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DTE Energy

10CFR50.90
10CFR50.67

July 30, 2004
NRC-04-0051

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

3) Detroit Edison's Letter to NRC, "Response to NRC Request for Additional Information Regarding the Implementation of Alternative Source Term," NRC-03-0053, dated July 8, 2003

4) Detroit Edison's Letter to NRC, "Response to NRC Request for Additional Information Regarding the Implementation of Alternative Source Term," NRC-03-0095, dated December 12, 2003

5) Detroit Edison's Letter to NRC, "Response to NRC Request for Additional Information Regarding the Use of Standby Liquid Control System in Suppression Pool pH Control Post LOCA," NRC-04-0037, dated June 4, 2004

6) NRC Letter to Detroit Edison, "Request for Additional Information Related to Proposed License Amendment for the Implementation of the Alternative Radiological Source Term Methodology (TAC No. MB7794)," dated June 20, 2004

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

A001

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. In References 3 and 4, Detroit Edison provided responses to NRC requests for additional information regarding the proposed license amendment. In Reference 5, Detroit Edison responded to additional NRC questions regarding the use of the Standby Liquid Control System in controlling the pH level of the suppression pool water post LOCA.

In Reference 6, the NRC requested additional information in order to complete the review of the proposed license amendment. The first two questions have been discussed in telephone conversations between the NRC staff and Detroit Edison personnel on February 27 and May 20, 2004.

Enclosure 1 to this letter provides responses to the NRC questions. Previously submitted marked up pages of the TS in References 2 and 4 remain valid. Updates of the RADTRAD computer program input files and LOCA radionuclide information files, included in Reference 4, are provided in Enclosure 2 to this letter.

The conclusions made in Reference 2 regarding no significant hazards consideration and categorical exclusion from environmental assessment are not impacted by the changes described herein. No new commitments are made in this letter.

Detroit Edison understands based on discussion with NRC staff that NRC plans to complete their review of this license amendment to support its approval by September 30, 2004. This approval date is required to support the upcoming tenth refueling outage planned to start on November 6, 2004.

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

Sincerely,

William O. O'Connor

Enclosures

cc: D. P. Beaulieu
E R. Duncan
NRC Resident Office
Regional Administrator, Region III
Supervisor, Electric Operators,
Michigan Public Service Commission

I, WILLIAM T. O'CONNOR, JR., 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.

WILLIAM T. O'CONNOR, JR.
Vice President - Nuclear Generation

On this 30 day of July, 2004 before me personally appeared William T. O'Connor, Jr., being first duly sworn and says that he executed the foregoing as his free act and deed.

Notary Public

CYNTHIA L. SMITH
Notary Public, Monroe County, MI
My Commission Expires Oct. 5, 2005

ENCLOSURE 1 TO
NRC-04-0051

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 question (in italics):

NRC Question:

1. *With regard to DECo's modeling of the deposition of fission products in main steam line piping, the staff's position is that credit for deposition cannot be taken for one of the main steam lines between the reactor pressure vessel (RPV) and the inboard main steam isolation valve (MSIV). DECo's analysis credited deposition in all four steam lines. NRC regulations and regulatory guidance require an evaluation of a spectrum of potential break sizes and locations within the reactor coolant pressure boundary with regard to emergency core coolant system (ECCS) performance. Analyses of DBLOCA radiological consequences stylistically assume that the ECCS fails, resulting in the substantial release of fission products, regardless of break size or location. Although the rupture of recirculation system piping was used as the limiting case in the licensing of Fermi, DECo's proposal to credit fission product deposition in the main steam lines raises the possibility that a rupture of one of the main steam lines upstream of the inboard MSIV could be more limiting since crediting deposition in the ruptured line would be inappropriate. The in-containment main steam line assumed to fail should be selected so as to minimize the assumed deposition credit. Note that the assignment of the limiting single failure of an MSIV to close may change as a result of the assumed main steam line failure. Please update the analyses and submittal or provide further justification for why DECo's proposed approach is adequately conservative.*

Detroit Edison's Response:

The analyses have been updated to incorporate an assumed rupture of the limiting main steam line (MSL) inside the primary containment with an assumed limiting single failure of one MSIV. All changes made to the analyses parameters described in Reference 4 are updated below:

MSL Break:

As proposed in the requested TS change and described in Reference 4, the analyses assume MSIV leakage at a maximum of 100 standard cubic foot per hour (scfh) per steam line and a total of no more than 150 scfh in all four lines. Therefore, MSIV leakage is modeled with 100 scfh in the shortest steam line (line B) and 50 scfh in the next shortest line (line D) to provide the most conservative distribution and minimize deposition credit. Line B is also the shortest MSL and line D is the next shortest when only horizontal sections of the main steam piping are considered. Tables 3 and 4 of Reference 4 provided more details on MSL geometry and nodalization.

Each of the two main steam lines with assumed flow (lines B and D) is modeled as two, well-mixed nodes. The first node represents the piping from the RPV nozzle to the inboard MSIV and the second node represents the piping between the inboard (first) and third MSIVs, which is the boundary of the seismically analyzed piping. This nodalization is conservative since it results in the depressurization of the penetration section between the inboard and outboard MSIVs; therefore, higher flow velocities leading to less settling and deposition are applied in that section.

In the updated analyses, a main steam line break is postulated upstream of the inboard MSIV for line B. Line B has the shortest total length of piping among the four MSLs and the shortest horizontal piping section; however, line B has a longer total and horizontal piping section inside containment than the next shortest steam line (Line D). Therefore, a line B break represents the worst case scenario since it minimizes the assumed deposition by not crediting any deposition in the first node (inside containment) of that line.

The failure of the outboard MSIV in line B to close is assumed since it is the worst case single failure. A failure of the inboard MSIV is not limiting since it would cause flow through the penetration section of the line to be at containment conditions, which has a lower volumetric flow than the depressurized piping section outside containment. Table 1 provides an updated summary of MSL deposition credit parameters used in the analyses.

Temperature Reduction:

A plant-specific, time-dependent MSL temperature analysis was performed to evaluate the outboard MSL wall temperature post LOCA. The methodology used was in accordance with topical report NEDC-31858P-A, "BWROG Report for Increasing MSIV Leakage Rate Limits and Elimination of Leakage Control Systems." A reduction in piping wall temperature will result in cooling of the radioactive gas transported in the pipe. Cooler gas temperatures will result in a reduction in flow velocity and more deposition.

The temperature reduction utilized in the MSL deposition analysis is only applied to the second node of the model (outboard piping including penetration section). Deposition in the inboard piping is only credited for the unbroken line and the temperature is conservatively assumed to remain constant at 554 degrees Fahrenheit for the duration of the accident.

For the outboard piping of the MSLs with assumed flow, a step-down temperature profile is conservatively applied based on the plant-specific analysis. For each time interval, the temperature is conservatively assumed to remain constant and equal to the calculated temperature at the start of the interval. Table 2 provides a summary of the temperature profile and Table 3 provides a summary of the decontamination factors used in the analyses.

Secondary Containment Bypass Release

In Reference 3, NRC requested Detroit Edison to identify the release path of the secondary containment bypass (SCB) leakage as used in the dose analysis. In response, Detroit Edison indicated that although SCB pathways terminate in the Turbine Building (TB) and would be released through the TB Heating, Ventilation and Air Conditioning (TBHVAC) stack, the analysis conservatively assumed this leakage to be released unfiltered through the Standby Gas Treatment System (SGTS) stack.

Further evaluation of the assumption used for SCB leakage release point indicates that a SGTS stack release is overly conservative and unrealistic. A more realistic assumption is to release SCB leakage through the TBHVAC stack, similar to MSIV leakage. The discussion provided below is a summary of the evaluation of SCB leakage pathways.

SCB leakage paths are described in Section 6.2.1.2.2.3 of the Updated Final Safety Analysis Report (UFSAR). The SCB piping systems penetrate the secondary containment wall and exit into the main steam tunnel, auxiliary building first floor, or turbine building basement. It is possible that radioactive contaminants in this piping leak out into these areas bypassing the SGTS filters. The radioactive contaminants may enter the shared auxiliary building and turbine building air space and exit to the environment. A representative release point for the potential release of SCB leakage is the TBHVAC stack. It is conservatively assumed that the leakage goes directly to the TBHVAC stack outlet with no credit taken for any deposition or holdup of the radioactive contaminants in the building and no credit for the travel distance between the SCB leakage pathway and the stack outlet. The release is modeled as a capped or "zero velocity" release. The assumed receptor location, approximately 215 feet to the southwest of the TBHVAC stack outlet, is the south control room emergency air intake.

The turbine building is an enclosed structure maintained at a negative pressure during normal plant operation by the TBHVAC system as discussed in Section 9.4.4 of the UFSAR. The interface between the building metal siding and the reinforced concrete structure is sealed with air-tight gaskets. All doors exiting the turbine building are closed during normal operation and are only opened to allow equipment or personnel ingress and egress. All concrete wall penetrations, including piping and electrical penetrations, on the outside walls, are sealed. The 13 turbine building smoke and heat vents located on the turbine building roof are equipped with air-tight gaskets and are normally closed. They only open due to a fire or explosive pressure transient in the building. There are indicating lights and an alarm in the main control room to alert operators when any of these vents are open. The vents are designed with 160 degree Fahrenheit fusible links, and are designed to open against a pressure of 20 pounds per square foot. There is also a keylock switch in the control room that may be utilized to open the vents in case of a fire.

The area of the SCB leakage pathways in the auxiliary building first floor is open to the turbine building. Therefore, any leakage into the auxiliary building first floor would be released into the turbine building air space. Any leakage into the turbine building basement would migrate from the basement air space up to the turbine building first floor. Leakage into the main steam tunnel would also migrate through the steam tunnel to the center of the building near the main condenser or to the auxiliary and turbine building first floor air space.

Review of the building drawings and confirmatory walkdown of the area verified that all external doors of the auxiliary and turbine buildings are further away from the anticipated receptor location than the TBHVAC stack with the exception of doors T1-20 and R1-15. Door T1-20 is located on the west wall of the turbine building. It provides access to the breezeway entering the outage building. The door is approximately 100 feet from the south control room emergency air intake; however, review of the leakage travel distance from the closest SCB leakage line shows that the travel distance to the intake through this door is approximately 200 feet. Although this distance is slightly shorter than the distance from the TBHVAC stack, any SCB leakage would have to traverse the expanse of the turbine building air space to reach this door. Therefore, considering this distance and the fact that this door is normally closed, door T1-20 is not considered as a release point in the dose analysis.

Door R1-15 is located close to door T1-20 on the auxiliary building south wall, approximately 96 feet from the south control room emergency air intake. The estimated travel distance from the closest SCB leakage line to the intake is also on the order of 200 feet and the path goes through two other normally closed interior doors. Based on similar discussion as provided above for door T1-20, door R1-15 is also not considered as a release point for SCB leakage.

Review of the location of the smoke and heat vents indicates that SCB leakage must travel about 110 feet vertically plus about 100 feet horizontally before reaching the vents. Adding these travel distances to the 90 feet distance between the south control room emergency air intake and the closest vent results in a total distance of about 300 feet. Based on this travel distance and since these vents are not expected to open post LOCA, they are also not considered as release points for SCB leakage.

Based on this evaluation, the updated dose analysis assumes all SCB leakage to be released through the TBHVAC stack. Table 4 provides the updated results of the LOCA radiological consequence analysis.

<u>NRC Question:</u>

2. *DECo's modeling of the MSIV leakage pathway appears to treat the drywell and primary containment as a single, well-mixed volume from the start of the event. This*

assumption may not be supportable during the early stages of the event. The initial blowdown of the reactor coolant system would have occurred prior to the onset of the in-vessel release phase. Thus, the driving force for mixing between the two volumes will be less. Since the LOCA break communicates with the drywell volume, only the use of the drywell and wetwell free volume has the effect of reducing the concentration of the fission products available for release via MSIV leakage, a nonconservative situation. Because of this uncertainty, the NRC staff deterministically assumes that complete mixing does not occur until 2 hours, when core reflood is projected. Please update the analyses and submittal or provide further justification for why DECo's proposed approach is adequately conservative.

Detroit Edison's Response:

The analyses have been updated to assume no mixing between the drywell and suppression pool air space in the initial two hours of the accident. After the two hour period, it is assumed that the activity in the primary containment is instantaneously and homogeneously mixed throughout the drywell and suppression pool air space.

NRC Question:

3. *In its June 4, 2004, supplemental letter, DECo provided a response to an NRC staff request for additional information related to the use of the standby liquid control (SLC) system in maintaining suppression pool pH. The staff agrees, on the basis of the information provided, that there appears to be sufficient ECCS flow and a flow path exists to affect mixing of the RPV and suppression pool contents. However, DECo's response does not establish that the SLC injection would be entrained in the ECCS flow that is spilling through the break. The NRC staff notes that a significant portion of the ECCS flow may not flow directly past the SLC injection point and that stratification of the injected SLC solution in the lower head is a possibility. For example:*

   a. *In the event that both low-pressure coolant injection (LPCI) divisions are operating, is it likely that a significant fraction of the LPCI flow would simply bypass the jet pumps and spill into the annulus and, therefore not be available to transport the injected SLC solution to the break point?*

   b. *In the event that one division of LPCI is operating (as a result of single failure or isolation), would the flow through the active jet pumps be sufficient to force ECCS flow into the lower head region (where it could mix with the injected SLC solution) and out the nonactive jet pumps in the reverse direction? If so, are procedural controls needed to isolate one LPCI division after the SLC injection is completed to promote mixing and sweeping of injected SLC solution from the RPV?*

c. *Core spray flow could create reverse flow through the core by which the injected SLC solution could be swept from the RPV via reverse flow through the nonactive jet pumps. However, steaming in the core region could affect this flow. Please provide an explanation of why DECo believes that the amount of SLC solution necessary to maintain a suppression pool pH greater than 7.0 would be transported from the RPV by the ECCS flow. If reconsideration of your earlier response affects your prior analysis of the suppression pool pH value and timing, please update those analyses and describe the changes in the inputs, assumptions, methods, and results.*

Detroit Edison's Response:

Fermi 2 has a LPCI "Loop Select" design. The LPCI loop select logic selects only one unbroken Reactor Recirculation (RR) discharge loop for injection, and all LPCI flow is injected into that unbroken loop. The LPCI valve into the other RR discharge line is automatically closed. Long term LPCI flow from operation of two of the four LPCI pumps is more than 20,000 gallons per minute (gpm), which is injected through the RR discharge line into the ten associated jet pumps. Flow from these pumps is directed into the lower head region of the Reactor Pressure Vessel (RPV), where it would mix with the injected SLC solution. Section 5.5.6.3.2 of the UFSAR notes that the reactor boil-off rate is approximately 600 gpm, fifteen minutes after reactor shutdown. Since LPCI flow far exceeds the long term steaming rate, most of this water would exit the lower head region through the 10 jet pumps associated with the non-selected RR loop and spill out through the postulated line break.

In addition to LPCI, there are two Core Spray (CS) loops. Each loop injects approximately 6,000 gpm through spargers above the reactor core. For long term cooling purposes, the flow from even one CS loop far exceeds the steaming rate in the reactor core. Thus, most of the CS flow would pass through the core into the lower RPV head region. This flow would then flow around the 185 Control Rod Drive (CRD) Guide Tubes and exit the lower head region through the jet pumps and the RR loops spilling out through the ruptured line. Even with only one CS loop, the water volume in the lower head area would be turned over several times per hour as a result. Responses to the three specific concerns are provided below:

a. Fermi 2 utilizes a LPCI loop select logic, which is designed to inject all of the LPCI flow through only one LPCI loop. LPCI flow is expected to enter the lower head area through the jet pumps in the selected loop, exit through the jet pumps in the non-selected loop in the reverse direction and spill out of the break. Thus the LPCI flow passes through the lower head region and mixes with the SLC solution before exiting the RPV.

b. The flow rate from one division of LPCI (with two pumps) is more than 20,000 gpm. This flow is directed into the lower head region through the 10 jet pump nozzles that accelerate the flow and drive it into the lower head region. The flow is then driven out of the lower head region through the non-active jet pumps in the reverse direction. In addition, CS flow will push water down through the reactor core and out around the CRD Guide Tubes to further sweep SLC solution out of the bottom head region. No single failure would disable both loops of CS. Based on these considerations, additional procedural controls are not considered necessary.

c. In the initial phases of ECCS injection there could be substantial steaming from decay and sensible heat in the core. However, longer term steaming rate is expected to be insignificant compared to the flow rate from even one CS loop. As stated in UFSAR Section 5.5.6.3.2, the reactor boil-off rate is approximately 600 gpm fifteen minutes after reactor shutdown, and declines thereafter. One loop of CS delivers approximately 6,000 gpm to the reactor through spargers above the reactor core. Only a small fraction of this water would boil in the core, even without considering the sub-cooled nature of the CS water. Therefore, most of this water would pass through the core and mix with the SLC solution in the bottom head region, flowing up through the non-active jet pumps and exiting the reactor through the postulated break.

Other Updates:

Reference 4 reported the latest results of an example of applying the methodology described in Reference 2 for the optional iodine deposition credit in secondary containment bypass leakage piping. The results reported for the Feedwater penetration on Page 3 of Enclosure 1 to Reference 4 are updated below:

- Using Approach A (see Reference 2) would require multiplying the measured penetration leak rate by 0.0167, and
- Using Approach B would require multiplying the measured leak rate by 6.59.

Table 1 Summary of Main Steam Line Piping Deposition Credit		
Parameter	**Value**	**Basis**
1) Leakage Limits	MSIV leakage per line: ≤ 100 scfh Total MSIV leakage for all lines: ≤ 150 scfh	Assumed values. The 100 scfh leak is assigned to the shortest steam line and the 50 scfh balance to the next shortest. This minimizes credit for settling and deposition by conservatively maximizing the velocity of the leakage inside the piping.
2) Steam Line Nodalization	Each steam line is modeled as two, well-mixed nodes. The first node is defined as the piping from the RPV nozzle to the inboard MSIV. The second node is defined as the piping between the inboard (first) and third MSIVs, which is the boundary of the seismically analyzed piping. A limiting faulted steam line upstream of the inboard MSIV is assumed.	This approach is consistent with the nodalization applied in AEB-98-03 for Perry as well as with previously approved analyses performed for Perry, Brunswick, Duane Arnold and Hope Creek. The Fermi 2 analysis assumes a worst case single active failure of an MSIV (see below) and assumes a faulted steam line. Piping take-off and corresponding line nodalization summary have been provided in Tables 3 and 4 of Reference 4.
3) Single Failure Assumptions	The outboard MSIV is assumed to be the worst case single failure. The outboard MSIV for the faulted line with maximum assigned MSIV flow is assumed to fail to close.	An active failure of an inboard MSIV would result in flow through penetration piping to be at containment conditions, i.e. at a lower volumetric flow than the depressurized flow outside of containment. A failure of the outboard MSIV depressurizes and speeds flow through penetration piping. For conservatism, two nodes are used for both steam lines with assigned MSIV leakage in the analysis.
4) Aerosol Deposition	Aerosol removal in the inboard and outboard piping nodes is evaluated using the formulations of the well-mixed methodology in AEB-98-03, Appendix A. This removal credit is implemented in the RADTRAD calculation in the form of an effective filter credit. No credit is assumed for the inboard node of the faulted line. The settling velocity is assumed as the median velocity based on the Monte Carlo analysis presented in AEB-98-03	This approach is consistent with the recommendations of Reg. Guide 1.183. Furthermore, it is conservative in that only horizontal piping is credited and the settling area is assumed to be only the bottom half of this piping. AEB-98-03 indicates that, based on the conservatism of the well-mixed assumption, the median velocity is an acceptable value. Table 3 provides a summary of the effective pipe filter efficiencies applied to the MSIV piping leak paths evaluated in the RADTRAD models.
5) Elemental Iodine Deposition	Elemental iodine removal in the inboard and outboard piping nodes is also evaluated using the formulations in AEB-98-03, Appendix A. However,	This approach is consistent with the formulations in AEB-98-03 and the guidance of Reg. Guide 1.183.

Table 1 Summary of Main Steam Line Piping Deposition Credit		
Parameter	**Value**	**Basis**
	Cline* deposition velocities are used, and with total piping credited, since gravitational settling is not an applicable transport mechanism. No credit is assumed for the inboard node of the faulted line.	
6) MS Line Temperature	For the inboard piping node, steam temperature of 554 degrees Fahrenheit is assumed for the 30-day accident duration. For the outboard piping node, a conservative plant-specific multi-step temperature profile is applied.	The application of a constant temperature for inboard piping is conservative. For the outboard node, the applicable temperature at the beginning of each time interval is held constant for the duration of the interval. Table 2 provides the temperature profile used in the analysis.
7) Organic Iodine Deposition	No organic iodine removal is credited.	Conservative
8) Transit Delay Credit	No plug flow based holdup credit will be taken.	Conservative
9) MSIV Containment Leak Rate	LLRT acceptance criterion is converted to its containment leak rate equivalent by applying pressure and temperature adjustment factors: Pressure: 14.7 / (14.7 + 25) Temperature: (554 + 460)/(68 + 460) After 24 hours, the MSIV leak rate is assumed to decrease by 50%. Where: 14.7 psi is standard atmospheric pressure, 25 psig is MSIV test pressure, 554° F is Accident steam temperature, and 68° F is standard atmospheric temperature	The temperature adjustment is an arbitrary conservatism; however, it provides an allowance for other effects such as a potentially higher volumetric flow rate during the estimated 10 minute post-LOCA period before containment pressure falls below the MSIV test pressure. This assumption has been made in accordance with Reg. Guide 1.183, Appendix A. This is supported by the expected post-accident pressure response of the containment and the conservatism inherent in the application of the full MSIV leak rate during the first 24 hours, as well as the calculation of inboard piping filter credit based on a 30-day post-accident constant pipe wall temperature that corresponds to normal steam line conditions with no credit for the expected post-accident cooldown.
10) Flow Rates Inside Piping	Inboard piping flow rates are the same as established above. Flow rates in outboard piping are "expanded" by not applying pressure adjustment.	Credit is taken for outboard MS pipe cooling based on a conservative application of a plant-specific steam line temperature evaluation.

* J.E.Cline, "MSIV Leakage Iodine Transport Analysis," Letter Report, March 26, 1991 (ADAMS ML003683718) as implemented in NUREG/CR-6604, Supplement 2

Table 2 Outboard MSL Temperature Profile	
Interval	**Temperature (degrees Fahrenheit)**
0-8 hours	554.00
8-16 hours	510.69
16-24 hours	472.08
24-96 hours	437.66
96-720 hours	289.39

Table 3 MSL Decontamination Factors Due to Iodine Deposition				
Description	**Inboard B**	**Inboard D**	**Outboard B**	**Outboard D**
Uncorrected Flow Rate (scfh)	100 (faulted)	50	100	50
Aerosol Settling Velocity (m/s)	1.170E-03	1.170E-03	1.170E-03	1.170E-03
Initial Elemental Deposition Velocity [0-8 hours] (m/s)	5.465E-06	5.465E-06	5.465E-06	5.465E-06
Initial Pipe Flow Rate [0-8 hours] corrected for Temp and Press (cfm)	1.185	0.593	3.201	1.600
Aerosol Settling Rate Constant (hr^{-1})	0.00	1.38E+01	1.48E+01	1.49E+01
Initial Elemental Deposition Rate Constant [0-8 hours] (hr^{-1})	0.00	1.29E-01	1.39E-01	1.40E-01
Aerosol Filter Efficiency (0-8 hrs)	0.00%	98.27%	96.30%	98.56%
Aerosol Filter Efficiency (8-16 hrs)	0.00%	98.27%	96.45%	98.62%
Aerosol Filter Efficiency (16-24 hrs)	0.00%	98.27%	96.59%	98.68%
Aerosol Filter Efficiency (24-96 hrs)	0.00%	99.13%	98.33%	99.36%
Aerosol Filter Efficiency (96-720 hrs)	0.00%	99.13%	98.60%	99.46%
Elemental Filter Efficiency (0-8 hrs)	0.00%	53.61%	24.42%	44.46%
Elemental Filter Efficiency (8-16 hrs)	0.00%	53.61%	29.66%	51.09%
Elemental Filter Efficiency (16-24 hrs)	0.00%	53.61%	35.27%	57.45%
Elemental Filter Efficiency (24-96 hrs)	0.00%	69.80%	58.22%	77.54%
Elemental Filter Efficiency (96-720 hrs)	0.00%	69.80%	83.58%	92.66%

Notes: No flow assumed in lines A and C.
No organic iodine removal is credited.

Table 4 LOCA Radiological Consequence Analysis Results			
Location	**Duration**	**TEDE (rem)**	**Regulatory Limit TEDE (rem)**
Control Room	30 days	4.68	5
EAB	Maximum, 2 hours	6.69	25
LPZ	30 days	3.42	25

ENCLOSURE 2 TO
NRC-04-0051

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

RADTRAD Files

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Radtrad 3.03 4/15/2001
 3499MWth Power Level - Fermi Unit 2 MSIV Leakage and Unfiltered SC Bypass PC
Leakage - Separate Compartmentalized Inboard/Outboard Piping Deposition Credit
- AEB-98-03 Type Dep Model - 600 cfm CR Unfiltered Inleakage
 Nuclide Inventory File:
 h:\nuc\detedis\process\ast\loca\attachment f\fermiast-loca (corrected).nif
 Plant Power Level:
  3.4990E+03
 Compartments:
  10
 Compartment 1:
 Containment
   3
  2.9460E+05
   0
   0
   0
   1
   0
 Compartment 2:
 MS Line B Inboard
   3
  1.0000E-03
   0
   0
   0
   0
   0
 Compartment 3:
 MS Line D Inboard
   3
  3.2000E+02
   0
   0
   0
   0
   0
 Compartment 4:
 MS Line A Inboard
   3
  3.2000E+02
   0
   0
   0
   0
   0
 Compartment 5:
 Environment
   2
  0.0000E+00
   0
   0
   0
   0
   0
 Compartment 6:
 Control Room
   1
  5.6960E+04
   0
   0
   1
   0
```

```
  0
Compartment 7:
MS Line B Outboard
  3
 4.4600E+02
  0
  0
  0
  0
  0
Compartment 8:
MS Line D Outboard
  3
 5.4800E+02
  0
  0
  0
  0
  0
Compartment 9:
MS Line A Outboard
  3
 5.5000E+02
  0
  0
  0
  0
  0
Compartment 10:
Hold
  3
 1.0000E+00
  0
  0
  0
  0
  0
Pathways:
 14
Pathway 1:
Containment to Environment (Unfiltered PC Leakage Bypassing SC)
  1
  5
  4
Pathway 2:
Containment Leak to Node 1 MSL B
  1
  2
  2
Pathway 3:
Containment Leak to Node 1 MSL D
  1
  3
  2
Pathway 4:
Containment Leak to Node 1 MSL A
  1
  4
  2
Pathway 5:
Filtered Environment to Control Room (Intake)
  5
  6
```

```
  2
Pathway 6:
Unfiltered Environment to Control Room (Inleakage)
  5
  6
  2
Pathway 7:
Control Room to Environment (Exhaust)
  6
  5
  2
Pathway 8:
MS Line B Node 1 Inboard to MS Line B Node 2 Outboard
  2
  7
  2
Pathway 9:
MS Line D Node 1 Inboard to MS Line D Node 2 Outboard
  3
  8
  2
Pathway 10:
MS Line A Node 1 Inboard to MS Line A Node 2 Outboard
  4
  9
  2
Pathway 11:
MS Line B Node 2 Outboard to Environment
  7
  5
  2
Pathway 12:
MS Line D Node 2 Outboard to Environment
  8
  5
  2
Pathway 13:
MS Line A Node 2 Outboard to Environment
  9
  5
  2
Pathway 14:
Containment to Hold (Filtered PC Leakage)
  1
  10
  4
End of Plant Model File
Scenario Description Name:

Plant Model Filename:

Source Term:
  1
  1   1.0000E+00
c:\program files\radtrad3-03\defaults\fgr11&12.inp
c:\program files\radtrad3-03\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:
 10
Compartment 1:
  0
  1
  0
  0
  0
  0
  0
  3
  3
  1.0000E+01
  1
  1
  0.0000E+00   0.0000E+00
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
  0
  0
  0
Compartment 5:
  0
  1
  0
  0
  0
  0
  0
  0
  0
Compartment 6:
  0
  1
  0
```

```
  0
  0
  0
  1
  2.7050E+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 7:
  0
  1
  0
  0
  0
  0
  0
  0
  0
Compartment 8:
  0
  1
  0
  0
  0
  0
  0
  0
  0
Compartment 9:
  0
  1
  0
  0
  0
  0
  0
  0
  0
Compartment 10:
  0
  1
  0
  0
  0
  0
  0
  0
  0
Pathways:
 14
Pathway 1:
  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 2:
  0
  0
  0
  0
  0
  1
  4
  0.0000E+00   2.0390E+00   0.0000E+00   0.0000E+00   0.0000E+00
  2.0000E+00   1.1850E+00   0.0000E+00   0.0000E+00   0.0000E+00
  2.4000E+01   5.9260E-01   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 3:
  0
  0
  0
  0
  0
  1
  4
  0.0000E+00   1.0190E+00   0.0000E+00   0.0000E+00   0.0000E+00
  2.0000E+00   5.9260E-01   0.0000E+00   0.0000E+00   0.0000E+00
  2.4000E+01   2.9630E-01   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 4:
  0
  0
  0
  0
  0
  1
  4
  0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  2.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  2.4000E+01   0.0000E+00   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
```

```
  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 6:
  0
  0
  0
  0
  0
  1
  2
  0.0000E+00   1.3526E+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 7:
  0
  0
  0
  0
  0
  1
  2
  0.0000E+00   5.4086E+02   1.0000E+02   1.0000E+02   1.0000E+02
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 8:
  0
  0
  0
  0
  0
  1
  4
  0.0000E+00   1.1850E+00   0.0000E+00   0.0000E+00   0.0000E+00
  2.4000E+01   5.9260E-01   0.0000E+00   0.0000E+00   0.0000E+00
  9.6000E+01   5.9260E-01   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 9:

0
0
0
0
0
1
4

0.0000E+00	5.9260E-01	9.8270E+01	5.3610E+01	0.0000E+00
2.4000E+01	2.9630E-01	9.9130E+01	6.9800E+01	0.0000E+00
9.6000E+01	2.9630E-01	9.9130E+01	6.9800E+01	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 10:

0
0
0
0
0
1
4

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
2.4000E+01	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
9.6000E+01	0.0000E+00	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 11:

0
0
0
0
0
1
6

0.0000E+00	3.2010E+00	9.6300E+01	2.4420E+01	0.0000E+00
8.0000E+00	3.0640E+00	9.6450E+01	2.9660E+01	0.0000E+00
1.6000E+01	2.9420E+00	9.6590E+01	3.5270E+01	0.0000E+00
2.4000E+01	1.4170E+00	9.8330E+01	5.8220E+01	0.0000E+00
9.6000E+01	1.1830E+00	9.8600E+01	8.3580E+01	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 12:

0
0
0
0
0
1

```
  6
  0.0000E+00   1.6000E+00   9.8560E+01   4.4460E+01   0.0000E+00
  8.0000E+00   1.5320E+00   9.8620E+01   5.1090E+01   0.0000E+00
  1.6000E+01   1.4710E+00   9.8680E+01   5.7450E+01   0.0000E+00
  2.4000E+01   7.0840E-01   9.9360E+01   7.7540E+01   0.0000E+00
  9.6000E+01   5.9140E-01   9.9460E+01   9.2660E+01   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 13:
  0
  0
  0
  0
  0
  1
  6
  0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  8.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  1.6000E+01   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  2.4000E+01   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  9.6000E+01   0.0000E+00   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 14:
  0
  0
  0
  0
  0
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   4.7500E-02
  2.4000E+01   2.3750E-02
  7.2000E+02   0.0000E+00
  0
Dose Locations:
  3
Location 1:
Control Room
  6
  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
Location 2:
EAB
  5
  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 3:
LPZ
  5
  1
  5
  0.0000E+00   2.1700E-05
  8.0000E+00   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   3.5000E-04
  8.0000E+00   1.8000E-04
  2.4000E+01   2.3000E-04
  7.2000E+02   0.0000E+00
  0
Effective Volume Location:
  1
  6
  0.0000E+00   3.1000E-04
  2.0000E+00   2.3300E-04
  8.0000E+00   9.9300E-05
  2.4000E+01   7.0800E-05
  9.6000E+01   5.4800E-05
  7.2000E+02   0.0000E+00
Simulation Parameters:
  1
  0.0000E+00   0.0000E+00
Output Filename:
H:\NUC\DETEDIS\PROCESS\AST\LOCA\AST LOCA Rev 2 RADTRAD Runs and Supporting
Files\Fermi 2 MSIV and SC Bypass Leakage - 150 scfh Leak - 600cfm CR Unfilt
Inleak.o0
  1
  1
  1
  0
  0
End of Scenario File
```

```
Radtrad 3.03 4/15/2001
 3499 MWth Power Level - Filtered PC Leakage Only, 600 cfm CR bypass
 Nuclide Inventory File:
 h:\nuc\detedis\process\ast\loca\attachment f\fermiast-loca (corrected).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
  2
Pathway 6:
MS Line D Containment to Hold
  1
  5
  2
Pathway 7:
MS Line A  Containment to Hold
  1
  5
  2
Pathway 8:
Containment Leakage Bypassing Secondary Containment to Hold
  1
  5
  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\radtrad3-03\defaults\fgr11&12.inp
c:\program files\radtrad3-03\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   5.4086E+02   9.9000E+01   9.9000E+01   9.9000E+01
  5.0000E-01   5.4086E+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   1.3530E+02   0.0000E+00   0.0000E+00   0.0000E+00
  5.0000E-01   1.3530E+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
  0
  0
  0
```

```
  1
  4
  0.0000E+00   2.0385E+00   0.0000E+00   0.0000E+00   0.0000E+00
  2.0000E+00   1.1852E+00   0.0000E+00   0.0000E+00   0.0000E+00
  2.4000E+01   5.9260E-01   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 6:
  0
  0
  0
  0
  0
  1
  4
  0.0000E+00   1.0193E+00   0.0000E+00   0.0000E+00   0.0000E+00
  2.0000E+00   5.9260E-01   0.0000E+00   0.0000E+00   0.0000E+00
  2.4000E+01   2.9630E-01   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 7:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  2.4000E+01   0.0000E+00   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 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
  5
  0.0000E+00   2.1700E-05
  8.0000E+00   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
  6
  0.0000E+00   6.1800E-04
  2.0000E+00   4.5300E-04
  8.0000E+00   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\AST LOCA Rev 2 RADTRAD Runs and Supporting
Files\Fermi 2 Filtered PC Leakage - (with 150scfh MSIV Leak) smallCR-with 600
CR unfiltered.o0
  1
  2
  1
  0
  1
End of Scenario File
```

```
Radtrad 3.03 4/15/2001
 3499 MWth Power Level ECCS Peak w reduced flashing, 15 min SC bypass, 600 cfm
unfiltered CR intake
 Nuclide Inventory File:
 H:\NUC\DETEDIS\PROCESS\AST\LOCA\Attachment F\fermiast-eccs.nif
 Plant Power Level:
  3.4990E+03
 Compartments:
   4
 Compartment 1:
 ECCS FLUID
   3
  9.4934E+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\radtrad3.03\defaults\fgr11&12.inp
c:\program files\radtrad3.03\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   5.4086E+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   1.3526E+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
  5
  0.0000E+00   2.1700E-05
  8.0000E+00   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
  6
  0.0000E+00   3.1000E-04
  2.0000E+00   2.3300E-04
  8.0000E+00   9.9300E-05
  2.4000E+01   7.0800E-05
  9.6000E+01   5.4800E-05
  7.2000E+02   0.0000E+00
 Simulation Parameters:
  1
  0.0000E+00   0.0000E+00
 Output Filename:
 H:\NUC\DETEDIS\PROCESS\AST\LOCA\New Folder\(~3499MWth) ECCS PEAK-600ufil 15min
drawdown reduced flash.o0
  1
  2
  1
  0
  1
 End of Scenario File
```

```
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
 0.5051E+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
 0.8162E+02
U-234    0.1000E+01
none     0.0000E+00
none     0.0000E+00
Nuclide 055:
Pu-239
  8
 0.7594336440E+12
 0.2390E+03
 0.1041E+02
U-235    0.1000E+01
none     0.0000E+00
none     0.0000E+00
Nuclide 056:
```

```
Pu-240
  8
 0.2062920312E+12
 0.2400E+03
 0.1826E+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
 0.3847E+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
 0.4902E+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
 0.1233E+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
 0.5321E+02
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
```