+03
U-234     0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 055:
Pu-239
  8
 0.7594336440E+12
 0.2390E+03
 0.9678E+01
U-235     0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 056:
Pu-240
  8
 0.2062920312E+12
 0.2400E+03
 0.2662E+02
U-236     0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 057:
Pu-241
  8
 0.4544294400E+09
 0.2410E+03
 0.5126E+04
U-237     0.2400E-04
Am-241    0.1000E+01
none      0.0000E+00
Nuclide 058:
Am-241
  9
 0.1363919472E+11
 0.2410E+03
 0.6880E+01
Np-237    0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 059:
Cm-242
  9
 0.1406592000E+08
 0.2420E+03
 0.3129E+04
Pu-238    0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 060:
Cm-244
  9
 0.5715081360E+09
 0.2440E+03
 0.6024E+03
Pu-240    0.1000E+01
none      0.0000E+00
none      0.0000E+00
```

End of Nuclear Inventory File

```
Nuclide Inventory Name:  FERMI-ECCS

FERMI AST ECCS - 35 GWD/MTU 4.58 MW bundle - in Ci/MW

Power Level:

 0.1000E+01

Nuclides:

 60

Nuclide 001:

Co-58

  7

 0.6117120000E+07

 0.5800E+02
 0.0000E+00
none     0.0000E+00
none     0.0000E+00
none     0.0000E+00
Nuclide 002:
Co-60
  7
 0.1663401096E+09
 0.6000E+02
 0.0000E+00
none     0.0000E+00
none     0.0000E+00
none     0.0000E+00
Nuclide 003:
Kr-85
  1
 0.3382974720E+09
 0.8500E+02
 0.0000E+00
none     0.0000E+00
none     0.0000E+00
none     0.0000E+00
Nuclide 004:
Kr-85m
  1
 0.1612800000E+05
 0.8500E+02
 0.0000E+00
Kr-85    0.2100E+00
none     0.0000E+00
none     0.0000E+00
Nuclide 005:
Kr-87
  1
 0.4578000000E+04
 0.8700E+02
 0.0000E+00
```

```
Rb-87     0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 006:
Kr-88
  1
 0.1022400000E+05
 0.8800E+02
 0.0000E+00
Rb-88     0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 007:
Rb-86
  3
 0.1612224000E+07
 0.8600E+02
 0.0000E+00
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 008:
Sr-89
  5
 0.4363200000E+07
 0.8900E+02
 0.0000E+00
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 009:
Sr-90
  5
 0.9189573120E+09
 0.9000E+02
 0.0000E+00
Y-90      0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 010:
Sr-91
  5
 0.3420000000E+05
 0.9100E+02
 0.0000E+00
Y-91m     0.5800E+00
Y-91      0.4200E+00
none      0.0000E+00
Nuclide 011:
Sr-92
  5
 0.9756000000E+04
 0.9200E+02
 0.0000E+00
Y-92      0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 012:
Y-90
  9
 0.2304000000E+06
```

```
 0.9000E+02
 0.0000E+00
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 013:
Y-91
  9
 0.5055264000E+07
 0.9100E+02
 0.0000E+00
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 014:
Y-92
  9
 0.1274400000E+05
 0.9200E+02
 0.0000E+00
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 015:
Y-93
  9
 0.3636000000E+05
 0.9300E+02
 0.0000E+00
Zr-93     0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 016:
Zr-95
  9
 0.5527872000E+07
 0.9500E+02
 0.0000E+00
Nb-95m    0.7000E-02
Nb-95     0.9900E+00
none      0.0000E+00
Nuclide 017:
Zr-97
  9
 0.6084000000E+05
 0.9700E+02
 0.0000E+00
Nb-97m    0.9500E+00
Nb-97     0.5300E-01
none      0.0000E+00
Nuclide 018:
Nb-95
  9
 0.3036960000E+07
 0.9500E+02
 0.0000E+00
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 019:
Mo-99
```

```
  7
 0.2376000000E+06
 0.9900E+02
 0.0000E+00
Tc-99m   0.8800E+00
Tc-99    0.1200E+00
none     0.0000E+00
Nuclide 020:
Tc-99m
  7
 0.2167200000E+05
 0.9900E+02
 0.0000E+00
Tc-99    0.1000E+01
none     0.0000E+00
none     0.0000E+00
Nuclide 021:
Ru-103
  7
 0.3393792000E+07
 0.1030E+03
 0.0000E+00
Rh-103m  0.1000E+01
none     0.0000E+00
none     0.0000E+00
Nuclide 022:
Ru-105
  7
 0.1598400000E+05
 0.1050E+03
 0.0000E+00
Rh-105   0.1000E+01
none     0.0000E+00
none     0.0000E+00
Nuclide 023:
Ru-106
  7
 0.3181248000E+08
 0.1060E+03
 0.0000E+00
Rh-106   0.1000E+01
none     0.0000E+00
none     0.0000E+00
Nuclide 024:
Rh-105
  7
 0.1272960000E+06
 0.1050E+03
 0.0000E+00
none     0.0000E+00
none     0.0000E+00
none     0.0000E+00
Nuclide 025:
Sb-127
  4
 0.3326400000E+06
 0.1270E+03
 0.0000E+00
Te-127m  0.1800E+00
Te-127   0.8200E+00
none     0.0000E+00
```

```
Nuclide 026:
Sb-129
  4
 0.1555200000E+05
 0.1290E+03
 0.0000E+00
Te-129m  0.2200E+00
Te-129   0.7700E+00
none     0.0000E+00
Nuclide 027:
Te-127
  4
 0.3366000000E+05
 0.1270E+03
 0.0000E+00
none     0.0000E+00
none     0.0000E+00
none     0.0000E+00
Nuclide 028:
Te-127m
  4
 0.9417600000E+07
 0.1270E+03
 0.0000E+00
Te-127   0.9800E+00
none     0.0000E+00
none     0.0000E+00
Nuclide 029:
Te-129
  4
 0.4176000000E+04
 0.1290E+03
 0.0000E+00
I-129    0.1000E+01
none     0.0000E+00
none     0.0000E+00
Nuclide 030:
Te-129m
  4
 0.2903040000E+07
 0.1290E+03
 0.0000E+00
Te-129   0.6500E+00
I-129    0.3500E+00
none     0.0000E+00
Nuclide 031:
Te-131m
  4
 0.1080000000E+06
 0.1310E+03
 0.0000E+00
Te-131   0.2200E+00
I-131    0.7800E+00
none     0.0000E+00
Nuclide 032:
Te-132
  4
 0.2815200000E+06
 0.1320E+03
 0.0000E+00
I-132    0.1000E+01
```

```
none      0.0000E+00
none      0.0000E+00
Nuclide 033:
I-131
  2
 0.6946560000E+06
 0.1310E+03
 0.2657E+05
Xe-131m  0.1100E-01
none      0.0000E+00
none      0.0000E+00
Nuclide 034:
I-132
  2
 0.8280000000E+04
 0.1320E+03
 0.3901E+05
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 035:
I-133
  2
 0.7488000000E+05
 0.1330E+03
 0.5500E+05
Xe-133m  0.2900E-01
Xe-133   0.9700E+00
none      0.0000E+00
Nuclide 036:
I-134
  2
 0.3156000000E+04
 0.1340E+03
 0.6078E+05
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 037:
I-135
  2
 0.2379600000E+05
 0.1350E+03
 0.5235E+05
Xe-135m  0.1500E+00
Xe-135   0.8500E+00
none      0.0000E+00
Nuclide 038:
Xe-133
  1
 0.4531680000E+06
 0.1330E+03
 0.0000E+00
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 039:
Xe-135
  1
 0.3272400000E+05
 0.1350E+03
```

```
 0.0000E+00
Cs-135    0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 040:
Cs-134
  3
 0.6507177120E+08
 0.1340E+03
 0.0000E+00
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 041:
Cs-136
  3
 0.1131840000E+07
 0.1360E+03
 0.0000E+00
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 042:
Cs-137
  3
 0.9467280000E+09
 0.1370E+03
 0.0000E+00
Ba-137m   0.9500E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 043:
Ba-139
  6
 0.4962000000E+04
 0.1390E+03
 0.0000E+00
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 044:
Ba-140
  6
 0.1100736000E+07
 0.1400E+03
 0.0000E+00
La-140    0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 045:
La-140
  9
 0.1449792000E+06
 0.1400E+03
 0.0000E+00
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 046:
La-141
  9
```

```
 0.1414800000E+05
 0.1410E+03
 0.0000E+00
Ce-141   0.1000E+01
none     0.0000E+00
none     0.0000E+00
Nuclide 047:
La-142
  9
 0.5550000000E+04
 0.1420E+03
 0.0000E+00
none     0.0000E+00
none     0.0000E+00
none     0.0000E+00
Nuclide 048:
Ce-141
  8
 0.2808086400E+07
 0.1410E+03
 0.0000E+00
none     0.0000E+00
none     0.0000E+00
none     0.0000E+00
Nuclide 049:
Ce-143
  8
 0.1188000000E+06
 0.1430E+03
 0.0000E+00
Pr-143   0.1000E+01
none     0.0000E+00
none     0.0000E+00
Nuclide 050:
Ce-144
  8
 0.2456352000E+08
 0.1440E+03
 0.0000E+00
Pr-144m  0.1800E-01
Pr-144   0.9800E+00
none     0.0000E+00
Nuclide 051:
Pr-143
  9
 0.1171584000E+07
 0.1430E+03
 0.0000E+00
none     0.0000E+00
none     0.0000E+00
none     0.0000E+00
Nuclide 052:
Nd-147
  9
 0.9486720000E+06
 0.1470E+03
 0.0000E+00
Pm-147   0.1000E+01
none     0.0000E+00
none     0.0000E+00
Nuclide 053:
```

```
Np-239
  8
 0.2034720000E+06
 0.2390E+03
 0.0000E+00
Pu-239    0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 054:
Pu-238
  8
 0.2768863824E+10
 0.2380E+03
 0.0000E+00
U-234     0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 055:
Pu-239
  8
 0.7594336440E+12
 0.2390E+03
 0.0000E+00
U-235     0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 056:
Pu-240
  8
 0.2062920312E+12
 0.2400E+03
 0.0000E+00
U-236     0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 057:
Pu-241
  8
 0.4544294400E+09
 0.2410E+03
 0.0000E+00
U-237     0.2400E-04
Am-241    0.1000E+01
none      0.0000E+00
Nuclide 058:
Am-241
  9
 0.1363919472E+11
 0.2410E+03
 0.0000E+00
Np-237    0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 059:
Cm-242
  9
 0.1406592000E+08
 0.2420E+03
 0.0000E+00
Pu-238    0.1000E+01
none      0.0000E+00
```

```
none      0.0000E+00
Nuclide 060:
Cm-244
  9
 0.5715081360E+09
 0.2440E+03
 0.0000E+00
Pu-240    0.1000E+01
none      0.0000E+00
none      0.0000E+00
End of Nuclear Inventory File
```