CRWMS/M&O

Design Analysis Cover Sheet

Complete only applicable items.

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12. REMARKS

This analysis was started under procedure QAP-3-9, REV 06. During the development of this analysis QAP-3-9 was modified to REV 07. Impact review HAB-IR-002 was performed, and it was determined that this analysis should be completed under procedure QAP-3-9, REV 06, with some procedure modifications as documented in the impact review.

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CRC Depletion Calculations for the Non-Rodded Assemblies in Batches 1, 2, and 3 of Crystal River Unit 3	
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Table of Contents

Item **Page**

1. Purpose 4

2. Quality Assurance 4

3. Method 4

4. Design Inputs 5
   - 4.1 Design Parameters 5
     - 4.1.1 Fuel Assembly Descriptions 5
     - 4.1.2 Burnable Poison Rod Assembly (BPRA) Description 6
     - 4.1.3 System Pressure 7
     - 4.1.4 Fuel Assembly Insertion and Burnable Poison Loading Histories 7
     - 4.1.5 Fuel Assembly Insertion Position Histories 8
     - 4.1.6 Reactor Cycle History Data 9
     - 4.1.7 Boron Letdown Data 13
     - 4.1.8 Burnup, Fuel Temperature, and Moderator Specific Volume Data 19
   - 4.2 Criteria 42
   - 4.3 Assumptions 43
   - 4.4 Codes and Standards 43

5. References 44

6. Use of Computer Software 45
   - 6.1 Scientific and Engineering Software 45
   - 6.2 Computational Support Software 46

7. Design Analysis 46
   - 7.1 Assembly Depletion Calculation Procedure 46
   - 7.2 Path B Unit Cell Model Development 47
   - 7.3 Cycle Irradiation History Layouts for the Depletion of Non-Rodded Assemblies 55
   - 7.4 The Commercial Reactor Assembly Follow Taskmaster (CRAFT) Code & Usage 59
   - 7.5 Input & Output Filename Descriptions for CRAFT and SAS2H 62
   - 7.6 Non-Rodded Assembly Depletion Calculations for Fuel Batches 1, 2, and 3 of Crystal River Unit 3 63
   - 7.7 Isotopic Results 77

8. Conclusions 78

9. Attachments 78

1. Purpose

The purpose of this design analysis is to document the SAS2H depletion calculations of certain non-rodded fuel assemblies from batches 1, 2, and 3 of the Crystal River Unit 3 pressurized water reactor (PWR) that are required for Commercial Reactor Critical (CRC) evaluations to support development of the disposal criticality methodology. A non-rodded assembly is one which never contains a control rod assembly (CRA) or an axial power shaping rod assembly (APSRA) during its irradiation history. The objective of this analysis is to provide SAS2H generated isotopic compositions for each fuel assembly's depleted fuel and depleted burnable poison materials. These SAS2H generated isotopic compositions are acceptable for use in CRC benchmark reactivity calculations containing the various fuel assemblies.

2. Quality Assurance

The Quality Assurance (QA) program applies to this analysis. The work reported in this document is part of the criticality disposal methodology development that will eventually support the License Application Design phase. This activity, when appropriately confirmed, can impact the proper functioning of the Mined Geologic Disposal System (MGDS) waste package; the waste package has been identified as an MGDS Q-List item important to safety and waste isolation (pp. 4, 15, Ref. 5.6). The waste package is on the Q-List by direct inclusion by the Department of Energy (DOE), without conducting a QAP-2-3 evaluation. As determined by an evaluation performed in accordance with QAP-2-0, *Conduct of Activities*, the work performed for this analysis is subject to *Quality Assurance Requirements and Description* (QARD; Ref. 5.2) requirements. As specified in NLP-3-18 "Documentation of QA Controls on Drawings, Specifications, Design Analyses, and Technical Documents", the development of this analysis is subject to QA controls. The Waste Package Development Department (WPDD) responsible manager has selected the applicable procedural controls for this activity commensurate with the work control activity evaluation entitled "Perform Criticality, Thermal, Structural, and Shielding Analyses" (Ref. 5.1).

The work reported in this document is part of the CRC neutronic analyses to support the development of the disposal criticality methodology. All design parameters utilized in this analysis are from a qualified source (Ref. 5.3). Therefore, all design parameters utilized in this analysis are qualified.

3. Method

The method for obtaining fuel and burnable poison isotopic compositions at specific points during each assembly's irradiation history is based upon the use of the SAS2H control module of the SCALE 4.3 modular code system (Ref. 5.4). The effective full-power day (EFPD) times during reactor operation that correspond to a CRC evaluation are called "statepoints". An assembly depletion calculation between two CRC statepoints is called a "statepoint calculation". The depleted fuel and depleted burnable poison compositions obtained from statepoint calculations may be used in subsequent CRC reactivity calculations. The SAS2H input decks are automatically developed by the Commercial Reactor Assembly Follow Taskmaster (CRAFT) program which is a software routine documented in Sections 7.4 and 7.5 and Attachment I of this analysis. The SAS2H input decks and depletion models are

developed using actual assembly specifications and irradiation histories. The isotopic results obtained from the SAS2H depletion calculations are reviewed and analyzed to identify any anomalous results which may propagate to subsequent CRC reactivity calculations and ultimately impact the development of the disposal criticality methodology.

4. Design Inputs

The design inputs documented in this analysis describe the design specifications and irradiation histories for certain non-rodded fuel assemblies in fuel batches 1, 2, and 3 of the Crystal River Unit 3 PWR. All of the design inputs listed in this analysis are obtained from reference 5.3, which is an intermediate reference summarizing the necessary input parameters and documenting the original references from which the input parameters are obtained.

4.1 Design Parameters

4.1.1 Fuel Assembly Descriptions

Table 4.1.1-1 contains a description of the fuel assemblies corresponding to fuel batches 1, 2, and 3 of Crystal River Unit 3. All fuel assemblies within a given fuel batch have the same characteristics as identified in Table 4.1.1-1.

Table 4.1.1-1 Fuel Assembly Descriptions for Batches 1, 2, and 3 of Crystal River Unit 3

	Fuel Batch Identifier		
Parameter	**1**	**2**	**3**
Assembly Type	Mark-B3	Mark-B3	Mark-B3
Weight Percent U-235	1.93	2.54	2.83
kg of U per Assembly	463.63	463.63	463.63
Fuel Height (cm)	360.172	360.172	360.172
Fuel Pellet OD[1] (cm)	0.9398	0.9398	0.9398
Fuel Rod Clad OD (cm)	1.0922	1.0922	1.0922
Fuel Rod Clad ID[2] (cm)	0.95758	0.95758	0.95758
Spacer Grid Material	Inconel	Inconel	Inconel
Volume Fraction of Spacer Grid in Moderator	0.005757609	0.005757609	0.005757609
Guide Tube Material	Zircaloy	Zircaloy	Zircaloy

	Fuel Batch Identifier		
Parameter	1	2	3
Guide Tube OD (cm)	1.3462	1.3462	1.3462
Guide Tube ID (cm)	1.26492	1.26492	1.26492
Instrument Tube Material	Zircaloy	Zircaloy	Zircaloy
Instrument Tube OD (cm)	1.38193	1.38193	1.38193
Instrument Tube ID (cm)	1.12014	1.12014	1.12014
Array Size	15x15	15x15	15x15
Number of Fuel Rods	208	208	208
Number of Guide Tubes	16	16	16
Number of Instr. Tubes	1	1	1
Pin Pitch (cm)	1.44272	1.44272	1.44272
Assembly Pitch (cm)	21.81098	21.81098	21.81098

[1]OD means outer diameter
[2]ID means inner diameter

4.1.2 Burnable Poison Rod Assembly (BPRA) Description

Table 4.1.2-1 contains a description of the burnable poison rod assembly utilized in the various fuel assemblies from fuel batches 1, 2, and 3 of Crystal River Unit 3. The rods of the BPRA are inserted into the guide tubes of the fuel assembly during irradiation to produce a lower thermal flux which ultimately allows for longer fuel assembly burnup and better core power distributions.

Table 4.1.2-1 BPRA Descriptions for Use in Batches 1, 2, and 3 of Crystal River Unit 3

Parameter	Value
Burnable Poison (BP) Material	Al_2O_3-B_4C
BP Density (g/cc)	3.7
BP Pellet OD (cm)	0.8636
Burnable Poison Rod (BPR) Cladding Material	Zircaloy
BPR Cladding OD (cm)	1.0922

Parameter	Value
BPR Cladding ID (cm)	0.9144
Number of BPR's in a BPRA	16

4.1.3 System Pressure

Crystal River Unit 3 is a pressurized water reactor that operates at a constant pressure of 2200 psi.

4.1.4 Fuel Assembly Insertion and Burnable Poison Loading Histories

The actual irradiation histories of the fuel assemblies in batches 1, 2, and 3 must be used to appropriately perform the various assembly depletion calculations relevant to the CRC analyses. Table 4.1.4-1 contains the assembly insertion and BP loading histories for the non-rodded assemblies in fuel batches 1, 2, and 3 which are required for the CRC analyses of Crystal River Unit 3. (Note: Assembly A14a was removed from the reactor after Cycle-2 and re-inserted during Cycle-7.)

Table 4.1.4-1 Crystal River Unit 3, Batches 1, 2, and 3, Non-Rodded Fuel Assembly Insertion and BP Loading Histories

Assembly Number/Batch	Assembly Location in Cycle 1A	1B	2	3	4	5	6	7	Comments
A2/2	**1.34**	X	X						**The "A" designation in the assembly number indicates that Cycle 1A is the assembly's initial insertion cycle.**
A3/1	X	X							
A6/2	**1.18**	X	X						
A8/3	X	X	X	X					
A9/1	X	X							
A10/2	**1.34**	X	X						
A11/1	X	X							
A12/2	**1.18**	X	X						**For BP rods, the wt% of B4C in the BP pellet material is given.**
A12a/2	**1.18**	X	X						
A13/1	X	X							
A14a/2	**1.34**	X	X					X	
A15/3	X	X	X	X					**The "X" indicates that the assembly is present in the cycle indicated.**
A16/1	X	X							
A17/2	**1.01**	X	X						
A19/2	**1.18**	X	X						

Assembly Number/Batch	Assembly Location in Cycle 1A	1B	2	3	4	5	6	7	Comments
A21/3	X	X	X	X					
A24/1	X	X							
A27/3	1.18	X	X	X					

4.1.5 Fuel Assembly Insertion Position Histories

The positions of the various assemblies in the core must be known to correlate the burnup, fuel temperature, and moderator specific volume data with the appropriate assembly. The assembly position data is also used to document the depletion cases so that the appropriate isotopic results may be identified at a later time for a specific assembly in a particular position of the core. Table 4.1.5-1 contains the assembly position histories for the non-rodded assemblies in batches 1, 2, and 3 of Crystal River Unit 3 which are relevant to the CRC analyses. The assembly position identifiers refer to locations in a one-eighth core symmetrical arrangement for Crystal River Unit 3 as shown in Figure 4.1.5-1. The integer values (1-29) shown in Figure 4.1.5-1 are used in the SAS2H depletion calculations to identify the various assembly locations.

Table 4.1.5-1 Assembly Position Histories for the Non-Rodded Assemblies from Batches 1, 2, and 3 of Crystal River Unit 3

Assembly Number	Assembly Location in Cycle 1A	1B	2	3	4	5	6	7
A2	H9	H9	H9					
A3	H10	H10						
A6	H13	H13	H13					
A8	H15	H15	H12	H9				
A9	K9	K9						
A10	K10	K10	M13					
A11	K11	K11						
A12	K12	K12	K9					
A12a	K12	K12	H11					
A13	K13	K13						
A14a	K14	K14	K14					L10
A15	K15	K15	K10	K14				
A16	L10	L10						
A17	L11	L11	L11					
A19	L13	L13	L13					

Assembly Number	Assembly Location in Cycle							
	1A	1B	2	3	4	5	6	7
A21	L15	L15	K11	L11				
A24	M13	M13						
A27	N13	N13	K12	M13				

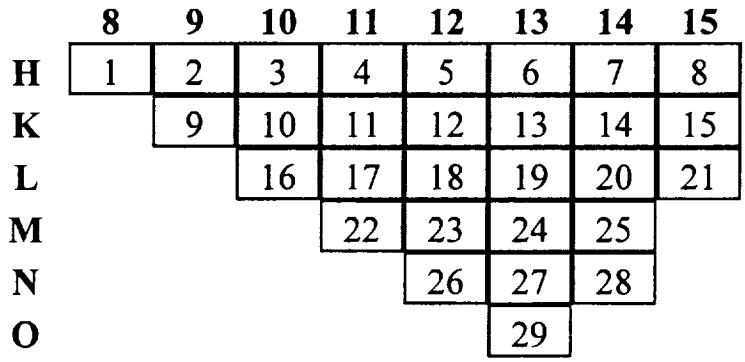


Figure 4.1.5-1 One-Eighth Symmetry Core Layout for Crystal River Unit 3

4.1.6 Reactor Cycle History Data

Table 4.1.6-1 contains a listing of the Crystal River Unit 3 reactor cycle history data that is relevant to the SAS2H depletion calculations for the CRC analyses. The time durations other than the days of downtime and the total cycle effective full power days presented in Table 4.1.6-1 are calculated using the appropriate dates from Table 4.1.6-1 and the Lotus 1-2-3 "DATEDIF" function.

Table 4.1.6-1 Crystal River Unit 3 Reactor Cycle History Data

Crystal River, Unit-3, Cycle-1A Summary

01/14/77 : Cycle Start Date
03/03/78 : Cycle End Date
413 : Cycle Length (Calendar Days)
268.8 : Cycle Effective Full Power Day (EFPD) Value

195.292 : Calendar Days of Downtime Between Cycle 1A and 1B

Table 4.1.6-1 Crystal River Unit 3 Reactor Cycle History Data

Crystal River, Unit-3, Cycle-1B Summary

09/18/78 : Cycle Start Date (09/15/78: Ref. 5.3)
03/03/79 : 411.0 EFPD Shutdown Date
03/18/79 : Restart Date After the 411.0 EFPD Shutdown
04/23/79 : Cycle End Date
166 : Cycle Length to 411.0 EFPD Date
36 : Cycle Length from 411.0 EFPD Restart to End of Cycle (EOC)
217 : Total Cycle Length (Calendar Days)
14.792 : Days of Downtime During Shutdown at 411.0 EFPD
171.3 : Total Cycle Effective Full Power Days

97 : Calendar Days of Downtime Between Cycle 1B and 2

Crystal River, Unit-3, Cycle-2 Summary

07/29/79 : Cycle Start Date
02/26/80 : Cycle End Date
212 : Cycle Length (Calendar Days)
166.5 : Cycle Effective Full Power Days

164 : Calendar Days of Downtime Between Cycle 2 and 3

Crystal River, Unit-3, Cycle-3 Summary

08/08/80 : Cycle Start Date
02/17/81 : 168.5 EFPD Shutdown Date
03/06/81 : Restart Date After the 168.5 EFPD Shutdown
06/30/81 : 250.0 EFPD Shutdown Date
07/13/81 : Restart Date After the 250.0 EFPD Shutdown
09/28/81 : Cycle End Date
193 : Cycle Length to 168.5 EFPD Date
116 : Cycle Length from 168.5 EFPD Restart to 250.0 EFPD Date
77 : Cycle Length from 250.0 EFPD Restart to EOC Date
416 : Total Cycle Length (Calendar Days)
16.792 : Days of Downtime During Shutdown at 168.5 EFPD

Table 4.1.6-1 Crystal River Unit 3 Reactor Cycle History Data

12.333 : Days of Downtime During Shutdown at 250.0 EFPD
323 : Total Cycle Effective Full Power Days

73 : Calendar Days of Downtime Between Cycle 3 and 4

Crystal River, Unit-3, Cycle-4 Summary

12/10/81 : Cycle Start Date
10/14/82 : 228.1 EFPD Shutdown Date
10/31/82 : Restart Date After the 228.1 EFPD Shutdown (10/29/82: Ref. 5.3)
11/25/82 : 253.0 EFPD Shutdown Date (11/26/82: Ref. 5.3)
12/20/82 : Restart Date After the 253.0 EFPD Shutdown
03/19/83 : Cycle End Date
308 : Cycle Length to 228.1 EFPD Date
25 : Cycle Length from 228.1 EFPD Restart to 253.0 EFPD Date
89 : Cycle Length from 253.0 EFPD Restart to EOC Date
464 : Total Cycle Length (Calendar Days)
15.167 : Days of Downtime During Shutdown at 228.1 EFPD
24 : Days of Downtime During Shutdown at 253.0 EFPD
336.6 : Total Cycle Effective Full Power Days

127 : Calendar Days of Downtime Between Cycle 4 and 5

Crystal River, Unit-3, Cycle-5 Summary

07/24/83 : Cycle Start Date
11/05/84 : 388.5 EFPD Shutdown Date
11/10/84 : Restart Date After the 388.5 EFPD Shutdown
03/08/85 : Cycle End Date
470 : Cycle Length to 388.5 EFPD Date
118 : Cycle Length from 388.5 EFPD Restart to EOC Date
593 : Total Cycle Length (Calendar Days)
4.958 : Days of Downtime During Shutdown at 388.5 EFPD
484.4 : Total Cycle Effective Full Power Days

163 : Calendar Days of Downtime Between Cycle 5 and 6

Table 4.1.6-1 Crystal River Unit 3 Reactor Cycle History Data

Crystal River, Unit-3, Cycle-6 Summary

08/18/85 : Cycle Start Date
01/01/86 : 96.0 EFPD Shutdown Date
06/19/86 : Restart Date After the 96.0 EFPD Shutdown
08/21/87 : 400.0 EFPD Shutdown Date
08/31/87 : Restart Date After the 400.0 EFPD Shutdown (09/01/87: Ref. 5.3)
09/18/87 : Cycle End Date
136 : Cycle Length to 96.0 EFPD Date
428 : Cycle Length from 96.0 EFPD Restart to 400.0 EFPD Date
18 : Cycle Length from 400.0 EFPD Restart to EOC Date
761 : Total Cycle Length (Calendar Days)
168.917 : Days of Downtime During Shutdown at 96.0 EFPD
10.417 : Days of Downtime During Shutdown at 400.0 EFPD
412.07 : Total Cycle Effective Full Power Days

113 : Calendar Days of Downtime Between Cycle 6 and 7

Crystal River, Unit-3, Cycle-7 Summary

01/08/88 : Cycle Start Date
10/09/88 : 260.3 EFPD Shutdown Date
10/28/88 : Restart Date After the 260.3 EFPD Shutdown (10/27/88: Ref. 5.3)
12/07/88 : 291.0 EFPD Shutdown Date
01/16/89 : Restart Date After the 291.0 EFPD Shutdown (01/15/89: Ref. 5.3)
02/26/89 : 319.0 EFPD Shutdown Date
06/16/89 : Restart Date After the 319.0 EFPD Shutdown
01/22/90 : 462.3 EFPD Shutdown Date
01/24/90 : Restart Date After the 462.3 EFPD Shutdown
02/12/90 : 479.0 EFPD Shutdown Date (02/13/90: Ref. 5.3)
02/19/90 : Restart Date After the 479.0 EFPD Shutdown (02/20/90: Ref. 5.3)
03/14/90 : Cycle End Date
275 : Cycle Length to 260.3 EFPD Date
40 : Cycle Length from 260.3 EFPD Restart to 291.0 EFPD Date

Table 4.1.6-1 Crystal River Unit 3 Reactor Cycle History Data

41	Cycle Length from 291.0 EFPD Restart to 319.0 EFPD Date
220	Cycle Length from 319.0 EFPD Restart to 462.3 EFPD Date
19	Cycle Length from 462.3 EFPD Restart to 479.0 EFPD Date
23	Cycle Length from 479.0 EFPD Restart to EOC
796	Total Cycle Length (Calendar Days)
18.875	Days of Downtime During Shutdown at 260.3 EFPD
39.5	Days of Downtime During Shutdown at 291.0 EFPD
109.5	Days of Downtime During Shutdown at 319.0 EFPD
2.229	Days of Downtime During Shutdown at 462.3 EFPD
7.208	Days of Downtime During Shutdown at 479.0 EFPD
497.9	Total Cycle Effective Full Power Days
99	Calendar Days of Downtime Between Cycle 7 and 8

A number of the dates presented in Table 4.1.6-1 do not correspond directly with the dates presented in reference 5.3. The date contained in reference 5.3, is presented in parentheses next to each inconsistency. Differences in the restart and shutdown date values do not affect the calculations due to the fact that the depletions are based upon effective full-power day durations rather than calendar day durations. The various calendar day time periods between statepoints as presented in Table 4.1.6-1 are used for documentation purposes only. The cycle starting and ending dates are the only dates presented in Table 4.1.6-1 which are involved in calculations that are documented in this analysis. A cycle's starting and ending dates are used to calculate calendar day decay durations for fuel assemblies which skip that particular cycle. Cycle-1B is the only cycle relevant to this analysis which used a starting date that does not directly correspond to the dates provided in reference 5.3. There are no assembly depletion and decay calculations documented in this analysis which were in Cycle-1A and skipped Cycle-1B to be inserted at a later time. The days of downtime between cycles are not calculated from the dates presented in Table 4.1.6-1. The days of downtime between cycles are obtained directly from reference 5.3 in units of hours to be converted to days for presentation in Table 4.1.6-1 and use in this analysis. Therefore, no calculations documented in this analysis are affected by the date inconsistencies between Table 4.1.6-1 and reference 5.3.

4.1.7 Boron Letdown Data

The boron letdown data provided in the Core Operations Reports for Cycle 1A through Cycle 7 of Crystal River Unit 3 is used to determine the soluble boron concentration in the moderator at the mid-point of each irradiation step in the various SAS2H depletion calculations performed to deplete the non-rodded fuel assemblies of batches 1, 2, and 3. The boron concentrations at the irradiation step mid-point effective full-power day (EFPD) times are determined by linear interpolation between the measured values listed in Tables 4.1.7-1 through 4.1.7-5. The boron letdown data tables presented in this section

are obtained from reference 5.3, which is a summary compilation of data pertinent to CRC analyses for Crystal River Unit 3. The specific irradiation step mid-point boron concentrations obtained from this data are presented in Section 7.3.

Table 4.1.7-1 Boron Letdown Data for Cycle 1A of Crystal River Unit 3

Exposure (EFPD)	Boron Concentration (ppm*)
0.0	1147
7.2	968
18.6	912
55.2	934
63.8	909
69.9	909
94.9	884
184.7	705
192.3	683
216.0	627
224.8	610
228.5	666
238.0	584
244.0	575
250.8	614
254.7	588

* The acronym "ppm" means parts per million by mass of moderator.

Table 4.1.7-2 Boron Letdown Data for Cycle 1B of Crystal River Unit 3

EFPD with Cycles 1A & 1B Continuous [EFPD with BOC*-1B set to 0.0 EFPD]	Boron Concentration (ppm)
269.4 [0.6]	843
269.8 [1.0]	783

Table 4.1.7-2 Boron Letdown Data for Cycle 1B of Crystal River Unit 3

EFPD with Cycles 1A & 1B Continuous [EFPD with BOC*-1B set to 0.0 EFPD]	Boron Concentration (ppm)
272.0 [3.2]	748
280.2 [11.4]	558
287.2 [18.4]	571
306.2 [37.4]	513
313.2 [44.4]	441
337.2 [68.4]	419
345.7 [76.9]	346
364.2 [95.4]	309
377.6 [108.8]	246
389.5 [120.7]	279
401.7 [132.9]	290
419.3 [150.5]	272
427.1 [158.3]	229
431.8 [163.0]	231
437.1 [168.3]	229
440.1 [171.3]	242

* The acronym "BOC" means beginning of cycle.

Table 4.1.7-3 Boron Letdown Data for Cycle 2 of Crystal River Unit 3

Exposure (EFPD)	Boron Concentration (ppm)
0.6	930
0.8	930
0.9	930
2.1	826

Table 4.1.7-3 Boron Letdown Data for Cycle 2 of Crystal River Unit 3

Exposure (EFPD)	Boron Concentration (ppm)
3.0	809
4.4	778
11.4	809
15.8	735
22.5	709
29.3	683
35.3	666
42.3	644
50.0	623
55.8	614
60.8	592
69.1	571
75.2	558
83.1	528
89.8	506
97.8	480
104.7	463
116.4	441
122.5	406
129.1	385
135.9	372
139.9	346
148.6	333
156.4	320

Table 4.1.7-3 Boron Letdown Data for Cycle 2 of Crystal River Unit 3

Exposure (EFPD)	Boron Concentration (ppm)
161.4	316

Table 4.1.7-4 Boron Letdown Data for Cycle 3 of Crystal River Unit 3

Exposure (EFPD)	Boron Concentration (ppm)
0.7	1090
2.0	1020
4.0	947
6.7	951
12.6	908
26.8	891
32.6	843
50.7	822
66.0	757
69.9	746
85.0	692
100.2	666
111.2	636
130.5	562
143.8	528
163.9	467
174.0	432
184.2	394
212.9	324
227.5	272
246.4	229

Table 4.1.7-4 Boron Letdown Data for Cycle 3 of Crystal River Unit 3

Exposure (EFPD)	Boron Concentration (ppm)
262.9	250
283.8	190
304.0	130
322.0	86

Table 4.1.7-5 Boron Letdown Data for Cycle 7 of Crystal River Unit 3

Exposure (EFPD)	Boron Concentration (ppm)
7.5	1478
41.4	1405
60.3	1367
81.7	1333
102.9	1290
122.3	1245
139.8	1204
160.5	1167
180.8	1102
202.8	1040
230.9	963
251.2	898
306.7	803
317.9	775
345.3	593
412.3	398
459.8	260
485.0	193

4.1.8 Burnup, Fuel Temperature, and Moderator Specific Volume Data

Burnup, fuel temperature, and moderator specific volume data are required for each node of each assembly in each SAS2H depletion calculation. A set of nodal burnup data at the beginning and end of each SAS2H depletion calculation is required. A set of nodal fuel temperature and moderator specific volume data representative of full-power operation during each depletion calculation of interest is required. Tables 4.1.8-1 through 4.1.8-18 contain the burnup, fuel temperature, and moderator specific volume data necessary to perform all depletion calculations for each of the non-rodded fuel assemblies from batches 1, 2, and 3 of Crystal River Unit 3. Node number 1 in Tables 4.1.8-1 through 4.1.8-18 represents the top axial node of the active fuel. The burnup data is presented in units of gigawatt-days per metric ton of uranium (GWd/MTU). The fuel temperature data is presented in units of degrees Fahrenheit. The moderator specific volume data is presented in units of cubic feet per pound. The statepoint numbers shown in the tables identify the relative reactivity statepoint calculations that fuel and burnable poison isotopic data are generated to support. The EFPD statepoint and cycle number corresponding to each set of fuel temperature and moderator specific volume data are presented above their respective columns in the tables. Each set of fuel temperature and moderator specific volume data listed in the tables is applicable to the depletion calculation performed between the statepoint number identified above the particular data and the previous statepoint number.

Table 4.1.8-1 Burnup, Fuel Temperature, and Moderator Specific Volume Data for Assembly A2 of Crystal River Unit 3

	Assembly Number A2								
	Statepoint 1 (BOC Cycle 1)			Statepoint 2 (0.0 Cycle 1B)			Statepoint 3 (142.2 Cycle 1B)		
Node No.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.
		Not Required		268.8 Cy1B	184.7 Cy1A	184.7 Cy1A	411.0 Cy1B	358.3 Cy1B	358.3 Cy1B
1	0.0			4.165	1017.4	0.0237	7.139	1139.0	0.0235
2	0.0			6.642	1225.4	0.0236	11.297	1331.9	0.0234
3	0.0			8.681	1356.1	0.0235	14.093	1393.0	0.0233
4	0.0			10.034	1425.4	0.0234	15.601	1377.7	0.0232
5	0.0			10.864	1456.5	0.0233	16.355	1340.8	0.0230
6	0.0			11.345	1468.4	0.0231	16.695	1304.8	0.0229
7	0.0			11.602	1473.9	0.0230	16.824	1277.1	0.0228
8	0.0			11.715	1480.8	0.0229	16.853	1258.7	0.0227
9	0.0			11.733	1492.4	0.0227	16.835	1248.6	0.0225
10	0.0			11.681	1506.9	0.0226	16.796	1245.5	0.0224
11	0.0			11.582	1522.1	0.0224	16.754	1247.9	0.0223
12	0.0			11.463	1533.3	0.0223	16.731	1254.9	0.0222
13	0.0			11.360	1536.7	0.0222	16.749	1265.3	0.0221
14	0.0			11.315	1532.1	0.0220	16.838	1278.1	0.0220
15	0.0			11.318	1528.2	0.0219	16.988	1296.9	0.0219

Table 4.1.8-1 Burnup, Fuel Temperature, and Moderator Specific Volume Data for Assembly A2 of Crystal River Unit 3

16	0.0			10.993	1516.9	0.0218	16.743	1320.8	0.0218
17	0.0			9.608	1415.1	0.0217	14.923	1294.7	0.0217
18	0.0			6.503	1172.5	0.0216	10.001	1100.3	0.0216

	Statepoint 4 (BOC Cycle 2)			Statepoint 5			Statepoint 6		
Node No.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.
	BOC Cy2	408.4 Cy1B	408.4 Cy1B						
1	7.703	1036.9	0.0235	No additional statepoints.			No additional statepoints		
2	12.146	1184.3	0.0234						
3	15.070	1235.6	0.0233						
4	16.635	1256.4	0.0232						
5	17.420	1287.7	0.0231						
6	17.783	1303.9	0.0229						
7	17.919	1306.7	0.0228						
8	17.948	1306.4	0.0227						
9	17.930	1306.4	0.0225						
10	17.898	1307.2	0.0224						
11	17.870	1308.6	0.0223						
12	17.864	1308.4	0.0222						
13	17.893	1302.4	0.0221						
14	17.976	1284.0	0.0219						
15	18.087	1246.9	0.0218						
16	17.769	1196.5	0.0217						
17	15.824	1133.5	0.0217						
18	10.594	971.5	0.0216						

Table 4.1.8-2 Burnup, Fuel Temperature, and Moderator Specific Volume Data for Assembly A3 of Crystal River Unit 3

	Assembly Number A3								
	Statepoint 1 (BOC Cycle 1)			Statepoint 2 (0.0 Cycle 1B)			Statepoint 3 (142.2 Cycle 1B)		
Node No.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.
		Not Required		268.8 Cy1A	184.7 Cy1A	184.7 Cy1A	411.0 Cy1B	358.3 Cy1B	358.3 Cy1B
1	0.0			4.068	1004.6	0.0237	6.835	1108.7	0.0234
2	0.0			6.985	1235.8	0.0236	11.317	1286.1	0.0233
3	0.0			9.147	1365.6	0.0235	14.188	1344.9	0.0232
4	0.0			10.553	1431.7	0.0234	15.741	1330.3	0.0230

Table 4.1.8-2 Burnup, Fuel Temperature, and Moderator Specific Volume Data for Assembly A3 of Crystal River Unit 3

5	0.0			11.408	1459.7	0.0232	16.520	1294.0	0.0229
6	0.0			11.895	1468.5	0.0231	16.872	1258.7	0.0228
7	0.0			12.152	1472.4	0.0230	17.005	1231.7	0.0227
8	0.0			12.260	1479.0	0.0228	17.028	1213.9	0.0226
9	0.0			12.261	1491.8	0.0227	16.989	1204.0	0.0225
10	0.0			12.176	1510.3	0.0225	16.905	1200.5	0.0224
11	0.0			12.023	1527.9	0.0224	16.798	1202.6	0.0223
12	0.0			11.839	1539.5	0.0223	16.703	1209.5	0.0222
13	0.0			11.662	1540.6	0.0221	16.648	1220.6	0.0221
14	0.0			11.483	1530.2	0.0220	16.607	1235.2	0.0220
15	0.0			11.184	1504.4	0.0219	16.425	1252.2	0.0219
16	0.0			10.485	1451.5	0.0218	15.702	1261.6	0.0218
17	0.0			8.928	1341.4	0.0217	13.667	1226.6	0.0217
18	0.0			5.493	1086.8	0.0216	8.599	1060.3	0.0216

Table 4.1.8-3 Burnup, Fuel Temperature, and Moderator Specific Volume Data for Assembly A6 of Crystal River Unit 3

	Assembly Number A6								
	Statepoint 1 (BOC Cycle 1)			Statepoint 2 (0.0 Cycle 1B)			Statepoint 3 (142.2 Cycle 1B)		
Node No.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.
		Not Required		268.8 Cy1B	184.7 Cy1A	184.7 Cy1A	411.0 Cy1B	358.3 Cy1B	358.3 Cy1B
1	0.0			3.654	957.1	0.0237	6.144	1075.2	0.0235
2	0.0			6.130	1168.4	0.0236	10.136	1275.7	0.0234
3	0.0			8.399	1322.1	0.0235	13.264	1360.0	0.0233
4	0.0			9.932	1413.0	0.0234	15.149	1358.1	0.0231
5	0.0			10.847	1454.4	0.0232	16.120	1324.0	0.0230
6	0.0			11.372	1471.5	0.0231	16.571	1290.0	0.0229
7	0.0			11.656	1480.9	0.0230	16.763	1264.3	0.0228
8	0.0			11.778	1491.8	0.0228	16.819	1247.8	0.0226
9	0.0			11.774	1508.5	0.0227	16.781	1238.9	0.0225
10	0.0			11.648	1529.1	0.0225	16.651	1235.7	0.0224
11	0.0			11.411	1549.2	0.0224	16.449	1237.6	0.0223
12	0.0			11.136	1558.9	0.0223	16.255	1244.9	0.0222
13	0.0			10.925	1551.7	0.0221	16.169	1256.9	0.0221
14	0.0			10.811	1529.0	0.0220	16.216	1273.8	0.0220
15	0.0			10.674	1492.1	0.0219	16.291	1303.1	0.0219
16	0.0			10.155	1433.3	0.0218	15.934	1341.4	0.0218

Table 4.1.8-3 Burnup, Fuel Temperature, and Moderator Specific Volume Data for Assembly A6 of Crystal River Unit 3

17	0.0			8.760	1321.9	0.0217	14.138	1321.0	0.0217
18	0.0			5.876	1102.3	0.0216	9.407	1120.7	0.0216

	Statepoint 4 (BOC Cycle 2)			Statepoint 5			Statepoint 6		
Node No.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.
	BOC Cy2	408.4 Cy1B	408.4 Cy1B						
1	6.728	1066.9	0.0236	No additional statepoints.			No additional statepoints		
2	11.018	1219.1	0.0235						
3	14.265	1262.6	0.0234						
4	16.196	1272.7	0.0233						
5	17.196	1299.8	0.0231						
6	17.672	1318.1	0.0230						
7	17.873	1325.1	0.0229						
8	17.928	1328.3	0.0227						
9	17.887	1330.2	0.0226						
10	17.763	1332.6	0.0225						
11	17.582	1338.4	0.0224						
12	17.423	1346.7	0.0222						
13	17.371	1349.6	0.0221						
14	17.434	1339.5	0.0220						
15	17.487	1311.5	0.0219						
16	17.059	1266.6	0.0218						
17	15.123	1197.1	0.0217						
18	10.050	1017.1	0.0216						

Table 4.1.8-4 Burnup, Fuel Temperature, and Moderator Specific Volume Data for Assembly A8 of Crystal River Unit 3

	Assembly Number A8								
	Statepoint 1 (BOC Cycle 1)			Statepoint 2 (0.0 Cycle 1B)			Statepoint 3 (142.2 Cycle 1B)		
Node No.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.
		Not Required		268.8 Cy1B	184.7 Cy1A	184.7 Cy1A	411.0 Cy1B	358.3 Cy1B	358.3 Cy1B
1	0.0			2.376	831.5	0.0228	3.894	884.1	0.0227
2	0.0			4.230	998.8	0.0228	6.705	1032.0	0.0226
3	0.0			5.599	1100.7	0.0227	8.582	1084.2	0.0226
4	0.0			6.481	1152.6	0.0227	9.647	1086.8	0.0225
5	0.0			7.028	1178.3	0.0226	10.227	1073.2	0.0224

Table 4.1.8-4 Burnup, Fuel Temperature, and Moderator Specific Volume Data for Assembly A8 of Crystal River Unit 3

6	0.0			7.355	1190.2	0.0225	10.525	1056.1	0.0223
7	0.0			7.539	1197.3	0.0224	10.668	1041.7	0.0223
8	0.0			7.631	1204.6	0.0223	10.731	1031.9	0.0222
9	0.0			7.656	1214.5	0.0223	10.749	1026.8	0.0221
10	0.0			7.633	1226.5	0.0222	10.739	1025.6	0.0221
11	0.0			7.579	1237.7	0.0221	10.717	1027.5	0.0220
12	0.0			7.522	1245.0	0.0220	10.708	1031.8	0.0220
13	0.0			7.494	1246.2	0.0219	10.737	1038.0	0.0219
14	0.0			7.509	1241.8	0.0218	10.824	1047.5	0.0218
15	0.0			7.490	1231.6	0.0218	10.934	1069.8	0.0218
16	0.0			7.165	1202.4	0.0217	10.749	1104.7	0.0217
17	0.0			6.119	1122.0	0.0216	9.474	1092.1	0.0216
18	0.0			3.653	915.0	0.0216	5.849	948.1	0.0216

	Statepoint 4 (BOC Cycle 2)			Statepoint 5 (BOC Cycle 3)			Statepoint 6 (168.5 Cycle 3)		
Node No.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.
	BOC Cy2	408.4 Cy1B	408.4 Cy1B	BOC Cy3	89.8 Cy2	89.8 Cy2	168.5 Cy3	85.0 Cy3	85.0 Cy3
1	4.202	847.9	0.0230	7.971	1134.5	0.0237	10.717	975.9	0.0234
2	7.197	968.4	0.0229	12.979	1314.3	0.0236	17.322	1123.0	0.0233
3	9.186	1026.9	0.0229	15.872	1382.3	0.0234	21.146	1175.9	0.0232
4	10.333	1079.8	0.0228	17.259	1393.7	0.0233	22.931	1182.7	0.0231
5	10.980	1145.2	0.0227	17.908	1389.9	0.0231	23.721	1171.9	0.0229
6	11.330	1186.1	0.0226	18.197	1385.9	0.0230	24.043	1158.2	0.0228
7	11.502	1204.7	0.0225	18.296	1385.5	0.0228	24.145	1148.0	0.0227
8	11.578	1214.6	0.0224	18.288	1386.6	0.0227	24.151	1144.1	0.0226
9	11.605	1221.5	0.0223	18.207	1383.7	0.0226	24.123	1148.9	0.0225
10	11.606	1227.7	0.0222	18.080	1368.6	0.0224	24.100	1162.5	0.0224
11	11.600	1233.0	0.0221	17.962	1339.1	0.0223	24.115	1181.0	0.0223
12	11.606	1235.0	0.0220	17.915	1305.1	0.0222	24.185	1198.0	0.0222
13	11.642	1228.6	0.0219	17.965	1275.2	0.0221	24.300	1207.8	0.0221
14	11.718	1207.6	0.0219	18.100	1254.0	0.0220	24.420	1207.5	0.0220
15	11.787	1168.0	0.0218	18.218	1244.3	0.0219	24.406	1196.1	0.0219
16	11.531	1113.7	0.0217	17.871	1240.3	0.0218	23.765	1173.9	0.0218
17	10.144	1042.4	0.0216	15.941	1210.7	0.0217	21.200	1131.9	0.0217
18	6.276	897.3	0.0216	10.186	1058.2	0.0216	13.734	1001.4	0.0216

Table 4.1.8-4 Burnup, Fuel Temperature, and Moderator Specific Volume Data for Assembly A8 of Crystal River Unit 3

Node No.	Statepoint 7 (250.0 Cycle 3)			Statepoint 8			Statepoint 9		
	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.
	250.0 Cy3	246.4 Cy3	246.4 Cy3						
1	12.299	1013.2	0.0233	No additional statepoints.			No additional statepoints.		
2	19.680	1121.8	0.0232						
3	23.822	1144.6	0.0231						
4	25.656	1132.8	0.0230						
5	26.413	1115.7	0.0229						
6	26.697	1102.5	0.0228						
7	26.777	1094.5	0.0227						
8	26.780	1090.8	0.0226						
9	26.768	1090.7	0.0225						
10	26.779	1093.5	0.0224						
11	26.839	1097.2	0.0223						
12	26.957	1100.3	0.0221						
13	27.120	1102.4	0.0221						
14	27.284	1103.9	0.0220						
15	27.285	1102.9	0.0219						
16	26.591	1097.7	0.0218						
17	23.819	1081.7	0.0217						
18	15.601	999.0	0.0216						

Table 4.1.8-5 Burnup, Fuel Temperature, and Moderator Specific Volume Data for Assembly A9 of Crystal River Unit 3

Node No.	Assembly Number A9								
	Statepoint 1 (BOC Cycle 1)			Statepoint 2 (0.0 Cycle 1B)			Statepoint 3 (142.2 Cycle 1B)		
	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.
		Not Required		268.8 Cy1B	184.7 Cy1A	184.7 Cy1A	411.0 Cy1B	358.3 Cy1B	358.3 Cy1B
1	0.0			3.985	999.6	0.0237	6.728	1102.0	0.0234
2	0.0			6.804	1227.4	0.0236	11.097	1277.9	0.0233
3	0.0			8.867	1352.3	0.0235	13.855	1334.3	0.0231
4	0.0			10.203	1415.3	0.0233	15.328	1320.4	0.0230
5	0.0			11.019	1442.2	0.0232	16.064	1285.7	0.0229
6	0.0			11.488	1451.1	0.0231	16.397	1251.7	0.0228
7	0.0			11.736	1454.9	0.0229	16.523	1225.3	0.0227
8	0.0			11.843	1461.0	0.0228	16.547	1207.8	0.0226

Table 4.1.8-5 Burnup, Fuel Temperature, and Moderator Specific Volume Data for Assembly A9 of Crystal River Unit 3

9	0.0			11.852	1472.6	0.0227	16.519	1198.1	0.0224
10	0.0			11.787	1489.3	0.0225	16.460	1194.7	0.0223
11	0.0			11.669	1507.0	0.0224	16.390	1196.7	0.0223
12	0.0			11.527	1519.3	0.0223	16.334	1203.2	0.0222
13	0.0			11.395	1522.0	0.0221	16.315	1213.2	0.0221
14	0.0			11.282	1514.8	0.0220	16.328	1226.3	0.0220
15	0.0			11.104	1498.7	0.0219	16.268	1243.0	0.0219
16	0.0			10.552	1461.8	0.0218	15.717	1255.6	0.0218
17	0.0			9.076	1358.8	0.0217	13.792	1223.7	0.0217
18	0.0			5.614	1102.7	0.0216	8.718	1059.0	0.0216

Table 4.1.8-6 Burnup, Fuel Temperature, and Moderator Specific Volume Data for Assembly A10 of Crystal River Unit 3

	Assembly Number A10								
	Statepoint 1 (BOC Cycle 1)			Statepoint 2 (0.0 Cycle 1B)			Statepoint 3 (142.2 Cycle 1B)		
Node No.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.
		Not Required		268.8 Cy1B	184.7 Cy1A	184.7 Cy1A	411.0 Cy1B	358.3 Cy1B	358.3 Cy1B
1	0.0			4.480	1042.1	0.0239	7.588	1162.6	0.0236
2	0.0			7.222	1260.6	0.0238	12.079	1362.7	0.0235
3	0.0			9.503	1402.6	0.0237	15.142	1424.9	0.0234
4	0.0			11.023	1478.2	0.0235	16.819	1405.3	0.0232
5	0.0			11.950	1511.0	0.0234	17.660	1363.8	0.0231
6	0.0			12.481	1522.4	0.0232	18.041	1324.6	0.0230
7	0.0			12.761	1526.4	0.0231	18.185	1295.0	0.0228
8	0.0			12.879	1531.9	0.0229	18.210	1275.8	0.0227
9	0.0			12.874	1543.4	0.0228	18.160	1265.3	0.0226
10	0.0			12.763	1560.8	0.0226	18.049	1261.9	0.0225
11	0.0			12.560	1579.9	0.0225	17.896	1264.4	0.0224
12	0.0			12.314	1592.3	0.0223	17.753	1272.9	0.0222
13	0.0			12.088	1590.6	0.0222	17.673	1286.3	0.0221
14	0.0			11.875	1574.7	0.0220	17.632	1304.0	0.0220
15	0.0			11.546	1545.8	0.0219	17.452	1324.5	0.0219
16	0.0			10.797	1486.6	0.0218	16.696	1337.8	0.0218
17	0.0			9.199	1365.7	0.0217	14.571	1302.5	0.0217
18	0.0			6.173	1134.8	0.0216	9.673	1103.9	0.0216

Table 4.1.8-6 Burnup, Fuel Temperature, and Moderator Specific Volume Data for Assembly A10 of Crystal River Unit 3

Node No.	Statepoint 4 (BOC Cycle 2) Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Statepoint 5 Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Statepoint 6 Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.
	BOC Cy2	408.4 Cy1B	408.4 Cy1B						
1	8.214	1077.7	0.0233	No additional statepoints.			No additional statepoints.		
2	13.010	1230.5	0.0233						
3	16.177	1263.7	0.0231						
4	17.855	1246.8	0.0230						
5	18.672	1227.1	0.0229						
6	19.031	1214.0	0.0228						
7	19.158	1205.8	0.0227						
8	19.169	1200.3	0.0226						
9	19.110	1196.3	0.0224						
10	18.999	1193.8	0.0223						
11	18.860	1194.5	0.0222						
12	18.742	1198.1	0.0221						
13	18.692	1200.6	0.0220						
14	18.670	1198.7	0.0219						
15	18.490	1190.9	0.0218						
16	17.700	1174.8	0.0217						
17	15.471	1131.8	0.0217						
18	10.269	975.1	0.0216						

Table 4.1.8-7 Burnup, Fuel Temperature, and Moderator Specific Volume Data for Assembly A11 of Crystal River Unit 3

	Assembly Number A11								
Node No.	Statepoint 1 (BOC Cycle 1) Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Statepoint 2 (0.0 Cycle 1B) Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Statepoint 3 (142.2 Cycle 1B) Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.
		Not Required		268.8 Cy1B	184.7 Cy1A	184.7 Cy1A	411.0 Cy1B	358.3 Cy1B	358.3 Cy1B
1	0.0			3.886	979.3	0.0237	6.514	1094.1	0.0234
2	0.0			6.799	1211.4	0.0236	10.954	1277.8	0.0233
3	0.0			9.069	1350.8	0.0235	13.973	1344.5	0.0232
4	0.0			10.564	1426.2	0.0233	15.684	1333.8	0.0230
5	0.0			11.459	1458.4	0.0232	16.548	1297.0	0.0229
6	0.0			11.961	1469.0	0.0231	16.934	1261.0	0.0228
7	0.0			12.220	1474.1	0.0229	17.076	1233.9	0.0227
8	0.0			12.317	1482.6	0.0228	17.088	1216.3	0.0226

Table 4.1.8-7 Burnup, Fuel Temperature, and Moderator Specific Volume Data for Assembly A11 of Crystal River Unit 3

9	0.0			12.281	1498.7	0.0226	17.000	1206.3	0.0225
10	0.0			12.100	1521.9	0.0225	16.785	1200.8	0.0224
11	0.0			11.748	1545.4	0.0224	16.427	1198.9	0.0223
12	0.0			11.307	1558.4	0.0222	16.046	1204.4	0.0222
13	0.0			10.965	1545.0	0.0221	15.833	1217.0	0.0221
14	0.0			10.729	1508.0	0.0220	15.770	1234.6	0.0220
15	0.0			10.461	1458.3	0.0219	15.682	1257.0	0.0219
16	0.0			9.895	1390.2	0.0217	15.158	1273.0	0.0218
17	0.0			8.520	1279.2	0.0217	13.320	1238.8	0.0217
18	0.0			5.265	1040.3	0.0216	8.404	1068.5	0.0216

Table 4.1.8-8 Burnup, Fuel Temperature, and Moderator Specific Volume Data for Assembly A12 of Crystal River Unit 3

	Assembly Number A12								
	Statepoint 1 (BOC Cycle 1)			Statepoint 2 (0.0 Cycle 1B)			Statepoint 3 (142.2 Cycle 1B)		
Node No.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.
		Not Required		268.8 Cy1B	184.7 Cy1A	184.7 Cy1A	411.0 Cy1B	358.3 Cy1B	358.3 Cy1B
1	0.0			3.858	971.1	0.0237	6.629	1125.7	0.0236
2	0.0			6.474	1187.3	0.0236	10.901	1335.1	0.0235
3	0.0			8.867	1346.9	0.0235	14.191	1422.5	0.0234
4	0.0			10.477	1440.1	0.0234	16.133	1414.5	0.0232
5	0.0			11.427	1481.2	0.0232	17.104	1374.1	0.0231
6	0.0			11.961	1496.7	0.0231	17.534	1335.6	0.0229
7	0.0			12.238	1505.0	0.0229	17.697	1307.0	0.0228
8	0.0			12.340	1515.3	0.0228	17.716	1289.0	0.0227
9	0.0			12.288	1531.5	0.0227	17.608	1279.1	0.0226
10	0.0			12.043	1554.4	0.0225	17.296	1271.6	0.0224
11	0.0			11.505	1582.6	0.0224	16.676	1263.1	0.0223
12	0.0			10.774	1595.7	0.0222	15.962	1265.7	0.0222
13	0.0			10.311	1562.0	0.0221	15.634	1279.4	0.0221
14	0.0			10.097	1499.9	0.0220	15.622	1298.9	0.0220
15	0.0			9.956	1440.0	0.0218	15.743	1327.8	0.0219
16	0.0			9.643	1367.5	0.0217	15.584	1358.7	0.0218
17	0.0			8.531	1258.8	0.0217	13.991	1325.4	0.0217
18	0.0			5.796	1064.1	0.0216	9.347	1119.6	0.0216

Table 4.1.8-8 Burnup, Fuel Temperature, and Moderator Specific Volume Data for Assembly A12 of Crystal River Unit 3

	Statepoint 4 (BOC Cycle 2)			Statepoint 5			Statepoint 6		
Node No.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.
	BOC Cy2	408.4 Cy1B	408.4 Cy1B						
1	7.281	1113.1	0.0234	No additional statepoints.			No additional statepoints		
2	11.873	1273.0	0.0233						
3	15.263	1300.7	0.0232						
4	17.199	1275.7	0.0231						
5	18.145	1254.7	0.0229						
6	18.556	1243.9	0.0228						
7	18.703	1238.5	0.0227						
8	18.700	1234.4	0.0226						
9	18.559	1226.9	0.0225						
10	18.218	1212.7	0.0224						
11	17.610	1204.6	0.0223						
12	16.943	1218.5	0.0222						
13	16.676	1232.9	0.0221						
14	16.736	1243.7	0.0220						
15	16.893	1254.1	0.0219						
16	16.688	1238.6	0.0218						
17	14.958	1178.6	0.0217						
18	9.978	1004.8	0.0216						

Table 4.1.8-9 Burnup, Fuel Temperature, and Moderator Specific Volume Data for Assembly A12a of Crystal River Unit 3

	Assembly Number A12a								
	Statepoint 1 (BOC Cycle 1)			Statepoint 2 (0.0 Cycle 1B)			Statepoint 3 (142.2 Cycle 1B)		
Node No.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.
		Not Required		268.8 Cy1B	184.7 Cy1A	184.7 Cy1A	411.0 Cy1B	358.3 Cy1B	358.3 Cy1B
1	0.0			3.858	971.1	0.0237	6.629	1125.7	0.0236
2	0.0			6.474	1187.3	0.0236	10.901	1335.1	0.0235
3	0.0			8.867	1346.9	0.0235	14.191	1422.5	0.0234
4	0.0			10.477	1440.1	0.0234	16.133	1414.5	0.0232
5	0.0			11.427	1481.2	0.0232	17.104	1374.1	0.0231
6	0.0			11.961	1496.7	0.0231	17.534	1335.6	0.0229
7	0.0			12.238	1505.0	0.0229	17.697	1307.0	0.0228

Table 4.1.8-9 Burnup, Fuel Temperature, and Moderator Specific Volume Data for Assembly A12a of Crystal River Unit 3

8	0.0			12.340	1515.3	0.0228	17.716	1289.0	0.0227
9	0.0			12.288	1531.5	0.0227	17.608	1279.1	0.0226
10	0.0			12.043	1554.4	0.0225	17.296	1271.6	0.0224
11	0.0			11.505	1582.6	0.0224	16.676	1263.1	0.0223
12	0.0			10.774	1595.7	0.0222	15.962	1265.7	0.0222
13	0.0			10.311	1562.0	0.0221	15.634	1279.4	0.0221
14	0.0			10.097	1499.9	0.0220	15.622	1298.9	0.0220
15	0.0			9.956	1440.0	0.0218	15.743	1327.8	0.0219
16	0.0			9.643	1367.5	0.0217	15.584	1358.7	0.0218
17	0.0			8.531	1258.8	0.0217	13.991	1325.4	0.0217
18	0.0			5.796	1064.1	0.0216	9.347	1119.6	0.0216

	Statepoint 4 (BOC Cycle 2)			Statepoint 5			Statepoint 6		
Node No.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.
	BOC Cy2	408.4 Cy1B	408.4 Cy1B						
1	7.305	1113.1	0.0234	No additional statepoints.			No additional statepoints		
2	11.915	1273.0	0.0233						
3	15.317	1300.7	0.0232	Note: The only difference in A12 and A12a is BOC Cy2 burnups. A12 is from K9. A12a is from H11.					
4	17.257	1275.7	0.0231						
5	18.205	1254.7	0.0229						
6	18.616	1243.9	0.0228						
7	18.762	1238.5	0.0227						
8	18.755	1234.4	0.0226						
9	18.606	1226.9	0.0225						
10	18.247	1212.7	0.0224						
11	17.602	1204.6	0.0223						
12	16.892	1218.5	0.0222						
13	16.599	1232.9	0.0221						
14	16.647	1243.7	0.0220						
15	16.807	1254.1	0.0219						
16	16.634	1238.6	0.0218						
17	14.948	1178.6	0.0217						
18	9.986	1004.8	0.0216						

Table 4.1.8-10 Burnup, Fuel Temperature, and Moderator Specific Volume Data for Assembly A13 of Crystal River Unit 3

	Assembly Number A13								
	Statepoint 1 (BOC Cycle 1)			Statepoint 2 (0.0 Cycle 1B)			Statepoint 3 (142.2 Cycle 1B)		
Node No.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.
				268.8 Cy1A	184.7 Cy1A	184.7 Cy1A	411.0 Cy1B	358.3 Cy1B	358.3 Cy1B
1	0.0			3.288	922.1	0.0234	5.740	1068.9	0.0234
2	0.0			5.786	1137.8	0.0233	9.726	1261.5	0.0233
3	0.0			7.754	1268.8	0.0232	12.470	1330.8	0.0232
4	0.0			9.071	1342.4	0.0231	14.054	1330.2	0.0230
5	0.0			9.872	1377.2	0.0230	14.875	1301.4	0.0229
6	0.0			10.330	1391.9	0.0229	15.258	1271.0	0.0228
7	0.0			10.571	1400.3	0.0228	15.415	1247.5	0.0227
8	0.0			10.666	1410.2	0.0226	15.449	1232.4	0.0226
9	0.0			10.639	1425.7	0.0225	15.387	1224.2	0.0225
10	0.0			10.475	1447.2	0.0224	15.203	1219.9	0.0224
11	0.0			10.152	1470.2	0.0223	14.878	1218.5	0.0223
12	0.0			9.756	1479.3	0.0222	14.538	1223.6	0.0222
13	0.0			9.488	1459.3	0.0220	14.382	1234.6	0.0221
14	0.0			9.394	1422.3	0.0219	14.431	1249.0	0.0220
15	0.0			9.373	1386.3	0.0218	14.567	1269.4	0.0219
16	0.0			9.113	1340.6	0.0217	14.352	1286.9	0.0218
17	0.0			8.002	1246.5	0.0216	12.786	1251.6	0.0217
18	0.0			4.988	1017.0	0.0216	8.108	1076.1	0.0216

Table 4.1.8-11 Burnup, Fuel Temperature, and Moderator Specific Volume Data for Assembly A14a of Crystal River Unit 3

	Assembly Number A14a								
	Statepoint 1 (BOC Cycle 1)			Statepoint 2 (0.0 Cycle 1B)			Statepoint 3 (142.2 Cycle 1B)		
Node No.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.
				268.8 Cy1B	184.7 Cy1A	184.7 Cy1A	411.0 Cy1B	358.3 Cy1B	358.3 Cy1B
1	0.0			3.042	898.5	0.0232	5.483	1066.3	0.0234
2	0.0	Data not required.		4.939	1070.7	0.0231	8.892	1268.6	0.0233
3	0.0			6.561	1193.8	0.0230	11.299	1338.5	0.0232
4	0.0			7.668	1260.2	0.0230	12.673	1340.7	0.0231
5	0.0			8.361	1294.1	0.0229	13.401	1318.5	0.0229
6	0.0			8.770	1310.7	0.0228	13.759	1292.8	0.0228
7	0.0			8.995	1320.6	0.0226	13.920	1272.1	0.0227

Table 4.1.8-11 Burnup, Fuel Temperature, and Moderator Specific Volume Data for Assembly A14a of Crystal River Unit 3

8	0.0			9.097	1330.3	0.0225	13.980	1258.7	0.0226
9	0.0			9.105	1342.9	0.0224	13.977	1252.1	0.0225
10	0.0			9.030	1358.2	0.0223	13.922	1250.9	0.0224
11	0.0			8.888	1372.4	0.0222	13.831	1254.2	0.0223
12	0.0			8.731	1378.6	0.0221	13.759	1261.6	0.0222
13	0.0			8.635	1372.7	0.0220	13.768	1271.6	0.0221
14	0.0			8.663	1358.8	0.0219	13.903	1282.7	0.0220
15	0.0			8.790	1348.7	0.0218	14.142	1299.2	0.0219
16	0.0			8.660	1334.6	0.0217	14.055	1319.4	0.0218
17	0.0			7.628	1251.7	0.0217	12.572	1284.6	0.0217
18	0.0			5.173	1049.6	0.0216	8.373	1088.6	0.0216

	Statepoint 4 (BOC Cycle 2)			Statepoint 16 (BOC Cycle 7)			Statepoint 17 (260.3 Cycle 7)		
Node No.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.
	BOC Cy2	408.4 Cy1B	408.4 Cy1B	BOC Cy7	89.8 Cy2+dt	89.8 Cy2+dt	260.3 Cy7	160.5 Cy7	160.5 Cy7
1	5.980	1002.2	0.0236	8.381	927.3	0.0230	12.578	963.7	0.0232
2	9.666	1160.9	0.0235	13.468	1061.1	0.0229	19.862	1083.6	0.0231
3	12.216	1226.2	0.0234	16.719	1115.0	0.0228	24.178	1114.1	0.0230
4	13.671	1270.2	0.0233	18.422	1126.9	0.0227	26.326	1119.2	0.0229
5	14.457	1323.1	0.0232	19.272	1127.2	0.0226	27.358	1114.4	0.0228
6	14.858	1357.9	0.0230	19.674	1126.4	0.0225	27.834	1107.7	0.0227
7	15.044	1374.9	0.0229	19.836	1126.8	0.0225	28.034	1102.0	0.0226
8	15.113	1384.7	0.0228	19.869	1127.4	0.0224	28.092	1097.8	0.0225
9	15.116	1391.5	0.0226	19.822	1125.5	0.0223	28.062	1095.0	0.0224
10	15.072	1397.8	0.0225	19.717	1118.0	0.0222	27.967	1093.1	0.0223
11	15.005	1405.1	0.0224	19.595	1104.3	0.0221	27.842	1091.6	0.0222
12	14.962	1410.8	0.0222	19.516	1087.2	0.0220	27.741	1089.7	0.0221
13	14.994	1407.9	0.0221	19.536	1069.7	0.0219	27.700	1085.9	0.0220
14	15.127	1386.9	0.0220	19.676	1053.7	0.0218	27.709	1078.0	0.0219
15	15.321	1340.3	0.0219	19.881	1041.6	0.0218	27.660	1062.7	0.0218
16	15.142	1273.1	0.0218	19.636	1035.0	0.0217	26.978	1039.2	0.0217
17	13.506	1186.3	0.0217	17.591	1013.6	0.0216	24.130	1004.7	0.0216
18	8.974	1002.4	0.0216	11.651	889.8	0.0216	16.089	906.4	0.0216

Table 4.1.8-11 Burnup, Fuel Temperature, and Moderator Specific Volume Data for Assembly A14a of Crystal River Unit 3

	Statepoint 18 (291.0 Cycle 7)			Statepoint 19 (319.0 Cycle 7)			Statepoint 20 (462.3 Cycle 7)		
Node No.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.
	291.0 Cy7	345.3 Cy7	345.3 Cy7	319.0 Cy7	345.3 Cy7	345.3 Cy7	462.3 Cy7	402.3 Cy7	402.3 Cy7
1	13.161	981.5	0.0232	13.725	981.5	0.0232	16.648	993.9	0.0232
2	20.719	1064.9	0.0231	21.540	1064.9	0.0231	25.684	1069.3	0.0231
3	25.146	1077.2	0.0230	26.064	1077.2	0.0230	30.625	1074.7	0.0230
4	27.322	1065.2	0.0229	28.256	1065.2	0.0229	32.859	1063.2	0.0229
5	28.351	1053.7	0.0228	29.276	1053.7	0.0228	33.820	1051.5	0.0228
6	28.818	1044.5	0.0227	29.727	1044.5	0.0227	34.209	1041.7	0.0227
7	29.010	1039.2	0.0226	29.907	1039.2	0.0226	34.348	1035.4	0.0226
8	29.063	1037.4	0.0225	29.951	1037.4	0.0225	34.375	1032.0	0.0225
9	29.032	1038.3	0.0224	29.914	1038.3	0.0224	34.339	1030.9	0.0224
10	28.939	1041.3	0.0223	29.818	1041.3	0.0223	34.257	1031.3	0.0223
11	28.817	1045.8	0.0222	29.695	1045.8	0.0222	34.161	1033.1	0.0222
12	28.722	1051.6	0.0221	29.601	1051.6	0.0221	34.105	1036.0	0.0221
13	28.688	1058.1	0.0220	29.570	1058.1	0.0220	34.124	1039.9	0.0220
14	28.700	1064.2	0.0219	29.584	1064.2	0.0219	34.190	1044.3	0.0219
15	28.647	1067.2	0.0218	29.526	1067.2	0.0218	34.167	1047.5	0.0218
16	27.938	1064.0	0.0218	28.795	1064.0	0.0218	33.402	1045.5	0.0218
17	25.010	1049.8	0.0217	25.797	1049.8	0.0217	30.126	1031.6	0.0217
18	16.703	966.8	0.0216	17.256	966.8	0.0216	20.386	960.0	0.0216

	Statepoint 21 (479.0 Cycle 7)			Statepoint 22			Statepoint 23		
Node No.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.
	479.0 Cy7	402.3 Cy7	402.3 Cy7						
1	17.005	993.9	0.0232	No additional statepoints.			No additional statepoints.		
2	26.176	1069.3	0.0231						
3	31.158	1074.7	0.0230						
4	33.391	1063.2	0.0229						
5	34.343	1051.5	0.0228						
6	34.724	1041.7	0.0227						
7	34.858	1035.4	0.0226						
8	34.883	1032.0	0.0225						
9	34.847	1030.9	0.0224						
10	34.767	1031.3	0.0223						
11	34.674	1033.1	0.0222						
12	34.622	1036.0	0.0221						

Table 4.1.8-11 Burnup, Fuel Temperature, and Moderator Specific Volume Data for Assembly A14a of Crystal River Unit 3

13	34.646	1039.9	0.0220						
14	34.720	1044.3	0.0219						
15	34.703	1047.5	0.0218						
16	33.939	1045.5	0.0218						
17	30.639	1031.6	0.0217						
18	20.766	960.0	0.0216						

Table 4.1.8-12 Burnup, Fuel Temperature, and Moderator Specific Volume Data for Assembly A15 of Crystal River Unit 3

	Assembly Number A15								
	Statepoint 1 (BOC Cycle 1)			Statepoint 2 (0.0 Cycle 1B)			Statepoint 3 (142.2 Cycle 1B)		
Node No.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.
		Not Required		268.8 Cy1B	184.7 Cy1A	184.7 Cy1A	411.0 Cy1B	358.3 Cy1B	358.3 Cy1B
1	0.0			2.089	797.4	0.0227	3.735	911.8	0.0228
2	0.0			3.709	945.2	0.0226	6.410	1076.0	0.0227
3	0.0			4.917	1042.2	0.0226	8.182	1137.8	0.0226
4	0.0			5.701	1093.0	0.0225	9.165	1143.5	0.0226
5	0.0			6.188	1118.2	0.0225	9.685	1129.7	0.0225
6	0.0			6.476	1130.7	0.0224	9.943	1112.0	0.0224
7	0.0			6.636	1138.2	0.0223	10.063	1097.4	0.0223
8	0.0			6.712	1145.4	0.0223	10.113	1087.6	0.0223
9	0.0			6.728	1154.2	0.0222	10.124	1082.7	0.0222
10	0.0			6.698	1164.7	0.0221	10.112	1082.0	0.0221
11	0.0			6.640	1174.4	0.0220	10.092	1084.6	0.0220
12	0.0			6.580	1179.9	0.0220	10.088	1089.6	0.0220
13	0.0			6.555	1179.4	0.0219	10.125	1096.1	0.0219
14	0.0			6.595	1175.1	0.0218	10.222	1103.4	0.0218
15	0.0			6.652	1171.3	0.0217	10.328	1113.5	0.0218
16	0.0			6.475	1156.1	0.0217	10.123	1120.1	0.0217
17	0.0			5.604	1086.5	0.0216	8.899	1088.1	0.0216
18	0.0			3.380	890.8	0.0216	5.493	935.6	0.0216

	Statepoint 4 (BOC Cycle 2)			Statepoint 5 (BOC Cycle 3)			Statepoint 6 (168.5 Cycle 3)		
Node No.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.
	BOC Cy2	408.4 Cy1B	408.4 Cy1B	BOC Cy3	89.8 Cy2	89.8 Cy2	168.5 Cy3	85.0 Cy3	85.0 Cy3
1	4.068	868.2	0.0229	7.023	1013.1	0.0234	9.290	896.4	0.0230

Table 4.1.8-12 Burnup, Fuel Temperature, and Moderator Specific Volume Data for Assembly A15 of Crystal River Unit 3

2	6.942	1001.9	0.0229	11.611	1172.9	0.0233	15.210	1016.5	0.0229
3	8.824	1061.8	0.0228	14.464	1255.2	0.0232	18.778	1064.3	0.0228
4	9.871	1103.0	0.0227	15.888	1295.8	0.0231	20.505	1074.9	0.0227
5	10.436	1144.2	0.0227	16.533	1306.7	0.0230	21.264	1072.7	0.0226
6	10.728	1173.6	0.0226	16.798	1305.5	0.0228	21.552	1064.8	0.0226
7	10.868	1189.4	0.0225	16.883	1303.8	0.0227	21.608	1054.3	0.0225
8	10.928	1198.5	0.0224	16.883	1303.0	0.0226	21.540	1044.4	0.0224
9	10.947	1205.0	0.0223	16.838	1299.8	0.0225	21.417	1039.7	0.0223
10	10.946	1210.5	0.0222	16.778	1290.1	0.0224	21.309	1043.8	0.0222
11	10.941	1215.2	0.0221	16.733	1272.8	0.0222	21.277	1056.4	0.0221
12	10.952	1216.9	0.0220	16.733	1251.3	0.0221	21.353	1074.4	0.0221
13	10.997	1210.6	0.0219	16.791	1229.2	0.0220	21.530	1092.3	0.0220
14	11.083	1190.3	0.0218	16.913	1210.1	0.0219	21.783	1103.9	0.0219
15	11.151	1152.6	0.0218	17.041	1199.9	0.0218	22.004	1108.7	0.0218
16	10.878	1100.1	0.0217	16.782	1203.6	0.0218	21.660	1103.2	0.0217
17	9.544	1029.4	0.0216	15.055	1189.4	0.0217	19.386	1061.1	0.0216
18	5.902	885.4	0.0216	9.654	1047.4	0.0216	12.470	925.1	0.0216

	Statepoint 7 (250.0 Cycle 3)			Statepoint 8			Statepoint 9		
Node No.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.
	250.0 Cy3	246.4 Cy3	246.4 Cy3						
1	10.571	946.1	0.0230	No additional statepoints.			No additional statepoints.		
2	17.128	1048.6	0.0230						
3	20.970	1067.6	0.0229						
4	22.771	1063.3	0.0228						
5	23.537	1054.8	0.0227						
6	23.817	1047.6	0.0226						
7	23.864	1042.5	0.0225						
8	23.787	1038.7	0.0224						
9	23.657	1036.4	0.0223						
10	23.553	1036.7	0.0223						
11	23.543	1039.6	0.0222						
12	23.661	1044.6	0.0221						
13	23.910	1052.3	0.0220						
14	24.281	1066.7	0.0219						
15	24.637	1086.1	0.0218						
16	24.288	1087.7	0.0217						

Table 4.1.8-12 Burnup, Fuel Temperature, and Moderator Specific Volume Data for Assembly A15 of Crystal River Unit 3

17	21.783	1063.7	0.0217						
18	14.116	968.2	0.0216						

Table 4.1.8-13 Burnup, Fuel Temperature, and Moderator Specific Volume Data for Assembly A16 of Crystal River Unit 3

	Assembly Number A16								
	Statepoint 1 (BOC Cycle 1)			Statepoint 2 (0.0 Cycle 1B)			Statepoint 3 (142.2 Cycle 1B)		
Node No.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.
		Not Required		268.8 Cy1A	184.7 Cy1A	184.7 Cy1A	411.0 Cy1B	358.3 Cy1B	358.3 Cy1B
1	0.0			3.967	989.1	0.0237	6.627	1096.5	0.0234
2	0.0			6.909	1221.8	0.0236	11.100	1277.2	0.0233
3	0.0			9.171	1359.2	0.0235	14.094	1341.2	0.0232
4	0.0			10.653	1431.9	0.0234	15.768	1329.0	0.0230
5	0.0			11.540	1462.4	0.0232	16.609	1292.0	0.0229
6	0.0			12.040	1472.1	0.0231	16.983	1256.0	0.0228
7	0.0			12.298	1476.7	0.0229	17.119	1228.8	0.0227
8	0.0			12.395	1484.9	0.0228	17.129	1211.0	0.0226
9	0.0			12.363	1500.8	0.0227	17.044	1200.8	0.0225
10	0.0			12.197	1522.9	0.0225	16.855	1195.9	0.0224
11	0.0			11.898	1545.0	0.0224	16.567	1195.8	0.0223
12	0.0			11.535	1557.7	0.0222	16.276	1202.1	0.0222
13	0.0			11.229	1549.6	0.0221	16.101	1214.8	0.0221
14	0.0			10.992	1521.6	0.0220	16.035	1232.7	0.0220
15	0.0			10.695	1475.2	0.0219	15.904	1254.3	0.0219
16	0.0			10.060	1408.0	0.0217	15.292	1268.1	0.0218
17	0.0			8.605	1294.8	0.0217	13.376	1234.3	0.0217
18	0.0			5.300	1049.4	0.0216	8.424	1066.0	0.0216

Table 4.1.8-14 Burnup, Fuel Temperature, and Moderator Specific Volume Data for Assembly A17 of Crystal River Unit 3

	Assembly Number A17								
	Statepoint 1 (BOC Cycle 1)			Statepoint 2 (0.0 Cycle 1B)			Statepoint 3 (142.2 Cycle 1B)		
Node No.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.
		Not Required		268.8 Cy1B	184.7 Cy1A	184.7 Cy1A	411.0 Cy1B	358.3 Cy1B	358.3 Cy1B
1	0.0			4.023	987.6	0.0237	6.794	1122.0	0.0236
2	0.0			6.795	1210.5	0.0237	11.197	1324.2	0.0235

Table 4.1.8-14 Burnup, Fuel Temperature, and Moderator Specific Volume Data for Assembly A17 of Crystal River Unit 3

3	0.0			9.272	1371.6	0.0236	14.536	1407.1	0.0233
4	0.0			10.920	1462.5	0.0234	16.484	1395.8	0.0232
5	0.0			11.888	1500.7	0.0233	17.448	1353.9	0.0230
6	0.0			12.429	1514.0	0.0231	17.870	1314.2	0.0229
7	0.0			12.707	1520.3	0.0230	18.022	1285.0	0.0228
8	0.0			12.804	1528.4	0.0228	18.026	1266.4	0.0227
9	0.0			12.738	1544.1	0.0227	17.893	1255.9	0.0225
10	0.0			12.461	1569.4	0.0225	17.533	1247.2	0.0224
11	0.0			11.866	1601.4	0.0224	16.838	1237.5	0.0223
12	0.0			11.060	1617.5	0.0222	16.040	1239.4	0.0222
13	0.0			10.532	1582.8	0.0221	15.652	1253.9	0.0221
14	0.0			10.267	1516.8	0.0220	15.613	1275.8	0.0220
15	0.0			10.088	1449.1	0.0218	15.735	1308.8	0.0219
16	0.0			9.751	1368.5	0.0217	15.596	1344.6	0.0218
17	0.0			8.616	1255.6	0.0217	14.017	1315.6	0.0217
18	0.0			5.801	1057.5	0.0216	9.328	1115.4	0.0216

	Statepoint 4 (BOC Cycle 2)			Statepoint 5			Statepoint 6		
Node No.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.
	BOC Cy2	408.4 Cy1B	408.4 Cy1B						
1	7.442	1106.5	0.0233	No additional statepoints.			No additional statepoints		
2	12.158	1261.5	0.0232						
3	15.590	1284.2	0.0231						
4	17.526	1254.6	0.0230						
5	18.458	1228.6	0.0229						
6	18.852	1213.1	0.0228						
7	18.982	1204.1	0.0226						
8	18.959	1197.1	0.0225						
9	18.787	1186.8	0.0224						
10	18.394	1169.8	0.0223						
11	17.709	1159.9	0.0222						
12	16.961	1174.3	0.0221						
13	16.643	1192.5	0.0220						
14	16.688	1210.0	0.0219						
15	16.858	1228.8	0.0218						
16	16.682	1220.7	0.0217						
17	14.971	1166.1	0.0217						

Table 4.1.8-14 Burnup, Fuel Temperature, and Moderator Specific Volume Data for Assembly A17 of Crystal River Unit 3

18	9.952	997.9	0.0216						

Table 4.1.8-15 Burnup, Fuel Temperature, and Moderator Specific Volume Data for Assembly A19 of Crystal River Unit 3

	Assembly Number A19								
	Statepoint 1 (BOC Cycle 1)			Statepoint 2 (0.0 Cycle 1B)			Statepoint 3 (142.2 Cycle 1B)		
Node No.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.
				268.8 Cy1B	184.7 Cy1A	184.7 Cy1A	411.0 Cy1B	358.3 Cy1B	358.3 Cy1B
1	0.0			3.311	922.5	0.0233	6.174	1144.8	0.0236
2	0.0			5.425	1112.1	0.0232	10.024	1362.2	0.0235
3	0.0			7.233	1242.2	0.0231	12.703	1438.7	0.0234
4	0.0			8.467	1315.0	0.0230	14.203	1437.7	0.0233
5	0.0			9.230	1352.2	0.0229	14.969	1407.7	0.0231
6	0.0			9.670	1369.7	0.0228	15.322	1375.4	0.0230
7	0.0			9.899	1380.3	0.0227	15.462	1350.7	0.0228
8	0.0			9.979	1391.7	0.0226	15.481	1335.3	0.0227
9	0.0			9.923	1408.3	0.0225	15.387	1327.5	0.0226
10	0.0			9.688	1430.9	0.0223	15.100	1321.5	0.0225
11	0.0			9.174	1455.9	0.0222	14.514	1313.7	0.0223
12	0.0			8.484	1460.5	0.0221	13.843	1316.6	0.0222
13	0.0			8.089	1414.1	0.0220	13.572	1329.5	0.0221
14	0.0			8.019	1350.8	0.0219	13.666	1344.3	0.0220
15	0.0			8.197	1312.2	0.0218	14.022	1361.6	0.0219
16	0.0			8.350	1282.9	0.0217	14.220	1375.1	0.0218
17	0.0			7.639	1202.0	0.0216	12.954	1326.0	0.0217
18	0.0			5.251	1020.2	0.0216	8.668	1114.5	0.0216

	Statepoint 4 (BOC Cycle 2)			Statepoint 5			Statepoint 6		
Node No.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.
	BOC Cy2	408.4 Cy1B	408.4 Cy1B						
1	6.770	1073.6	0.0235	No additional statepoints.			No additional statepoints		
2	10.934	1239.6	0.0234						
3	13.746	1299.0	0.0233						
4	15.279	1308.1	0.0232						
5	16.050	1311.3	0.0231						
6	16.404	1316.0	0.0229						

Table 4.1.8-15 Burnup, Fuel Temperature, and Moderator Specific Volume Data for Assembly A19 of Crystal River Unit 3

7	16.540	1320.1	0.0228						
8	16.546	1322.1	0.0227						
9	16.425	1318.7	0.0226						
10	16.114	1307.2	0.0224						
11	15.543	1301.5	0.0223						
12	14.923	1317.8	0.0222						
13	14.713	1330.8	0.0221						
14	14.869	1333.3	0.0220						
15	15.241	1325.6	0.0219						
16	15.363	1284.8	0.0218						
17	13.935	1202.6	0.0217						
18	9.298	1016.0	0.0216						

Table 4.1.8-16 Burnup, Fuel Temperature, and Moderator Specific Volume Data for Assembly A21 of Crystal River Unit 3

	Assembly Number A21								
	Statepoint 1 (BOC Cycle 1)			Statepoint 2 (0.0 Cycle 1B)			Statepoint 3 (142.2 Cycle 1B)		
Node No.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.
		Not Required		268.8 Cy1B	184.7 Cy1A	184.7 Cy1A	411.0 Cy1B	358.3 Cy1B	358.3 Cy1B
1	0.0			1.326	708.6	0.0223	2.726	864.6	0.0226
2	0.0			2.386	807.4	0.0222	4.724	1023.9	0.0226
3	0.0			3.186	876.5	0.0222	6.040	1091.3	0.0225
4	0.0			3.703	916.6	0.0222	6.746	1104.1	0.0224
5	0.0			4.021	938.4	0.0221	7.099	1095.5	0.0224
6	0.0			4.206	949.8	0.0221	7.263	1081.6	0.0223
7	0.0			4.305	956.5	0.0221	7.330	1069.4	0.0222
8	0.0			4.347	962.3	0.0220	7.351	1061.2	0.0222
9	0.0			4.347	968.6	0.0220	7.348	1057.1	0.0221
10	0.0			4.313	975.3	0.0219	7.329	1056.6	0.0220
11	0.0			4.258	980.8	0.0219	7.306	1059.0	0.0220
12	0.0			4.203	982.6	0.0218	7.299	1063.5	0.0219
13	0.0			4.184	979.9	0.0218	7.330	1068.6	0.0218
14	0.0			4.251	976.4	0.0217	7.424	1071.2	0.0218
15	0.0			4.435	984.9	0.0217	7.573	1066.0	0.0217
16	0.0			4.538	1000.7	0.0216	7.522	1047.0	0.0217
17	0.0			4.040	955.3	0.0216	6.633	998.8	0.0216
18	0.0			2.427	800.1	0.0216	4.040	854.6	0.0216

Table 4.1.8-16 Burnup, Fuel Temperature, and Moderator Specific Volume Data for Assembly A21 of Crystal River Unit 3

	Statepoint 4 (BOC Cycle 2)			Statepoint 5 (BOC Cycle 3)			Statepoint 6 (168.5 Cycle 3)		
Node No.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.
	BOC Cy2	408.4 Cy1B	408.4 Cy1B	BOC Cy3	89.8 Cy2	89.8 Cy2	168.5 Cy3	85.0 Cy3	85.0 Cy3
1	3.009	825.6	0.0226	6.609	1125.3	0.0237	9.583	1004.0	0.0233
2	5.183	955.5	0.0226	10.829	1324.4	0.0236	15.451	1148.7	0.0232
3	6.591	1016.0	0.0225	13.276	1415.5	0.0235	18.742	1202.1	0.0231
4	7.338	1043.9	0.0225	14.387	1450.3	0.0233	20.186	1209.5	0.0230
5	7.714	1063.4	0.0224	14.839	1460.7	0.0232	20.744	1200.8	0.0229
6	7.892	1078.8	0.0223	14.992	1463.2	0.0230	20.894	1183.9	0.0228
7	7.969	1089.4	0.0223	15.009	1466.2	0.0229	20.819	1157.2	0.0227
8	7.995	1096.3	0.0222	14.952	1469.9	0.0227	20.534	1120.5	0.0226
9	7.996	1101.0	0.0221	14.830	1468.4	0.0226	20.067	1093.9	0.0225
10	7.985	1104.8	0.0221	14.656	1451.1	0.0225	19.666	1095.4	0.0224
11	7.974	1108.1	0.0220	14.498	1412.4	0.0223	19.501	1118.4	0.0223
12	7.979	1109.3	0.0219	14.434	1370.5	0.0222	19.606	1160.5	0.0222
13	8.018	1104.4	0.0218	14.499	1336.8	0.0221	20.012	1217.5	0.0221
14	8.105	1087.7	0.0218	14.690	1314.1	0.0220	20.661	1253.5	0.0220
15	8.224	1054.7	0.0217	14.939	1308.4	0.0219	21.208	1264.0	0.0219
16	8.116	1007.6	0.0217	14.829	1315.9	0.0218	21.082	1260.8	0.0218
17	7.135	944.5	0.0216	13.319	1288.9	0.0217	18.971	1215.2	0.0217
18	4.353	815.8	0.0216	8.491	1112.6	0.0216	12.261	1051.1	0.0216

	Statepoint 7 (250.0 Cycle 3)			Statepoint 8			Statepoint 9		
Node No.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.
	250.0 Cy3	246.4 Cy3	246.4 Cy3						
1	11.187	1025.4	0.0233	No additional statepoints.			No additional statepoints.		
2	17.792	1132.0	0.0232						
3	21.372	1151.0	0.0231						
4	22.866	1142.2	0.0229						
5	23.406	1129.1	0.0228						
6	23.526	1118.3	0.0227						
7	23.417	1108.3	0.0226						
8	23.066	1092.6	0.0225						
9	22.482	1070.0	0.0224						
10	22.002	1060.8	0.0223						

Table 4.1.8-16 Burnup, Fuel Temperature, and Moderator Specific Volume Data for Assembly A21 of Crystal River Unit 3

11	21.840	1064.4	0.0223						
12	22.009	1075.5	0.0222						
13	22.562	1098.0	0.0221						
14	23.470	1133.4	0.0220						
15	24.242	1161.3	0.0219						
16	24.134	1162.6	0.0218						
17	21.793	1139.4	0.0217						
18	14.248	1038.6	0.0216						

Table 4.1.8-17 Burnup, Fuel Temperature, and Moderator Specific Volume Data for Assembly A24 of Crystal River Unit 3

	Assembly Number A24								
	Statepoint 1 (BOC Cycle 1)			Statepoint 2 (0.0 Cycle 1B)			Statepoint 3 (142.2 Cycle 1B)		
Node No.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.
				268.8 Cy1A	184.7 Cy1A	184.7 Cy1A	411.0 Cy1B	358.3 Cy1B	358.3 Cy1B
1	0.0			2.805	878.2	0.0231	5.017	1026.1	0.0232
2	0.0			4.961	1073.1	0.0230	8.547	1215.2	0.0231
3	0.0			6.609	1197.5	0.0230	10.902	1278.3	0.0230
4	0.0			7.706	1261.1	0.0229	12.219	1277.4	0.0229
5	0.0			8.384	1293.4	0.0228	12.890	1252.8	0.0228
6	0.0			8.775	1308.8	0.0227	13.199	1225.3	0.0227
7	0.0			8.978	1318.5	0.0226	13.322	1204.1	0.0226
8	0.0			9.049	1329.3	0.0225	13.339	1190.8	0.0225
9	0.0			9.002	1345.0	0.0224	13.262	1183.9	0.0224
10	0.0			8.818	1365.7	0.0223	13.056	1180.3	0.0223
11	0.0			8.469	1386.8	0.0222	12.701	1179.0	0.0222
12	0.0			8.045	1392.1	0.0221	12.328	1184.2	0.0221
13	0.0			7.757	1366.5	0.0220	12.148	1195.9	0.0220
14	0.0			7.662	1323.7	0.0219	12.195	1211.2	0.0219
15	0.0			7.676	1283.8	0.0218	12.363	1231.8	0.0218
16	0.0			7.519	1238.3	0.0217	12.247	1247.6	0.0217
17	0.0			6.618	1152.2	0.0216	10.915	1212.7	0.0217
18	0.0			4.080	936.2	0.0216	6.848	1038.8	0.0216

Table 4.1.8-18 Burnup, Fuel Temperature, and Moderator Specific Volume Data for Assembly A27 of Crystal River Unit 3

	Assembly Number A27								
	Statepoint 1 (BOC Cycle 1)			Statepoint 2 (0.0 Cycle 1B)			Statepoint 3 (142.2 Cycle 1B)		
Node No.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.
				268.8 Cy1B	184.7 Cy1A	184.7 Cy1A	411.0 Cy1B	358.3 Cy1B	358.3 Cy1B
1	0.0			2.734	875.4	0.0230	4.711	981.0	0.0230
2	0.0			4.492	1041.9	0.0230	7.726	1167.7	0.0230
3	0.0			5.988	1164.5	0.0229	9.885	1230.7	0.0229
4	0.0			7.017	1232.2	0.0228	11.123	1229.1	0.0228
5	0.0			7.664	1267.0	0.0227	11.754	1203.3	0.0227
6	0.0			8.044	1285.0	0.0226	12.044	1175.5	0.0226
7	0.0			8.246	1296.5	0.0225	12.165	1154.7	0.0225
8	0.0			8.322	1308.0	0.0224	12.191	1142.1	0.0224
9	0.0			8.292	1322.8	0.0223	12.142	1136.2	0.0223
10	0.0			8.159	1340.3	0.0222	12.016	1135.2	0.0222
11	0.0			7.935	1355.5	0.0221	11.829	1138.8	0.0222
12	0.0			7.680	1359.2	0.0220	11.648	1147.3	0.0221
13	0.0			7.477	1344.7	0.0219	11.557	1160.5	0.0220
14	0.0			7.359	1315.0	0.0219	11.589	1179.2	0.0219
15	0.0			7.241	1274.8	0.0218	11.671	1210.2	0.0218
16	0.0			6.856	1217.6	0.0217	11.443	1248.5	0.0217
17	0.0			5.875	1121.7	0.0216	10.126	1227.9	0.0217
18	0.0			3.941	939.2	0.0216	6.676	1039.2	0.0216

	Statepoint 4 (BOC Cycle 2)			Statepoint 5 (BOC Cycle 3)			Statepoint 6 (168.5 Cycle 3)		
Node No.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.
	BOC Cy2	408.4 Cy1B	408.4 Cy1B	BOC Cy3	89.8 Cy2	89.8 Cy2	168.5 Cy3	85.0 Cy3	85.0 Cy3
1	5.127	937.6	0.0232	8.896	1120.7	0.0236	11.580	945.1	0.0233
2	8.383	1088.9	0.0232	14.190	1299.5	0.0235	18.500	1088.0	0.0232
3	10.673	1148.1	0.0231	17.401	1365.2	0.0234	22.655	1141.2	0.0231
4	11.985	1188.2	0.0230	18.972	1374.6	0.0233	24.667	1157.2	0.0230
5	12.658	1232.7	0.0229	19.670	1372.1	0.0231	25.549	1155.5	0.0229
6	12.976	1256.8	0.0228	19.943	1370.5	0.0230	25.870	1144.8	0.0228
7	13.107	1265.3	0.0227	20.003	1372.6	0.0228	25.884	1127.6	0.0227
8	13.133	1269.3	0.0226	19.925	1376.9	0.0227	25.668	1107.5	0.0226
9	13.083	1272.0	0.0224	19.705	1376.9	0.0225	25.258	1095.9	0.0225
10	12.964	1275.5	0.0223	19.329	1356.5	0.0224	24.762	1102.3	0.0224

Table 4.1.8-18 Burnup, Fuel Temperature, and Moderator Specific Volume Data for Assembly A27 of Crystal River Unit 3

11	12.800	1282.7	0.0222	18.913	1304.5	0.0223	24.360	1124.5	0.0223
12	12.655	1293.0	0.0221	18.640	1255.4	0.0222	24.220	1157.9	0.0222
13	12.602	1299.7	0.0220	18.614	1222.2	0.0221	24.411	1192.7	0.0221
14	12.653	1294.6	0.0219	18.814	1201.9	0.0220	24.823	1210.1	0.0220
15	12.719	1270.7	0.0218	19.083	1203.4	0.0219	25.114	1200.7	0.0219
16	12.426	1225.1	0.0217	18.840	1226.3	0.0218	24.589	1167.8	0.0218
17	10.975	1148.0	0.0216	16.893	1210.6	0.0217	21.902	1108.2	0.0217
18	7.214	971.1	0.0216	11.178	1049.9	0.0216	14.397	962.0	0.0216

	Statepoint 7 (250.0 Cycle 3)			Statepoint 8			Statepoint 9		
Node No.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.	Burnup (GWd/MTU)	Fuel Temp.	Moderator Spec. Vol.
	250.0 Cy3	246.4 Cy3	246.4 Cy3						
1	13.090	990.1	0.0233	No additional statepoints.			No additional statepoints.		
2	20.768	1091.2	0.0232						
3	25.255	1116.0	0.0231						
4	27.354	1109.4	0.0230						
5	28.240	1097.7	0.0229						
6	28.547	1088.3	0.0227						
7	28.543	1081.2	0.0226						
8	28.298	1073.5	0.0225						
9	27.845	1066.0	0.0224						
10	27.328	1066.1	0.0223						
11	26.946	1073.1	0.0222						
12	26.859	1082.8	0.0221						
13	27.133	1093.9	0.0220						
14	27.641	1103.1	0.0219						
15	27.976	1103.0	0.0219						
16	27.397	1095.0	0.0218						
17	24.467	1072.4	0.0217						
18	16.163	976.8	0.0216						

4.2 Criteria

The design of the waste package will depend on waste package configuration criticality analyses performed using an acceptable disposal criticality analysis methodology. Criteria that relate to the development and design of repository and engineered barrier components are derived from the applicable requirements and planning documents. Upper-level systems requirements are provided in the

Mined Geologic Repository System Requirements Document (MGDSRD, Ref. 5.7). The requirements flow down to the Engineered Barrier Design Requirements Document (EBDRD, Ref. 5.8) as specific requirements for engineered barrier segment design and the Repository Design Requirements Document (RDRD, Ref. 5.9) as specific requirements for repository design. The Controlled Design Assumptions Document (Ref. 5.10) provides guidance for requirements listed in the EBDRD and RDRD which have unqualified or unconfirmed data associated with the requirement.

This analysis supports the disposal criticality analysis methodology by providing input, in the form of fuel and burnable poison depletion results, to benchmark calculations which address the prediction of both spent fuel isotopic compositions and their associated reactivity. These benchmark calculations will contribute to the determination of bias values in the method of critical multiplication factor calculation that is implemented by the analytic tools to be used in the disposal criticality methodology. The requirements for utilizing the bias in the method of calculation of the critical multiplication factor for disposal configurations containing spent nuclear fuel are located in Section 3.2.2.5 of the RDRD and Section 3.2.2.6 of the EBDRD.

4.3 Assumptions

4.3.1 The inherent approximation of uniformly distributed non-fuel lattice cells in the Path B unit cell models of the SAS2H calculations as described in Section 7.2 is considered acceptable within the fidelity of these calculations as documented in Section S2.2.3.1 of Volume 1, Rev. 5 in reference 5.4. The basis for this assumption is provided in the previously identified section of reference 5.4. This assumption is used throughout all depletion calculations documented in Section 7.

4.3.2 With the utilization of one cross-section update per irradiation time step, the maximum duration of any time step in any reactor cycle irradiation layout of this analysis should not exceed 80 days. The basis for this assumption is that the 80 day irradiation time step limit assures that the isotopic concentrations of the system (primarily fuel and borated moderator) will not alter the neutron spectrum radically enough to cause a time step of the depletion calculation to be performed without the availability of cross-sections which have been properly weighted with an updated neutron spectrum and spatial flux. This assumption is used throughout all depletion calculations documented in Section 7.

4.3.3 Distributing the spacer grid material uniformly in the moderator composition of the Path A and B models is acceptable. The basis for this assumption is that the limited reactivity worth of the spacer grid materials will have negligible impact on the neutron spectrum when placed homogeneously in axial regions of the assembly. This assumption is used throughout all depletion calculations documented in Section 7.

4.4 Codes and Standards

Not applicable.

5. References

5.1 Activity Evaluation: *Perform Criticality, Thermal, Structural, and Shielding Analyses.* Document Identifier Number (DI#): BB0000000-01717-2200-00025 REV 02, Civilian Radioactive Waste Management System (CRWMS) Management and Operating Contractor (M&O).

5.2 *Quality Assurance Requirements and Description.* DOE/RW-0333P REV 07, DOE (U.S. Department of Energy).

5.3 *Summary Report of Commercial Reactor Criticality Data for Crystal River Unit 3.* DI#: B00000000-01717-5705-00060 REV 00, CRWMS M&O.

5.4 *SCALE 4.3: Modular Code System for Performing Standardized Computer Analyses for Licensing Evaluation.* User's Manual Volumes 0 through 3, Oak Ridge National Laboratory, Document Number: CCC-545.

5.5 *Software Qualification Report for the SCALE Modular Code System Version 4.3.* SCALE Version 4.3 Configuration Software Configuration Identifier (CSCI): 30011 V4.3, DI#: 30011-2002 REV 00, CRWMS M&O.

5.6 *Q-List.* YMP/90-55Q, REV 04, YMP (Yucca Mountain Site Characterization Project).

5.7 *Mined Geologic Repository System Requirements Document.* DOE/RW-0404P, DI#: B00000000-00811-1708-00002 REV 02, DCN 02, DOE Office of Civilian Radioactive Waste Management (OCRWM).

5.8 *Engineered Barrier Design Requirements Document.* YMP/CM-0024, REV 0, ICN 1, DOE OCRWM.

5.9 *Repository Design Requirements Document.* YMP/CM-0023, REV 0, ICN 1, DOE OCRWM.

5.10 *Controlled Design Assumptions Document.* DI#: B00000000-01717-4600-00032 REV 04, ICN 01, CRWMS M&O.

5.11* CRC Depletion Calculations for the Non-Rodded Assemblies in Batches 1, 2, and 3 of Crystal River Unit 3 (DI#: BBA000000-01717-0200-00032 REV 00) - Attachments IV, XLII, XLIII - 2 Data Cartridges + Special Instruction Sheet. Batch Number: MOY-970724-03

5.12* Attachments for BBA000000-01717-0200-00032 REV 00 - CRC Depletion Calculations for the Non-Rodded Assemblies in Batches 1, 2, and 3 of Crystal River Unit 3. Batch Number: MOY-970724-04

5.13 *Interoffice Correspondence (IOC) from Hugh Benton to Greg Carlisle, Subject: Software Routines.* July 29, 1997, IOC Number: LV.WP.DAT.07/97-164.

* These references are submitted with this analyis records package.

6. Use of Computer Software

6.1 Scientific and Engineering Software

The SAS2H control module of the SCALE 4.3 modular code system (Ref. 5.4) was used in this analysis to perform fuel assembly depletion calculations required for CRC evaluations. The SCALE 4.3 code system is subject to the requirements of the QARD (Ref. 5.2). The SCALE 4.3 code system was obtained from the Software Configuration Management in accordance with appropriate procedures. The CSCI number for SCALE 4.3 is 30011 V4.3. The SAS2H calculations documented in this analysis were performed on Hewlett Packard (HP) 9000 series workstations. The SAS2H control module utilizes the BONAMI, NITAWL, XSDRNPM, COUPLE, and ORIGEN-S calculational modules to perform isotopic depletion calculations. A detailed description of the SAS2H control module is provided in Volume 1, Section S2 of reference 5.4. The SAS2H control module of the SCALE 4.3 code system is applicable to the engineering application within this analysis and is used within the range of verification and validation as documented in reference 5.5.

A software routine entitled "Commercial Reactor Assembly Follow Taskmaster" (CRAFT) was written to automate the production of SAS2H input decks as required to support fuel assembly depletion calculations relevant to CRC evaluations. The CRAFT code does not generate data. All calculations performed by the CRAFT code are verified by visual inspection and/or hand calculations. The CRAFT code, Version 1.0, compiled on December 16, 1996, was utilized to orchestrate the fuel assembly depletion calculations included in this analysis. The CRAFT 1.0 source code ("CRAFT.f.V-1.compiled_on_12_16_96") and executable file ("CRAFT1.0") exist in the directory "/users/wright/CRAFT_V1" on the Waste Package Development Department (WPDD) HP 9000 series workstation designated "Opus". The CRAFT code is subject to the requirements of the QARD as defined by Section I.2.1 Part C of Supplement I Rev. 1 of the QARD. Complete documentation of the CRAFT code, Version 1.0, including code description, user information, and documentation that the software provides correct results for a specified range of input parameters is included in Attachment I of this analysis. The CRAFT Version 1.0 software routine will ultimately be documented as an addendum to the existing SCALE V4.3 baseline and assume the SCALE V4.3 baseline CSCI identifier number of 30011 V4.3 (Ref. 5.13).

A software routine entitled "CRC_DATA_TABULIZER" was written to automate the production of tables containing the isotopic results and other pertinent data for a set of 29 principal isotopes at each

CRC statepoint for each assembly. The CRC_DATA_TABULIZER code does not generate data. All calculations performed by the CRC_DATA_TABULIZER code are verified by visual inspection and/or hand calculations. The CRC_DATA_TABULIZER code, Versions 1.0 and 2.0, were utilized to tabulate the principal isotope results for the fuel assemblies at each CRC statepoint. The CRC_DATA_TABULIZER, Version 1.0, source code (CRC_DATA_TABULIZER_V1.f) and executable file (CRC_DATA_TABULIZER_V1.exe) exist in the directory "/users/wright/CRC_DATA_TABULIZER" on the WPDD HP 9000 series workstation designated "Opus". The CRC_DATA_TABULIZER, Version 2.0, source code (CRC_DATA_TABULIZER_V2.f) and executable file (CRC_DATA_TABULIZER_V2.exe) exist in the directory "/users/wright/CRC_DATA_TABULIZER" on the WPDD HP 9000 series workstation designated "Opus". The CRC_DATA_TABULIZER code is subject to the requirements of the QARD as defined by Section I.2.1 Part C of Supplement I Rev. 1 of the QARD. Complete documentation of the CRC_DATA_TABULIZER code (Versions 1.0 and 2.0) including code description, user information, and documentation that the software provides correct results for a specified range of input parameters is included in Attachment V of this analysis. The CRC_DATA_TABULIZER Versions 1.0 and 2.0 software routine will ultimately be documented as an addendum to the existing SCALE V4.3 baseline and assume the SCALE V4.3 baseline CSCI identifier number of 30011 V4.3 (Ref. 5.13).

6.2 Computational Support Software

The Excel, Version 5.0, and Lotus 1-2-3, Version 4.0, spreadsheet packages are two of the computational support software packages utilized in this analysis. The user-defined formulas, inputs, and results for all calculations performed with these spreadsheet packages are documented, where applicable, throughout this analysis. The "sed" line editor (Revision: 70.12) available in the "/bin" directory on the HP 9000 series workstations is utilized in the "sedexecute" script file which is called and executed by the CRAFT code. The usage of the "sed" line editor is described in Section 6 of Attachment I.

7. Design Analysis

This design analysis documents the fuel assembly SAS2H depletion calculations for the non-rodded assemblies of fuel batches 1, 2, and 3 which are required for the CRC evaluations of Crystal River Unit 3. Sections 7.1 through 7.5 describe how the parameters listed in Section 4.1 are utilized to perform the appropriate SAS2H depletion calculations relevant to CRC evaluations. The CRAFT description and user information provided in Attachment I of this analysis is essential for understanding the SAS2H modeling techniques employed in this analysis. The information in Attachment I, the input parameters in Section 4.1, and the CRAFT input decks in Attachment VI through XXIII work together to provide a complete description of how all of the SAS2H depletion calculations in this analysis were performed.

7.1 Assembly Depletion Calculation Procedure

The calculational procedure for the fuel assembly SAS2H depletion calculations performed in this analysis is based on the utilization of the CRAFT Version 1.0 code. The CRAFT 1.0 code is described

generally in Sections 7.4 and 7.5 and in complete detail in Attachment I. The procedure for performing a fuel assembly depletion calculation with CRAFT Version 1.0 consists of the following four steps:

1) Create a CRAFT input deck for the assembly depletion calculation.
2) Assure that the CRAFT executable file and the CRAFT input deck entitled "datain" and the "sedexecute" executable file are in the same directory. The "sedexecute" executable file is a script file which is used in conjunction with the CRAFT code to create the consolidated output files described in Section 7.5.
3) Execute CRAFT.
4) Check and analyze the CRAFT generated SAS2H input decks and the SAS2H isotopic results.

The various CRAFT generated and consolidated SAS2H output files contain unique filenames which specify the following information:

1) reactor identifier,
2) one-eighth core symmetry assembly number in current reactor cycle,
3) axial node number,
4) reactor cycle number in which the SAS2H calculation begins,
5) EFPD statepoint at which the SAS2H calculation begins,
6) reactor cycle number in which the SAS2H calculation ends,
7) EFPD statepoint at which the SAS2H calculation ends.

A complete detailed description of the filename content and format is provided on page 74 of Attachment I. Specific isotopic results contained in the various consolidated output files generated by CRAFT may be retrieved using the output filename information.

7.2 Path B Unit Cell Model Development

The SAS2H control module uses ORIGEN-S to perform a point depletion calculation for the fuel assembly or section of the fuel assembly described in the SAS2H input deck. The ORIGEN-S calculational module uses cell-weighted cross-sections based on one-dimensional (1-D) transport calculations performed by XSDRNPM. One-dimensional transport calculations are performed on two unit cell models, Path A and Path B, to calculate energy dependent spatial neutron flux distributions necessary to perform cross-section cell-weighting calculations.

The Path A unit cell model is simply a unit cell of the fuel assembly lattice containing a fuel rod. In the Path A model, the fuel pellet, gap, and clad are modeled explicitly. The only modification required to develop the Path A model is the conversion of the fuel assembly's square lattice unit cell perimeter to a radial perimeter conserving moderator volume within the unit cell, exterior to the fuel rod cladding. This modification is performed automatically by the SAS2H control module. A 1-D transport calculation is performed on the Path A unit cell model for each energy group, and the unit cell spatial flux distributions for each energy group are used to calculate cell-weighted cross-sections for the fuel.

The Path B unit cell model is a larger unit cell representation than the Path A model; hence, it is sometimes referred to as the larger unit cell model. The Path B unit cell model represents all or part of the fuel assembly. The Path B unit cell model attempts to account for spectral effects due to heterogeneities within the fuel assembly such as water gaps, burnable poison rods, control rods, or axial power shaping rods. Typically, fuel assemblies contain a number of similar non-fuel lattice cells dispersed somewhat uniformly throughout the assembly lattice. The structure of the Path B unit cell model is based on a uniform distribution of these non-fuel lattice cells. In reality, most fuel assemblies do not have uniformly distributed non-fuel lattice cells, but the approximation of uniformly distributed non-fuel lattice cells is considered acceptable within the fidelity of these calculations as documented in Section S2.2.3.1 of Volume 1, Rev. 5 in reference 5.4.

The basic structure of the Path B unit cell model for the fuel assembly depletion calculations performed in this analysis includes an inner region composed of an explicit representation of the non-fuel lattice cell. This inner region has essentially the same format as the Path A model with the fuel rod replaced by the non-fuel rod. A region representing the homogenization of the remainder of the fuel assembly surrounds the inner region in the Path B unit cell model. A final region representing the moderator in the assembly-to-assembly spacing surrounds the homogenized region in the Path B unit cell model. The size of each radial region surrounding the inner region in the Path B unit cell model is determined by conserving the fuel-to-moderator volume ratio in the system. The cell-weighted cross-sections from the Path A model are used with the fuel of the homogenized region during the Path B model transport calculations. New cell-weighted cross-sections for each energy group are then developed using the unit cell spatial flux distribution results from the Path B model transport calculations. These cell-weighted cross-sections are used in point depletion calculations performed by ORIGEN-S to calculate depleted fuel and depleted burnable poison, if present, isotopics in the fuel assembly. A detailed description of the calculations used to produce time-dependent cross-sections by SAS2H is documented in Section S2.2.4 of Volume 1, Rev. 5 in reference 5.4.

The Path B unit cell models for the various fuel assembly configurations must be developed manually and input to the SAS2H control module. The primary concern in the development of the Path B model for PWR assemblies is the conservation of the fuel-to-moderator volume ratio in the system. For the fuel assemblies in batches 1, 2, and 3 of Crystal River Unit 3 either one, two, or three Path B unit cell models are required. The first Path B unit cell model represents a cross-section of the fuel assembly containing water-filled guide tubes and one water-filled instrument tube. The second Path B unit cell model represents a cross-section of the fuel assembly containing the absorbing region of a 16 rod BPRA and one water-filled instrument tube. The third Path B unit cell model represents a cross-section of the fuel assembly containing the non-absorbing region of a 16 rod BPRA and one water-filled instrument tube. The non-absorbing region of a BPRA is the region above the neutron absorber Al_2O_3-B_4C. The BPR's in this non-absorbing region contain Al_2O_3. Not all assemblies require all of these Path B unit cell models. If no BPRA is inserted in the fuel assembly at a given time, the first Path B unit cell model is employed. If a BPRA is inserted in the fuel assembly at a given time and the axial region of the fuel assembly represented in the SAS2H calculation contains the absorbing region of the BPRA, the second Path B model is employed. If a BPRA is inserted in the fuel assembly at a given time and the axial

region of the fuel assembly represented in the SAS2H calculation contains the non-absorbing region of the BPRA, the third Path B model is employed.

The required input parameters for developing the various Path B unit cell models are the same for every assembly in fuel batches 1, 2, and 3, depending on whether or not a BPRA is present in the assembly Path B model. Therefore, the three different Path B unit cell models previously discussed will be the same for each assembly in fuel batches 1, 2, and 3. Two Excel 5.0 spreadsheets were used to develop the three Path B unit cell models for use in this analysis. Both of the spreadsheets present the input parameters required, the parameters calculated, references to equations used to calculate the parameters, and the final Path B unit cell model dimensions for direct implementation in a SAS2H input deck. One of the spreadsheets calculates the dimensions of the Path B unit cell model with no BPRA inserted. The other spreadsheet calculates the dimensions of the Path B unit cell model with a BPRA inserted. The second and third Path B unit cell models previously described (absorbing BP and non-absorbing BP) utilize the same Path B unit cell model dimensions. The only difference between these two unit cell models is the composition of the BP region. Tables 7.2-1 through 7.2-2 contain both Path B unit cell development spreadsheets followed by a listing of the equations referenced and utilized in each of the spreadsheets, respectively. Table 7.2-3 presents the equations referenced in Tables 7.2-1 and 7.2-2.

Table 7.2-1 Path B Unit Cell Model Dimension Calculation Spreadsheet for Non-Rodded Assembly Regions from Fuel Batches 1, 2, and 3 of Crystal River Unit 3 that do not have a BPRA Inserted

SAS2H Path B Unit Cell Model Dimension Calculations for the Base Fuel Assembly Configurations in Fuel Batches 1, 2, and 3 of Crystal River Unit 3

Input Parameters

Number of unit cells in assembly:	225
Number of fuel rods in assembly:	208
Number of guide tubes in assembly:	16
Rod pitch in assembly (cm):	1.44272
Fuel pellet diameter (cm):	0.9398
Fuel cladding outer diameter (cm):	1.0922
Guide tube outer diameter (cm):	1.3462
Guide tube inner diameter (cm):	1.26492
Instrument tube outer diameter (cm):	1.38193
Instrument tube inner diameter (cm):	1.12014
Assembly pitch (cm):	21.81098

Fuel-to-Moderator Volume Ratio Calculation:

Identifier of Equation(s) Utilized:	1 (Table 7.2-3)

Table 7.2-1 Path B Unit Cell Model Dimension Calculation Spreadsheet for Non-Rodded Assembly Regions from Fuel Batches 1, 2, and 3 of Crystal River Unit 3 that do not have a BPRA Inserted

Fuel-to-Moderator Volume Ratio = 0.533864

Moderator Unit Volume in Central Unit Cell of Path B Model:

Identifier of Equation(s) Utilized: 2 (Table 7.2-3)

Moderator Unit Volume in Central Unit Cell of Path B Model = 1.914755

Fuel Unit Volume in Fuel Rod Unit Cell:

Identifier of Equation(s) Utilized: 3 (Table 7.2-3)

Fuel Unit Volume in Fuel Rod Unit Cell = 0.693683

Moderator Unit Volume in Fuel Rod Unit Cell:

Identifier of Equation(s) Utilized: 4 (Table 7.2-3)

Moderator Unit Volume in Fuel Rod Unit Cell = 1.144539

Number of Fuel Rod Unit Cells that must be Represented in the Homogenized Zone of the Path B Model:

Identifier of Equation(s) Utilized: 5 (Table 7.2-3)

Number of Fuel Rod Unit Cells that must be Represented in the Homogenized Zone of the Path B Model = 12.36742

Path B Unit Cell Model Dimensions:

	Zone #	Outer Radius (cm)	Zone Description
Inner	1	0.63246	Water filled gap
	2	0.67310	Guide tube
	3	0.81397	Guide tube unit cell moderator
	4	2.97599	Homogenized region
Outer	5	2.99939	Moderator in the assembly-to-assembly gap

Table 7.2-1 Path B Unit Cell Model Dimension Calculation Spreadsheet for Non-Rodded Assembly Regions from Fuel Batches 1, 2, and 3 of Crystal River Unit 3 that do not have a BPRA Inserted

Notes: The Zone 4 outer radius is calculated using Equation 6.
The Zone 5 outer radius is calculated using Equation 7.

Table 7.2-2 Path B Unit Cell Model Dimension Calculation Spreadsheet for Non-Rodded Assembly Regions from Fuel Batches 1, 2, and 3 of Crystal River Unit 3 that have a BPRA Inserted

SAS2H Path B Unit Cell Model Dimension Calculations for Fuel Assemblies Containing 16 Rod Non-Annular BPRA's in Fuel Batches 1, 2, and 3 of Crystal River Unit 3

Input Parameters

Number of unit cells in assembly:	225
Number of fuel rods in assembly:	208
Number of guide tubes in assembly:	16
Number of BPR's in assembly:	16
Rod pitch in assembly (cm):	1.44272
Fuel pellet diameter (cm):	0.9398
Fuel cladding outer diameter (cm):	1.0922
Guide tube outer diameter (cm):	1.3462
Guide tube inner diameter (cm):	1.26492
BPR cladding outer diameter (cm):	1.0922
BPR cladding inner diameter (cm):	0.9144
BP pellet diameter (cm):	0.8636
Instrument tube outer diameter (cm):	1.38193
Instrument tube inner diameter (cm):	1.12014
Assembly pitch (cm):	21.81098

Fuel-to-Moderator Volume Ratio Calculation:

Identifier of Equation(s) Utilized: 1 (Table 7.2-3)

Fuel-to-Moderator Volume Ratio = 0.565214

Moderator Unit Volume in Central Unit Cell of Path B Model:

Table 7.2-2 Path B Unit Cell Model Dimension Calculation Spreadsheet for Non-Rodded Assembly Regions from Fuel Batches 1, 2, and 3 of Crystal River Unit 3 that have a BPRA Inserted

Identifier of Equation(s) Utilized: 2 (Table 7.2-3)

Moderator Unit Volume in Central Unit Cell of Path B Model = 0.977852

Fuel Unit Volume in Fuel Rod Unit Cell:

Identifier of Equation(s) Utilized: 3 (Table 7.2-3)

Fuel Unit Volume in Fuel Rod Unit Cell = 0.693683

Moderator Unit Volume in Fuel Rod Unit Cell:

Identifier of Equation(s) Utilized: 4 (Table 7.2-3)

Moderator Unit Volume in Fuel Rod Unit Cell = 1.144539

Number of Fuel Rod Unit Cells that must be Represented in the Homogenized Zone of the Path B Model:

Identifier of Equation(s) Utilized: 5 (Table 7.2-3)

Number of Fuel Rod Unit Cells that must be Represented in the Homogenized Zone of the Path B Model = 11.81651

Path B Unit Cell Model Dimensions:

	Zone #	Outer Radius (cm)	Zone Descriptions With Absorbing BPRA Inserted	Zone Descriptions With Non-Absorbing BPRA Inserted
Inner	1	0.43180	Absorbing BP Material	Non-Absorbing BP Material
	2	0.45720	Helium Gap	Helium Gap
	3	0.54610	BPR cladding	BPR cladding
	4	0.63246	Water Filled Gap	Water Filled Gap
	5	0.67310	Guide tube	Guide tube
	6	0.81397	Unit cell moderator	Unit cell moderator
	7	2.91402	Homogenized region	Homogenized region

Table 7.2-2 Path B Unit Cell Model Dimension Calculation Spreadsheet for Non-Rodded Assembly Regions from Fuel Batches 1, 2, and 3 of Crystal River Unit 3 that have a BPRA Inserted

Outer	8	2.93693	Moderator Outside Assembly	Moderator Outside Assembly

Notes: The Zone 7 outer radius is calculated using Equation 6.
The Zone 8 outer radius is calculated using Equation 7.

The Path B model that is used after the removal of the BPRA during a statepoint depletion calculation must use the same number of radial zones as the Path B model with the BPRA inserted. One difference between the Path B model with the BPRA removed and the Path B model with the BPRA inserted is that the materials in zones 1 through 3 are changed to water. Another difference is that the outer radius of zones 7 and 8 are adjusted to match the homogenized region and outer water region dimensions of the base Path B model (the Path B model with all empty guide tubes). Typically, a BPRA is not moved or removed during a reactor cycle. In this analysis there is no instance when a BPRA would need to be removed from an assembly axial node during a statepoint calculation. For this reason, the Path B model for the assembly node after removal of a BPRA during a statepoint calculation is not used in any of the assembly depletion calculations documented in this analysis. This dimensions of zones 7 and 8 for the Path B model representing the removal of the BPRA during a statepoint calculation are specified incorrectly in the CRAFT input decks for the assembly depletion calculations which are documented in this analysis. The fact that the Path B model representing the removal of a BPRA during a statepoint calculation is never used in any of the calculations of this analysis allows all of the results generated in this analysis to remain unaffected.

Table 7.2-3 Equations Utilized in the Path B Model Dimension Calculation Spreadsheets Presented in Tables 7.2-1 and 7.2-2

Equation 1 (Fuel-to-Moderator Volume Ratio in Actual Assembly):

$$\frac{F}{M}\ Ratio = \frac{(Number\ of\ Fuel\ Rods)(\frac{\pi}{4})(Fuel\ Pellet\ Diameter)^2}{\{(Number\ of\ Fuel\ Rods)[Rod\ Pitch^2-(Clad\ OD)^2(\frac{\pi}{4})]+ (Number\ of\ Empty\ GT's)[Rod\ Pitch^2-(GT\ OD)^2(\frac{\pi}{4})+(GT\ ID)^2(\frac{\pi}{4})]+ (Number\ of\ Rodded\ GT's)[Rod\ Pitch^2-(GT\ OD)^2(\frac{\pi}{4})+(GT\ ID)^2(\frac{\pi}{4})-(Inserted\ Rod\ OD)^2(\frac{\pi}{4})]+ [Rod\ Pitch^2-(IT\ OD)^2(\frac{\pi}{4})+(IT\ ID)^2(\frac{\pi}{4})]\}}$$

where GT means guide tube, IT means instrument tube, and ID means inner diameter, OD means outer diameter. This equation assumes that there is no instrument inserted in the instrument tube, and the instrument tube is filled with moderator.

Equation 2 (Central Unit Cell Moderator Volume):

$$CUCMV = Rod\ Pitch^2 - (GT\ OD)^2\left(\frac{\pi}{4}\right) + (GT\ ID)^2\left(\frac{\pi}{4}\right) - (Inserted\ Rod\ OD)^2\left(\frac{\pi}{4}\right)$$

Equation 3 (Fuel Volume in an Assembly Lattice Cell Containing a Fuel Rod):

$$FV = (Fuel\ Pellet\ OD)^2\left(\frac{\pi}{4}\right)$$

Equation 4 (Moderator Volume in an Assembly Lattice Cell Containing a Fuel Rod):

$$MV = Rod\ Pitch^2 - (Fuel\ Clad\ OD)^2\left(\frac{\pi}{4}\right)$$

Base equation from which Equation 5 is derived:

$$\frac{F}{M}\ Ratio = \frac{x\ (FV)}{CUCMV + x\ (MV)}$$

where x is the number of assembly lattice cells containing fuel rods that must be represented in the Path B homogenized region.

Equation 5:

$$x = \frac{\left(\frac{F}{M}\ Ratio\right)(CUCMV)}{FV - \left(\frac{F}{M}\ Ratio\right)(MV)}$$

Base equations from which Equations 6 and 7 are derived:

$$Area\ of\ Any\ Annular\ Region\ in\ the\ Path\ B\ Model = \pi\ (Outer\ Radius\ of\ Annular\ Region^2 - Inner\ Radius\ of\ Annular\ Region^2)$$

$$\updownarrow$$

$$Outer\ Radius\ of\ Annular\ Region = \sqrt{\frac{Area\ of\ Annular\ Region}{\pi} + IR^2}$$

where IR means the inner radius of the annular region.

Equation 6:

$$Path\ B\ Model\ Homogenized\ Region\ Outer\ Radius = \sqrt{\frac{x\ (Rod\ Pitch)^2}{\pi} + IR^2}$$

Equation 7:

$$Assembly\text{-}to\text{-}Assembly\ Spacing\ Moderator\ Zone\ Outer\ Radius =$$
$$\left\{ \frac{(x+1)}{Number\ of\ Lattice\ Cells\ in\ Assembly} * \right.$$
$$\left. [Assembly\ Pitch^2 - (Rod\ Pitch)^2 (Number\ of\ Lattice\ Cells\ in\ Assembly)] \left(\frac{1}{\pi}\right) + IR^2 \right\}^{0.5}$$

7.3 Cycle Irradiation History Layouts for the Depletion of Non-Rodded Assemblies

The depletion layout for a given reactor cycle in the SAS2H calculations of this analysis does not change from one assembly depletion calculation to another. This is due to the fact that non-rodded assemblies may only contain BPRA's which are not moved during a reactor cycle's operation. Therefore, detailed intra-cycle variable time steps are not required to accurately follow the characteristics of a given fuel assembly axial node during each reactor cycle of irradiation. In SAS2H, the duration of an irradiation interval may be separated into a number of time steps of variable length. Typically, an irradiation interval is a CRC statepoint calculation interval, or the continuous irradiation time required to go from one CRC statepoint to another. A user specified number of cross-section library updates are performed during each time step of an irradiation interval. The boron letdown curve of the reactor cycle may also be followed by specifying a fraction of the soluble boron concentration defined in the base moderator material specification. This boron concentration is applied uniformly over the irradiation time step. The boron concentration fraction at the mid-point of each irradiation time step is specified in the SAS2H depletion calculations of this analysis to appropriately follow the boron letdown curve. Two primary requirements apply to determining an appropriate reactor cycle irradiation layout:

1) The duration of each time step should be specified such that a maximum of 80 days of irradiation is not exceeded between cross-section updates. The SAS2H calculations in this analysis utilize one cross-section update per irradiation step. Therefore, the maximum duration of any time step in any reactor cycle irradiation layout of this analysis should not exceed 80 days. The 80 day limit is an arbitrary limit based on engineering judgement. The 80 day irradiation time step limit should assure that the isotopic concentrations of the system (primarily fuel and borated moderator) will not alter the neutron spectrum radically enough to cause a time step of the depletion calculation to be performed without the availability of cross-sections which have been properly weighted with an appropriate neutron spectrum and spatial flux.

2) Any radical perturbations in the boron letdown curve should be followed by defining irradiation time step durations such that the average boron concentration over each time step is representative of the actual boron letdown. Usually, the 80 day time step limit imposed for cross-section update frequency is adequate to properly follow the reactor cycle's boron letdown curve.

Tables 7.3-1 through 7.3-5 contain the cycle irradiation history layouts required to perform the SAS2H depletion calculations included in this analysis. The mid-step boron concentrations are obtained by using linear interpolation within the data presented in Tables 4.1.7-1 through 4.1.7-5. A description of the linear interpolation procedures employed are presented in the "UNITS_CONVERSION" subroutine description section of the CRAFT code description in Attachment I. The acronym "ppmb" in the following tables refer to parts per million of boron by mass of moderator.

Table 7.3-1 Crystal River Unit 3 Cycle-1A
Irradiation History Layout for Non-Rodded Assemblies

Cycle-1A

BOC to EOC (268.8 EFPD of Cycle-1)

4 : Number of Irradiation Steps
67.2 : Length of Each Irradiation Step (EFPD)

Step Number	Mid-Step ppmb	Mid-Step EFPD
1	921.02	33.60
2	872.24	100.80
3	738.29	168.00
4	608.17	235.20

Table 7.3-2 Crystal River Unit 3 Cycle-1B
Irradiation History Layout for Non-Rodded Assemblies

Cycle-1B

BOC to Stpt2 (142.2 EFPD of Cycle-1B or 411.0 EFPD of Cycle-1)

2 : Number of Irradiation Steps
71.1 : Length of Each Irradiation Step (EFPD)

Step Number	Mid-Step ppmb	Mid-Step EFPD of Cycle-1B	Mid-Step EFPD of Cycle-1
1	518.65	35.55	304.35
2	256.11	106.65	375.45

Stpt2 (142.2 EFPD of Cycle-1B or 411.0 EFPD of Cycle-1) to EOC

1 : Number of Irradiation Steps
29.1 : Length of Each Irradiation Step (EFPD)

Step Number	Mid-Step ppmb	Mid-Step EFPD of Cycle-1B	Mid-Step EFPD of Cycle-1
1	237.54	156.75	425.55

Table 7.3-3 Crystal River Unit 3 Cycle-2 Irradiation History Layout for Non-Rodded Assemblies

Cycle-2

BOC to EOC

3 : Number of Irradiation Steps
55.5 : Length of Each Irradiation Step (EFPD)

Step Number	Mid-Step ppmb	Mid-Step EFPD
1	688.93	27.75
2	527.51	83.25
3	353.48	138.75

Table 7.3-4 Crystal River Unit 3 Cycle-3 Irradiation History Layout for Non-Rodded Assemblies

Cycle-3

BOC to Stpt2 (168.5 EFPD)

3 : Number of Irradiation Steps
56.167 : Length of Each Irradiation Step (EFPD)

Step Number	Mid-Step ppmb	Mid-Step EFPD
1	880.38	28.08
2	694.68	84.25
3	536.65	140.42

Stpt2 (168.5 EFPD) to Stpt3 (250.0 EFPD)

2 : Number of Irradiation Steps
40.75 : Length of Each Irradiation Step (EFPD)

Step Number	Mid-Step ppmb	Mid-Step EFPD
1	382.60	188.88
2	267.17	229.63

Stpt3 (250.0 EFPD) to EOC (323.0 EFPD)

2 : Number of Irradiation Steps
36.5 : Length of Each Irradiation Step (EFPD)

Step Number	Mid-Step ppmb	Mid-Step EFPD
1	234.64	268.25
2	128.17	304.75

Table 7.3-5 Crystal River Unit 3 Cycle-7 Irradiation History Layout for Non-Rodded Assemblies

Cycle-7

BOC to Stpt2 (260.3 EFPD)

4 : Number of Irradiation Steps
65.075 : Length of Each Irradiation Step (EFPD)

Step Number	Mid-Step ppmb	Mid-Step EFPD
1	1424.17	32.54
2	1300.75	97.61
3	1159.96	162.69
4	971.50	227.76

Stpt2 (260.3 EFPD) to Stpt3 (291.0 EFPD)

1 : Number of Irradiation Steps
30.7 : Length of Each Irradiation Step (EFPD)

Step Number	Mid-Step ppmb	Mid-Step EFPD
1	856.06	275.65

Stpt3 (291.0 EFPD) to Stpt4 (319.0 EFPD)

1 : Number of Irradiation Steps
28 : Length of Each Irradiation Step (EFPD)

Step Number	Mid-Step ppmb	Mid-Step EFPD
1	805.91	305.00

Stpt4 (319.0 EFPD) to Stpt5 (462.3 EFPD)

2 : Number of Irradiation Steps
71.65 : Length of Each Irradiation Step (EFPD)

Step Number	Mid-Step ppmb	Mid-Step EFPD
1	565.35	354.83
2	356.75	426.48

Stpt5 (462.3 EFPD) to Stpt6 (479.0 EFPD)

1 : Number of Irradiation Steps
16.7 : Length of Each Irradiation Step (EFPD)

Step Number	Mid-Step ppmb	Mid-Step EFPD
1	231.02	470.65

Stpt6 (479.0 EFPD) to EOC (497.9 EFPD)

1 : Number of Irradiation Steps
18.9 : Length of Each Irradiation Step (EFPD)

Step Number	Mid-Step ppmb	Mid-Step EFPD
1	183.83	488.45

7.4 The Commercial Reactor Assembly Follow Taskmaster (CRAFT) Code & Usage

The Commercial Reactor Assembly Follow Taskmaster (CRAFT) code directs the performance of assembly depletion and decay calculations relevant to CRC evaluations. The CRAFT code generates input decks for the SAS2H control module of the SCALE V4.3 modular code system based on user defined input which describes the fuel assembly's specifications and irradiation history. Appropriate isotopic concentrations relevant to both the CRC evaluations containing the fuel assembly and subsequent depletion and decay calculations of the fuel assembly are extracted and stored by CRAFT as

it generates and executes SAS2H cases required to simulate the complete fuel assembly irradiation history.

The CRAFT code is developed with a high degree of flexibility that provides for the depletion and decay of fuel assemblies with widely varying features under either standard or non-standard core operating procedures. The following listing describes some of the capabilities and usage of the CRAFT code.

- The CRAFT code generates and executes appropriate SAS2H cases required to perform a prescribed depletion and decay sequence for a fuel assembly. The depletion and decay sequence is orchestrated from the BOC statepoint calculation of the initial prescribed insertion cycle through the final statepoint calculation of the last prescribed insertion cycle. The CRAFT code extracts and saves fuel and burnable poison isotopics at each statepoint, including BOC statepoints, during the fuel assembly's depletion and decay sequence. A certain number of the generated isotopics in the depleted fuel composition obtained from a SAS2H calculation are not used in the initial charge composition to the next SAS2H calculation due to a lack of cross-section data in the specified cross-section library. The CRAFT code provides a listing of the fuel isotopics from the output of a SAS2H calculation which are not used in the initial charge to the next SAS2H calculation. The isotopics left out of the initial charge are fission products whose reactivity worth is small relative to the isotopics retained in the initial charge composition. The listing of excluded initial charge isotopics allows for a determination of the impact upon the reactivity worth of the initial fuel composition in the subsequent depletion calculation.

- Any assembly design may be analyzed within the bounds of the SAS2H control module through the use of the CRAFT code. This includes both PWR and BWR fuel assemblies.

- An axial blanket fuel modeling option is available in the CRAFT code. Any UO_2 enrichment may be specified for the axial blanket fuel. The axial blanket fuel may be defined to exist in any of the CRC axial nodes which are defined for the CRAFT calculation.

- A spacer grid modeling technique is available with the CRAFT code. The modeling technique homogenizes the spacer grid material throughout the moderator of the fuel assembly by utilizing a user defined spacer material and spacer material volume fraction in the moderator. The available spacer grid materials include the following-- ZIRC-4, INCONEL, SS316, SS316S, SS304, SS304S. Any volume fraction of spacer material in the moderator may be specified (including zero).

- The fuel cladding, BPR cladding, axial power shaping rod (APSR) cladding, or control rod (CR) cladding in the CRAFT calculation may be designated as any of the following materials-- ZIRC-4, INCONEL, SS316, SS316S, SS304, SS304S.

- The insertion of a BPR assembly during the irradiation of the fuel assembly may be modeled in the CRAFT calculation. Up to 10 unique BPR assembly designs may be specified for use during the depletion of a fuel assembly. Any type of BPR assembly design may be specified. The

default BP material for use in CRAFT calculation is Al_2O_3-B_4C. Any arbitrary BP material may be specified for use in a BPR assembly design. A maximum of 10 unique BP materials may be specified. A maximum of 20 unique elements or isotopes may be specified in any given BP material. A BPR assembly may be inserted in any reactor cycle specified in the CRAFT calculation. Only one BPR assembly design may be specified per cycle. The position of the BPR assembly in the fuel assembly is specified by identifying the top and bottom axial nodes of the BP material. The BPR assembly remains fixed during a given reactor cycle. The depletion of the BP material is tracked during the CRAFT calculation. The appropriate depleted BP material is utilized in statepoint calculations following the BOC to statepoint 1 calculation for a given reactor cycle. Depleted BP material isotopic concentrations are also retained for use in subsequent mid-cycle statepoint reactivity calculations which may be performed as part of the CRC evaluation process.

- The insertion of a CR assembly during the irradiation of the fuel assembly may be modeled in the CRAFT calculation. Up to 10 unique CR assembly designs may be specified for use during the depletion of a fuel assembly. Any type of CR assembly design may be specified. Any arbitrary CR absorber material may be specified for use in a CR assembly design. A maximum of 10 unique CR absorber materials may be specified. A maximum of 10 unique elements or isotopes may be specified in any given CR absorber material. A CR assembly may be inserted in any reactor cycle specified in the CRAFT calculation. Multiple CR assembly designs may be specified per cycle. The position of the CR assembly in the fuel assembly is specified by identifying the top and bottom axial nodes of the CR absorber material. The CR assembly position may be changed between each irradiation step of a SAS2H calculation generated by CRAFT. The CR assembly design may also be changed between any two statepoint calculations in a given reactor cycle.

- The insertion of an APSR assembly during the irradiation of the fuel assembly may be modeled in the CRAFT calculation. Up to 10 unique APSR assembly designs may be specified for use during the depletion of a fuel assembly. Any type of APSR assembly design may be specified. Any arbitrary APSR absorber material may be specified for use in an APSR assembly design. A maximum of 10 unique APSR absorber materials may be specified. A maximum of 10 unique elements or isotopes may be specified in any given APSR absorber material. An APSR assembly may be inserted in any reactor cycle specified in the CRAFT calculation. Multiple APSR assembly designs may be specified per cycle. The position of the APSR assembly in the fuel assembly is specified by identifying the top and bottom axial nodes of the APSR absorber material. The APSR assembly position may be changed between each irradiation step of a SAS2H calculation generated by CRAFT. The APSR assembly design may also be changed between any statepoint calculations in a given reactor cycle. For any APSRA modeled, the APSR follow rods are modeled in the axial region above the absorbing region of the APSR. The APSR follow rod material may be specified as a cladding material in the CRAFT input deck.

- A fuel assembly may be inserted in a maximum of 10 reactor cycles during a CRAFT calculation.

- A maximum of 20 statepoints (BOC is always considered a statepoint) may be specified in any given reactor cycle in a CRAFT calculation.

- A maximum of 23 irradiation steps of variable duration may be specified in any given SAS2H statepoint calculation to be generated during a CRAFT calculation.

- A maximum of 50 axial nodes may be specified in the CRC nodal format for use in a CRAFT calculation. Each axial node may have a unique height.

- The CRAFT code utilizes a user-defined input format for fuel temperature, moderator specific volume, and burnup data. The input data must be specified for each axial node in a user-defined nodal format of up to 50 nodes of arbitrary height. The total assembly active fuel height for the input data descriptions may be different than that specified in the CRC nodal format. Depending on the users needs, the fuel temperature, moderator specific volume and burnup input data may be specified in a different nodal format each time an assembly set of this input data is provided. Nominal fuel temperature input data representing full-power reactor operation must be provided in units of degrees Fahrenheit for each node in each statepoint calculation to be generated by the CRAFT calculation. Nominal moderator specific volume input data representing full-power reactor operation must be provided in units of cubic feet per pound for each node in each statepoint calculation to be generated by the CRAFT calculation. The nodal average burnup input data must be provided in units of GWd/MTU for each node at each statepoint including the BOC statepoint. All burnup input data that is specified must be cumulative from the initial insertion of the fuel assembly in the reactor.

- A continuation CRAFT calculation for an assembly may be initiated from any statepoint in any reactor cycle if all of the nodal consolidated output files ("*.cut" files) from the statepoint calculation immediately preceding the continuation calculation exist in the CRAFT execution directory.

Additional information on the CRAFT code is provided in the CRAFT user information of Attachment I. Instructions on how to develop CRAFT input decks and execute CRAFT calculations are provided in Attachment I. Attachment I also discusses specific modeling procedures and details relevant to the SAS2H fuel assembly depletion calculations which are generated by CRAFT.

7.5 Input & Output Filename Descriptions for CRAFT and SAS2H

The CRAFT code generates five types of files identified as either "*.input", "*.output", "*.cut", "*.msgs", or "*.notes", where the "*" is the base file set identifier for the statepoint calculation of interest. The "*.cut" and "*.notes" files are the only files that must be retained for CRC evaluation and documentation purposes. All files are generated in the working directory in which the CRAFT calculation is performed.

All CRAFT generated filenames utilize the following format-- "{Base File Set Identifier}.{suffix}". Where the suffix corresponds to one of the five file types previously mentioned, and the base file set identifier is a 25 character name containing essential information necessary to delineate one CRAFT generated SAS2H calculation from another.

The base file set identifier for a statepoint calculation contains the following information:

1) reactor identifier (three character);
2) one-eighth core symmetry assembly number in current reactor cycle (two digit);
3) axial node number (node 1 is always the top node) (two digit);
4) reactor cycle number in which the SAS2H calculation starts (two character);
5) EFPD statepoint at which the SAS2H calculation starts (three digit);
6) reactor cycle number in which the SAS2H calculation ends (two character);
7) EFPD statepoint at which the SAS2H calculation ends (three digit).

The format of the base file set identifier is as follows where the numbers identified as #{number} correspond to one of the seven items previously listed-- #1 A #2 N #3 DC #4 T #5 AC #6 T #7. The letters contained in the base file set identifier are presented explicitly as shown in the previous format. The base file set identifier does not contain any spaces.

The "*.input" files contain a CRAFT generated SAS2H input deck. The "*.output" files contain a complete SAS2H calculation output file. The "*.cut" files contain the corresponding SAS2H input deck followed by an output extraction, from the final ORIGEN pass of the SAS2H calculation, which contains data relevant to CRC evaluations. The "*.msgs" files contain the standard run-time messages associated with the SAS2H calculation. The "*.notes" files contain a listing of the isotopes and their concentration which were left behind in generating the initial charge fuel composition for a continuation SAS2H calculation. The "*.notes" files are only created for CRAFT generated SAS2H calculations which represent continuation depletion and decay calculations. The "*.cut" and "*.notes" files contain all of the information which is required to perform CRC evaluations or repeat calculations as necessary for quality assurance purposes. The remainder of the CRAFT generated files may be discarded once the "*.cut" and "*.notes" files have been produced correctly.

7.6 Non-Rodded Assembly Depletion Calculations for Fuel Batches 1, 2, and 3 of Crystal River Unit 3

Depletion calculations for 18 non-rodded fuel assemblies from fuel batches 1, 2, and 3 of Crystal River Unit 3 are documented in this analysis. The depleted fuel and depleted burnable poison isotopics for these fuel assemblies must be calculated at a number of statepoints during several reactor cycles of Crystal River Unit 3 for use in subsequent CRC reactivity calculations. The assembly depletion calculations documented in this analysis are applicable to CRC statepoints in Cycle-1A, -1B, -2, -3, and -7 of Crystal River Unit 3. Table 7.6-1 identifies the CRC statepoint EFPD values in each of these cycles for which isotopic compositions are required.

Table 7.6-1 CRC Statepoint EFPD Values Relevant to Non-Rodded Assembly Depletion Calculations from Fuel Batches 1, 2, and 3 of Crystal River Unit 3

Crystal River Unit 3 Reactor Cycle	CRC Statepoint EFPD Values
1A	0.0 (BOC)
1B	0.0 (BOC)
1B	142.2
2	0.0 (BOC)
3	0.0 (BOC)
3	168.5
3	250.0
7	0.0 (BOC)
7	260.3
7	291.0
7	319.0
7	462.3
7	479.0

CRAFT input decks for each of the fuel assemblies identified in Tables 4.1.4-1 and 4.1.5-1 were developed and executed such that their depleted fuel and depleted burnable poison (if applicable) isotopic concentrations were retained at each of the CRC statepoints identified in Table 7.6-1 for which a particular assembly is inserted. The CRAFT input decks were developed in accordance with the instructions presented in Sections 5 and 7 of Attachment I. SAS2H modeling features incorporated in the depletion calculations of this analysis are described in Attachment I. The CRAFT input decks for the assembly depletions documented in this analysis are provided in Attachments VI through XXIII, as documented in Section 9.

After the CRAFT calculations were completed for the non-rodded assemblies documented in this analysis, it was realized that the 12.333 days of downtime, during the 250.0 EFPD shutdown of Cycle-3, had been specified as 13.333 days in the CRAFT input decks for all of the assemblies analyzed in this analysis. The CRAFT calculations which used the 13.333 day downtime were not redone. The one additional day of specified downtime does not significantly affect the isotopic composition of either the fuel or the burnable poison.

The SAS2H input decks generated for the various depletion calculations have similar structures depending on the characteristics of the fuel assembly axial node that is being depleted. The following listing presents the base SAS2H input deck descriptions.

- Fuel assembly axial node containing empty guide tubes
- Fuel assembly axial node containing an absorbing BPR region in each guide tube
- Fuel assembly axial node (top node) containing a non-absorbing BPR region in each guide tube

All of the SAS2H input decks generated by CRAFT will correspond to one of the aforementioned base SAS2H input decks depending on the assembly characteristics being modeled in the specific depletion calculation. The material compositions of the fuel, burnable absorber, and moderator are modified for each SAS2H case depending on the depleted material compositions at the beginning of the SAS2H case and the irradiation parameters for the SAS2H case as defined in the CRAFT input deck. The material specifications for the fuel and burnable absorber have different formats in the SAS2H input decks depending on whether the depletion case represents the initial depletion calculation for the assembly axial node or a continuation depletion calculation for the axial node utilizing previously calculated fuel and burnable poison (if applicable) isotopics for the initial charge compositions.

The following six example SAS2H input decks are presented to demonstrate the modeling techniques employed by CRAFT in generating appropriate SAS2H depletion cases for the fuel assembly depletion calculations relevant to this analysis. These example input decks are actual SAS2H input decks which were generated and executed during the depletion of fuel assemblies relevant to CRC evaluations. Each section of these example SAS2H input decks are modified as necessary to perform each depletion calculation according to the pertinent information provide in the CRAFT input deck.

SAS2H Depletion Input Deck Example 1: BOL Depletion Calculation for a B&W Fuel Assembly Axial Node Containing 208 Fuel Rods, 16 Empty Guide Tubes, and 1 Empty Instrument Tube

```
=sas2h    parm=skipshipdata
Crystal River, Unit 3 Assy-03, Node-05 (Cyc-1A,    .0 to Cyc-1B,    .0 EFPD)
44group         latticecell
'
'   fuel density based on mass of uranium per assembly & total pellet stack
'   volume to account for fuel volume loss to pellet chamfers
'
'     material specification input
'
uo2 1 den=10.121 1 1066.3 92234  .016 92235 1.930 92236  .009 92238 98.045 end
kr-83        1   0   1-21   1066.3   end
kr-85        1   0   1-21   1066.3   end
sr-90        1   0   1-21   1066.3   end
y-89         1   0   1-21   1066.3   end
mo-95        1   0   1-21   1066.3   end
zr-93        1   0   1-21   1066.3   end
zr-94        1   0   1-21   1066.3   end
zr-95        1   0   1-21   1066.3   end
```

```
nb-94          1    0    1-21    1066.3    end
tc-99          1    0    1-21    1066.3    end
rh-103         1    0    1-21    1066.3    end
rh-105         1    0    1-21    1066.3    end
ru-101         1    0    1-21    1066.3    end
ru-106         1    0    1-21    1066.3    end
pd-105         1    0    1-21    1066.3    end
pd-108         1    0    1-21    1066.3    end
ag-109         1    0    1-21    1066.3    end
sb-124         1    0    1-21    1066.3    end
xe-131         1    0    1-21    1066.3    end
xe-132         1    0    1-21    1066.3    end
xe-135         1    0    1-21    1066.3    end
xe-136         1    0    1-21    1066.3    end
cs-134         1    0    1-21    1066.3    end
cs-135         1    0    1-21    1066.3    end
cs-137         1    0    1-21    1066.3    end
ba-136         1    0    1-21    1066.3    end
la-139         1    0    1-21    1066.3    end
ce-144         1    0    1-21    1066.3    end
nd-143         1    0    1-21    1066.3    end
nd-145         1    0    1-21    1066.3    end
pm-147         1    0    1-21    1066.3    end
pm-148         1    0    1-21    1066.3    end
nd-147         1    0    1-21    1066.3    end
sm-147         1    0    1-21    1066.3    end
sm-149         1    0    1-21    1066.3    end
sm-150         1    0    1-21    1066.3    end
sm-151         1    0    1-21    1066.3    end
sm-152         1    0    1-21    1066.3    end
gd-155         1    0    1-21    1066.3    end
eu-153         1    0    1-21    1066.3    end
eu-154         1    0    1-21    1066.3    end
eu-155         1    0    1-21    1066.3    end
arbm-zirc4 6.56 5 0 0 0 8016 0.12 24000 0.10 26000 0.20 50000 1.40
           40000 98.18 2 1.0 640.0 end
'
'     material composition of moderator within unit cell
'     with smeared inconel spacer grids
h2o    3   den=.7343    .99424      588.9    end
arbm-bormod     .7343 1 0 0 0 5000 100 3 .00092    588.9 end
arbm-spacer     .7343 5 0 0 0 14000 2.5 22000 2.5 24000 15.0
                26000 7.0 28000 73.0 3 .00576    588.9 end
'
'
he     5    end
end comp
'
'     base reactor lattice specification
'
squarepitch    1.44272     .9398    1    3    1.0922    2     .9576    0    end
more data szf=0.50 end
'
'     assembly specification
'
npin/assembly=208 fuelngth=20.003 ncycles=04 nlib/cyc=1 lightel=0
printlevel=05 inplevel=2 numztotal=05 mxrepeats=1 mixmod=3 facmesh=.50 end
  3   .63246    2   .67310    3   .81397 500 2.97599    3 2.99939
```

```
'
'     assembly depletion/decay parameters
'
'   Cycle-1A, one-eighth core assembly number 03
power=1.0928     burn=67.20     down=.00000E+00 bfrac=1.000     end
power=1.0928     burn=67.20     down=.00000E+00 bfrac=.9470     end
power=1.0928     burn=67.20     down=.00000E+00 bfrac=.8016     end
power=1.0928     burn=67.20     down=195.29     bfrac=.6603     end
'
'     end of input
'
end
```

SAS2H Depletion Input Deck Example 2: Continuation Depletion Calculation for a B&W Fuel Assembly Axial Node Containing 208 Fuel Rods, 16 Empty Guide Tubes, and 1 Empty Instrument Tube

```
=sas2h    parm=skipshipdata
Crystal River, Unit 3 Assy-03, Node-05 (Cyc-1B,     .0 to Cyc-1B, 142.2 EFPD)
44group         latticecell
'
'   fuel density based on mass of uranium per assembly & total pellet stack
'   volume to account for fuel volume loss to pellet chamfers
'
'     material specification input
'
arbm-fuel   10.1     183 0 0 0 8016   11.8
      2004   .135E-05      90230   .373E-07
     90232   .411E-08      91231   .568E-08      92233   .578E-07
     92234   .112E-01      92235   .887          92236   .147
     92238   85.6          93237   .934E-02      94236   .466E-08
     94238   .126E-02      94239   .356          94240   .907E-01
     94241   .383E-01      94242   .650E-02      95241   .137E-02
     95601   .578E-05      95243   .524E-03      96242   .289E-04
     96243   .640E-06      96244   .507E-04      96245   .760E-06
     96246   .400E-07       1003   .153E-05       3006   .876E-08
     32072   .147E-06      32073   .448E-06      32074   .373E-06
     33075   .363E-05      32076   .111E-04      34076   .397E-07
     34077   .255E-04      34078   .784E-04      34080   .428E-03
     35081   .640E-03      34082   .103E-02      36082   .897E-05
     36083   .151E-02      36084   .353E-02      36085   .763E-03
     37085   .299E-02      36086   :602E-02      38086   .390E-05
     37087   .787E-02      38087   .249E-07      38088   .113E-01
     38089   .249E-03      39089   .149E-01      38090   .180E-01
     39090   .469E-05      40090   .418E-03      39091   .541E-03
     40091   .189E-01      40092   .205E-01      40093   .151E-01
     40094   .240E-01      41094   .137E-07      40095   .948E-03
     41095   .103E-02      42095   .228E-01      40096   .251E-01
     42096   .221E-03      42097   .235E-01      42098   .252E-01
     43099   .261E-01      44099   .952E-06      42100   .285E-01
     44100   .122E-02      44101   .238E-01      44102   .224E-01
     44103   .145E-03      45103   .176E-01      44104   .150E-01
     46104   .215E-02      46105   .989E-02      44106   .448E-02
     46106   .496E-02      46107   .544E-02      46108   .342E-02
     47109   .248E-02      46110   .101E-02      48110   .380E-03
     48111   .527E-03      48112   .277E-03      48113   .548E-05
```

```
      49113   .123E-06      48114   .311E-03      48601   .575E-07
      49115   .664E-04      50115   .493E-05      48116   .142E-03
      50116   .346E-04      50117   .129E-03      50118   .105E-03
      50119   .112E-03      50120   .109E-03      51121   .115E-03
      50122   .142E-03      52122   .282E-05      50123   .212E-05
      51123   .133E-03      52123   .136E-07      50124   .239E-03
      51124   .114E-06      52124   .225E-05      51125   .234E-03
      52125   .534E-04      50126   .531E-03      52126   .774E-05
      52601   .337E-04      53127   .122E-02      52128   .264E-02
      54128   .217E-04      52611   .359E-05      53129   .544E-02
      54129   .424E-07      52130   .110E-01      54130   .907E-04
      54131   .160E-01      54132   .298E-01      55133   .383E-01
      54134   .462E-01      55134   .147E-02      56134   .435E-03
      55135   .654E-02      56135   .366E-06      54136   .736E-01
      55136   .863E-09      56136   .227E-03      55137   .380E-01
      56137   .815E-03      56138   .394E-01      57139   .377E-01
      56140   .620E-07      57140   .938E-08      58140   .380E-01
      58141   .928E-04      59141   .346E-01      58142   .349E-01
      60142   .192E-03      59143   .118E-06      60143   .304E-01
      58144   .142E-01      60144   .217E-01      60145   .224E-01
      60146   .197E-01      60147   .366E-08      61147   .887E-02
      62147   .224E-02      60148   .112E-01      61148   .166E-07
      61601   .241E-05      62148   .153E-02      62149   .273E-03
      60150   .524E-02      62150   .859E-02      62151   .695E-03
      63151   .334E-05      62152   .459E-02      63152   .763E-06
      64152   .555E-06      63153   .266E-02      62154   .989E-03
      63154   .310E-03      64154   .198E-04      63155   .114E-03
      64155   .986E-05      63156   .184E-07      64156   .989E-03
      64157   .507E-05      64158   .373E-03      65159   .531E-04
      64160   .235E-04      65160   .222E-06      66160   .229E-05
      66161   .917E-05      66162   .599E-05      66163   .319E-05
      66164   .753E-06      67165   .804E-06      68166   .110E-06
     1   1.0    974.3   end
arbm-zirc4 6.56 5 0 0 0 8016 0.12 24000 0.10 26000 0.20 50000 1.40
          40000 98.18 2 1.0 640.0 end
'
'     material composition of moderator within unit cell
'     with smeared inconel spacer grids
h2o   3   den=.7433    .99424      585.2   end
arbm-bormod     .7433 1 0 0 0 5000 100 3 .00052   585.2 end
arbm-spacer     .7433 5 0 0 0 14000 2.5 22000 2.5 24000 15.0
                26000 7.0 28000 73.0 3 .00576   585.2 end
'
'
he    5   end
end comp
'
'     base reactor lattice specification
'
squarepitch   1.44272    .9398   1   3   1.0922   2    .9576   0   end
more data szf=0.50 end
'
'     assembly specification
'
npin/assembly=208 fuelngth=20.003 ncycles=02 nlib/cyc=1 lightel=0
printlevel=05 inplevel=2 numztotal=05 mxrepeats=1 mixmod=3 facmesh=.50 end
  3  .63246   2  .67310   3  .81397 500 2.97599   3 2.99939
'
```

```
'     assembly depletion/decay parameters
'
'   Cycle-1B, one-eighth core assembly number 03
power=.92563     burn=71.10     down=.00000E+00 bfrac=1.000     end
power=.92563     burn=71.10     down=14.792     bfrac=.4938     end
'
'     end of input
'
end
```

SAS2H Depletion Input Deck Example 3: BOL Depletion Calculation for a B&W Fuel Assembly Top Axial Node Containing 208 Fuel Rods, 16 Guide Tubes with BPR's Inserted, and 1 Empty Instrument Tube

```
=sas2h    parm=skipshipdata
Crystal River, Unit 3 Assy-02, Node-01 (Cyc-1A,     .0 to Cyc-1B,     .0 EFPD)
44group         latticecell
'
'   fuel density based on mass of uranium per assembly & total pellet stack
'   volume to account for fuel volume loss to pellet chamfers
'
'     material specification input
'
uo2 1 den=10.121 1  820.6 92234  .021 92235 2.540 92236  .012 92238 97.427 end
kr-83        1   0   1-21    820.6   end
kr-85        1   0   1-21    820.6   end
sr-90        1   0   1-21    820.6   end
y-89         1   0   1-21    820.6   end
mo-95        1   0   1-21    820.6   end
zr-93        1   0   1-21    820.6   end
zr-94        1   0   1-21    820.6   end
zr-95        1   0   1-21    820.6   end
nb-94        1   0   1-21    820.6   end
tc-99        1   0   1-21    820.6   end
rh-103       1   0   1-21    820.6   end
rh-105       1   0   1-21    820.6   end
ru-101       1   0   1-21    820.6   end
ru-106       1   0   1-21    820.6   end
pd-105       1   0   1-21    820.6   end
pd-108       1   0   1-21    820.6   end
ag-109       1   0   1-21    820.6   end
sb-124       1   0   1-21    820.6   end
xe-131       1   0   1-21    820.6   end
xe-132       1   0   1-21    820.6   end
xe-135       1   0   1-21    820.6   end
xe-136       1   0   1-21    820.6   end
cs-134       1   0   1-21    820.6   end
cs-135       1   0   1-21    820.6   end
cs-137       1   0   1-21    820.6   end
ba-136       1   0   1-21    820.6   end
la-139       1   0   1-21    820.6   end
ce-144       1   0   1-21    820.6   end
nd-143       1   0   1-21    820.6   end
nd-145       1   0   1-21    820.6   end
pm-147       1   0   1-21    820.6   end
pm-148       1   0   1-21    820.6   end
```

```
nd-147        1    0    1-21     820.6    end
sm-147        1    0    1-21     820.6    end
sm-149        1    0    1-21     820.6    end
sm-150        1    0    1-21     820.6    end
sm-151        1    0    1-21     820.6    end
sm-152        1    0    1-21     820.6    end
gd-155        1    0    1-21     820.6    end
eu-153        1    0    1-21     820.6    end
eu-154        1    0    1-21     820.6    end
eu-155        1    0    1-21     820.6    end
arbm-zirc4 6.56 5 0 0 0 8016 0.12 24000 0.10 26000 0.20 50000 1.40
           40000 98.18 2 1.0 640.0 end
'
'     material composition of moderator within unit cell
'     with smeared inconel spacer grids
h2o    3   den=.7198    .99424      594.5    end
arbm-bormod     .7198 1 0 0 0 5000 100 3 .00092    594.5 end
arbm-spacer     .7198 5 0 0 0 14000 2.5 22000 2.5 24000 15.0
                 26000 7.0 28000 73.0 3 .00576    594.5 end
'
'
'     BPR above the BP absorber region
'
al      6   den=3.700   .52924    594.5 end
o       6   den=3.700   .47076    594.5 end
'
he      5   end
end comp
'
'     base reactor lattice specification
'
squarepitch    1.44272     .9398    1    3    1.0922    2     .9576    0    end
more data szf=0.50 end
'
'     assembly specification
'
npin/assembly=208 fuelngth=17.780 ncycles=04 nlib/cyc=1 lightel=0
printlevel=05 inplevel=2 numztotal=08 mxrepeats=1 mixmod=3 facmesh=.50 end
  6  .43180    5  .45720    2  .54610    3  .63246    2  .67310
  3  .81397 500 2.91402    3 2.93693
'
'     assembly depletion/decay parameters
'
'   Cycle-1A, one-eighth core assembly number 02
power=.35463      burn=67.20      down=.00000E+00 bfrac=1.000      end
power=.35463      burn=67.20      down=.00000E+00 bfrac=.9470      end
power=.35463      burn=67.20      down=.00000E+00 bfrac=.8016      end
power=.35463      burn=67.20      down=195.29     bfrac=.6603      end
'
'     end of input
'
end
```

SAS2H Depletion Input Deck Example 4: Continuation Depletion Calculation for a B&W Fuel Assembly Top Axial Node Containing 208 Fuel Rods, 16 Guide Tubes with BPR's Inserted, and 1 Empty Instrument Tube

```
=sas2h    parm=skipshipdata
Crystal River, Unit 3 Assy-04, Node-01 {Cyc-04, 228.1 to Cyc-04, 253.0 EFPD}
44group         latticecell
'
'    fuel density based on mass of uranium per assembly & total pellet stack
'    volume to account for fuel volume loss to pellet chamfers
'
'      material specification input
'
arbm-fuel    10.2      192 0 0 0 8016    11.9
      2004    .114E-06       90230    .327E-07
     92233    .309E-07       92234    .177E-01       92235    1.84
     92236    .977E-01       92237    .305E-04       92238    85.4
     93237    .311E-02       93238    .302E-07       94238    .184E-03
     94239    .216           94240    .243E-01       94241    .636E-02
     94242    .337E-03       95241    .915E-04       95601    .946E-06
     95243    .103E-04       96242    .563E-05       96243    .334E-07
     96244    .387E-06        1003    .678E-06        3006    .406E-08
     32072    .410E-07       32073    .142E-06       32074    .119E-06
     33075    .174E-05       32076    .555E-05       34076    .747E-08
     34077    .126E-04       34078    .354E-04       34080    .208E-03
     35081    .311E-03       34082    .521E-03       36082    .185E-05
     36083    .827E-03       36084    .177E-02       36085    .398E-03
     37085    .157E-02       36086    .319E-02       37086    .747E-07
     38086    .720E-06       37087    .417E-02       38087    .674E-08
     38088    .597E-02       38089    .140E-02       39089    .670E-02
     38090    .961E-02       39090    .250E-05       40090    .242E-03
     39091    .208E-02       40091    .816E-02       40092    .106E-01
     40093    .766E-02       40094    .119E-01       41094    .363E-08
     40095    .277E-02       41095    .162E-02       42095    .781E-02
     40096    .121E-01       42096    .659E-04       42097    .112E-01
     42098    .118E-01       42099    .346E-05       43099    .125E-01
     44099    .320E-06       42100    .131E-01       44100    .239E-03
     44101    .109E-01       44102    .973E-02       44103    .115E-02
     45103    .628E-02       44104    .540E-02       46104    .440E-03
     45105    .277E-07       46105    .353E-02       44106    .149E-02
     46106    .793E-03       46107    .129E-02       46108    .770E-03
     47109    .563E-03       46110    .236E-03       48110    .339E-04
     47111    .160E-05       48111    .129E-03       48112    .770E-04
     48113    .429E-05       49113    .123E-07       48114    .102E-03
     48601    .275E-06       49115    .299E-04       50115    .180E-05
     48116    .536E-04       50116    .597E-05       50117    .429E-04
     50118    .383E-04       50119    .414E-04       50120    .410E-04
     51121    .440E-04       50122    .525E-04       52122    .394E-06
     50123    .189E-05       51123    .502E-04       50124    .877E-04
     51124    .137E-06       52124    .245E-06       50125    .467E-06
     51125    .854E-04       52125    .169E-04       50126    .170E-03
     51126    .317E-07       52126    .185E-05       52601    .303E-04
     53127    .410E-03       52128    .107E-02       54128    .331E-05
     52611    .506E-04       53129    .221E-02       54129    .296E-08
     52130    .490E-02       54130    .155E-04       53131    .862E-04
     54131    .766E-02       52132    .735E-05       54132    .128E-01
     54133    .709E-04       55133    .183E-01       54134    .217E-01
     55134    .338E-03       56134    .483E-04       55135    .800E-02
     56135    .682E-07       54136    .287E-01       55136    .350E-05
     56136    .758E-04       55137    .175E-01       56137    .398E-03
     56138    .188E-01       57139    .180E-01       56140    .460E-03
     57140    .693E-04       58140    .182E-01       58141    .178E-02
```

```
      59141   .149E-01      58142   .168E-01      60142   .391E-04
      58143   .498E-07      59143   .509E-03      60143   .156E-01
      58144   .869E-02      60144   .770E-02      60145   .112E-01
      60146   .911E-02      60147   .131E-03      61147   .486E-02
      62147   .119E-02      60148   .521E-02      61148   .207E-05
      61601   .211E-04      62148   .421E-03      61149   .359E-06
      62149   .183E-03      60150   .225E-02      62150   .343E-02
      61151   .123E-08      62151   .601E-03      63151   .170E-05
      62152   .179E-02      63152   .229E-05      64152   .124E-05
      62153   .475E-07      63153   .804E-03      62154   .338E-03
      63154   .586E-04      64154   .206E-05      63155   .490E-04
      64155   .900E-06      63156   .119E-04      64156   .222E-03
      64157   .216E-05      64158   .827E-04      65159   .124E-04
      64160   .529E-05      65160   .124E-06      66160   .148E-06
      66161   .214E-05      66162   .108E-05      66163   .460E-06
      66164   .137E-06      67165   .835E-07      68166   .115E-07
      1   1.0    872.8   end
arbm-zirc4 6.56 5 0 0 0 8016 0.12 24000 0.10 26000 0.20 50000 1.40
           40000 98.18 2 1.0 640.0 end
'
'     material composition of moderator within unit cell
'     with smeared inconel spacer grids
h2o   3   den=.7198   .99424     594.5   end
arbm-bormod     .7198 1 0 0 0 5000 100 3 .00022   594.5 end
arbm-spacer     .7198 5 0 0 0 14000 2.5 22000 2.5 24000 15.0
                26000 7.0 28000 73.0 3 .00576   594.5 end
'
'
'     BPR above the BP absorber region
'
al     6   den=3.700  .52924   594.5 end
o      6   den=3.700  .47076   594.5 end
'
he     5   end
end comp
'
'     base reactor lattice specification
'
squarepitch   1.44272    .9390   1   3   1.0922   2    .9576   0   end
more data szf=0.50 end
'
'     assembly specification
'
npin/assembly=208 fuelngth=17.780 ncycles=01 nlib/cyc=1 lightel=0
printlevel=05 inplevel=2 numztotal=08 mxrepeats=1 mixmod=3 facmesh=.50 end
  6  .43180   5  .45720   2  .54610   3  .63246   2  .67310
  3  .81397 500 2.91402   3 2.93693
'
'     assembly depletion/decay parameters
'
'   Cycle-04, one-eighth core assembly number 04
power=.45617     burn=24.90     down=24.000     bfrac=1.000     end
'
'     end of input
'
end
```

SAS2H Depletion Input Deck Example 5: BOL Depletion Calculation for a B&W Fuel Assembly Axial Node (Other than Top Node) Containing 208 Fuel Rods, 16 Guide Tubes with BPR's Inserted, and 1 Empty Instrument Tube

```
=sas2h    parm=skipshipdata
Crystal River, Unit 3 Assy-02, Node-02 {Cyc-1A,     .0 to Cyc-1B,     .0 EFPD}
44group         latticecell
'
'   fuel density based on mass of uranium per assembly & total pellet stack
'   volume to account for fuel volume loss to pellet chamfers
'
'     material specification input
'
uo2 1 den=10.121 1  936.2 92234  .021 92235 2.540 92236  .012 92238 97.427 end
kr-83        1   0   1-21    936.2   end
kr-85        1   0   1-21    936.2   end
sr-90        1   0   1-21    936.2   end
y-89         1   0   1-21    936.2   end
mo-95        1   0   1-21    936.2   end
zr-93        1   0   1-21    936.2   end
zr-94        1   0   1-21    936.2   end
zr-95        1   0   1-21    936.2   end
nb-94        1   0   1-21    936.2   end
tc-99        1   0   1-21    936.2   end
rh-103       1   0   1-21    936.2   end
rh-105       1   0   1-21    936.2   end
ru-101       1   0   1-21    936.2   end
ru-106       1   0   1-21    936.2   end
pd-105       1   0   1-21    936.2   end
pd-108       1   0   1-21    936.2   end
ag-109       1   0   1-21    936.2   end
sb-124       1   0   1-21    936.2   end
xe-131       1   0   1-21    936.2   end
xe-132       1   0   1-21    936.2   end
xe-135       1   0   1-21    936.2   end
xe-136       1   0   1-21    936.2   end
cs-134       1   0   1-21    936.2   end
cs-135       1   0   1-21    936.2   end
cs-137       1   0   1-21    936.2   end
ba-136       1   0   1-21    936.2   end
la-139       1   0   1-21    936.2   end
ce-144       1   0   1-21    936.2   end
nd-143       1   0   1-21    936.2   end
nd-145       1   0   1-21    936.2   end
pm-147       1   0   1-21    936.2   end
pm-148       1   0   1-21    936.2   end
nd-147       1   0   1-21    936.2   end
sm-147       1   0   1-21    936.2   end
sm-149       1   0   1-21    936.2   end
sm-150       1   0   1-21    936.2   end
sm-151       1   0   1-21    936.2   end
sm-152       1   0   1-21    936.2   end
gd-155       1   0   1-21    936.2   end
eu-153       1   0   1-21    936.2   end
eu-154       1   0   1-21    936.2   end
eu-155       1   0   1-21    936.2   end
```

```
arbm-zirc4 6.56 5 0 0 0 8016 0.12 24000 0.10 26000 0.20 50000 1.40
           40000 98.18 2 1.0 640.0 end
'
'     material composition of moderator within unit cell
'     with smeared inconel spacer grids
h2o   3   den=.7226   .99424     593.4   end
arbm-bormod    .7226 1 0 0 0 5000 100 3 .00092   593.4 end
arbm-spacer    .7226 5 0 0 0 14000 2.5 22000 2.5 24000 15.0
                26000 7.0 28000 73.0 3 .00576   593.4 end
'
'
'     burnable absorber pellet specification
'
b4c   4   den=3.700  .01340   593.4 end
al    4   den=3.700  .52215   593.4 end
o     4   den=3.700  .46445   593.4 end
'
he    5   end
end comp
'
'     base reactor lattice specification
'
squarepitch   1.44272    .9398   1   3   1.0922   2    .9576   0   end
more data szf=0.50 end
'
'     assembly specification
'
npin/assembly=208 fuelngth=20.003 ncycles=04 nlib/cyc=1 lightel=0
printlevel=05 inplevel=2 numztotal=08 mxrepeats=1 mixmod=3 facmesh=.50 end
  4  .43180   5  .45720   2  .54610   3  .63246   2  .67310
  3  .81397 500 2.91402   3 2.93693
'
'     assembly depletion/decay parameters
'
'   Cycle-1A, one-eighth core assembly number 02
power=.63623     burn=67.20     down=.00000E+00 bfrac=1.000     end
power=.63623     burn=67.20     down=.00000E+00 bfrac=.9470     end
power=.63623     burn=67.20     down=.00000E+00 bfrac=.8016     end
power=.63623     burn=67.20     down=195.29     bfrac=.6603     end
'
'     end of input
'
end
```

SAS2H Depletion Input Deck Example 6: Continuation Depletion Calculation for a B&W Fuel Assembly Axial Node (Other than Top Node) Containing 208 Fuel Rods, 16 Guide Tubes with BPR's Inserted, and 1 Empty Instrument Tube

```
=sas2h    parm=skipshipdata
Crystal River, Unit 3 Assy-04, Node-05 {Cyc-04, 228.1 to Cyc-04, 253.0 EFPD}
44group         latticecell
'
'   fuel density based on mass of uranium per assembly & total pellet stack
```

```
'   volume to account for fuel volume loss to pellet chamfers
'
'     material specification input
'
arbm-fuel   10.3     199 0 0 0 8016   11.8
      2004   .129E-05       90230   .284E-07
     90232   .273E-08       91231   .302E-08       92233   .657E-07
     92234   .154E-01       92235   1.30           92236   .192
     92237   .128E-03       92238   85.0           93237   .116E-01
     93238   .275E-06       94236   .657E-08       94237   .299E-08
     94238   .159E-02       94239   .388           94240   .873E-01
     94241   .408E-01       94242   .593E-02       95241   .637E-03
     95601   .995E-05       95243   .512E-03       96242   .118E-03
     96243   .189E-05       96244   .533E-04       96245   .860E-06
     96246   .401E-07        1003   .174E-05        3006   .833E-08
     32072   .123E-06       32073   .506E-06       32074   .311E-06
     33075   .425E-05       32076   .132E-04       34076   .472E-07
     34077   .302E-04       34078   .904E-04       34080   .502E-03
     35081   .752E-03       34082   .123E-02       36082   .105E-04
     36083   .182E-02       36084   .421E-02       36085   .914E-03
     37085   .361E-02       36086   .728E-02       37086   .452E-06
     38086   .482E-05       37087   .951E-02       38087   .229E-07
     38088   .136E-01       38089   .290E-02       39089   .154E-01
     38090   .218E-01       39090   .566E-05       40090   .614E-03
     39091   .442E-02       40091   .191E-01       40092   .246E-01
     40093   .180E-01       40094   .285E-01       41094   .116E-07
     40095   .630E-02       41095   .371E-02       42095   .190E-01
     40096   .295E-01       42096   .421E-03       42097   .275E-01
     42098   .293E-01       42099   .829E-05       43099   .302E-01
     44099   .112E-05       42100   .330E-01       44100   .151E-02
     44101   .274E-01       44102   .256E-01       44103   .322E-02
     45103   .160E-01       44104   .162E-01       46104   .279E-02
     45105   .914E-07       46105   .111E-01       44106   .560E-02
     46106   .337E-02       46107   .539E-02       46108   .341E-02
     47109   .242E-02       46110   .100E-02       48110   .381E-03
     47111   .671E-05       48111   .523E-03       48112   .285E-03
     48113   .634E-05       49113   .405E-07       48114   .332E-03
     48601   .860E-06       49115   .715E-04       50115   .536E-05
     48116   .155E-03       50116   .367E-04       50117   .137E-03
     50118   .114E-03       50119   .121E-03       50120   .119E-03
     51121   .125E-03       50122   .154E-03       52122   .312E-05
     50123   .496E-05       51123   .143E-03       52123   .131E-07
     50124   .260E-03       51124   .974E-06       52124   .170E-05
     50125   .138E-05       51125   .259E-03       52125   .509E-04
     50126   .560E-03       51126   .134E-06       52126   .786E-05
     52601   .934E-04       53127   .125E-02       52128   .295E-02
     54128   .275E-04       52611   .138E-03       53129   .597E-02
     54129   .644E-07       52130   .126E-01       54130   .991E-04
     53131   .217E-03       54131   .180E-01       52132   .182E-04
     54132   .344E-01       54133   .171E-03       55133   .442E-01
     54134   .539E-01       55134   .205E-02       56134   .313E-03
     55135   .113E-01       56135   .110E-05       54136   .813E-01
     55136   .130E-04       56136   .290E-03       55137   .438E-01
     56137   .106E-02       56138   .462E-01       57139   .438E-01
     56140   .108E-02       57140   .163E-03       58140   .448E-01
     58141   .418E-02       59141   .364E-01       58142   .411E-01
     60142   .245E-03       58143   .113E-06       59143   .115E-02
     60143   .347E-01       58144   .200E-01       60144   .221E-01
```

```
      60145   .264E-01      60146   .231E-01      60147   .310E-03
      61147   .101E-01      62147   .264E-02      60148   .130E-01
      61148   .900E-05      61601   .698E-04      62148   .203E-02
      61149   .108E-05      62149   .300E-03      60150   .593E-02
      62150   .957E-02      61151   .337E-08      62151   .880E-03
      63151   .107E-05      62152   .496E-02      63152   .273E-05
      64152   .246E-05      62153   .225E-06      63153   .297E-02
      62154   .106E-02      63154   .384E-03      64154   .137E-04
      63155   .133E-03      64155   .156E-05      63156   .624E-04
      64156   .988E-03      64157   .512E-05      64158   .364E-03
      65159   .526E-04      64160   .233E-04      65160   .126E-05
      66160   .141E-05      66161   .887E-05      66162   .580E-05
      66163   .317E-05      66164   .755E-06      67165   .627E-06
      68166   .860E-07
     1   1.0   1010.8   end
arbm-zirc4 6.56 5 0 0 0 8016 0.12 24000 0.10 26000 0.20 50000 1.40
           40000 98.18 2 1.0 640.0 end
'
'     material composition of moderator within unit cell
'     with smeared inconel spacer grids
h2o   3   den=.7343   .99424     588.9   end
arbm-bormod    .7343 1 0 0 0 5000 100 3 .00022   588.9 end
arbm-spacer    .7343 5 0 0 0 14000 2.5 22000 2.5 24000 15.0
                26000 7.0 28000 73.0 3 .00576   588.9 end
'
'
'     burnable absorber pellet specification
'
arbm-bp   3.699 5 0 0 0
       5010   .225E-02
       5011   .140
       6012   .435E-01
     13027  52.827  8016  46.987
     4 1.0  588.9 end
'
he    5   end
end comp
'
'     base reactor lattice specification
'
squarepitch   1.44272    .9390   1   3   1.0922   2    .9576   0   end
more data szf=0.50 end
'
'     assembly specification
'
npin/assembly=208 fuelngth=20.003 ncycles=01 nlib/cyc=1 lightel=0
printlevel=05 inplevel=2 numztotal=08 mxrepeats=1 mixmod=3 facmesh=.50 end
  4  .43180   5  .45720   2  .54610   3  .63246   2  .67310
  3  .81397 500 2.91402   3 2.93693
'
'     assembly depletion/decay parameters
'
'   Cycle-04, one-eighth core assembly number 04
power=1.0347     burn=24.90     down=24.000     bfrac=1.000     end
'
'     end of input
'
end
```

Attachment XLII contains a listing of the CRAFT generated consolidated SAS2H output files for the depletion calculations documented in this analysis. The files referred to by Attachment XLII are contained on magnetic media identified by reference 5.11. The consolidated output files contain the following information:

- time/date stamp for when the SAS2H depletion calculation was performed,
- echo of the SAS2H input deck generated by CRAFT,
- the output extraction of information pertinent to CRC evaluations from the final ORIGEN calculation of the SAS2H depletion calculation.

7.7 Isotopic Results

Isotopic results for the set of 29 principal isotopes identified in Table 7.7-1 are tabulated for each axial node of each fuel assembly at each CRC statepoint other than beginning of life (BOC of first reactor cycle of in which the assembly is inserted) statepoints. The CRC_DATA_TABULIZER Version 1.0 program, described in Section 6.1 and Attachment V, was used to create the principal isotope result tables for every assembly included in this analysis except assembly A12a. The CRC_DATA_TABULIZER Version 2.0 program, described in Section 6.1 and Attachment V, was used to create the principal isotope result table for assembly A12a. Attachments XXIV through XLI contain the principal isotope tabulations for the assemblies documented in this analysis. Attachments XXIV through XLI were moved to an idependent reference (Ref. 5.12) after the initial check and backcheck of this analysis was completed. The consolidated output files for the SAS2H depletion calculations contain isotopic concentrations for all isotopes included in the ORIGEN cross-section library. The ORIGEN cross-section library contains a considerably larger number of isotopes than the 29 isotopes included in the principal isotope set. Isotopic concentrations may be extracted from the consolidated SAS2H output files for subsequent evaluation and/or use in CRC reactivity analyses.

Table 7.7-1 Principal Isotopes

Mo-95	Tc-99	Ru-101	Rh-103	Ag-109
Nd-143	Nd-145	Sm-147	Sm-149	Sm-150
Sm-151	Sm-152	Eu-151	Eu-153	Gd-155
U-233	U-234	U-235	U-236	U-238
Np-237	Pu-238	Pu-239	Pu-240	Pu-241
Pu-242	Am-241	Am-242m	Am-243	---

Between CRC statepoints in the depletion sequence for a fuel assembly axial region, a new SAS2H input deck must be created using the fuel isotopic results from the previous calculation as the initial charge.

Since the 44-group cross-section library utilized in the SAS2H depletion calculations of this analysis has a reduced isotopic inventory relative to the ORIGEN cross-section library, a number of isotopes present in the ORIGEN output cannot be transferred to the initial fuel charge of the subsequent SAS2H depletion calculation. The isotopic inventory in the ORIGEN output which cannot be propagated to the following SAS2H depletion calculation does not significantly affect integral reactivity or the energy dependent neutron spectrum as documented in Section 4.9.1 of Attachment I. The non-propagated isotopic inventory is written to a file entitled "{depletion case identifier}.notes" to allow for subsequent analysis of the impact of excluding these isotopics in the initial charge to the subsequent SAS2H depletion calculation. The "*.notes" files are listed in Attachment XLIII. The files referred to in Attachment XLIII are contained on magnetic media identified by reference 5.11.

8. Conclusions

The SAS2H depletion calculations of the non-rodded fuel assemblies from batches 1, 2, and 3 of the Crystal River Unit 3 PWR that are required for CRC evaluations to support development of the disposal criticality methodology are fully documented in this analysis. The isotopic compositions of depleted fuel and depleted burnable poison for the various assemblies documented in this analysis are available in the consolidated SAS2H output files, listed in Attachment XLII and contained in reference 5.11, for subsequent evaluation and/or use in CRC reactivity evaluations. The inputs for the depletion calculations are obtained from a qualified source (Ref. 5.3). The SAS2H modeling techniques employed in the depletion calculations within this analysis are dictated by the CRAFT code which is fully documented in Attachment I.

9. Attachments

The attachments referenced throughout this design analysis are listed in Table 9-1. Attachment II contains the documentation of Appendix A of the CRAFT Version 1.0 User Information which is described in Attachment I. Attachment III contains the documentation of Appendix B of the CRAFT Version 1.0 User Information which is described in Attachment I. The CRAFT generated consolidated SAS2H output files for the CRAFT test cases which are documented in Attachments I and III are listed in Attachment IV and contained on magnetic media identified by reference 5.11. Attachment XLII is the listing of the CRAFT generated consolidated SAS2H output files for the assembly depletion calculations documented in this analysis. The files referred to in Attachment XLII are contained on magnetic media identified by reference 5.11. Attachment XLIII contains a listing of the "*.notes" files which are generated during the CRAFT calculations for the assemblies documented in this analysis. The files referred to in Attachment XLIII are contained on magnetic media identified by reference 5.11. The file listings contained in Attachments IV, XLII, and XLIII include the following information for each of the files that are written to the tape (Ref. 5.11):

- the directory and filename as taken from the HP workstation,
- the corresponding filename on the tape attachment,
- the number of text pages in the file on tape after the addition of page headers,
- the date that the file was created on the HP workstation,

- the size of the file on the HP workstation in bytes,
- the file type (ASCII or BINARY).

The tape (Ref. 5.11) containing the files listed in Attachments IV, XLII, and XLIII contain text files only. The tape is written using the Colorado Trakker Model 350 External Parallel Port Backup System for personal computers.

Table 9-1 Attachment Listing

Attachment #	Number of Pages	Generation Date	Description
I	92	03/27/97	CRAFT Version 1.0 User Information
II	82	03/27/97	CRAFT Version 1.0 Fortran Source Code Listing This is Appendix A: CRAFT Version 1.0 Fortran Source Code Listing of the CRAFT User Information Documented in Attachment I.
III	76	03/27/97	CRAFT Quality Assurance Test Case Input Decks This is Appendix B: CRAFT Quality Assurance Test Case Input Decks of the CRAFT Version 1.0 User Information Documented in Attachment I.
IV	Total Page Count for Listing of Files Contained in Reference 5.11 = 4	03/26/97.	Listing of Consolidated Output Files for the CRAFT Test Cases Documented in Attachment I This is Appendix C of the CRAFT Version 1.0 User Information which is provided in Attachment I. The files listed in this attachment are contained on magnetic media identfied by reference 5.11.
V	44	03/27/97	CRC_DATA_TABULIZER Version 1.0 and 2.0 Program Descriptions
VI	8	03/27/97	CRAFT Input Deck for Fuel Assembly A02
VII	6	03/27/97	CRAFT Input Deck for Fuel Assembly A03
VIII	8	03/27/97	CRAFT Input Deck for Fuel Assembly A06
IX	13	03/27/97	CRAFT Input Deck for Fuel Assembly A08

Attachment #	Number of Pages	Generation Date	Description
X	6	03/27/97	CRAFT Input Deck for Fuel Assembly A09
XI	8	03/27/97	CRAFT Input Deck for Fuel Assembly A10
XII	6	03/27/97	CRAFT Input Deck for Fuel Assembly A11
XIII	8	03/27/97	CRAFT Input Deck for Fuel Assembly A12
XIV	8	03/27/97	CRAFT Input Deck for Fuel Assembly A12a
XV	6	03/27/97	CRAFT Input Deck for Fuel Assembly A13
XVI	18	03/27/97	CRAFT Input Deck for Fuel Assembly A14a
XVII	13	03/27/97	CRAFT Input Deck for Fuel Assembly A15
XVIII	6	03/27/97	CRAFT Input Deck for Fuel Assembly A16
XIX	8	03/27/97	CRAFT Input Deck for Fuel Assembly A17
XX	8	03/27/97	CRAFT Input Deck for Fuel Assembly A19
XXI	13	03/27/97	CRAFT Input Deck for Fuel Assembly A21
XXII	6	03/27/97	CRAFT Input Deck for Fuel Assembly A24
XXIII	13	03/27/97	CRAFT Input Deck for Fuel Assembly A27
XXIV	40	03/27/97	Principal Isotope Results for Assembly A02 This attachment was moved to reference 5.12 after the initial check and backcheck of this analysis was completed.
XXV	27	03/27/97	Principal Isotope Results for Assembly A03 This attachment was moved to reference 5.12 after the initial check and backcheck of this analysis was completed.
XXVI	40	03/27/97	Principal Isotope Results for Assembly A06 This attachment was moved to reference 5.12 after the initial check and backcheck of this analysis was completed.

Attachment #	Number of Pages	Generation Date	Description
XXVII	80	03/27/97	Principal Isotope Results for Assembly A08 This attachment was moved to reference 5.12 after the initial check and backcheck of this analysis was completed.
XXVIII	27	03/27/97	Principal Isotope Results for Assembly A09 This attachment was moved to reference 5.12 after the initial check and backcheck of this analysis was completed.
XXIX	40	03/27/97	Principal Isotope Results for Assembly A10 This attachment was moved to reference 5.12 after the initial check and backcheck of this analysis was completed.
XXX	27	03/27/97	Principal Isotope Results for Assembly A11 This attachment was moved to reference 5.12 after the initial check and backcheck of this analysis was completed.
XXXI	40	03/27/97	Principal Isotope Results for Assembly A12 This attachment was moved to reference 5.12 after the initial check and backcheck of this analysis was completed.
XXXII	14	03/27/97	Principal Isotope Results for Assembly A12a This attachment was moved to reference 5.12 after the initial check and backcheck of this analysis was completed.
XXXIII	27	03/27/97	Principal Isotope Results for Assembly A13 This attachment was moved to reference 5.12 after the initial check and backcheck of this analysis was completed.
XXXIV	120	03/27/97	Principal Isotope Results for Assembly A14a This attachment was moved to reference 5.12 after the initial check and backcheck of this analysis was completed.

Attachment #	Number of Pages	Generation Date	Description
XXXV	80	03/27/97	Principal Isotope Results for Assembly A15 This attachment was moved to reference 5.12 after the initial check and backcheck of this analysis was completed.
XXXVI	27	03/27/97	Principal Isotope Results for Assembly A16 This attachment was moved to reference 5.12 after the initial check and backcheck of this analysis was completed.
XXXVII	40	03/27/97	Principal Isotope Results for Assembly A17 This attachment was moved to reference 5.12 after the initial check and backcheck of this analysis was completed.
XXXVIII	40	03/27/97	Principal Isotope Results for Assembly A19 This attachment was moved to reference 5.12 after the initial check and backcheck of this analysis was completed.
XXXIX	80	03/27/97	Principal Isotope Results for Assembly A21 This attachment was moved to reference 5.12 after the initial check and backcheck of this analysis was completed.
XL	27	03/27/97	Principal Isotope Results for Assembly A24 This attachment was moved to reference 5.12 after the initial check and backcheck of this analysis was completed.
XLI	80	03/27/97	Principal Isotope Results for Assembly A27 This attachment was moved to reference 5.12 after the initial check and backcheck of this analysis was completed.
XLII	Total Page Count for Hard-Copy Listing of Files Contained in Reference 5.11 = 18	02/26/97.	Listing of CRAFT Generated Consolidated SAS2H Output Decks for Assemblies A02, A03, A06, A08, A09, A10, A11, A12, A12a, A13, A14a, A15, A16, A17, A19, A21, A24, A27 The files listed in this attachment are contained on magnetic media identified by reference 5.11.

Attachment #	Number of Pages	Generation Date	Description
XLIII	Total Page Count for Hard-Copy Listing of Files Contained in Reference 5.11 = 14	02/26/97.	Listing of CRAFT Generated "*.notes" files for Assemblies A02, A03, A06, A08, A09, A10, A11, A12, A12a, A13, A14a, A15, A16, A17, A19, A21, A24, A27 The files listed in this attachment are contained on magnetic media identified by reference 5.11.

Attachment I

CRAFT Version 1.0 User Information

CRAFT Version 1.0

Commercial Reactor Assembly Follow Taskmaster

Developed by Kenneth D. Wright
Framatome Cogema Fuels
High-Level Waste Division

under contract with the

Management and Operating Contractor for the
Yucca Mountain High-Level Radioactive Waste Repository Project

Table of Contents

Item			Page
1.	Introduction		5
2.	CRAFT Applications		5
3.	CRAFT Methodology		8
4.	CRAFT Subroutine Descriptions		12
	4.1	Program CRAFT	12
	4.2	DATA_AQUISITION Subroutine	13
	4.3	STD_HEIGHT Subroutine	13
	4.4	FUELTEMP_FORMAT, MODSPECVOL_FORMAT, and BURNUP_FORMAT Subroutines	13
	4.5	POWER_CALCS Subroutine	20
	4.6	UNITS_CONVERSION Subroutine	21
	4.7	EXECUTION_CONTROL Subroutine	24
	4.8	STANDARD_WRITER Subroutine	24
		4.8.1 Identification and Global Comment Section	24
		4.8.2 Material Specification Section	24
		4.8.3 Base Fuel Assembly Lattice Specification Section	27
		4.8.4 SAS2H Control Specifications and Unit Cell Models Section	27
		4.8.5 Irradiation History Specification Section	28
		4.8.6 Calculations Performed within the STANDARD_WRITER Subroutine	28
	4.9	CONTINUATION_WRITER Subroutine	30
		4.9.1 Initial Charge Fuel and Burnable Poison Material Composition Specifications	31
		4.9.2 Calculations Performed within the CONTINUATION_WRITER Subroutine	38
	4.10	CUTTER Subroutine	40
	4.11	RETRIEVER Subroutine	41
	4.12	ZEROS Subroutine	41
5.	CRAFT Input Summary		41
6.	CRAFT Code Limits and Execution Instructions		51
7.	Detailed Descriptions of CRAFT Input Cards		53
8.	CRAFT Output Description		81
9.	CRAFT Quality Assurance Testing		82
	9.1	Quality Assurance Test Cases 1 through 18	84
	9.2	Quality Assurance Test Cases 19 through 21	85

9.3 Quality Assurance Test Case 22 87
9.4 Quality Assurance Test Case 23 91

10. References 92

Appendix A: CRAFT Version 1.0 Fortran Source Code Listing
Appendix B: CRAFT Quality Assurance Test Case Input Decks
Appendix C: Consolidated SAS2H Output Files for the CRAFT Quality Assurance Test Cases

1. Introduction

The Commercial Reactor Assembly Follow Taskmaster (CRAFT) code directs the performance of assembly depletion and decay calculations relevant to Commercial Reactor Critical (CRC) evaluations. The CRAFT code generates input decks for the SAS2H control module of the SCALE modular code system (Ref. 1) based on user defined input which describes the fuel assembly's irradiation history. Appropriate isotopic concentrations relevant to both the CRC evaluations containing the fuel assembly and the subsequent depletion and decay calculations for the fuel assembly are extracted and stored by CRAFT as it generates and executes SAS2H cases.

2. CRAFT Applications

The CRAFT code directs the performance of depletion and decay calculations required to simulate the complete irradiation history of a fuel assembly. During the CRAFT orchestration of the fuel assembly depletion and decay calculations, fuel and burnable poison isotopic concentrations are retained at user-defined statepoints. The fuel and burnable poison isotopic concentrations may be used for input to subsequent CRC statepoint reactivity calculations or in other analyses concerning spent nuclear fuel from commercial power reactors.

The CRAFT code is developed with a high degree of flexibility that provides for the depletion and decay of fuel assemblies with widely varying features under either standard or non-standard core operating procedures. The following list describes some of the capabilities of the CRAFT code.

1) The CRAFT code generates and executes appropriate SAS2H cases required to perform a prescribed depletion and decay sequence for a fuel assembly. The depletion and decay sequence is orchestrated from the beginning of cycle (BOC) statepoint calculation of the initial prescribed insertion cycle through the final statepoint calculation of the last prescribed insertion cycle. The CRAFT code extracts and saves fuel and burnable poison isotopics at each statepoint, including BOC statepoints, during the fuel assembly's depletion and decay sequence. A certain portion of generated isotopics in the depleted fuel composition obtained from a SAS2H calculation are not used in the charge composition to the next SAS2H calculation due to a lack of cross-section data in the specified cross-section library. The CRAFT code provides a listing of the fuel isotopics from the output of a SAS2H calculation which are not used in the initial charge to the next SAS2H calculation. The isotopics left out of the initial charge are fission products whose reactivity worth is small relative to the isotopics retained in the charge composition. The listing of excluded charge isotopics allows for a determination of the impact upon the reactivity of the initial fuel composition in the subsequent calculation.

2) Any assembly design may be analyzed within the bounds of the SAS2H control module through the use of the CRAFT code. This includes both PWR and BWR fuel assemblies.

3) An axial blanket fuel modeling option is available in the CRAFT code. Any UO_2 enrichment may be specified for the axial blanket fuel. The axial blanket fuel may be defined to exist in any of the CRC axial nodes which are defined for the CRAFT

calculation.

4) A spacer grid modeling technique is available with the CRAFT code. The modeling technique homogenizes the spacer grid material throughout the moderator of the fuel assembly by utilizing a user defined spacer material and spacer material volume fraction in the moderator. The available spacer grid materials include the following-- ZIRC-4, INCONEL, SS316, SS316S, SS304, SS304S. Any volume fraction of spacer material in the moderator may be specified (including zero).

5) The fuel cladding, burnable poison rod (BPR) cladding, axial power shaping rod (APSR) cladding, or control rod (CR) cladding in the CRAFT calculation may be designated as any of the following materials-- ZIRC-4, SS316, SS316S, SS304, SS304S, or INCONEL.

6) The insertion of a BPR assembly during the irradiation of the fuel assembly may be modeled in the CRAFT calculation. Up to ten unique BPR assembly designs may be specified for use during the depletion of a fuel assembly. Any type of BPR assembly design may be specified. The default BP material for use in CRAFT calculation is Al_2O_3-B_4C. Any arbitrary BP material may be specified for use in a BPR assembly design. A maximum of ten unique BP materials may be specified. A maximum of twenty unique elements or isotopes may be specified in any given BP material. A BPR assembly may be inserted in any reactor cycle specified in the CRAFT calculation. Only one BPR assembly design may be specified per cycle. The position of the BPR assembly in the fuel assembly is specified by identifying the top and bottom axial nodes of the BP material. The BPR assembly remains fixed during a given reactor cycle. The depletion of the BP material is tracked during the CRAFT calculation. The appropriate depleted BP material is utilized in statepoint calculations following the BOC to statepoint number two calculation for a given reactor cycle. Depleted BP material isotopic concentrations are also retained for use in subsequent mid-cycle statepoint reactivity calculations which may be performed as part of the CRC evaluation process.

7) The insertion of a CR assembly during the irradiation of the fuel assembly may be modeled in the CRAFT calculation. Up to ten unique CR assembly designs may be specified for use during the depletion of a fuel assembly. Any type of CR assembly design may be specified. Any arbitrary CR absorber material may be specified for use in a CR assembly design. A maximum of ten unique CR absorber materials may be specified. A maximum of ten unique elements or isotopes may be specified in any given CR absorber material. A CR assembly may be inserted in any reactor cycle specified in the CRAFT calculation. Multiple CR assembly designs may be specified per cycle. The position of the CR assembly in the fuel assembly is specified by identifying the top and bottom axial nodes of the CR absorber material. The CR assembly position may be changed between each irradiation step of a SAS2H calculation generated by CRAFT. The CR assembly design may also be changed between any two statepoint calculations in a given reactor cycle.

8) The insertion of an APSR assembly during the irradiation of the fuel assembly may be

modeled in the CRAFT calculation. Up to ten unique APSR assembly designs may be specified for use during the depletion of a fuel assembly. Any type of APSR assembly design may be specified. Any arbitrary APSR absorber material may be specified for use in an APSR assembly design. A maximum of ten unique APSR absorber materials may be specified. A maximum of ten unique elements or isotopes may be specified in any given APSR absorber material. An APSR assembly may be inserted in any reactor cycle specified in the CRAFT calculation. Multiple APSR assembly designs may be specified per cycle. The position of the APSR assembly in the fuel assembly is specified by identifying the top and bottom axial nodes of the APSR absorber material. The APSR assembly position may be changed between each irradiation step of a SAS2H calculation generated by CRAFT. The APSR assembly design may also be changed between any statepoint calculations in a given reactor cycle. For any APSRA modeled, the APSR follow rods are modeled in the axial region above the poison region of the APSR's. The APSR follow rod material may be specified as a cladding material as previously described in item number five of this listing.

9) A fuel assembly may be inserted in a maximum of ten reactor cycles during a CRAFT calculation.

10) A maximum of twenty statepoints (BOC is always considered a statepoint) may be specified in any given reactor cycle in a CRAFT calculation.

11) A maximum of twenty-three irradiation steps of variable duration may be specified in any given SAS2H statepoint calculation to be generated during a CRAFT calculation.

12) A maximum of fifty axial nodes may be specified in the CRC nodal format for use in a CRAFT calculation. Each axial node may have a unique height.

13) The CRAFT code utilizes a user-defined input format for fuel temperature, moderator specific volume, and burnup data. The input data must be specified for each axial node in a user-defined nodal format of up to fifty nodes of arbitrary height. The total assembly active fuel height for the input data descriptions may be different than that specified in the CRC nodal format. Depending on the users needs, the fuel temperature, moderator specific volume, and burnup input data may be specified in a different nodal format each time an assembly set of this input data is provided. Nominal full-power operation nodal average fuel temperature input data must be provided in units of degrees Fahrenheit for each node in each statepoint calculation to be generated by the CRAFT calculation. Nominal full-power operation nodal average specific moderator input data must be provided in units of cubic feet per pound for each node in each statepoint calculation to be generated by the CRAFT calculation. The nodal average burnup input data must be provided in units of gigawatt-days per metric ton of uranium (GWd/MTU) for each node at each statepoint including the BOC statepoint. All burnup input data that is specified must be cumulative from the initial insertion of the fuel assembly in the reactor.

14) Up to fifty axial nodes of arbitrary height may be specified in a CRC nodal format.

15) A continuation CRAFT calculation for an assembly may be initiated from any statepoint in any reactor cycle if all of the nodal consolidated output files ("*.cut" files, see Section 8) from the statepoint calculation immediately preceding the continuation calculation exist in the CRAFT execution directory.

3. CRAFT Methodology

The objective of the CRAFT methodology was to develop a mechanism by which fuel assembly depletion and decay calculations required to support CRC evaluations could be performed most efficiently with minimal required user interface. The result was the CRAFT code which automates the process of performing numerous complex SAS2H depletion and decay calculations while extracting and archiving results pertinent to CRC analyses. The information provided in this section describes the general flow of a CRAFT calculation. Figure 3-1, presents a general calculational flow diagram for the CRAFT code. The identifiers for the CRAFT subroutines where the various processes and calculations take place are identified in this section. Detailed information on the calculations performed by the craft code may be found in Section 4, "CRAFT Subroutine Descriptions".

The CRAFT calculation begins by reading a well-defined yet flexible user input which describes the fuel assembly depletion and decay calculation to be performed. The input contains all data necessary to describe the fuel assembly and any insertion assemblies such as burnable poison rod assemblies (BPRA's), axial power shaping rod assemblies (APSRA's), or control rod assemblies (CRA's) Fuel temperature and moderator specific volume data (which may be obtained from reactor design core-follow codes) is also utilized to provide input to the depletion calculations which are to be generated by the CRAFT code. The use of nominal full-power fuel temperatures and moderator specific volumes from core-follow codes provide an additional level of detail in the calculation due to the fact that feedback and flux redistribution effects are incorporated into the development of this input parameter data. The "DATA_AQUISITION" subroutine performs the input data acquisition functions in the CRAFT code. A detailed description of the CRAFT input deck format is provided in the CRAFT input description in Sections 5 and 7.

After data acquisition, the next procedure is to standardize all fuel assembly heights corresponding to the input data specification to a prescribed CRC fuel assembly height. The fuel assembly depletion and decay calculations must be performed on an assembly which has the same total active fuel height as that prescribed for the CRC calculation. The fuel assembly nodal formats used for providing various input to the CRAFT code are allowed to have an arbitrary active fuel height which may differ from that required for the CRC calculation. The assembly height standardization procedure performed by the "STD_HEIGHT" subroutine puts all of the input data specification active fuel heights on a common basis with the CRC active fuel height.

After active fuel height standardization, the next procedure is to convert all of the axial node formats for the fuel temperature, moderator specific volume, and burnup input data to the prescribed CRC axial node format. There must be a one-to-one correspondence between the various axial node input data and the CRC axial nodes. The input data nodal format conversions are performed by the "FUELTEMP_FORMAT", "MODSPECVOL_FORMAT", and "BURNUP_FORMAT" subroutines for the fuel temperature data, moderator specific volume data, and burnup data, respectively.

After the input data nodal formats are converted, the next procedure is to calculate the power to be specified in each SAS2H statepoint calculation that will be generated by the CRAFT code. The power is calculated in units of megawatts for each axial node of the fuel assembly based upon the nodal burnup during the statepoint calculation, the initial mass of uranium in the node (fresh fuel), and the duration of the statepoint calculation irradiation period in days. The nodal power calculations are performed by the "POWER_CALCS" subroutine.

After the nodal powers are calculated, the next procedure is to convert units and calculate moderator densities and temperatures. At this point in the CRAFT calculation, there is a nominal full-power fuel temperature and moderator specific volume value for each axial node of the assembly in each statepoint calculation. The fuel temperatures, initially input in units of degrees Fahrenheit, are converted to units of degrees Kelvin. The moderator specific volume, initially input in units of cubic feet per pound, are converted to densities in units of grams per cubic centimeter. The system pressure and moderator density are used to determine the moderator temperature in units of degrees Kelvin. The units conversions and moderator density and temperature calculations are performed by the "UNITS_CONVERSION" subroutine.

After the "UNITS_CONVERSION" subroutine is finished, the next procedure is to initiate the "EXECUTION_CONTROL" subroutine. The "EXECUTION_CONTROL" subroutine directs the development and execution of SAS2H cases required to appropriately deplete and decay the fuel assembly. The subroutine also directs the extraction of results pertinent to CRC evaluations. The development of a unique SAS2H case is required for each CRC axial node in each statepoint calculation. The CRAFT code directs the development and execution of SAS2H cases beginning with the top assembly node (always identified as node number one) working sequentially through the assembly to the bottom node. The complete irradiation history of the assembly as defined in the CRAFT input deck is performed for each axial node before initiating the development and execution of SAS2H cases for the next axial node. Three subroutines are called by the "EXECUTION_CONTROL" subroutine--

1) the "STANDARD_WRITER" subroutine
2) the "CONTINUATION_WRITER" subroutine
3) the "CUTTER" subroutine.

Two of these called subroutines create SAS2H input decks, and one extracts isotopic results for use in subsequent CRC analyses. The "EXECUTION_CONTROL" subroutine then calls either "STANDARD_WRITER" or "CONTINUATION_WRITER" to create the next SAS2H input deck. "EXECUTION_CONTROL" then executes the generated SAS2H calculation. Upon completion of the SAS2H calculation, "EXECUTION_CONTROL" calls the "CUTTER" subroutine to extract and archive the fuel and burnable poison isotopic compositions calculated by SAS2H. The next SAS2H input deck is then generated as appropriate. This cycle continues until the prescribed fuel assembly depletion and decay history is completed.

The subroutine called "STANDARD_WRITER", as previously mentioned in relation to the "EXECUTION_CONTROL" subroutine, creates an appropriate SAS2H input deck for the initial statepoint calculation in the initial insertion reactor cycle for a fuel assembly axial node. The fuel and burnable poison compositions in the SAS2H cases generated by the "STANDARD_WRITER"

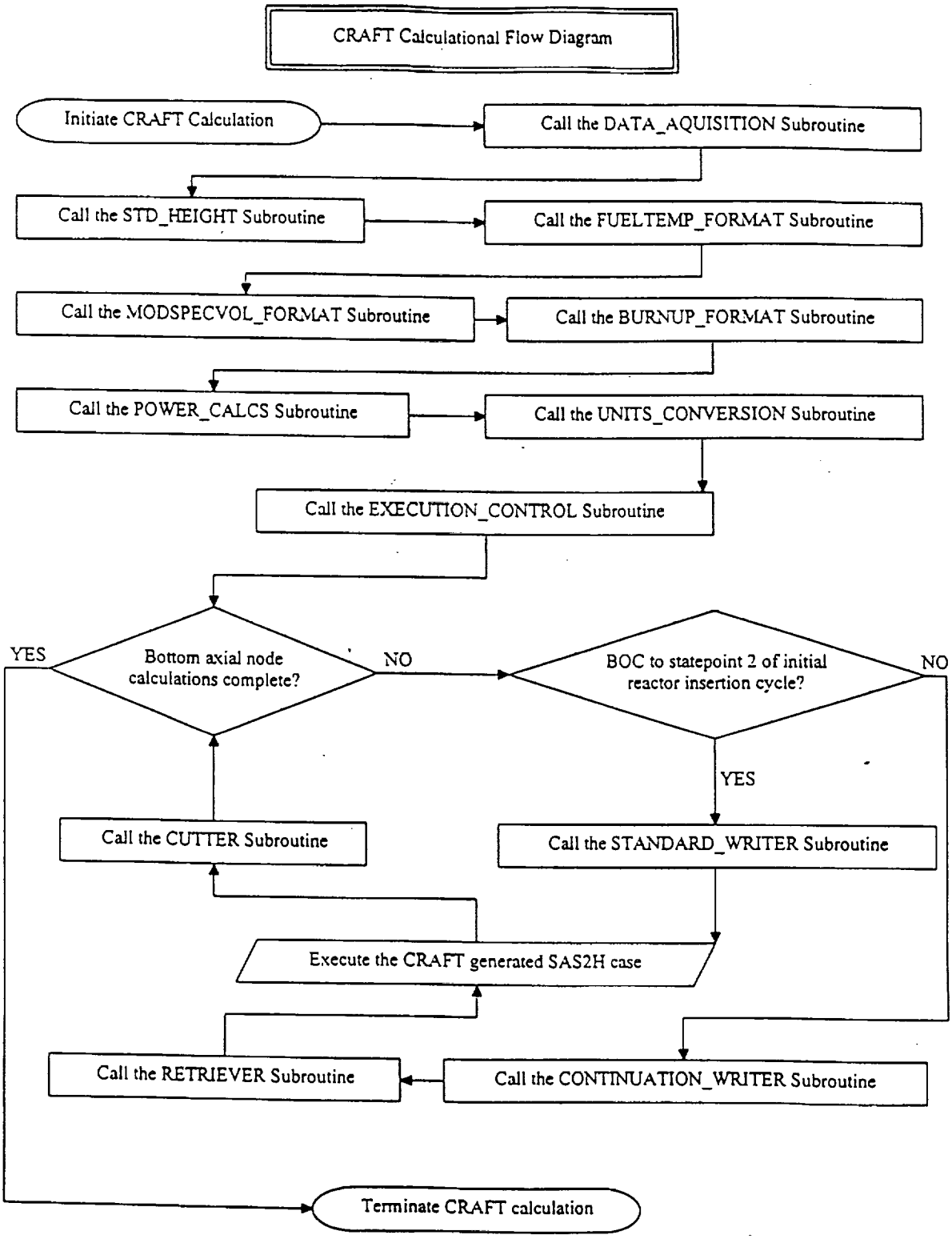
subroutine are always fresh. The sole source of input data for the SAS2H cases generated by the "STANDARD_WRITER" subroutine is the CRAFT input deck.

The subroutine called "CONTINUATION_WRITER", as previously mentioned in relation to the "EXECUTION_CONTROL" subroutine, writes SAS2H input decks for all statepoint calculations other than the initial statepoint calculation in the initial insertion reactor cycle. The "CONTINUATION_WRITER" subroutine calls a subroutine "RETRIEVER" to access and retrieve the fuel and burnable poison, if applicable, initial charge compositions for the statepoint calculation. The "CONTINUATION_WRITER" subroutine generates SAS2H input decks utilizing the appropriate depleted compositions such that the fuel assembly depletion and decay history continues uninterrupted.

The subroutine "CUTTER", as previously mentioned in relation to the "EXECUTION_CONTROL" subroutine, creates a CRC depletion output file for each statepoint. The file created by "CUTTER" contains the time/date stamp printed in the SAS2H output, the echoed SAS2H input deck for the statepoint calculation printed in the SAS2H output, and the pertinent section of the final ORIGEN output from the SAS2H output containing the desired depleted and decayed fuel and burnable poison isotopic concentrations. The CRC depletion output files created by "CUTTER" are identified by the same base filename identifier as the SAS2H statepoint calculation to which they apply followed by a ".cut" suffix. The CRAFT generated filenames are described in detail in Section 8.

The subroutine "RETRIEVER" reads through the appropriate "*.cut" file to obtain the fuel and burnable poison initial charge compositions for the next SAS2H calculation as previously mentioned in relation to the "CONTINUATION_WRITER" subroutine. Additionally, the "RETRIEVER" subroutine writes a file which contains a listing of all isotopes and their concentrations which were present in the ORIGEN output of the SAS2H calculation, but not utilized in the initial charge composition of the next SAS2H calculation. This file is identified by the base filename identifier corresponding to the SAS2H case which is being generated followed by a "*.notes" suffix. The CRAFT generated filenames are described in detail in Section 8.

Figure 3-1


CRAFT Calculational Flow Diagram
Initiate CRAFT Calculation
Call the DATA_AQUISITION Subroutine
Call the STD_HEIGHT Subroutine
Call the FUELTEMP_FORMAT Subroutine
Call the MODSPECVOL_FORMAT Subroutine
Call the BURNUP_FORMAT Subroutine
Call the POWER_CALCS Subroutine
Call the UNITS_CONVERSION Subroutine
Call the EXECUTION_CONTROL Subroutine
YES
Bottom axial node calculations complete?
NO
BOC to statepoint 2 of initial reactor insertion cycle?
NO
YES
Call the CUTTER Subroutine
Call the STANDARD_WRITER Subroutine
Execute the CRAFT generated SAS2H case
Call the RETRIEVER Subroutine
Call the CONTINUATION_WRITER Subroutine
Terminate CRAFT calculation

4. CRAFT Subroutine Descriptions

The CRAFT code is organized into fourteen subroutines. Each of the subroutines has a specific responsibility in performing a CRAFT calculation. The following sections provide descriptions of the structure and task of each subroutine. The subroutines comprising the CRAFT code include the following:

1) Main program block--
"PROGRAM CRAFT"
2) Reactor and problem data acquisition subroutine--
"DATA_AQUISITION"
3) Assembly height standardization subroutine--
"STD_HEIGHT"
4) Fuel temperature input nodal format conversion subroutine--
"FUELTEMP_FORMAT"
5) Moderator specific volume input nodal format conversion subroutine--
"MODSPECVOL_FORMAT"
6) Burnup input nodal format conversion subroutine--
"BURNUP_FORMAT"
7) Nodal power calculation subroutine--
"POWER_CALCS"
8) Units conversion subroutine--
"UNITS_CONVERSION"
9) SAS2H input deck creation and execution control subroutine--
"EXECUTION_CONTROL"
10) Standard beginning of assembly life SAS2H input deck writing subroutine--
"STANDARD_WRITER"
11) Continuation SAS2H input deck writing subroutine--
"CONTINUATION_WRITER"
12) CRC statepoint depletion/decay output file generator subroutine--
"CUTTER"
13) Fuel and burnable poison composition retrieval subroutine--
"RETRIEVER"
14) Two digit integer conversion utility subroutine.--
"ZEROS"

4.1 Program CRAFT

The main program block is the orchestrator of the CRAFT calculation. The purpose of the main program block is to define fixed data sets and initiate the sequential execution of appropriate subroutines to perform the CRAFT calculation. The subroutines initiated by the main program block of the CRAFT code include the following, in order of initiation-- DATA_AQUISITION, STD_HEIGHT, FUELTEMP_FORMAT, MODSPECVOL_FORMAT, BURNUP_FORMAT, POWER_CALCS, UNITS_CONVERSION, and EXECUTION_CONTROL.

4.2 DATA_AQUISITION Subroutine

A sufficient description of the DATA_AQUISITION subroutine is provided in Section 3. A detailed description of the CRAFT input deck format is provided in Sections 5 and 7.

4.3 STD_HEIGHT Subroutine

This subroutine standardizes all assembly total active fuel heights as specified in the user-defined input to the standard assembly active fuel height being utilized in the CRC evaluation. The active fuel height standardization calculation performed on the various input data requires the adjustment of input data nodal heights. The input data nodal height adjustment is performed by multiplying each input data node height by a factor equal to the ratio of the CRC assembly total active fuel height to the input data assembly total active fuel height. This calculation is summarized in the following equation--

$$\textit{Standardized Input Node Height} = \frac{[\textit{Original Input Node Height} * \textit{CRC Assembly Total Active Fuel Height}]}{\textit{Input Data Assembly Total Active Fuel Height}}$$

All nodal input data which is a constituent of a complete set of assembly input data is adjusted using the equation above such that all sets of assembly input data have the same total active fuel height corresponding to the prescribed CRC total active fuel height.

4.4 FUELTEMP_FORMAT, MODSPECVOL_FORMAT, and BURNUP_FORMAT Subroutines

This subroutine standardizes all nodal input data such that there exists a one-to-one correspondence between input data values and CRC axial nodes. This basically means that the assembly axial node formats in which the input data is provided are adjusted such that they identically match the prescribed CRC axial node format. Appropriate averaging of the nodal input data values must be performed to adjust the input parameter nodal formats to the CRC nodal format. A nodal shadowing technique is used to calculate appropriate nodal average input values corresponding to the specified CRC nodal format using the data as provided in the arbitrary input nodal formats. The shadowing technique consists of determining which input data axial nodes shadow a particular CRC axial node. The relative shadowing contributions from the input data nodes upon the CRC axial node are used to determine the appropriate average input value for the CRC axial node. Average input data values for fuel temperature, moderator specific volume, and burnup are determined for each CRC axial node using each set of assembly input data provided in the CRAFT input deck.

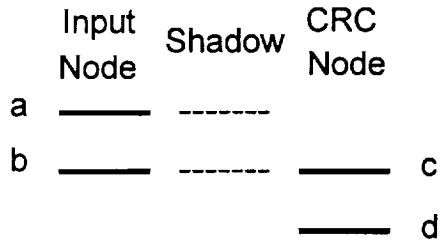
The method for implementing the nodal shadowing technique consists of determining all of the possible combinations of input axial node to CRC axial node shadows that may exists. Three classes of input axial node to CRC axial node shadows are defined:

1) shadows created by input axial nodes which are the same height as the CRC axial nodes;

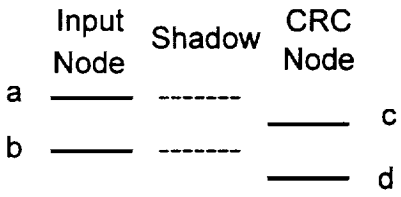
2) shadows created by input axial nodes which are smaller than the CRC axial nodes;
3) shadows created by input axial nodes which are larger than the CRC axial nodes.

Determining the average input parameter for a given CRC axial node requires that the input data values in the nodes which contribute to the average input data value for the CRC axial node be averaged appropriately. This averaging requires the determination of the relative weight which should be attributed to each of the contributing input data values. The shadowing technique determines the relative contribution of each input data axial node to the average input data value for the CRC axial node by weighting the input data values by their relative shadow contributions. The nodal shadowing descriptions below demonstrate how the contribution from each input data node to a CRC axial node is calculated. The CRAFT code calculates an average input data value for each CRC axial node by summing the contributions from all input data nodes which shadow the CRC axial node. This averaging process is performed for all fuel temperature input data, moderator specific volume input data, and burnup input data.

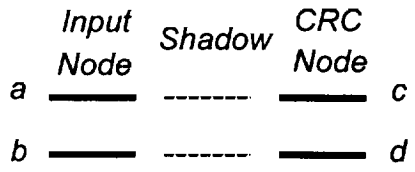
Shadows created by input axial nodes which are the same height as the CRC axial nodes--



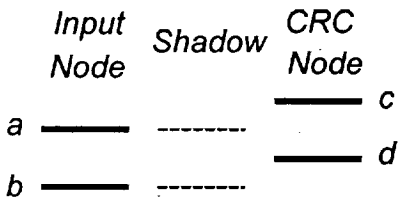
No Contribution from the Input Node to the CRC Node



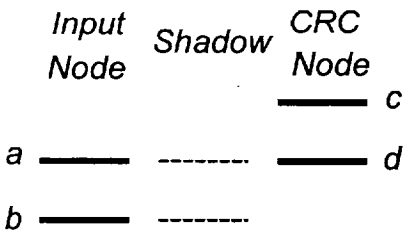
$$\textit{Input Node Contribution to CRC Node} = \left(\frac{b-c}{d-c}\right) * (\textit{Input Data Value})$$



Input Node Contribution to CRC Node = Input Data Value

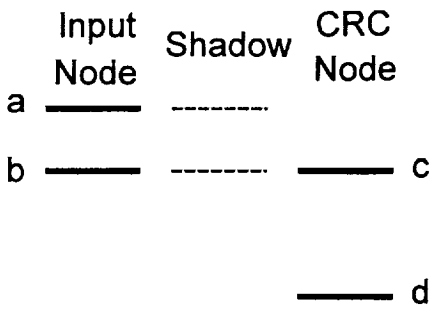


$$\textit{Input Node Contribution to CRC Node} = \left(\frac{d-a}{d-c}\right) * (\textit{Input Data Value})$$

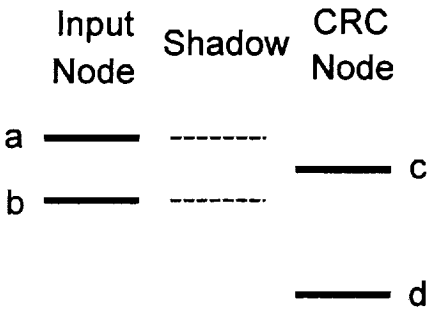


No Contribution from the Input Node to the CRC Node

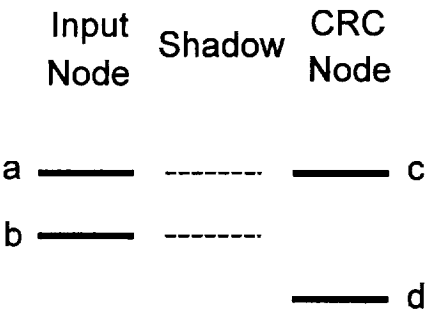
Shadows created by input axial nodes which are smaller than the CRC axial nodes--



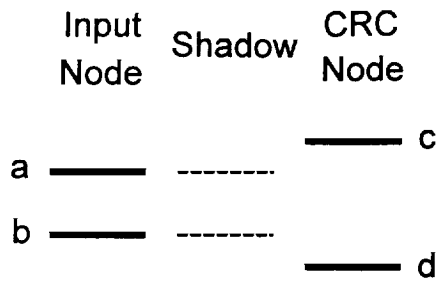
No Contribution from the Input Node to the CRC Node



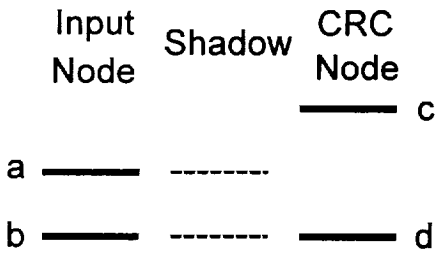
$$\textit{Input Node Contribution to CRC Node} = \left(\frac{b-c}{d-c}\right) * (\textit{Input Data Value})$$



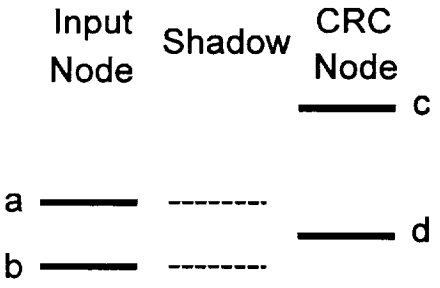
$$\textit{Input Node Contribution to CRC Node} = \left(\frac{b-a}{d-c}\right) * (\textit{Input Data Value})$$



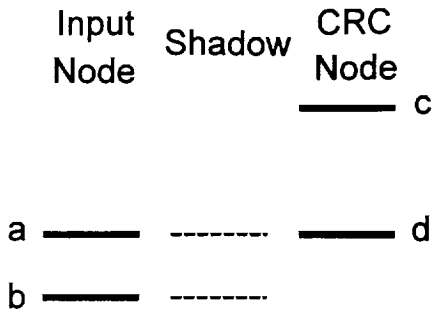
$$\textit{Input Node Contribution to CRC Node} = \left(\frac{b-a}{d-c}\right) * (\textit{Input Data Value})$$



$$\textit{Input Node Contribution to CRC Node} = \left(\frac{b-a}{d-c}\right) * (\textit{Input Data Value})$$

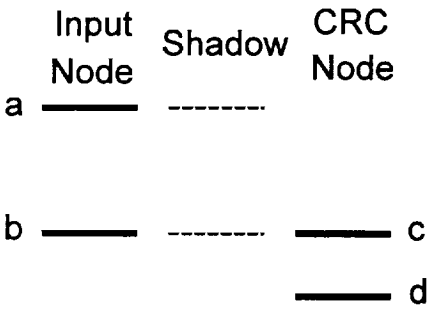


$$\textit{Input Node Contribution to CRC Node} = \left(\frac{d-a}{d-c}\right) * (\textit{Input Data Value})$$

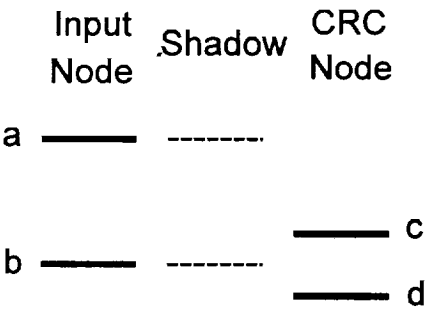


No Contribution from the Input Node to the CRC Node

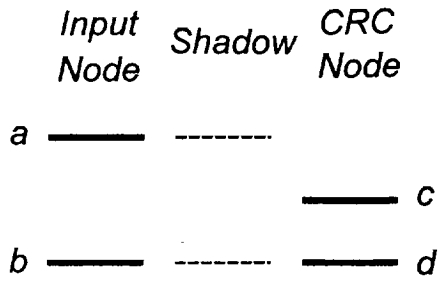
Shadows created by input axial nodes which are larger than the CRC axial nodes--



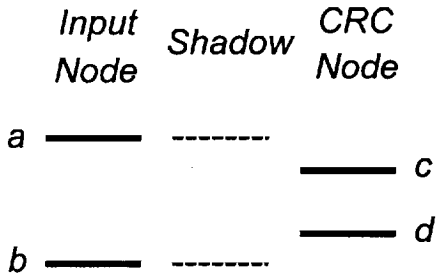
No Contribution from the Input Node to the CRC Node



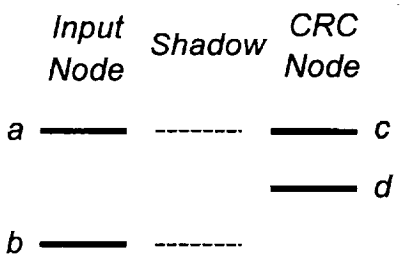
$$\textit{Input Node Contribution to CRC Node} = \left(\frac{b-c}{d-c}\right) * (\textit{Input Data Value})$$



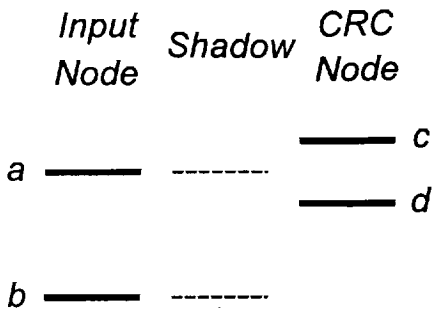
Input Node Contribution to CRC Node = Input Data Value



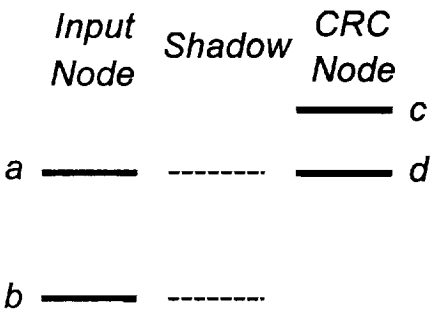
Input Node Contribution to CRC Node = Input Data Value



Input Node Contribution to CRC Node = Input Data Value



Input Node Contribution to CRC Node = $(\frac{d-a}{d-c})*(\textit{Input Data Value})$



No Contribution from the Input Node to the CRC Node

4.5 POWER_CALCS Subroutine

This subroutine calculates the average nodal power to be applied to each CRC axial node in the CRAFT generated statepoint calculations. The average nodal powers are calculated in megawatts using the average nodal burnup during the entire statepoint calculation, the initial uranium mass in the node, and the duration which the statepoint calculation covers in EFPD. The following equation shows how an average nodal power is calculated for a given statepoint calculation.

$$\textit{Average Nodal Power (MW)} = \frac{\textit{(Average Nodal Burnup During Statepoint Calculation in GWd/MTU)} * \textit{(Initial Uranium Mass in Node in Grams)} * (\frac{1}{\textit{Duration of Calculation in EFPD}}) *}{(\frac{1}{1000})}$$

where,

$$Initial\ Uranium\ Mass\ in\ Node = (Initial\ Uranium\ Mass\ in\ Assembly) * \left(\frac{CRC\ Node\ Height}{CRC\ Total\ Active\ Fuel\ Height}\right)$$

An average nodal power in units of megawatts is calculated for each node of the assembly for each statepoint calculation. The average nodal power is constant for a given node during a given statepoint calculation. The average nodal powers are not adjusted between the irradiation steps of a given SAS2H calculation. The use of the average nodal burnup in the determination of the average nodal power results in a final total burnup for the node which is equivalent to the node's total average burnup.

4.6 UNITS_CONVERSION Subroutine

This subroutine converts all of the CRC formatted fuel temperature input data from units of degrees Fahrenheit to units of degrees Kelvin. The following equation is used to make this units conversion.

$$Temperature\ (K) = [(Temperature\ (F) - 32.0) * (\frac{5}{9})] + 273.15$$

This subroutine also converts the CRC formatted moderator specific volume input data from units of cubic feet per pound to density input data in units of grams per cubic centimeter. The following equation is used to make this conversion. The (1/62.42691) conversion factor appearing in the following equation is obtained from conversion data in reference 3.

$$Density\ (g/cm^3) = \frac{1}{(Specific\ Volume\ (ft^3/lb)) * (62.42691)}$$

This subroutine also calculates the CRC formatted moderator temperature input data in units of degrees Fahrenheit using linear interpolation in the following density versus temperature versus pressure table for subcooled water shown in Table 4.6-1. Table 4.6-1 is obtained from the SCALE-4.3 user documentation (Ref. 1, p. S2.5.12).

Table 4.6-1
Density (g/cm³) of Subcooled Water at Various Temperatures and Pressures

	Pressure, psia								
Temp. (°F)	**3000**	**2500**	**2000**	**1500**	**1000**	**800**	**600**	**400**	**200**
50	1.0084	1.0069	1.0055	1.0040	1.0025	1.0019	1.0013	1.0007	1.0000

	Pressure, psia								
Temp. (°F)	3000	2500	2000	1500	1000	800	600	400	200
100	1.0018	1.0004	0.9989	0.9975	0.9960	0.9954	0.9948	0.9942	0.9936
150	0.9893	0.9878	0.9864	0.9849	0.9834	0.9828	0.9822	0.9815	0.9809
200	0.9725	0.9709	0.9694	0.9679	0.9663	0.9656	0.9650	0.9644	0.9637
250	0.9522	0.9505	0.9489	0.9472	0.9455	0.9449	0.9442	0.9435	0.9428
300	0.9289	0.9271	0.9252	0.9234	0.9215	0.9208	0.9200	0.9192	0.9185
350	0.9026	0.9006	0.8985	0.8964	0.8943	0.8934	0.8925	0.8916	
400	0.8733	0.8709	0.8685	0.8660	0.8634	0.8624	0.8613	0.8603	
450	0.8405	0.8375	0.8345	0.8314	0.8281	0.8268	0.8255		
500	0.8029	0.7992	0.7952	0.7911	0.7869	0.7851			
510	0.7947	0.7907	0.7866	0.7822	0.7776				
520	0.7862	0.7820	0.7776	0.7729	0.7680				
530	0.7775	0.7729	0.7682	0.7632	0.7579				
540	0.7683	0.7635	0.7584	0.7530	0.7472				
550	0.7589	0.7537	0.7482	0.7423					
560	0.7490	0.7434	0.7374	0.7310					
570	0.7386	0.7326	0.7261	0.7190					
580	0.7278	0.7212	0.7141	0.7062					
590	0.7164	0.7092	0.7012	0.6923					
600	0.7043	0.6963	0.6874						
610	0.6915	0.6825	0.6724						
620	0.6777	0.6676	0.6558						
630	0.6629	0.6512	0.6370						
640	0.6467	0.6329							
650	0.6288	0.6119							
660	0.6086	0.5866							

	Pressure, psia								
Temp. (°F)	**3000**	**2500**	**2000**	**1500**	**1000**	**800**	**600**	**400**	**200**
670	0.5850								
680	0.5559								

Once the moderator temperature is determined in degrees Fahrenheit, the same units conversion equation previously described for use with the fuel temperature data is used to convert the moderator temperature to degrees Kelvin.

The CRAFT code utilizes a standard linear interpolation scheme to determine the moderator temperature values once the pressure and density are known. Linear interpolation is performed using the following equation:

$$\frac{Target\ Value - x_1}{Reference\ Value - y_1} = \frac{x_2 - x_1}{y_2 - y_1}$$

where,

Target Value = the value for which the interpolation is being performed to obtain;
Reference Value = the known value which has a one-to-one correspondence to the Target Value;
x_1 = *the target parameter value displayed in the table which corresponds to* y_1;
x_2 = *the target parameter value displayed in the table which corresponds to* y_2;
y_1 = *the reference parameter value displayed in the table which is the largest value less than the Reference Value;*
y_2 = *the reference parameter value displayed in the table which is the smallest value greater than the Reference Value.*

The UNITS_CONVERSION subroutine utilizes the following procedure to perform the linear interpolation.

1) Determine which two adjacent columns of densities in the table correspond to pressures which bound the user-defined system pressure.
2) Linear interpolate between each of the columns defined in step 1 for each row of the table to create a new density column which corresponds to the system pressure.
3) Determine which two adjacent rows in the new density column created in step two correspond to densities which bound the calculated moderator density.
4) Linear interpolate between the two bounding density rows to determine the moderator temperature which corresponds to the system pressure and moderator density.

Once the moderator temperatures are calculated in degrees Kelvin for each of the CRC nodes in each statepoint calculation, the UNITS_CONVERSION subroutine's duties are complete.

4.7 EXECUTION_CONTROL Subroutine

A description of the EXECUTION_CONTROL subroutine is provided in Section 3.

4.8 STANDARD_WRITER Subroutine

This subroutine generates all SAS2H input decks which correspond to BOC to statepoint two depletion cases for the initial insertion cycle of the fuel assembly in the reactor. The SAS2H input decks created by the STANDARD_WRITER subroutine contain all fresh fuel. A detailed explanation of how to develop a SAS2H input deck to perform a fuel assembly depletion and decay calculation is provided in reference 1. The purpose of this discussion is not to explain how to develop a SAS2H input deck, but to explain the general format of the CRAFT generated SAS2H input decks.

The SAS2H input decks generated by the CRAFT code incorporate a general format consisting of the following five sections:

1) Identification and Global Comment Section;
2) Material Specification Section;
3) Base Fuel Assembly Lattice Specification Section;
4) SAS2H Control Specifications and Unit Cell Models Section;
5) Irradiation History Specification Section.

4.8.1 Identification and Global Comment Section

The first line of every SAS2H input deck relevant to CRC evaluations contains the SAS2H control module identifier and the "skipshipdata" parameter which tells the SAS2H control module not to perform an optional shielding analysis for a shipping container. The second line of every SAS2H input deck relevant to CRC evaluations is a case identification card. This card identifies the reactor in which the assembly is inserted, the relative one-eighth core symmetry assembly number, the CRC axial node to which the case pertains, the reactor cycle and statepoint at which the case begins, and the reactor cycle and statepoint at which the case ends. The third line identifies the cross-section library which is utilized in the SAS2H calculation. The ENDF/B-V based 44-group cross-section library is currently the suggested library for use in all CRAFT calculations relevant to CRC analyses. The remainder of the Identification and Global Comment Section contains general comments related to the SAS2H calculation.

4.8.2 Material Specification Section

The material specification section defines the fuel composition, the burnable poison composition, the control rod absorber material composition, the axial power shaping rod absorber material composition, the moderator composition, the fill gas composition, the fuel cladding composition, and other cladding

compositions for use in either BPRA's, CRA's, or APSRA's. Only the material compositions necessary for use in a given CRAFT generated SAS2H calculation are specified in the SAS2H input deck. Each material composition specification has a unique material mixture identifier. The fuel composition's material mixture number is always one. The fuel cladding's material mixture number is always two. The moderator's material mixture is always three. The Al_2O_3-B_4C burnable poison's material mixture number is always 4. The helium fill gas' material mixture number is always 5. Other compositions such as control rod or axial power shaping rod absorber materials, cladding materials other than the fuel cladding material, or burnable absorber materials other than Al_2O_3-B_4C must be given unique material mixture identifier numbers greater than 5. These additional material mixture number specifications are provided by the user in the CRAFT input deck.

The material specification section defines the UO_2 fresh fuel composition for the axial node to which the CRAFT generated SAS2H calculation pertains. The UO_2 fresh fuel composition is characterized by the fuel density, fuel temperature, and weight percentages of U-234, U-235, U-236, and U-238. For fresh fuel SAS2H cases, a number of additional isotopes are specified in trace amounts in the fuel composition to assure that their buildup and decay is tracked during the depletion calculation. Table 4.8.2-1 contains a listing of the trace isotopes which are always specified as each having a concentration of 1E-21 atoms/b-cm in the fresh fuel composition.

Table 4.8.2-1
Trace Isotopes Specified in Fresh Fuel Compositions

kr-83	kr-85	sr-90	y-89	mo-95	zr-93	zr-94
zr-95	nb-94	tc-99	rh-103	rh-105	ru-101	ru-106
pd-105	pd-108	ag-109	sb-124	xe-131	xe-132	xe-135
xe-136	cs-134	cs-135	cs-137	ba-136	la-139	ce-144
nd-143	nd-145	pm-147	pm-148	nd-147	sm-147	sm-149
sm-150	sm-151	sm-152	gd-155	eu-153	eu-154	eu-155

Several of the additional material composition specifications that must be provided in the SAS2H input decks include cladding materials for either fuel rods, control rod assemblies, axial power shaping rod assemblies, or burnable poison rod assemblies. The cladding materials available for specification include ZIRC-4, INCONEL, SS316, SS316S, SS304, and SS304S. The SS316/SS316S and SS304/SS304S materials are delineated by the use of two special weighting functions. The special weighting functions affect the generation of multigroup cross-sections for iron, nickel, and chromium. One of the special weighting functions corresponds to $1/E\ \sigma_t(E)$, where $\sigma_t(E)$ is the total cross-section of the stainless steel material. In the other special weighting function, $\sigma_t(E)$ is the total cross-section for the referenced nuclide. The stainless steel material identifiers ending in "S" use the weighting function where $\sigma_t(E)$ is the total cross-section for the referenced nuclide. The compositions and SCALE nuclide identifiers for the various cladding material compositions are shown in Table 4.8.2-2.

Table 4.8.2-2
Cladding Material Compositions Available in the CRAFT Code

Element/ Isotope	SCALE Identifier	Constituent wt% in Each Cladding Material Composition					
		ZIRC-4	INCONEL	SS316	SS316S	SS304	SS304S
C	6012	---	---	0.08	0.08	---	---
O	8016	0.12	---	---	---	---	---
Si	14000	---	2.5	1.0	1.0	---	---
Ti	22000	---	2.5	---	---	---	---
Cr	24000	0.10	---	---	17.0	---	19.0
Cr*	24304	---	---	17.0	---	19.0	---
Cr*	24404	---	15.0	---	---	---	---
Mn	25055	---	---	2.0	2.0	2.0	2.0
Fe	26000	0.20	---	---	65.42	---	69.5
Fe*	26304	---	---	65.42	---	69.5	---
Fe*	26404	---	7.0	---	---	---	---
Ni	28000	---	---	---	12.0	---	9.5
Ni*	28304	---	---	12.0	---	9.5	---
Ni*	28404	---	73.0	---	---	---	---
Zr	40000	98.18	---	---	---	---	---
Mo	42000	---	---	2.5	2.5	---	---
Sn	50000	1.40	---	---	---	---	---

* These SCALE nuclide identifiers refer to the special 1/E σ_t(E) weighted multigroup cross-sections.

Once the fuel material specification is complete, the fuel cladding material specification is defined. The fuel cladding material may be either ZIRC-4, INCONEL, SS316, SS316S, SS304, or SS404S. The compositions of these materials are hard-wired in the CRAFT code. The user is required to define an average fuel cladding temperature that will be applied to all fuel cladding material specifications.

The moderator material specification may contain homogenized spacer grid materials and/or soluble boron. The appropriate CRAFT calculated moderator density and temperature values are utilized in the moderator material composition description. The soluble boron concentration corresponding to the first

irradiation step of the SAS2H case is used to define the base soluble boron content in the moderator composition. The soluble boron concentrations in each of the irradiation steps of the SAS2H calculation are defined by specifying a fraction of the initial boron concentration specified in the base moderator material composition description. The material and volume fraction of spacer grids displacing moderator in the fuel assembly are specified by the user in the CRAFT input deck. The spacer grid materials available for specification include ZIRC-4, INCONEL, SS316, SS316S, SS404, and SS404S. The spacer grids are homogenized in the moderator composition based on the volume fraction of spacer grids in the moderator that is specified in the CRAFT input deck. The sum of the volume fractions of spacer grid material and moderator material (light-water) should equal unity.

If the fuel assembly contains a BPRA during the CRAFT generated SAS2H calculation, the material specifications for the BPR cladding and burnable poison material are specified. The BPR cladding may be designated as either ZIRC-4, INCONEL, SS316, SS316S, SS304, and SS304S. The default burnable poison material is Al_2O_3-B_4C, but any arbitrary burnable poison material may be specified. The BPR cladding and burnable poison material compositions are given the same temperature as the moderator.

If the fuel assembly contains a CRA or APSRA during the CRAFT generated SAS2H calculation, the material specifications for the CR or APSR cladding and absorber material are specified. The CR or APSR cladding may be designated as either ZIRC-4, INCONEL, SS316, SS316S, SS304, and SS304S. The CR or APSR cladding and absorber material compositions are given the same temperature as the moderator.

The fuel rod fill gas material is always specified as helium. The helium material temperature is allowed to default to 293 degrees Kelvin.

4.8.3 Base Fuel Assembly Lattice Specification Section

The base fuel assembly lattice specification section describes the fuel assembly configuration and specifies special control parameters that are to be utilized in performing the XSDRNPM calculations associated with the CRAFT generated SAS2H calculation. The fuel assembly lattice specification includes a "squarepitch" designator which tells SAS2H that the fuel assembly is a square array of unit cells with a constant pitch. The fuel rod pitch, fuel pellet outer diameter, fuel rod cladding inner diameter, and fuel rod cladding outer diameter are specified. The number of fuel rods per fuel assembly and active fuel length are also specified. The active fuel length represents the fuel stack height for the CRC node that the CRAFT generated SAS2H calculation represents. The special parameters that allow more control over the XSDRNPM calculation are described in Section 7. One special control parameter is always specified in the CRAFT generated SAS2H calculations. This parameter is designated "szf", and represents the spatial mesh factor for use in defining the XSDRNPM one-dimensional transport calculations.

4.8.4 SAS2H Control Specifications and Unit Cell Models Section

The SAS2H control specifications and unit cell models are provided in this section of the SAS2H input deck. The control specifications for SAS2H include the number of irradiation steps in the calculation, the number of cross-section libraries to be specified per irradiation step, and the SAS2H output print

level. The unit cell model specification includes the following:

1) the unit cell model input level;
2) the number of radial zones to be specified in all unit cells of the SAS2H calculation;
3) the moderator material mixture number in the unit cell models;
4) the XSDRNPM spatial mesh factor;
5) the signal to specify if a single unit cell model description will be provided for all irradiation steps or if multiple unit cell model descriptions will be provided to accommodate each irradiation step.

4.8.5 Irradiation History Specification Section

The irradiation history specification section includes the following data for each irradiation step:

1) the assembly (node) power in megawatts;
2) the irradiation step burn duration in calendar days;
3) the down time following the irradiation step in calendar days;
4) the fraction of the soluble boron concentration specified in the base moderator material composition that corresponds to the average soluble boron concentration in the moderator over the duration of the irradiation step.

The irradiation history specification section is always the final section in CRAFT generated SAS2H input decks.

4.8.6 Calculations Performed within the STANDARD_WRITER Subroutine

- The density of UO_2 in the fresh fuel composition is calculated by the STANDARD_WRITER subroutine based on the initial mass loading of uranium in the assembly. The initial mass loading of uranium in an axial node is calculated using the following equation.

$$Initial\ Uranium\ Mass\ in\ Node = (Initial\ Uranium\ Mass\ in\ Assembly) * \left(\frac{CRC\ Node\ Height}{CRC\ Total\ Active\ Fuel\ Height}\right)$$

The mass of oxygen in the UO_2 of the node must be calculated after the initial uranium mass in the node is determined. The following equation is used to calculate the mass of oxygen in the fuel. The weight percentages of the uranium isotopes (U-234, U-235, U-236, and U-238) are calculated using the equations presented in the next bulleted calculation.

$$Oxygen\ Mass\ in\ UO_2 = \frac{[(Mass\ of\ Uranium\ in\ UO_2)*(2)*(15.994915)]}{[(wt\%\ U^{235})*(235.043915) + (wt\%\ U^{234})*(234.040904) + (wt\%\ U^{236})*(236.045637) + (wt\%\ U^{238})*(238.05077)]}$$

The mass of UO_2 in the axial node is then calculated by summing the mass of the uranium in the axial node and the mass of oxygen in the axial node.

The fuel volume in the axial node must be calculated prior to calculating the fuel density. The fuel volume is calculated using the following equation.

$$\textit{Fuel Volume in Axial Node} = \left(\frac{\pi}{4}\right) * (\textit{Fuel Outer Diameter})^2 * (\textit{Node Height}) * (\textit{Number of Fuel Rods in Assembly})$$

The fuel density in the axial node is then calculated by dividing the UO_2 mass in the node by the fuel volume in the node.

- The weight percentages of the various isotopes in the fresh UO_2 fuel composition are calculated using the following equations (Ref. 2).

$$U^{234}\ wt\% = (0.007731) * (U^{235}\ wt\%)^{1.0837}$$

$$U^{236}\ wt\% = (0.0046) * (U^{235}\ wt\%)$$

$$U^{238}\ wt\% = 100 - U^{234}\ wt\% - U^{235}\ wt\% - U^{236}\ wt\%$$

- The volume fraction of H_2O in the homogenized moderator composition must be calculated by the STANDARD_WRITER subroutine to define the moderator material composition. The following equation is used to calculate the appropriate volume fraction of H_2O.

$$\textit{Volume Fraction of } H_2O \textit{ in Homogenized Moderator Composition} = 1.0 - \textit{Volume Fraction of Spacer Material in Homogenized Moderator Composition}$$

- The volume fraction of soluble boron in the H_2O of the homogenized moderator composition must be calculated by the STANDARD_WRITER subroutine to define the moderator material composition. The following equation is used to calculate the appropriate volume fraction of soluble boron.

$$\textit{Volume Fraction of Soluble Boron in Homogenized Moderator Composition} = \frac{\textit{Boron (Concentration)} * (1.0E\text{-}6) * \textit{ppm}}{(\textit{Volume Fraction of } H_2O \textit{ in Homogenized Moderator Composition})}$$

- The density of the homogenized moderator composition must be calculated by the STANDARD_WRITER subroutine to define the moderator material composition. The following equation is used to calculate the appropriately averaged homogenized moderator density in grams per cubic centimeter.

$$\text{Density of Homogenized Moderator Composition} = \frac{[(\text{Actual Moderator Density}) * (\text{Volume Fraction of } H_2O \text{ in the Moderator Composition})] + [(\text{Actual Density of Spacer Material}) * (\text{Volume Fraction of Spacer Material in the Moderator Composition})]}{}$$

- If the fuel assembly contains a BPRA with Al_2O_3-B_4C burnable absorber material during the irradiation history covered in a SAS2H calculation, the aluminum and oxygen weight fractions must be calculated to define the fresh burnable absorber material composition. The following equation are used to calculate the aluminum and oxygen weight fractions in Al_2O_3-B_4C.

$$\text{Aluminum Weight Fraction in } Al_2O_3\text{-}B_4C = \left(\frac{100 - B_4C \text{ wt\% in } Al_2O_3\text{-}B_4C}{100}\right) * (\text{Density of } Al_2O_3\text{-}B_4C)^2 * (2) * (26.981539) * \left(\frac{1}{101.9631}\right)$$

$$\text{Oxygen Weight Fraction in } Al_2O_3\text{-}B_4C = 1 - \left(\frac{B_4C \text{ wt\% in } Al_2O_3\text{-}B_4C}{100}\right) - (\text{Aluminum Weight Fraction in } Al_2O_3\text{-}B_4C)$$

- The soluble boron fraction must be calculated by the STANDARD_WRITER subroutine for all irradiation steps. The soluble boron fraction for a given irradiation step is calculated using the following equation.

$$\text{Soluble Boron Fraction in Irradiation Step} = \frac{\text{Soluble Boron ppm in Irradiation Step}}{\text{Soluble Boron ppm in Base Moderator Composition of the SAS2H Input Deck}}$$

4.9 CONTINUATION_WRITER Subroutine

This subroutine generates all SAS2H input decks which correspond to continuation cases in which the fuel and burnable poison isotopic initial charge compositions are obtained from the output of a previous CRAFT generated SAS2H calculation. A detailed explanation of how to develop a SAS2H input deck to perform a fuel assembly depletion and decay calculation is provided in reference 1. The purpose of

this discussion is not to explain how to develop a SAS2H input deck, but to explain the general format and calculations utilized by CRAFT in generating SAS2H input decks for calculations which initially contain spent fuel and burnable poison material compositions.

The format of the CRAFT generated SAS2H input decks for the continuation of a fuel assembly depletion and decay calculation relevant to CRC analyses is the same as that previously described for the standard beginning-of-life SAS2H input decks. The material specification section of the SAS2H input deck is the only input section where the continuation case differs from the standard case.

The CRAFT code tracks the depletion and decay of the fuel and burnable absorber materials during the fuel assembly depletion and decay calculation. The CONTINUATION_WRITER subroutine is designed to locate the appropriate fuel and burnable poison isotopic concentrations, and utilize them in developing the correct fuel and burnable poison initial charge compositions to allow for continuation of the fuel assembly depletion calculation. All calculations performed by the STANDARD_WRITER subroutine other than those related to the fuel and burnable poison material composition specifications are performed identically by the CONTINUATION_WRITER subroutine.

4.9.1 Initial Charge Fuel and Burnable Poison Material Composition Specifications

The initial charge fuel material composition specification for a continuation SAS2H calculation utilizes all available isotopic concentrations from the appropriate previous SAS2H depletion and decay calculation's output for which cross-section data is available in the SCALE 44-group library (Vol. 3, p. M4.2.19, Ref. 1) (recommended CRC cross-section library). Table 4.9.1-1 contains a listing of all the isotopes for which data is available in the 44-group cross-section library.

Table 4.9.1-1
Isotopic Inventory of the 44-group Cross-Section Library

H-1	H-2	H-3	He-3	He-4	Li-6	Li-7	Be-9	B-10
B-11	C-12	N-14	N-15	O-16	O-17	F-19	Na-23	Mg
Al-27	Si	P-31	S	S-32	Cl	K	Ca	Ti
V	Cr	Mn-55	Fe	Co-59	Ni	Cu	Ga	Ge-72
Ge-73	Ge-74	Ge-76	As-75	Se-74	Se-76	Se-77	Se-78	Se-80
Se-82	Br-79	Br-81	Kr-78	Kr-80	Kr-82	Kr-83	Kr-84	Kr-85
Kr-86	Rb-85	Rb-86	Rb-87	Sr-84	Sr-86	Sr-87	Sr-88	Sr-89
Sr-90	Y-89	Y-90	Y-91	Zr	Zr-90	Zr-91	Zr-92	Zr-93
Zr-94	Zr-95	Zr-96	Nb-93	Nb-94	Nb-95	Mo	Mo-92	Mo-94
Mo-95	Mo-96	Mo-97	Mo-98	Mo-99	Mo-100	Tc-99	Ru-96	Ru-98

Table 4.9.1-1
Isotopic Inventory of the 44-group Cross-Section Library

Ru-99	Ru-100	Ru-101	Ru-102	Ru-103	Ru-104	Ru-105	Ru-106	Rh-103
Rh-105	Pd-102	Pd-104	Pd-105	Pd-106	Pd-107	Pd-108	Pd-110	Ag-107
Ag-109	Ag-111	Cd	Cd-106	Cd-108	Cd-110	Cd-111	Cd-112	Cd-113
Cd-114	Cd-116	Cd-115m	In-113	In-115	Sn-112	Sn-114	Sn-115	Sn-116
Sn-117	Sn-118	Sn-119	Sn-120	Sn-122	Sn-123	Sn-124	Sn-125	Sn-126
Sb-121	Sb-123	Sb-124	Sb-125	Sb-126	Te-120	Te-122	Te-123	Te-124
Te-125	Te-126	Te-128	Te-130	Te-132	Te-127m	Te-129m	I-127	I-129
I-130	I-131	I-135	Xe-124	Xe-126	Xe-128	Xe-129	Xe-130	Xe-131
Xe-132	Xe-133	Xe-134	Xe-135	Xe-136	Cs-133	Cs-134	Cs-135	Cs-136
Cs-137	Ba-134	Ba-135	Ba-136	Ba-137	Ba-138	Ba-140	La-139	La-140
Ce-140	Ce-141	Ce-142	Ce-143	Ce-144	Pr-141	Pr-142	Pr-143	Nd-142
Nd-143	Nd-144	Nd-145	Nd-146	Nd-147	Nd-148	Nd-150	Pm-147	Pm-148
Pm-149	Pm-151	Pm-148m	Sm-144	Sm-147	Sm-148	Sm-149	Sm-150	Sm-151
Sm-152	Sm-153	Sm-154	Eu	Eu-151	Eu-152	Eu-153	Eu-154	Eu-155
Eu-156	Eu-157	Gd-152	Gd-154	Gd-155	Gd-156	Gd-157	Gd-158	Gd-160
Tb-159	Tb-160	Dy-160	Dy-161	Dy-162	Dy-163	Dy-164	Ho-165	Er-166
Er-167	Lu-175	Lu-176	Hf	Hf-174	Hf-176	Hf-177	Hf-178	Hf-179
Hf-180	Ta-181	Ta-182	W	W-182	W-183	W-184	W-186	Re-185
Re-187	Au-197	Pb	Bi-209	Th-230	Th-232	Pa-231	Pa-233	U-232
U-233	U-234	U-235	U-236	U-237	U-238	Np-237	Np-238	Pu-236
Pu-237	Pu-238	Pu-239	Pu-240	Pu-241	Pu-242	Pu-243	Pu-244	Am-241
Am-242	Am-243	Am-242m	Cm-241	Cm-242	Cm-243	Cm-244	Cm-245	Cm-246
Cm-247	Cm-248	Bk-249	Cf-249	Cf-250	Cf-251	Cf-252	Cf-253	Es-253

The fuel composition is composed of the initial oxygen mass in the fresh UO_2 and the mass of each of the actinides and fission products of the depleted fuel composition which are available in the 44-group library. There are some isotopes listed in the ORIGEN output of the spent fuel composition which are not available in the 44-group library. These isotopes are excluded from the initial charge composition

for the continuation of the fuel assembly depletion. A listing of all excluded isotopes and their abundance in grams per node is retained in the CRAFT generated "*.notes" file corresponding to the SAS2H calculation for which the initial charge composition is obtained. The total mass of all isotopes (including oxygen) in the fuel composition is calculated to assist in determining the weight percentages of each isotope in the composition and the density of the composition. The fuel composition is then defined as an arbitrary material specification in the SAS2H input deck with the appropriate nodal fuel temperature applied.

Excluding the isotopic concentrations from the ORIGEN-S output, that are not available in the 44-group library, from the fuel charge composition of a subsequent depletion calculation has a negligible effect on the neutron spectrum. The neutron spectrum must be predicted correctly during the SAS2H depletion calculations to obtain the proper cell-weighting of the cross-sections. For an absorber isotope to have a significant effect on the neutron spectrum, the absorber isotope must be present in a significant quantity and have a significant absorption cross-section. Three simple calculations were performed to demonstrate that the isotopes excluded from the continuation SAS2H depletion calculations (as identified in the "*.notes" files) do not effect the neutron spectrum significantly enough to result in a change in the final depleted composition. The first two of the three calculations represent a simple fuel depletion calculation that was split into parts and continued via CRAFT. The third of these calculations is a continuous calculation equivalent to the simple depletion represented by the first two calculations. The final depleted isotopic results at the end of the second calculation (the second part of the total depletion composed of the first two calculations) are identical to the final depleted isotopic results obtained from the third calculation. The SAS2H input decks for these three calculations are presented in Figure 4.9.1-1 through Figure 4.9.1-3.

Figure 4.9.1-1 Calculation 1 of the Isotopic Exclusion Test Depletion Calculation

```
=sas2h    parm=skipshipdata
Crystal River, Unit 3 Assy-03, Node-01 (Cyc-1B,     .0 to Cyc-1B,  75.0 EFPD)
44group          latticecell
'
'    fuel density based on mass of uranium per assembly & total pellet stack
'    volume to account for fuel volume loss to pellet chamfers
'
'      material specification input
'
uo2 1 den=10.121 1  929.8 92234  .016 92235 1.930 92236  .009 92238 98.045 end
kr-83         1   0   1-21    929.8   end
kr-85         1   0   1-21    929.8   end
sr-90         1   0   1-21    929.8   end
y-89          1   0   1-21    929.8   end
mo-95         1   0   1-21    929.8   end
zr-93         1   0   1-21    929.8   end
zr-94         1   0   1-21    929.8   end
zr-95         1   0   1-21    929.8   end
nb-94         1   0   1-21    929.8   end
tc-99         1   0   1-21    929.8   end
rh-103        1   0   1-21    929.8   end
rh-105        1   0   1-21    929.8   end
ru-101        1   0   1-21    929.8   end
ru-106        1   0   1-21    929.8   end
pd-105        1   0   1-21    929.8   end
```

```
pd-108        1    0    1-21     929.8    end
ag-109        1    0    1-21     929.8    end
sb-124        1    0    1-21     929.8    end
xe-131        1    0    1-21     929.8    end
xe-132        1    0    1-21     929.8    end
xe-135        1    0    1-21     929.8    end
xe-136        1    0    1-21     929.8    end
cs-134        1    0    1-21     929.8    end
cs-135        1    0    1-21     929.8    end
cs-137        1    0    1-21     929.8    end
ba-136        1    0    1-21     929.8    end
la-139        1    0    1-21     929.8    end
ce-144        1    0    1-21     929.8    end
nd-143        1    0    1-21     929.8    end
nd-145        1    0    1-21     929.8    end
pm-147        1    0    1-21     929.8    end
pm-148        1    0    1-21     929.8    end
nd-147        1    0    1-21     929.8    end
sm-147        1    0    1-21     929.8    end
sm-149        1    0    1-21     929.8    end
sm-150        1    0    1-21     929.8    end
sm-151        1    0    1-21     929.8    end
sm-152        1    0    1-21     929.8    end
gd-155        1    0    1-21     929.8    end
eu-153        1    0    1-21     929.8    end
eu-154        1    0    1-21     929.8    end
eu-155        1    0    1-21     929.8    end
arbm-zirc4 6.56 5 0 0 0 8016 0.12 24000 0.10 26000 0.20 50000 1.40
           40000 98.18 2 1.0 640.0 end
'
'     material composition of moderator within unit cell
'     with smeared inconel spacer grids
h2o    3   den=.7556    .99424      579.8    end
arbm-bormod     .7556 1 0 0 0 5000 100 3 .00052    579.8 end
arbm-spacer     .7556 5 0 0 0 14000 2.5 22000 2.5 24000 15.0
                26000 7.0 28000 73.0 3 .00576    579.8 end
'
'
he     5   end
end comp
'
'     base reactor lattice specification
'
squarepitch    1.44272     .9398    1    3    1.0922    2     .9576    0    end
more data szf=0.50 end
'
'     assembly specification
'
npin/assembly=208 fuelngth=360.172 ncycles=02 nlib/cyc=1 lightel=0
printlevel=05 inplevel=2 numztotal=05 mxrepeats=1 mixmod=3 facmesh=.50 end
  3   .63246    2   .67310    3   .81397 500 2.97599    3 2.99939
'
'     assembly depletion/decay parameters
'
'   Cycle-1B, one-eighth core assembly number 03
power=74.181      burn=71.10      down=.00000E+00 bfrac=1.000      end
power=74.181      burn=71.10      down=10.000     bfrac=.4938      end
'
'     end of input
'
```

```
end
```

Figure 4.9.1-2 Calculation 2 of the Isotopic Exclusion Test Depletion Calculation

```
=sas2h    parm=skipshipdata
Crystal River, Unit 3 Assy-03, Node-01 (Cyc-1B,  75.0 to Cyc-1B, 142.2 EFPD)
44group         latticecell
'
'   fuel density based on mass of uranium per assembly & total pellet stack
'   volume to account for fuel volume loss to pellet chamfers
'
'     material specification input
'
arbm-fuel   10.1     216 0 0 0 8016   11.9
      2004   .837E-06       90230   .858E-08
     90232   .166E-08       91231   .365E-08       91233   .478E-09
     92232   .242E-08       92233   .679E-07       92234   .887E-02
     92235   .434           92236   .213           92237   .101E-02
     92238   84.7           93237   .209E-01       93238   .119E-04
     94236   .238E-07       94237   .242E-07       94238   .468E-02
     94239   .419           94240   .171           94241   .912E-01
     94242   .350E-01       95241   .508E-03       95601   .689E-05
     95242   .265E-09       95243   .560E-02       96242   .180E-03
     96243   .345E-05       96244   .118E-02       96245   .276E-04
     96246   .346E-05       96247   .400E-07       96248   .242E-08
      1003   .324E-05        3006   .113E-07        3007   .607E-09
      4009   .117E-08       32072   .327E-06       32073   .914E-06
     32074   .767E-06       33075   .685E-05       32076   .202E-04
     34076   .148E-06       34077   .468E-04       34078   .156E-03
     35079   .246E-09       34080   .796E-03       36080   .377E-08
     35081   .119E-02       34082   .189E-02       36082   .299E-04
     36083   .240E-02       36084   .660E-02       36085   .142E-02
     37085   .522E-02       36086   .106E-01       37086   .299E-05
     38086   .112E-04       37087   .138E-01       38087   .674E-07
     38088   .196E-01       38089   .923E-02       39089   .170E-01
     38090   .318E-01       39090   .837E-05       40090   .200E-03
     39091   .140E-01       40091   .206E-01       40092   .369E-01
     40093   .276E-01       41093   .695E-09       40094   .447E-01
     41094   .310E-07       40095   .209E-01       41095   .104E-01
     42095   .150E-01       40096   .476E-01       42096   .468E-03
     42097   .455E-01       42098   .493E-01       42099   .118E-03
     43099   .489E-01       44099   .171E-05       42100   .561E-01
     44100   .449E-02       44101   .468E-01       44102   .466E-01
     44103   .142E-01       45103   .223E-01       44104   .346E-01
     46104   .617E-02       45105   .402E-05       46105   .177E-01
     44106   .183E-01       46106   .130E-01       46107   .149E-01
     47107   .280E-09       46108   .971E-02       48108   .942E-08
     47109   .636E-02       46110   .287E-02       48110   .198E-02
     47111   .672E-04       48111   .141E-02       48112   .759E-03
     48113   .746E-05       49113   .699E-07       48114   .773E-03
     50114   .142E-08       48601   .392E-05       49115   .109E-03
     50115   .111E-04       48116   .312E-03       50116   .121E-03
     50117   .299E-03       50118   .236E-03       50119   .247E-03
     50120   .242E-03       51121   .249E-03       50122   .316E-03
     52122   .121E-04       50123   .153E-04       51123   .274E-03
     52123   .617E-07       50124   .527E-03       51124   .556E-05
     52124   .423E-05       50125   .925E-05       51125   .613E-03
     52125   .263E-04       50126   .124E-02       51126   .105E-05
     52126   .198E-04       52601   .327E-03       53127   .246E-02
```

```
      52128   .556E-02      54128   .908E-04      52611   .615E-03
      53129   .106E-01      54129   .333E-06      52130   .219E-01
      54130   .369E-03      53131   .137E-02      54131   .274E-01
      52132   .217E-03      54132   .626E-01      54133   .129E-02
      55133   .697E-01      54134   .917E-01      55134   .609E-02
      56134   .316E-03      54135   .948E-11      55135   .453E-02
      56135   .127E-05      54136   .155          55136   .546E-04
      56136   .424E-03      55137   .763E-01      56137   .421E-03
      56138   .761E-01      57139   .719E-01      56140   .537E-02
      57140   .813E-03      58140   .712E-01      58141   .168E-01
      59141   .495E-01      58142   .678E-01      59142   .209E-08
      60142   .601E-03      58143   .544E-05      59143   .535E-02
      60143   .451E-01      58144   .483E-01      60144   .263E-01
      60145   .405E-01      60146   .398E-01      60147   .159E-02
      61147   .151E-01      62147   .758E-03      60148   .228E-01
      61148   .590E-04      61601   .839E-04      62148   .244E-02
      61149   .280E-04      62149   .765E-03      60150   .108E-01
      62150   .206E-01      61151   .312E-06      62151   .973E-03
      63151   .348E-06      62152   .912E-02      63152   .354E-06
      64152   .407E-06      62153   .994E-05      63153   .702E-02
      62154   .263E-02      63154   .107E-02      64154   .129E-04
      63155   .314E-03      64155   .160E-05      63156   .615E-03
      64156   .282E-02      63157   .278E-09      64157   .257E-04
      64158   .153E-02      65159   .159E-03      64160   .674E-04
      65160   .845E-05      66160   .386E-05      66161   .232E-04
      66162   .172E-04      66163   .117E-04      66164   .240E-05
      67165   .398E-05      68166   .727E-06      68167   .123E-07
      1   1.0     929.8   end
arbm-zirc4 6.56 5 0 0 0 8016 0.12 24000 0.10 26000 0.20 50000 1.40
           40000 98.18 2 1.0 640.0 end
'
'     material composition of moderator within unit cell
'     with smeared inconel spacer grids
h2o   3   den=.7556    .99424      579.8   end
arbm-bormod     .7556 1 0 0 0 5000 100 3 .00024    579.8 end
arbm-spacer     .7556 5 0 0 0 14000 2.5 22000 2.5 24000 15.0
                26000 7.0 28000 73.0 3 .00576    579.8 end
'
'
he    5   end
end comp
'
'     base reactor lattice specification
'
squarepitch   1.44272     .9398   1   3   1.0922   2    .9576   0   end
more data szf=0.50 end
'
'     assembly specification
'
npin/assembly=208 fuelngth=360.172 ncycles=01 nlib/cyc=1 lightel=0
printlevel=05 inplevel=2 numztotal=05 mxrepeats=1 mixmod=3 facmesh=.50 end
  3  .63246   2  .67310   3  .81397 500 2.97599   3 2.99939
'
'     assembly depletion/decay parameters
'
'   Cycle-1B, one-eighth core assembly number 03
power=27.597     burn=29.10     down=14.792     bfrac=1.000     end
'
'     end of input
'
```

```
end
```

Figure 4.9.1-3 Calculation 3 of the Isotopic Exclusion Test Depletion Calculation

```
=sas2h    parm=skipshipdata
Crystal River, Unit 3 Assy-03, Node-01 {Cyc-1B,     .0 to Cyc-1B,   75.0 EFPD}
44group         latticecell
'
'    fuel density based on mass of uranium per assembly & total pellet stack
'    volume to account for fuel volume loss to pellet chamfers
'
'      material specification input
'
uo2 1 den=10.121 1   929.8 92234  .016 92235 1.930 92236  .009 92238 98.045 end
kr-83         1    0    1-21     929.8    end
kr-85         1    0    1-21     929.8    end
sr-90         1    0    1-21     929.8    end
y-89          1    0    1-21     929.8    end
mo-95         1    0    1-21     929.8    end
zr-93         1    0    1-21     929.8    end
zr-94         1    0    1-21     929.8    end
zr-95         1    0    1-21     929.8    end
nb-94         1    0    1-21     929.8    end
tc-99         1    0    1-21     929.8    end
rh-103        1    0    1-21     929.8    end
rh-105        1    0    1-21     929.8    end
ru-101        1    0    1-21     929.8    end
ru-106        1    0    1-21     929.8    end
pd-105        1    0    1-21     929.8    end
pd-108        1    0    1-21     929.8    end
ag-109        1    0    1-21     929.8    end
sb-124        1    0    1-21     929.8    end
xe-131        1    0    1-21     929.8    end
xe-132        1    0    1-21     929.8    end
xe-135        1    0    1-21     929.8    end
xe-136        1    0    1-21     929.8    end
cs-134        1    0    1-21     929.8    end
cs-135        1    0    1-21     929.8    end
cs-137        1    0    1-21     929.8    end
ba-136        1    0    1-21     929.8    end
la-139        1    0    1-21     929.8    end
ce-144        1    0    1-21     929.8    end
nd-143        1    0    1-21     929.8    end
nd-145        1    0    1-21     929.8    end
pm-147        1    0    1-21     929.8    end
pm-148        1    0    1-21     929.8    end
nd-147        1    0    1-21     929.8    end
sm-147        1    0    1-21     929.8    end
sm-149        1    0    1-21     929.8    end
sm-150        1    0    1-21     929.8    end
sm-151        1    0    1-21     929.8    end
sm-152        1    0    1-21     929.8    end
gd-155        1    0    1-21     929.8    end
eu-153        1    0    1-21     929.8    end
eu-154        1    0    1-21     929.8    end
eu-155        1    0    1-21     929.8    end
arbm-zirc4 6.56 5 0 0 0 8016 0.12 24000 0.10 26000 0.20 50000 1.40
           40000 98.18 2 1.0 640.0 end
'
```

```
'     material composition of moderator within unit cell
'     with smeared inconel spacer grids
h2o   3   den=.7556   .99424     579.8   end
arbm-bormod     .7556 1 0 0 0 5000 100 3 .00052   579.8 end
arbm-spacer     .7556 5 0 0 0 14000 2.5 22000 2.5 24000 15.0
                 26000 7.0 28000 73.0 3 .00576   579.8 end
'
'
he    5   end
end comp
'
'     base reactor lattice specification
'
squarepitch   1.44272    .9398   1   3   1.0922   2    .9576   0   end
more data szf=0.50 end
'
'     assembly specification
'
npin/assembly=208 fuelngth=360.172 ncycles=03 nlib/cyc=1 lightel=0
printlevel=05 inplevel=2 numztotal=05 mxrepeats=1 mixmod=3 facmesh=.50 end
  3  .63246   2  .67310   3  .81397 500 2.97599   3 2.99939
'
'     assembly depletion/decay parameters
'
'   Cycle-1B, one-eighth core assembly number 03
power=74.181     burn=71.10     down=.00000E+00 bfrac=1.000     end
power=74.181     burn=71.10     down=10.000     bfrac=.4938     end
power=27.597     burn=29.10     down=14.792     bfrac=.4615     end
'
'     end of input
'
end
```

The burnable poison initial charge composition for continuing a fuel assembly depletion calculation is developed using the depleted abundances of B-10 and B-11 in the burnable poison material. These depleted abundances of B-10 and B-11 are obtained from the appropriate previous SAS2H depletion and decay calculation's output. The depletion of other isotopes in the burnable poison composition are not tracked in the CRAFT calculation. The isotopes in the burnable poison material other than B-10 and B-11 are respecified in the burnable poison composition of the continuing depletion calculation with their initial abundances. The total mass of all isotopes in the burnable poison composition is calculated to assist in determining the weight percentages of each isotope in the composition and the density of the composition. The burnable poison composition is then defined as an arbitrary material specification in the SAS2H input deck with the nodal moderator temperature applied.

4.9.2 Calculations Performed within the CONTINUATION_WRITER Subroutine

- The density of the fuel composition in the CRAFT generated continuing depletion SAS2H input deck must be calculated by the CONTINUATION_WRITER subroutine. This calculation is performed by simply dividing the total mass of the charge fuel composition (including oxygen) in the node by the total fuel volume in the node. The charge fuel composition (excluding oxygen) is obtained from the appropriate previous SAS2H calculation's output. The oxygen contribution and fuel volume of the node are calculated in the same manner as previously described in the STANDARD_WRITER subroutine description.

- The weight percentages of each isotope in the depleted initial charge compositions for the fuel and burnable poison are calculated by using the following equation.

$$\frac{\text{Weight Percent}}{\text{of Constituent in Material}} = \frac{\text{Mass of Constituent}}{\text{Total Material Mass}} * 100$$

- The default burnable poison material is Al_2O_3-B_4C. If this burnable poison material is specified for use in the BPRA of a continuing depletion calculation, the initial mass abundances of the aluminum, oxygen, and carbon in the fresh material must be calculated for use is defining the depleted burnable material composition for the continuation case. The first step in calculating the mass abundances of these elements is to use the following equation to calculate the mass of B_4C in the Al_2O_3-B_4C material in the node.

$$\frac{B_4C \text{ Mass}}{\text{in Node}} = \left(\frac{B_4C \text{ wt\% in } Al_2O_3\text{-}B_4C}{100}\right) * \left(\frac{\text{Density of}}{Al_2O_3\text{-}B_4C}\right) * \left(\frac{\text{Burnable Poison}}{\text{Volume in Node}}\right)$$

The carbon mass in the Al_2O_3-B_4C material of the node may then be calculated using the following equation.

$$\text{Carbon Mass in } Al_2O_3\text{-}B_4 = (B_4C \text{ Mass in Node}) * (0.217374)$$

The aluminum mass in the Al_2O_3-B_4C of the node is calculated using the following equation.

$$\frac{\text{Aluminum Mass}}{\text{in } Al_2O_3\text{-}B_4C} = \left(\frac{100 - B_4C \text{ wt\%}}{100}\right) * \left(\frac{\text{Density of}}{Al_2O_3\text{-}B_4C}\right) * \left(\frac{\text{Burnable Poison}}{\text{Volume in Node}}\right) * \left(\frac{2 * 26.981539}{101.961278}\right)$$

The oxygen mass in the Al_2O_3-B_4C of the node is calculated using the following equation.

$$\frac{\text{Oxygen Mass}}{\text{in } Al_2O_3\text{-}B_4C} = \left[\left(\frac{100 - B_4C \text{ wt\%}}{100}\right) * \left(\frac{\text{Density of}}{Al_2O_3\text{-}B_4C}\right) * \left(\frac{\text{Burnable Poison}}{\text{Volume in Node}}\right)\right] - \left(\frac{\text{Aluminum Mass}}{\text{in } Al_2O_3\text{-}B_4C}\right)$$

The total mass of the Al_2O_3-B_4C material in the node for the continuation case is the sum of the aluminum, oxygen, and carbon masses calculated from the fresh burnable poison description, plus the depleted B-10 and B-11 masses in the burnable poison of the node obtained from the appropriate previous SAS2H depletion and decay calculation's output. The volume of the burnable poison material in the node must be calculated using the following equation for use in calculating the density of the depleted burnable poison material.

$$\begin{matrix}\text{Volume of}\\ \text{Burnable Poison}\\ \text{in Node}\end{matrix} = \begin{matrix}\text{Burnable Poison}\\ \text{(Cross-Sectional Area)}\\ \text{in a BPR}\end{matrix} * \left(\begin{matrix}\text{Number of BPR's}\\ \text{in Assembly}\end{matrix}\right) * (\text{Node Height})$$

where the burnable poison cross-sectional area is defined in the CRAFT input deck.

The density of the depleted burnable poison for the continuing depletion SAS2H case is calculated by dividing the total mass of the depleted burnable poison material in the node by the burnable poison volume in the node. The weight percentages of the constituents of the Al_2O_3-B_4C material are calculated and used by CRAFT in generating the SAS2H input deck.

- The CRAFT code has the ability to model burnable poison materials other than Al_2O_3-B_4C. If a burnable poison material other than Al_2O_3-B_4C is specified, the CONTINUATION_WRITER subroutine must calculate the appropriate depleted composition for the continuing depletion SAS2H case. The first step in determining the depleted burnable poison material composition is to calculate the total mass of the depleted burnable poison in the node using the following equation.

$$\begin{matrix}\text{Depleted Burnable}\\ \text{Poison Total Mass}\\ \text{in Node}\end{matrix} = \sum_{\substack{\text{All Isotopes}\\ \text{Other Than}\\ \text{B-10 and B-11}}} \left[\left(\frac{\text{Isotope wt\%}}{100}\right) * \left(\begin{matrix}\text{Original Burnable}\\ \text{Poison Density}\end{matrix}\right)\right] + \begin{matrix}\text{B-10 and B-11 Mass}\\ \text{in Node from Previous}\\ \text{Depletion Calculation}\end{matrix}$$

The density of the depleted burnable poison composition is then calculated by dividing the total depleted burnable poison mass in the node by the total burnable poison material volume in the node.

The weight percents of the constituents of the burnable poison composition other than B-10 and B-11 are calculated using the following equation.

$$\begin{matrix}\text{Weight Percent of}\\ \text{Constituent in}\\ \text{Burnable Poison other}\\ \text{than B-10 and B-11}\end{matrix} = \frac{\left(\frac{\text{Original wt\% of Constituent}}{100}\right) * \left(\begin{matrix}\text{Original Burnable}\\ \text{Poison Density}\end{matrix}\right) * \left(\begin{matrix}\text{Burnable Poison}\\ \text{Volume in Node}\end{matrix}\right)}{\text{Total Mass of Depleted Burnable Poison in Node}} * 100$$

The weight percentages of the constituents of the burnable poison material are calculated and used by CRAFT in generating the SAS2H input deck.

4.10 CUTTER Subroutine

The cutter subroutine creates a consolidated output file for each CRAFT generated SAS2H calculation. This output file contains the time/date stamp from the SAS2H calculation output file, the echo of the

SAS2H input deck from the SAS2H output file, and the portion of the final ORIGEN calculation's output produced as part of the SAS2H calculation which contains the light element, actinide, and fission product material compositions relevant to CRC evaluations. The output files generated by the CUTTER subroutine contain the statepoint calculation's base filename followed by the "*.cut" suffix. Section 8 contains a detailed description of the CRAFT generated filenames.

4.11 RETRIEVER Subroutine

The RETRIEVER subroutine reads through the appropriate "*.cut" file to obtain the fuel and burnable poison initial charge compositions for the next SAS2H calculation. Additionally, the RETRIEVER subroutine writes a file which contains a listing of all isotopes and their concentrations which were present in the ORIGEN output of the SAS2H calculation, but not utilized in the initial charge composition of the next SAS2H calculation. This file is identified by the initial filename identifier corresponding to the SAS2H case which is being generated followed by a "*.notes" suffix. The RETRIEVER subroutine calculates the total mass of the depleted fuel composition in the node which will be used as the initial charge for the next SAS2H calculation. The total oxygen mass in the node, which is calculated in the CONTINUATION_WRITER subroutine, is included in the total fuel mass calculated by RETRIEVER. The weight percentages of each isotope in the fuel composition are then calculated by RETRIEVER to be transferred through an array designation to the CONTINUATION_WRITER subroutine where they will be implemented into the appropriate SAS2H input deck.

4.12 ZEROS Subroutine

The ZEROS subroutine is a utility for converting integer values less than 100 to a two character string representation with leading zeros if necessary.

5. CRAFT Input Summary

The following table summarizes the input card formats and parameters required to perform a CRAFT calculation. The CRAFT input deck filename must be "datain".

Card Number	Special Notes	Card Format	Card Description
1		1 Character	[Y] to signal that this case should pick up from a previous statepoint, any other character equals alternative
1A	✯	Integer	Relative cycle number at which to begin the calculation {If Input Card (IC) 1 = "Y"}
1B	✯	Integer	Relative statepoint number within the startup cycle at which to begin the calculation {If IC 1 = "Y"}

Card Number	Special Notes	Card Format	Card Description
2		21 Characters	Problem identifier (i.e.,Crystal River, Unit 3)
3		3 Characters	Problem prefix to be used as an identifier in all filenames
4		15 Characters	SCALE cross-section library to be utilized by SAS2H
5		Real	wt% U-235 enrichment in UO_2
6		Real	Mass of U per assembly (g)
7		Real	Number of fuel rods in assembly
8		Real	Rod pitch in assembly (cm)
9		Real	Fuel pellet diameter (cm)
10		Real	Fuel rod cladding inner diameter (cm)
11		Real	Fuel rod cladding outer diameter (cm)
12		Real	Active fuel length (cm)
13		1 Character	[Y] to indicate that the assembly contains axial blanket fuel, any other character equals alternative
13A	✯	Real	wt% U-235 enrichment in UO_2 for axial blanket fuel {If IC 13 = "Y"}
13B	✯	Integer	Number of CRC axial nodes containing axial blanket fuel {If IC 13 = "Y"}
13C	✯, ℜ	Integer	CRC axial node number(s) (1=top node) containing axial blanket fuel {If IC 13 = "Y"}
14		7 Characters	Spacer grid material identification (ZIRC-4, INCONEL, SS304, SS304S, SS316, SS316S)
14A		Real	Volume fraction of spacer grids in the moderator of the fuel assembly
15		10 Characters	Fuel cladding material identification (ZIRC-4 or ZIRCALLOY4, SS304, SS304S, SS316, SS316S)
15A		Real	Average fuel cladding temperature (K)

Card Number	Special Notes	Card Format	Card Description
16		1 Character	[Y] to indicate if a cladding specification other than Zirc-4 is required by any CR, BPR, or APSR
16A	✯	Integer	Total number of special cladding material compositions to be specified other than Zirc-4 {If IC 16 = "Y"}
16B	✯, ℜ	Integer	Material mixture number to be used in SAS2H calculations for special cladding composition {If IC 16 = "Y"}
16C	✯, ℜ	6 Characters	Special cladding material identification (INCONEL, SS304, SS304S, SS316, SS316S) {If IC 16 = "Y"}
17		Real	System pressure (psia)
18		1 Character	[Y] to indicate if the assembly ever contains a BPRA, any other character equals alternative
18A	✯	Integer	Number of reactor cycles in which the assembly contains a BPRA {If IC 18 = "Y"}
18B	✯	Integer, Integer	Number of different BPRA designs inserted in assembly throughout its irradiation history, Number of BP material used other than Al_2O_3-B_4C {If IC 18 = "Y"}
18C	✯, ℜ	Real, Real, Real, Integer, Integer, Integer	Density of burnable poison (g/cc), B_4C wt% in burnable poison, Cross-sectional area of burnable poison in BPR (cm^2), Number of BPR's in BPRA, SAS2H material mixture number for BPR cladding, SAS2H material mixture number for BP material {If IC 18 = "Y"}
18D	✯, ℜ	Integer	Number of radial zones in BPRA Path B model {If IC 18 = "Y"}
18E	✯, ℜ	Integer, Real	Material mixture number for zone of BPRA Path B model, Outer radii (cm) for zone of BPRA Path B model (This combination must be specified from inner zone to outer zone.) {If IC 18 = "Y"}

Card Number	Special Notes	Card Format	Card Description
18F	★, ℜ	Integer, Real	Material mixture number for zone of Path B model with removed BPRA, Outer radii (cm) for zone of Path B model with removed BPRA (This combination must be specified from inner zone to outer zone.) {If IC 18 = "Y"}
18G	★, ℜ	Integer, Real	Material mixture number for zone of Path B model for BPRA region above the BP absorber region, Outer radii (cm) for zone of Path B model for BPRA region above the BP absorber region (This combination must be specified from inner zone to outer zone.) {If IC 18 = "Y"}
18H	★, ℜ	5 Characters, Integer	Material in BPR above the BP absorber material (i.e.,"AL2O3"), Corresponding SAS2H material mixture number {If IC 18 = "Y"}
18I	★, ℜ	Integer	Number of isotopes in material composition above the BP absorber material in the BPR {If IC 18 = "Y"} & {Value #1 of IC 18H ≠ "AL2O3"}
18J	★, ℜ	Integer, Real	SCALE nuclide identifier in material composition above the BP absorber material in the BPR, Corresponding wt% of nuclide in material composition {If IC 18 = "Y"} & {Value #1 of IC 18H ≠ "AL2O3"}
18K	★	Integer	SAS2H material mixture number to be used for the BP material specified in 18L and 18M {If IC 18 = "Y"} & {Value #2 of IC 18B > 0}
18L	★	Integer	Number of isotopes in the BP absorber material mixture {If IC 18 = "Y"} & {Value #2 of IC 18B > 0}
18M	★, ℜ	Integer, Real	SCALE nuclide identifier in BP absorber material mixture, wt% for nuclide in mixture {If IC 18 = "Y"} & {Value #2 of IC 18B > 0}

Card Number	Special Notes	Card Format	Card Description
18N	★, ℜ	Integer, Integer, Integer, Integer	Relative cycle number containing BPRA, Relative BPRA design number, Top axial node containing BPRA, Bottom axial node containing BPRA {If IC 18 = "Y"}
19		Integer	Number of radial zones in standard Path B model
20	ℜ	Integer, Real	Material mixture number for zone of standard Path B model, Outer radii (cm) for zone of standard Path B model (This combination must be specified from inner zone to outer zone.)
21		Integer	Number of cross-section libraries to be created per irradiation step
22		Integer	SAS2H print level
23		Real	Zone mesh factor for use by XSDRNPM
24		7 Character	[SPECIAL] to indicate the input of 7 XSDRNPM calculational control parameters to follow, any other character string indicates no XSDRNPM calculational control parameter input
24A	★	Real	XSDRNPM calculational control parameter: Spatial Mesh Factor (SZF < 1 for finer, SZF > 1 for coarser), Default = 1 {If IC 24 = "SPECIAL"}
24B	★	Integer	XSDRNPM calculational control parameter: Order of Angular Quadrature, Default = 8 {If IC 24 = "SPECIAL"}
24C	★	Integer	XSDRNPM calculational control parameter: Maximum Number of Inner Iterations, Default = 20 {If IC 24 = "SPECIAL"}
24D	★	Integer	XSDRNPM calculational control parameter: Maximum Number of Outer Iterations, Default = 25 {If IC 24 = "SPECIAL"}

Card Number	Special Notes	Card Format	Card Description
24E	✯	Real	XSDRNPM calculational control parameter: Overall Convergence Criteria, Default = 0.0001 {If IC 24 = "SPECIAL"}
24F	✯	Real	XSDRNPM calculational control parameter: Scalar Flux Point Convergence, Default = 0.0001 {If IC 24 = "SPECIAL"}
24G	✯	Integer	XSDRNPM calculational control parameter: IUS = 1 for upscatter scaling to speed convergence, IUS = 0 for no scaling, Default = 0 {If IC 24 = "SPECIAL"}
25		Integer	Number of reactor cycles in which the assembly is inserted
26	ℜ	2 Characters	Reactor cycle identifier in which assembly is inserted
27	ℜ	Integer	Number of CRC statepoints in reactor cycle in which the assembly is inserted (BOC is always considered statepoint 1 in a cycle)
28	ℜ	Real	Statepoint EFPD
29	ℜ	Real	Length to statepoint in calendar days
30	ℜ	Real	Downtime at statepoint
31	ℜ	Real	Days of downtime at EOC
32	ℜ	Real	Total cycle length in EFPD
33	ℜ	Real	Total cycle length in calendar days
34	ℜ	Integer	Integer position of assembly in cycle
35		1 Character	Flag to signal if constant or variable irradiation step histories will be specified [Y=variable, N=constant]
36	✯, ℜ	Integer	Relative cycle number to which the following boron letdown data applies {If IC 35 = "N"}

Card Number	Special Notes	Card Format	Card Description
37	★, ℜ	Integer	Relative statepoint number in the relative cycle to which the following boron letdown data applies (BOC statepoint equals 1) {If IC 35 = "N"}
38	★, ℜ	Real	Irradiation step length in EFPD {If IC 35 = "N"}
39	★, ℜ	Real	Number of irradiation steps to next statepoint {If IC 35 = "N"}
40	★, ℜ	Real	Mid-point ppmb concentration for irradiation step {If IC 35 = "N"}
41	★, ℜ	Integer	Relative cycle number to which the following boron letdown data applies {If IC 35 = "Y"}
42	★, ℜ	Integer	Relative statepoint number in the relative cycle to which the following boron letdown data applies (BOC statepoint equals 1) {If IC 35 = "Y"}
43	★, ℜ	Real	Number of irradiation steps to next statepoint {If IC 35 = "Y"}
44	★, ℜ	Real, Real	Irradiation step length in EFPD, Mid-point ppmb concentration for irradiation step {If IC 35 = "Y"}
45		Integer	Number of axial nodes for CRC calculation
46	ℜ	Real, Real	Node number, Node height (cm)
47		6 Characters	'RODDED' if any control rod assembly data is to be provided, any other character string equals alternative
47A	★	Integer	Number of previously defined irradiation steps in which the assembly contains a CRA {If IC 47 = "RODDED"}

Card Number	Special Notes	Card Format	Card Description
47B	★, ℜ	Integer, Integer, Integer, Integer, Integer, Integer	Relative cycle number containing the CRA, Relative statepoint in cycle (BOC=stpt 1), Relative irradiation step number, Top axial node number containing CRA, Bottom axial node number containing CRA, CRA absorber material mixture, CRA design description number {If IC 47 = "RODDED"}
47C	★	Integer	Number of different CRA absorber material mixtures that will be specified for use in this fuel assembly {If IC 47 = "RODDED"}
47D	★, ℜ	Integer	SAS2H material mixture identifier for CRA absorber material mixture {If IC 47 = "RODDED"}
47E	★, ℜ	Integer	Number of isotopes in CRA absorber material mixture {If IC 47 = "RODDED"}
47F	★, ℜ	Integer, Real	SCALE nuclide identifier in CRA absorber material mixture, wt% for nuclide in mixture {If IC 47 = "RODDED"}
47G	★	Integer	Number of different CRA designs that will be specified for use with this fuel assembly {If IC 47 = "RODDED"}
47H	★, ℜ	Real, Integer	CRA absorber material density for design, SAS2H material mixture number for CR cladding in CRA design {If IC 47 = "RODDED"}
47I	★, ℜ	Integer	Number of radial zones in the Path B unit cell model for the assembly containing CRA design {If IC 47 = "RODDED"}
47J	★, ℜ	Integer, Real	Zone mixture identifier for use in CRA design Path B unit cell model, Corresponding zone outer radii (cm) {If IC 47 = "RODDED"}
47K	★, ℜ	Integer, Real	Zone mixture identifier for use in Path B unit cell model after the CRA is removed, Corresponding zone outer radii (cm) {If IC 47 = "RODDED"}

Card Number	Special Notes	Card Format	Card Description
48		6 Characters	'RODDED' if any axial power shaping rod assembly data is to be provided, any other character string equals alternative
48A	★	Integer	Number of previously defined irradiation steps in which the assembly contains an APSR assembly {If IC 48 = "RODDED"}
48B	★, ℜ	Integer, Integer, Integer, Integer, Integer, Integer, Integer, Integer	Relative cycle number containing the APSR, Relative statepoint in cycle (BOC=stpt 1), Relative irradiation step number in cycle, Top axial node number containing APSR, Bottom axial node number containing APSR, APSR absorber material mixture number, APSR assembly design description number, APSR follow rod material mixture number {If IC 48 = "RODDED"}
48C	★	Integer	Number of different APSR assembly absorber material mixtures that will be specified for use with this fuel assembly {If IC 48 = "RODDED"}
48D	★, ℜ	Integer	SAS2H material mixture identifier for APSR assembly absorber material mixture {If IC 48 = "RODDED"}
48E	★, ℜ	Integer	Number of isotopes in APSR assembly absorber material mixture {If IC 48 = "RODDED"}
48F	★, ℜ	Integer, Real	SCALE nuclide identifier in APSR absorber material mixture, wt% for nuclide in mixture {If IC 48 = "RODDED"}
48G	★	Integer	Number of different APSR assembly designs that will be specified for use with this fuel assembly {If IC 48 = "RODDED"}
48H	★, ℜ	Real, Integer	APSR absorber material density for APSR assembly design, SAS2H material mixture number for APSR cladding in APSRA design {If IC 48 = "RODDED"}

Card Number	Special Notes	Card Format	Card Description
48I	★, ℜ	Integer	Number of radial zones in the Path B unit cell model for the assembly containing APSR assembly design {If IC 48 = "RODDED"}
48J	★, ℜ	Integer, Real	Zone mixture identifier for use in APSR assembly design Path B unit cell model, Corresponding zone outer radii (cm) {If IC 48 = "RODDED"}
48K	★, ℜ	Integer, Real	Zone mixture identifier for use in Path B unit cell model after the APSR assembly is removed, Corresponding zone outer radii (cm) {If IC 48 = "RODDED"}
48L	★, ℜ	Integer, Real	Zone mixture identifier for use in Path B unit cell model for the follow rod section of the APSR assembly, Corresponding zone outer radii (cm) {If IC 48 = "RODDED"}
49	ℜ	Integer	Number of axial nodes for fuel temperature input
50	ℜ	Real, Real	Axial node number for fuel temperature input, Corresponding axial node height (cm)
51	ℜ	Real	Axial node fuel temperature input data (F)
52	ℜ	Integer	Number of axial nodes for moderator specific volume input
53	ℜ	Real, Real	Axial node number for moderator specific volume input, Corresponding axial node height (cm)
54	ℜ	Real	Axial node moderator specific volume input data (ft^3/lb)
55	ℜ	Integer	Number of axial nodes for burnup input data
56	ℜ	Real, Real	Axial node number for burnup input, Corresponding axial node height (cm)
57	ℜ	Real	Axial node burnup input data (GWd/MTU)

★: The existence of these input cards is dependent on certain previous input card values. The

detailed descriptions for these input cards in Section 7 explain the various dependencies.

ℜ: These are recursive input cards that must be entered multiple times in a specific grouping format. The detailed descriptions for the recursive input cards in Section 7 explain the specific grouping formats and number of required input iterations.

: The continuous shaded boxes in the special notes column indicate groupings of recursive input cards. The format and content of these recursive groupings are explained in the detailed input descriptions in Section 7.

6. CRAFT Code Limits and Execution Instructions

The following listing describes the CRAFT code limitations.

1) The maximum number of irradiation steps allowed in a given CRAFT generated SAS2H input deck is twenty-three.
2) The maximum number of isotopes allowed in a CR or APSR absorber material specification is ten.
3) The maximum number of concentric zones allowed in a SAS2H Path B model is fifteen.
4) The maximum number of axial nodes allowed in any axial format is fifty.
5) The maximum number of reactor cycles in which an assembly may be inserted is ten.
6) The maximum number of CRC statepoints allowed in a single reactor cycle (BOC counts as one statepoint) is twenty.
7) The maximum number of BPRA design description specifications allowed is ten.
8) The maximum number of different CR absorber material mixtures allowed is twenty-five.
9) The maximum number of CRA design description specifications allowed is ten.
10) The maximum number of APSR absorber material mixtures allowed is twenty-five.
11) The maximum number of APSRA design description specifications allowed is ten.

The procedure for performing a fuel assembly depletion calculation with CRAFT Version 1.0 consists of the following four steps:

1) Create a CRAFT input deck for the assembly depletion calculation.
2) Assure that the CRAFT executable file, the CRAFT input deck entitled "datain", the "batch43" executable file, and the "sedexecute" executable file are in the same directory. The "batch43" executable file is a script file which is used by CRAFT to execute the SCALE code system. An ASCII listing of the "batch43" script is shown in Table 6-1. The "sedexecute" executable file is a script file which is used in conjunction with the CRAFT code to create the consolidated output files described in Section 8 of this document. An ASCII listing of the "sedexecute" script is shown in Table 6-2.
3) Assure that the "sed" line editor is loaded onto the computer system and is in the command path (i.e.,executable from the command line through the issuance of the "sed" command).
4) Execute CRAFT.

Table 6-1 Listing of the "batch43" Script Required for the Execution of CRAFT

```
#!/bin/csh
if ( ! ( $?SCALE ) )   setenv SCALE /neutronics/Scale4.3
setenv CMDS $SCALE/cmds
set pid=`$CMDS/ppid`
setenv TMPDIR /users/wright/scale4.3/tmp
if ( -e $1 ) then
  set input=$1
  set output=$1:r.output
  set msgs=$1:r.msgs
else if ( -e $1.inp ) then
  set input=$1.inp
  set output=$1.out
  set msgs=$1.msg
else if ( -e $1.input ) then
  set input=$1.input
  set output=$1.output
  set msgs=$1.msgs
else
  echo ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
  echo          "the input file you specified does not exist"
  echo ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
  exit
endif
$CMDS/scale43 $input $output >& $msgs
rm -r $TMPDIR
```

The stucture of the "batch43" script shown in Table 6-1 is only understandable if examined in the context in which it is used in the CRAFT code.

Table 6-2 Listing of the "sedexecute" Script Required for the Execution of CRAFT

```
print '*************************************************************************'
> $1.cut
print '*    Date and Time Validation Stamp for the Execution of the SAS2H Case    *'
>> $1.cut
print '*************************************************************************'
>> $1.cut
print ' ' >> $1.cut
sed -n $3,$4p $1.output >> $1.cut
print ' ' >> $1.cut
print '*************************************************************************'
>> $1.cut
print '*          Echo of SAS2H Input Deck Obtained from SAS2H Output           *'
>> $1.cut
print '*************************************************************************'
>> $1.cut
print ' ' >> $1.cut
sed -n "/1          primary module access and input record/,/      '     end of
input/p" $1.output >> $1.cut
print ' ' >> $1.cut
print '*************************************************************************'
>> $1.cut
print '* SAS2H Output Relevant to CRC Evaluations Obtained from Final ORIGEN Case *'
>> $1.cut
print '*************************************************************************'
>> $1.cut
print ' ' >> $1.cut
```

```
sed -n "$2,/0 halt/p" $1.output >> $1.cut
print ' ' >> $1.cut
print '*************************************************************************'
>> $1.cut
print '*        End of Extracted SAS2H Output Relevant to CRC Evaluations       *'
>> $1.cut
print '*************************************************************************'
>> $1.cut
print ' ' >> $1.cut
```

The stucture of the "sedexecute" script shown in Table 6-1 is only understandable if examined in the context in which it is used in the "CUTTER" subroutine of the CRAFT code. The "sed" command issued in the "sedexecute" script initiates the execution of the sed line editor.

7. Detailed Descriptions of CRAFT Input Cards

Input Card Number		Detailed Description
1	:	The CRAFT code is capable of continuing an assembly depletion/decay calculation from a statepoint other than the BOC statepoint of relative cycle number one. The requirements for continuing a CRAFT calculation from an arbitrary statepoint include the following-- 1) all CRAFT input for the statepoints prior to the continuation statepoint must be specified in the CRAFT input deck for the continuation calculation; 2) all "*.cut" files from the last statepoint calculation prior to the continuation statepoint, for each node, must be present in the CRAFT execution directory. If the CRAFT calculation is a continuation calculation, an uppercase letter "Y" should be placed in column 1 of this card. Otherwise, any character other than "Y" will signal that the CRAFT calculation is to begin from BOC of relative cycle number one as defined in the CRAFT input deck.

Input Card Number		Detailed Description
1A	:	This card should only be specified if the value of card number 1 is "Y". This card should contain an integer value representing the relative cycle number as specified in the CRAFT input deck from which the calculation should commence. The relative cycle number refers to the sequential cycle number in which the assembly is inserted. The relative cycle number is not the cycle identifier. For example, if a CRAFT calculation is to be performed for an assembly inserted in the actual reactor cycles 1 and 4, input data for the assembly would be provided to CRAFT for cycles 1 and 4, in that order. Cycle 1 would be considered relative cycle number 1, and cycle 4 would be considered relative cycle number 2.
1B	:	This card should only be specified if the value of card number 1 is "Y". This card should contain an integer value representing the relative statepoint, within the continuation relative cycle number provided on card 1A, from which the calculation should commence.
2	:	This card should contain a 21 character problem identifier which will be placed on all SAS2H input decks and echoed throughout the SAS2H output. The problem identifier must be placed in columns 1 through 21 of this card. An example of a problem identifier would be "Crystal River, Unit 3".
3	:	This card should contain a 3 character prefix which will be used as the initial 3 characters of each file generated in the CRAFT calculation. The prefix must be placed in columns 1 through 3 of this card. An example of a prefix meaningful for use with the problem identifier example previously provided would be "CR3".

Input Card Number		Detailed Description
4	:	This card should contain the identifier for the SCALE cross-section library which is to be used in all of the SAS2H calculations generated by the CRAFT calculation. Available SCALE cross-section libraries include the following-- 1) 44GROUPNDF5 or 44group; 2) 27BURNUPLIB; 3) 27GROUPNDF4; 4) 238GROUPNDF5; 5) HANSEN-ROACH. The 44group cross-section library is recommended for use in all CRAFT calculations relevant to Commercial Reactor Critical evaluations.
5	:	This card should contain the weight percent of U-235 in the UO_2 fuel of the assembly. This value should not be adjusted to compensate for axial blanket fuel. Axial blanket fuel descriptions provided later in the CRAFT input deck will override the enrichment specified on this card as appropriate.
6	:	This card should contain the total mass of uranium metal in the fuel assembly in units of grams per assembly.
7	:	This card should contain the number of fuel rods in the assembly.
8	:	This card should contain the rod pitch in the assembly in units of cm.
9	:	This card should contain the nominal fuel pellet diameter in the assembly in units of cm.
10	:	This card should contain the nominal fuel rod cladding inner diameter in the assembly in units of cm.
11	:	This card should contain the nominal fuel rod cladding outer diameter in the assembly in units of cm.
12	:	This card should contain the nominal active fuel length in the assembly in units of cm.

Input Card Number		Detailed Description
13	:	The CRAFT code is capable of modeling fuel assemblies which utilize axial blanket fuel designs. If the assembly utilizes an axial blanket fuel design, an uppercase letter "Y" should be placed in column 1 of this card. If the assembly does not utilize an axial blanket fuel design, any character other than "Y" should be specified.
13A	:	This card should only be specified if the value of card number 13 is "Y". This card should contain the weight percent of U-235 in the UO_2 fuel of the axial blanket region of the assembly.
13B	:	This card should only be specified if the value of card number 13 is "Y". This card should contain an integer number representing the number of CRC axial nodes that will contain the axial blanket fuel.
13C	:	This card should only be specified if the value of card number 13 is "Y". This card should contain a single integer value which identifies a CRC axial node containing axial blanket fuel. This input card must be repeated a number of times equal to the value specified on input card 13B.
14	:	This card should contain a 7 character name, beginning in column 1, which specifies the spacer grid material. The currently available spacer grid material specifications include-- 1) ZIRC-4 2) INCONEL 2) SS304 3) SS304S 4) SS316 5) SS316S.
14A	:	This card should contain a value representing the volume fraction of the moderated region of the fuel assembly which is displaced by spacer grid material. The sum of the moderator volume fraction and the spacer grid volume fraction should equal one. The moderator and spacer grid volumes present in the assembly-to-assembly spacing region may also be included in calculation of the spacer grid volume fraction to be input on this card.

Input Card Number		Detailed Description
15	:	This card should contain the identification of the fuel cladding material. The identification must be specified in columns 1 through 10. The currently available cladding material specifications include-- 1) Zirc-4 or ZIRCALLOY4 2) INCONEL 3) SS304 4) SS304S 5) SS316 6) SS316S.
15A	:	This card should contain an average fuel rod cladding temperature value in units of degrees Kelvin that will be used consistently throughout the CRAFT generated SAS2H calculations.
16	:	The CRAFT code is capable of modeling CRA's, APSRA's, and BPRA's with cladding material compositions other than the default Zirc-4. If any cladding material must be specified other than the default Zirc-4, an uppercase letter "Y" should be placed in column 1 of this card. If Zirc-4 is the only cladding material utilized in the CRAFT calculation, any character other than "Y" should be specified.
16A	:	This card should only be specified if the value of card number 16 is "Y". This card should contain an integer value specifying the number of additional cladding materials to be specified other than the default cladding material Zirc-4.

Input cards 16B and 16C represent an input grouping that must be specified recursively for each cladding material as denoted on input card 16A. This means that input cards 16B and 16C would be input for the first cladding material, and then input again for the second cladding material, etc., until all of the cladding materials other than Zirc-4 which are utilized in the CRAFT calculation, as specified on input card 16A, have been described.

16B	:	This card should only be specified if the value of card number 16 is "Y". This card should contain an integer value representing the material mixture number which corresponds to a cladding material specification that may be specified in the SAS2H input decks generated by the CRAFT calculation.

Input Card Number		Detailed Description
16C	:	This card should only be specified if the value of card number 16 is "Y". This card should contain either a 5 or 6 character identifier corresponding to the cladding material. The cladding material identifiers currently available in CRAFT include the following-- 1) SS304 2) SS304S 3) SS316 4) SS316S. 5) INCONEL
17	:	This card should contain the system pressure in units of psi.
18	:	The CRAFT code is capable of modeling an assembly that contains a BPRA. Usually, fuel assemblies may contain a BPRA in one cycle but not in subsequent cycles. If the fuel assembly for which the CRAFT calculation is to be performed contains a BPRA in any of its specified reactor cycles, an uppercase letter "Y" should be placed in column 1 of this card. Any other character signifies that the assembly never contains a BPRA.
18A	:	This card should only be specified if the value of card number 18 is "Y". This card should contain an integer value representing the number of reactor cycles in which the fuel assembly contains a BPRA.
18B	:	This card should only be specified if the value of card number 18 is "Y". This card should contain two integer values delineated by spaces. The first value represents the number of different BPRA designs inserted in the fuel assembly during its irradiation history. The second value represents the number of BP absorber materials other than the default, Al_2O_3-B_4C, which are utilized during the irradiation of the assembly as specified in the CRAFT calculation.

Input cards 18C through 18J represent an input grouping that must be specified recursively for each BPRA design as denoted on input card 18B. This means that input cards 18C through 18J would be input for BPRA design 1, and then input again for BPRA design 2, etc., until all of the number of BPRA designs specified on input card 18B have been described.

Input Card Number		Detailed Description
18C	:	This card should only be specified if the value of card number 18 is "Y". This card should contain 6 values delineated by spaces. The first value should be the density of the Al_2O_3-B_4C burnable absorber material. The second value should be the weight percent of the B_4C in the Al_2O_3-B_4C absorber material. The third value should be the cross-sectional area of the burnable poison material in a single BPR. The fourth value should be the number of BPR's in the BPRA. The fifth value should be the BPR cladding material mixture number to be utilized in the CRAFT generated SAS2H calculations. The sixth value should be the BP absorber material mixture number to be utilized in the CRAFT generated SAS2H calculations.
18D	:	This card should only be specified if the value of card number 18 is "Y". This card should contain the integer number of radial zones that will be used to describe the SAS2H Path B model for the assembly node containing the BPRA.
18E	:	This card should only be specified if the value of card number 18 is "Y". This card contains the description of a single radial zone in the SAS2H Path B model for the assembly containing the BPRA. This card should contain two values delineated by spaces. The first of which should be an integer value representing the SAS2H material mixture number for the Path B model radial zone which this card represents. The second value should be the outer radius (cm) of the Path B model radial zone which this card represents. This input card must be repeated a number of times equal to that specified on input card 18D.

Input Card Number		Detailed Description
18F	:	This card should only be specified if the value of card number 18 is "Y". If an assembly contains a BPRA in one cycle but not in another, an alternative SAS2H Path B model must be provided that describes the assembly after removal of the BPRA. This alternative Path B model must contain the same number of radial zones as the Path B model with the BPRA inserted. This card contains the description of a single radial zone in the SAS2H Path B model for the assembly node with the BPRA removed. This card should contain two values delineated by spaces. The first of which should be an integer value representing the SAS2H material mixture number for the Path B model radial zone which this card represents. The second value should be the outer radius (cm) of the Path B model radial zone which this card represents. This input card must be repeated a number of times equal to that specified on input card 18D.
18G	:	This card should only be specified if the value of card number 18 is "Y". Some BPR designs incorporate a non-absorbing region above the poison region in the BPR. To accomodate this type of BPR design an alternative SAS2H Path B model must be provided that describes the BPR assembly above the poison region of the BPR. This alternative Path B model must contain the same number of radial zones as the Path B model with the BPRA inserted. This card contains the description of a single radial zone in the SAS2H Path B model for the assembly node containing the BPRA region above the poison region of the BPR. This card should contain two values delineated by spaces. The first of which should be an integer value representing the SAS2H material mixture number for the Path B model radial zone which this card represents. The second value should be the outer radius (cm) of the Path B model radial zone which this card represents. This input card must be repeated a number of times equal to that specified on input card 18D.

Input Card Number		Detailed Description
18H	:	This card should only be specified if the value of card number 18 is "Y". This card should contain two entries. The first entry should be the 5 character string "AL2O3" if the material in the non-absorbing region of the BPR (above the poison region of the BPR) is composed of Al2O3. Any other character string indicates that a material other than Al2O3 is present in the BPR above the poison region. The second entry should be an integer value corresponding to the SAS2H material mixture number for the material in the BPR above the BP absorbing material.
18I	:	This card should only be specified if the value of card number 18 is "Y", and the character string specified on input card 18H is not "AL2O3". This card should contain an integer value indicating the number of isotopes in the composition of the material contained within the BPR above the poison region.
18J	:	This card should only be specified if the value of card number 18 is "Y", and the character string specified on input card 18H is not "AL2O3". This card should contain an integer value and a floating-point value. The first value specified on this card should be an integer representing the SCALE nuclide identifier for a constituent of the material composition within the BPR above the poison region. The second value should be a floating-point value representing the corresponding wt% of this nuclide in the material composition. This input card should be repeated a number of times equal to that specified on input card 18I.
18K	:	This card should only be specified if the last value of card number 18B is greater than zero. This card should contain an integer value representing the SAS2H material mixture number for the BP absorber material being specified on cards 18L and 18M.
18L	:	This card should only be specified if the last value of card number 18B is greater than zero. This card should contain an integer value specifying the number of isotopes in the BP absorber material mixture specified on input card 18K.

Input Card Number		Detailed Description
18M	:	This card should only be specified if the last value of card number 18B is greater than zero. This card should contain two values delineated by spaces. The first value should be the SCALE nuclide identifier corresponding to a constituent of the BP absorber material mixture specified on input card 18K. The second value should be the weight percent of the nuclide, identified by the first value, in the BP absorber material mixture specified on input card 18K. If the BP absorber material contains boron, the SCALE nuclide identifiers for B-10 and B-11 must be specified explicitly. This input card must be repeated a number of times equal to that specified on input card 18L such that data for all nuclides in the BP absorber material mixture are provided, and the sum of the weight percents of the nuclides in the mixture equals 100.
18N	:	This card should only be specified if the value of card number 18 is "Y". This input card contains four integer values delineated by spaces. The first value is the relative cycle number containing a BPRA. The second value is the relative BPRA design number corresponding to the order in which information was provided in the groupings of input cards 18C through 18F. The third value is the upper CRC axial node number containing the BPRA (the topmost CRC node number is always considered 1). The fourth value is the lower CRC axial node number containing the BPRA. This input card must be repeated a number of times equal to the value specified on input card 18A.
19	:	This card should contain an integer value representing the number of radial zones in the SAS2H Path B model for the fuel assembly as it would be if the assembly never contained a BPRA, a CRA, or an APSR assembly during its irradiation history. This is called the standard Path B model.
20	:	This card contains the description of a single radial zone in the standard Path B model for the fuel assembly. This card should contain two values delineated by spaces. The first of which should be an integer value representing the SAS2H material mixture number for the Path B model radial zone which this card represents. The second value should be the outer radius (cm) of the Path B model radial zone which this card represents. This input card must be repeated a number of times equal to that specified on input card 19.

Input Card Number		Detailed Description
21	:	This card should contain an integer value representing the number of cross-section libraries that are to be produced for each irradiation step in the SAS2H calculations generated by CRAFT. The number of cross-section libraries per irradiation step for CRC evaluations should be set to 1.
22	:	This card should contain an integer value representing the SAS2H print level desired for the output of SAS2H calculations generated by CRAFT. The minimum print level allowed for CRC evaluations is 5. A complete listing and description of the available print levels is provided on page S2.5.18 of reference 1.
23	:	This card should contain the zone mesh factor that should be utilized by XSDRNPM in the SAS2H calculations generated by CRAFT. A description of the zone mesh factor is provided on page S2.5.5 of reference 1.
24	:	The CRAFT calculation allows the specification of special XSDRNPM control parameters that will be utilized in SAS2H calculations generated by CRAFT. If any of the special control parameters described in cards 24A through 24G are to be specified, the character string "SPECIAL" must be provided in columns 1 through 7 of this card. Any other character string specification indicates that the default XSDRNPM control parameters are to be utilized.
24A	:	This card should only be specified if the value of card number 24 is "SPECIAL". This card contains the XSDRNPM calculational control parameter SZF. The size of the largest spatial mesh interval can be adjusted by entering a value for SZF. SZF less than 1 indicates a finer mesh spacing. SZF greater than one indicates a coarser mesh spacing. SZF equal to 1 is the default.
24B	:	This card should only be specified if the value of card number 24 is "SPECIAL". This card contains the XSDRNPM calculational control parameter ISN. The ISN value specifies the order of angular quadrature for XSDRNPM. Quadrature sets are geometry-dependent quantities that are defaulted to a value of 8.

Input Card Number		Detailed Description
24C	:	This card should only be specified if the value of card number 24 is "SPECIAL". This card contains the XSDRNPM calculational control parameter IIM. The IIM value specifies the maximum number of inner iterations to be used by XSDRNPM. The default value is 20.
24D	:	This card should only be specified if the value of card number 24 is "SPECIAL". This card contains the XSDRNPM calculational control parameter ICM. The ICM value specifies the maximum number of outer iterations to be used by XSDRNPM. The default value is 25.
24E	:	This card should only be specified if the value of card number 24 is "SPECIAL". This card contains the XSDRNPM calculational control parameter EPS. The EPS value specifies the overall convergence criteria. This value is used by XSDRNPM after each outer iteration to determine if the problem has converged. The default value of EPS is 0.0001. A smaller value tightens the convergence criteria, and a larger value loosens the convergence criteria.
24F	:	This card should only be specified if the value of card number 24 is "SPECIAL". This card contains the XSDRNPM calculational control parameter PTC. The PTC value specifies the point flux convergence criteria used by XSDRNPM to determine if convergence has been achieved after an inner iteration. The default value of PTC is 0.0001. A smaller value tightens the convergence criteria, and a larger value loosens the convergence criteria.
24G	:	This card should only be specified if the value of card number 24 is "SPECIAL". This card contains the XSDRNPM calculational control parameter IUS. The IUS value is a flag to direct XSDRNPM to use an upscatter scaling technique to accelerate the solution or force convergence. The default value is 0, which indicates that upscatter scaling is not used. An IUS value of 1 directs XSDRNPM to use the upscatter scaling technique. The default value is 0.
25	:	This card should specify an integer number of reactor cycles in which the fuel assembly is inserted in the CRAFT calculation.

Input Card Number		Detailed Description

Input cards 26 through 34 represent an input grouping that must be specified recursively for each reactor cycle in which the fuel assembly is inserted in the CRAFT calculation as denoted on input card 25. This means that input cards 26 through 34 would be input for the first reactor cycle, and then input again for the second reactor cycle, etc., until all of the number of reactor cycles specified on input card 25 have been described.

26	:	This card should contain a 2 character reactor cycle identifier that will be used to identify the cycle on appropriate SAS2H input decks generated by the CRAFT calculation. For example, if the first reactor cycle were identified as "Cycle-1A", the value of this input card should be "1A". If a reactor cycle were identified as "Cycle-1", the value of this input card should be "01", etc...
27	:	This card should contain an integer value specifying the number of CRC statepoints in the reactor cycle specified on input card number 25. The BOC is always considered statepoint 1 in a CRC evaluation. For example, if the reactor cycle specified on card 25 contained one mid-cycle CRC statepoint, the value specified on this card would be 2.

Input cards 28 through 30 represent an input grouping that must be specified recursively for each CRC statepoint in the reactor cycle as denoted on input card 27. This means that input cards 28 through 30 would be input for the first statepoint (BOC), and then input again for the second statepoint, etc., until all of the number of CRC statepoints in the reactor cycle as specified on input card 27 have been described.

28	:	This card should contain a value specifying the EFPD for the statepoint. If the first statepoint in a reactor cycle (BOC) is being described, the value of this card should be 0.
29	:	This card should contain a value specifying the length in calendar days from the BOC to the CRC statepoint. If the first statepoint in a reactor cycle (BOC) is being described, the value of this card should be 0.
30	:	This card should contain a value specifying the downtime in calendar days for the reactor shutdown at the CRC statepoint. If the first statepoint in a reactor cycle (BOC) is being described, the value of this card should be 0.
31	:	This card should contain a value specifying the downtime in calendar days at the EOC reactor shutdown.

Input Card Number		Detailed Description
32	:	This card should contain a value specifying the total EFPD for the reactor cycle from the BOC startup to the EOC shutdown.
33	:	This card should contain a value specifying the total cycle length in calendar days from the BOC startup to the EOC shutdown.
34	:	This card should contain an integer value less than 100 that specifies the position of the fuel assembly in the symmetrical representation of the reactor core. Typically, a CRC evaluation is performed using core symmetry to reduce the overall calculation time required to perform the evaluation. When core symmetry is used, the input parameters utilized in the CRAFT calculation for each node of an assembly are the average of the parameters from each symmetric core location corresponding to the assembly node. Usually, one-eighth core symmetry is utilized in performing CRC evaluations.
35	:	This card should contain a single character to signal to CRAFT whether variable or constant irradiation step description data will be provided. The variable irradiation step description input allows the specification of unique irradiation step durations for each irradiation step in a statepoint calculation. This option may be useful when modeling rodded cycles. The constant irradiation step duration applies the same irradiation step length to a specified number of irradiation steps in a given statepoint calculation. The character "Y" placed in column one of the input card specifies variable irradiation step duration input. The character "N" placed in column one of the input card specifies constant irradiation step duration input.

Input cards 36 through 40 should be specified only if the value of input card 35 is "N". Input cards 36 through 40 represent an input grouping that must be specified recursively for each reactor cycle in which the fuel assembly is inserted in the CRAFT calculation as denoted on input card 25. This means that input cards 36 through 40 would be input for the first reactor cycle, and then input again for the second reactor cycle, etc., until all of the number of reactor cycles specified on input card 25 have been described.

Input Card Number		Detailed Description
36	:	This card should only be specified if the value of card number 35 is "N". This card should contain an integer value specifying the relative cycle number to which the input data provided in the current grouping of input cards 36 through 40 apply. For example, if the CRAFT calculation involved two reactor cycles labeled Cycle-1 and Cycle-5, the relative cycle number corresponding to Cycle-5 would be specified as 2.

Input cards 37 through 40 represent an input grouping that must be specified recursively for the SAS2H calculations commencing from each statepoint in the relative reactor cycle specified on input card 36. This means that input cards 37 through 40 would be input for the first statepoint calculation (BOC to statepoint 2) in the reactor cycle, and then input again for the second statepoint calculation (perhaps statepoint 2 to statepoint 3) in the reactor cycle, etc., until all of the statepoint calculations in the reactor cycle, as specified on input card 27 corresponding to the appropriate reactor cycle, have been described. The last iteration of input cards 37 through 40 for a given reactor cycle should correspond to the last mid-cycle statepoint to EOC SAS2H calculation.

37	:	This card should only be specified if the value of card number 35 is "N". This card should contain an integer value corresponding to the relative statepoint calculation number in the reactor cycle for which input data is being provided. The BOC to mid-cycle statepoint 2 calculation is always considered relative statepoint calculation 1. The last mid-cycle statepoint to EOC calculation is always considered the last relative statepoint calculation in a given reactor cycle.
38	:	This card should only be specified if the value of card number 35 is "N". This card should contain a value specifying the irradiation step length in EFPD for the SAS2H statepoint calculation for which input data is being provided. If the value on input card 35 is "N", the CRAFT code only allows the use of a fixed irradiation step length in each generated SAS2H calculation. However, different irradiation step lengths may be specified for different CRAFT generated SAS2H calculations.
39	:	This card should only be specified if the value of card number 35 is "N". This card should contain an integer value specifying the number of irradiation steps to be utilized in the CRAFT generated SAS2H calculation corresponding to the statepoint calculation for which input data is being provided.

Input Card Number		Detailed Description
40	:	This card should only be specified if the value of card number 35 is "N". This card should contain the soluble boron concentration in units of ppmb at the mid-point of a given irradiation step in the current statepoint calculation for which input data is being provided. This input card must be repeated a number of times equal to that specified on input card 39. The order of repetition of this input card should be such that the initial ppmb concentration corresponds to the first irradiation step, and the final ppmb concentration corresponds to the last irradiation step in the statepoint calculation of interest.

Input cards 41 through 44 should be specified only if the value of input card 35 is "Y". Input cards 41 through 44 represent an input grouping that must be specified recursively for each reactor cycle in which the fuel assembly is inserted in the CRAFT calculation as denoted on input card 25. This means that input cards 41 through 44 would be input for the first reactor cycle, and then input again for the second reactor cycle, etc., until all of the number of reactor cycles specified on input card 25 have been described.

41	:	This card should only be specified if the value of card number 35 is "Y". This card should contain an integer value specifying the relative cycle number to which the input data provided in the current grouping of input cards 41 through 44 apply. For example, if the CRAFT calculation involved two reactor cycles labeled Cycle-1 and Cycle-5, the relative cycle number corresponding to Cycle-5 would be specified as 2.

Input cards 42 through 44 represent an input grouping that must be specified recursively for the SAS2H calculations commencing from each statepoint in the relative reactor cycle specified on input card 41. This means that input cards 42 through 44 would be input for the first statepoint calculation (BOC to statepoint 2) in the reactor cycle, and then input again for the second statepoint calculation (perhaps statepoint 2 to statepoint 3) in the reactor cycle, etc., until all of the statepoint calculations in the reactor cycle, as specified on input card 27 corresponding to the appropriate reactor cycle, have been described. The last iteration of input cards 42 through 44 for a given reactor cycle should correspond to the last mid-cycle statepoint to EOC SAS2H calculation.

Input Card Number		Detailed Description
42	:	This card should only be specified if the value of card number 35 is "Y". This card should contain an integer value corresponding to the relative statepoint calculation number in the reactor cycle for which input data is being provided. The BOC to mid-cycle statepoint 2 calculation is always considered relative statepoint calculation 1. The last mid-cycle statepoint to EOC calculation is always considered the last relative statepoint calculation in a given reactor cycle.
43	:	This card should only be specified if the value of card number 35 is "Y". This card should contain an integer value specifying the number of irradiation steps to be utilized in the CRAFT generated SAS2H calculation corresponding to the statepoint calculation for which input data is being provided.
44	:	This card should only be specified if the value of card number 35 is "Y". This card should contain two real values delineated by spaces. The first value on this card should specify the irradiation step length in EFPD for the SAS2H statepoint calculation for which input data is being provided. The second value on this card should specify the soluble boron concentration in units of ppmb at the mid-point of a given irradiation step in the current statepoint calculation for which input data is being provided. This input card must be repeated a number of times equal to that specified on input card 43. The order of repetition of this input card should be such that the initial ppmb concentration corresponds to the first irradiation step, and the final ppmb concentration corresponds to the last irradiation step in the statepoint calculation of interest.
45	:	This card should contain an integer value corresponding to the number of axial nodes utilized in the CRC evaluation.
46	:	This card contains two integer values delineated by spaces. The first value specifies an axial node number in the CRC axial format. The second value specifies the corresponding node height in units of cm. This card must be repeated a number of times equal to that specified on input card 45. The repetition of this card should be performed such that the CRC axial node data is provided in sequential order (i.e.,node 1 through node N, where N is the final node). Node 1should always be specified as the top node of the fuel assembly.

Input Card Number		Detailed Description
47	:	The CRAFT code is capable of modeling an assembly that contains a CRA. If the fuel assembly for which the CRAFT calculation is to be performed contains a CRA in any of its specified reactor cycles, the character string "RODDED" should be placed in columns 1 through 6 of this card. Any other character string signifies that the assembly never contains a CRA.
47A	:	This card should only be specified if the value of card number 47 is "RODDED". This card should contain an integer value specifying the number of previously defined irradiation steps in the CRAFT calculation in which the fuel assembly contains a CRA.

Input Card Number		Detailed Description
47B	:	This card should only be specified if the value of card number 47 is "RODDED". This card must be repeated a number of times equal to that specified on input card 47A. This card should contain 7 integer values delineated by spaces. The first integer value specifies the relative cycle number in the CRAFT calculation in which a CRA is inserted. The second integer value specifies the relative statepoint calculation number in which a CRA is inserted in the cycle identified by the first value of this card. The BOC to statepoint 1 is always considered statepoint calculation 1. The third value specifies the relative irradiation step number in the statepoint calculation identified by the second value of this card in which the CRA is inserted. The fourth value specifies the upper CRC axial node of the axial assembly section containing the CRA in the relative irradiation step specified by the third value of this card. The top node in the CRC axial format is always node 1. The fifth value specifies the lower CRC axial node of the axial assembly section containing the CRA in the relative irradiation step specified by the third value of this card. The CRAFT code is capable of modeling numerous CRA absorber material mixtures and CRA designs for insertion in an assembly throughout its irradiation history. The sixth value specifies the CRA absorber material mixture number for SAS2H corresponding to the CRA described on this card. The CRA absorber material specifications and mixture numbers are specified on input cards 47C through 47F. The seventh value specifies the CRA design description number corresponding to the CRA described on this card. The CRA design inputs are specified on input cards 47G through 47K. The CRA design description number corresponds to the relative position in which the relevant CRA design description input is provided in the CRAFT input deck.
47C	:	This card should only be specified if the value of card number 47 is "RODDED". This card should contain an integer value specifying the number of different CRA absorber material mixtures which must be specified for use in the various CRA designs which are inserted in the fuel assembly during its irradiation history relevant to the CRAFT calculation.

Input Card Number		Detailed Description

Input cards 47D through 47F represent an input grouping that must be specified recursively for each CRA absorber material mixture used in the CRAFT calculation as denoted on input card 47C. This means that input cards 47D through 47F would be input for the first CRA absorber material mixture, and then input again for the second CRA absorber material mixture, etc., until all of the CRA absorber material mixtures specified on input card 47C have been described.

47D	:	This card should only be specified if the value of card number 47 is "RODDED". This card should contain an integer value denoting the material mixture number that should be utilized in the CRAFT generated SAS2H calculations to identify the CRA absorber material mixture for which input is being provided.
47E	:	This card should only be specified if the value of card number 47 is "RODDED". This card should contain an integer value specifying the number of isotopes in the CRA absorber material mixture specified on input card 47D.
47F	:	This card should only be specified if the value of card number 47 is "RODDED". This card should contain two values delineated by spaces. The first value should be the SCALE nuclide identifier corresponding to a constituent of the CRA absorber material mixture specified on input card 47D. The second value should be the weight percent of the nuclide, identified by the first value, in the CRA absorber material mixture specified on input card 47D. This input card must be repeated a number of times equal to that specified on input card 47E such that data for all nuclides in the CRA absorber material mixture are provided, and the sum of the weight percents of the nuclides in the mixture equals 100.
47G	:	This card should only be specified if the value of card number 47 is "RODDED". This card should contain an integer value specifying the number of different CRA design descriptions that will be specified for use in the CRAFT calculation.

Input cards 47H through 47K represent an input grouping that must be specified recursively for each CRA design used in the CRAFT calculation as denoted on input card 47G. This means that input cards 47H through 47K would be input for the first CRA design description, and then input again for the second CRA design description, etc., until all of the CRA design descriptions specified on input card 47G have been described. The order in which the CRA design descriptions are provided determines the relative CRA design number which corresponds to the description.

Input Card Number		Detailed Description
47H	:	This card should only be specified if the value of card number 47 is "RODDED". This card contains two values delineated by spaces. The first value should specify the absorber material density in units of g/cc for the CRA design for which input is being provided. The second value should be an integer specifying the SAS2H material mixture number for the CR cladding in the CRA design for which input is being provided.
47I	:	This card should only be specified if the value of card number 47 is "RODDED". This card should contain an integer value specifying the number of radial zones utilized in the SAS2H Path B model for the fuel assembly containing the CRA design for which input is being provided.
47J	:	This card should only be specified if the value of card number 47 is "RODDED". This card contains the description of a single radial zone in the SAS2H Path B model for the fuel assembly containing the CRA design for which input is being provided. This card should contain two values delineated by spaces. The first of which should be an integer value representing the SAS2H material mixture number for the Path B model radial zone which this card represents. The second value should be the outer radius of the Path B model radial zone which this card represents. This input card must be repeated a number of times equal to that specified on input card 47I.
47K	:	This card should only be specified if the value of card number 47 is "RODDED". If an assembly contains a CRA in one cycle but not in another, an alternative SAS2H Path B model must be provided that describes the assembly after removal of the CRA. This alternative Path B model must contain the same number of radial zones as the Path B model with the CRA inserted. This card contains the description of a single radial zone in the SAS2H Path B model for the assembly after the removal of the CRA design for which input is being provided. This card should contain two values delineated by spaces. The first of which should be an integer value representing the SAS2H material mixture number for the Path B model radial zone which this card represents. The second value should be the outer radius of the Path B model radial zone which this card represents. This input card must be repeated a number of times equal to that specified on input card 47I.

Input Card Number		Detailed Description
48	:	The CRAFT code is capable of modeling a fuel assembly that contains a APSRA. If the fuel assembly for which the CRAFT calculation is to be performed contains an APSRA in any of its specified reactor cycles, the character string "RODDED" should be placed in columns 1 through 6 of this card. Any other character string signifies that the assembly never contains an APSRA.
48A	:	This card should only be specified if the value of card number 48 is "RODDED". This card should contain an integer value specifying the number of previously defined irradiation steps in the CRAFT calculation in which the fuel assembly contains an APSRA.

Input Card Number		Detailed Description
48B	:	This card should only be specified if the value of card number 48 is "RODDED". This card must be repeated a number of times equal to that specified on input card 48A. This card should contain 8 integer values delineated by spaces. The first integer value specifies the relative cycle number in the CRAFT calculation in which a APSRA is inserted. The second integer value specifies the relative statepoint calculation number in which a APSRA is inserted in the cycle identified by the first value of this card. The BOC to statepoint 1 is always considered statepoint calculation 1. The third value specifies the relative irradiation step number in the statepoint calculation identified by the second value of this card in which the APSRA is inserted. The fourth value specifies the upper CRC axial node of the axial assembly section containing the APSRA in the relative irradiation step specified by the third value of this card. The top node in the CRC axial format is always node 1. The fifth value specifies the lower CRC axial node of the axial assembly section containing the APSRA in the relative irradiation step specified by the third value of this card. The CRAFT code is capable of modeling numerous APSRA absorber material mixtures and APSRA designs for insertion in an assembly throughout its irradiation history. The sixth value specifies the APSRA absorber material mixture number for SAS2H corresponding to the APSRA described on this card. The APSRA absorber material specifications and mixture numbers are specified on input cards 48C through 48F. The seventh value specifies the APSRA design description number corresponding to the APSRA described on this card. The APSRA design inputs are specified on input cards 48G through 48K. The APSRA design description number corresponds to the relative position in which the relevant APSRA design description input is provided in the CRAFT input deck. The eighth value is the SAS2H material mixture number corresponding to the APSR follow rod material.
48C	:	This card should only be specified if the value of card number 48 is "RODDED". This card should contain an integer value specifying the number of different APSRA absorber material mixtures which must be specified for use in the various APSRA designs which are inserted in the fuel assembly during its irradiation history relevant to the CRAFT calculation.

Input Card Number		Detailed Description

Input cards 48D through 48F represent an input grouping that must be specified recursively for each APSRA absorber material mixture used in the CRAFT calculation as denoted on input card 48C. This means that input cards 48D through 48F would be input for the first APSRA absorber material mixture, and then input again for the second APSRA absorber material mixture, etc., until all of the APSRA absorber material mixtures specified on input card 48C have been described.

48D	:	This card should only be specified if the value of card number 48 is "RODDED". This card should contain an integer value denoting the material mixture number that should be utilized in the CRAFT generated SAS2H calculations to identify the APSRA absorber material mixture for which input is being provided.
48E	:	This card should only be specified if the value of card number 48 is "RODDED". This card should contain an integer value specifying the number of isotopes in the APSRA absorber material mixture specified on input card 48D.
48F	:	This card should only be specified if the value of card number 48 is "RODDED". This card should contain two values delineated by spaces. The first value should be the SCALE nuclide identifier corresponding to a constituent of the APSRA absorber material mixture specified on input card 48D. The second value should be the weight percent of the nuclide, identified by the first value, in the APSRA absorber material mixture specified on input card 48D. This input card must be repeated a number of times equal to that specified on input card 48E such that data for all nuclides in the APSRA absorber material mixture are provided, and the sum of the weight percents of the nuclides in the mixture equals 100.
48G	:	This card should only be specified if the value of card number 48 is "RODDED". This card should contain an integer value specifying the number of different APSRA design descriptions that will be specified for use in the CRAFT calculation.

Input Card Number		Detailed Description

Input cards 48H through 48L represent an input grouping that must be specified recursively for each APSRA design used in the CRAFT calculation as denoted on input card 48G. This means that input cards 48H through 48L would be input for the first APSRA design description, and then input again for the second APSRA design description, etc., until all of the APSRA design descriptions specified on input card 48G have been described. The order in which the APSRA design descriptions are provided determines the relative APSRA design number which corresponds to the description.

48H	:	This card should only be specified if the value of card number 48 is "RODDED". This card should contain two values delineated by spaces. The first value should specify the absorber material density in units of g/cc for the APSRA design for which input is being provided. The second value should be an integer specifying the SAS2H material mixture for the APSR cladding in the APSRA for which input is being provided.
48I	:	This card should only be specified if the value of card number 48 is "RODDED". This card should contain an integer value specifying the number of radial zones utilized in the SAS2H Path B model for the fuel assembly containing the APSRA design for which input is being provided.
48J	:	This card should only be specified if the value of card number 48 is "RODDED". This card contains the description of a single radial zone in the SAS2H Path B model for the fuel assembly containing the APSRA design for which input is being provided. This card should contain two values delineated by spaces. The first of which should be an integer value representing the SAS2H material mixture number for the Path B model radial zone which this card represents. The second value should be the outer radius of the Path B model radial zone which this card represents. This input card must be repeated a number of times equal to that specified on input card 48I.

Input Card Number		Detailed Description
48K	:	This card should only be specified if the value of card number 48 is "RODDED". If an assembly contains a APSRA in one cycle but not in another, an alternative SAS2H Path B model must be provided that describes the assembly after removal of the APSRA. This alternative Path B model must contain the same number of radial zones as the Path B model with the APSRA inserted. This card contains the description of a single radial zone in the SAS2H Path B model for the assembly after the removal of the APSRA design for which input is being provided. This card should contain two values delineated by spaces. The first of which should be an integer value representing the SAS2H material mixture number for the Path B model radial zone which this card represents. The second value should be the outer radius of the Path B model radial zone which this card represents. This input card must be repeated a number of times equal to that specified on input card 48I.
48L	:	This card should only be specified if the value of card number 48 is "RODDED". APSRA designs typically utilize follow rods which are not of the same material composition as the APSR cladding. To facilitate modeling of the APSR follow rod region, an alternative SAS2H Path B model must be provided that describes the follow rod region of the APR's above the poison region in the APSRA. This alternative Path B model must contain the same number of radial zones as the Path B model with the APSRA inserted. This card contains the description of a single radial zone in the SAS2H Path B model for the follow rod region of the APSRA design for which input is being provided. This card should contain two values delineated by spaces. The first of which should be an integer value representing the SAS2H material mixture number for the Path B model radial zone which this card represents. The second value should be the outer radius of the Path B model radial zone which this card represents. This input card must be repeated a number of times equal to that specified on input card 48I.

Input Card Number		Detailed Description

Input cards 49 through 51 represent an input grouping that must be specified recursively for each statepoint calculation to be generated by the CRAFT calculation. This means that input cards 49 through 51 would be input for the first statepoint calculation (BOC to statepoint 2 of relative cycle number 1), and then input again for the second statepoint calculation, etc., until all of the statepoint calculations to be generated by CRAFT have been addressed (the final statepoint calculation would be that ending at the final statepoint in the last relative cycle).

49	:	This card should contain an integer value specifying the number of axial nodes in the axial format in which the current fuel temperature input data is being provided.
50	:	This card should contain two values delineated by spaces. The first value should be the appropriate node number in the fuel temperature axial format for the statepoint calculation for which input is being provided. The second value should be the node height corresponding to the axial node number identified by the first value. This input card specification should be repeated the number of times identified on input card 49. The nodal format input specified with this card should be ordered sequentially such that node 1 represents the top node of the fuel assembly.
51	:	This card should contain an exposure weighted average fuel temperature value in units of degrees Fahrenheit for the appropriate node in the fuel temperature input axial format corresponding to the statepoint calculation for which input data is being provided. This input card specification should be repeated the number of times identified on input card 49. The data provided in the sequential repetition of this input card should be ordered to correspond to the nodal input format described by the previous repetition of input card 50.

Input cards 52 through 54 represent an input grouping that must be specified recursively for each statepoint calculation to be generated by the CRAFT calculation. This means that input cards 52 through 54 would be input for the first statepoint calculation (BOC to statepoint 2 of relative cycle number 1), and then input again for the second statepoint calculation, etc., until all of the statepoint calculations to be generated by CRAFT have been addressed (the final statepoint calculation would be that ending at the final statepoint in the last relative cycle).

52	:	This card should contain an integer value specifying the number of axial nodes in the axial format in which the current moderator specific volume input data is being provided.

Input Card Number		Detailed Description
53	:	This card should contain two values delineated by spaces. The first value should be the appropriate node number in the moderator specific volume axial format for the statepoint calculation for which input is being provided. The second value should be the node height corresponding to the axial node number identified by the first value. This input card specification should be repeated the number of times identified on input card 52. The nodal format input specified with this card should be ordered sequentially such that node 1 represents the top node of the fuel assembly.
54	:	This card should contain an exposure weighted average moderator specific volume value in units of ft^3/lb for the appropriate node in the moderator specific volume input axial format corresponding to the statepoint calculation for which input data is being provided. This input card specification should be repeated the number of times identified on input card 52. The data provided in the sequential repetition of this input card should be ordered to correspond to the nodal input format described by the previous repetition of input card 53.

Input cards 55 through 57 represent an input grouping that must be specified recursively for each statepoint calculation to be generated by the CRAFT calculation. This means that input cards 55 through 57 would be input for the first statepoint calculation (BOC to statepoint 2 of relative cycle number 1), and then input again for the second statepoint calculation, etc., until all of the statepoint calculations to be generated by CRAFT have been addressed (the final statepoint calculation would be that ending at the final statepoint in the last relative cycle).

55	:	This card should contain an integer value specifying the number of axial nodes in the axial format in which the current burnup input data is being provided.
56	:	This card should contain two values delineated by spaces. The first value should be the appropriate node number in the burnup axial format for the statepoint calculation for which input is being provided. The second value should be the node height corresponding to the axial node number identified by the first value. This input card specification should be repeated the number of times identified on input card 55. The nodal format input specified with this card should be ordered sequentially such that node 1 represents the top node of the fuel assembly.

Input Card Number		Detailed Description
57	:	This card should contain an exposure weighted average burnup value in units of GWd/MTU corresponding to the total burnup of the node at the beginning of the statepoint calculation for which input data is being provided. This input card specification should be repeated the number of times identified on input card 55. The data provided in the sequential repetition of this input card should be ordered to correspond to the nodal input format described by the previous repetition of input card 56.

8. CRAFT Output Description

The CRAFT code generates five types of files identified as either "*.input", "*.output", "*.cut", "*.msgs", or "*.notes", where the "*" is the base file set identifier for the statepoint calculation of interest. The "*.cut" and "*.notes" files are the only files that must be retained for CRC evaluation and documentation purposes. All files are generated in the working directory in which the CRAFT calculation is performed.

All CRAFT generated filenames utilize the following format: "{Base File Set Identifier}.{suffix}". Where the suffix corresponds to one of the five file types previously mentioned, and the base file set identifier is a 25 character name containing essential information necessary to delineate one CRAFT generated SAS2H calculation from another.

The base file set identifier for a statepoint calculation contains the following information:

1) reactor identifier (three character);
2) one-eighth core symmetry assembly number in current reactor cycle (two digit);
3) axial node number (node 1 is always the top node) (two digit);
4) reactor cycle number in which the SAS2H calculation starts (two character);
5) EFPD statepoint at which the SAS2H calculation starts (truncated to three digits);
6) reactor cycle number in which the SAS2H calculation ends (two character);
7) EFPD statepoint at which the SAS2H calculation ends (truncated to three digits).

The format of the base file set identifier is as follows where the numbers identified as #{number} correspond to one of the seven items previously listed-- #1 A #2 N #3 DC #4 T #5 AC #6 T #7. The base file set identifier does not contain any spaces.

The "*.input" files contain a CRAFT generated SAS2H input deck. The "*.output" files contain a complete SAS2H calculation output file. The "*.cut" files contain the corresponding SAS2H input deck followed by an output extraction, from the final ORIGEN pass of the SAS2H calculation, which contains data relevant to CRC evaluations. The "*.msgs" files contain the standard run-time messages associated with the SAS2H calculation. The "*.notes" files contain a listing of the isotopes and their concentration

which were left behind in generating the initial charge fuel composition for a continuation SAS2H calculation. The "*.notes" files are only generated for CRAFT generated SAS2H calculations which are continuing depletion and decay calculations. The "*.cut" and "*.notes" files contain all of the information which is required to perform CRC evaluations or repeat calculations as necessary for quality assurance purposes. The remainder of the CRAFT generated files may be discarded once the "*.cut" and "*.notes" files have been produced correctly.

9. CRAFT Quality Assurance Testing

Twenty-three CRAFT calculations are documented in this section to demonstrate the correct implementation and performance of features available in the CRAFT code. Table 9-1 summarizes the features which are tested in these quality assurance (QA) calculations. The CRAFT input decks and the CRAFT generated consolidated output files ("*.cut" files) for each of the test cases are contained in Appendices B and C, respectively. The information provided in this section is to be used in conjunction with the CRAFT input decks to provide descriptive details for the twenty-three quality assurance test cases. Analysis of the information provided in this section, the information provided in the CRAFT input decks, and the CRAFT generated SAS2H calculations for the QA test cases demonstrate the correct implementation and performance of features available in the CRAFT code.

Table 9-1
QA Test Case Summary Descriptions

QA Test Case #	QA Test Case File Set Prefix (Initial 3 Char)	QA Test Case Description
1	QA1	This case demonstrates the implementation of ZIRC-4 spacer grids, fuel cladding, and BPR cladding.
2	QA2	This case demonstrates the implementation of INCONEL spacer grids and BPR cladding and SS316 fuel cladding.
3	QA3	This case demonstrates the implementation of SS316 spacer grids and BPR cladding and SS316S fuel cladding.
4	QA4	This case demonstrates the implementation of SS316S spacer grids and BPR cladding and SS304 fuel cladding.
5	QA5	This case demonstrates the implementation of SS304 spacer grids and BPR cladding and SS304S fuel cladding.
6	QA6	This case demonstrates the implementation of SS304S spacer grids and BPR cladding.

QA Test Case #	QA Test Case File Set Prefix (Initial 3 Char)	QA Test Case Description
7	QA7	This case demonstrates the implementation of ZIRC-4 control rod cladding.
8	QA8	This case demonstrates the implementation of INCONEL control rod cladding.
9	QA9	This case demonstrates the implementation of SS316 control rod cladding.
10	Q10	This case demonstrates the implementation of SS316S control rod cladding.
11	Q11	This case demonstrates the implementation of SS304 control rod cladding.
12	Q12	This case demonstrates the implementation of SS304S control rod cladding.
13	Q13	This case demonstrates the implementation of ZIRC-4 axial power shaping rod cladding.
14	Q14	This case demonstrates the implementation of INCONEL axial power shaping rod cladding.
15	Q15	This case demonstrates the implementation of SS316 axial power shaping rod cladding.
16	Q16	This case demonstrates the implementation of SS316S axial power shaping rod cladding.
17	Q17	This case demonstrates the implementation of SS304 axial power shaping rod cladding.
18	Q18	This case demonstrates the implementation of SS304S axial power shaping rod cladding.
19	Q19	This case demonstrates the implementation of multiple BPRA design insertions during a multi-cycle fuel assembly depletion and decay calculation.
20	Q20	This case demonstrates the implementation of multiple CRA design insertions and movements during a multi-cycle fuel assembly depletion and decay calculation.

QA Test Case #	QA Test Case File Set Prefix (Initial 3 Char)	QA Test Case Description
21	Q21	This case demonstrates the implementation of multiple APSRA design insertions and movements during a multi-cycle fuel assembly depletion and decay calculation.
22	Q22	This case demonstrates the calculations associated with flexible fuel temperature, moderator specific volume, burnup, and CRC nodal format input specifications.
23	Q23	This case demonstrates CRAFT's ability to continue a previous assembly depletion calculation from a specified statepoint.

9.1 Quality Assurance Test Cases 1 through 18

The quality assurance test cases 1 through 18 are designed to primarily demonstrate CRAFT's ability to correctly specify each of the material options which are available for fuel rods, burnable poison rods, control rods, and axial power shaping rods. The various material specifications are identified in the previous table for these cases. If the fuel rod or spacer grid materials are not specified in the previous table, the ZIRC-4 material is utilized for these components.

The irradiation history for QA test cases 1 through 18 consists of 1 irradiation step of 210 days. These cases utilize a single CRC axial node format. Table 9.1-1 contains the base fuel assembly parameters.

Table 9.1-1
Base Fuel Assembly Description for QA Test Cases 1 through 23

Parameter	Value
Wt% U-235 Enrichment	3.25
Pellet Outer Diameter (cm)	0.9362
Fuel Clad Inner Diameter (cm)	0.9576
Fuel Clad Outer Diameter (cm)	1.0922
Active Fuel Length (cm)	360.172
Mass of Uranium per Assembly (grams)	4.636E5
Array Size	15x15
Rod Pitch (cm)	1.44272

Parameter	Value
Number of Fuel Rods	208
Number of Guide Tubes	16
Number of Instrument Tubes	1
Spacer Grid Material	Zircaloy-4
Spacer Grid Volume Fraction	0.0002
Fuel Rod Cladding Material	Zircaloy-4
Average Fuel Rod Cladding Temperature (K)	694.0

The CRAFT input decks and the CRAFT generated "*.cut" files for QA test cases 1 through 18 are presented in Appendices B and C. A comparison between each CRAFT input deck and its associated "*.cut" file demonstrates CRAFT's ability to correctly model each fuel assembly component with any of the available materials.

9.2 Quality Assurance Test Cases 19 through 21

The quality assurance test cases 19 through 21 demonstrate different features available with CRAFT for modeling the insertion and movement of BPRA's, CRA's, and APSRA's. These three cases utilize the following base reactor cycle irradiation history:

Cycle-01 Assembly Position Number 18
BOC to Statepoint 2 to EOC
Statepoint 2 occurs at 205 EFPD and 210 calendar days from the BOC.
There is a 10 day downtime at statepoint 2.
The EOC occurs at 410 EFPD and 430 calendar days from the BOC.
There is a 30 day downtime at the EOC.

Cycle-02 Assembly Position Number 13
BOC to EOC
The EOC occurs at 430 EFPD and 500 calendar days from the BOC.
There is a 575 day downtime at the EOC.

Cycle-03 Assembly Position Number 02
BOC to Statepoint 2 to Statepoint 3 to EOC
Statepoint 2 occurs at 98 EFPD and 100 calendar days from the BOC.
There is a 10 day downtime at statepoint 2.
Statepoint 3 occurs at 196 EFPD and 200 calendar days from the BOC.
There is a 10 day downtime at statepoint 3.

The quality assurance test case 19 demonstrates the insertion and removal of BPRA's. Two BPRA

designs are utilized in this test case. Both of the BPRA designs contain 16 solid BPR's clad in Zircaloy-4. However, each design utilizes a different absorber material in the BPR's. The burnable poison material in a single BPR of either design has a cross-sectional area of 0.5858 cm^2. The burnable poison material in design one is Al_2O_3-B_4C with a B_4C weight percent of 1.177. The density of the burnable poison material in design one is 3.147 g/cc. The burnable poison material in design two has the following composition (element (wt%))-- O (53.58), Na (2.82), Al (1.16), Si (37.63), K (0.33), B-10 (0.7151), B-11 (3.7649). The density of the burnable poison material in design two is 2.23 g/cc. BPRA design one is inserted in Cycle-01 in the fuel assembly axial nodes 2 and 3. The BPRA design two is inserted in Cycle-03 in the fuel assembly axial nodes 1 through 4.

The quality assurance test case 20 demonstrates the insertion, movement, and removal of CRA's. Three CRA designs are utilized in this case. Each of the CRA designs contain a number of control rods clad in Zircaloy-4. The number of rods and absorber materials are different for the three designs. The first design contains 16 control rods. The absorber material in the first design has a density of 3.7 g/cc with the following composition (isotope (wt%))-- B-10 (12.0), B-11 (48.0), C-12 (40.0). The second design contains 4 control rods. The absorber material in the second design has a density of 3.0 g/cc with the following composition (isotope (wt%))-- B-10 (16.0), B-11 (64.0), C-12 (20.0). The third design contains 8 control rods. The absorber material in the third design has a density of 2.5 g/cc with the following composition (isotope (wt%))-- B-10 (20.0) and B-11 (80.0).

The following is a summary of the insertion, movement, and removal data for the three CRA designs utilized in case 20.

CRA Design 1

Cycle-01 BOC to Statepoint 2
0 to 80 EFPD: CRA inserted in fuel assembly axial nodes 1 through 5
80 to 205 EFPD: CRA inserted in fuel assembly axial nodes 1 through 4
Statepoint 2 to EOC
205 to 305 EFPD: CRA inserted in fuel assembly axial nodes 1 through 3
305 to 410 EFPD: CRA inserted in fuel assembly axial nodes 1 through 2

CRA Design 2

Cycle-03 BOC to Statepoint 2
0 to 50 EFPD: CRA inserted in fuel assembly axial nodes 1 through 5
50 to 98 EFPD: CRA inserted in fuel assembly axial nodes 1 through 4

CRA Design 3

Cycle-03 Statepoint 2 to Statepoint 3
98 to 138 EFPD: CRA inserted in fuel assembly axial nodes 1 through 3
138 to 196 EFPD: CRA inserted in fuel assembly axial nodes 1 through 2

The quality assurance test case 21 demonstrates the insertion, movement, and removal of APSRA's.

Three APSRA designs are utilized in this case. Each of the APSRA designs contain a number of axial power shaping rods clad in Zircaloy-4. The number of rods and absorber materials are different for the three designs. The first design contains 16 axial power shaping rods. The absorber material in the first design has a density of 3.7 g/cc with the following composition (isotope (wt%))-- B-10 (12.0), B-11 (48.0), C-12 (40.0). The second design contains 4 axial power shaping rods. The absorber material in the second design has a density of 3.0 g/cc with the following composition (isotope (wt%))-- B-10 (16.0), B-11 (64.0), C-12 (20.0). The third design contains 8 axial power shaping rods. The absorber material in the third design has a density of 2.5 g/cc with the following composition (isotope (wt%))-- B-10 (20.0) and B-11 (80.0). The APSR's have inconel follow rods attached.

The following is a summary of the insertion, movement, and removal data for the three APSRA designs utilized in case 21.

APSRA Design 1

Cycle-01 BOC to Statepoint 2
0 to 107.5 EFPD: APSRA inserted in fuel assembly axial nodes 4 through 5
107.5 to 215 EFPD: APSRA inserted in fuel assembly axial nodes 3 through 4
Statepoint 2 to EOC
215 to 322.5 EFPD: APSRA inserted in fuel assembly axial nodes 2 through 3
322.5 to 430 EFPD: APSRA inserted in fuel assembly axial nodes 1 through 2

APSRA Design 2

Cycle-03 BOC to Statepoint 2
0 to 50 EFPD: APSRA inserted in fuel assembly axial nodes 4 through 5
50 to 100 EFPD: APSRA inserted in fuel assembly axial nodes 3 through 4

APSRA Design 3

Cycle-03 Statepoint 2 to Statepoint 3
100 to 200 EFPD: APSRA inserted in fuel assembly axial nodes 2 through 3
200 to 300 EFPD: APSRA inserted in fuel assembly axial nodes 1 through 2

9.3 Quality Assurance Test Case 22

The quality assurance test case 22 demonstrates CRAFT's performance in handling and reformatting arbitrary fuel temperature, moderator specific volume, and burnup input specifications to fit the requirements of the CRC evaluations. The axial blanket fuel option is also demonstrated in this test case.

Test case 22 utilizes the same base fuel assembly design as test cases 1 through 21 with the exception that in test case 22, the fuel assembly axial nodes 1 and 12 contain 0.71 wt% U-235 enriched UO_2 fuel (axial blanket fuel). Nodes 1 and 12 represent the top and bottom axial nodes, respectively. The following irradiation history is modeled in test case 22.

Cycle-01 Assembly Position Number 18
BOC to Statepoint 2
Statepoint 2 occurs at 205 EFPD and 210 calendar days from the BOC.
There is a 10 day downtime at statepoint 2.

The CRC nodal format consists of twelve axial nodes with the following format.

Table 9.3-1
QA Test Case 22 CRC Nodal Format

Axial Node Number	Node Height (cm)	Orientation
1	10.0	Top of Assembly
2	15.0	
3	20.0	
4	25.0	
5	55.0	
6	55.0	
7	55.0	
8	55.0	
9	25.0	
10	20.0	
11	15.0	
12	10.0	Bottom of Assembly

The following exposure weighted nodal fuel temperature input data is specified for use in the Cycle-01, BOC to Statepoint 2 calculation.

Table 9.3-2
QA Test Case 22: Cycle-01, BOC to Statepoint 2 Fuel Temperature Input

Axial Node Number	Node Height (cm)	Fuel Temp. (F)	Orientation
1	18.05	933.3	Top of Assembly
2	18.05	1083.2	
3	18.05	1148.6	
4	18.05	1161.1	

Axial Node Number	Node Height (cm)	Fuel Temp. (F)	Orientation
5	18.05	1152.5	
6	18.05	1136.2	
7	18.05	1119.8	
8	18.05	1107.6	
9	18.05	1101.2	
10	18.05	1101.7	
11	18.05	1110.3	
12	18.05	1128.1	
13	18.05	1156.7	
14	18.05	1201.3	
15	18.05	1251.1	
16	18.05	1251.7	
17	18.05	1188.5	
18	18.05	1027.6	
19	18.05	1024.3	
20	18.05	1023.7	Bottom of Assembly

The total active fuel height specified in the previous fuel temperature input to the CRAFT calculation is 361 cm. The total CRC active fuel height specified for use in the CRAFT calculation is 360 cm. Therefore, CRAFT multiplies all of the fuel temperature input data nodal heights by a factor of (360/361). The result of this scaling procedure for the fuel temperature input data is that all of the input axial node heights are scaled from 18.05 cm down to 18.0 cm.

The fuel temperature input data must then be reformatted to fit the CRC nodal format specified for the CRAFT calculation. The shadowing technique described in Section 4.4 is utilized by CRAFT to perform this function. The following table contains the reformatted fuel temperature input for the BOC to Statepoint 2 calculation of test case 22.

Table 9.3-3
Reformatted Fuel Temperature Input for the BOC to Stpt 2 Calculation of Test Case 22

CRC Axial Node Number	Node Height (cm)	Fuel Temp. Input (K)
1	10.0	773.7

CRC Axial Node Number	Node Height (cm)	Fuel Temp. Input (K)
2	15.0	812.6
3	20.0	873.4
4	25.0	897.8
5	55.0	887.1
6	55.0	868.4
7	55.0	884.6
8	55.0	940.6
9	25.0	883.3
10	20.0	825.1
11	15.0	824.1
12	10.0	823.9

The previous description and example of fuel temperature reformatting performed for the fuel temperature input data is also performed for the moderator specific volume and burnup nodal input data. The following table contains the moderator density values obtained by dividing the reformatted moderator specific volume input data into unity for the BOC to Statepoint 2 calculation of test case 22.

Table 9.3-4
Reformatted Moderator Density Input
for the BOC to Stpt 2 Calculation of Test Case 22

CRC Axial Node Number	Node Height (cm)	Moderator Density Input (g/cc)
1	10.0	0.6916
2	15.0	0.6916
3	20.0	0.6943
4	25.0	0.6991
5	55.0	0.7072
6	55.0	0.7166
7	55.0	0.7287
8	55.0	0.7384

CRC Axial Node Number	Node Height (cm)	Moderator Density Input (g/cc)
9	25.0	0.7462
10	20.0	0.7494
11	15.0	0.7507
12	10.0	0.7532

The following table contains the burnup and associated nodal power values obtained by reformatting the burnup input data for the BOC to Statepoint 2 calculation of test case 22.

Table 9.3-5
Reformatted Burnup Input Data and Associated Nodal Powers for the BOC to Stpt 2 Calculation of Test Case 22

CRC Axial Node Number	Node Height (cm)	Nodal Power (MW)
1	10.0	0.2616
2	15.0	0.5049
3	20.0	0.9272
4	25.0	1.4674
5	55.0	3.8072
6	55.0	4.0403
7	55.0	3.9997
8	55.0	3.9177
9	25.0	1.7421
10	20.0	1.2303
11	15.0	0.6646
12	10.0	0.4085

9.4 Quality Assurance Test Case 23

The quality assurance test case 23 demonstrates CRAFT's ability to continue the depletion and decay of an assembly from a statepoint in a previous CRAFT calculation. Test case 23 is a continuation of test case 22. The following irradiation history is implemented at the completion point of the Cycle-01, BOC

to Statepoint 2 calculation performed in test case 22.

Cycle-01 Assembly Position Number 18
Statepoint 2 to EOC
The EOC occurs at 410 EFPD and 430 calendar days from the BOC.
There is a 30 day downtime at the EOC.

Cycle-02 Assembly Position Number 18
BOC to Statepoint 2
Statepoint 2 occurs at 205 EFPD and 210 calendar days from the BOC.
There is a 10 day downtime at statepoint 2.

10. References

1) *SCALE 4.3: Modular Code System for Performing Standardized Computer Analyses for Licensing Evaluation User Manuals, Volumes 0 through 3*, Oak Ridge National Laboratory, Document Number: CCC-545.

2) S. M. Bowman, O. W. Hermann, and M. C. Brady. *Scale-4 Analysis of Pressurized Water Reactor Critical Configurations: Volume 2-Sequoyah Unit 2 Cycle 3*, Oak Ridge National Laboratory, Document Number: ORNL/TM-12294/V2.

3) F. W. Walker, J. R. Parrington, and F. Feiner. *Nuclides and Isotopes, Fourteenth Edition*, General Electric Company, 1989.

Attachment II

CRAFT Version 1.0 Fortran Source Code Listing

This is Appendix A: CRAFT Version 1.0 Fortran Source Code Listing of the CRAFT User Information Documented in Attachment I

```
      PROGRAM CRAFT
************************************************************
*     Commercial Reactor Assembly Follow Taskmaster        *
************************************************************
*     This code writes the SAS2H input decks necessary to  *
*     perform depletion and decay calculations on an assembly *
*     required in subsequent Commercial Reactor Critical   *
*     evaluations.  The code controls the SAS2H input deck *
*     creation such that a new SAS2H input deck is developed *
*     to perform depletion and decay calculations between CRC *
*     statepoints in a given sequence.  The depletion and  *
*     decay of the fuel assembly through all CRC statepoints *
*     is simulated as a continuous process by using feed fuel *
*     isotopics from the previous calculation in the sequence.*
************************************************************
*
      INTEGER*4 BPZONE(10), BPMA(15,10), LMA(15,10), LUZONE,
     c LMB(15), NLIB, PLEVEL, ISN, IIM, ICM, IUS, NBR, AXNUM,
     c FTNUM(20), MONUM(20), BUNUM(20), CT1, CT2,
     c APSRINS(10,20,23,50), APSRSTEPNUM,
     c APSRMIXNUM, APSRMIXID(25),
     c CRINS(10,20,23,50), CRSTEPNUM,
     c CRMIXNUM, CRMIXID(25), CRNUMISOS(25),
     c CRISOID(25,10), AXBLANK(50), AXBLANKNODNUM,
     c STPTS(10), CYCPOS(10), APSRNUMISOS(25), APSRISOID(25,10),
     c STPTSUM, BPRADESNUM, CRDESNUM, CRZONE(10), CRMA(15,10),
     c LMC(15,10), APSRDESNUM, APSRZONE(10), APSRMA(15,10),
     c LMD(15,10), BPCYCID, BPTN(10), BPBN(10), DES, BPCYCNUM,
     c BPDESID(10), CRDES(10,20,23,50), APSRDES(10,20,23,50),
     c RELATIVE_STPT_NUM, RELATIVE_APSR_MIX_ID,
     c STPTTALLY(20), CT1START, CT2START, CLADTOT, CLADDESNUM(10),
     c BPRCLAD(10), CRCLAD(10), APSRCLAD(10), BPMIXNUM, BPMIX(10),
     c BPMIXID(10), BPNUMISOS(20), BPISOID(10,20), VARSTEPNUM(10,20),
     c BPRFM(15,10), BPFMNUMISOS(25), BPFISOID(25,10), ABOVEBPNUM(10),
     c APSRFM(15,10), APSRFOLLOWMIX(10,20,23,50)
*
      REAL CLTEMP, PRESS, BPDEN(10), BPRA(15,10), CRISOWTPCT(25,10),
     c LRA(15,10), LRB(15), MESH, SZF, EPS, PTC, APSRISOWTPCT(25,10),
     c NODES(50,2), BLETDOWN(10,20,25), AXBLANKRICH, STPTDAT(10,20,3),
     c FTNDES(50,2,20), FTDAT(50,20), MONDES(50,2,20), MODAT(50,20),
     c BUNDES(50,2,20), BUDAT(50,20), RICH, FMASS, RODS, CYCLEN(10,2),
     c PITCH, FOD, CID, COD, LENGTH, CYCDOWN(10), CRDEN(10),
     c CRRA(15,10), LRC(15,10), APSRDEN(10), APSRRA(15,10), LRD(15,10),
     c BPWTPCT(10), HTOT, FDHT(20), MDHT(20), BDHT(20), FTIN(50,20),
     c MOIN(50,20), BUIN(50,20), GRAMS(50), POWER(50,20),
     c FTFINAL(50,20), MODDENFINAL(50,20), MODTEMPFINAL(50,20),
     c DENDAT(29,10), BPISOWTPCT(10,20), BPXSECT(10), UCSPACERFRAC,
     c VARBLETDOWN(10,20,25,25), VARPOWER(10,20,25,50), BPRFR(15,10),
     c BPFISOWTPCT(25,10), APSRFR(15,10)
*
      CHARACTER REACT*21, PREFIX*3, AXBLANKET*1, BPRFLAG*1,
     c FUELCLAD*10, FLAG2*7, CYCLEID(10)*2, CRSTAT*6,
     c APSRSTAT*6, LIB*15, NM*31, CLADDESNAME(10)*7,
     c SPACERMAT*7, STEPCONTROL*1, ABOVEBP(10)*5
*
*     Data input for table of subcooled water density (g/cc) at
*     various temperatures (F) and pressures (psia).
*     (REFERENCE: Radiation Shielding Information Center Number
*     CCC-545, "SCALE 4.2, Modular Code System for Performing
*     Standardized Computer Analyses for Licensing Evaluation,
```

```
*     Volume 1, Page S2.5.14, Table S2.5.2.)
*
      DATA ((DENDAT(E,Q),Q=1,10),E=1,29) /0.0,3000.0,2500.0,
     c 2000.0,1500.0,1000.0,
     c 800.0,600.0,400.0,200.0,50.0,1.0084,1.0069,1.0055,1.0040,
     c 1.0025,1.0019,
     c 1.0013,1.0007,1.000,100,1.0018,1.0004,0.9989,0.9975,0.9960,
     c 0.9954,0.9948,0.9942,0.9936,150.0,0.9893,0.9878,0.9864,0.9849,
     c 0.9834,0.9828,0.9822,0.9815,0.9809,200,0.9725,0.9709,0.9694,
     c 0.9679,0.9663,0.9656,0.9650,0.9644,0.9637,250.0,0.9522,0.9505,
     c 0.9489,0.9472,0.9455,0.9449,0.9442,0.9435,0.9428,300,0.9289,
     c 0.9271,0.9252,0.9234,0.9215,0.9208,0.9200,0.9192,0.9185,350.0,
     c 0.9026,0.9006,0.8985,0.8964,0.8943,0.8934,0.8925,0.8916,0,
     c 400.0,0.8733,0.8709,0.8685,0.8660,0.8634,0.8624,0.8613,0.8603,0,
     c 450.0,0.8405,0.8375,0.8345,0.8314,0.8281,0.8268,0.8255,0,0,
     c 500.0,0.8029,0.7992,0.7952,0.7911,0.7869,0.7851,0,0,0,
     c 510.0,0.7947,0.7907,0.7866,0.7822,0.7776,0,0,0,0,
     c 520.0,0.7862,0.7820,0.7776,0.7729,0.7680,0,0,0,0,
     c 530.0,0.7775,0.7729,0.7682,0.7632,0.7579,0,0,0,0,
     c 540.0,0.7683,0.7635,0.7584,0.7530,0.7472,0,0,0,0,
     c 550.0,0.7589,0.7537,0.7482,0.7423,0,0,0,0,0,
     c 560.0,0.7490,0.7434,0.7374,0.7310,0,0,0,0,0,
     c 570.0,0.7386,0.7326,0.7261,0.7190,0,0,0,0,0,
     c 580.0,0.7278,0.7212,0.7141,0.7062,0,0,0,0,0,
     c 590.0,0.7164,0.7092,0.7012,0.6923,0,0,0,0,0,
     c 600.0,0.7043,0.6963,0.6874,0,0,0,0,0,0,
     c 610.0,0.6915,0.6825,0.6724,0,0,0,0,0,0,
     c 620.0,0.6777,0.6676,0.6558,0,0,0,0,0,0,
     c 630.0,0.6629,0.6512,0.6370,0,0,0,0,0,0,
     c 640.0,0.6467,0.6329,0,0,0,0,0,0,0,
     c 650.0,0.6288,0.6119,0,0,0,0,0,0,0,
     c 660.0,0.6086,0.5866,0,0,0,0,0,0,0,
     c 670.0,0.5850,0,0,0,0,0,0,0,0,
     c 680.0,0.5559,0,0,0,0,0,0,0,0/
*
      write (*,*) 'calling data_aquisition'
      CALL DATA_AQUISITION (BPZONE, BPMA,
     c LMB, NLIB, PLEVEL, ISN, IIM, ICM, IUS, NBR, AXNUM,
     c FTNUM, MONUM, BUNUM, APSRINS,
     c APSRSTEPNUM, APSRMIXNUM, APSRMIXID, CRINS,
     c CRSTEPNUM, CRMIXNUM, CRMIXID, CRNUMISOS,
     c CRISOID, AXBLANK, AXBLANKNODNUM, STPTS,
     c CYCPOS, APSRNUMISOS, APSRISOID, STPTSUM,
     c BPRADESNUM, CRDESNUM, CRZONE, CRMA, LMC,
     c APSRDESNUM, APSRZONE, APSRMA, LMD,
     c BPCYCID, BPTN, BPBN, DES, BPCYCNUM, BPDESID,
     c CRDES, APSRDES, LMA, LUZONE,
     c CLTEMP, PRESS, BPDEN, BPRA, CRISOWTPCT,
     c LRA, LRB, MESH, SZF, EPS, PTC, APSRISOWTPCT,
     c NODES, BLETDOWN, AXBLANKRICH, STPTDAT,
     c FTNDES, FTDAT, MONDES, MODAT,
     c BUNDES, BUDAT, RICH, FMASS, RODS, CYCLEN,
     c PITCH, FOD, CID, COD, LENGTH, CYCDOWN, CRDEN,
     c CRRA, LRC, APSRDEN, APSRRA, LRD,
     c BPWTPCT, REACT, PREFIX, AXBLANKET, BPRFLAG,
     c FUELCLAD, FLAG2, CYCLEID, CRSTAT,
     c APSRSTAT, LIB, BPXSECT, BPRODS, CT1START,
     c CT2START, CLADTOT, CLADDESNUM, CLADDESNAME,
     c BPRCLAD, CRCLAD, APSRCLAD, BPMIXNUM, BPMIX, BPMIXID,
     c BPNUMISOS, BPISOID, BPISOWTPCT, UCSPACERFRAC,
```

```
      c SPACERMAT, STEPCONTROL, VARBLETDOWN, VARSTEPNUM,
      c BPRFM, BPFMNUMISOS, BPFISOID, ABOVEBPNUM, APSRFM,
      c BPRFR, BPFISOWTPCT, APSRFR, ABOVEBP, APSRFOLLOWMIX)
*
       write (*,*) 'calling std_height'
       CALL STD_HEIGHT (AXNUM, FTNUM,
      c MONUM, BUNUM, HTOT, NODES, STPTSUM,
      c FDHT, FTNDES, MDHT, MONDES,
      c BDHT, BUNDES)
*
       write (*,*) 'calling fueltemp_format'
       CALL FUELTEMP_FORMAT (STPTSUM, AXNUM, FTNUM,
      c NODES, FTNDES, FTDAT, FTIN)
*
       write (*,*) 'calling modspecvol_format'
       CALL MODSPECVOL_FORMAT (STPTSUM, AXNUM, MONUM,
      c NODES, MONDES, MODAT, MOIN)
*
       write (*,*) 'calling burnup_format'
       CALL BURNUP_FORMAT (STPTSUM, AXNUM, BUNUM,
      c NODES, BUNDES, BUDAT, BUIN)
*
       write (*,*) 'calling power_calcs'
       CALL POWER_CALCS (NBR, AXNUM, STPTSUM, STPTTALLY,
      c STPTS, GRAMS, FMASS, NODES, HTOT, BUIN,
      c STPTDAT, POWER, CYCLEN, STEPCONTROL, VARBLETDOWN,
      c VARSTEPNUM, VARPOWER)
*
       write (*,*) 'calling units_conversion'
       CALL UNITS_CONVERSION (STPTSUM, AXNUM, FTFINAL,
      c FTIN, MODDENFINAL, MOIN, PRESS, MODTEMPFINAL,
      c DENDAT)
*
       write (*,*) 'calling execution_control'
       CALL EXECUTION_CONTROL (NBR, RELATIVE_STPT_NUM,
      c CT1, CT2, CT3, AXNUM, CYCPOS, AXBLANK,
      c BPDESID, CRINS, CRDES,
      c CRMIXNUM, CRMIXID, CRNUMISOS, CRISOID,
      c APSRINS, APSRMIXNUM, APSRMIXID,
      c RELATIVE_APSR_MIX_ID, APSRNUMISOS,
      c APSRISOID, ISN, IIM, ICM, IUS, PLEVEL,
      c BPZONE, BPMA, CRZONE, CRMA,
      c LMC, APSRZONE, APSRMA, LMD,
      c BPTN, BPBN, STPTS, APSRDES,
      c STPTDAT, AXBLANKRICH, GRAMS,
      c NODES, RODS, RICH, FTFINAL,
      c MODDENFINAL, MODTEMPFINAL,
      c BLETDOWN, BPWTPCT, BPDEN, CRDEN,
      c CRISOWTPCT, APSRDEN, APSRISOWTPCT,
      c PITCH, FOD, COD, CID, SZF, EPS, PTC, MESH,
      c BPRA, CRRA, LRC, APSRRA,
      c LRD, POWER, CYCDOWN, PREFIX,
      c NM, CYCLEID, REACT, LIB, AXBLANKET,
      c FUELCLAD, BPRFLAG, CRSTAT, APSRSTAT, FLAG2,
      c LUZONE, LMB, LRB, BPXSECT, BPRODS,
      c CT1START, CT2START, STPTTALLY, CLADTOT,
      c CLADDESNUM, CLADDESNAME, BPRCLAD, CRCLAD,
      c APSRCLAD, CLTEMP, BPMIXNUM, BPMIX, BPMIXID,
      c BPNUMISOS, BPISOID, BPISOWTPCT, UCSPACERFRAC,
      c SPACERMAT, STEPCONTROL, VARBLETDOWN, VARSTEPNUM,
```

```
      c VARPOWER, BPRFM, BPFMNUMISOS, BPFISOID,
      c ABOVEBPNUM, APSRFM, BPRFR, BPFISOWTPCT,
      c APSRFR, ABOVEBP, APSRFOLLOWMIX)
*
       END


************************************************************
*     Reactor and Problem Data Acquisition Subroutine      *
************************************************************
       SUBROUTINE DATA_AQUISITION (BPZONE, BPMA,
      c LMB, NLIB, PLEVEL, ISN, IIM, ICM, IUS, NBR, AXNUM,
      c FTNUM, MONUM, BUNUM, APSRINS,
      c APSRSTEPNUM, APSRMIXNUM, APSRMIXID, CRINS,
      c CRSTEPNUM, CRMIXNUM, CRMIXID, CRNUMISOS,
      c CRISOID, AXBLANK, AXBLANKNODNUM, STPTS,
      c CYCPOS, APSRNUMISOS, APSRISOID, STPTSUM,
      c BPRADESNUM, CRDESNUM, CRZONE, CRMA, LMC,
      c APSRDESNUM, APSRZONE, APSRMA, LMD,
      c BPCYCID, BPTN, BPBN, DES, BPCYCNUM, BPDESID,
      c CRDES, APSRDES, LMA, LUZONE,
      c CLTEMP, PRESS, BPDEN, BPRA, CRISOWTPCT,
      c LRA, LRB, MESH, SZF, EPS, PTC, APSRISOWTPCT,
      c NODES, BLETDOWN, AXBLANKRICH, STPTDAT,
      c FTNDES, FTDAT, MONDES, MODAT,
      c BUNDES, BUDAT, RICH, FMASS, RODS, CYCLEN,
      c PITCH, FOD, CID, COD, LENGTH, CYCDOWN, CRDEN,
      c CRRA, LRC, APSRDEN, APSRRA, LRD,
      c BPWTPCT, REACT, PREFIX, AXBLANKET, BPRFLAG,
      c FUELCLAD, FLAG2, CYCLEID, CRSTAT,
      c APSRSTAT, LIB, BPXSECT, BPRODS, CT1START,
      c CT2START, CLADTOT, CLADDESNUM, CLADDESNAME,
      c BPRCLAD, CRCLAD, APSRCLAD, BPMIXNUM, BPMIX, BPMIXID,
      c BPNUMISOS, BPISOID, BPISOWTPCT, UCSPACERFRAC,
      c SPACERMAT, STEPCONTROL, VARBLETDOWN, VARSTEPNUM,
      c BPRFM, BPFMNUMISOS, BPFISOID, ABOVEBPNUM, APSRFM,
      c BPRFR, BPFISOWTPCT, APSRFR, ABOVEBP, APSRFOLLOWMIX)
*
       INTEGER*4 BPZONE(10), BPMA(15,10), LMA(15,10), LUZONE,
      c LMB(15), NLIB, PLEVEL, ISN, IIM, ICM, IUS, NBR, AXNUM,
      c FTNUM(20), MONUM(20), BUNUM(20), CT1, CT2, CT3,
      c APSRINS(10,20,23,50), APSRSTEPNUM, APSRCYC, APSRSTEP,
      c TOPN, BOTN, APSRMIX, APSRMIXNUM, APSRMIXID(25),
      c CRINS(10,20,23,50), CRSTEPNUM, CRCYC, CRSTEP, CYCHOLDER,
      c CRMIX, STPTHOLDER, CRMIXNUM, CRMIXID(25), CRNUMISOS(25),
      c CRISOID(25,10), AXBLANK(50), AXBLANKNODNUM, AXBLANKTEMP,
      c STPTS(10), CYCPOS(10), APSRNUMISOS(25), APSRISOID(25,10),
      c STPTSUM, BPRADESNUM, CRDESNUM, CRZONE(10), CRMA(15,10),
      c LMC(15,10), APSRDESNUM, APSRZONE(10), APSRMA(15,10),
      c LMD(15,10), BPCYCID, BPTN(10), BPBN(10), DES, BPCYCNUM,
      c BPDESID(10), CRDES(10,20,23,50), APSRDES(10,20,23,50),
      c BPRODS(10), CT1START, CT2START, APSRSTPT, CRSTPT,
      c CLADTOT, CLADDESNUM(10), BPRCLAD(10), CRCLAD(10),
      c APSRCLAD(10), BPMIXNUM, BPMIX(10), BPMIXID(10),
      c BPNUMISOS(20), BPISOID(10,20), VARSTEPNUM(10,20),
      c BPRFM(15,10), BPFMNUMISOS(25), BPFISOID(25,10),
      c ABOVEBPNUM(10), APSRFM(15,10), FMIX, APSRFOLLOWMIX(10,20,23,50)
*
       REAL CLTEMP, PRESS, BPDEN(10), BPRA(15,10), CRISOWTPCT(25,10),
      c LRA(15,10), LRB(15), MESH, SZF, EPS, PTC, APSRISOWTPCT(25,10),
```

```
      c NODES(50,2), BLETDOWN(10,20,25), AXBLANKRICH, STPTDAT(10,20,3),
      c FTNDES(50,2,20), FTDAT(50,20), MONDES(50,2,20), MODAT(50,20),
      c BUNDES(50,2,20), BUDAT(50,20), RICH, FMASS, RODS, CYCLEN(10,2),
      c PITCH, FOD, CID, COD, LENGTH, CYCDOWN(10), CRDEN(10),
      c CRRA(15,10), LRC(15,10), APSRDEN(10), APSRRA(15,10), LRD(15,10),
      c BPWTPCT(10), BPXSECT(10), BPISOWTPCT(10,20), UCSPACERFRAC,
      c VARBLETDOWN(10,20,25,25), BPRFR(15,10), BPFISOWTPCT(25,10),
      c APSRFR(15,10)
*
       CHARACTER REACT*21, PREFIX*3, AXBLANKET*1, BPRFLAG*1,
      c FUELCLAD*10, FLAG2*7, CYCLEID(10)*2, CRSTAT*6,
      c APSRSTAT*6, LIB*15, PICKUPFLAG*1, CLADFLAG*1, CLADDESNAME(10)*7,
      c SPACERMAT*7, STEPCONTROL*1, ABOVEBP(10)*5
*
*     Hardwired ASSYFOLLOW limitations:
*******************************************************************************
*
*     Maximum number of irradiation steps in a given SAS2H input deck = 23.
*
*     Maximum number of isotopes in a CR or APSR material composition = 10.
*
*     Maximum number of concentric zones in a Path B Model = 15.
*
*     Maximum number of axial nodes in any axial format = 50.
*
*     Maximum number of reactor cycles in which an assembly may be inserted = 10.
*
*     Maximum number of CRC statepoints allowed in a given cycle = 20.
*
*     Maximum number of BPRA designs = 10.
*
*     Maximum number of CR absorber material mixtures = 25.
*
*     Maximum number of CRA designs = 10.
*
*     Maximum number of APSR absorber material mixtures = 25.
*
*     Maximum number of APSR assembly designs = 10.
*
*******************************************************************************
*
*
      OPEN (UNIT=10, FILE='datain', STATUS='OLD')
      REWIND (UNIT=10)
      READ (10,2) PICKUPFLAG ! PICKUPFLAG is a signal to begin the assembly
*                            depletion and decay calculation at a point
*                            other than the beginning of the assembly's
*                            irradiation history as specified in the input
*                            deck
    2 FORMAT(A1)
      IF (PICKUPFLAG.EQ.'Y') THEN
         READ(10,*) CT1START
         READ(10,*) CT2START
      ELSE
         CT1START=1
         CT2START=1
      ENDIF
*
      READ (10,10) REACT    ! REACT is the problem identification
*                           (up to 21 characters).
```

```
      READ (10,20) PREFIX  ! PREFIX is a 3 character prefix to be
*                          placed at the beginning of all SAS2H
*                          input decks produced.
      READ (10,40) LIB     ! LIB is a 15 character identification
*                          of the cross-section library requested
*                          for use in the SCALE code system.
   10 FORMAT (A21)
   20 FORMAT (A3)
   30 FORMAT (A2)
   40 FORMAT (A15)
*
*     Fuel Batch Data Acquisition
*
      READ (10,*) RICH  ! RICH is the fuel assy wt% U-235 in UO2
*                         enrichment.
      READ (10,*) FMASS ! FMASS is the fuel assy loading of
*                         uranium in g/assy.
      READ (10,*) RODS  ! RODS is the number of fuel rods in the assy.
      READ (10,*) PITCH ! PITCH is the fuel rod pitch in the assy.
      READ (10,*) FOD   ! FOD is the fuel rod outer diameter in cm.
      READ (10,*) CID   ! CID is the clad inner diameter in cm.
      READ (10,*) COD   ! COD is the clad outer diameter in cm.
      READ (10,*) LENGTH ! LENGTH is the active fuel length in cm.
      READ (10,70) AXBLANKET ! Flag for axial blanket modelling.
   70 FORMAT(A1)
      IF (AXBLANKET.EQ.'Y') THEN
         READ (10,*) AXBLANKRICH ! Axial blanket fuel U-235 enrichment.
*        Initialize AXBLANK array
         DO 80 CT1=1,50
            AXBLANK(CT1)=0
   80    CONTINUE
*        Gather data for AXBLANK array
         READ (10,*) AXBLANKNODNUM ! Number of nodes with axial
*                                    blanket fuel.
         DO 90 CT1=1,AXBLANKNODNUM
            READ (10,*) AXBLANKTEMP ! Node containing axial
*                                     blanket fuel.
            AXBLANK(AXBLANKTEMP)=1 ! Identify axial blanket fuel
*                                    node location in AXBLANK.
   90    CONTINUE
      ENDIF
*     Spacer data acquisition
      READ (10,92) SPACERMAT
   92 FORMAT(A7)
      READ (10,*) UCSPACERFRAC
*     Cladding data acquisition
      READ (10,100) FUELCLAD
  100 FORMAT (A10)
      READ (10,*) CLTEMP
      READ (10,101) CLADFLAG
  101 FORMAT (A1)
      IF (CLADFLAG.EQ.'Y') THEN
         READ(10,*) CLADTOT
         DO 108 CT1=1,CLADTOT
            READ(10,*) CLADDESNUM(CT1)
            READ(10,105) CLADDESNAME(CT1)
  105       FORMAT (A7)
  108    CONTINUE
      ENDIF
*     System Pressure
```

```
      READ (10,*) PRESS
      READ (10,110) BPRFLAG
  110 FORMAT (A1)
      IF (BPRFLAG.EQ.'Y') THEN
         READ(10,*) BPCYCNUM  ! Number of cycles with BPRA
         READ(10,*) BPRADESNUM, BPMIXNUM
         DO 145 CT2=1,BPRADESNUM
*           Get BP density, B4C wt% in Al2O3-B4C,
*           BP x-sectional area, # BP rods, and BPR clad mix num
            READ (10,*) BPDEN(CT2), BPWTPCT(CT2), BPXSECT(CT2),
     c      BPRODS(CT2), BPRCLAD(CT2), BPMIX(CT2)
*           Larger BPRA unit cell data acquisition
            READ (10,*) BPZONE(CT2)
            DO 112 CT1=1,BPZONE(CT2)
               READ (10,*) BPMA(CT1,CT2), BPRA(CT1,CT2)
  112       CONTINUE
*           Larger standard unit cell for use with BPRAs
            DO 114 CT1=1,BPZONE(CT2)
               READ (10,*) LMA(CT1,CT2), LRA(CT1,CT2)
  114       CONTINUE
            DO 116 CT1=1,BPZONE(CT2)
               READ(10,*) BPRFM(CT1,CT2), BPRFR(CT1,CT2)
  116       CONTINUE
            READ(10,118) ABOVEBP(CT2), ABOVEBPNUM(CT2)
  118       FORMAT (A5,1X,I3)
            IF (ABOVEBP(CT2).NE.'AL2O3') THEN
               READ (10,*) BPFMNUMISOS(CT2)
               DO 120 CT1=1,BPFMNUMISOS(CT2)
                  READ (10,*) BPFISOID(CT2,CT1),
     c            BPFISOWTPCT(CT2,CT1)
  120          CONTINUE
            ENDIF
  145    CONTINUE
         DO 147 CT1=1,10
            DO 146 CT2=1,20
               BPISOID(CT1,CT2)=0
               BPISOWTPCT(CT1,CT2)=0.0
  146       CONTINUE
  147    CONTINUE
         IF (BPMIXNUM.NE.0) THEN
            DO 150 CT1=1,BPMIXNUM
               READ (10,*) BPMIXID(CT1) ! SAS2H Mixture ID for CR
               READ (10,*) BPNUMISOS(CT1)
               DO 149 CT2=1,BPNUMISOS(CT1)
                  READ (10,*) BPISOID(CT1,CT2), BPISOWTPCT(CT1,CT2)
  149          CONTINUE
  150       CONTINUE
         ENDIF
         DO 156 CT1=1,10
            BPDESID(CT1)=0
  156    CONTINUE
         DO 157 CT1=1,BPCYCNUM
            READ(10,*) BPCYCID, BPDESID(BPCYCID), BPTN(BPCYCID),
     c      BPBN(BPCYCID)
  157    CONTINUE
      ENDIF
*     Larger standard unit cell
      READ (10,*) LUZONE
      DO 170 CT1=1,LUZONE
         READ (10,*) LMB(CT1), LRB(CT1)
```

```
  170 CONTINUE
*     Contol parameter data acquisition
      READ (10,*) NLIB
      READ (10,*) PLEVEL
      READ (10,*) MESH
      READ (10,180) FLAG2
  180 FORMAT (A7)
      IF (FLAG2.EQ.'SPECIAL') THEN
         READ (10,*) SZF
         READ (10,*) ISN
         READ (10,*) IIM
         READ (10,*) ICM
         READ (10,*) EPS
         READ (10,*) PTC
         READ (10,*) IUS
      ENDIF
*     Reactor history data acquisition
      READ (10,*) NBR
      DO 210 CT1=1,NBR
         READ (10,190) CYCLEID(CT1)
  190    FORMAT (A2)
         READ (10,*) STPTS(CT1)
         DO 200 CT2=1,STPTS(CT1)
            READ (10,*) STPTDAT(CT1,CT2,1)
            READ (10,*) STPTDAT(CT1,CT2,2)
            READ (10,*) STPTDAT(CT1,CT2,3)
  200    CONTINUE
         READ (10,*) CYCDOWN(CT1)
         READ (10,*) CYCLEN(CT1,1)
         READ (10,*) CYCLEN(CT1,2)
         READ (10,*) CYCPOS(CT1)
  210 CONTINUE
      STEPCONTROL='N'
      READ (10,212) STEPCONTROL
  212 FORMAT(A1)
      IF (STEPCONTROL.EQ.'N') THEN
         DO 220 CT1=1,NBR
            READ (10,*) CYCHOLDER
            DO 217 CT2=1,STPTS(CYCHOLDER)
               READ (10,*) STPTHOLDER
               READ (10,*) BLETDOWN(CYCHOLDER,STPTHOLDER,1)
               READ (10,*) BLETDOWN(CYCHOLDER,STPTHOLDER,2)
               DO 213 CT3=3,(INT(BLETDOWN(CYCHOLDER,STPTHOLDER,2))+2)
                  READ (10,*) BLETDOWN(CYCHOLDER,STPTHOLDER,CT3)
  213          CONTINUE
  217       CONTINUE
  220    CONTINUE
      ELSEIF (STEPCONTROL.EQ.'Y') THEN
         DO 240 CT1=1,NBR
            READ (10,*) CYCHOLDER
            DO 235 CT2=1,STPTS(CYCHOLDER)
               READ (10,*) STPTHOLDER
               READ (10,*) VARSTEPNUM(CYCHOLDER,STPTHOLDER)
               DO 230 CT3=1,VARSTEPNUM(CYCHOLDER,STPTHOLDER)
                  READ (10,*) VARBLETDOWN(CYCHOLDER,STPTHOLDER,CT3,1),
     c            VARBLETDOWN(CYCHOLDER,STPTHOLDER,CT3,2)
  230          CONTINUE
  235       CONTINUE
  240    CONTINUE
      ENDIF
```

```
      READ (10,*) AXNUM
      DO 260 CT1=1,AXNUM
         READ (10,250) NODES(CT1,1), NODES(CT1,2)
  250    FORMAT (F3.0,1X,F10.7)
  260 CONTINUE
*     Control Rod Data Aquisition
      READ (10,270) CRSTAT
  270 FORMAT (A6)
      IF (CRSTAT.EQ.'RODDED') THEN
         DO 300 CT1=1,10
            DO 295 CT2=1,20
               DO 290 CT3=1,23
                  DO 280 CT4=1,50
                     CRINS(CT1,CT2,CT3,CT4)=0
  280             CONTINUE
  290          CONTINUE
  295       CONTINUE
  300    CONTINUE
         READ (10,*) CRSTEPNUM ! Number of pre-defined irradiation steps
*                              in which the assembly contains a control
*                              rod assembly.
         DO 320 CT1=1,CRSTEPNUM
            READ (10,*) CRCYC, CRSTPT, CRSTEP, TOPN, BOTN, CRMIX, DES
            DO 310 CT2=TOPN,BOTN
               CRINS(CRCYC,CRSTPT,CRSTEP,CT2)=CRMIX
               CRDES(CRCYC,CRSTPT,CRSTEP,CT2)=DES
  310       CONTINUE
  320    CONTINUE
      READ (10,*) CRMIXNUM
      DO 340 CT1=1,CRMIXNUM
         READ (10,*) CRMIXID(CT1) ! SAS2H Mixture ID for CR
         READ (10,*) CRNUMISOS(CT1)
         DO 330 CT2=1,CRNUMISOS(CT1)
            READ(10,*) CRISOID(CT1,CT2), CRISOWTPCT(CT1,CT2)
  330    CONTINUE
  340 CONTINUE
      READ(10,*) CRDESNUM
      DO 349 CT2=1,CRDESNUM
         READ(10,*) CRDEN(CT2), CRCLAD(CT2)
         READ(10,*) CRZONE(CT2)
         DO 344 CT1=1,CRZONE(CT2)
            READ(10,*) CRMA(CT1,CT2), CRRA(CT1,CT2)
  344    CONTINUE
         DO 347 CT1=1,CRZONE(CT2)
            READ(10,*) LMC(CT1,CT2), LRC(CT1,CT2)
  347    CONTINUE
  349 CONTINUE
      ENDIF
*     Axial Power Shaping Rod Data Aquisition
      READ (10,350) APSRSTAT
  350 FORMAT (A6)
      IF (APSRSTAT.EQ.'RODDED') THEN
         DO 380 CT1=1,10
            DO 375 CT2=1,20
               DO 370 CT3=1,23
                  DO 360 CT4=1,50
                     APSRINS(CT1,CT2,CT3,CT4)=0
  360             CONTINUE
  370          CONTINUE
  375       CONTINUE
```

```
  380     CONTINUE
          READ (10,*) APSRSTEPNUM ! Number of pre-defined irradiation steps
*                                 in which the assembly contains an axial
*                                 power shaping rod assembly.
          DO 400 CT1=1,APSRSTEPNUM
             READ (10,*) APSRCYC, APSRSTPT, APSRSTEP, TOPN, BOTN,
     c       APSRMIX, DES, FMIX
             DO 390 CT2=TOPN,BOTN
                APSRINS(APSRCYC,APSRSTPT,APSRSTEP,CT2)=APSRMIX
                APSRDES(APSRCYC,APSRSTPT,APSRSTEP,CT2)=DES
                APSRFOLLOWMIX(APSRCYC,APSRSTPT,APSRSTEP,CT2)=FMIX
  390        CONTINUE
  400     CONTINUE
      READ (10,*) APSRMIXNUM
      DO 410 CT1=1,APSRMIXNUM
         READ (10,*) APSRMIXID(CT1) ! SAS2H Mixture ID for APSR's
         READ (10,*) APSRNUMISOS(CT1)
         DO 405 CT2=1,APSRNUMISOS(CT1)
            READ(10,*) APSRISOID(CT1,CT2), APSRISOWTPCT(CT1,CT2)
  405    CONTINUE
  410 CONTINUE
      READ(10,*) APSRDESNUM
      DO 429 CT2=1,APSRDESNUM
         READ(10,*) APSRDEN(CT2), APSRCLAD(CT2)
         READ(10,*) APSRZONE(CT2)
         DO 412 CT1=1,APSRZONE(CT2)
            READ(10,*) APSRMA(CT1,CT2), APSRRA(CT1,CT2)
  412    CONTINUE
         DO 414 CT1=1,APSRZONE(CT2)
            READ(10,*) LMD(CT1,CT2), LRD(CT1,CT2)
  414    CONTINUE
         DO 416 CT1=1,APSRZONE(CT2)
            READ(10,*) APSRFM(CT1,CT2), APSRFR(CT1,CT2)
  416    CONTINUE
  429 CONTINUE
      ENDIF
      STPTSUM=0
      DO 430 CT1=1,10
         STPTSUM=STPTSUM+STPTS(CT1)
  430 CONTINUE
*     Acquisition of fuel temperature data for each node
         DO 470 CT1=1,(STPTSUM-1)
            READ (10,*) FTNUM(CT1)
            DO 450 CT2=1,FTNUM(CT1)
              READ (10,440) FTNDES(CT2,1,CT1), FTNDES(CT2,2,CT1)
  440         FORMAT (F3.0,1X,F10.7)
  450       CONTINUE
            DO 460 CT2=1,FTNUM(CT1)
               READ (10,*) FTDAT(CT2,CT1)
  460       CONTINUE
  470    CONTINUE
*     Acquisition of moderator specific volume data for each node
         DO 510 CT1=1,(STPTSUM-1)
            READ (10,*) MONUM(CT1)
            DO 490 CT2=1,MONUM(CT1)
               READ (10,480) MONDES(CT2,1,CT1), MONDES(CT2,2,CT1)
  480          FORMAT (F3.0,1X,F10.7)
  490       CONTINUE
            DO 500 CT2=1,MONUM(CT1)
               READ (10,*) MODAT(CT2,CT1)
```

```
  500        CONTINUE
  510     CONTINUE
*     Acquisition of nodal burnup data for each statepoint in each cycle
        DO 550 CT1=1,STPTSUM
           READ (10,*) BUNUM(CT1)
           DO 530 CT2=1,BUNUM(CT1)
              READ (10,520) BUNDES(CT2,1,CT1), BUNDES(CT2,2,CT1)
  520         FORMAT (F3.0,1X,F10.7)
  530        CONTINUE
             DO 540 CT2=1,BUNUM(CT1)
                READ (10,*) BUDAT(CT2,CT1)
  540        CONTINUE
  550     CONTINUE

        RETURN
        END


*****************************************************************
*   Subroutine to standardize the assembly height to            *
*   the desired CRC assembly height.                            *
*****************************************************************
        SUBROUTINE STD_HEIGHT (AXNUM, FTNUM,
       c MONUM, BUNUM, HTOT, NODES, STPTSUM,
       c FDHT, FTNDES, MDHT, MONDES,
       c BDHT, BUNDES)
*
        INTEGER*4 AXNUM, CT1, CT2, FTNUM(20), MONUM(20), BUNUM(20),
       c STPTSUM
*
        REAL HTOT, NODES(50,2), FDHT(20), FTNDES(50,2,20),
       c MDHT(20), MONDES(50,2,20), BDHT(20), BUNDES(50,2,20)
*
*
        HTOT=0
        DO 10 CT1=1,AXNUM
           HTOT=HTOT+NODES(CT1,2)
   10   CONTINUE
        DO 30 CT1=1,STPTSUM
           FDHT(CT1)=0
           DO 20 CT2=1,FTNUM(CT1)
              FDHT(CT1)=FDHT(CT1)+FTNDES(CT2,2,CT1)
   20      CONTINUE
   30   CONTINUE
        DO 50 CT1=1,STPTSUM
           MDHT(CT1)=0
           DO 40 CT2=1,MONUM(CT1)
              MDHT(CT1)=MDHT(CT1)+MONDES(CT2,2,CT1)
   40      CONTINUE
   50   CONTINUE
        DO 70 CT1=1,STPTSUM
           BDHT(CT1)=0
           DO 60 CT2=1,BUNUM(CT1)
              BDHT(CT1)=BDHT(CT1)+BUNDES(CT2,2,CT1)
   60      CONTINUE
   70   CONTINUE
        DO 90 CT1=1,STPTSUM
           DO 80 CT2=1,FTNUM(CT1)
              FTNDES(CT2,2,CT1)=FTNDES(CT2,2,CT1)*(HTOT/FDHT(CT1))
   80      CONTINUE
```

```
   90 CONTINUE
      DO 110 CT1=1,STPTSUM
         DO 100 CT2=1,MONUM(CT1)
            MONDES(CT2,2,CT1)=MONDES(CT2,2,CT1)*(HTOT/MDHT(CT1))
  100    CONTINUE
  110 CONTINUE
      DO 130 CT1=1,STPTSUM
         DO 120 CT2=1,BUNUM(CT1)
            BUNDES(CT2,2,CT1)=BUNDES(CT2,2,CT1)*(HTOT/BDHT(CT1))
  120    CONTINUE
  130 CONTINUE

      RETURN
      END


*********************************************************************
*   Subroutine to convert fuel temperature input nodal formats      *
*   into the requested CRC nodal format                             *
*********************************************************************
      SUBROUTINE FUELTEMP_FORMAT (STPTSUM, AXNUM, FTNUM,
     c NODES, FTNDES, FTDAT, FTIN)
*
      INTEGER*4 CT1, CT2, CT3, STPTSUM, AXNUM, FTNUM(20)
*
      REAL HCTOLD, HCT, SUM, NODES(50,2), FTHOLD, FTHCT,
     c FTNDES(50,2,20), FTDAT(50,20), FTIN(50,20)
*
      DO 30 CT1=1,STPTSUM
         HCTOLD=0
         HCT=0
         DO 20 CT2=1,AXNUM
            SUM=0
            HCTOLD=HCT
            HCT=HCT+NODES(CT2,2)
            FTHOLD=0
            FTHCT=0
            DO 10 CT3=1,FTNUM(CT1)
               FTHOLD=FTHCT
               FTHCT=FTHCT+FTNDES(CT3,2,CT1)
               IF ((FTHOLD.LT.HCTOLD).AND.(FTHCT.GT.HCTOLD).AND.
     c             (FTHCT.LT.HCT)) THEN
                  SUM=SUM+(((FTHCT-HCTOLD)/NODES(CT2,2))
     c                *FTDAT(CT3,CT1))
               ENDIF
               IF ((FTHOLD.EQ.HCTOLD).AND.(FTHCT.EQ.HCT)) THEN
                  SUM=SUM+FTDAT(CT3,CT1)
               ENDIF
               IF ((FTHOLD.GT.HCTOLD).AND.(FTHOLD.LT.HCT).AND.
     c             (FTHCT.GT.HCT)) THEN
                  SUM=SUM+(((HCT-FTHOLD)/NODES(CT2,2))
     c                *FTDAT(CT3,CT1))
               ENDIF
               IF ((FTHOLD.EQ.HCTOLD).AND.(FTHCT.GT.HCTOLD).AND.
     c             (FTHCT.LT.HCT)) THEN
                  SUM=SUM+(((FTHCT-FTHOLD)/NODES(CT2,2))
     c                *FTDAT(CT3,CT1))
               ENDIF
               IF ((FTHOLD.GT.HCTOLD).AND.(FTHCT.LT.HCT)) THEN
                  SUM=SUM+(((FTHCT-FTHOLD)/NODES(CT2,2))
```

```
     c               *FTDAT(CT3,CT1))
               ENDIF
               IF ((FTHOLD.GT.HCTOLD).AND.(FTHOLD.LT.HCT).AND.
     c            (FTHCT.EQ.HCT)) THEN
                  SUM=SUM+(((FTHCT-FTHOLD)/NODES(CT2,2))
     c               *FTDAT(CT3,CT1))
               ENDIF
               IF ((FTHOLD.LT.HCTOLD).AND.(FTHCT.EQ.HCT)) THEN
                  SUM=SUM+FTDAT(CT3,CT1)
               ENDIF
               IF ((FTHOLD.LT.HCTOLD).AND.(FTHCT.GT.HCT)) THEN
                  SUM=SUM+FTDAT(CT3,CT1)
               ENDIF
               IF ((FTHOLD.EQ.HCTOLD).AND.(FTHCT.GT.HCT)) THEN
                  SUM=SUM+FTDAT(CT3,CT1)
               ENDIF
   10       CONTINUE
            FTIN(CT2,CT1)=SUM
   20    CONTINUE
   30 CONTINUE

      RETURN
      END


*************************************************************************
*   Subroutine to convert moderator specific volume input nodal   *
*   formats into the requested CRC nodal format                   *
*************************************************************************
      SUBROUTINE MODSPECVOL_FORMAT (STPTSUM, AXNUM, MONUM,
     c NODES, MONDES, MODAT, MOIN)
*
      INTEGER*4 CT1, CT2, CT3, STPTSUM, AXNUM, MONUM(20)
*
      REAL HCTOLD, HCT, SUM, NODES(50,2), MOHOLD, MOHCT,
     c MONDES(50,2,20), MODAT(50,20), MOIN(50,20)
*
      DO 30 CT1=1,STPTSUM
         HCTOLD=0
         HCT=0
         DO 20 CT2=1,AXNUM
            SUM=0
            HCTOLD=HCT
            HCT=HCT+NODES(CT2,2)
            MOHOLD=0
            MOHCT=0
            DO 10 CT3=1,MONUM(CT1)
               MOHOLD=MOHCT
               MOHCT=MOHCT+MONDES(CT3,2,CT1)
               IF ((MOHOLD.LT.HCTOLD).AND.(MOHCT.GT.HCTOLD).AND.
     c            (MOHCT.LT.HCT)) THEN
                  SUM=SUM+(((MOHCT-HCTOLD)/NODES(CT2,2))
     c               *MODAT(CT3,CT1))
               ENDIF
               IF ((MOHOLD.EQ.HCTOLD).AND.(MOHCT.EQ.HCT)) THEN
                  SUM=SUM+MODAT(CT3,CT1)
               ENDIF
               IF ((MOHOLD.GT.HCTOLD).AND.(MOHOLD.LT.HCT).AND.
     c            (MOHCT.GT.HCT)) THEN
                  SUM=SUM+(((HCT-MOHOLD)/NODES(CT2,2))
```

```
c                *MODAT(CT3,CT1))
               ENDIF
               IF ((MOHOLD.EQ.HCTOLD).AND.(MOHCT.GT.HCTOLD).AND.
c                 (MOHCT.LT.HCT)) THEN
                  SUM=SUM+(((MOHCT-MOHOLD)/NODES(CT2,2))
c                    *MODAT(CT3,CT1))
               ENDIF
               IF ((MOHOLD.GT.HCTOLD).AND.(MOHCT.LT.HCT)) THEN
                  SUM=SUM+(((MOHCT-MOHOLD)/NODES(CT2,2))
c                    *MODAT(CT3,CT1))
               ENDIF
               IF ((MOHOLD.GT.HCTOLD).AND.(MOHOLD.LT.HCT).AND.
c                 (MOHCT.EQ.HCT)) THEN
                  SUM=SUM+(((MOHCT-MOHOLD)/NODES(CT2,2))
c                    *MODAT(CT3,CT1))
               ENDIF
               IF ((MOHOLD.LT.HCTOLD).AND.(MOHCT.EQ.HCT)) THEN
                  SUM=SUM+MODAT(CT3,CT1)
               ENDIF
               IF ((MOHOLD.LT.HCTOLD).AND.(MOHCT.GT.HCT)) THEN
                  SUM=SUM+MODAT(CT3,CT1)
               ENDIF
               IF ((MOHOLD.EQ.HCTOLD).AND.(MOHCT.GT.HCT)) THEN
                  SUM=SUM+MODAT(CT3,CT1)
               ENDIF
   10        CONTINUE
             MOIN(CT2,CT1)=SUM
   20     CONTINUE
   30  CONTINUE

       RETURN
       END


*********************************************************************
*   Subroutine to convert burnup input nodal formats into the       *
*   requested CRC nodal format                                      *
*********************************************************************
       SUBROUTINE BURNUP_FORMAT (STPTSUM, AXNUM, BUNUM,
      c NODES, BUNDES, BUDAT, BUIN)
*
       INTEGER*4 CT1, CT2, CT3, STPTSUM, AXNUM, BUNUM(20)
*
       REAL HCTOLD, HCT, SUM, NODES(50,2), BUHOLD, BUHCT,
      c BUNDES(50,2,20), BUDAT(50,20), BUIN(50,20)
*
       DO 30 CT1=1,STPTSUM
          HCTOLD=0
          HCT=0
          DO 20 CT2=1,AXNUM
             SUM=0
             HCTOLD=HCT
             HCT=HCT+NODES(CT2,2)
             BUHOLD=0
             BUHCT=0
             DO 10 CT3=1,BUNUM(CT1)
                BUHOLD=BUHCT
                BUHCT=BUHCT+BUNDES(CT3,2,CT1)
                IF ((BUHOLD.LT.HCTOLD).AND.(BUHCT.GT.HCTOLD).AND.
      c            (BUHCT.LT.HCT)) THEN
```

```
                  SUM=SUM+(((BUHCT-HCTOLD)/NODES(CT2,2))
     c               *BUDAT(CT3,CT1))
                  ENDIF
                  IF ((BUHOLD.EQ.HCTOLD).AND.(BUHCT.EQ.HCT)) THEN
                     SUM=SUM+BUDAT(CT3,CT1)
                  ENDIF
                  IF ((BUHOLD.GT.HCTOLD).AND.(BUHOLD.LT.HCT).AND.
     c               (BUHCT.GT.HCT)) THEN
                     SUM=SUM+(((HCT-BUHOLD)/NODES(CT2,2))
     c               *BUDAT(CT3,CT1))
                  ENDIF
                  IF ((BUHOLD.EQ.HCTOLD).AND.(BUHCT.GT.HCTOLD).AND.
     c               (BUHCT.LT.HCT)) THEN
                     SUM=SUM+(((BUHCT-BUHOLD)/NODES(CT2,2))
     c               *BUDAT(CT3,CT1))
                  ENDIF
                  IF ((BUHOLD.GT.HCTOLD).AND.(BUHCT.LT.HCT)) THEN
                     SUM=SUM+(((BUHCT-BUHOLD)/NODES(CT2,2))
     c               *BUDAT(CT3,CT1))
                  ENDIF
                  IF ((BUHOLD.GT.HCTOLD).AND.(BUHOLD.LT.HCT).AND.
     c               (BUHCT.EQ.HCT)) THEN
                     SUM=SUM+(((BUHCT-BUHOLD)/NODES(CT2,2))
     c               *BUDAT(CT3,CT1))
                  ENDIF
                  IF ((BUHOLD.LT.HCTOLD).AND.(BUHCT.EQ.HCT)) THEN
                     SUM=SUM+BUDAT(CT3,CT1)
                  ENDIF
                  IF ((BUHOLD.LT.HCTOLD).AND.(BUHCT.GT.HCT)) THEN
                     SUM=SUM+BUDAT(CT3,CT1)
                  ENDIF
                  IF ((BUHOLD.EQ.HCTOLD).AND.(BUHCT.GT.HCT)) THEN
                     SUM=SUM+BUDAT(CT3,CT1)
                  ENDIF
   10          CONTINUE
               BUIN(CT2,CT1)=SUM
   20       CONTINUE
   30    CONTINUE

         RETURN
         END


*************************************************************************
*     Subroutine to calculate nodal powers for each reactor cycle       *
*************************************************************************
      SUBROUTINE POWER_CALCS (NBR, AXNUM, STPTSUM, STPTTALLY,
     c STPTS, GRAMS, FMASS, NODES, HTOT, BUIN,
     c STPTDAT, POWER, CYCLEN, STEPCONTROL, VARBLETDOWN,
     c VARSTEPNUM, VARPOWER)
*
      INTEGER*4 CT1, NBR, AXNUM, CT2, CT3, CYCLENUMBER, STPTNUMBER,
     c STPTSUM, STPTTALLY(20), STPTS(10), VARSTEPNUM(10,20), CT4
*
      REAL GRAMS(50), FMASS, NODES(50,2), HTOT, BURN, BUIN(50,20),
     c DAYS, STPTDAT(10,20,3), POWER(50,20), CYCLEN(10,2),
     c VARPOWER(10,20,25,50), VARBLETDOWN(10,20,25,25),
     c TOTALBURNDAYS
*
      CHARACTER STEPCONTROL*1
```

```
*
      DO 10 CT1=1,10
         STPTTALLY(CT1)=0
   10 CONTINUE
      STPTTALLY(1)=STPTS(1)
      IF (NBR.GE.2) THEN
         DO 20 CT1=2,NBR
            STPTTALLY(CT1)=STPTTALLY(CT1-1)+STPTS(CT1)
   20    CONTINUE
      ENDIF
      IF (STEPCONTROL.EQ.'N') THEN
       DO 50 CT1=1,AXNUM
         GRAMS(CT1)=FMASS*(NODES(CT1,2)/HTOT)
         DO 40 CT2=1,(STPTSUM-1)
            BURN=BUIN(CT1,(CT2+1))-BUIN(CT1,CT2)
            IF (NBR.GE.2) THEN
               DO 30 CT3=2,NBR
                  IF((CT2.LE.STPTTALLY(CT3)).AND.
     c               (CT2.GT.STPTTALLY(CT3-1))) THEN
                     CYCLENUMBER=CT3
                  ELSEIF (CT2.LE.STPTTALLY(1)) THEN
                     CYCLENUMBER=1
                  ENDIF
   30          CONTINUE
            ELSEIF (NBR.EQ.1) THEN
               CYCLENUMBER=1
            ENDIF
            IF (CYCLENUMBER.EQ.1) THEN
               STPTNUMBER=CT2
            ELSEIF (CYCLENUMBER.GT.1) THEN
               STPTNUMBER=CT2-STPTTALLY(CYCLENUMBER-1)
            ENDIF
            IF (STPTNUMBER.EQ.STPTS(CYCLENUMBER)) THEN
               DAYS=CYCLEN(CYCLENUMBER,1)-
     c         STPTDAT(CYCLENUMBER,STPTNUMBER,1)
            ELSE
               DAYS=STPTDAT(CYCLENUMBER,(STPTNUMBER+1),1)-
     c         STPTDAT(CYCLENUMBER,STPTNUMBER,1)
            ENDIF
            POWER(CT1,CT2)=BURN*GRAMS(CT1)*(1.0/1000.0)*(1/DAYS)
   40    CONTINUE
   50  CONTINUE
      ELSEIF (STEPCONTROL.EQ.'Y') THEN
       DO 100 CT1=1,AXNUM
         GRAMS(CT1)=FMASS*(NODES(CT1,2)/HTOT)
         DO 90 CT2=1,(STPTSUM-1)
            IF (NBR.GE.2) THEN
               DO 70 CT3=2,NBR
                  IF((CT2.LE.STPTTALLY(CT3)).AND.
     c               (CT2.GT.STPTTALLY(CT3-1))) THEN
                     CYCLENUMBER=CT3
                  ELSEIF (CT2.LE.STPTTALLY(1)) THEN
                     CYCLENUMBER=1
                  ENDIF
   70          CONTINUE
            ELSEIF (NBR.EQ.1) THEN
               CYCLENUMBER=1
            ENDIF
            IF (CYCLENUMBER.EQ.1) THEN
               STPTNUMBER=CT2
```

```
            ELSEIF (CYCLENUMBER.GT.1) THEN
               STPTNUMBER=CT2-STPTTALLY(CYCLENUMBER-1)
            ENDIF
            TOTALBURNDAYS=0.0
            DO 75 CT4=1,VARSTEPNUM(CYCLENUMBER,STPTNUMBER)
               TOTALBURNDAYS=TOTALBURNDAYS+
     c         VARBLETDOWN(CYCLENUMBER,STPTNUMBER,CT4,1)
   75        CONTINUE
            DO 80 CT4=1,VARSTEPNUM(CYCLENUMBER,STPTNUMBER)
               DAYS=VARBLETDOWN(CYCLENUMBER,STPTNUMBER,CT4,1)
               BURN=(BUIN(CT1,(CT2+1))-BUIN(CT1,CT2))*
     c         (DAYS/TOTALBURNDAYS)
               VARPOWER(CYCLENUMBER,STPTNUMBER,CT4,CT1)=BURN*
     c         GRAMS(CT1)*(1.0/1000.0)*(1/DAYS)
   80        CONTINUE
   90     CONTINUE
  100   CONTINUE
      ENDIF

      RETURN
      END


*************************************************************************
*     Subroutine to convert fuel temperature units and calculate        *
*     moderator specific volumes and densities with the correct units   *
*************************************************************************
      SUBROUTINE UNITS_CONVERSION (STPTSUM, AXNUM, FTFINAL,
     c FTIN, MODDENFINAL, MOIN, PRESS, MODTEMPFINAL, DENDAT)
*
      INTEGER*4 CT1, CT2, CT3, STPTSUM, AXNUM, COL1, COL2, ROW1, ROW2
*
      REAL FTFINAL(50,20), FTIN(50,20), MODDENFINAL(50,20), MOIN(50,20),
     c PRESS, DENDAT(29,10), P1, P2, DENCOL(29), T, MODTEMPFINAL(50,20)
*
      DO 50 CT1=1,STPTSUM
         DO 40 CT2=1,AXNUM
            FTFINAL(CT2,CT1)=((FTIN(CT2,CT1)-32.0)*(5.0/9.0))
     c                       +273.15
            MODDENFINAL(CT2,CT1)=(1/(MOIN(CT2,CT1)*62.42691))
            DO 10 CT3=2,10
               IF ((PRESS.LT.DENDAT(1,CT3)).AND.
     c         (PRESS.GT.DENDAT(1,(CT3+1)))) THEN
                  P1=DENDAT(1,CT3)
                  P2=DENDAT(1,(CT3+1))
                  COL1=CT3
                  COL2=(CT3+1)
               ELSEIF (PRESS.EQ.DENDAT(1,CT3)) THEN
                  P1=PRESS
                  P2=DENDAT(1,(CT3+1))
                  COL1=CT3
                  COL2=(CT3+1)
               ENDIF
   10       CONTINUE
            DO 20 CT3=2,29
               DENCOL(CT3)=((PRESS-P2)*((DENDAT(CT3,COL1)
     c         -DENDAT(CT3,COL2))/(P1-P2)))+DENDAT(CT3,COL2)
   20       CONTINUE
            DO 30 CT3=2,29
               IF ((MODDENFINAL(CT2,CT1).LT.DENCOL(CT3)).AND.
```

```
     c              (MODDENFINAL(CT2,CT1).GT.DENCOL(CT3+1))) THEN
                    ROW1=CT3
                    ROW2=CT3+1
                    T=(((MODDENFINAL(CT2,CT1)-DENCOL(ROW2))*
     c                (DENDAT(ROW1,1)-DENDAT(ROW2,1)))/(DENCOL(ROW1)
     c                -DENCOL(ROW2)))+DENDAT(ROW2,1)
                 ELSEIF ((MODDENFINAL(CT2,CT1)).EQ.DENCOL(CT3)) THEN
                    T=DENDAT(CT3,1)
                 ENDIF
   30         CONTINUE
              MODTEMPFINAL(CT2,CT1)=((T-32.0)*(5.0/9.0))+273.15
   40      CONTINUE
   50 CONTINUE

      RETURN
      END


*************************************************************************
*     SAS2H Input Deck Creation and Execution Control Subroutine        *
*************************************************************************
      SUBROUTINE EXECUTION_CONTROL (NBR, RELATIVE_STPT_NUM,
     c          CT1, CT2, CT3, AXNUM, CYCPOS, AXBLANK,
     c          BPDESID, CRINS, CRDES,
     c          CRMIXNUM, CRMIXID, CRNUMISOS, CRISOID,
     c          APSRINS, APSRMIXNUM, APSRMIXID,
     c          RELATIVE_APSR_MIX_ID, APSRNUMISOS,
     c          APSRISOID, ISN, IIM, ICM, IUS, PLEVEL,
     c          BPZONE, BPMA, CRZONE, CRMA,
     c          LMC, APSRZONE, APSRMA, LMD,
     c          BPTN, BPBN, STPTS, APSRDES,
     c          STPTDAT, AXBLANKRICH, GRAMS,
     c          NODES, RODS, RICH, FTFINAL,
     c          MODDENFINAL, MODTEMPFINAL,
     c          BLETDOWN, BPWTPCT, BPDEN, CRDEN,
     c          CRISOWTPCT, APSRDEN, APSRISOWTPCT,
     c          PITCH, FOD, COD, CID, SZF, EPS, PTC, MESH,
     c          BPRA, CRRA, LRC, APSRRA,
     c          LRD, POWER, CYCDOWN, PREFIX,
     c          NM, CYCLEID, REACT, LIB, AXBLANKET,
     c          FUELCLAD, BPRFLAG, CRSTAT, APSRSTAT, FLAG2,
     c          LUZONE, LMB, LRB, BPXSECT, BPRODS, CT1START,
     c          CT2START, STPTTALLY, CLADTOT, CLADDESNUM,
     c          CLADDESNAME, BPRCLAD, CRCLAD, APSRCLAD,
     c          CLTEMP, BPMIXNUM, BPMIX, BPMIXID,
     c          BPNUMISOS, BPISOID, BPISOWTPCT, UCSPACERFRAC,
     c          SPACERMAT, STEPCONTROL, VARBLETDOWN, VARSTEPNUM,
     c          VARPOWER, BPRFM, BPFMNUMISOS, BPFISOID,
     c          ABOVEBPNUM, APSRFM, BPRFR, BPFISOWTPCT,
     c          APSRFR, ABOVEBP, APSRFOLLOWMIX)
*
      INTEGER*4 CT1, CT2, CT3, NBR, RELATIVE_STPT_NUM,
     c          AXNUM, CYCPOS(10), AXBLANK(50),
     c          BPDESID(10), CRINS(10,20,23,50), CRDES(10,20,23,50),
     c          CRMIXNUM, CRMIXID(25), CRNUMISOS(25), CRISOID(25,10),
     c          APSRINS(10,20,23,50), APSRMIXNUM, APSRMIXID(25),
     c          RELATIVE_APSR_MIX_ID, APSRNUMISOS(25),
     c          APSRISOID(25,10), ISN, IIM, ICM, IUS, PLEVEL,
     c          BPZONE(10), BPMA(15,10), CRZONE(10), CRMA(15,10),
     c          LMC(15,10), APSRZONE(10), APSRMA(15,10), LMD(15,10),
```

```
      c          BPTN(10), BPBN(10), STPTS(10), APSRDES(10,20,23,50),
      c          BPRODS(10), SYSTEM, SASEXERESULT,
      c          CARRYCOUNTER, CT1START, CT2START, CT2GOVALUE,
      c          STPTTALLY(20), CT2ENDVALUE, CLADTOT, CLADDESNUM(10),
      c          BPRCLAD(10), CRCLAD(10), APSRCLAD(10), BPMIXNUM,
      c          BPMIX(10), BPMIXID(10), BPNUMISOS(20), BPISOID(10,20),
      c          VARSTEPNUM(10,20), BPRFM(15,10), BPFMNUMISOS(25),
      c          BPFISOID(25,10), ABOVEBPNUM(10), APSRFM(15,10),
      c          APSRFOLLOWMIX(10,20,23,50), APSRINSOLD(10,20,23,50)
*
       REAL      STPTDAT(10,20,3), AXBLANKRICH, GRAMS(50),
      c          NODES(50,2), RODS, RICH, FTFINAL(50,20),
      c          MODDENFINAL(50,20), MODTEMPFINAL(50,20),
      c          BLETDOWN(10,20,25), BPWTPCT(10), BPDEN(10), CRDEN(10),
      c          CRISOWTPCT(25,10), APSRDEN(10), APSRISOWTPCT(25,10),
      c          PITCH, FOD, COD, CID, SZF, EPS, PTC, MESH,
      c          BPRA(15,10), CRRA(15,10), LRC(15,10), APSRRA(15,10),
      c          LRD(15,10), POWER(50,20), CYCDOWN(10), BPXSECT(10),
      c          FINALDOWNTIME, MASSTOTAL, FUELISOWTPCT(1000),
      c          BPRAISOVALUE(2), LEFTVAL(1000), CLTEMP,
      c          BPISOWTPCT(10,20), UCSPACERFRAC,
      c          VARBLETDOWN(10,20,25,25), VARPOWER(10,20,25,50),
      c          BPRFR(15,10), BPFISOWTPCT(25,10), APSRFR(15,10)
*
       CHARACTER PREFIX*3, NM*31, CYCLEID(10)*2, REACT*21, LIB*15,
      c          AXBLANKET*1, FUELCLAD*10, BPRFLAG*1, CRSTAT*6,
      c          APSRSTAT*6, FLAG2*7, SASEXECOMMAND*33,
      c          PREVIOUSNAME*25, FUELISONAME(1000)*5,
      c          BPRAISONAME(2)*6, LEFTLIST(1000)*6,
      c          CLADDESNAME(10)*7, SPACERMAT*7, STEPCONTROL*1,
      c          ABOVEBP(10)*5
*
       LOGICAL  BPRA_INSERTED
*
       RELATIVE_STPT_NUM=0
       DO 30 CT3=1,AXNUM
        IF (CT1START.EQ.1) THEN
           RELATIVE_STPT_NUM=CT2START-1
        ELSE
           RELATIVE_STPT_NUM=STPTTALLY(CT1START-1)+CT2START-1
        ENDIF
        DO 20 CT1=CT1START,NBR
*  CT1 is the insertion cycle incrementer
          IF (CT1.EQ.CT1START) THEN
             CT2GOVALUE=CT2START
          ELSE
             CT2GOVALUE=1
          ENDIF
          IF (CT1.EQ.NBR) THEN
             CT2ENDVALUE=STPTS(CT1)-1
          ELSE
             CT2ENDVALUE=STPTS(CT1)
          ENDIF
*  CT2 is the statepoint incrementer within cycle CT1
          DO 10 CT2=CT2GOVALUE,CT2ENDVALUE
                RELATIVE_STPT_NUM=RELATIVE_STPT_NUM+1
                IF ((CT1.EQ.1).AND.(CT2.EQ.1)) THEN
                CALL STANDARD_WRITER (RELATIVE_STPT_NUM, CT1,
      c         CT2, CT3, AXNUM, CYCPOS, AXBLANK,
      c         BPDESID, CRINS, CRDES,
```

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c          CRMIXNUM, CRMIXID, CRNUMISOS, CRISOID,
c          APSRINS, APSRMIXNUM, APSRMIXID,
c          RELATIVE_APSR_MIX_ID, APSRNUMISOS,
c          APSRISOID, ISN, IIM, ICM, IUS, PLEVEL,
c          BPZONE, BPMA, CRZONE, CRMA,
c          LMC, APSRZONE, APSRMA, LMD,
c          BPTN, BPBN, STPTS, APSRDES,
c          STPTDAT, AXBLANKRICH, GRAMS,
c          NODES, RODS, RICH, FTFINAL,
c          MODDENFINAL, MODTEMPFINAL,
c          BLETDOWN, BPWTPCT, BPDEN, CRDEN,
c          CRISOWTPCT, APSRDEN, APSRISOWTPCT,
c          PITCH, FOD, COD, CID, SZF, EPS, PTC, MESH,
c          BPRA, CRRA, LRC, APSRRA,
c          LRD, POWER, CYCDOWN, PREFIX,
c          NM, CYCLEID, REACT, LIB, AXBLANKET,
c          FUELCLAD, BPRFLAG, CRSTAT, APSRSTAT, FLAG2,
c          LUZONE, LMB, LRB, PREVIOUSNAME, FINALDOWNTIME,
c          BPRA_INSERTED, CLADTOT, CLADDESNUM,
c          CLADDESNAME, BPRCLAD, CRCLAD, APSRCLAD,
c          CLTEMP, BPMIXNUM, BPMIX, BPMIXID,
c          BPNUMISOS, BPISOID, BPISOWTPCT, UCSPACERFRAC,
c          SPACERMAT, STEPCONTROL, VARBLETDOWN, VARSTEPNUM,
c          VARPOWER, BPRFM, BPFMNUMISOS, BPFISOID,
c          ABOVEBPNUM, APSRFM, BPRFR, BPFISOWTPCT,
c          APSRFR, ABOVEBP, APSRFOLLOWMIX, CT1START,
c          CT2GOVALUE, APSRINSOLD)
           SASEXECOMMAND(1:8)='batch43 '
           SASEXECOMMAND(9:33)=NM(1:25)
           SASEXERESULT=SYSTEM(SASEXECOMMAND)
           IF (SASEXERESULT.LT.0) THEN
              WRITE (*,*) 'AN ERROR OCCURRED DURING SAS2H',
c             'EXECUTION OF ', NM(1:25)
           ENDIF
           CALL CUTTER (NM)
        ELSE
           CALL CONTINUATION_WRITER (RELATIVE_STPT_NUM,
c          CT1, CT2, CT3, AXNUM, CYCPOS, AXBLANK, BPDESID,
c          CRINS, CRDES, CRMIXNUM, CRMIXID,
c          CRNUMISOS, CRISOID, APSRINS,
c          APSRMIXNUM, APSRMIXID, RELATIVE_APSR_MIX_ID,
c          APSRNUMISOS, APSRISOID, ISN, IIM, ICM, IUS,
c          PLEVEL, BPZONE, BPMA, CRZONE, CRMA,
c          LMC, APSRZONE, APSRMA, LMD,
c          BPTN, BPBN, STPTS, APSRDES,
c          STPTDAT, AXBLANKRICH, GRAMS,
c          NODES, RODS, RICH, FTFINAL, MODDENFINAL,
c          MODTEMPFINAL, BLETDOWN, BPWTPCT,
c          BPDEN, CRDEN, CRISOWTPCT, APSRDEN,
c          APSRISOWTPCT, PITCH, FOD, COD, CID, SZF,
c          EPS, PTC, MESH, BPRA, CRRA, LRC, APSRRA,
c          LRD, POWER, CYCDOWN, PREFIX, NM,
c          CYCLEID, REACT, LIB, AXBLANKET, FUELCLAD,
c          BPRFLAG, CRSTAT, APSRSTAT, FLAG2, LUZONE,
c          LMB, LRB, MASSTOTAL, FUELISONAME, FUELISOWTPCT,
c          BPRAISONAME, BPRAISOVALUE, LEFTLIST, CARRYCOUNTER,
c          BPXSECT, BPRODS, PREVIOUSNAME, FINALDOWNTIME,
c          LEFTVAL, BPRA_INSERTED, CLADTOT, CLADDESNUM,
c          CLADDESNAME, BPRCLAD, CRCLAD, APSRCLAD,
c          CLTEMP, BPMIXNUM, BPMIX, BPMIXID,
```

```
     c          BPNUMISOS, BPISOID, BPISOWTPCT, UCSPACERFRAC,
     c          SPACERMAT, STEPCONTROL, VARBLETDOWN, VARSTEPNUM,
     c          VARPOWER, BPRFM, BPFMNUMISOS, BPFISOID,
     c          ABOVEBPNUM, APSRFM, BPRFR, BPFISOWTPCT,
     c          APSRFR, ABOVEBP, APSRFOLLOWMIX, CT1START,
     c          CT2GOVALUE, APSRINSOLD)
                SASEXECOMMAND(1:8)='batch43 '
                SASEXECOMMAND(9:33)=NM(1:25)
                SASEXERESULT=SYSTEM(SASEXECOMMAND)
                IF (SASEXERESULT.LT.0) THEN
                   WRITE (*,*) 'AN ERROR OCCURRED DURING SAS2H',
     c             'EXECUTION OF ', NM(1:25)
                ENDIF
                CALL CUTTER (NM)
             ENDIF
  10      CONTINUE
  20    CONTINUE
  30  CONTINUE

      RETURN
      END


*************************************************************************
*     Subroutine to write standard beginning of assembly life           *
*     SAS2H input decks                                                 *
*************************************************************************
      SUBROUTINE STANDARD_WRITER (RELATIVE_STPT_NUM, CT1, CT2, CT3,
     c AXNUM, CYCPOS, AXBLANK, BPDESID,
     c CRINS, CRDES, CRMIXNUM, CRMIXID,
     c CRNUMISOS, CRISOID, APSRINS,
     c APSRMIXNUM, APSRMIXID, RELATIVE_APSR_MIX_ID,
     c APSRNUMISOS, APSRISOID, ISN, IIM, ICM, IUS,
     c PLEVEL, BPZONE, BPMA, CRZONE, CRMA,
     c LMC, APSRZONE, APSRMA, LMD,
     c BPTN, BPBN, STPTS, APSRDES,
     c STPTDAT, AXBLANKRICH, GRAMS,
     c NODES, RODS, RICH, FTFINAL, MODDENFINAL,
     c MODTEMPFINAL, BLETDOWN, BPWTPCT,
     c BPDEN, CRDEN, CRISOWTPCT, APSRDEN,
     c APSRISOWTPCT, PITCH, FOD, COD, CID, SZF, EPS, PTC,
     c MESH, BPRA, CRRA, LRC, APSRRA,
     c LRD, POWER, CYCDOWN, PREFIX, NM,
     c CYCLEID, REACT, LIB, AXBLANKET, FUELCLAD,
     c BPRFLAG, CRSTAT, APSRSTAT, FLAG2, LUZONE, LMB, LRB,
     c PREVIOUSNAME, FINALDOWNTIME, BPRA_INSERTED, CLADTOT,
     c CLADDESNUM, CLADDESNAME, BPRCLAD, CRCLAD, APSRCLAD,
     c CLTEMP, BPMIXNUM, BPMIX, BPMIXID,
     c BPNUMISOS, BPISOID, BPISOWTPCT, UCSPACERFRAC,
     c SPACERMAT, STEPCONTROL, VARBLETDOWN, VARSTEPNUM,
     c VARPOWER, BPRFM, BPFMNUMISOS, BPFISOID,
     c ABOVEBPNUM, APSRFM, BPRFR, BPFISOWTPCT,
     c APSRFR, ABOVEBP, APSRFOLLOWMIX, CT1START, CT2GOVALUE,
     c APSRINSOLD)
*
      INTEGER*4 RELATIVE_STPT_NUM, CT1, CT2, CT3, AXNUM,
     c NUMSTPT1, NUMSTPT2, NUMSTPT3, CYCPOS(10), AXBLANK(50),
     c BPDESID(10), BPRA_DESCRIPTION_ID, CT4, CT5, CRINS(10,20,23,50),
     c CR_MIXTURE_ID, CR_DESCRIPTION, CRDES(10,20,23,50), CRMIXNUM,
     c CRMIXID(25), RELATIVE_CR_MIX_ID, CRNUMISOS(25),
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```
      c CRISOID(25,10), APSRINS(10,20,23,50), APSR_MIXTURE_ID,
      c APSR_DESCRIPTION, APSRMIXNUM, APSRMIXID(25),
      c RELATIVE_APSR_MIX_ID, APSRNUMISOS(25), APSRISOID(25,10),
      c ISN, IIM, ICM, IUS, PLEVEL, BPZONE(10), BPMA(15,10),
      c CRZONE(10), CRMA(15,10), LMC(15,10), APSRZONE(10),
      c APSRMA(15,10), LMD(15,10), BPTN(10), BPBN(10), STPTS(10),
      c APSRDES(10,20,23,50), LUZONE, LMB(15), NUMSTPT4, NUMSTPT5,
      c NUMSTPT6, CLADTOT, CLADDESNUM(10), BPRCLAD(10), CRCLAD(10),
      c APSRCLAD(10), APSRCLNUM, CRCLNUM, BPRCLNUM, BPMIXNUM,
      c BPMIX(10), BPMIXID(10), BPNUMISOS(20), BPISOID(10,20),
      c VARSTEPNUM(10,20), BPRFM(15,10), BPFMNUMISOS(25),
      c BPFISOID(25,10), ABOVEBPNUM(10), APSRFM(15,10),
      c APSRFOLLOWMIX(10,20,23,50), FOLNODKEEP,
      c FOLSTEPKEEP, APSRFOLNUM, APSRFOLLOWDATA(10,20,23,50),
      c CT1START, CT2GOVALUE, APSRINSOLD(10,20,23,50)
*
       REAL STPTDAT(10,20,3), ENR, AXBLANKRICH, OXYGMS, GRAMS(50),
      c UO2GMS, FVOL, PI, NODES(50,2), RODS, FDEN, WT234,
      c WT235, WT236, WT238, RICH, FTFINAL(50,20),
      c MODDENFINAL(50,20), MODTEMPFINAL(50,20), BLETDOWN(10,20,25),
      c BPWTPCT(10), BPDEN(10), ALFRAC, OFRAC, CRDEN(10),
      c CRISOWTPCT(25,10), APSRDEN(10), APSRISOWTPCT(25,10),
      c PITCH, FOD, COD, CID, SZF, EPS, PTC, MESH, BPRA(15,10),
      c CRRA(15,10), LRC(15,10), APSRRA(15,10), LRD(15,10),
      c DOWNTIME, BORON_FRACTION, POWER(50,20), CYCDOWN(10), LRB(15),
      c FINALDOWNTIME, CLTEMP, BPISOWTPCT(10,20), UCSPACERFRAC,
      c BORATEDMODVF, BORONVF, UCMODREGIONDEN,
      c VARBLETDOWN(10,20,25,25), VARPOWER(10,20,25,50),
      c BPRFR(15,10), BPFISOWTPCT(25,10), APSRFR(15,10)
*
       CHARACTER CHNODE*2, CHID*2, PREFIX*3, CHSTPT1*1, CHSTPT2*1,
      c CHSTPT3*1, NM*31, CYCLEID(10)*2, REACT*21, LIB*15,
      c AXBLANKET*1, FUELCLAD*10, BPRFLAG*1, CRSTAT*6, APSRSTAT*6,
      c FLAG2*7, IRRAD_STEPS*2, PLEVELCH*2, BPZONECH*2, CRZONECH*2,
      c APSRZONECH*2, LUZONECH*2, PREVIOUSNAME*25, ASSYPOSITION*2,
      c CHSTPT4*1, CHSTPT5*1, CHSTPT6*1, CLADDESNAME(10)*7,
      c SPACERMAT*7, STEPCONTROL*1, ABOVEBP(10)*5
*
       LOGICAL BPRA_INSERTED, CR_INSERTED, CRCOMPFLAG, APSR_INSERTED,
      c APSRCOMPFLAG, BPRA_FOLLOW, APSRBOTFLAG, FOLLOWIN
*
       PI=3.14159265359
*  Determination of the input deck filename
           CALL ZEROS(CT3,CHNODE)
           CALL ZEROS(CYCPOS(CT1),CHID)
           NUMSTPT1=INT(STPTDAT(CT1,CT2,1)/100.0)
           CHSTPT1=CHAR(NUMSTPT1+48)
           NUMSTPT2=INT((STPTDAT(CT1,CT2,1)-(NUMSTPT1*100))/10.0)
           CHSTPT2=CHAR(NUMSTPT2+48)
           NUMSTPT3=INT((STPTDAT(CT1,CT2,1)-(NUMSTPT1*100)-
      c    (NUMSTPT2*10)))
           CHSTPT3=CHAR(NUMSTPT3+48)
           IF (CT2.LT.STPTS(CT1)) THEN
              NUMSTPT4=INT(STPTDAT(CT1,(CT2+1),1)/100.0)
              CHSTPT4=CHAR(NUMSTPT4+48)
              NUMSTPT5=INT((STPTDAT(CT1,(CT2+1),1)-(NUMSTPT4*100))/10.0)
              CHSTPT5=CHAR(NUMSTPT5+48)
              NUMSTPT6=INT((STPTDAT(CT1,(CT2+1),1)-(NUMSTPT4*100)-
      c       (NUMSTPT5*10)))
              CHSTPT6=CHAR(NUMSTPT6+48)
```

```
         ELSEIF (CT2.EQ.STPTS(CT1)) THEN
            NUMSTPT4=INT(STPTDAT((CT1+1),1,1)/100.0)
            CHSTPT4=CHAR(NUMSTPT4+48)
            NUMSTPT5=INT((STPTDAT((CT1+1),1,1)-(NUMSTPT4*100))/10.0)
            CHSTPT5=CHAR(NUMSTPT5+48)
            NUMSTPT6=INT((STPTDAT((CT1+1),1,1)-(NUMSTPT4*100)-
     c      (NUMSTPT5*10)))
            CHSTPT6=CHAR(NUMSTPT6+48)
         ENDIF
         NM(1:3)=PREFIX
         NM(4:4)='A'
         NM(5:6)=CHID
         NM(7:7)='N'
         NM(8:9)=CHNODE
         NM(10:11)='DC'
         NM(12:13)=CYCLEID(CT1)
         NM(14:14)='T'
         NM(15:15)=CHSTPT1
         NM(16:16)=CHSTPT2
         NM(17:17)=CHSTPT3
         NM(18:19)='AC'
         IF (CT2.EQ.STPTS(CT1)) THEN
            NM(20:21)=CYCLEID(CT1+1)
         ELSE
            NM(20:21)=CYCLEID(CT1)
         ENDIF
         NM(22:22)='T'
         NM(23:23)=CHSTPT4
         NM(24:24)=CHSTPT5
         NM(25:25)=CHSTPT6
         NM(26:31)='.input'
         PREVIOUSNAME=NM(1:25)
*  Open and rewind the input deck file
         OPEN(UNIT=100, FILE=NM, STATUS='UNKNOWN')
         REWIND(UNIT=100)
*  Write first section of input deck
         WRITE (100,10)
   10    FORMAT ('=sas2h',T11,'parm=skipshipdata')
         IF (CT2.LT.STPTS(CT1)) THEN
            WRITE (100,20) REACT, CHID, CHNODE,
     c      NM(12:13), STPTDAT(CT1,CT2,1), NM(20:21),
     c      STPTDAT(CT1,(CT2+1),1)
   20       FORMAT (A21,1X,'Assy-',A2,
     c      ', Node-',A2,1X,
     c      '{Cyc-',A2,', 'F5.1,' to Cyc-',
     c      A2,', ',F5.1,' EFPD}')
         ELSEIF (CT2.EQ.STPTS(CT1)) THEN
            WRITE (100,25) REACT, CHID, CHNODE,
     c      NM(12:13), STPTDAT(CT1,CT2,1), NM(20:21),
     c      STPTDAT((CT1+1),1,1)
   25       FORMAT (A21,1X,'Assy-',A2,
     c      ', Node-',A2,1X,
     c      '{Cyc-',A2,', 'F5.1,' to Cyc-',
     c      A2,', ',F5.1,' EFPD}')
         ENDIF
         WRITE (100,30) LIB
   30    FORMAT (A15,1X,'latticecell')
         WRITE (100,40)
   40    FORMAT ('''')
         WRITE (100,50)
```

```
   50     FORMAT ('''   fuel density based on mass of uranium per',
     c    ' assembly',T56,'& total pellet stack')
          WRITE (100,60)
   60     FORMAT ('''   volume to account for fuel volume loss to',
     c    ' pellet c',T55,'hamfers')
          WRITE (100,70)
   70     FORMAT ('''')
*  Write second section of input deck (material specifications)
          WRITE (100,80)
   80     FORMAT ('''',5X,'material specification input')
          WRITE (100,90)
   90     FORMAT ('''')
*  Calculate initital fuel parameters depending upon whether or not the
*  node represents axial blanket fuel
          IF ((AXBLANKET.EQ.'Y').AND.(AXBLANK(CT3).EQ.1)) THEN
             ENR=AXBLANKRICH
             OXYGMS=(GRAMS(CT3)*2*15.994915)/(((ENR/100)*235.043915)+
      c      (((0.007731*((ENR)**1.0837))/100)*234.040904)+
      c      (((0.0046*ENR)/100)*236.045637)+(((100-(0.007731*
      c      (ENR**1.0837))-(ENR)-(0.0046*ENR))/100)*238.05077))
             UO2GMS=GRAMS(CT3)+OXYGMS
             FVOL=(PI/4)*(FOD**2)*(NODES(CT3,2))*(RODS)
             FDEN=UO2GMS/FVOL
             WT234=0.007731*(ENR**1.0837)
             WT235=ENR
             WT236=0.0046*ENR
             WT238=100.0-WT234-ENR-WT236
          ELSE
             ENR=RICH
             OXYGMS=(GRAMS(CT3)*2*15.994915)/(((ENR/100)*235.043915)+
      c      (((0.007731*((ENR)**1.0837))/100)*234.040904)+
      c      (((0.0046*ENR)/100)*236.045637)+(((100-(0.007731*
      c      (ENR**1.0837))-(ENR)-(0.0046*ENR))/100)*238.05077))
             UO2GMS=GRAMS(CT3)+OXYGMS
             FVOL=(PI/4)*(FOD**2)*(NODES(CT3,2))*(RODS)
             FDEN=UO2GMS/FVOL
             WT234=0.007731*(ENR**1.0837)
             WT235=ENR
             WT236=0.0046*ENR
             WT238=100.0-WT234-ENR-WT236
          ENDIF
*  Write fuel composition input description
          IF (FDEN.LT.(10.0)) THEN
             WRITE (100,100) FDEN, FTFINAL(CT3,RELATIVE_STPT_NUM), WT234,
      c      WT235, WT236, WT238
  100        FORMAT ('uo2 1 den=',F5.3,1X,'1',1X,F6.1,1X,'92234',1X,F5.3,
      c      1X,'92235',1X,F5.3,1X,'92236',1X,F5.3,1X,'92238',1X,F6.3,1X,
      c      'end')
          ELSE
             WRITE (100,110) FDEN, FTFINAL(CT3,RELATIVE_STPT_NUM), WT234,
      c      WT235, WT236, WT238
  110        FORMAT ('uo2 1 den=',F6.3,1X,'1',1X,F6.1,1X,'92234',1X,F5.3,
      c      1X,'92235',1X,F5.3,1X,'92236',1X,F5.3,1X,'92238',1X,F6.3,1X,
      c      'end')
          ENDIF
          WRITE (100,120) FTFINAL(CT3,RELATIVE_STPT_NUM)
  120     FORMAT ('kr-83        1   0   1-21   ',F6.1,'   end')
          WRITE (100,130) FTFINAL(CT3,RELATIVE_STPT_NUM)
  130     FORMAT ('kr-85        1   0   1-21   ',F6.1,'   end')
          WRITE (100,140) FTFINAL(CT3,RELATIVE_STPT_NUM)
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140     FORMAT ('sr-90        1   0   1-21    ',F6.1,'   end')
        WRITE (100,150) FTFINAL(CT3,RELATIVE_STPT_NUM)
150     FORMAT ('y-89         1   0   1-21    ',F6.1,'   end')
        WRITE (100,160) FTFINAL(CT3,RELATIVE_STPT_NUM)
160     FORMAT ('mo-95        1   0   1-21    ',F6.1,'   end')
        WRITE (100,170) FTFINAL(CT3,RELATIVE_STPT_NUM)
170     FORMAT ('zr-93        1   0   1-21    ',F6.1,'   end')
        WRITE (100,180) FTFINAL(CT3,RELATIVE_STPT_NUM)
180     FORMAT ('zr-94        1   0   1-21    ',F6.1,'   end')
        WRITE (100,190) FTFINAL(CT3,RELATIVE_STPT_NUM)
190     FORMAT ('zr-95        1   0   1-21    ',F6.1,'   end')
        WRITE (100,200) FTFINAL(CT3,RELATIVE_STPT_NUM)
200     FORMAT ('nb-94        1   0   1-21    ',F6.1,'   end')
        WRITE (100,210) FTFINAL(CT3,RELATIVE_STPT_NUM)
210     FORMAT ('tc-99        1   0   1-21    ',F6.1,'   end')
        WRITE (100,220) FTFINAL(CT3,RELATIVE_STPT_NUM)
220     FORMAT ('rh-103       1   0   1-21    ',F6.1,'   end')
        WRITE (100,230) FTFINAL(CT3,RELATIVE_STPT_NUM)
230     FORMAT ('rh-105       1   0   1-21    ',F6.1,'   end')
        WRITE (100,240) FTFINAL(CT3,RELATIVE_STPT_NUM)
240     FORMAT ('ru-101       1   0   1-21    ',F6.1,'   end')
        WRITE (100,250) FTFINAL(CT3,RELATIVE_STPT_NUM)
250     FORMAT ('ru-106       1   0   1-21    ',F6.1,'   end')
        WRITE (100,260) FTFINAL(CT3,RELATIVE_STPT_NUM)
260     FORMAT ('pd-105       1   0   1-21    ',F6.1,'   end')
        WRITE (100,270) FTFINAL(CT3,RELATIVE_STPT_NUM)
270     FORMAT ('pd-108       1   0   1-21    ',F6.1,'   end')
        WRITE (100,280) FTFINAL(CT3,RELATIVE_STPT_NUM)
280     FORMAT ('ag-109       1   0   1-21    ',F6.1,'   end')
        WRITE (100,290) FTFINAL(CT3,RELATIVE_STPT_NUM)
290     FORMAT ('sb-124       1   0   1-21    ',F6.1,'   end')
        WRITE (100,300) FTFINAL(CT3,RELATIVE_STPT_NUM)
300     FORMAT ('xe-131       1   0   1-21    ',F6.1,'   end')
        WRITE (100,310) FTFINAL(CT3,RELATIVE_STPT_NUM)
310     FORMAT ('xe-132       1   0   1-21    ',F6.1,'   end')
        WRITE (100,320) FTFINAL(CT3,RELATIVE_STPT_NUM)
320     FORMAT ('xe-135       1   0   1-21    ',F6.1,'   end')
        WRITE (100,330) FTFINAL(CT3,RELATIVE_STPT_NUM)
330     FORMAT ('xe-136       1   0   1-21    ',F6.1,'   end')
        WRITE (100,340) FTFINAL(CT3,RELATIVE_STPT_NUM)
340     FORMAT ('cs-134       1   0   1-21    ',F6.1,'   end')
        WRITE (100,350) FTFINAL(CT3,RELATIVE_STPT_NUM)
350     FORMAT ('cs-135       1   0   1-21    ',F6.1,'   end')
        WRITE (100,360) FTFINAL(CT3,RELATIVE_STPT_NUM)
360     FORMAT ('cs-137       1   0   1-21    ',F6.1,'   end')
        WRITE (100,370) FTFINAL(CT3,RELATIVE_STPT_NUM)
370     FORMAT ('ba-136       1   0   1-21    ',F6.1,'   end')
        WRITE (100,380) FTFINAL(CT3,RELATIVE_STPT_NUM)
380     FORMAT ('la-139       1   0   1-21    ',F6.1,'   end')
        WRITE (100,390) FTFINAL(CT3,RELATIVE_STPT_NUM)
390     FORMAT ('ce-144       1   0   1-21    ',F6.1,'   end')
        WRITE (100,400) FTFINAL(CT3,RELATIVE_STPT_NUM)
400     FORMAT ('nd-143       1   0   1-21    ',F6.1,'   end')
        WRITE (100,410) FTFINAL(CT3,RELATIVE_STPT_NUM)
410     FORMAT ('nd-145       1   0   1-21    ',F6.1,'   end')
        WRITE (100,420) FTFINAL(CT3,RELATIVE_STPT_NUM)
420     FORMAT ('pm-147       1   0   1-21    ',F6.1,'   end')
        WRITE (100,430) FTFINAL(CT3,RELATIVE_STPT_NUM)
430     FORMAT ('pm-148       1   0   1-21    ',F6.1,'   end')
        WRITE (100,440) FTFINAL(CT3,RELATIVE_STPT_NUM)
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  440     FORMAT ('nd-147       1   0   1-21   ',F6.1,'   end')
          WRITE (100,450) FTFINAL(CT3,RELATIVE_STPT_NUM)
  450     FORMAT ('sm-147       1   0   1-21   ',F6.1,'   end')
          WRITE (100,460) FTFINAL(CT3,RELATIVE_STPT_NUM)
  460     FORMAT ('sm-149       1   0   1-21   ',F6.1,'   end')
          WRITE (100,470) FTFINAL(CT3,RELATIVE_STPT_NUM)
  470     FORMAT ('sm-150       1   0   1-21   ',F6.1,'   end')
          WRITE (100,480) FTFINAL(CT3,RELATIVE_STPT_NUM)
  480     FORMAT ('sm-151       1   0   1-21   ',F6.1,'   end')
          WRITE (100,490) FTFINAL(CT3,RELATIVE_STPT_NUM)
  490     FORMAT ('sm-152       1   0   1-21   ',F6.1,'   end')
          WRITE (100,500) FTFINAL(CT3,RELATIVE_STPT_NUM)
  500     FORMAT ('gd-155       1   0   1-21   ',F6.1,'   end')
          WRITE (100,510) FTFINAL(CT3,RELATIVE_STPT_NUM)
  510     FORMAT ('eu-153       1   0   1-21   ',F6.1,'   end')
          WRITE (100,520) FTFINAL(CT3,RELATIVE_STPT_NUM)
  520     FORMAT ('eu-154       1   0   1-21   ',F6.1,'   end')
          WRITE (100,530) FTFINAL(CT3,RELATIVE_STPT_NUM)
  530     FORMAT ('eu-155       1   0   1-21   ',F6.1,'   end')
*  Write cladding material specifications
*  Additional cladding material specifications may be added to the
*  following IF statement as required
          IF ((FUELCLAD.EQ.'ZIRC-4    ').OR.
     c    (FUELCLAD.EQ.'ZIRCALLOY4')) THEN
             WRITE (100,532)
  532        FORMAT ('arbm-zirc4 6.56 5 0 0 0 8016 0.12 24000',
     c       ' 0.10 26000 0.20 50000 1.40')
             WRITE (100,535) CLTEMP
  535        FORMAT (T12,'40000 98.18 2 1.0 ',F5.1,' end')
          ELSEIF (FUELCLAD.EQ.'SS304     ') THEN
             WRITE (100,537)
  537        FORMAT ('arbm-ss304 7.92 4 0 0 0 24304 19.0 25055',
     c       ' 2.0 26304 69.5 28304 9.5')
             WRITE (100,540) CLTEMP
  540        FORMAT (T12,'2 1.0 ',F5.1,' end')
          ELSEIF (FUELCLAD.EQ.'SS304S    ') THEN
             WRITE (100,542)
  542        FORMAT ('arbm-ss304s 7.92 4 0 0 0 24000 19.0 25055',
     c       ' 2.0 26000 69.5 28000 9.5')
             WRITE (100,545) CLTEMP
  545        FORMAT (T13,'2 1.0 ',F5.1,' end')
          ELSEIF (FUELCLAD.EQ.'SS316     ') THEN
             WRITE (100,547)
  547        FORMAT ('arbm-ss316 7.75 7 0 0 0 6012 0.08 14000',
     c       ' 1.0 24304 17.0 25055 2.0')
             WRITE (100,550)
  550        FORMAT (T12,'26304 65.42 28304 12.0 42000 2.5')
             WRITE (100,552) CLTEMP
  552        FORMAT (T12,'2 1.0 ',F5.1,' end')
          ELSEIF (FUELCLAD.EQ.'SS316S    ') THEN
             WRITE (100,555)
  555        FORMAT ('arbm-ss316s 7.75 7 0 0 0 6012 0.08 14000',
     c       ' 1.0 24000 17.0 25055 2.0')
             WRITE (100,557)
  557        FORMAT (T13,'26000 65.42 28000 12.0 42000 2.5')
             WRITE (100,559) CLTEMP
  559        FORMAT (T13,'2 1.0 ',F5.1,' end')
          ENDIF
*  Write moderator material specifications
          BORATEDMODVF=1.0-UCSPACERFRAC
```

```
      IF (STEPCONTROL.EQ.'N') THEN
         BORONVF=BLETDOWN(CT1,CT2,3)*(1E-6)*BORATEDMODVF
      ELSEIF (STEPCONTROL.EQ.'Y') THEN
         BORONVF=VARBLETDOWN(CT1,CT2,1,2)*(1E-6)*BORATEDMODVF
      ENDIF
      WRITE (100,560)
560   FORMAT ('''')
      IF ((SPACERMAT.EQ.'ZIRC-4 ').AND.
     c (UCSPACERFRAC.GT.(0.0))) THEN
         WRITE (100,561)
561      FORMAT ('''     material composition of moderator',
     c   ' within unit cell')
         WRITE (100,562)
562      FORMAT ('''     with smeared zirc-4 spacer grids')
         UCMODREGIONDEN=(MODDENFINAL(CT3,RELATIVE_STPT_NUM)*
     c   BORATEDMODVF)+(6.56*UCSPACERFRAC)
         IF (MODDENFINAL(CT3,RELATIVE_STPT_NUM).LT.(1.0)) THEN
            WRITE (100,563) UCMODREGIONDEN, BORATEDMODVF,
     c      MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
563         FORMAT ('h2o   3   den=',F5.4,3X,F6.5,3X,F7.1,3X,'end')
         ELSE
            WRITE (100,564) UCMODREGIONDEN, BORATEDMODVF,
     c      MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
564         FORMAT ('h2o   3   den=',F6.4,3X,F6.5,3X,F7.1,3X,'end')
         ENDIF
         WRITE (100,565) UCMODREGIONDEN, BORONVF,
     c   MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
565      FORMAT ('arbm-bormod',3X,F6.4,1X,'1 0 0 0 5000 100 3',
     c   1X,F6.5,1X,F7.1,1X,'end')
         WRITE (100,566) UCMODREGIONDEN
566      FORMAT ('arbm-spacer',3X,F6.4,1X,'5 0 0 0 8016 0.12',
     c   ' 24000 0.10 26000 0.25')
         WRITE (100,567) UCSPACERFRAC,
     c   MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
567      FORMAT (T17'50000 1.40 40000 98.18 3',1X,F6.5,1X,
     c   F7.1,1X,'end')
      ELSEIF ((SPACERMAT.EQ.'INCONEL').AND.
     c (UCSPACERFRAC.GT.(0.0))) THEN
         WRITE (100,568)
568      FORMAT ('''     material composition of moderator',
     c   ' within unit cell')
         WRITE (100,569)
569      FORMAT ('''     with smeared inconel spacer grids')
         UCMODREGIONDEN=(MODDENFINAL(CT3,RELATIVE_STPT_NUM)*
     c   BORATEDMODVF)+(8.3*UCSPACERFRAC)
         IF (MODDENFINAL(CT3,RELATIVE_STPT_NUM).LT.(1.0)) THEN
            WRITE (100,570) UCMODREGIONDEN, BORATEDMODVF,
     c      MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
570         FORMAT ('h2o   3   den=',F5.4,3X,F6.5,3X,F7.1,3X,'end')
         ELSE
            WRITE (100,571) UCMODREGIONDEN, BORATEDMODVF,
     c      MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
571         FORMAT ('h2o   3   den=',F6.4,3X,F6.5,3X,F7.1,3X,'end')
         ENDIF
         WRITE (100,572) UCMODREGIONDEN, BORONVF,
     c   MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
572      FORMAT ('arbm-bormod',3X,F6.4,1X,'1 0 0 0 5000 100 3',
     c   1X,F6.5,1X,F7.1,1X,'end')
         WRITE (100,573) UCMODREGIONDEN
573      FORMAT ('arbm-spacer',3X,F6.4,1X,'5 0 0 0 14000 2.5',
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     c       ' 22000 2.5 24000 15.0')
             WRITE (100,574) UCSPACERFRAC,
     c       MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
   574       FORMAT (T17'26000 7.0 28000 73.0 3',1X,F6.5,1X,
     c       F7.1,1X,'end')
           ELSEIF ((SPACERMAT.EQ.'SS316  ').AND.
     c     (UCSPACERFRAC.GT.(0.0))) THEN
             WRITE (100,575)
   575       FORMAT ('''     material composition of moderator',
     c       ' within unit cell')
             WRITE (100,576)
   576       FORMAT ('''     with smeared ss316 spacer grids')
             UCMODREGIONDEN=(MODDENFINAL(CT3,RELATIVE_STPT_NUM)*
     c       BORATEDMODVF)+(7.75*UCSPACERFRAC)
             IF (MODDENFINAL(CT3,RELATIVE_STPT_NUM).LT.(1.0)) THEN
               WRITE (100,577) UCMODREGIONDEN, BORATEDMODVF,
     c         MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
   577         FORMAT ('h2o   3   den=',F5.4,3X,F6.5,3X,F7.1,3X,'end')
             ELSE
               WRITE (100,578) UCMODREGIONDEN, BORATEDMODVF,
     c         MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
   578         FORMAT ('h2o   3   den=',F6.4,3X,F6.5,3X,F7.1,3X,'end')
             ENDIF
             WRITE (100,579) UCMODREGIONDEN, BORONVF,
     c       MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
   579       FORMAT ('arbm-bormod',3X,F6.4,1X,'1 0 0 0 5000 100 3',
     c       1X,F6.5,1X,F7.1,1X,'end')
             WRITE (100,580) UCMODREGIONDEN
   580       FORMAT ('arbm-spacer',3X,F6.4,1X,'7 0 0 0 6012 0.08',
     c       ' 14000 1.0 24304 17.0 25055 2.0')
             WRITE (100,581) UCSPACERFRAC,
     c       MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
   581       FORMAT (T5'26304 65.42 28304 12.0 42000 2.5 3',1X,F6.5,1X,
     c       F7.1,1X,'end')
           ELSEIF ((SPACERMAT.EQ.'SS316S ').AND.
     c     (UCSPACERFRAC.GT.(0.0))) THEN
             WRITE (100,582)
   582       FORMAT ('''     material composition of moderator',
     c       ' within unit cell')
             WRITE (100,583)
   583       FORMAT ('''     with smeared ss316s spacer grids')
             UCMODREGIONDEN=(MODDENFINAL(CT3,RELATIVE_STPT_NUM)*
     c       BORATEDMODVF)+(7.75*UCSPACERFRAC)
             IF (MODDENFINAL(CT3,RELATIVE_STPT_NUM).LT.(1.0)) THEN
               WRITE (100,584) UCMODREGIONDEN, BORATEDMODVF,
     c         MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
   584         FORMAT ('h2o   3   den=',F5.4,3X,F6.5,3X,F7.1,3X,'end')
             ELSE
               WRITE (100,585) UCMODREGIONDEN, BORATEDMODVF,
     c         MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
   585         FORMAT ('h2o   3   den=',F6.4,3X,F6.5,3X,F7.1,3X,'end')
             ENDIF
             WRITE (100,586) UCMODREGIONDEN, BORONVF,
     c       MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
   586       FORMAT ('arbm-bormod',3X,F6.4,1X,'1 0 0 0 5000 100 3',
     c       1X,F6.5,1X,F7.1,1X,'end')
             WRITE (100,587) UCMODREGIONDEN
   587       FORMAT ('arbm-spacer',3X,F6.4,1X,'7 0 0 0 6012 0.08',
     c       ' 14000 1.0 24000 17.0 25055 2.0')
             WRITE (100,588) UCSPACERFRAC,
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     c       MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
   588       FORMAT (T5'26000 65.42 28000 12.0 42000 2.5 3',1X,F6.5,1X,
     c       F7.1,1X,'end')
           ELSEIF ((SPACERMAT.EQ.'SS304  ').AND.
     c     (UCSPACERFRAC.GT.(0.0))) THEN
             WRITE (100,589)
   589       FORMAT ('''     material composition of moderator',
     c       ' within unit cell')
             WRITE (100,590)
   590       FORMAT ('''     with smeared ss304 spacer grids')
             UCMODREGIONDEN=(MODDENFINAL(CT3,RELATIVE_STPT_NUM)*
     c       BORATEDMODVF)+(7.92*UCSPACERFRAC)
             IF (MODDENFINAL(CT3,RELATIVE_STPT_NUM).LT.(1.0)) THEN
               WRITE (100,591) UCMODREGIONDEN, BORATEDMODVF,
     c         MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
   591         FORMAT ('h2o   3   den=',F5.4,3X,F6.5,3X,F7.1,3X,'end')
             ELSE
               WRITE (100,592) UCMODREGIONDEN, BORATEDMODVF,
     c         MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
   592         FORMAT ('h2o   3   den=',F6.4,3X,F6.5,3X,F7.1,3X,'end')
             ENDIF
             WRITE (100,593) UCMODREGIONDEN, BORONVF,
     c       MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
   593       FORMAT ('arbm-bormod',3X,F6.4,1X,'1 0 0 0 5000 100 3',
     c       1X,F6.5,1X,F7.1,1X,'end')
             WRITE (100,594) UCMODREGIONDEN
   594       FORMAT ('arbm-spacer',3X,F6.4,1X,'4 0 0 0 24304 19.0',
     c       ' 25055 2.0 26304 69.5 28304 9.5')
             WRITE (100,595) UCSPACERFRAC,
     c       MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
   595       FORMAT (T15'3',1X,F6.5,1X,F7.1,1X,'end')
           ELSEIF ((SPACERMAT.EQ.'SS304S ').AND.
     c     (UCSPACERFRAC.GT.(0.0))) THEN
             WRITE (100,596)
   596       FORMAT ('''     material composition of moderator',
     c       ' within unit cell')
             WRITE (100,597)
   597       FORMAT ('''     with smeared ss304s spacer grids')
             UCMODREGIONDEN=(MODDENFINAL(CT3,RELATIVE_STPT_NUM)*
     c       BORATEDMODVF)+(7.92*UCSPACERFRAC)
             IF (MODDENFINAL(CT3,RELATIVE_STPT_NUM).LT.(1.0)) THEN
               WRITE (100,598) UCMODREGIONDEN, BORATEDMODVF,
     c         MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
   598         FORMAT ('h2o   3   den=',F5.4,3X,F6.5,3X,F7.1,3X,'end')
             ELSE
               WRITE (100,599) UCMODREGIONDEN, BORATEDMODVF,
     c         MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
   599         FORMAT ('h2o   3   den=',F6.4,3X,F6.5,3X,F7.1,3X,'end')
             ENDIF
             WRITE (100,600) UCMODREGIONDEN, BORONVF,
     c       MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
   600       FORMAT ('arbm-bormod',3X,F6.4,1X,'1 0 0 0 5000 100 3',
     c       1X,F6.5,1X,F7.1,1X,'end')
             WRITE (100,601) UCMODREGIONDEN
   601       FORMAT ('arbm-spacer',3X,F6.4,1X,'4 0 0 0 24000 19.0',
     c       ' 25055 2.0 26000 69.5 28000 9.5')
             WRITE (100,602) UCSPACERFRAC,
     c       MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
   602       FORMAT (T15'3',1X,F6.5,1X,F7.1,1X,'end')
           ELSEIF (UCSPACERFRAC.EQ.(0.0)) THEN
```

```
            WRITE (100,603)
  603       FORMAT ('''     material composition of moderator',
     c      ' within unit cell')
            WRITE (100,604)
  604       FORMAT ('''     with no smeared spacer grids')
            UCMODREGIONDEN=(MODDENFINAL(CT3,RELATIVE_STPT_NUM)*
     c      BORATEDMODVF)
            IF (MODDENFINAL(CT3,RELATIVE_STPT_NUM).LT.(1.0)) THEN
               WRITE (100,605) UCMODREGIONDEN, BORATEDMODVF,
     c         MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
  605          FORMAT ('h2o   3   den=',F5.4,3X,F6.5,3X,F7.1,3X,'end')
            ELSE
               WRITE (100,606) UCMODREGIONDEN, BORATEDMODVF,
     c         MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
  606          FORMAT ('h2o   3   den=',F6.4,3X,F6.5,3X,F7.1,3X,'end')
            ENDIF
            WRITE (100,607) UCMODREGIONDEN, BORONVF,
     c      MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
  607       FORMAT ('arbm-bormod',3X,F6.4,1X,'1 0 0 0 5000 100 3',
     c      1X,F6.5,1X,F7.1,1X,'end')
         ENDIF
         WRITE (100,608)
  608    FORMAT ('''')
*  Write BPRA material specifications
*  BPR follow specifications
         BPRA_FOLLOW=.FALSE.
         IF ((BPRFLAG.EQ.'Y').AND.(BPDESID(CT1).NE.0).AND.
     c      (CT3.LT.BPTN(CT1))) THEN
            BPRA_FOLLOW=.TRUE.
            BPRA_DESCRIPTION_ID=BPDESID(CT1)
            WRITE(100,610)
  610       FORMAT('''')
            WRITE(100,612)
  612       FORMAT('''',5X,'BPR above the BP absorber region')
            WRITE(100,614)
  614       FORMAT('''')
            IF ((BPRCLAD(BPDESID(CT1)).NE.0).AND.
     c      (BPRCLAD(BPDESID(CT1)).NE.2)) THEN
              DO 616 CT5=1,10
               IF (BPRCLAD(BPDESID(CT1)).EQ.CLADDESNUM(CT5)) THEN
                BPRCLNUM=CT5
                EXIT
               ENDIF
  616         CONTINUE
              IF (CLADDESNAME(BPRCLNUM).EQ.'SS304   ') THEN
               WRITE (100,618)
  618          FORMAT ('arbm-ss304 7.92 4 0 0 0 24304 19.0 25055',
     c         ' 2.0 26304 69.5 28304 9.5')
               WRITE (100,620) CLADDESNUM(BPRCLNUM), CLTEMP
  620          FORMAT (T12,I2,' 1.0 ',F5.1,' end')
              ELSEIF (CLADDESNAME(BPRCLNUM).EQ.'SS304S ') THEN
               WRITE (100,622)
  622          FORMAT ('arbm-ss304s 7.92 4 0 0 0 24000 19.0 25055',
     c         ' 2.0 26000 69.5 28000 9.5')
               WRITE (100,624) CLADDESNUM(BPRCLNUM), CLTEMP
  624          FORMAT (T13,I2,' 1.0 ',F5.1,' end')
              ELSEIF (CLADDESNAME(BPRCLNUM).EQ.'SS316   ') THEN
               WRITE (100,626)
  626          FORMAT ('arbm-ss316 7.75 7 0 0 0 6012 0.08 14000',
     c         ' 1.0 24304 17.0 25055 2.0')
```

```
            WRITE (100,628)
628         FORMAT (T12,'26304 65.42 28304 12.0 42000 2.5')
            WRITE (100,630) CLADDESNUM(BPRCLNUM), CLTEMP
630         FORMAT (T12,I2,' 1.0 ',F5.1,' end')
           ELSEIF (CLADDESNAME(BPRCLNUM).EQ.'SS316S ') THEN
            WRITE (100,632)
632         FORMAT ('arbm-ss316s 7.75 7 0 0 0 6012 0.08 14000',
     c      ' 1.0 24000 17.0 25055 2.0')
            WRITE (100,633)
633         FORMAT (T13,'26000 65.42 28000 12.0 42000 2.5')
            WRITE (100,634) CLADDESNUM(BPRCLNUM), CLTEMP
634         FORMAT (T13,I2,' 1.0 ',F5.1,' end')
           ELSEIF (CLADDESNAME(BPRCLNUM).EQ.'INCONEL') THEN
            WRITE (100,635)
635         FORMAT ('arbm-inconel 8.3 5 0 0 0 14000 2.5',
     c      ' 22000 2.5 24000 15.0')
            WRITE (100,636)
636         FORMAT (T13,'26000 7.0 28000 73.0')
            WRITE (100,637) CLADDESNUM(BPRCLNUM), CLTEMP
637         FORMAT (T13,I2,' 1.0 ',F5.1,' end')
           ENDIF
          ENDIF
          IF (ABOVEBP(BPDESID(CT1)).EQ.'AL2O3') THEN
             ALFRAC=(((BPDEN(BPDESID(CT1)))*2.0*26.981539)/
     c       (101.9631))/BPDEN(BPDESID(CT1))
             OFRAC=1.0-ALFRAC
             IF (BPDEN(BPDESID(CT1)).LT.(1.0)) THEN
                WRITE (100,638) ABOVEBPNUM(BPDESID(CT1)),
     c          BPDEN(BPDESID(CT1)), ALFRAC,
     c          MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
638             FORMAT ('al',3X,I3,3X,'den=',F4.3,1X,F7.5,
     c          1X,F7.1,1X,'end')
                WRITE (100,640) ABOVEBPNUM(BPDESID(CT1)),
     c          BPDEN(BPDESID(CT1)), OFRAC,
     c          MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
640             FORMAT ('o',3X,I3,3X,'den=',F4.3,1X,F7.5,
     c          1X,F7.1,1X,'end')
             ELSE
                WRITE (100,642) ABOVEBPNUM(BPDESID(CT1)),
     c          BPDEN(BPDESID(CT1)), ALFRAC,
     c          MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
642             FORMAT ('al',3X,I3,3X,'den=',F5.3,1X,F7.5,
     c          1X,F7.1,1X,'end')
                WRITE (100,644) ABOVEBPNUM(BPDESID(CT1)),
     c          BPDEN(BPDESID(CT1)), OFRAC,
     c          MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
644             FORMAT ('o',3X,I3,3X,'den=',F5.3,1X,F7.5,
     c          1X,F7.1,1X,'end')
             ENDIF
          ELSE
             WRITE (100,*) 'arbm-bp   ',
     c       BPDEN(BPRA_DESCRIPTION_ID),
     c       '   ', BPFMNUMISOS(BPRA_DESCRIPTION_ID),
     c       '   0   0   0'
             DO 650 CT4=1,BPFMNUMISOS(BPRA_DESCRIPTION_ID)
                WRITE (100,648)
     c          BPFISOID(BPRA_DESCRIPTION_ID,CT4),
     c          BPFISOWTPCT(BPRA_DESCRIPTION_ID,CT4)
648             FORMAT (10X,I6,3X,F10.5)
650          CONTINUE
```

```
              WRITE (100,*) '           ',
     c        ABOVEBPNUM(BPRA_DESCRIPTION_ID),
     c        ' 1.0 ',MODTEMPFINAL(CT3,RELATIVE_STPT_NUM),
     c        '   end'
           ENDIF
         ENDIF
*  Actual BPRA specifications
         BPRA_INSERTED=.FALSE.
         IF ((BPRFLAG.EQ.'Y').AND.(BPDESID(CT1).NE.0).AND.
     c      (CT3.GE.BPTN(CT1)).AND.(CT3.LE.BPBN(CT1))) THEN
            BPRA_INSERTED=.TRUE.
            BPRA_DESCRIPTION_ID=BPDESID(CT1)
            WRITE (100,685)
  685       FORMAT ('''')
            IF (BPMIX(BPRA_DESCRIPTION_ID).EQ.0) THEN
               WRITE (100,690) BPWTPCT(BPDESID(CT1))
  690          FORMAT ('''',5X,'Al2O3-B4C burnable absorber pellet',1X,
     c         'specification (',F4.2,1X,'wt% b4c)')
            ELSE
               WRITE (100,695)
  695          FORMAT ('''',5X,'burnable absorber pellet ',
     c         'specification')
            ENDIF
            WRITE (100,700)
  700       FORMAT ('''')
*  Write B4C material specification
            IF ((BPRCLAD(BPDESID(CT1)).NE.0).AND.
     c      (BPRCLAD(BPDESID(CT1)).NE.2)) THEN
              DO 701 CT5=1,10
               IF (BPRCLAD(BPDESID(CT1)).EQ.CLADDESNUM(CT5)) THEN
                BPRCLNUM=CT5
                EXIT
               ENDIF
  701          CONTINUE
               IF (CLADDESNAME(BPRCLNUM).EQ.'SS304  ') THEN
                WRITE (100,702)
  702           FORMAT ('arbm-ss304 7.92 4 0 0 0 24304 19.0 25055',
     c          ' 2.0 26304 69.5 28304 9.5')
                WRITE (100,703) CLADDESNUM(BPRCLNUM), CLTEMP
  703           FORMAT (T12,I2,' 1.0 ',F5.1,' end')
               ELSEIF (CLADDESNAME(BPRCLNUM).EQ.'SS304S ') THEN
                WRITE (100,704)
  704           FORMAT ('arbm-ss304s 7.92 4 0 0 0 24000 19.0 25055',
     c          ' 2.0 26000 69.5 28000 9.5')
                WRITE (100,705) CLADDESNUM(BPRCLNUM), CLTEMP
  705           FORMAT (T13,I2,' 1.0 ',F5.1,' end')
               ELSEIF (CLADDESNAME(BPRCLNUM).EQ.'SS316  ') THEN
                WRITE (100,706)
  706           FORMAT ('arbm-ss316 7.75 7 0 0 0 6012 0.08 14000',
     c          ' 1.0 24304 17.0 25055 2.0')
                WRITE (100,707)
  707           FORMAT (T12,'26304 65.42 28304 12.0 42000 2.5')
                WRITE (100,708) CLADDESNUM(BPRCLNUM), CLTEMP
  708           FORMAT (T12,I2,' 1.0 ',F5.1,' end')
               ELSEIF (CLADDESNAME(BPRCLNUM).EQ.'SS316S ') THEN
                WRITE (100,709)
  709           FORMAT ('arbm-ss316s 7.75 7 0 0 0 6012 0.08 14000',
     c          ' 1.0 24000 17.0 25055 2.0')
                WRITE (100,710)
  710           FORMAT (T13,'26000 65.42 28000 12.0 42000 2.5')
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               WRITE (100,711) CLADDESNUM(BPRCLNUM), CLTEMP
  711          FORMAT (T13,I2,' 1.0 ',F5.1,' end')
              ELSEIF (CLADDESNAME(BPRCLNUM).EQ.'INCONEL') THEN
               WRITE (100,712)
  712          FORMAT ('arbm-inconel 8.3 5 0 0 0 14000 2.5',
     c         ' 22000 2.5 24000 15.0')
               WRITE (100,713)
  713          FORMAT (T13,'26000 7.0 28000 73.0')
               WRITE (100,714) CLADDESNUM(BPRCLNUM), CLTEMP
  714          FORMAT (T13,I2,' 1.0 ',F5.1,' end')
              ENDIF
            ENDIF
*  Material specification for AL2O3-B4C
            IF ((BPMIX(BPRA_DESCRIPTION_ID).EQ.0).OR.
     c      (BPMIX(BPRA_DESCRIPTION_ID).EQ.4)) THEN
               IF (BPWTPCT(BPDESID(CT1)).NE.(0.0)) THEN
                  IF (BPDEN(BPDESID(CT1)).LT.(1.0)) THEN
                     WRITE (100,718) BPDEN(BPDESID(CT1)),
     c               (BPWTPCT(BPDESID(CT1))/100.0),
     c               MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
  718                FORMAT ('b4c   4   den=',F4.3,1X,F7.5,1X,F7.1,1X,
     c               'end')
                  ELSE
                     WRITE (100,720) BPDEN(BPDESID(CT1)),
     c               (BPWTPCT(BPDESID(CT1))/100.0),
     c               MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
  720                FORMAT ('b4c   4   den=',F5.3,1X,F7.5,1X,F7.1,1X,
     c               'end')
                  ENDIF
               ENDIF
*  Calculate aluminum and oxygen material specifications
               ALFRAC=(((((100.0-BPWTPCT(BPDESID(CT1)))/100.0)*
     c         BPDEN(BPDESID(CT1)))*2.0*26.981539)/(101.9631))/
     c         BPDEN(BPDESID(CT1))
               OFRAC=1.0-(BPWTPCT(BPDESID(CT1))/100.0)-ALFRAC
               IF (BPDEN(BPDESID(CT1)).LT.(1.0)) THEN
                  WRITE (100,734) BPDEN(BPDESID(CT1)), ALFRAC,
     c            MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
  734             FORMAT ('al    4   den=',F4.3,1X,F7.5,1X,F7.1,1X,'end')
                  WRITE (100,736) BPDEN(BPDESID(CT1)), OFRAC,
     c            MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
  736             FORMAT ('o     4   den=',F4.3,1X,F7.5,1X,F7.1,1X,'end')
               ELSE
                  WRITE (100,738) BPDEN(BPDESID(CT1)), ALFRAC,
     c            MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
  738             FORMAT ('al    4   den=',F5.3,1X,F7.5,1X,F7.1,1X,'end')
                  WRITE (100,740) BPDEN(BPDESID(CT1)), OFRAC,
     c            MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
  740             FORMAT ('o     4   den=',F5.3,1X,F7.5,1X,F7.1,1X,'end')
               ENDIF
            ELSE
*  Material specification for BP other than Al2O3-B4C
               DO 742 CT4=1,BPMIXNUM
                  IF (BPMIXID(CT4).EQ.BPMIX(BPRA_DESCRIPTION_ID)) THEN
                     RELATIVE_BP_MIX_ID=CT4
                  ENDIF
  742          CONTINUE
               WRITE (100,*) 'arbm-bp   ', BPDEN(BPRA_DESCRIPTION_ID),
     c         '  ', BPNUMISOS(RELATIVE_BP_MIX_ID),
     c         '   0   0   0'
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               DO 750 CT4=1,BPNUMISOS(RELATIVE_BP_MIX_ID)
                  WRITE (100,745) BPISOID(RELATIVE_BP_MIX_ID,CT4),
     c            BPISOWTPCT(RELATIVE_BP_MIX_ID,CT4)
  745              FORMAT (10X,I6,3X,F10.5)
  750           CONTINUE
                WRITE (100,*) '          ', BPMIX(BPRA_DESCRIPTION_ID),
     c          ' 1.0 ',MODTEMPFINAL(CT3,RELATIVE_STPT_NUM), '   end'
             ENDIF
          ENDIF
*  Write control rod material specification
          CR_INSERTED=.FALSE.
          IF (CRSTAT.EQ.'RODDED') THEN
             CRCOMPFLAG=.FALSE.
             DO 760 CT4=1,23
                IF (CRINS(CT1,CT2,CT4,CT3).NE.0) THEN
                   CRCOMPFLAG=.TRUE.
                   CR_INSERTED=.TRUE.
                   CR_MIXTURE_ID=CRINS(CT1,CT2,CT4,CT3)
                   CR_DESCRIPTION=CRDES(CT1,CT2,CT4,CT3)
                   EXIT
                ENDIF
  760        CONTINUE
             IF (CRCOMPFLAG.EQ..TRUE.) THEN
                DO 770 CT4=1,CRMIXNUM
                   IF (CRMIXID(CT4).EQ.CR_MIXTURE_ID) THEN
                      RELATIVE_CR_MIX_ID=CT4
                   ENDIF
  770           CONTINUE
                WRITE (100,780)
  780           FORMAT ('''')
                WRITE (100,790)
  790           FORMAT ('''',T5,' control rod material specification')
                WRITE (100,800)
  800           FORMAT ('''')
             IF (CRCLAD(CR_DESCRIPTION).NE.0) THEN
               DO 801 CT5=1,10
                IF (CRCLAD(CR_DESCRIPTION).EQ.CLADDESNUM(CT5)) THEN
                 CRCLNUM=CT5
                 EXIT
                ENDIF
  801           CONTINUE
                IF (CLADDESNAME(CRCLNUM).EQ.'SS304   ') THEN
                 WRITE (100,802)
  802            FORMAT ('arbm-ss304 7.92 4 0 0 0 24304 19.0 25055 ',
     c           '2.0 26304 69.5 28304 9.5')
                 WRITE (100,803) CLADDESNUM(CRCLNUM), CLTEMP
  803            FORMAT (T12,I2,' 1.0 ',F5.1,' end')
                ELSEIF (CLADDESNAME(CRCLNUM).EQ.'SS304S ') THEN
                 WRITE (100,804)
  804            FORMAT ('arbm-ss304s 7.92 4 0 0 0 24000 19.0 25055 ',
     c           '2.0 26000 69.5 28000 9.5')
                 WRITE (100,805) CLADDESNUM(CRCLNUM), CLTEMP
  805            FORMAT (T13,I2,' 1.0 ',F5.1,' end')
                ELSEIF (CLADDESNAME(CRCLNUM).EQ.'SS316   ') THEN
                 WRITE (100,806)
  806            FORMAT ('arbm-ss316 7.75 7 0 0 0 6012 0.08 14000 ',
     c           '1.0 24304 17.0 25055 2.0')
                 WRITE (100,807)
  807            FORMAT (T12,'26304 65.42 28304 12.0 42000 2.5')
                 WRITE (100,808) CLADDESNUM(CRCLNUM), CLTEMP
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 808           FORMAT (T12,I2,' 1.0 ',F5.1,' end')
              ELSEIF (CLADDESNAME(CRCLNUM).EQ.'SS316S ') THEN
               WRITE (100,809)
 809           FORMAT ('arbm-ss316s 7.75 7 0 0 0 6012 0.08 14000 ',
     c         '1.0 24000 17.0 25055 2.0')
               WRITE (100,810)
 810           FORMAT (T13,'26000 65.42 28000 12.0 42000 2.5')
               WRITE (100,811) CLADDESNUM(CRCLNUM), CLTEMP
 811           FORMAT (T13,I2,' 1.0 ',F5.1,' end')
              ELSEIF (CLADDESNAME(CRCLNUM).EQ.'INCONEL') THEN
               WRITE (100,812)
 812           FORMAT ('arbm-inconel 8.3 5 0 0 0 14000 2.5',
     c         ' 22000 2.5 24000 15.0')
               WRITE (100,813)
 813           FORMAT (T13,'26000 7.0 28000 73.0')
               WRITE (100,814) CLADDESNUM(CRCLNUM), CLTEMP
 814           FORMAT (T13,I2,' 1.0 ',F5.1,' end')
              ENDIF
            ENDIF
               WRITE (100,*) 'arbm-cr    ', CRDEN(CR_DESCRIPTION),
     c         '    ', CRNUMISOS(RELATIVE_CR_MIX_ID), '    0    0    0'
               DO 820 CT4=1,CRNUMISOS(RELATIVE_CR_MIX_ID)
                  WRITE (100,815) CRISOID(RELATIVE_CR_MIX_ID,CT4),
     c            CRISOWTPCT(RELATIVE_CR_MIX_ID, CT4)
 815              FORMAT (10X,I5,3X,F10.5)
 820           CONTINUE
               WRITE (100,*) '           ', CR_MIXTURE_ID, ' 1.0 ',
     c         MODTEMPFINAL(CT3,RELATIVE_STPT_NUM), '    end'
            ENDIF
         ENDIF
*  Write APSR material specification
         IF ((CT1.EQ.CT1START).AND.(CT2.EQ.CT2GOVALUE).AND.
     c   (CT3.EQ.1)) THEN
         DO 824 CT4=1,10
            DO 823 CT5=1,20
               DO 822 CT6=1,23
                  DO 821 CT7=1,50
                     APSRINSOLD(CT4,CT5,CT6,CT7)=
     c               APSRINS(CT4,CT5,CT6,CT7)
 821              CONTINUE
 822           CONTINUE
 823        CONTINUE
 824     CONTINUE
         ENDIF
         APSR_INSERTED=.FALSE.
         IF (APSRSTAT.EQ.'RODDED') THEN
            DO 830 CT4=1,23
               APSRBOTFLAG=.FALSE.
               DO 825 CT5=50,1,-1
                  IF ((APSRINSOLD(CT1,CT2,CT4,CT5).NE.0).AND.
     c            (APSRBOTFLAG.EQ..FALSE.)) THEN
                     APSR_DESCRIPTION=APSRDES(CT1,CT2,CT4,CT5)
                     APSRBOTFLAG=.TRUE.
                     FOLNODKEEP=CT5
                     FOLSTEPKEEP=CT4
                  ENDIF
                  IF ((APSRINSOLD(CT1,CT2,CT4,CT5).EQ.0).AND.
     c            (APSRBOTFLAG.EQ..TRUE.)) THEN
                     APSRINS(CT1,CT2,CT4,CT5)=
     c               APSRFOLLOWMIX(CT1,CT2,FOLSTEPKEEP,FOLNODKEEP)
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                  APSRFOLLOWDATA(CT1,CT2,CT4,CT5)=3
               ENDIF
825         CONTINUE
830      CONTINUE
         FOLLOWIN=.FALSE.
         DO 831 CT4=1,23
            IF (APSRFOLLOWDATA(CT1,CT2,CT4,CT3).EQ.3) THEN
               FOLLOWIN=.TRUE.
               EXIT
            ENDIF
831      CONTINUE
         IF (FOLLOWIN.EQ..TRUE.) THEN
            WRITE (100,832)
832         FORMAT ('''')
            WRITE (100,834)
834         FORMAT ('''',T5,' APSR follow rod material',
   c        ' specification')
            WRITE (100,836)
836         FORMAT ('''')
         IF ((APSRFOLLOWMIX(CT1,CT2,FOLSTEPKEEP,FOLNODKEEP).NE.0)
   c     .AND.
   c     (APSRFOLLOWMIX(CT1,CT2,FOLSTEPKEEP,FOLNODKEEP).NE.2)) THEN
           DO 838 CT5=1,10
            IF (APSRFOLLOWMIX(CT1,CT2,FOLSTEPKEEP,FOLNODKEEP)
   c        .EQ.CLADDESNUM(CT5)) THEN
             APSRFOLNUM=CT5
             EXIT
            ENDIF
838         CONTINUE
            IF (CLADDESNAME(APSRFOLNUM).EQ.'SS304  ') THEN
             WRITE (100,840)
840          FORMAT ('arbm-ss304 7.92 4 0 0 0 24304 19.0 25055 ',
   c         '2.0 26304 69.5 28304 9.5')
             WRITE (100,842) CLADDESNUM(APSRFOLNUM), CLTEMP
842          FORMAT (T12,I2,' 1.0 ',F5.1,' end')
            ELSEIF (CLADDESNAME(APSRFOLNUM).EQ.'SS304S ') THEN
             WRITE (100,844)
844          FORMAT ('arbm-ss304s 7.92 4 0 0 0 24000 19.0 25055 ',
   c         '2.0 26000 69.5 28000 9.5')
             WRITE (100,846) CLADDESNUM(APSRFOLNUM), CLTEMP
846          FORMAT (T13,I2,' 1.0 ',F5.1,' end')
            ELSEIF (CLADDESNAME(APSRFOLNUM).EQ.'SS316  ') THEN
             WRITE (100,848)
848          FORMAT ('arbm-ss316 7.75 7 0 0 0 6012 0.08 14000 ',
   c         '1.0 24304 17.0 25055 2.0')
             WRITE (100,850)
850          FORMAT (T12,'26304 65.42 28304 12.0 42000 2.5')
             WRITE (100,852) CLADDESNUM(APSRFOLNUM), CLTEMP
852          FORMAT (T12,I2,' 1.0 ',F5.1,' end')
            ELSEIF (CLADDESNAME(APSRFOLNUM).EQ.'SS316S ') THEN
             WRITE (100,854)
854          FORMAT ('arbm-ss316s 7.75 7 0 0 0 6012 0.08 14000 ',
   c         '1.0 24000 17.0 25055 2.0')
             WRITE (100,856)
856          FORMAT (T13,'26000 65.42 28000 12.0 42000 2.5')
             WRITE (100,858) CLADDESNUM(APSRFOLNUM), CLTEMP
858          FORMAT (T13,I2,' 1.0 ',F5.1,' end')
            ELSEIF (CLADDESNAME(APSRFOLNUM).EQ.'INCONEL') THEN
             WRITE (100,860)
860          FORMAT ('arbm-inconel 8.3 5 0 0 0 14000 2.5',
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     c          ' 22000 2.5 24000 15.0')
                WRITE (100,862)
  862           FORMAT (T13,'26000 7.0 28000 73.0')
                WRITE (100,864) CLADDESNUM(APSRFOLNUM), CLTEMP
  864           FORMAT (T13,I2,' 1.0 ',F5.1,' end')
               ENDIF
             ENDIF
             ENDIF
             APSRCOMPFLAG=.FALSE.
             DO 865 CT4=1,23
                IF ((APSRINS(CT1,CT2,CT4,CT3).NE.0).AND.
     c          (APSRINS(CT1,CT2,CT4,CT3).NE.
     c          APSRFOLLOWMIX(CT1,CT2,FOLSTEPKEEP,FOLNODKEEP))) THEN
                   APSRCOMPFLAG=.TRUE.
                   APSR_INSERTED=.TRUE.
                   APSR_MIXTURE_ID=APSRINS(CT1,CT2,CT4,CT3)
                   APSR_DESCRIPTION=APSRDES(CT1,CT2,CT4,CT3)
                   EXIT
                ENDIF
  865        CONTINUE
             IF (APSRCOMPFLAG.EQ..TRUE.) THEN
                DO 866 CT4=1,APSRMIXNUM
                   IF (APSRMIXID(CT4).EQ.APSR_MIXTURE_ID) THEN
                      RELATIVE_APSR_MIX_ID=CT4
                   ENDIF
  866              CONTINUE
                   WRITE (100,868)
  868              FORMAT ('''')
                   WRITE (100,870)
  870              FORMAT ('''',T5,' axial power shaping rod material',
     c             ' specification')
                   WRITE (100,880)
  880              FORMAT ('''')
             IF (APSRCLAD(APSR_DESCRIPTION).NE.0) THEN
               DO 881 CT5=1,10
                IF (APSRCLAD(APSR_DESCRIPTION).EQ.CLADDESNUM(CT5)) THEN
                 APSRCLNUM=CT5
                 EXIT
                ENDIF
  881           CONTINUE
               IF (CLADDESNAME(APSRCLNUM).EQ.'SS304   ') THEN
                WRITE (100,882)
  882           FORMAT ('arbm-ss304 7.92 4 0 0 0 24304 19.0 25055 ',
     c          '2.0 26304 69.5 28304 9.5')
                WRITE (100,883) CLADDESNUM(APSRCLNUM), CLTEMP
  883           FORMAT (T12,I2,' 1.0 ',F5.1,' end')
               ELSEIF (CLADDESNAME(APSRCLNUM).EQ.'SS304S ') THEN
                WRITE (100,884)
  884           FORMAT ('arbm-ss304s 7.92 4 0 0 0 24000 19.0 25055 ',
     c          '2.0 26000 69.5 28000 9.5')
                WRITE (100,885) CLADDESNUM(APSRCLNUM), CLTEMP
  885           FORMAT (T13,I2,' 1.0 ',F5.1,' end')
               ELSEIF (CLADDESNAME(APSRCLNUM).EQ.'SS316   ') THEN
                WRITE (100,886)
  886           FORMAT ('arbm-ss316 7.75 7 0 0 0 6012 0.08 14000 ',
     c          '1.0 24304 17.0 25055 2.0')
                WRITE (100,887)
  887           FORMAT (T12,'26304 65.42 28304 12.0 42000 2.5')
                WRITE (100,888) CLADDESNUM(APSRCLNUM), CLTEMP
  888           FORMAT (T12,I2,' 1.0 ',F5.1,' end')
```

```
               ELSEIF (CLADDESNAME(APSRCLNUM).EQ.'SS316S ') THEN
                WRITE (100,889)
  889           FORMAT ('arbm-ss316s 7.75 7 0 0 0 6012 0.08 14000 ',
     c          '1.0 24000 17.0 25055 2.0')
                WRITE (100,890)
  890           FORMAT (T13,'26000 65.42 28000 12.0 42000 2.5')
                WRITE (100,891) CLADDESNUM(APSRCLNUM), CLTEMP
  891           FORMAT (T13,I2,' 1.0 ',F5.1,' end')
               ELSEIF (CLADDESNAME(APSRCLNUM).EQ.'INCONEL') THEN
                WRITE (100,892)
  892           FORMAT ('arbm-inconel 8.3 5 0 0 0 14000 2.5',
     c          ' 22000 2.5 24000 15.0')
                WRITE (100,893)
  893           FORMAT (T13,'26000 7.0 28000 73.0')
                WRITE (100,894) CLADDESNUM(APSRCLNUM), CLTEMP
  894           FORMAT (T13,I2,' 1.0 ',F5.1,' end')
               ENDIF
            ENDIF
               WRITE (100,*) 'arbm-apsr    ', APSRDEN(APSR_DESCRIPTION),
     c         '    ', APSRNUMISOS(RELATIVE_APSR_MIX_ID), '    0    0    0'
               DO 900 CT4=1,APSRNUMISOS(RELATIVE_APSR_MIX_ID)
                  WRITE (100,895) APSRISOID(RELATIVE_APSR_MIX_ID,CT4),
     c            APSRISOWTPCT(RELATIVE_APSR_MIX_ID, CT4)
  895             FORMAT (10X,I5,3X,F10.5)
  900          CONTINUE
               WRITE (100,*) '           ', APSR_MIXTURE_ID, ' 1.0 ',
     c         MODTEMPFINAL(CT3,RELATIVE_STPT_NUM), '    end'
            ENDIF
         ENDIF
*  Write fuel rod fill gas material specification
         WRITE (100,910)
  910    FORMAT ('''')
         WRITE (100,920)
  920    FORMAT ('he    5    end')
         WRITE (100,930)
  930    FORMAT ('end comp')
*  Write base reactor lattice specifications
         WRITE (100,940)
  940    FORMAT ('''')
         WRITE (100,950)
  950    FORMAT (''''     base reactor lattice specification')
         WRITE (100,960)
  960    FORMAT ('''')
         WRITE (100,970) PITCH, FOD, COD, CID
  970    FORMAT ('squarepitch',3X,F7.5,3X,F6.4,3X,'1    3',3X,F6.4,
     c   3X,'2',3X,F6.4,3X,'0    end')
* The following writing routine for 'SPECIAL' input data
* has not been formatted to compensate for FORTRAN's ingenious
* incapability to print leading zeros in numeric fields.
* Errors will occur in the FIDO input if null space exists
* between an equal sign and the appropriate value.  Therefore,
* the IIM and ICM factors must always be at least 10.
         IF (FLAG2.EQ.'SPECIAL') THEN
            IF (SZF.LT.1) THEN
               WRITE (100,980) SZF, ISN, IIM, ICM, EPS, PTC, IUS
  980          FORMAT ('more data',1X,'szf=0',F3.2,1X,'isn=',I1,1X,
     c         'iim=',I2,1X,'icm=',I2,1X,'eps=0',G7.2,1X,'ptc=0',G7.2,.
     c         1X,'ius=',I1,3X,'end')
            ELSE
               WRITE (100,990) SZF, ISN, IIM, ICM, EPS, PTC, IUS
```

```
 990          FORMAT ('more data',1X,'szf=',F4.2,1X,'isn=',I1,1X,
     c        'iim=',I2,1X,'icm=',I2,1X,'eps=0',G7.2,1X,'ptc=0',G7.2,
     c        1X,'ius=',I1,3X,'end')
           ENDIF
        ELSEIF (FLAG2.NE.'SPECIAL') THEN
           IF (MESH.LT.1) THEN
              WRITE (100,1000) MESH
1000          FORMAT ('more data',1X,'szf=0',F3.2,1X,'end')
           ELSE
              WRITE (100,1010) MESH
1010          FORMAT ('more data',1X,'szf=',F4.2,1X,'end')
           ENDIF
        ENDIF
*  Write assembly specifications
        WRITE (100,1020)
1020    FORMAT ('''')
        WRITE (100,1030)
1030    FORMAT ('''     assembly specification')
        WRITE (100,1040)
1040    FORMAT ('''')
        IF (STEPCONTROL.EQ.'Y') THEN
           CALL ZEROS(VARSTEPNUM(CT1,CT2),IRRAD_STEPS)
        ELSEIF (STEPCONTROL.EQ.'N') THEN
           CALL ZEROS(INT(BLETDOWN(CT1,CT2,2)),IRRAD_STEPS)
        ENDIF
*  Assembly specification if no BPRA, no CR, and no APSR is inserted
        IF ((BPRA_INSERTED.EQ..FALSE.).AND.(CR_INSERTED.EQ..FALSE.)
     c  .AND.(APSR_INSERTED.EQ..FALSE.)
     c  .AND.(BPRA_FOLLOW.EQ..FALSE.)
     c  .AND.(FOLLOWIN.EQ..FALSE.)) THEN
           IF (NODES(CT3,2).GE.(100.0)) THEN
              WRITE (100,1041) RODS, NODES(CT3,2), IRRAD_STEPS
1041          FORMAT ('npin/assembly=',I3,1X,'fuelngth=',F7.3,1X,
     c        'ncycles=',A2,1X,'nlib/cyc=1 lightel=0')
           ELSEIF ((NODES(CT3,2).LT.(100.0)).AND.
     c     (NODES(CT3,2).GE.(10.0))) THEN
              WRITE (100,1042) RODS, NODES(CT3,2), IRRAD_STEPS
1042          FORMAT ('npin/assembly=',I3,1X,'fuelngth=',F6.3,1X,
     c        'ncycles=',A2,1X,'nlib/cyc=1 lightel=0')
           ELSEIF (NODES(CT3,2).LT.(10.0)) THEN
              WRITE (100,1043) RODS, NODES(CT3,2), IRRAD_STEPS
1043          FORMAT ('npin/assembly=',I3,1X,'fuelngth=',F5.3,1X,
     c        'ncycles=',A2,1X,'nlib/cyc=1 lightel=0')
           ENDIF
           CALL ZEROS(PLEVEL,PLEVELCH)
           CALL ZEROS(LUZONE,LUZONECH)
           IF (MESH.LT.(1.0)) THEN
              WRITE (100,1044) PLEVELCH, LUZONECH, MESH
1044          FORMAT ('printlevel=',A2,1X,'inplevel=2',1X,
     c        'numztotal=',A2,1X,'mxrepeats=1',1X,
     c        'mixmod=3 facmesh=',F3.2,1X,'end')
           ELSE
              WRITE (100,1045) PLEVELCH, LUZONECH, MESH
1045          FORMAT ('printlevel=',A2,1X,'inplevel=2',1X,
     c        'numztotal=',A2,1X,'mxrepeats=1',1X,
     c        'mixmod=3 facmesh=',F4.2,1X,'end')
           ENDIF
           DO 1047 CT4=1,LUZONE
              IF (MOD(CT4,6).EQ.0) THEN
                 WRITE (100,*)
```

```
               ENDIF
               WRITE (100,1046) LMB(CT4), LRB(CT4)
 1046          FORMAT (I3,1X,F7.5,1X,$)
 1047       CONTINUE
            WRITE (100,*)
         ENDIF
*  Assembly specification if BPRA is inserted
         IF (BPRA_FOLLOW.EQ..TRUE.) THEN
            IF (NODES(CT3,2).GE.(100.0)) THEN
               WRITE (100,1050) RODS, NODES(CT3,2), IRRAD_STEPS
 1050          FORMAT ('npin/assembly=',I3,1X,'fuelngth=',F7.3,1X,
     c         'ncycles=',A2,1X,'nlib/cyc=1 lightel=0')
            ELSEIF ((NODES(CT3,2).LT.(100.0)).AND.
     c      (NODES(CT3,2).GE.(10.0))) THEN
               WRITE (100,1052) RODS, NODES(CT3,2), IRRAD_STEPS
 1052          FORMAT ('npin/assembly=',I3,1X,'fuelngth=',F6.3,1X,
     c         'ncycles=',A2,1X,'nlib/cyc=1 lightel=0')
            ELSEIF (NODES(CT3,2).LT.(10.0)) THEN
               WRITE (100,1054) RODS, NODES(CT3,2), IRRAD_STEPS
 1054          FORMAT ('npin/assembly=',I3,1X,'fuelngth=',F5.3,1X,
     c         'ncycles=',A2,1X,'nlib/cyc=1 lightel=0')
            ENDIF
            CALL ZEROS(PLEVEL,PLEVELCH)
            CALL ZEROS(BPZONE(BPRA_DESCRIPTION_ID),BPZONECH)
            IF (MESH.LT.(1.0)) THEN
               WRITE (100,1056) PLEVELCH, BPZONECH, MESH
 1056          FORMAT ('printlevel=',A2,1X,'inplevel=2',1X,
     c         'numztotal=',A2,1X,'mxrepeats=1',1X,
     c         'mixmod=3 facmesh=',F3.2,1X,'end')
            ELSE
               WRITE (100,1058) PLEVELCH, BPZONECH, MESH
 1058          FORMAT ('printlevel=',A2,1X,'inplevel=2',1X,
     c         'numztotal=',A2,1X,'mxrepeats=1',1X,
     c         'mixmod=3 facmesh=',F4.2,1X,'end')
            ENDIF
            DO 1062 CT4=1,BPZONE(BPRA_DESCRIPTION_ID)
               IF (MOD(CT4,6).EQ.0) THEN
                  WRITE (100,*)
               ENDIF
               WRITE (100,1060) BPRFM(CT4,BPRA_DESCRIPTION_ID),
     c         BPRFR(CT4,BPRA_DESCRIPTION_ID)
 1060          FORMAT (I3,1X,F7.5,1X,$)
 1062       CONTINUE
            WRITE (100,*)
         ENDIF
         IF (BPRA_INSERTED.EQ..TRUE.) THEN
            IF (NODES(CT3,2).GE.(100.0)) THEN
               WRITE (100,1098) RODS, NODES(CT3,2), IRRAD_STEPS
 1098          FORMAT ('npin/assembly=',I3,1X,'fuelngth=',F7.3,1X,
     c         'ncycles=',A2,1X,'nlib/cyc=1 lightel=0')
            ELSEIF ((NODES(CT3,2).LT.(100.0)).AND.
     c      (NODES(CT3,2).GE.(10.0))) THEN
               WRITE (100,1100) RODS, NODES(CT3,2), IRRAD_STEPS
 1100          FORMAT ('npin/assembly=',I3,1X,'fuelngth=',F6.3,1X,
     c         'ncycles=',A2,1X,'nlib/cyc=1 lightel=0')
            ELSEIF (NODES(CT3,2).LT.(10.0)) THEN
               WRITE (100,1103) RODS, NODES(CT3,2), IRRAD_STEPS
 1103          FORMAT ('npin/assembly=',I3,1X,'fuelngth=',F5.3,1X,
     c         'ncycles=',A2,1X,'nlib/cyc=1 lightel=0')
            ENDIF
```

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            CALL ZEROS(PLEVEL,PLEVELCH)
            CALL ZEROS(BPZONE(BPRA_DESCRIPTION_ID),BPZONECH)
            IF (MESH.LT.(1.0)) THEN
               WRITE (100,1104) PLEVELCH, BPZONECH, MESH
 1104          FORMAT ('printlevel=',A2,1X,'inplevel=2',1X,
     c         'numztotal=',A2,1X,'mxrepeats=1',1X,
     c         'mixmod=3 facmesh=',F3.2,1X,'end')
            ELSE
               WRITE (100,1106) PLEVELCH, BPZONECH, MESH
 1106          FORMAT ('printlevel=',A2,1X,'inplevel=2',1X,
     c         'numztotal=',A2,1X,'mxrepeats=1',1X,
     c         'mixmod=3 facmesh=',F4.2,1X,'end')
            ENDIF
            DO 1110 CT4=1,BPZONE(BPRA_DESCRIPTION_ID)
               IF (MOD(CT4,6).EQ.0) THEN
                  WRITE (100,*)
               ENDIF
               WRITE (100,1108) BPMA(CT4,BPRA_DESCRIPTION_ID),
     c         BPRA(CT4,BPRA_DESCRIPTION_ID)
 1108          FORMAT (I3,1X,F7.5,1X,$)
 1110       CONTINUE
            WRITE (100,*)
         ENDIF
*  Assembly specification if CR is inserted
         IF (CR_INSERTED.EQ..TRUE.) THEN
            IF (NODES(CT3,2).GE.(100.0)) THEN
               WRITE (100,1120) RODS, NODES(CT3,2), IRRAD_STEPS
 1120          FORMAT ('npin/assembly=',I3,1X,'fuelngth=',F7.3,1X,
     c         'ncycles=',A2,1X,'nlib/cyc=1 lightel=0')
            ELSEIF ((NODES(CT3,2).LT.(100.0)).AND.
     c      (NODES(CT3,2).GE.(10.0))) THEN
               WRITE (100,1130) RODS, NODES(CT3,2), IRRAD_STEPS
 1130          FORMAT ('npin/assembly=',I3,1X,'fuelngth=',F6.3,1X,
     c         'ncycles=',A2,1X,'nlib/cyc=1 lightel=0')
            ELSEIF (NODES(CT3,2).LT.(10.0)) THEN
               WRITE (100,1140) RODS, NODES(CT3,2), IRRAD_STEPS
 1140          FORMAT ('npin/assembly=',I3,1X,'fuelngth=',F5.3,1X,
     c         'ncycles=',A2,1X,'nlib/cyc=1 lightel=0')
            ENDIF
            CALL ZEROS(PLEVEL,PLEVELCH)
            CALL ZEROS(CRZONE(CR_DESCRIPTION),CRZONECH)
            IF (MESH.LT.(1.0)) THEN
               WRITE (100,1150) PLEVELCH, CRZONECH, MESH
 1150          FORMAT ('printlevel=',A2,1X,'inplevel=2',1X,
     c         'numztotal=',A2,1X,'mxrepeats=0',1X,
     c         'mixmod=3 facmesh=',F3.2,1X,'end')
            ELSE
               WRITE (100,1160) PLEVELCH, CRZONECH, MESH
 1160          FORMAT ('printlevel=',A2,1X,'inplevel=2',1X,
     c         'numztotal=',A2,1X,'mxrepeats=0',1X,
     c         'mixmod=3 facmesh=',F4.2,1X,'end')
            ENDIF
            IF (STEPCONTROL.EQ.'N') THEN
             DO 1169 CT4=1,INT(BLETDOWN(CT1,CT2,2))
               IF (CRINS(CT1,CT2,CT4,CT3).NE.0) THEN
                  DO 1164 CT5=1,CRZONE(CR_DESCRIPTION)
                     IF (MOD(CT5,6).EQ.0) THEN
                        WRITE (100,*)
                     ENDIF
                     WRITE (100,1162) CRMA(CT5,CR_DESCRIPTION),
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     c                CRRA(CT5,CR_DESCRIPTION)
 1162                 FORMAT (I3,1X,F7.5,1X,$)
 1164              CONTINUE
                   WRITE (100,*)
                ELSEIF (CRINS(CT1,CT2,CT4,CT3).EQ.0) THEN
                   DO 1168 CT5=1,CRZONE(CR_DESCRIPTION)
                      IF (MOD(CT5,6).EQ.0) THEN
                         WRITE (100,*)
                      ENDIF
                      WRITE (100,1166) LMC(CT5,CR_DESCRIPTION),
     c                LRC(CT5,CR_DESCRIPTION)
 1166                 FORMAT (I3,1X,F7.5,1X,$)
 1168              CONTINUE
                   WRITE (100,*)
                ENDIF
 1169           CONTINUE
              ELSEIF (STEPCONTROL.EQ.'Y') THEN
               DO 1210 CT4=1,VARSTEPNUM(CT1,CT2)
                 IF (CRINS(CT1,CT2,CT4,CT3).NE.0) THEN
                    DO 1180 CT5=1,CRZONE(CR_DESCRIPTION)
                       IF (MOD(CT5,6).EQ.0) THEN
                          WRITE (100,*)
                       ENDIF
                       WRITE (100,1170) CRMA(CT5,CR_DESCRIPTION),
     c                 CRRA(CT5,CR_DESCRIPTION)
 1170                  FORMAT (I3,1X,F7.5,1X,$)
 1180              CONTINUE
                   WRITE (100,*)
                 ELSEIF (CRINS(CT1,CT2,CT4,CT3).EQ.0) THEN
                    DO 1200 CT5=1,CRZONE(CR_DESCRIPTION)
                       IF (MOD(CT5,6).EQ.0) THEN
                          WRITE (100,*)
                       ENDIF
                       WRITE (100,1190) LMC(CT5,CR_DESCRIPTION),
     c                 LRC(CT5,CR_DESCRIPTION)
 1190                  FORMAT (I3,1X,F7.5,1X,$)
 1200              CONTINUE
                   WRITE (100,*)
                 ENDIF
 1210           CONTINUE
              ENDIF
           ENDIF
*  Assembly specification if APSR is inserted
           IF ((APSR_INSERTED.EQ..TRUE.).OR.(FOLLOWIN.EQ..TRUE.)) THEN
              IF (NODES(CT3,2).GE.(100.0)) THEN
                 WRITE (100,1220) RODS, NODES(CT3,2), IRRAD_STEPS
 1220            FORMAT ('npin/assembly=',I3,1X,'fuelngth=',F7.3,1X,
     c           'ncycles=',A2,1X,'nlib/cyc=1 lightel=0')
              ELSEIF ((NODES(CT3,2).LT.(100.0)).AND.
     c        (NODES(CT3,2).GE.(10.0))) THEN
                 WRITE (100,1230) RODS, NODES(CT3,2), IRRAD_STEPS
 1230            FORMAT ('npin/assembly=',I3,1X,'fuelngth=',F6.3,1X,
     c           'ncycles=',A2,1X,'nlib/cyc=1 lightel=0')
              ELSEIF (NODES(CT3,2).LT.(10.0)) THEN
                 WRITE (100,1240) RODS, NODES(CT3,2), IRRAD_STEPS
 1240            FORMAT ('npin/assembly=',I3,1X,'fuelngth=',F5.3,1X,
     c           'ncycles=',A2,1X,'nlib/cyc=1 lightel=0')
              ENDIF
              CALL ZEROS(PLEVEL,PLEVELCH)
              CALL ZEROS(APSRZONE(APSR_DESCRIPTION),APSRZONECH)
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            IF (MESH.LT.(1.0)) THEN
               WRITE (100,1250) PLEVELCH, APSRZONECH, MESH
1250           FORMAT ('printlevel=',A2,1X,'inplevel=2',1X,
     c         'numztotal=',A2,1X,'mxrepeats=0',1X,
     c         'mixmod=3 facmesh=',F3.2,1X,'end')
            ELSE
               WRITE (100,1252) PLEVELCH, APSRZONECH, MESH
1252           FORMAT ('printlevel=',A2,1X,'inplevel=2',1X,
     c         'numztotal=',A2,1X,'mxrepeats=0',1X,
     c         'mixmod=3 facmesh=',F4.2,1X,'end')
            ENDIF
            IF (STEPCONTROL.EQ.'N') THEN
             DO 1268 CT4=1,INT(BLETDOWN(CT1,CT2,2))
               IF ((APSRINS(CT1,CT2,CT4,CT3).NE.0).AND.
     c         (APSRFOLLOWDATA(CT1,CT2,CT4,CT3).NE.3)) THEN
                  DO 1258 CT5=1,APSRZONE(APSR_DESCRIPTION)
                     IF (MOD(CT5,6).EQ.0) THEN
                        WRITE (100,*)
                     ENDIF
                     WRITE (100,1256) APSRMA(CT5,APSR_DESCRIPTION),
     c               APSRRA(CT5,APSR_DESCRIPTION)
1256                 FORMAT (I3,1X,F7.5,1X,$)
1258              CONTINUE
                  WRITE (100,*)
               ELSEIF ((APSRINS(CT1,CT2,CT4,CT3).NE.0).AND.
     c         (APSRFOLLOWDATA(CT1,CT2,CT4,CT3).EQ.3)) THEN
                  DO 1262 CT5=1,APSRZONE(APSR_DESCRIPTION)
                     IF (MOD(CT5,6).EQ.0) THEN
                        WRITE (100,*)
                     ENDIF
                     WRITE (100,1260) APSRFM(CT5,APSR_DESCRIPTION),
     c               APSRFR(CT5,APSR_DESCRIPTION)
1260                 FORMAT (I3,1X,F7.5,1X,$)
1262              CONTINUE
                  WRITE (100,*)
               ELSEIF (APSRINS(CT1,CT2,CT4,CT3).EQ.0) THEN
                  DO 1266 CT5=1,APSRZONE(APSR_DESCRIPTION)
                     IF (MOD(CT5,6).EQ.0) THEN
                        WRITE (100,*)
                     ENDIF
                     WRITE (100,1264) LMD(CT5,APSR_DESCRIPTION),
     c               LRD(CT5,APSR_DESCRIPTION)
1264                 FORMAT (I3,1X,F7.5,1X,$)
1266              CONTINUE
                  WRITE (100,*)
               ENDIF
1268           CONTINUE
            ELSEIF (STEPCONTROL.EQ.'Y') THEN
             DO 1310 CT4=1,VARSTEPNUM(CT1,CT2)
               IF ((APSRINS(CT1,CT2,CT4,CT3).NE.0).AND.
     c         (APSRFOLLOWDATA(CT1,CT2,CT4,CT3).NE.3)) THEN
                  DO 1280 CT5=1,APSRZONE(APSR_DESCRIPTION)
                     IF (MOD(CT5,6).EQ.0) THEN
                        WRITE (100,*)
                     ENDIF
                     WRITE (100,1270) APSRMA(CT5,APSR_DESCRIPTION),
     c               APSRRA(CT5,APSR_DESCRIPTION)
1270                 FORMAT (I3,1X,F7.5,1X,$)
1280              CONTINUE
                  WRITE (100,*)
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                ELSEIF ((APSRINS(CT1,CT2,CT4,CT3).NE.0).AND.
     c          (APSRFOLLOWDATA(CT1,CT2,CT4,CT3).EQ.3)) THEN
                   DO 1290 CT5=1,APSRZONE(APSR_DESCRIPTION)
                      IF (MOD(CT5,6).EQ.0) THEN
                         WRITE (100,*)
                      ENDIF
                      WRITE (100,1285) APSRFM(CT5,APSR_DESCRIPTION),
     c                APSRFR(CT5,APSR_DESCRIPTION)
 1285                 FORMAT (I3,1X,F7.5,1X,$)
 1290              CONTINUE
                   WRITE (100,*)
                ELSEIF (APSRINS(CT1,CT2,CT4,CT3).EQ.0) THEN
                   DO 1300 CT5=1,APSRZONE(APSR_DESCRIPTION)
                      IF (MOD(CT5,6).EQ.0) THEN
                         WRITE (100,*)
                      ENDIF
                      WRITE (100,1295) LMD(CT5,APSR_DESCRIPTION),
     c                LRD(CT5,APSR_DESCRIPTION)
 1295                 FORMAT (I3,1X,F7.5,1X,$)
 1300              CONTINUE
                   WRITE (100,*)
                ENDIF
 1310          CONTINUE
              ENDIF
           ENDIF
*  Write assembly depletion/decay parameters
           WRITE (100,1320)
 1320      FORMAT ('''')
           WRITE (100,1330)
 1330      FORMAT ('''     assembly depletion/decay parameters')
           WRITE (100,1340)
 1340      FORMAT ('''')
           CALL ZEROS(CYCPOS(CT1),ASSYPOSITION)
           WRITE (100,1350) CYCLEID(CT1), ASSYPOSITION
 1350      FORMAT ('''',T5,'Cycle-',A2,', one-eighth core',
     c     ' assembly number ',A2)
           IF (STEPCONTROL.EQ.'N') THEN
            DO 1380 CT4=3,(INT(BLETDOWN(CT1,CT2,2))+2)
              IF (CT4.LT.(BLETDOWN(CT1,CT2,2)+2)) THEN
                 DOWNTIME=0.0
                 BORON_FRACTION=(BLETDOWN(CT1,CT2,CT4)/
     c           BLETDOWN(CT1,CT2,3))
                 WRITE (100,1360) POWER(CT3,RELATIVE_STPT_NUM),
     c           BLETDOWN(CT1,CT2,1), DOWNTIME, BORON_FRACTION
 1360            FORMAT ('power=',G10.5,1X,'burn=',G9.4,1X,'down=',
     c           G10.5,1X,'bfrac=',G9.4,1X,'end')
              ELSEIF ((CT4.EQ.(INT(BLETDOWN(CT1,CT2,2))+2)).AND.
     c        (CT2.LT.STPTS(CT1))) THEN
                 DOWNTIME=STPTDAT(CT1,(CT2+1),3)
                 BORON_FRACTION=(BLETDOWN(CT1,CT2,CT4)/
     c           BLETDOWN(CT1,CT2,3))
                 WRITE (100,1365) POWER(CT3,RELATIVE_STPT_NUM),
     c           BLETDOWN(CT1,CT2,1), DOWNTIME, BORON_FRACTION
 1365            FORMAT ('power=',G10.5,1X,'burn=',G9.4,1X,'down=',
     c           G10.5,1X,'bfrac=',G9.4,1X,'end')
              ELSEIF ((CT4.EQ.(INT(BLETDOWN(CT1,CT2,2))+2)).AND.
     c        (CT2.EQ.STPTS(CT1))) THEN
                 DOWNTIME=CYCDOWN(CT1)
                 BORON_FRACTION=(BLETDOWN(CT1,CT2,CT4)/
     c           BLETDOWN(CT1,CT2,3))
```

```
                WRITE (100,1370) POWER(CT3,RELATIVE_STPT_NUM),
     c          BLETDOWN(CT1,CT2,1), DOWNTIME, BORON_FRACTION
 1370           FORMAT ('power=',G10.5,1X,'burn=',G9.4,1X,'down=',
     c          G10.5,1X,'bfrac=',G9.4,1X,'end')
              ENDIF
 1380       CONTINUE
           ELSEIF (STEPCONTROL.EQ.'Y') THEN
            DO 1388 CT4=1,VARSTEPNUM(CT1,CT2)
              IF (CT4.LT.VARSTEPNUM(CT1,CT2)) THEN
                DOWNTIME=0.0
                BORON_FRACTION=(VARBLETDOWN(CT1,CT2,CT4,2)/
     c          VARBLETDOWN(CT1,CT2,1,2))
                WRITE (100,1382) VARPOWER(CT1,CT2,CT4,CT3),
     c          VARBLETDOWN(CT1,CT2,CT4,1), DOWNTIME, BORON_FRACTION
 1382           FORMAT ('power=',G10.5,1X,'burn=',G9.4,1X,'down=',
     c          G10.5,1X,'bfrac=',G9.4,1X,'end')
              ELSEIF ((CT4.EQ.VARSTEPNUM(CT1,CT2)).AND.
     c        (CT2.LT.STPTS(CT1))) THEN
                DOWNTIME=STPTDAT(CT1,(CT2+1),3)
                BORON_FRACTION=(VARBLETDOWN(CT1,CT2,CT4,2)/
     c          VARBLETDOWN(CT1,CT2,1,2))
                WRITE (100,1384) VARPOWER(CT1,CT2,CT4,CT3),
     c          VARBLETDOWN(CT1,CT2,CT4,1), DOWNTIME, BORON_FRACTION
 1384           FORMAT ('power=',G10.5,1X,'burn=',G9.4,1X,'down=',
     c          G10.5,1X,'bfrac=',G9.4,1X,'end')
              ELSEIF ((CT4.EQ.VARSTEPNUM(CT1,CT2)).AND.
     c        (CT2.EQ.STPTS(CT1))) THEN
                DOWNTIME=CYCDOWN(CT1)
                BORON_FRACTION=(VARBLETDOWN(CT1,CT2,CT4,2)/
     c          VARBLETDOWN(CT1,CT2,1,2))
                WRITE (100,1386) VARPOWER(CT1,CT2,CT4,CT3),
     c          VARBLETDOWN(CT1,CT2,CT4,1), DOWNTIME, BORON_FRACTION
 1386           FORMAT ('power=',G10.5,1X,'burn=',G9.4,1X,'down=',
     c          G10.5,1X,'bfrac=',G9.4,1X,'end')
              ENDIF
 1388       CONTINUE
           ENDIF
*  Store final downtime for use in extraction script 'sedexecute.exe'
           FINALDOWNTIME=DOWNTIME
*  Write input deck closing statement
           WRITE (100,1390)
 1390      FORMAT ('''')
           WRITE (100,1400)
 1400      FORMAT (''' end of input')
           WRITE (100,1410)
 1410      FORMAT ('''')
           WRITE (100,1420)
 1420      FORMAT ('end')
           CLOSE(UNIT=100)

      RETURN
      END


*****************************************************************
*     Subroutine to write continuation depletion/decay SAS2H    *
*     input decks utilizing fuel and burnable poison compositions *
*     from the assembly's previous depletion/decay calculation  *
*     en-route to the final CRC depletion/decay calculation     *
*****************************************************************
```

```
      SUBROUTINE CONTINUATION_WRITER (RELATIVE_STPT_NUM, CT1, CT2,
     c CT3, AXNUM, CYCPOS, AXBLANK, BPDESID,
     c CRINS, CRDES, CRMIXNUM, CRMIXID,
     c CRNUMISOS, CRISOID, APSRINS,
     c APSRMIXNUM, APSRMIXID, RELATIVE_APSR_MIX_ID,
     c APSRNUMISOS, APSRISOID, ISN, IIM, ICM, IUS,
     c PLEVEL, BPZONE, BPMA, CRZONE, CRMA,
     c LMC, APSRZONE, APSRMA, LMD,
     c BPTN, BPBN, STPTS, APSRDES,
     c STPTDAT, AXBLANKRICH, GRAMS,
     c NODES, RODS, RICH, FTFINAL, MODDENFINAL,
     c MODTEMPFINAL, BLETDOWN, BPWTPCT,
     c BPDEN, CRDEN, CRISOWTPCT, APSRDEN,
     c APSRISOWTPCT, PITCH, FOD, COD, CID, SZF, EPS, PTC,
     c MESH, BPRA, CRRA, LRC, APSRRA,
     c LRD, POWER, CYCDOWN, PREFIX, NM,
     c CYCLEID, REACT, LIB, AXBLANKET, FUELCLAD,
     c BPRFLAG, CRSTAT, APSRSTAT, FLAG2, LUZONE, LMB, LRB,
     c MASSTOTAL, FUELISONAME, FUELISOWTPCT, BPRAISONAME,
     c BPRAISOVALUE, LEFTLIST, CARRYCOUNTER, BPXSECT, BPRODS,
     c PREVIOUSNAME, FINALDOWNTIME, LEFTVAL, BPRA_INSERTED, CLADTOT,
     c CLADDESNUM, CLADDESNAME, BPRCLAD, CRCLAD, APSRCLAD,
     c CLTEMP, BPMIXNUM, BPMIX, BPMIXID,
     c BPNUMISOS, BPISOID, BPISOWTPCT, UCSPACERFRAC,
     c SPACERMAT, STEPCONTROL, VARBLETDOWN, VARSTEPNUM,
     c VARPOWER, BPRFM, BPFMNUMISOS, BPFISOID,
     c ABOVEBPNUM, APSRFM, BPRFR, BPFISOWTPCT,
     c APSRFR, ABOVEBP, APSRFOLLOWMIX, CT1START, CT2GOVALUE,
     c APSRINSOLD)
*
      INTEGER*4 RELATIVE_STPT_NUM, CT1, CT2, CT3, AXNUM,
     c NUMSTPT1, NUMSTPT2, NUMSTPT3, CYCPOS(10), AXBLANK(50),
     c BPDESID(10), BPRA_DESCRIPTION_ID, CT4, CT5, CRINS(10,20,23,50),
     c CR_MIXTURE_ID, CR_DESCRIPTION, CRDES(10,20,23,50), CRMIXNUM,
     c CRMIXID(25), RELATIVE_CR_MIX_ID, CRNUMISOS(25),
     c CRISOID(25,10), APSRINS(10,20,23,50), APSR_MIXTURE_ID,
     c APSR_DESCRIPTION, APSRMIXNUM, APSRMIXID(25),
     c RELATIVE_APSR_MIX_ID, APSRNUMISOS(25), APSRISOID(25,10),
     c ISN, IIM, ICM, IUS, PLEVEL, BPZONE(10), BPMA(15,10),
     c CRZONE(10), CRMA(15,10), LMC(15,10), APSRZONE(10),
     c APSRMA(15,10), LMD(15,10), BPTN(10), BPBN(10), STPTS(10),
     c APSRDES(10,20,23,50), LUZONE, LMB(15), CARRYCOUNTER,
     c FUELISOTOPENUMBER, BPRODS(10), PNMCT1, PNMCT2, PNUMSTPT1,
     c PNUMSTPT2, PNUMSTPT3, NUMSTPT4, NUMSTPT5, NUMSTPT6,
     c PNUMSTPT4, PNUMSTPT5, PNUMSTPT6, CLADTOT, CLADDESNUM(10),
     c BPRCLAD(10), CRCLAD(10), APSRCLAD(10), BPRCLNUM, CRCLNUM,
     c APSRCLNUM, BPMIXNUM, BPMIX(10), BPMIXID(10), BPNUMISOS(10),
     c BPISOID(10,20), VARSTEPNUM(10,20), BPRFM(15,10),
     c BPFMNUMISOS(25), BPFISOID(25,10), ABOVEBPNUM(10),
     c APSRFM(15,10), APSRFOLLOWMIX(10,20,23,50),
     c FOLNODKEEP, FOLSTEPKEEP, APSRFOLNUM, APSRINSOLD(10,20,23,50),
     c APSRFOLLOWDATA(10,20,23,50), CT1START, CT2GOVALUE
*
      REAL STPTDAT(10,20,3), ENR, AXBLANKRICH, OXYGMS, GRAMS(50),
     c FVOL, PI, NODES(50,2), RODS, FDEN,
     c RICH, FTFINAL(50,20),
     c MODDENFINAL(50,20), MODTEMPFINAL(50,20), BLETDOWN(10,20,25),
     c BPWTPCT(10), BPDEN(10), ALFRAC, OFRAC, CRDEN(10),
     c CRISOWTPCT(25,10), APSRDEN(10), APSRISOWTPCT(25,10),
     c PITCH, FOD, COD, CID, SZF, EPS, PTC, MESH, BPRA(15,10),
```

```
      c CRRA(15,10), LRC(15,10), APSRRA(15,10), LRD(15,10),
      c DOWNTIME, BORON_FRACTION, POWER(50,20), CYCDOWN(10), LRB(15),
      c MASSTOTAL, FUELISOWTPCT(1000), BPRAISOVALUE(2), BPXSECT(10),
      c BPVOL, FINALDOWNTIME, LEFTVAL(1000), CLTEMP,
      c BPISOWTPCT(10,20), UCSPACERFRAC, BORATEDMODVF,
      c BORONVF, UCMODREGIONDEN, B4CMASS, ALMASS, OMASS, CMASS,
      c NEWBPMASSTOTAL, NEWBPDEN, ALWTPCT, OWTPCT, CWTPCT, B10WTPCT,
      c B11WTPCT, VARBLETDOWN(10,20,25,25), VARPOWER(10,20,25,50),
      c BPRFR(15,10), BPFISOWTPCT(25,10), APSRFR(15,10)
*
       CHARACTER CHNODE*2, CHID*2, PREFIX*3, CHSTPT1*1, CHSTPT2*1,
      c CHSTPT3*1, NM*31, CYCLEID(10)*2, REACT*21, LIB*15,
      c AXBLANKET*1, FUELCLAD*10, BPRFLAG*1, CRSTAT*6, APSRSTAT*6,
      c FLAG2*7, IRRAD_STEPS*2, PLEVELCH*2, BPZONECH*2, CRZONECH*2,
      c APSRZONECH*2, LUZONECH*2, FUELISONAME(1000)*5, BPRAISONAME(2)*6,
      c LEFTLIST(1000)*6, PREVIOUSNAME*25, PCHSTPT1*1, PCHSTPT2*1,
      c PCHSTPT3*1, ASSYPOSITION*2, CHSTPT4*1, CHSTPT5*1, CHSTPT6*1,
      c PCHSTPT4*1, PCHSTPT5*1, PCHSTPT6*1, PCHID*2, CLADDESNAME(10)*7,
      c SPACERMAT*7, STEPCONTROL*1, ABOVEBP(10)*5
*
       LOGICAL BPRA_INSERTED, CR_INSERTED, CRCOMPFLAG, APSR_INSERTED,
      c APSRCOMPFLAG, BPRA_FOLLOW, APSRBOTFLAG, FOLLOWIN
*
       PI=3.14159265359
*  Determination of the input deck filename
           CALL ZEROS(CT3,CHNODE)
           CALL ZEROS(CYCPOS(CT1),CHID)
           IF ((CT2-1).EQ.0) THEN
              PNMCT1=CT1-1
              PNMCT2=STPTS(PNMCT1)
           ELSE
              PNMCT1=CT1
              PNMCT2=CT2-1
           ENDIF
           CALL ZEROS(CYCPOS(PNMCT1),PCHID)
*  Determine new filename
           NUMSTPT1=INT(STPTDAT(CT1,CT2,1)/100.0)
           CHSTPT1=CHAR(NUMSTPT1+48)
           NUMSTPT2=INT((STPTDAT(CT1,CT2,1)-(NUMSTPT1*100))/10.0)
           CHSTPT2=CHAR(NUMSTPT2+48)
           NUMSTPT3=INT((STPTDAT(CT1,CT2,1)-(NUMSTPT1*100)-
     c     (NUMSTPT2*10)))
           CHSTPT3=CHAR(NUMSTPT3+48)
           IF (CT2.LT.STPTS(CT1)) THEN
              NUMSTPT4=INT(STPTDAT(CT1,(CT2+1),1)/100.0)
              CHSTPT4=CHAR(NUMSTPT4+48)
              NUMSTPT5=INT((STPTDAT(CT1,(CT2+1),1)-(NUMSTPT4*100))/10.0)
              CHSTPT5=CHAR(NUMSTPT5+48)
              NUMSTPT6=INT((STPTDAT(CT1,(CT2+1),1)-(NUMSTPT4*100)-
     c        (NUMSTPT5*10)))
              CHSTPT6=CHAR(NUMSTPT6+48)
           ELSEIF (CT2.EQ.STPTS(CT1)) THEN
              NUMSTPT4=INT(STPTDAT((CT1+1),1,1)/100.0)
              CHSTPT4=CHAR(NUMSTPT4+48)
              NUMSTPT5=INT((STPTDAT((CT1+1),1,1)-(NUMSTPT4*100))/10.0)
              CHSTPT5=CHAR(NUMSTPT5+48)
              NUMSTPT6=INT((STPTDAT((CT1+1),1,1)-(NUMSTPT4*100)-
     c        (NUMSTPT5*10)))
              CHSTPT6=CHAR(NUMSTPT6+48)
           ENDIF
```

```
            NM(1:3)=PREFIX
            NM(4:4)='A'
            NM(5:6)=CHID
            NM(7:7)='N'
            NM(8:9)=CHNODE
            NM(10:11)='DC'
            NM(12:13)=CYCLEID(CT1)
            NM(14:14)='T'
            NM(15:15)=CHSTPT1
            NM(16:16)=CHSTPT2
            NM(17:17)=CHSTPT3
            NM(18:19)='AC'
            IF (CT2.EQ.STPTS(CT1)) THEN
               NM(20:21)=CYCLEID(CT1+1)
            ELSE
               NM(20:21)=CYCLEID(CT1)
            ENDIF
            NM(22:22)='T'
            NM(23:23)=CHSTPT4
            NM(24:24)=CHSTPT5
            NM(25:25)=CHSTPT6
            NM(26:31)='.input'
*   Determine previous filename
            PNUMSTPT1=INT(STPTDAT(PNMCT1,PNMCT2,1)/100.0)
            PCHSTPT1=CHAR(PNUMSTPT1+48)
            PNUMSTPT2=INT((STPTDAT(PNMCT1,PNMCT2,1)-
     c      (PNUMSTPT1*100))/10.0)
            PCHSTPT2=CHAR(PNUMSTPT2+48)
            PNUMSTPT3=INT((STPTDAT(PNMCT1,PNMCT2,1)-(PNUMSTPT1*100)-
     c      (PNUMSTPT2*10)))
            PCHSTPT3=CHAR(PNUMSTPT3+48)
            IF (PNMCT2.LT.STPTS(PNMCT1)) THEN
               PNUMSTPT4=INT(STPTDAT(PNMCT1,(PNMCT2+1),1)/100.0)
               PCHSTPT4=CHAR(PNUMSTPT4+48)
               PNUMSTPT5=INT((STPTDAT(PNMCT1,(PNMCT2+1),1)-
     c         (PNUMSTPT4*100))/10.0)
               PCHSTPT5=CHAR(PNUMSTPT5+48)
               PNUMSTPT6=INT((STPTDAT(PNMCT1,(PNMCT2+1),1)-
     c         (PNUMSTPT4*100)-(PNUMSTPT5*10)))
               PCHSTPT6=CHAR(PNUMSTPT6+48)
            ELSEIF (PNMCT2.EQ.STPTS(PNMCT1)) THEN
               PNUMSTPT4=INT(STPTDAT((PNMCT1+1),1,1)/100.0)
               PCHSTPT4=CHAR(PNUMSTPT4+48)
               PNUMSTPT5=INT((STPTDAT((PNMCT1+1),1,1)-
     c         (PNUMSTPT4*100))/10.0)
               PCHSTPT5=CHAR(PNUMSTPT5+48)
               PNUMSTPT6=INT((STPTDAT((PNMCT1+1),1,1)-(PNUMSTPT4*100)-
     c         (PNUMSTPT5*10)))
               PCHSTPT6=CHAR(PNUMSTPT6+48)
            ENDIF
            PREVIOUSNAME(1:3)=PREFIX
            PREVIOUSNAME(4:4)='A'
            PREVIOUSNAME(5:6)=PCHID
            PREVIOUSNAME(7:7)='N'
            PREVIOUSNAME(8:9)=CHNODE
            PREVIOUSNAME(10:11)='DC'
            IF (CT2.EQ.1) THEN
               PREVIOUSNAME(12:13)=CYCLEID(CT1-1)
            ELSE
               PREVIOUSNAME(12:13)=CYCLEID(CT1)
```

```
      ENDIF
      PREVIOUSNAME(14:14)='T'
      PREVIOUSNAME(15:15)=PCHSTPT1
      PREVIOUSNAME(16:16)=PCHSTPT2
      PREVIOUSNAME(17:17)=PCHSTPT3
      PREVIOUSNAME(18:19)='AC'
      PREVIOUSNAME(20:21)=CYCLEID(CT1)
      PREVIOUSNAME(22:22)='T'
      PREVIOUSNAME(23:23)=PCHSTPT4
      PREVIOUSNAME(24:24)=PCHSTPT5
      PREVIOUSNAME(25:25)=PCHSTPT6
*  Open and rewind the input deck file
      OPEN(UNIT=100, FILE=NM, STATUS='UNKNOWN')
      REWIND(UNIT=100)
*  Write first section of input deck
      WRITE (100,10)
10    FORMAT ('=sas2h',T11,'parm=skipshipdata')
      IF (CT2.LT.STPTS(CT1)) THEN
         WRITE (100,20) REACT, CHID, CHNODE,
     c   NM(12:13), STPTDAT(CT1,CT2,1), NM(20:21),
     c   STPTDAT(CT1,(CT2+1),1)
20       FORMAT (A21,1X,'Assy-',A2,
     c   ', Node-',A2,1X,
     c   '{Cyc-',A2,', 'F5.1,' to Cyc-',
     c   A2,', ',F5.1,' EFPD}')
      ELSEIF (CT2.EQ.STPTS(CT1)) THEN
         WRITE (100,25) REACT, CHID, CHNODE,
     c   NM(12:13), STPTDAT(CT1,CT2,1), NM(20:21),
     c   STPTDAT((CT1+1),1,1)
25       FORMAT (A21,1X,'Assy-',A2,
     c   ', Node-',A2,1X,
     c   '{Cyc-',A2,', 'F5.1,' to Cyc-',
     c   A2,', ',F5.1,' EFPD}')
      ENDIF
      WRITE (100,30) LIB
30    FORMAT (A15,1X,'latticecell')
      WRITE (100,40)
40    FORMAT ('''')
      WRITE (100,50)
50    FORMAT (''' fuel density based on mass of uranium per',
     c' assembly',T56,'& total pellet stack')
      WRITE (100,60)
60    FORMAT (''' volume to account for fuel volume loss to',
     c' pellet c',T55,'hamfers')
      WRITE (100,70)
70    FORMAT ('''')
*  Write second section of input deck (material specifications)
      WRITE (100,80)
80    FORMAT ('''',5X,'material specification input')
      WRITE (100,90)
90    FORMAT ('''')
*  Calculate initital fuel parameters depending upon whether or not the
*  node represents axial blanket fuel
      IF ((AXBLANKET.EQ.'Y').AND.(AXBLANK(CT3).EQ.1)) THEN
         ENR=AXBLANKRICH
      ELSE
         ENR=RICH
      ENDIF
      OXYGMS=(GRAMS(CT3)*2*15.994915)/(((ENR/100)*235.043915)+
     c(((0.007731*((ENR)**1.0837))/100)*234.040904)+
```

```
     c    (((0.0046*ENR)/100)*236.045637)+(((100-(0.007731*
     c    (ENR**1.0837))-(ENR)-(0.0046*ENR))/100)*238.05077))
*  Determine if the burnable poison charge isotopics should be retrieved
          BPRA_INSERTED=.FALSE.
          IF ((BPRFLAG.EQ.'Y').AND.(BPDESID(CT1).NE.0).AND.
     c       (CT3.GE.BPTN(CT1)).AND.(CT3.LE.BPBN(CT1))) THEN
             BPRA_INSERTED=.TRUE.
          ENDIF
*  Call subroutine to retrieve charge for fuel and bp isotopics
          CALL RETRIEVER (OXYGMS, MASSTOTAL,
     c    FUELISONAME, FUELISOWTPCT, BPRAISONAME,
     c    BPRAISOVALUE, LEFTLIST, CARRYCOUNTER,
     c    PREVIOUSNAME, LEFTVAL, NM, BPRA_INSERTED)
*  Calculate the nodal fuel volume, fuel density, and oxygen wt%
          FVOL=(PI/4)*(FOD**2)*(NODES(CT3,2))*(RODS)
          FDEN=MASSTOTAL/FVOL
          OXYWTPCT=(OXYGMS/MASSTOTAL)*100.0
          FUELISOTOPENUMBER=CARRYCOUNTER+1
*  Write fuel composition input description
          IF (FDEN.LT.(10.0)) THEN
             WRITE (100,100) FDEN, FUELISOTOPENUMBER, OXYWTPCT
  100        FORMAT ('arbm-fuel',1X,G10.3,1X,I3,1X,'0 0 0',1X,
     c       '8016',1X,G10.3)
          ELSE
             WRITE (100,110) FDEN, FUELISOTOPENUMBER, OXYWTPCT
  110        FORMAT ('arbm-fuel',1X,G10.3,1X,I3,1X,'0 0 0',1X,
     c       '8016',1X,G10.3)
          ENDIF
          DO 130 CT4=1,CARRYCOUNTER
             IF (MOD(CT4,3).EQ.0) THEN
                WRITE (100,*)
             ENDIF
             WRITE (100,120) FUELISONAME(CT4), FUELISOWTPCT(CT4)
  120        FORMAT (5X,A5,1X,G10.3,1X,$)
  130     CONTINUE
          WRITE (100,*)
          WRITE (100,140) FTFINAL(CT3,RELATIVE_STPT_NUM)
  140     FORMAT (5X,'1',3X,'1.0',3X,F6.1,'   end')
*  Write cladding material specifications
*  Additional cladding material specifications may be added to the
*  following IF statement as required
          IF ((FUELCLAD.EQ.'ZIRC-4    ').OR.
     c    (FUELCLAD.EQ.'ZIRCALLOY4')) THEN
             WRITE (100,532)
  532        FORMAT ('arbm-zirc4 6.56 5 0 0 0 8016 0.12 24000',
     c       ' 0.10 26000 0.20 50000 1.40')
             WRITE (100,535) CLTEMP
  535        FORMAT (T12,'40000 98.18 2 1.0 ',F5.1,' end')
          ELSEIF (FUELCLAD.EQ.'SS304     ') THEN
             WRITE (100,537)
  537        FORMAT ('arbm-ss304 7.92 4 0 0 0 24304 19.0 25055',
     c       ' 2.0 26304 69.5 28304 9.5')
             WRITE (100,540) CLTEMP
  540        FORMAT (T12,'2 1.0 ',F5.1,' end')
          ELSEIF (FUELCLAD.EQ.'SS304S    ') THEN
             WRITE (100,542)
  542        FORMAT ('arbm-ss304s 7.92 4 0 0 0 24000 19.0 25055',
     c       ' 2.0 26000 69.5 28000 9.5')
             WRITE (100,545) CLTEMP
  545        FORMAT (T13,'2 1.0 ',F5.1,' end')
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      ELSEIF (FUELCLAD.EQ.'SS316     ') THEN
         WRITE (100,547)
547      FORMAT ('arbm-ss316 7.75 7 0 0 0 6012 0.08 14000',
     c   ' 1.0 24304 17.0 25055 2.0')
         WRITE (100,550)
550      FORMAT (T12,'26304 65.42 28304 12.0 42000 2.5')
         WRITE (100,552) CLTEMP
552      FORMAT (T12,'2 1.0 ',F5.1,' end')
      ELSEIF (FUELCLAD.EQ.'SS316S    ') THEN
         WRITE (100,555)
555      FORMAT ('arbm-ss316s 7.75 7 0 0 0 6012 0.08 14000',
     c   ' 1.0 24000 17.0 25055 2.0')
         WRITE (100,557)
557      FORMAT (T13,'26000 65.42 28000 12.0 42000 2.5')
         WRITE (100,559) CLTEMP
559      FORMAT (T13,'2 1.0 ',F5.1,' end')
      ENDIF
*  Write moderator material specifications
      BORATEDMODVF=1.0-UCSPACERFRAC
      IF (STEPCONTROL.EQ.'N') THEN
         BORONVF=BLETDOWN(CT1,CT2,3)*(1E-6)*BORATEDMODVF
      ELSEIF (STEPCONTROL.EQ.'Y') THEN
         BORONVF=VARBLETDOWN(CT1,CT2,1,2)*(1E-6)*BORATEDMODVF
      ENDIF
      WRITE (100,560)
560   FORMAT ('''')
      IF ((SPACERMAT.EQ.'ZIRC-4 ').AND.
     c (UCSPACERFRAC.GT.(0.0))) THEN
         WRITE (100,561)
561      FORMAT ('''     material composition of moderator',
     c   ' within unit cell')
         WRITE (100,562)
562      FORMAT ('''     with smeared zirc-4 spacer grids')
         UCMODREGIONDEN=(MODDENFINAL(CT3,RELATIVE_STPT_NUM)*
     c   BORATEDMODVF)+(6.56*UCSPACERFRAC)
         IF (MODDENFINAL(CT3,RELATIVE_STPT_NUM).LT.(1.0)) THEN
            WRITE (100,563) UCMODREGIONDEN, BORATEDMODVF,
     c      MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
563         FORMAT ('h2o   3   den=',F5.4,3X,F6.5,3X,F7.1,3X,'end')
         ELSE
            WRITE (100,564) UCMODREGIONDEN, BORATEDMODVF,
     c      MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
564         FORMAT ('h2o   3   den=',F6.4,3X,F6.5,3X,F7.1,3X,'end')
         ENDIF
         WRITE (100,565) UCMODREGIONDEN, BORONVF,
     c   MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
565      FORMAT ('arbm-bormod',3X,F6.4,1X,'1 0 0 0 5000 100 3',
     c   1X,F6.5,1X,F7.1,1X,'end')
         WRITE (100,566) UCMODREGIONDEN
566      FORMAT ('arbm-spacer',3X,F6.4,1X,'5 0 0 0 8016 0.12',
     c   ' 24000 0.10 26000 0.25')
         WRITE (100,567) UCSPACERFRAC,
     c   MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
567      FORMAT (T17'50000 1.40 40000 98.18 3',1X,F6.5,1X,
     c   F7.1,1X,'end')
      ELSEIF ((SPACERMAT.EQ.'INCONEL').AND.
     c (UCSPACERFRAC.GT.(0.0))) THEN
         WRITE (100,568)
568      FORMAT ('''     material composition of moderator',
     c   ' within unit cell')
```

```
            WRITE (100,569)
569         FORMAT ('''     with smeared inconel spacer grids')
            UCMODREGIONDEN=(MODDENFINAL(CT3,RELATIVE_STPT_NUM)*
     c      BORATEDMODVF)+(8.3*UCSPACERFRAC)
            IF (MODDENFINAL(CT3,RELATIVE_STPT_NUM).LT.(1.0)) THEN
               WRITE (100,570) UCMODREGIONDEN, BORATEDMODVF,
     c         MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
570            FORMAT ('h2o   3   den=',F5.4,3X,F6.5,3X,F7.1,3X,'end')
            ELSE
               WRITE (100,571) UCMODREGIONDEN, BORATEDMODVF,
     c         MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
571            FORMAT ('h2o   3   den=',F6.4,3X,F6.5,3X,F7.1,3X,'end')
            ENDIF
            WRITE (100,572) UCMODREGIONDEN, BORONVF,
     c      MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
572         FORMAT ('arbm-bormod',3X,F6.4,1X,'1 0 0 0 5000 100 3',
     c      1X,F6.5,1X,F7.1,1X,'end')
            WRITE (100,573) UCMODREGIONDEN
573         FORMAT ('arbm-spacer',3X,F6.4,1X,'5 0 0 0 14000 2.5',
     c      ' 22000 2.5 24000 15.0')
            WRITE (100,574) UCSPACERFRAC,
     c      MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
574         FORMAT (T17'26000 7.0 28000 73.0 3',1X,F6.5,1X,
     c      F7.1,1X,'end')
         ELSEIF ((SPACERMAT.EQ.'SS316  ').AND.
     c   (UCSPACERFRAC.GT.(0.0))) THEN
            WRITE (100,575)
575         FORMAT ('''     material composition of moderator',
     c      ' within unit cell')
            WRITE (100,576)
576         FORMAT ('''     with smeared ss316 spacer grids')
            UCMODREGIONDEN=(MODDENFINAL(CT3,RELATIVE_STPT_NUM)*
     c      BORATEDMODVF)+(7.75*UCSPACERFRAC)
            IF (MODDENFINAL(CT3,RELATIVE_STPT_NUM).LT.(1.0)) THEN
               WRITE (100,577) UCMODREGIONDEN, BORATEDMODVF,
     c         MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
577            FORMAT ('h2o   3   den=',F5.4,3X,F6.5,3X,F7.1,3X,'end')
            ELSE
               WRITE (100,578) UCMODREGIONDEN, BORATEDMODVF,
     c         MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
578            FORMAT ('h2o   3   den=',F6.4,3X,F6.5,3X,F7.1,3X,'end')
            ENDIF
            WRITE (100,579) UCMODREGIONDEN, BORONVF,
     c      MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
579         FORMAT ('arbm-bormod',3X,F6.4,1X,'1 0 0 0 5000 100 3',
     c      1X,F6.5,1X,F7.1,1X,'end')
            WRITE (100,580) UCMODREGIONDEN
580         FORMAT ('arbm-spacer',3X,F6.4,1X,'7 0 0 0 6012 0.08',
     c      ' 14000 1.0 24304 17.0 25055 2.0')
            WRITE (100,581) UCSPACERFRAC,
     c      MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
581         FORMAT (T5'26304 65.42 28304 12.0 42000 2.5 3',1X,F6.5,1X,
     c      F7.1,1X,'end')
         ELSEIF ((SPACERMAT.EQ.'SS316S ').AND.
     c   (UCSPACERFRAC.GT.(0.0))) THEN
            WRITE (100,582)
582         FORMAT ('''     material composition of moderator',
     c      ' within unit cell')
            WRITE (100,583)
583         FORMAT ('''     with smeared ss316s spacer grids')
```

```
            UCMODREGIONDEN=(MODDENFINAL(CT3,RELATIVE_STPT_NUM)*
     c      BORATEDMODVF)+(7.75*UCSPACERFRAC)
            IF (MODDENFINAL(CT3,RELATIVE_STPT_NUM).LT.(1.0)) THEN
               WRITE (100,584) UCMODREGIONDEN, BORATEDMODVF,
     c         MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
   584         FORMAT ('h2o   3   den=',F5.4,3X,F6.5,3X,F7.1,3X,'end')
            ELSE
               WRITE (100,585) UCMODREGIONDEN, BORATEDMODVF,
     c         MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
   585         FORMAT ('h2o   3   den=',F6.4,3X,F6.5,3X,F7.1,3X,'end')
            ENDIF
            WRITE (100,586) UCMODREGIONDEN, BORONVF,
     c      MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
   586      FORMAT ('arbm-bormod',3X,F6.4,1X,'1 0 0 0 5000 100 3',
     c      1X,F6.5,1X,F7.1,1X,'end')
            WRITE (100,587) UCMODREGIONDEN
   587      FORMAT ('arbm-spacer',3X,F6.4,1X,'7 0 0 0 6012 0.08',
     c      ' 14000 1.0 24000 17.0 25055 2.0')
            WRITE (100,588) UCSPACERFRAC,
     c      MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
   588      FORMAT (T5'26000 65.42 28000 12.0 42000 2.5 3',1X,F6.5,1X,
     c      F7.1,1X,'end')
         ELSEIF ((SPACERMAT.EQ.'SS304  ').AND.
     c   (UCSPACERFRAC.GT.(0.0))) THEN
            WRITE (100,589)
   589      FORMAT ('''     material composition of moderator',
     c      ' within unit cell')
            WRITE (100,590)
   590      FORMAT ('''     with smeared ss304 spacer grids')
            UCMODREGIONDEN=(MODDENFINAL(CT3,RELATIVE_STPT_NUM)*
     c      BORATEDMODVF)+(7.92*UCSPACERFRAC)
            IF (MODDENFINAL(CT3,RELATIVE_STPT_NUM).LT.(1.0)) THEN
               WRITE (100,591) UCMODREGIONDEN, BORATEDMODVF,
     c         MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
   591         FORMAT ('h2o   3   den=',F5.4,3X,F6.5,3X,F7.1,3X,'end')
            ELSE
               WRITE (100,592) UCMODREGIONDEN, BORATEDMODVF,
     c         MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
   592         FORMAT ('h2o   3   den=',F6.4,3X,F6.5,3X,F7.1,3X,'end')
            ENDIF
            WRITE (100,593) UCMODREGIONDEN, BORONVF,
     c      MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
   593      FORMAT ('arbm-bormod',3X,F6.4,1X,'1 0 0 0 5000 100 3',
     c      1X,F6.5,1X,F7.1,1X,'end')
            WRITE (100,594) UCMODREGIONDEN
   594      FORMAT ('arbm-spacer',3X,F6.4,1X,'4 0 0 0 24304 19.0',
     c      ' 25055 2.0 26304 69.5 28304 9.5')
            WRITE (100,595) UCSPACERFRAC,
     c      MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
   595      FORMAT (T15'3',1X,F6.5,1X,F7.1,1X,'end')
         ELSEIF ((SPACERMAT.EQ.'SS304S ').AND.
     c   (UCSPACERFRAC.GT.(0.0))) THEN
            WRITE (100,596)
   596      FORMAT ('''     material composition of moderator',
     c      ' within unit cell')
            WRITE (100,597)
   597      FORMAT ('''     with smeared ss304s spacer grids')
            UCMODREGIONDEN=(MODDENFINAL(CT3,RELATIVE_STPT_NUM)*
     c      BORATEDMODVF)+(7.92*UCSPACERFRAC)
            IF (MODDENFINAL(CT3,RELATIVE_STPT_NUM).LT.(1.0)) THEN
```

```
               WRITE (100,598) UCMODREGIONDEN, BORATEDMODVF,
     c         MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
   598         FORMAT ('h2o   3   den=',F5.4,3X,F6.5,3X,F7.1,3X,'end')
            ELSE
               WRITE (100,599) UCMODREGIONDEN, BORATEDMODVF,
     c         MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
   599         FORMAT ('h2o   3   den=',F6.4,3X,F6.5,3X,F7.1,3X,'end')
            ENDIF
            WRITE (100,600) UCMODREGIONDEN, BORONVF,
     c      MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
   600      FORMAT ('arbm-bormod',3X,F6.4,1X,'1 0 0 0 5000 100 3',
     c      1X,F6.5,1X,F7.1,1X,'end')
            WRITE (100,601) UCMODREGIONDEN
   601      FORMAT ('arbm-spacer',3X,F6.4,1X,'4 0 0 0 24000 19.0',
     c      ' 25055 2.0 26000 69.5 28000 9.5')
            WRITE (100,602) UCSPACERFRAC,
     c      MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
   602      FORMAT (T15'3',1X,F6.5,1X,F7.1,1X,'end')
          ELSEIF (UCSPACERFRAC.EQ.(0.0)) THEN
            WRITE (100,603)
   603      FORMAT (''' material composition of moderator',
     c      ' within unit cell')
            WRITE (100,604)
   604      FORMAT (''' with no smeared spacer grids')
            UCMODREGIONDEN=(MODDENFINAL(CT3,RELATIVE_STPT_NUM)*
     c      BORATEDMODVF)
            IF (MODDENFINAL(CT3,RELATIVE_STPT_NUM).LT.(1.0)) THEN
               WRITE (100,605) UCMODREGIONDEN, BORATEDMODVF,
     c         MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
   605         FORMAT ('h2o   3   den=',F5.4,3X,F6.5,3X,F7.1,3X,'end')
            ELSE
               WRITE (100,606) UCMODREGIONDEN, BORATEDMODVF,
     c         MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
   606         FORMAT ('h2o   3   den=',F6.4,3X,F6.5,3X,F7.1,3X,'end')
            ENDIF
            WRITE (100,607) UCMODREGIONDEN, BORONVF,
     c      MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
   607      FORMAT ('arbm-bormod',3X,F6.4,1X,'1 0 0 0 5000 100 3',
     c      1X,F6.5,1X,F7.1,1X,'end')
          ENDIF
          WRITE (100,608)
   608    FORMAT ('''')
*  Write BPRA material specifications
*  BPR follow specifications
          BPRA_FOLLOW=.FALSE.
          IF ((BPRFLAG.EQ.'Y').AND.(BPDESID(CT1).NE.0).AND.
     c       (CT3.LT.BPTN(CT1))) THEN
             BPRA_FOLLOW=.TRUE.
             BPRA_DESCRIPTION_ID=BPDESID(CT1)
             WRITE(100,610)
   610       FORMAT('''')
             WRITE(100,612)
   612       FORMAT('''',5X,'BPR above the BP absorber region')
             WRITE(100,614)
   614       FORMAT('''')
             IF ((BPRCLAD(BPDESID(CT1)).NE.0).AND.
     c       (BPRCLAD(BPDESID(CT1)).NE.2)) THEN
               DO 616 CT5=1,10
                IF (BPRCLAD(BPDESID(CT1)).EQ.CLADDESNUM(CT5)) THEN
                 BPRCLNUM=CT5
```

```
              EXIT
             ENDIF
 616        CONTINUE
            IF (CLADDESNAME(BPRCLNUM).EQ.'SS304  ') THEN
             WRITE (100,618)
 618         FORMAT ('arbm-ss304 7.92 4 0 0 0 24304 19.0 25055',
    c        ' 2.0 26304 69.5 28304 9.5')
             WRITE (100,620) CLADDESNUM(BPRCLNUM), CLTEMP
 620         FORMAT (T12,I2,' 1.0 ',F5.1,' end')
            ELSEIF (CLADDESNAME(BPRCLNUM).EQ.'SS304S ') THEN
             WRITE (100,622)
 622         FORMAT ('arbm-ss304s 7.92 4 0 0 0 24000 19.0 25055',
    c        ' 2.0 26000 69.5 28000 9.5')
             WRITE (100,624) CLADDESNUM(BPRCLNUM), CLTEMP
 624         FORMAT (T13,I2,' 1.0 ',F5.1,' end')
            ELSEIF (CLADDESNAME(BPRCLNUM).EQ.'SS316  ') THEN
             WRITE (100,626)
 626         FORMAT ('arbm-ss316 7.75 7 0 0 0 6012 0.08 14000',
    c        ' 1.0 24304 17.0 25055 2.0')
             WRITE (100,628)
 628         FORMAT (T12,'26304 65.42 28304 12.0 42000 2.5')
             WRITE (100,630) CLADDESNUM(BPRCLNUM), CLTEMP
 630         FORMAT (T12,I2,' 1.0 ',F5.1,' end')
            ELSEIF (CLADDESNAME(BPRCLNUM).EQ.'SS316S ') THEN
             WRITE (100,632)
 632         FORMAT ('arbm-ss316s 7.75 7 0 0 0 6012 0.08 14000',
    c        ' 1.0 24000 17.0 25055 2.0')
             WRITE (100,633)
 633         FORMAT (T13,'26000 65.42 28000 12.0 42000 2.5')
             WRITE (100,634) CLADDESNUM(BPRCLNUM), CLTEMP
 634         FORMAT (T13,I2,' 1.0 ',F5.1,' end')
            ELSEIF (CLADDESNAME(BPRCLNUM).EQ.'INCONEL') THEN
             WRITE (100,635)
 635         FORMAT ('arbm-inconel 8.3 5 0 0 0 14000 2.5',
    c        ' 22000 2.5 24000 15.0')
             WRITE (100,636)
 636         FORMAT (T13,'26000 7.0 28000 73.0')
             WRITE (100,637) CLADDESNUM(BPRCLNUM), CLTEMP
 637         FORMAT (T13,I2,' 1.0 ',F5.1,' end')
            ENDIF
           ENDIF
           IF (ABOVEBP(BPDESID(CT1)).EQ.'AL2O3') THEN
              ALFRAC=(((BPDEN(BPDESID(CT1)))*2.0*26.981539)/
    c         (101.9631))/BPDEN(BPDESID(CT1))
              OFRAC=1.0-ALFRAC
              IF (BPDEN(BPDESID(CT1)).LT.(1.0)) THEN
                 WRITE (100,638) ABOVEBPNUM(BPDESID(CT1)),
    c            BPDEN(BPDESID(CT1)), ALFRAC,
    c            MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
 638             FORMAT ('al',3X,I3,3X,'den=',F4.3,1X,F7.5,
    c            1X,F7.1,1X,'end')
                 WRITE (100,640) ABOVEBPNUM(BPDESID(CT1)),
    c            BPDEN(BPDESID(CT1)), OFRAC,
    c            MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
 640             FORMAT ('o',3X,I3,3X,'den=',F4.3,1X,F7.5,
    c            1X,F7.1,1X,'end')
              ELSE
                 WRITE (100,642) ABOVEBPNUM(BPDESID(CT1)),
    c            BPDEN(BPDESID(CT1)), ALFRAC,
    c            MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
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  642             FORMAT ('al',3X,I3,3X,'den=',F5.3,1X,F7.5,
     c            1X,F7.1,1X,'end')
                  WRITE (100,644) ABOVEBPNUM(BPDESID(CT1)),
     c            BPDEN(BPDESID(CT1)), OFRAC,
     c            MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
  644             FORMAT ('o',3X,I3,3X,'den=',F5.3,1X,F7.5,
     c            1X,F7.1,1X,'end')
               ENDIF
            ELSE
               WRITE (100,*) 'arbm-bp    ',
     c         BPDEN(BPRA_DESCRIPTION_ID),
     c         '    ', BPFMNUMISOS(BPRA_DESCRIPTION_ID),
     c         '   0   0   0'
               DO 650 CT4=1,BPFMNUMISOS(BPRA_DESCRIPTION_ID)
                  WRITE (100,648)
     c            BPFISOID(BPRA_DESCRIPTION_ID,CT4),
     c            BPFISOWTPCT(BPRA_DESCRIPTION_ID,CT4)
  648             FORMAT (10X,I6,3X,F10.5)
  650          CONTINUE
               WRITE (100,*) '           ',
     c         ABOVEBPNUM(BPRA_DESCRIPTION_ID),
     c         ' 1.0 ',MODTEMPFINAL(CT3,RELATIVE_STPT_NUM),
     c         '   end'
            ENDIF
         ENDIF
*  Actual BPRA specifications
         BPRA_INSERTED=.FALSE.
         IF ((BPRFLAG.EQ.'Y').AND.(BPDESID(CT1).NE.0).AND.
     c      (CT3.GE.BPTN(CT1)).AND.(CT3.LE.BPBN(CT1))) THEN
            BPRA_INSERTED=.TRUE.
            BPRA_DESCRIPTION_ID=BPDESID(CT1)
            WRITE (100,685)
  685       FORMAT ('''')
            IF (BPMIX(BPRA_DESCRIPTION_ID).EQ.0) THEN
               WRITE (100,690) BPWTPCT(BPDESID(CT1))
  690          FORMAT ('''',5X,'Al2O3-B4C burnable absorber pellet',1X,
     c         'specification (',F4.2,1X,'wt% b4c)')
            ELSE
               WRITE (100,695)
  695          FORMAT ('''',5X,'burnable absorber pellet ',
     c         'specification')
            ENDIF
            WRITE (100,700)
  700       FORMAT ('''')
*  Write B4C material specification
            IF ((BPRCLAD(BPDESID(CT1)).NE.0).AND.
     c      (BPRCLAD(BPDESID(CT1)).NE.2)) THEN
              DO 701 CT5=1,10
               IF (BPRCLAD(BPDESID(CT1)).EQ.CLADDESNUM(CT5)) THEN
                BPRCLNUM=CT5
                EXIT
               ENDIF
  701         CONTINUE
              IF (CLADDESNAME(BPRCLNUM).EQ.'SS304  ') THEN
               WRITE (100,702)
  702          FORMAT ('arbm-ss304 7.92 4 0 0 0 24304 19.0 25055',
     c         ' 2.0 26304 69.5 28304 9.5')
               WRITE (100,703) CLADDESNUM(BPRCLNUM), CLTEMP
  703          FORMAT (T12,I2,' 1.0 ',F5.1,' end')
              ELSEIF (CLADDESNAME(BPRCLNUM).EQ.'SS304S ') THEN
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                WRITE (100,704)
  704           FORMAT ('arbm-ss304s 7.92 4 0 0 0 24000 19.0 25055',
     c          ' 2.0 26000 69.5 28000 9.5')
                WRITE (100,705) CLADDESNUM(BPRCLNUM), CLTEMP
  705           FORMAT (T13,I2,' 1.0 ',F5.1,' end')
               ELSEIF (CLADDESNAME(BPRCLNUM).EQ.'SS316  ') THEN
                WRITE (100,706)
  706           FORMAT ('arbm-ss316 7.75 7 0 0 0 6012 0.08 14000',
     c          ' 1.0 24304 17.0 25055 2.0')
                WRITE (100,707)
  707           FORMAT (T12,'26304 65.42 28304 12.0 42000 2.5')
                WRITE (100,708) CLADDESNUM(BPRCLNUM), CLTEMP
  708           FORMAT (T12,I2,' 1.0 ',F5.1,' end')
               ELSEIF (CLADDESNAME(BPRCLNUM).EQ.'SS316S ') THEN
                WRITE (100,709)
  709           FORMAT ('arbm-ss316s 7.75 7 0 0 0 6012 0.08 14000',
     c          ' 1.0 24000 17.0 25055 2.0')
                WRITE (100,710)
  710           FORMAT (T13,'26000 65.42 28000 12.0 42000 2.5')
                WRITE (100,711) CLADDESNUM(BPRCLNUM), CLTEMP
  711           FORMAT (T13,I2,' 1.0 ',F5.1,' end')
               ELSEIF (CLADDESNAME(BPRCLNUM).EQ.'INCONEL') THEN
                WRITE (100,712)
  712           FORMAT ('arbm-inconel 8.3 5 0 0 0 14000 2.5',
     c          ' 22000 2.5 24000 15.0')
                WRITE (100,713)
  713           FORMAT (T13,'26000 7.0 28000 73.0')
                WRITE (100,714) CLADDESNUM(BPRCLNUM), CLTEMP
  714           FORMAT (T13,I2,' 1.0 ',F5.1,' end')
               ENDIF
              ENDIF
*  Material specification if it is a BOC to statepoint 1 calculation
              IF (CT2.EQ.1) THEN
*  Material specification for AL2O3-B4C
               IF ((BPMIX(BPRA_DESCRIPTION_ID).EQ.0).OR.
     c         (BPMIX(BPRA_DESCRIPTION_ID).EQ.4)) THEN
                 IF (BPWTPCT(BPDESID(CT1)).NE.(0.0)) THEN
                    IF (BPDEN(BPDESID(CT1)).LT.(1.0)) THEN
                       WRITE (100,715) BPDEN(BPDESID(CT1)),
     c                 (BPWTPCT(BPDESID(CT1))/100.0),
     c                 MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
  715                  FORMAT ('b4c   4   den=',F4.3,1X,F7.5,1X,F7.1,1X,
     c                 'end')
                    ELSE
                       WRITE (100,716) BPDEN(BPDESID(CT1)),
     c                 (BPWTPCT(BPDESID(CT1))/100.0),
     c                 MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
  716                  FORMAT ('b4c   4   den=',F5.3,1X,F7.5,1X,F7.1,1X,
     c                 'end')
                    ENDIF
                 ENDIF
*  Calculate aluminum and oxygen material specifications
                 ALFRAC=(((((100.0-BPWTPCT(BPDESID(CT1)))/100)*
     c           BPDEN(BPDESID(CT1)))*2*26.981539)/(101.9631))/
     c           BPDEN(BPDESID(CT1))
                 OFRAC=1-(BPWTPCT(BPDESID(CT1))/100.0)-ALFRAC
                 WRITE (100,718) BPDEN(BPDESID(CT1)), ALFRAC,
     c           MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
  718            FORMAT ('al    4   den=',F5.3,1X,F7.5,1X,F7.1,1X,'end')
                 WRITE (100,720) BPDEN(BPDESID(CT1)), OFRAC,
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     c          MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
  720           FORMAT ('o     4    den=',F5.3,1X,F7.5,1X,F7.1,1X,'end')
               ELSE
*   Material specification for BP other than Al2O3-B4C
                DO 722 CT4=1,BPMIXNUM
                   IF (BPMIXID(CT4).EQ.BPMIX(BPRA_DESCRIPTION_ID)) THEN
                      RELATIVE_BP_MIX_ID=CT4
                   ENDIF
  722           CONTINUE
                WRITE (100,*) 'arbm-bp    ', BPDEN(BPRA_DESCRIPTION_ID),
     c          '    ', BPNUMISOS(RELATIVE_BP_MIX_ID),
     c          '   0   0   0'
                DO 726 CT4=1,BPNUMISOS(RELATIVE_BP_MIX_ID)
                   WRITE (100,724) BPISOID(RELATIVE_BP_MIX_ID,CT4),
     c             BPISOWTPCT(RELATIVE_BP_MIX_ID,CT4)
  724              FORMAT (10X,I6,3X,F10.5)
  726           CONTINUE
                WRITE (100,*) '           ', BPMIX(BPRA_DESCRIPTION_ID),
     c          ' 1.0 ',MODTEMPFINAL(CT3,RELATIVE_STPT_NUM), '   end'
               ENDIF
*   Material specification if it is not a BOC to statepoint 1 calculation
              ELSEIF(CT2.NE.1) THEN
               BPVOL=BPXSECT(BPRA_DESCRIPTION_ID)*
     c         BPRODS(BPRA_DESCRIPTION_ID)*NODES(CT3,2)
*   Material specification for AL2O3-B4C
               IF (BPMIX(BPRA_DESCRIPTION_ID).EQ.0) THEN
                 B4CMASS=(BPWTPCT(BPDESID(CT1))/100.0)*
     c           BPDEN(BPDESID(CT1))*BPVOL
                 ALMASS=((((100-BPWTPCT(BPDESID(CT1)))/100.0)*
     c           BPDEN(BPDESID(CT1)))*BPVOL)*((2*26.981539)/101.961278)
                 OMASS=((((100-BPWTPCT(BPDESID(CT1)))/100.0)*
     c           BPDEN(BPDESID(CT1)))*BPVOL)-ALMASS
                 CMASS=B4CMASS*0.217374
                 NEWBPMASSTOTAL=ALMASS+OMASS+CMASS+BPRAISOVALUE(1)+
     c           BPRAISOVALUE(2)
                 NEWBPDEN=NEWBPMASSTOTAL/BPVOL
                 ALWTPCT=(ALMASS/NEWBPMASSTOTAL)*100.0
                 OWTPCT=(OMASS/NEWBPMASSTOTAL)*100.0
                 CWTPCT=(CMASS/NEWBPMASSTOTAL)*100.0
                 B10WTPCT=(BPRAISOVALUE(1)/NEWBPMASSTOTAL)*100.0
                 B11WTPCT=(BPRAISOVALUE(2)/NEWBPMASSTOTAL)*100.0
                 IF (BPWTPCT(BPDESID(CT1)).NE.(0.0)) THEN
                    WRITE (100,728) NEWBPDEN
  728               FORMAT ('arbm-bp',1X,F7.3,1X,'5 0 0 0')
                    IF (BPRAISOVALUE(1).NE.0) THEN
                       WRITE (100,730) BPRAISONAME(1),
     c                 B10WTPCT
  730                  FORMAT(5X,A6,1X,G10.3)
                    ENDIF
                    IF (BPRAISOVALUE(2).NE.0) THEN
                       WRITE (100,732) BPRAISONAME(2),
     c                 B11WTPCT
  732                  FORMAT(5X,A6,1X,G10.3)
                    ENDIF
                    WRITE (100,734) CWTPCT
  734               FORMAT (5X,' 6012',1X,G10.3)
                 ELSE
                    WRITE (100,736) NEWBPDEN
  736               FORMAT ('arbm-bp',1X,F7.3,1X,'2 0 0 0')
                 ENDIF
```

```
*  Calculate aluminum and oxygen material specifications
               WRITE (100,738) ALWTPCT, OWTPCT
  738          FORMAT (5X,'13027',1X,F7.3,1X,' 8016',1X,F7.3)
               WRITE (100,740) MODTEMPFINAL(CT3,RELATIVE_STPT_NUM)
  740          FORMAT (5X,'4',1X,'1.0',1X,F6.1,1X,'end')
             ELSE
*  Material specification for BP other than Al2O3-B4C
               DO 742 CT4=1,BPMIXNUM
                  IF (BPMIXID(CT4).EQ.BPMIX(BPRA_DESCRIPTION_ID)) THEN
                     RELATIVE_BP_MIX_ID=CT4
                  ENDIF
  742          CONTINUE
               NEWBPMASSTOTAL=0.0
               DO 743 CT4=1,BPNUMISOS(RELATIVE_BP_MIX_ID)
                IF (BPISOID(RELATIVE_BP_MIX_ID,CT4).EQ.5010) THEN
                   NEWBPMASSTOTAL=NEWBPMASSTOTAL+BPRAISOVALUE(1)
                ELSEIF (BPISOID(RELATIVE_BP_MIX_ID,CT4).EQ.5011)
     c          THEN
                   NEWBPMASSTOTAL=NEWBPMASSTOTAL+BPRAISOVALUE(2)
                ELSE
                   NEWBPMASSTOTAL=NEWBPMASSTOTAL+
     c             ((BPISOWTPCT(RELATIVE_BP_MIX_ID,CT4)/100.0)*
     c             BPDEN(BPRA_DESCRIPTION_ID)*BPVOL)
                ENDIF
  743          CONTINUE
               NEWBPDEN=NEWBPMASSTOTAL/BPVOL
               WRITE (100,*) 'arbm-bp    ', NEWBPDEN,
     c         '    ', BPNUMISOS(RELATIVE_BP_MIX_ID),
     c         '   0   0   0'
               DO 750 CT4=1,BPNUMISOS(RELATIVE_BP_MIX_ID)
                IF (BPISOID(RELATIVE_BP_MIX_ID,CT4).EQ.5010) THEN
                   IF (BPRAISOVALUE(1).NE.0) THEN
                      WRITE (100,744) BPRAISONAME(1),
     c                ((BPRAISOVALUE(1)/NEWBPMASSTOTAL)*100.0)
  744                 FORMAT(5X,A6,1X,G10.3)
                   ENDIF
                ELSEIF (BPISOID(RELATIVE_BP_MIX_ID,CT4).EQ.5011)
     c          THEN
                   IF (BPRAISOVALUE(2).NE.0) THEN
                      WRITE (100,746) BPRAISONAME(2),
     c                ((BPRAISOVALUE(2)/NEWBPMASSTOTAL)*100.0)
  746                 FORMAT(5X,A6,1X,G10.3)
                   ENDIF
                ELSE
                   WRITE (100,748) BPISOID(RELATIVE_BP_MIX_ID,CT4),
     c             (((BPISOWTPCT(RELATIVE_BP_MIX_ID,CT4)/100.0)*
     c             BPDEN(BPRA_DESCRIPTION_ID)*BPVOL)/
     c             NEWBPMASSTOTAL)*100.0
  748              FORMAT (10X,I6,3X,F10.5)
                ENDIF
  750          CONTINUE
               WRITE (100,*) '          ', BPMIX(BPRA_DESCRIPTION_ID),
     c         ' 1.0 ',MODTEMPFINAL(CT3,RELATIVE_STPT_NUM), '   end'
             ENDIF
           ENDIF
         ENDIF
*  Write control rod material specification
         CR_INSERTED=.FALSE.
         IF (CRSTAT.EQ.'RODDED') THEN
            CRCOMPFLAG=.FALSE.
```

```
            DO 760 CT4=1,23
               IF (CRINS(CT1,CT2,CT4,CT3).NE.0) THEN
                  CRCOMPFLAG=.TRUE.
                  CR_INSERTED=.TRUE.
                  CR_MIXTURE_ID=CRINS(CT1,CT2,CT4,CT3)
                  CR_DESCRIPTION=CRDES(CT1,CT2,CT4,CT3)
                  EXIT
               ENDIF
 760        CONTINUE
            IF (CRCOMPFLAG.EQ..TRUE.) THEN
               DO 770 CT4=1,CRMIXNUM
                  IF (CRMIXID(CT4).EQ.CR_MIXTURE_ID) THEN
                     RELATIVE_CR_MIX_ID=CT4
                  ENDIF
 770              CONTINUE
                  WRITE (100,780)
 780              FORMAT ('''')
                  WRITE (100,790)
 790              FORMAT ('''',T5,' control rod material specification')
                  WRITE (100,800)
 800              FORMAT ('''')
               IF (CRCLAD(CR_DESCRIPTION).NE.0) THEN
                 DO 801 CT5=1,10
                  IF (CRCLAD(CR_DESCRIPTION).EQ.CLADDESNUM(CT5)) THEN
                   CRCLNUM=CT5
                   EXIT
                  ENDIF
 801              CONTINUE
                  IF (CLADDESNAME(CRCLNUM).EQ.'SS304   ') THEN
                   WRITE (100,802)
 802               FORMAT ('arbm-ss304 7.92 4 0 0 0 24304 19.0 25055 ',
     c             '2.0 26304 69.5 28304 9.5')
                   WRITE (100,803) CLADDESNUM(CRCLNUM), CLTEMP
 803               FORMAT (T12,I2,' 1.0 ',F5.1,' end')
                  ELSEIF (CLADDESNAME(CRCLNUM).EQ.'SS304S ') THEN
                   WRITE (100,804)
 804               FORMAT ('arbm-ss304s 7.92 4 0 0 0 24000 19.0 25055 ',
     c             '2.0 26000 69.5 28000 9.5')
                   WRITE (100,805) CLADDESNUM(CRCLNUM), CLTEMP
 805               FORMAT (T13,I2,' 1.0 ',F5.1,' end')
                  ELSEIF (CLADDESNAME(CRCLNUM).EQ.'SS316   ') THEN
                   WRITE (100,806)
 806               FORMAT ('arbm-ss316 7.75 7 0 0 0 6012 0.08 14000 ',
     c             '1.0 24304 17.0 25055 2.0')
                   WRITE (100,807)
 807               FORMAT (T12,'26304 65.42 28304 12.0 42000 2.5')
                   WRITE (100,808) CLADDESNUM(CRCLNUM), CLTEMP
 808               FORMAT (T12,I2,' 1.0 ',F5.1,' end')
                  ELSEIF (CLADDESNAME(CRCLNUM).EQ.'SS316S ') THEN
                   WRITE (100,809)
 809               FORMAT ('arbm-ss316s 7.75 7 0 0 0 6012 0.08 14000 ',
     c             '1.0 24000 17.0 25055 2.0')
                   WRITE (100,810)
 810               FORMAT (T13,'26000 65.42 28000 12.0 42000 2.5')
                   WRITE (100,811) CLADDESNUM(CRCLNUM), CLTEMP
 811               FORMAT (T13,I2,' 1.0 ',F5.1,' end')
                  ELSEIF (CLADDESNAME(CRCLNUM).EQ.'INCONEL') THEN
                   WRITE (100,812)
 812               FORMAT ('arbm-inconel 8.3 5 0 0 0 14000 2.5',
     c             ' 22000 2.5 24000 15.0')
```

```
               WRITE (100,813)
  813          FORMAT (T13,'26000 7.0 28000 73.0')
               WRITE (100,814) CLADDESNUM(CRCLNUM), CLTEMP
  814          FORMAT (T13,I2,' 1.0 ',F5.1,' end')
             ENDIF
           ENDIF
               WRITE (100,*) 'arbm-cr    ', CRDEN(CR_DESCRIPTION),
     c         '    ', CRNUMISOS(RELATIVE_CR_MIX_ID), '    0    0    0'
               DO 820 CT4=1,CRNUMISOS(RELATIVE_CR_MIX_ID)
                  WRITE (100,815) CRISOID(RELATIVE_CR_MIX_ID,CT4),
     c            CRISOWTPCT(RELATIVE_CR_MIX_ID, CT4)
  815             FORMAT (10X,I5,3X,F10.5)
  820          CONTINUE
               WRITE (100,*) '           ', CR_MIXTURE_ID, ' 1.0 ',
     c         MODTEMPFINAL(CT3,RELATIVE_STPT_NUM), '    end'
           ENDIF
        ENDIF
*  Write APSR material specification
        IF ((CT1.EQ.CT1START).AND.(CT2.EQ.CT2GOVALUE).AND.
     c  (CT3.EQ.1)) THEN
        DO 824 CT4=1,10
           DO 823 CT5=1,20
              DO 822 CT6=1,23
                 DO 821 CT7=1,50
                    APSRINSOLD(CT4,CT5,CT6,CT7)=
     c              APSRINS(CT4,CT5,CT6,CT7)
  821            CONTINUE
  822         CONTINUE
  823      CONTINUE
  824   CONTINUE
        ENDIF
        APSR_INSERTED=.FALSE.
        IF (APSRSTAT.EQ.'RODDED') THEN
           DO 830 CT4=1,23
              APSRBOTFLAG=.FALSE.
              DO 825 CT5=50,1,-1
                 IF ((APSRINSOLD(CT1,CT2,CT4,CT5).NE.0).AND.
     c           (APSRBOTFLAG.EQ..FALSE.)) THEN
                    APSR_DESCRIPTION=APSRDES(CT1,CT2,CT4,CT5)
                    APSRBOTFLAG=.TRUE.
                    FOLNODKEEP=CT5
                    FOLSTEPKEEP=CT4
                 ENDIF
                 IF ((APSRINSOLD(CT1,CT2,CT4,CT5).EQ.0).AND.
     c           (APSRBOTFLAG.EQ..TRUE.)) THEN
                    APSRINS(CT1,CT2,CT4,CT5)=
     c              APSRFOLLOWMIX(CT1,CT2,FOLSTEPKEEP,FOLNODKEEP)
                    APSRFOLLOWDATA(CT1,CT2,CT4,CT5)=3
                 ENDIF
  825         CONTINUE
  830      CONTINUE
           FOLLOWIN=.FALSE.
           DO 831 CT4=1,23
              IF (APSRFOLLOWDATA(CT1,CT2,CT4,CT3).EQ.3) THEN
                 FOLLOWIN=.TRUE.
                 EXIT
              ENDIF
  831      CONTINUE
           IF (FOLLOWIN.EQ..TRUE.) THEN
              WRITE (100,832)
```

```
832           FORMAT ('''')
              WRITE (100,834)
834           FORMAT ('''',T5,' APSR follow rod material',
     c        ' specification')
              WRITE (100,836)
836           FORMAT ('''')
            IF ((APSRFOLLOWMIX(CT1,CT2,FOLSTEPKEEP,FOLNODKEEP).NE.0)
     c      .AND.
     c      (APSRFOLLOWMIX(CT1,CT2,FOLSTEPKEEP,FOLNODKEEP).NE.2)) THEN
              DO 838 CT5=1,10
               IF (APSRFOLLOWMIX(CT1,CT2,FOLSTEPKEEP,FOLNODKEEP)
     c         .EQ.CLADDESNUM(CT5)) THEN
                APSRFOLNUM=CT5
                EXIT
               ENDIF
838           CONTINUE
              IF (CLADDESNAME(APSRFOLNUM).EQ.'SS304  ') THEN
               WRITE (100,840)
840            FORMAT ('arbm-ss304 7.92 4 0 0 0 24304 19.0 25055 ',
     c         '2.0 26304 69.5 28304 9.5')
               WRITE (100,842) CLADDESNUM(APSRFOLNUM), CLTEMP
842            FORMAT (T12,I2,' 1.0 ',F5.1,' end')
              ELSEIF (CLADDESNAME(APSRFOLNUM).EQ.'SS304S ') THEN
               WRITE (100,844)
844            FORMAT ('arbm-ss304s 7.92 4 0 0 0 24000 19.0 25055 ',
     c         '2.0 26000 69.5 28000 9.5')
               WRITE (100,846) CLADDESNUM(APSRFOLNUM), CLTEMP
846            FORMAT (T13,I2,' 1.0 ',F5.1,' end')
              ELSEIF (CLADDESNAME(APSRFOLNUM).EQ.'SS316  ') THEN
               WRITE (100,848)
848            FORMAT ('arbm-ss316 7.75 7 0 0 0 6012 0.08 14000 ',
     c         '1.0 24304 17.0 25055 2.0')
               WRITE (100,850)
850            FORMAT (T12,'26304 65.42 28304 12.0 42000 2.5')
               WRITE (100,852) CLADDESNUM(APSRFOLNUM), CLTEMP
852            FORMAT (T12,I2,' 1.0 ',F5.1,' end')
              ELSEIF (CLADDESNAME(APSRFOLNUM).EQ.'SS316S ') THEN
               WRITE (100,854)
854            FORMAT ('arbm-ss316s 7.75 7 0 0 0 6012 0.08 14000 ',
     c         '1.0 24000 17.0 25055 2.0')
               WRITE (100,856)
856            FORMAT (T13,'26000 65.42 28000 12.0 42000 2.5')
               WRITE (100,858) CLADDESNUM(APSRFOLNUM), CLTEMP
858            FORMAT (T13,I2,' 1.0 ',F5.1,' end')
              ELSEIF (CLADDESNAME(APSRFOLNUM).EQ.'INCONEL') THEN
               WRITE (100,860)
860            FORMAT ('arbm-inconel 8.3 5 0 0 0 14000 2.5',
     c         ' 22000 2.5 24000 15.0')
               WRITE (100,862)
862            FORMAT (T13,'26000 7.0 28000 73.0')
               WRITE (100,864) CLADDESNUM(APSRFOLNUM), CLTEMP
864            FORMAT (T13,I2,' 1.0 ',F5.1,' end')
              ENDIF
            ENDIF
            ENDIF
            APSRCOMPFLAG=.FALSE.
            DO 865 CT4=1,23
               IF ((APSRINS(CT1,CT2,CT4,CT3).NE.0).AND.
     c         (APSRINS(CT1,CT2,CT4,CT3).NE.
     c         APSRFOLLOWMIX(CT1,CT2,FOLSTEPKEEP,FOLNODKEEP))) THEN
```

```
                APSRCOMPFLAG=.TRUE.
                APSR_INSERTED=.TRUE.
                APSR_MIXTURE_ID=APSRINS(CT1,CT2,CT4,CT3)
                APSR_DESCRIPTION=APSRDES(CT1,CT2,CT4,CT3)
                EXIT
              ENDIF
 865        CONTINUE
            IF (APSRCOMPFLAG.EQ..TRUE.) THEN
              DO 866 CT4=1,APSRMIXNUM
                IF (APSRMIXID(CT4).EQ.APSR_MIXTURE_ID) THEN
                  RELATIVE_APSR_MIX_ID=CT4
                ENDIF
 866            CONTINUE
                WRITE (100,868)
 868            FORMAT ('''')
                WRITE (100,870)
 870            FORMAT ('''',T5,' axial power shaping rod material',
     c          ' specification')
                WRITE (100,880)
 880            FORMAT ('''')
              IF (APSRCLAD(APSR_DESCRIPTION).NE.0) THEN
                DO 881 CT5=1,10
                 IF (APSRCLAD(APSR_DESCRIPTION).EQ.CLADDESNUM(CT5)) THEN
                  APSRCLNUM=CT5
                  EXIT
                 ENDIF
 881             CONTINUE
                 IF (CLADDESNAME(APSRCLNUM).EQ.'SS304  ') THEN
                  WRITE (100,882)
 882              FORMAT ('arbm-ss304 7.92 4 0 0 0 24304 19.0 25055 ',
     c            '2.0 26304 69.5 28304 9.5')
                  WRITE (100,883) CLADDESNUM(APSRCLNUM), CLTEMP
 883              FORMAT (T12,I2,' 1.0 ',F5.1,' end')
                 ELSEIF (CLADDESNAME(APSRCLNUM).EQ.'SS304S ') THEN
                  WRITE (100,884)
 884              FORMAT ('arbm-ss304s 7.92 4 0 0 0 24000 19.0 25055 ',
     c            '2.0 26000 69.5 28000 9.5')
                  WRITE (100,885) CLADDESNUM(APSRCLNUM), CLTEMP
 885              FORMAT (T13,I2,' 1.0 ',F5.1,' end')
                 ELSEIF (CLADDESNAME(APSRCLNUM).EQ.'SS316  ') THEN
                  WRITE (100,886)
 886              FORMAT ('arbm-ss316 7.75 7 0 0 0 6012 0.08 14000 ',
     c            '1.0 24304 17.0 25055 2.0')
                  WRITE (100,887)
 887              FORMAT (T12,'26304 65.42 28304 12.0 42000 2.5')
                  WRITE (100,888) CLADDESNUM(APSRCLNUM), CLTEMP
 888              FORMAT (T12,I2,' 1.0 ',F5.1,' end')
                 ELSEIF (CLADDESNAME(APSRCLNUM).EQ.'SS316S ') THEN
                  WRITE (100,889)
 889              FORMAT ('arbm-ss316s 7.75 7 0 0 0 6012 0.08 14000 ',
     c            '1.0 24000 17.0 25055 2.0')
                  WRITE (100,890)
 890              FORMAT (T13,'26000 65.42 28000 12.0 42000 2.5')
                  WRITE (100,891) CLADDESNUM(APSRCLNUM), CLTEMP
 891              FORMAT (T13,I2,' 1.0 ',F5.1,' end')
                 ELSEIF (CLADDESNAME(APSRCLNUM).EQ.'INCONEL') THEN
                  WRITE (100,892)
 892              FORMAT ('arbm-inconel 8.3 5 0 0 0 14000 2.5',
     c            ' 22000 2.5 24000 15.0')
                  WRITE (100,893)
```

```
  893           FORMAT (T13,'26000 7.0 28000 73.0')
                WRITE (100,894) CLADDESNUM(APSRCLNUM), CLTEMP
  894           FORMAT (T13,I2,' 1.0 ',F5.1,' end')
              ENDIF
            ENDIF
               WRITE (100,*) 'arbm-apsr    ', APSRDEN(APSR_DESCRIPTION),
     c         '    ', APSRNUMISOS(RELATIVE_APSR_MIX_ID), '   0   0   0'
               DO 900 CT4=1,APSRNUMISOS(RELATIVE_APSR_MIX_ID)
                  WRITE (100,895) APSRISOID(RELATIVE_APSR_MIX_ID,CT4),
     c            APSRISOWTPCT(RELATIVE_APSR_MIX_ID, CT4)
  895             FORMAT (10X,I5,3X,F10.5)
  900          CONTINUE
               WRITE (100,*) '           ', APSR_MIXTURE_ID, ' 1.0 ',
     c         MODTEMPFINAL(CT3,RELATIVE_STPT_NUM), '   end'
            ENDIF
         ENDIF
*  Write fuel rod fill gas material specification
         WRITE (100,910)
  910    FORMAT ('''')
         WRITE (100,920)
  920    FORMAT ('he    5   end')
         WRITE (100,930)
  930    FORMAT ('end comp')
*  Write base reactor lattice specifications
         WRITE (100,940)
  940    FORMAT ('''')
         WRITE (100,950)
  950    FORMAT ('''     base reactor lattice specification')
         WRITE (100,960)
  960    FORMAT ('''')
         WRITE (100,970) PITCH, FOD, COD, CID
  970    FORMAT ('squarepitch',3X,F7.5,3X,F6.4,3X,'1   3',3X,F6.4,
     c   3X,'2',3X,F6.4,3X,'0   end')
* The following writing routine for 'SPECIAL' input data
* has not been formatted to compensate for FORTRAN's ingenious
* incapability to print leading zeros in numeric fields.
* Errors will occur in the FIDO input if null space exists
* between an equal sign and the appropriate value.  Therefore,
* the IIM and ICM factors must always be at least 10.
         IF (FLAG2.EQ.'SPECIAL') THEN
            IF (SZF.LT.1) THEN
               WRITE (100,980) SZF, ISN, IIM, ICM, EPS, PTC, IUS
  980          FORMAT ('more data',1X,'szf=0',F3.2,1X,'isn=',I1,1X,
     c         'iim=',I2,1X,'icm=',I2,1X,'eps=0',G7.2,1X,'ptc=0',G7.2,
     c         1X,'ius=',I1,3X,'end')
            ELSE
               WRITE (100,990) SZF, ISN, IIM, ICM, EPS, PTC, IUS
  990          FORMAT ('more data',1X,'szf=',F4.2,1X,'isn=',I1,1X,
     c         'iim=',I2,1X,'icm=',I2,1X,'eps=0',G7.2,1X,'ptc=0',G7.2,
     c         1X,'ius=',I1,3X,'end')
            ENDIF
         ELSEIF (FLAG2.NE.'SPECIAL') THEN
            IF (MESH.LT.1) THEN
               WRITE (100,1000) MESH
 1000          FORMAT ('more data',1X,'szf=0',F3.2,1X,'end')
            ELSE
               WRITE (100,1010) MESH
 1010          FORMAT ('more data',1X,'szf=',F4.2,1X,'end')
            ENDIF
         ENDIF
```

```
*  Write assembly specifications
         WRITE (100,1020)
 1020    FORMAT ('''')
         WRITE (100,1030)
 1030    FORMAT ('''     assembly specification')
         WRITE (100,1040)
 1040    FORMAT ('''')
         IF (STEPCONTROL.EQ.'Y') THEN
            CALL ZEROS(VARSTEPNUM(CT1,CT2),IRRAD_STEPS)
         ELSEIF (STEPCONTROL.EQ.'N') THEN
            CALL ZEROS(INT(BLETDOWN(CT1,CT2,2)),IRRAD_STEPS)
         ENDIF
*  Assembly specification if no BPRA, no CR, and no APSR is inserted
         IF ((BPRA_INSERTED.EQ..FALSE.).AND.(CR_INSERTED.EQ..FALSE.)
     c   .AND.(APSR_INSERTED.EQ..FALSE.)
     c   .AND.(BPRA_FOLLOW.EQ..FALSE.)
     c   .AND.(FOLLOWIN.EQ..FALSE.)) THEN
            IF (NODES(CT3,2).GE.(100.0)) THEN
               WRITE (100,1041) RODS, NODES(CT3,2), IRRAD_STEPS
 1041          FORMAT ('npin/assembly=',I3,1X,'fuelngth=',F7.3,1X,
     c         'ncycles=',A2,1X,'nlib/cyc=1 lightel=0')
            ELSEIF ((NODES(CT3,2).LT.(100.0)).AND.
     c      (NODES(CT3,2).GE.(10.0))) THEN
               WRITE (100,1042) RODS, NODES(CT3,2), IRRAD_STEPS
 1042          FORMAT ('npin/assembly=',I3,1X,'fuelngth=',F6.3,1X,
     c         'ncycles=',A2,1X,'nlib/cyc=1 lightel=0')
            ELSEIF (NODES(CT3,2).LT.(10.0)) THEN
               WRITE (100,1043) RODS, NODES(CT3,2), IRRAD_STEPS
 1043          FORMAT ('npin/assembly=',I3,1X,'fuelngth=',F5.3,1X,
     c         'ncycles=',A2,1X,'nlib/cyc=1 lightel=0')
            ENDIF
            CALL ZEROS(PLEVEL,PLEVELCH)
            CALL ZEROS(LUZONE,LUZONECH)
            IF (MESH.LT.(1.0)) THEN
               WRITE (100,1044) PLEVELCH, LUZONECH, MESH
 1044          FORMAT ('printlevel=',A2,1X,'inplevel=2',1X,
     c         'numztotal=',A2,1X,'mxrepeats=1',1X,
     c         'mixmod=3 facmesh=',F3.2,1X,'end')
            ELSE
               WRITE (100,1045) PLEVELCH, LUZONECH, MESH
 1045          FORMAT ('printlevel=',A2,1X,'inplevel=2',1X,
     c         'numztotal=',A2,1X,'mxrepeats=1',1X,
     c         'mixmod=3 facmesh=',F4.2,1X,'end')
            ENDIF
            DO 1047 CT4=1,LUZONE
               IF (MOD(CT4,6).EQ.0) THEN
                  WRITE (100,*)
               ENDIF
               WRITE (100,1046) LMB(CT4), LRB(CT4)
 1046          FORMAT (I3,1X,F7.5,1X,$)
 1047       CONTINUE
            WRITE (100,*)
         ENDIF
*  Assembly specification if BPRA is inserted
         IF (BPRA_FOLLOW.EQ..TRUE.) THEN
            IF (NODES(CT3,2).GE.(100.0)) THEN
               WRITE (100,1050) RODS, NODES(CT3,2), IRRAD_STEPS
 1050          FORMAT ('npin/assembly=',I3,1X,'fuelngth=',F7.3,1X,
     c         'ncycles=',A2,1X,'nlib/cyc=1 lightel=0')
            ELSEIF ((NODES(CT3,2).LT.(100.0)).AND.
```

```
     c       (NODES(CT3,2).GE.(10.0))) THEN
                WRITE (100,1052) RODS, NODES(CT3,2), IRRAD_STEPS
 1052           FORMAT ('npin/assembly=',I3,1X,'fuelngth=',F6.3,1X,
     c          'ncycles=',A2,1X,'nlib/cyc=1 lightel=0')
             ELSEIF (NODES(CT3,2).LT.(10.0)) THEN
                WRITE (100,1054) RODS, NODES(CT3,2), IRRAD_STEPS
 1054           FORMAT ('npin/assembly=',I3,1X,'fuelngth=',F5.3,1X,
     c          'ncycles=',A2,1X,'nlib/cyc=1 lightel=0')
             ENDIF
             CALL ZEROS(PLEVEL,PLEVELCH)
             CALL ZEROS(BPZONE(BPRA_DESCRIPTION_ID),BPZONECH)
             IF (MESH.LT.(1.0)) THEN
                WRITE (100,1056) PLEVELCH, BPZONECH, MESH
 1056           FORMAT ('printlevel=',A2,1X,'inplevel=2',1X,
     c          'numztotal=',A2,1X,'mxrepeats=1',1X,
     c          'mixmod=3 facmesh=',F3.2,1X,'end')
             ELSE
                WRITE (100,1058) PLEVELCH, BPZONECH, MESH
 1058           FORMAT ('printlevel=',A2,1X,'inplevel=2',1X,
     c          'numztotal=',A2,1X,'mxrepeats=1',1X,
     c          'mixmod=3 facmesh=',F4.2,1X,'end')
             ENDIF
             DO 1062 CT4=1,BPZONE(BPRA_DESCRIPTION_ID)
                IF (MOD(CT4,6).EQ.0) THEN
                   WRITE (100,*)
                ENDIF
                WRITE (100,1060) BPRFM(CT4,BPRA_DESCRIPTION_ID),
     c          BPRFR(CT4,BPRA_DESCRIPTION_ID)
 1060           FORMAT (I3,1X,F7.5,1X,$)
 1062        CONTINUE
             WRITE (100,*)
          ENDIF
          IF (BPRA_INSERTED.EQ..TRUE.) THEN
             IF (NODES(CT3,2).GE.(100.0)) THEN
                WRITE (100,1098) RODS, NODES(CT3,2), IRRAD_STEPS
 1098           FORMAT ('npin/assembly=',I3,1X,'fuelngth=',F7.3,1X,
     c          'ncycles=',A2,1X,'nlib/cyc=1 lightel=0')
             ELSEIF ((NODES(CT3,2).LT.(100.0)).AND.
     c       (NODES(CT3,2).GE.(10.0))) THEN
                WRITE (100,1100) RODS, NODES(CT3,2), IRRAD_STEPS
 1100           FORMAT ('npin/assembly=',I3,1X,'fuelngth=',F6.3,1X,
     c          'ncycles=',A2,1X,'nlib/cyc=1 lightel=0')
             ELSEIF (NODES(CT3,2).LT.(10.0)) THEN
                WRITE (100,1102) RODS, NODES(CT3,2), IRRAD_STEPS
 1102           FORMAT ('npin/assembly=',I3,1X,'fuelngth=',F5.3,1X,
     c          'ncycles=',A2,1X,'nlib/cyc=1 lightel=0')
             ENDIF
             CALL ZEROS(PLEVEL,PLEVELCH)
             CALL ZEROS(BPZONE(BPRA_DESCRIPTION_ID),BPZONECH)
             IF (MESH.LT.(1.0)) THEN
                WRITE (100,1104) PLEVELCH, BPZONECH, MESH
 1104           FORMAT ('printlevel=',A2,1X,'inplevel=2',1X,
     c          'numztotal=',A2,1X,'mxrepeats=1',1X,
     c          'mixmod=3 facmesh=',F3.2,1X,'end')
             ELSE
                WRITE (100,1106) PLEVELCH, BPZONECH, MESH
 1106           FORMAT ('printlevel=',A2,1X,'inplevel=2',1X,
     c          'numztotal=',A2,1X,'mxrepeats=1',1X,
     c          'mixmod=3 facmesh=',F4.2,1X,'end')
             ENDIF
```

```
            DO 1110 CT4=1,BPZONE(BPRA_DESCRIPTION_ID)
               IF (MOD(CT4,6).EQ.0) THEN
                  WRITE (100,*)
               ENDIF
               WRITE (100,1108) BPMA(CT4,BPRA_DESCRIPTION_ID),
     c         BPRA(CT4,BPRA_DESCRIPTION_ID)
 1108          FORMAT (I3,1X,F7.5,1X,$)
 1110       CONTINUE
            WRITE (100,*)
         ENDIF
*  Assembly specification if CR is inserted
         IF (CR_INSERTED.EQ..TRUE.) THEN
            IF (NODES(CT3,2).GE.(100.0)) THEN
               WRITE (100,1120) RODS, NODES(CT3,2), IRRAD_STEPS
 1120          FORMAT ('npin/assembly=',I3,1X,'fuelngth=',F7.3,1X,
     c         'ncycles=',A2,1X,'nlib/cyc=1 lightel=0')
            ELSEIF ((NODES(CT3,2).LT.(100.0)).AND.
     c      (NODES(CT3,2).GE.(10.0))) THEN
               WRITE (100,1130) RODS, NODES(CT3,2), IRRAD_STEPS
 1130          FORMAT ('npin/assembly=',I3,1X,'fuelngth=',F6.3,1X,
     c         'ncycles=',A2,1X,'nlib/cyc=1 lightel=0')
            ELSEIF (NODES(CT3,2).LT.(10.0)) THEN
               WRITE (100,1140) RODS, NODES(CT3,2), IRRAD_STEPS
 1140          FORMAT ('npin/assembly=',I3,1X,'fuelngth=',F5.3,1X,
     c         'ncycles=',A2,1X,'nlib/cyc=1 lightel=0')
            ENDIF
            CALL ZEROS(PLEVEL,PLEVELCH)
            CALL ZEROS(CRZONE(CR_DESCRIPTION),CRZONECH)
            IF (MESH.LT.(1.0)) THEN
               WRITE (100,1150) PLEVELCH, CRZONECH, MESH
 1150          FORMAT ('printlevel=',A2,1X,'inplevel=2',1X,
     c         'numztotal=',A2,1X,'mxrepeats=0',1X,
     c         'mixmod=3 facmesh=',F3.2,1X,'end')
            ELSE
               WRITE (100,1160) PLEVELCH, CRZONECH, MESH
 1160          FORMAT ('printlevel=',A2,1X,'inplevel=2',1X,
     c         'numztotal=',A2,1X,'mxrepeats=0',1X,
     c         'mixmod=3 facmesh=',F4.2,1X,'end')
            ENDIF
            IF (STEPCONTROL.EQ.'N') THEN
             DO 1168 CT4=1,INT(BLETDOWN(CT1,CT2,2))
               IF (CRINS(CT1,CT2,CT4,CT3).NE.0) THEN
                  DO 1162 CT5=1,CRZONE(CR_DESCRIPTION)
                     IF (MOD(CT5,6).EQ.0) THEN
                        WRITE (100,*)
                     ENDIF
                     WRITE (100,1161) CRMA(CT5,CR_DESCRIPTION),
     c               CRRA(CT5,CR_DESCRIPTION)
 1161                FORMAT (I3,1X,F7.5,1X,$)
 1162             CONTINUE
                  WRITE (100,*)
               ELSEIF (CRINS(CT1,CT2,CT4,CT3).EQ.0) THEN
                  DO 1166 CT5=1,CRZONE(CR_DESCRIPTION)
                     IF (MOD(CT5,6).EQ.0) THEN
                        WRITE (100,*)
                     ENDIF
                     WRITE (100,1164) LMC(CT5,CR_DESCRIPTION),
     c               LRC(CT5,CR_DESCRIPTION)
 1164                FORMAT (I3,1X,F7.5,1X,$)
 1166             CONTINUE
```

```
                  WRITE (100,*)
                ENDIF
 1168          CONTINUE
              ELSEIF (STEPCONTROL.EQ.'Y') THEN
               DO 1210 CT4=1,VARSTEPNUM(CT1,CT2)
                 IF (CRINS(CT1,CT2,CT4,CT3).NE.0) THEN
                    DO 1180 CT5=1,CRZONE(CR_DESCRIPTION)
                       IF (MOD(CT5,6).EQ.0) THEN
                          WRITE (100,*)
                       ENDIF
                       WRITE (100,1170) CRMA(CT5,CR_DESCRIPTION),
     c                 CRRA(CT5,CR_DESCRIPTION)
 1170                  FORMAT (I3,1X,F7.5,1X,$)
 1180               CONTINUE
                    WRITE (100,*)
                 ELSEIF (CRINS(CT1,CT2,CT4,CT3).EQ.0) THEN
                    DO 1200 CT5=1,CRZONE(CR_DESCRIPTION)
                       IF (MOD(CT5,6).EQ.0) THEN
                          WRITE (100,*)
                       ENDIF
                       WRITE (100,1190) LMC(CT5,CR_DESCRIPTION),
     c                 LRC(CT5,CR_DESCRIPTION)
 1190                  FORMAT (I3,1X,F7.5,1X,$)
 1200               CONTINUE
                    WRITE (100,*)
                 ENDIF
 1210          CONTINUE
              ENDIF
           ENDIF
*  Assembly specification if APSR is inserted
           IF ((APSR_INSERTED.EQ..TRUE.).OR.(FOLLOWIN.EQ..TRUE.)) THEN
              IF (NODES(CT3,2).GE.(100.0)) THEN
                 WRITE (100,1220) RODS, NODES(CT3,2), IRRAD_STEPS
 1220            FORMAT ('npin/assembly=',I3,1X,'fuelngth=',F7.3,1X,
     c           'ncycles=',A2,1X,'nlib/cyc=1 lightel=0')
              ELSEIF ((NODES(CT3,2).LT.(100.0)).AND.
     c        (NODES(CT3,2).GE.(10.0))) THEN
                 WRITE (100,1230) RODS, NODES(CT3,2), IRRAD_STEPS
 1230            FORMAT ('npin/assembly=',I3,1X,'fuelngth=',F6.3,1X,
     c           'ncycles=',A2,1X,'nlib/cyc=1 lightel=0')
              ELSEIF (NODES(CT3,2).LT.(10.0)) THEN
                 WRITE (100,1240) RODS, NODES(CT3,2), IRRAD_STEPS
 1240            FORMAT ('npin/assembly=',I3,1X,'fuelngth=',F5.3,1X,
     c           'ncycles=',A2,1X,'nlib/cyc=1 lightel=0')
              ENDIF
              CALL ZEROS(PLEVEL,PLEVELCH)
              CALL ZEROS(APSRZONE(APSR_DESCRIPTION),APSRZONECH)
              IF (MESH.LT.(1.0)) THEN
                 WRITE (100,1250) PLEVELCH, APSRZONECH, MESH
 1250            FORMAT ('printlevel=',A2,1X,'inplevel=2',1X,
     c           'numztotal=',A2,1X,'mxrepeats=0',1X,
     c           'mixmod=3 facmesh=',F3.2,1X,'end')
              ELSE
                 WRITE (100,1252) PLEVELCH, APSRZONECH, MESH
 1252            FORMAT ('printlevel=',A2,1X,'inplevel=2',1X,
     c           'numztotal=',A2,1X,'mxrepeats=0',1X,
     c           'mixmod=3 facmesh=',F4.2,1X,'end')
              ENDIF
              IF (STEPCONTROL.EQ.'N') THEN
               DO 1268 CT4=1,INT(BLETDOWN(CT1,CT2,2))
```

```
              IF ((APSRINS(CT1,CT2,CT4,CT3).NE.0).AND.
     c        (APSRFOLLOWDATA(CT1,CT2,CT4,CT3).NE.3)) THEN
                 DO 1258 CT5=1,APSRZONE(APSR_DESCRIPTION)
                    IF (MOD(CT5,6).EQ.0) THEN
                       WRITE (100,*)
                    ENDIF
                    WRITE (100,1256) APSRMA(CT5,APSR_DESCRIPTION),
     c              APSRRA(CT5,APSR_DESCRIPTION)
 1256               FORMAT (I3,1X,F7.5,1X,$)
 1258            CONTINUE
                 WRITE (100,*)
              ELSEIF ((APSRINS(CT1,CT2,CT4,CT3).NE.0).AND.
     c        (APSRFOLLOWDATA(CT1,CT2,CT4,CT3).EQ.3)) THEN
                 DO 1262 CT5=1,APSRZONE(APSR_DESCRIPTION)
                    IF (MOD(CT5,6).EQ.0) THEN
                       WRITE (100,*)
                    ENDIF
                    WRITE (100,1260) APSRFM(CT5,APSR_DESCRIPTION),
     c              APSRFR(CT5,APSR_DESCRIPTION)
 1260               FORMAT (I3,1X,F7.5,1X,$)
 1262            CONTINUE
                 WRITE (100,*)
              ELSEIF (APSRINS(CT1,CT2,CT4,CT3).EQ.0) THEN
                 DO 1266 CT5=1,APSRZONE(APSR_DESCRIPTION)
                    IF (MOD(CT5,6).EQ.0) THEN
                       WRITE (100,*)
                    ENDIF
                    WRITE (100,1264) LMD(CT5,APSR_DESCRIPTION),
     c              LRD(CT5,APSR_DESCRIPTION)
 1264               FORMAT (I3,1X,F7.5,1X,$)
 1266            CONTINUE
                 WRITE (100,*)
              ENDIF
 1268         CONTINUE
            ELSEIF (STEPCONTROL.EQ.'Y') THEN
             DO 1310 CT4=1,VARSTEPNUM(CT1,CT2)
               IF ((APSRINS(CT1,CT2,CT4,CT3).NE.0).AND.
     c         (APSRFOLLOWDATA(CT1,CT2,CT4,CT3).NE.3)) THEN
                 DO 1280 CT5=1,APSRZONE(APSR_DESCRIPTION)
                    IF (MOD(CT5,6).EQ.0) THEN
                       WRITE (100,*)
                    ENDIF
                    WRITE (100,1270) APSRMA(CT5,APSR_DESCRIPTION),
     c              APSRRA(CT5,APSR_DESCRIPTION)
 1270               FORMAT (I3,1X,F7.5,1X,$)
 1280            CONTINUE
                 WRITE (100,*)
               ELSEIF ((APSRINS(CT1,CT2,CT4,CT3).NE.0).AND.
     c         (APSRFOLLOWDATA(CT1,CT2,CT4,CT3).EQ.3)) THEN
                 DO 1290 CT5=1,APSRZONE(APSR_DESCRIPTION)
                    IF (MOD(CT5,6).EQ.0) THEN
                       WRITE (100,*)
                    ENDIF
                    WRITE (100,1285) APSRFM(CT5,APSR_DESCRIPTION),
     c              APSRFR(CT5,APSR_DESCRIPTION)
 1285               FORMAT (I3,1X,F7.5,1X,$)
 1290            CONTINUE
                 WRITE (100,*)
               ELSEIF (APSRINS(CT1,CT2,CT4,CT3).EQ.0) THEN
                 DO 1300 CT5=1,APSRZONE(APSR_DESCRIPTION)
```

```
                  IF (MOD(CT5,6).EQ.0) THEN
                     WRITE (100,*)
                  ENDIF
                  WRITE (100,1295) LMD(CT5,APSR_DESCRIPTION),
     c            LRD(CT5,APSR_DESCRIPTION)
 1295             FORMAT (I3,1X,F7.5,1X,$)
 1300           CONTINUE
                WRITE (100,*)
              ENDIF
 1310       CONTINUE
           ENDIF
         ENDIF
*  Write assembly depletion/decay parameters
         WRITE (100,1320)
 1320    FORMAT ('''')
         WRITE (100,1330)
 1330    FORMAT ('''     assembly depletion/decay parameters')
         WRITE (100,1340)
 1340    FORMAT ('''')
         CALL ZEROS(CYCPOS(CT1),ASSYPOSITION)
         WRITE (100,1350) CYCLEID(CT1), ASSYPOSITION
 1350    FORMAT ('''',T5,'Cycle-',A2,', one-eighth core',
     c   ' assembly number ',A2)
         IF (STEPCONTROL.EQ.'N') THEN
          DO 1380 CT4=3,(INT(BLETDOWN(CT1,CT2,2))+2)
            IF (CT4.LT.(BLETDOWN(CT1,CT2,2)+2)) THEN
               DOWNTIME=0.0
               BORON_FRACTION=(BLETDOWN(CT1,CT2,CT4)/
     c         BLETDOWN(CT1,CT2,3))
               WRITE (100,1360) POWER(CT3,RELATIVE_STPT_NUM),
     c         BLETDOWN(CT1,CT2,1), DOWNTIME, BORON_FRACTION
 1360          FORMAT ('power=',G10.5,1X,'burn=',G9.4,1X,'down=',
     c         G10.5,1X,'bfrac=',G9.4,1X,'end')
            ELSEIF ((CT4.EQ.(INT(BLETDOWN(CT1,CT2,2))+2)).AND.
     c      (CT2.LT.STPTS(CT1))) THEN
               DOWNTIME=STPTDAT(CT1,(CT2+1),3)
               BORON_FRACTION=(BLETDOWN(CT1,CT2,CT4)/
     c         BLETDOWN(CT1,CT2,3))
               WRITE (100,1365) POWER(CT3,RELATIVE_STPT_NUM),
     c         BLETDOWN(CT1,CT2,1), DOWNTIME, BORON_FRACTION
 1365          FORMAT ('power=',G10.5,1X,'burn=',G9.4,1X,'down=',
     c         G10.5,1X,'bfrac=',G9.4,1X,'end')
            ELSEIF ((CT4.EQ.(INT(BLETDOWN(CT1,CT2,2))+2)).AND.
     c      (CT2.EQ.STPTS(CT1))) THEN
               DOWNTIME=CYCDOWN(CT1)
               BORON_FRACTION=(BLETDOWN(CT1,CT2,CT4)/
     c         BLETDOWN(CT1,CT2,3))
               WRITE (100,1370) POWER(CT3,RELATIVE_STPT_NUM),
     c         BLETDOWN(CT1,CT2,1), DOWNTIME, BORON_FRACTION
 1370          FORMAT ('power=',G10.5,1X,'burn=',G9.4,1X,'down=',
     c         G10.5,1X,'bfrac=',G9.4,1X,'end')
            ENDIF
 1380      CONTINUE
         ELSEIF (STEPCONTROL.EQ.'Y') THEN
          DO 1388 CT4=1,VARSTEPNUM(CT1,CT2)
            IF (CT4.LT.VARSTEPNUM(CT1,CT2)) THEN
               DOWNTIME=0.0
               BORON_FRACTION=(VARBLETDOWN(CT1,CT2,CT4,2)/
     c         VARBLETDOWN(CT1,CT2,1,2))
               WRITE (100,1382) VARPOWER(CT1,CT2,CT4,CT3),
```

```
     c          VARBLETDOWN(CT1,CT2,CT4,1), DOWNTIME, BORON_FRACTION
 1382           FORMAT ('power=',G10.5,1X,'burn=',G9.4,1X,'down=',
     c          G10.5,1X,'bfrac=',G9.4,1X,'end')
               ELSEIF ((CT4.EQ.VARSTEPNUM(CT1,CT2)).AND.
     c         (CT2.LT.STPTS(CT1))) THEN
                  DOWNTIME=STPTDAT(CT1,(CT2+1),3)
                  BORON_FRACTION=(VARBLETDOWN(CT1,CT2,CT4,2)/
     c            VARBLETDOWN(CT1,CT2,1,2))
                  WRITE (100,1384) VARPOWER(CT1,CT2,CT4,CT3),
     c            VARBLETDOWN(CT1,CT2,CT4,1), DOWNTIME, BORON_FRACTION
 1384             FORMAT ('power=',G10.5,1X,'burn=',G9.4,1X,'down=',
     c            G10.5,1X,'bfrac=',G9.4,1X,'end')
               ELSEIF ((CT4.EQ.VARSTEPNUM(CT1,CT2)).AND.
     c         (CT2.EQ.STPTS(CT1))) THEN
                  DOWNTIME=CYCDOWN(CT1)
                  BORON_FRACTION=(VARBLETDOWN(CT1,CT2,CT4,2)/
     c            VARBLETDOWN(CT1,CT2,1,2))
                  WRITE (100,1386) VARPOWER(CT1,CT2,CT4,CT3),
     c            VARBLETDOWN(CT1,CT2,CT4,1), DOWNTIME, BORON_FRACTION
 1386             FORMAT ('power=',G10.5,1X,'burn=',G9.4,1X,'down=',
     c            G10.5,1X,'bfrac=',G9.4,1X,'end')
               ENDIF
 1388       CONTINUE
           ENDIF
*  Store final downtime for use in extraction script 'sedexecute.exe'
           FINALDOWNTIME=DOWNTIME
*  Write input deck closing statement
           WRITE (100,1390)
 1390      FORMAT ('''')
           WRITE (100,1400)
 1400      FORMAT ('''      end of input')
           WRITE (100,1410)
 1410      FORMAT ('''')
           WRITE (100,1420)
 1420      FORMAT ('end')
           CLOSE(UNIT=100)

         RETURN
         END

*************************************************************
*     This subroutine cuts the final ORIGEN output in       *
*     the SAS2H output file down to the essential           *
*     data needed for the CRC calculations.                 *
*************************************************************
         SUBROUTINE CUTTER (NM)
*
         INTEGER*4 LINECOUNTER, CUTLINE, NUM1, NUM2,
        c NUM3, NUM4, NUM5, NUM6, NUM7, SEDEXERESULT,
        c VERIFCOUNTER, VERIFCUTLINE, VERIFENDCUTLINE,
        c OUTPUTREMOVALRESULT
*
         CHARACTER NM*31, OUTPUTFILE*32, BPLABEL*14,
        c LINVAL*7, SEDEXECOMMAND*60, FORMATLABEL*29,
        c VERIFLABEL*14, VERIFLINVAL*7, VERIFENDLINVAL*7,
        c OUTPUTREMOVAL*35
*
         LOGICAL BPFIND, NUMZEROFLAG, VERIFFIND
*
         OUTPUTFILE(1:25)=NM(1:25)
```

```
      OUTPUTFILE(26:32)='.output'
      OPEN (UNIT=700, FILE=OUTPUTFILE, STATUS='OLD')
      REWIND(700)
      LINECOUNTER=0
      BPFIND=.FALSE.
      DO 14 WHILE (BPFIND.EQ..FALSE.)
         LINECOUNTER=LINECOUNTER+1
         READ(700,12) BPLABEL
 12      FORMAT (T98,A14)
         IF (BPLABEL.EQ.'light elements') THEN
            READ(700,*)
            READ(700,13) FORMATLABEL
 13         FORMAT (T46,A29)
            IF (FORMATLABEL.EQ.'nuclide concentrations, grams') THEN
               BPFIND=.TRUE.
            ELSE
               BACKSPACE(700)
               BACKSPACE(700)
            ENDIF
         ENDIF
 14   CONTINUE
      NUMZEROFLAG=.FALSE.
      CUTLINE=LINECOUNTER-2
               NUM1=INT(CUTLINE/1000000.0)
               IF ((NUM1.EQ.0).AND.(NUMZEROFLAG.EQ..FALSE.)) THEN
                  LINVAL(1:1)=' '
               ELSE
                  LINVAL(1:1)=CHAR(NUM1+48)
                  NUMZEROFLAG=.TRUE.
               ENDIF
               NUM2=INT((CUTLINE-(NUM1*1000000))/100000.0)
               IF ((NUM2.EQ.0).AND.(NUMZEROFLAG.EQ..FALSE.)) THEN
                  LINVAL(2:2)=' '
               ELSE
                  LINVAL(2:2)=CHAR(NUM2+48)
                  NUMZEROFLAG=.TRUE.
               ENDIF
               NUM3=INT((CUTLINE-(NUM2*100000)-
     c         (NUM1*1000000))/10000.0)
               IF ((NUM3.EQ.0).AND.(NUMZEROFLAG.EQ..FALSE.)) THEN
                  LINVAL(3:3)=' '
               ELSE
                  LINVAL(3:3)=CHAR(NUM3+48)
                  NUMZEROFLAG=.TRUE.
               ENDIF
               NUM4=INT((CUTLINE-(NUM3*10000)-
     c         (NUM2*100000)-(NUM1*1000000))/1000.0)
               IF ((NUM4.EQ.0).AND.(NUMZEROFLAG.EQ..FALSE.)) THEN
                  LINVAL(4:4)=' '
               ELSE
                  LINVAL(4:4)=CHAR(NUM4+48)
                  NUMZEROFLAG=.TRUE.
               ENDIF
               NUM5=INT((CUTLINE-(NUM4*1000)-(NUM3*10000)-
     c         (NUM2*100000)-(NUM1*1000000))/100.0)
               IF ((NUM5.EQ.0).AND.(NUMZEROFLAG.EQ..FALSE.)) THEN
                  LINVAL(5:5)=' '
               ELSE
                  LINVAL(5:5)=CHAR(NUM5+48)
                  NUMZEROFLAG=.TRUE.
```

```
            ENDIF
            NUM6=INT((CUTLINE-(NUM5*100)-(NUM4*1000)-
     c      (NUM3*10000)-(NUM2*100000)-
     c      (NUM1*1000000))/10.0)
            IF ((NUM6.EQ.0).AND.(NUMZEROFLAG.EQ..FALSE.)) THEN
               LINVAL(6:6)=' '
            ELSE
               LINVAL(6:6)=CHAR(NUM6+48)
               NUMZEROFLAG=.TRUE.
            ENDIF
            NUM7=INT(CUTLINE-(NUM6*10)-(NUM5*100)-
     c      (NUM4*1000)-(NUM3*10000)-(NUM2*100000)-
     c      (NUM1*1000000))
            LINVAL(7:7)=CHAR(NUM7+48)
      REWIND(700)
      VERIFCOUNTER=0
      VERIFFIND=.FALSE.
      DO 30 WHILE (VERIFFIND.EQ..FALSE.)
         VERIFCOUNTER=VERIFCOUNTER+1
         READ(700,20) VERIFLABEL
20       FORMAT (T45,A14)
         IF (VERIFLABEL.EQ.'program:  sas2') THEN
            VERIFFIND=.TRUE.
         ENDIF
30    CONTINUE
      NUMZEROFLAG=.FALSE.
      VERIFCUTLINE=VERIFCOUNTER-12
      VERIFENDCUTLINE=VERIFCOUNTER+18
            NUM1=INT(VERIFCUTLINE/1000000.0)
            IF ((NUM1.EQ.0).AND.(NUMZEROFLAG.EQ..FALSE.)) THEN
               VERIFLINVAL(1:1)=' '
            ELSE
               VERIFLINVAL(1:1)=CHAR(NUM1+48)
               NUMZEROFLAG=.TRUE.
            ENDIF
            NUM2=INT((VERIFCUTLINE-(NUM1*1000000))/100000.0)
            IF ((NUM2.EQ.0).AND.(NUMZEROFLAG.EQ..FALSE.)) THEN
               VERIFLINVAL(2:2)=' '
            ELSE
               VERIFLINVAL(2:2)=CHAR(NUM2+48)
               NUMZEROFLAG=.TRUE.
            ENDIF
            NUM3=INT((VERIFCUTLINE-(NUM2*100000)-
     c      (NUM1*1000000))/10000.0)
            IF ((NUM3.EQ.0).AND.(NUMZEROFLAG.EQ..FALSE.)) THEN
               VERIFLINVAL(3:3)=' '
            ELSE
               VERIFLINVAL(3:3)=CHAR(NUM3+48)
               NUMZEROFLAG=.TRUE.
            ENDIF
            NUM4=INT((VERIFCUTLINE-(NUM3*10000)-
     c      (NUM2*100000)-(NUM1*1000000))/1000.0)
            IF ((NUM4.EQ.0).AND.(NUMZEROFLAG.EQ..FALSE.)) THEN
               VERIFLINVAL(4:4)=' '
            ELSE
               VERIFLINVAL(4:4)=CHAR(NUM4+48)
               NUMZEROFLAG=.TRUE.
            ENDIF
            NUM5=INT((VERIFCUTLINE-(NUM4*1000)-(NUM3*10000)-
     c      (NUM2*100000)-(NUM1*1000000))/100.0)
```

```
      IF ((NUM5.EQ.0).AND.(NUMZEROFLAG.EQ..FALSE.)) THEN
         VERIFLINVAL(5:5)=' '
      ELSE
         VERIFLINVAL(5:5)=CHAR(NUM5+48)
         NUMZEROFLAG=.TRUE.
      ENDIF
      NUM6=INT((VERIFCUTLINE-(NUM5*100)-(NUM4*1000)-
     c (NUM3*10000)-(NUM2*100000)-
     c (NUM1*1000000))/10.0)
      IF ((NUM6.EQ.0).AND.(NUMZEROFLAG.EQ..FALSE.)) THEN
         VERIFLINVAL(6:6)=' '
      ELSE
         VERIFLINVAL(6:6)=CHAR(NUM6+48)
         NUMZEROFLAG=.TRUE.
      ENDIF
      NUM7=INT(VERIFCUTLINE-(NUM6*10)-(NUM5*100)-
     c (NUM4*1000)-(NUM3*10000)-(NUM2*100000)-
     c (NUM1*1000000))
      VERIFLINVAL(7:7)=CHAR(NUM7+48)
      NUM1=INT(VERIFENDCUTLINE/1000000.0)
      IF ((NUM1.EQ.0).AND.(NUMZEROFLAG.EQ..FALSE.)) THEN
         VERIFENDLINVAL(1:1)=' '
      ELSE
         VERIFENDLINVAL(1:1)=CHAR(NUM1+48)
         NUMZEROFLAG=.TRUE.
      ENDIF
      NUM2=INT((VERIFENDCUTLINE-(NUM1*1000000))/100000.0)
      IF ((NUM2.EQ.0).AND.(NUMZEROFLAG.EQ..FALSE.)) THEN
         VERIFENDLINVAL(2:2)=' '
      ELSE
         VERIFENDLINVAL(2:2)=CHAR(NUM2+48)
         NUMZEROFLAG=.TRUE.
      ENDIF
      NUM3=INT((VERIFENDCUTLINE-(NUM2*100000)-
     c (NUM1*1000000))/10000.0)
      IF ((NUM3.EQ.0).AND.(NUMZEROFLAG.EQ..FALSE.)) THEN
         VERIFENDLINVAL(3:3)=' '
      ELSE
         VERIFENDLINVAL(3:3)=CHAR(NUM3+48)
         NUMZEROFLAG=.TRUE.
      ENDIF
      NUM4=INT((VERIFENDCUTLINE-(NUM3*10000)-
     c (NUM2*100000)-(NUM1*1000000))/1000.0)
      IF ((NUM4.EQ.0).AND.(NUMZEROFLAG.EQ..FALSE.)) THEN
         VERIFENDLINVAL(4:4)=' '
      ELSE
         VERIFENDLINVAL(4:4)=CHAR(NUM4+48)
         NUMZEROFLAG=.TRUE.
      ENDIF
      NUM5=INT((VERIFENDCUTLINE-(NUM4*1000)-(NUM3*10000)-
     c (NUM2*100000)-(NUM1*1000000))/100.0)
      IF ((NUM5.EQ.0).AND.(NUMZEROFLAG.EQ..FALSE.)) THEN
         VERIFENDLINVAL(5:5)=' '
      ELSE
         VERIFENDLINVAL(5:5)=CHAR(NUM5+48)
         NUMZEROFLAG=.TRUE.
      ENDIF
      NUM6=INT((VERIFENDCUTLINE-(NUM5*100)-(NUM4*1000)-
     c (NUM3*10000)-(NUM2*100000)-
     c (NUM1*1000000))/10.0)
```

```
               IF ((NUM6.EQ.0).AND.(NUMZEROFLAG.EQ..FALSE.)) THEN
                  VERIFENDLINVAL(6:6)=' '
               ELSE
                  VERIFENDLINVAL(6:6)=CHAR(NUM6+48)
                  NUMZEROFLAG=.TRUE.
               ENDIF
               NUM7=INT(VERIFENDCUTLINE-(NUM6*10)-(NUM5*100)-
     c         (NUM4*1000)-(NUM3*10000)-(NUM2*100000)-
     c         (NUM1*1000000))
               VERIFENDLINVAL(7:7)=CHAR(NUM7+48)
      SEDEXECOMMAND(1:11)='sedexecute '
      SEDEXECOMMAND(12:36)=NM(1:25)
      SEDEXECOMMAND(37:37)=' '
      SEDEXECOMMAND(38:44)=LINVAL
      SEDEXECOMMAND(45:45)=' '
      SEDEXECOMMAND(46:52)=VERIFLINVAL
      SEDEXECOMMAND(53:53)=' '
      SEDEXECOMMAND(54:60)=VERIFENDLINVAL
      SEDEXERESULT=SYSTEM(SEDEXECOMMAND)
      IF (SEDEXERESULT.LT.0) THEN
         WRITE (*,*) 'AN ERROR OCCURRED DURING OUTPUT',
     c   'EXTRACTION FROM ', NM(1:25), '.output'
      ENDIF
      OUTPUTREMOVAL(1:3)='rm '
      OUTPUTREMOVAL(4:28)=NM(1:25)
      OUTPUTREMOVAL(29:35)='.output'
      OUTPUTREMOVALRESULT=SYSTEM(OUTPUTREMOVAL)
      IF (OUTPUTREMOVALRESULT.LT.0) THEN
         WRITE (*,*) 'AN ERROR OCCURRED DURING ',
     c   'DELETION OF ', NM(1:25), '.output'
      ENDIF

      RETURN
      END


*********************************************************
*     This subroutine retrieves the fuel and burnable   *
*     poison composition information from the previous  *
*     depletion and decay calculation for the assembly.*
*********************************************************
      SUBROUTINE RETRIEVER (OXYGMS, MASSTOTAL,
     c FUELISONAME, FUELISOWTPCT, BPRAISONAME,
     c BPRAISOVALUE, LEFTLIST, CARRYCOUNTER,
     c PREVIOUSNAME, LEFTVAL, NM, BPRA_INSERTED)
*
      INTEGER*4 COLUMNSTART, COLUMNEND, ISONUMBER, CT1,
     c LEFTCOUNTER, CARRYCOUNTER, CT2, ISOFLAG(1000), Z
*
      REAL ISOVALUE(1000), BPRAISOVALUE(2), MASSTOTAL,
     c FUELISOVALUE(1000), FUELISOWTPCT(1000), OXYGMS,
     c LEFTVAL(1000)
*
      CHARACTER ROWFLAG*7, COL1*8, COL2*8, COL3*8, COL4*8,
     c COL5*8, COL6*8, COL7*8, COL8*8, ACTINIDELABEL*9,
     c FORMATLABEL*29, ISOLABEL*6, ISONAME(1000)*6,
     c FISSPRODLABEL*16, BPRAISONAME(2)*6, ORIGNAME(297)*6,
     c LIBRARYID(297)*5, FUELISONAME(1000)*5, LEFTLIST(1000)*6,
     c PREVIOUSNAME*25, RETRIEVALFILE*29, BPLABEL*14, NM*31,
     c NOTESFILE*31
```

```
*
      LOGICAL ROWFLAGLOG, ACTINIDEFIND, FISSPRODFIND, BPFIND,
     c BPRA_INSERTED
*
      DATA (LIBRARYID(Z),Z=1,297) /' 1001',
     c ' 1002',' 1003',' 2003',' 2004',' 3006',
     c ' 3007',' 4009',' 5010',' 5011',' 6012',' 7014',
     c ' 7015',' 8016',' 8017',' 9019','11023','12000',
     c '13027','14000','15031','16000','16032','17000',
     c '19000','20000','22000','23000','24000','25055',
     c '26000','27059','28000','29000','31000','32072',
     c '32073','32074','32076','33075','34074','34076',
     c '34077','34078','34080','34082','35079','35081',
     c '36078','36080','36082','36083','36084','36085',
     c '36086','37085','37086','37087','38084','38086',
     c '38087','38088','38089','38090','39089','39090',
     c '39091','40000','40090','40091','40092','40093',
     c '40094','40095','40096','41093','41094','41095',
     c '42000','42092','42094','42095','42096','42097',
     c '42098','42099','42100','43099','44096','44098',
     c '44099','44100','44101','44102','44103','44104',
     c '44105','44106','45103','45105','46102','46104',
     c '46105','46106','46107','46108','46110','47107',
     c '47109','47111','48000','48106','48108','48110',
     c '48111','48112','48113','48114','48116','48601',
     c '49113','49115','50112','50114','50115','50116',
     c '50117','50118','50119','50120','50122','50123',
     c '50124','50125','50126','51121','51123','51124',
     c '51125','51126','52120','52122','52123','52124',
     c '52125','52126','52128','52130','52132','52601',
     c '52611','53127','53129','53130','53131','53135',
     c '54124','54126','54128','54129','54130','54131',
     c '54132','54133','54134','54135','54136','55133',
     c '55134','55135','55136','55137','56134','56135',
     c '56136','56137','56138','56140','57139','57140',
     c '58140','58141','58142','58143','58144','59141',
     c '59142','59143','60142','60143','60144','60145',
     c '60146','60147','60148','60150','61147','61148',
     c '61149','61151','61601','62144','62147','62148',
     c '62149','62150','62151','62152','62153','62154',
     c '63000','63151','63152','63153','63154','63155',
     c '63156','63157','64152','64154','64155','64156',
     c '64157','64158','64160','65159','65160','66160',
     c '66161','66162','66163','66164','67165','68166',
     c '68167','71175','71176','72000','72174','72176',
     c '72177','72178','72179','72180','73181','73182',
     c '74000','74182','74183','74184','74186','75185',
     c '75187','79197','82000','83209','90230','90232',
     c '91231','91233','92232','92233','92234','92235',
     c '92236','92237','92238','93237','93238','94236',
     c '94237','94238','94239','94240','94241','94242',
     c '94243','94244','95241','95242','95243','95601',
     c '96241','96242','96243','96244','96245','96246',
     c '96247','96248','97249','98249','98250','98251',
     c '98252','98253','99253'/
      DATA (ORIGNAME(Z),Z=1,297) /' h  1 ',
     c ' h  2 ',' h  3 ','he  3 ','he  4 ','li  6 ',
     c 'li  7 ','be  9 ',' b 10 ',' b 11 ',' c 12 ',
     c ' n 14 ',' n 15 ',' o 16 ',' o 17 ',' f 19 ',
     c 'na 23 ',' mg   ','al 27 ',' si   ',' p 31 ',
```

```
c '  s   ',' s 32 ',' cl   ','  k   ',' ca   ',
c ' ti   ','  v   ',' cr   ','mn 55 ',' fe   ',
c 'co 59 ',' ni   ',' cu   ',' ga   ','ge 72 ',
c 'ge 73 ','ge 74 ','ge 76 ','as 75 ','se 74 ',
c 'se 76 ','se 77 ','se 78 ','se 80 ','se 82 ',
c 'br 79 ','br 81 ','kr 78 ','kr 80 ','kr 82 ',
c 'kr 83 ','kr 84 ','kr 85 ','kr 86 ','rb 85 ',
c 'rb 86 ','rb 87 ','sr 84 ','sr 86 ','sr 87 ',
c 'sr 88 ','sr 89 ','sr 90 ',' y 89 ',' y 90 ',
c ' y 91 ',' zr   ','zr 90 ','zr 91 ','zr 92 ',
c 'zr 93 ','zr 94 ','zr 95 ','zr 96 ','nb 93 ',
c 'nb 94 ','nb 95 ',' mo   ','mo 92 ','mo 94 ',
c 'mo 95 ','mo 96 ','mo 97 ','mo 98 ','mo 99 ',
c 'mo100 ','tc 99 ','ru 96 ','ru 98 ','ru 99 ',
c 'ru100 ','ru101 ','ru102 ','ru103 ','ru104 ',
c 'ru105 ','ru106 ','rh103 ','rh105 ','pd102 ',
c 'pd104 ','pd105 ','pd106 ','pd107 ','pd108 ',
c 'pd110 ','ag107 ','ag109 ','ag111 ',' cd   ',
c 'cd106 ','cd108 ','cd110 ','cd111 ','cd112 ',
c 'cd113 ','cd114 ','cd116 ','cd115m','in113 ',
c 'in115 ','sn112 ','sn114 ','sn115 ','sn116 ',
c 'sn117 ','sn118 ','sn119 ','sn120 ','sn122 ',
c 'sn123 ','sn124 ','sn125 ','sn126 ','sb121 ',
c 'sb123 ','sb124 ','sb125 ','sb126 ','te120 ',
c 'te122 ','te123 ','te124 ','te125 ','te126 ',
c 'te128 ','te130 ','te132 ','te127m','te129m',
c ' i127 ',' i129 ',' i130 ',' i131 ',' i135 ',
c 'xe124 ','xe126 ','xe128 ','xe129 ','xe130 ',
c 'xe131 ','xe132 ','xe133 ','xe134 ','xe135 ',
c 'xe136 ','cs133 ','cs134 ','cs135 ','cs136 ',
c 'cs137 ','ba134 ','ba135 ','ba136 ','ba137 ',
c 'ba138 ','ba140 ','la139 ','la140 ','ce140 ',
c 'ce141 ','ce142 ','ce143 ','ce144 ','pr141 ',
c 'pr142 ','pr143 ','nd142 ','nd143 ','nd144 ',
c 'nd145 ','nd146 ','nd147 ','nd148 ','nd150 ',
c 'pm147 ','pm148 ','pm149 ','pm151 ','pm148m',
c 'sm144 ','sm147 ','sm148 ','sm149 ','sm150 ',
c 'sm151 ','sm152 ','sm153 ','sm154 ',' eu   ',
c 'eu151 ','eu152 ','eu153 ','eu154 ','eu155 ',
c 'eu156 ','eu157 ','gd152 ','gd154 ','gd155 ',
c 'gd156 ','gd157 ','gd158 ','gd160 ','tb159 ',
c 'tb160 ','dy160 ','dy161 ','dy162 ','dy163 ',
c 'dy164 ','ho165 ','er166 ','er167 ','lu175 ',
c 'lu176 ',' hf   ','hf174 ','hf176 ','hf177 ',
c 'hf178 ','hf179 ','hf180 ','ta181 ','ta182 ',
c '  w   ',' w182 ',' w183 ',' w184 ',' w186 ',
c 're185 ','re187 ','au197 ',' pb   ','bi209 ',
c 'th230 ','th232 ','pa231 ','pa233 ',' u232 ',
c ' u233 ',' u234 ',' u235 ',' u236 ',' u237 ',
c ' u238 ','np237 ','np238 ','pu236 ','pu237 ',
c 'pu238 ','pu239 ','pu240 ','pu241 ','pu242 ',
c 'pu243 ','pu244 ','am241 ','am242 ','am243 ',
c 'am242m','cm241 ','cm242 ','cm243 ','cm244 ',
c 'cm245 ','cm246 ','cm247 ','cm248 ','bk249 ',
c 'cf249 ','cf250 ','cf251 ','cf252 ','cf253 ',
c 'es253 '/
*
 RETRIEVALFILE(1:25)=PREVIOUSNAME
 RETRIEVALFILE(26:29)='.cut'
 NOTESFILE(1:25)=NM(1:25)
```

```
      NOTESFILE(26:31)='.notes'
      OPEN(UNIT=300, FILE=RETRIEVALFILE, STATUS='OLD')
      OPEN(UNIT=500, FILE=NOTESFILE, STATUS='UNKNOWN')
      REWIND(300)
      REWIND(500)
      DO 5 CT1=1,1000
         ISOVALUE(CT1)=0.0
         FUELISOVALUE(CT1)=0.0
         FUELISOWTPCT(CT1)=0.0
         LEFTVAL=0.0
         ISONAME='      '
         FUELISONAME='      '
         LEFTLIST='      '
         ISOFLAG=0
    5 CONTINUE
      ROWFLAGLOG=.FALSE.
      DO 11 WHILE (ROWFLAGLOG.EQ..FALSE.)
         READ (300,10) ROWFLAG, COL1, COL2, COL3,
     c   COL4, COL5, COL6, COL7, COL8
   10    FORMAT (T15,A7,T24,A8,T34,A8,T44,A8,T54,A8,
     c   T64,A8,T74,A8,T84,A8,T94,A8)
         IF (ROWFLAG.EQ.'initial') THEN
            ROWFLAGLOG=.TRUE.
         ENDIF
   11 CONTINUE
      IF (COL1.NE.'        ') THEN
         COLUMNSTART=23
         COLUMNEND=32
      ENDIF
      IF (COL2.NE.'        ') THEN
         COLUMNSTART=33
         COLUMNEND=42
      ENDIF
      IF (COL3.NE.'        ') THEN
         COLUMNSTART=43
         COLUMNEND=52
      ENDIF
      IF (COL4.NE.'        ') THEN
         COLUMNSTART=53
         COLUMNEND=62
      ENDIF
      IF (COL5.NE.'        ') THEN
         COLUMNSTART=63
         COLUMNEND=72
      ENDIF
      IF (COL6.NE.'        ') THEN
         COLUMNSTART=73
         COLUMNEND=82
      ENDIF
      IF (COL7.NE.'        ') THEN
         COLUMNSTART=83
         COLUMNEND=92
      ENDIF
      IF (COL8.NE.'        ') THEN
         COLUMNSTART=93
         COLUMNEND=102
      ENDIF
*  Get B-10 and B-11 composition data for BPRA
      IF (BPRA_INSERTED.EQ..TRUE.) THEN
         BPRAISOVALUE(1)=0.0
```

```
      BPRAISOVALUE(2)=0.0
      BPRAISONAME(1)='       '
      BPRAISONAME(2)='       '
      REWIND(300)
      BPFIND=.FALSE.
      DO 14 WHILE (BPFIND.EQ..FALSE.)
         READ(300,12) BPLABEL
12       FORMAT (T98,A14)
         IF (BPLABEL.EQ.'light elements') THEN
            READ(300,*)
            READ(300,13) FORMATLABEL
13          FORMAT (T46,A29)
            IF (FORMATLABEL.EQ.'nuclide concentrations, grams') THEN
               BPFIND=.TRUE.
            ENDIF
         ENDIF
14    CONTINUE
      DO 24 CT1=1,25
         READ (300,22) BPRAISONAME(1)
22       FORMAT(T6,A6)
         IF (BPRAISONAME(1).EQ.' b 10 ') THEN
            BACKSPACE(300)
            EXIT
         ENDIF
24    CONTINUE
      READ (300,26) BPRAISONAME(1), BPRAISOVALUE(1)
26       FORMAT(T6,A6,T<COLUMNSTART>,G10.2)
      READ (300,29) BPRAISONAME(2), BPRAISOVALUE(2)
29       FORMAT(T6,A6,T<COLUMNSTART>,G10.2)
      IF (BPRAISONAME(1).EQ.' b 10 ') THEN
         BPRAISONAME(1)='  5010'
      ENDIF
      IF (BPRAISONAME(2).EQ.' b 11 ') THEN
         BPRAISONAME(2)='  5011'
      ENDIF
   ENDIF
*  Get fuel composition data
   REWIND(300)
   ACTINIDEFIND=.FALSE.
   DO 50 WHILE (ACTINIDEFIND.EQ..FALSE.)
      READ(300,30) ACTINIDELABEL
30    FORMAT (T103,A9)
      IF (ACTINIDELABEL.EQ.'actinides') THEN
         READ(300,*)
         READ(300,40) FORMATLABEL
40       FORMAT (T46,A29)
         IF (FORMATLABEL.EQ.'nuclide concentrations, grams') THEN
            ACTINIDEFIND=.TRUE.
         ENDIF
      ENDIF
50 CONTINUE
   READ(300,*)
   READ(300,*)
   ISOLABEL='      '
   ISONUMBER=0
   DO 70 WHILE (ISOLABEL.NE.'tal   ')
      ISONUMBER=ISONUMBER+1
      READ(300,60) ISONAME(ISONUMBER), ISOVALUE(ISONUMBER)
60    FORMAT(T6,A6,T<COLUMNSTART>,G10.2)
      ISOLABEL=ISONAME(ISONUMBER)
```

```
      IF (ISOLABEL.EQ.'tal    ') THEN
         ISONAME(ISONUMBER)='       '
         ISOVALUE(ISONUMBER)=0
      ENDIF
 70 CONTINUE
    ISONUMBER=ISONUMBER-1
    REWIND(300)
    FISSPRODFIND=.FALSE.
    DO 110 WHILE (FISSPRODFIND.EQ..FALSE.)
       READ(300,90) FISSPRODLABEL
 90    FORMAT (T96,A16)
       IF (FISSPRODLABEL.EQ.'fission products') THEN
          READ(300,*)
          READ(300,100) FORMATLABEL
100       FORMAT (T46,A29)
          IF (FORMATLABEL.EQ.'nuclide concentrations, grams') THEN
             FISSPRODFIND=.TRUE.
          ENDIF
       ENDIF
110 CONTINUE
    READ(300,*)
    READ(300,*)
    ISOLABEL='       '
    DO 130 WHILE (ISOLABEL.NE.'tal    ')
       ISONUMBER=ISONUMBER+1
       READ(300,120) ISONAME(ISONUMBER), ISOVALUE(ISONUMBER)
120    FORMAT(T6,A6,T<COLUMNSTART>,G10.2)
       ISOLABEL=ISONAME(ISONUMBER)
       IF (ISOLABEL.EQ.'       ') THEN
          ISONUMBER=ISONUMBER-1
          READ(300,*)
          READ(300,*)
          READ(300,*)
          READ(300,*)
          READ(300,*)
       ENDIF
       IF (ISOLABEL.EQ.'tal    ') THEN
          ISONAME(ISONUMBER)='       '
          ISOVALUE(ISONUMBER)=0
       ENDIF
130 CONTINUE
    ISONUMBER=ISONUMBER-1
    WRITE (500,*) 'FUEL COMPOSITION'
    DO 140 CT1=1,ISONUMBER
       WRITE (500,*) ISONAME(CT1), '     ', ISOVALUE(CT1)
140 CONTINUE
    WRITE (500,*)
    IF (BPRA_INSERTED.EQ..TRUE.) THEN
       WRITE (500,*) 'B-10 AND B-11 IN BPRA'
       DO 150 CT1=1,2
          WRITE (500,*) BPRAISONAME(CT1), '     ',
   c      BPRAISOVALUE(CT1)
150    CONTINUE
    ENDIF
    MASSTOTAL=OXYGMS
    LEFTCOUNTER=0
    CARRYCOUNTER=0
    DO 190 CT1=1,ISONUMBER
       DO 180 CT2=1,297
          IF (ISONAME(CT1).EQ.ORIGNAME(CT2)) THEN
```

```
               CARRYCOUNTER=CARRYCOUNTER+1
               ISOFLAG(CT1)=1
               FUELISONAME(CARRYCOUNTER)=LIBRARYID(CT2)
               FUELISOVALUE(CARRYCOUNTER)=ISOVALUE(CT1)
            ENDIF
            IF ((CT2.EQ.297).AND.(ISOFLAG(CT1).NE.1)) THEN
               LEFTCOUNTER=LEFTCOUNTER+1
               LEFTLIST(LEFTCOUNTER)=ISONAME(CT1)
               LEFTVAL(LEFTCOUNTER)=ISOVALUE(CT1)
            ENDIF
  180    CONTINUE
  190 CONTINUE
      DO 195 CT1=1,CARRYCOUNTER
         MASSTOTAL=MASSTOTAL+FUELISOVALUE(CT1)
  195 CONTINUE
      DO 200 CT1=1,CARRYCOUNTER
         FUELISOWTPCT(CT1)=(FUELISOVALUE(CT1)/MASSTOTAL)*100.0
  200 CONTINUE
      WRITE (500,*) 'SAS2H FUEL COMPOSITION INPUT FROM ORIGIN OUTPUT'
      DO 230 CT1=1,CARRYCOUNTER
         WRITE (500,*) FUELISONAME(CT1), '      ', FUELISOVALUE(CT1)
  230 CONTINUE
      WRITE (500,*) 'ISOTOPES IN ORIGIN OUTPUT LEFT OUT OF SAS2H INPUT'
      DO 240 CT1=1,LEFTCOUNTER
         WRITE (500,*) LEFTLIST(CT1), '      ', LEFTVAL(CT1)
  240 CONTINUE

      RETURN
      END

*************************************************************************
*      Two digit integer conversion subroutine which adds leading zeros      *
*************************************************************************
      SUBROUTINE ZEROS(IN,CHOUT)

      INTEGER*4 IN
      CHARACTER CHOUT*2, CH1, CH2

      CH1=CHAR((IN/10)+48)
      CH2=CHAR((IN-(INT(IN/10)*10))+48)
      CHOUT(1:1)=CH1
      CHOUT(2:2)=CH2

      RETURN
      END
```

Attachment III

CRAFT Quality Assurance Test Case Input Decks

This is Appendix B: CRAFT Quality Assurance Test Case Input Decks of the CRAFT Version 1.0 User Information Documented in Attachment I.

The CRAFT input decks are presented in sequential order from QA Test Case 1 through QA Test Case 23.

```
**********************************************************************
   CRAFT Version 1.0 Input Deck for QA Test Case Number 1
**********************************************************************

N                          :Continuation Case
QA Test Case 1             :This is an input deck for testing purposes
QA1                        :Input Deck Prefix
44group                    :Cross-Section Library
3.25                       :Weight Percent U-235 in Uranium of UO2
4.6360E5                   :Mass U/Assembly
208                        :Number of Fuel Rods per Assembly
1.44272                    :Fuel Rod Pitch
0.936244                   :Fuel Pellet OD
0.9576                     :Fuel Rod Clad ID
1.0922                     :Fuel Rod Clad OD
360.172                    :Active Fuel Length
N                          :Axial Blanket Fuel [Y or N]
ZIRC-4                     :Spacer Grid Material
0.0002                     :Homogenized Spacer Vol. Frac. in Mod. of Unit Cell
ZIRC-4                     :Cladding Material
694.0                      :Cladding Temperature (K)
N                          :Multiple cladding material specification flag [Y or N]
2200.0                     :System Pressure (psia)
Y                          :BPRA existence in assembly [Y or N]
1                          :Number of cycles containing BPRA
1 0                        :# BPRA designs, # BP materials other than Al2O3-B4C
3.147  1.177 0.5858 16 0 0 :BP Den. (g/cc), B4C wt%, BP cross-sectional area, # BPRs
in BPRA, BPR clad, BP #
8                          :Number of Zones in BPRA Larger Unit Cell
4       0.43180            :BPRA Larger Unit Cell
5       0.45970
2       0.54610
3       0.63245
2       0.67310
3       0.81397
500     2.89332
3       2.91607
3       0.20000            :Larger Unit Cell for Use with BPRA Larger Unit Cell
3       0.40000
3       0.50000
3       0.63245
2       0.67310
3       0.81397
500     2.96459
3       2.98790
6       0.43180            :BPRA Larger Unit Cell for Region Above Absorber Material
5       0.45970
2       0.54610
3       0.63245
2       0.67310
3       0.81397
500     2.89332
3       2.91607
AL2O3 6
1 1 1 1                    :BPRA rel. ins. cyc., BPRA rel. desc. #, BPRA top node,
BPRA bottom node
5                          :Number of Zones in Standard Larger Unit Cell
3       0.63245
2       0.67310
3       0.81397
```

```
500     2.96459
3       2.98790
1                       :Number of cross-section libraries per irradiation step
5                       :Print Level for SAS2H
0.5                     :FACMESH for XSDRNPMS
SKIP                    :Read Flag for XSDRNPMS Control Features
1                       :Number of cycles in which assembly is inserted
01                      :Insertion cycle ID
2                       :Number of statepoints in cycle including BOC
0                       :EFPD for statepoint
0                       :Cycle length to statepoint
0                       :Days of downtime at statepoint
205                     :EFPD for statepoint
210                     :Cycle length to statepoint
10                      :Days of downtime at statepoint
30                      :Days of downtime at EOC
410                     :Total cycle EFPD
430                     :Total cycle length in calendar days
18                      :Integer position of assembly in cycle
N                       :[N=Constant Irrad. Step Lengths, Y=Variable Irrad. Step
Lengths]
1                       :Relative cycle number for boron letdown data
1                       :BOC to statepoint 2
205                     :Irradiation step length in days
1                       :Number of irradiation steps
900                     :ppmb
2                       :Statepoint 2 to EOC
205                     :Irradiation step length in days
1                       :Number of irradiation steps
600                     :ppmb
1                       :Number of axial nodes for CRC
1       360.0
NO CRA                  :Flag for control rod assy input
NO APSRA                :Flag for APSR assy input
1                       :# nodes with fuel temp input for BOC to stpt 2 of rel.
cyc. #1
1       360.0
990
1                       :# nodes with mod spec vol data for BOC to stpt 2 of rel.
cyc. #1
1       360.0
0.02239
1                       :# of axial nodes with BOC burnup input data for Cycle-1
1       360.0
0
1                       :# of axial nodes with stpt 2 burnup input data for Cycle-1
1       360.0
4.0

**********************************************************************
   CRAFT Version 1.0 Input Deck for QA Test Case Number 2
**********************************************************************

N                       :Continuation Case
QA Test Case 2          :This is an input deck for testing purposes
QA2                     :Input Deck Prefix
44group                 :Cross-Section Library
3.25                    :Weight Percent U-235 in Uranium of UO2
4.6360E5                :Mass U/Assembly
208                     :Number of Fuel Rods per Assembly
```

```
1.44272                    :Fuel Rod Pitch
0.936244                   :Fuel Pellet OD
0.9576                     :Fuel Rod Clad ID
1.0922                     :Fuel Rod Clad OD
360.172                    :Active Fuel Length
N                          :Axial Blanket Fuel [Y or N]
INCONEL                    :Spacer Grid Material
0.0002                     :Homogenized Spacer Vol. Frac. in Mod. of Unit Cell
SS316                      :Cladding Material
694.0                      :Cladding Temperature (K)
Y                          :Multiple cladding material specification flag [Y or N]
1                          :# of alternative cladding materials needed
7                          :SAS2H material mixture # for alternative cladding
INCONEL                    :Alternative cladding material
2200.0                     :System Pressure (psia)
Y                          :BPRA existence in assembly [Y or N]
1                          :Number of cycles containing BPRA
1 0                        :# BPRA designs, # BP materials other than Al2O3-B4C
3.147  1.177 0.5858 16 7 0 :BP Den. (g/cc), B4C wt%, BP cross-sectional area, # BPRs
in BPRA, BPR clad, BP #
8                          :Number of Zones in BPRA Larger Unit Cell
4       0.43180            :BPRA Larger Unit Cell
5       0.45970
7       0.54610
3       0.63245
7       0.67310
3       0.81397
500     2.89332
3       2.91607
3       0.20000            :Larger Unit Cell for Use with BPRA Larger Unit Cell
3       0.40000
3       0.50000
3       0.63245
7       0.67310
3       0.81397
500     2.96459
3       2.98790
6       0.43180            :BPRA Larger Unit Cell for Region Above Absorber Material
5       0.45970
2       0.54610
3       0.63245
2       0.67310
3       0.81397
500     2.89332
3       2.91607
AL2O3 6
1 1 1 1                    :BPRA rel. ins. cyc., BPRA rel. desc. #, BPRA top node,
BPRA bottom node
5                          :Number of Zones in Standard Larger Unit Cell
3       0.63245
2       0.67310
3       0.81397
500     2.96459
3       2.98790
1                          :Number of cross-section libraries per irradiation step
5                          :Print Level for SAS2H
0.5                        :FACMESH for XSDRNPMS
SKIP                       :Read Flag for XSDRNPMS Control Features
1                          :Number of cycles in which assembly is inserted
01                         :Insertion cycle ID
```

```
2                       :Number of statepoints in cycle including BOC
0                       :EFPD for statepoint
0                       :Cycle length to statepoint
0                       :Days of downtime at statepoint
205                     :EFPD for statepoint
210                     :Cycle length to statepoint
10                      :Days of downtime at statepoint
30                      :Days of downtime at EOC
410                     :Total cycle EFPD
430                     :Total cycle length in calendar days
18                      :Integer position of assembly in cycle
N                       :[N=Constant Irrad. Step Lengths, Y=Variable Irrad. Step
Lengths]
1                       :Relative cycle number for boron letdown data
1                       :BOC to statepoint 2
205                     :Irradiation step length in days
1                       :Number of irradiation steps
900                     :ppmb
2                       :Statepoint 2 to EOC
205                     :Irradiation step length in days
1                       :Number of irradiation steps
600                     :ppmb
1                       :Number of axial nodes for CRC
1       360.0
NO CRA                  :Flag for control rod assy input
NO APSRA                :Flag for APSR assy input
1                       :# nodes with fuel temp input for BOC to stpt 2 of rel.
cyc. #1
1       360.0
990
1                       :# nodes with mod spec vol data for BOC to stpt 2 of rel.
cyc. #1
1       360.0
0.02239
1                       :# of axial nodes with BOC burnup input data for Cycle-1
1       360.0
0
1                       :# of axial nodes with stpt 2 burnup input data for Cycle-1
1       360.0
4.0

**********************************************************************
   CRAFT Version 1.0 Input Deck for QA Test Case Number 3
**********************************************************************

N                       :Continuation Case
QA Test Case 3          :This is an input deck for testing purposes
QA3                     :Input Deck Prefix
44group                 :Cross-Section Library
3.25                    :Weight Percent U-235 in Uranium of UO2
4.6360E5                :Mass U/Assembly
208                     :Number of Fuel Rods per Assembly
1.44272                 :Fuel Rod Pitch
0.936244                :Fuel Pellet OD
0.9576                  :Fuel Rod Clad ID
1.0922                  :Fuel Rod Clad OD
360.172                 :Active Fuel Length
N                       :Axial Blanket Fuel [Y or N]
SS316                   :Spacer Grid Material
0.0002                  :Homogenized Spacer Vol. Frac. in Mod. of Unit Cell
```

```
SS316S                      :Cladding Material
694.0                       :Cladding Temperature (K)
Y                           :Multiple cladding material specification flag [Y or N]
1                           :# of alternative cladding materials needed
7                           :SAS2H material mixture # for alternative cladding
SS316                       :Alternative cladding material
2200.0                      :System Pressure (psia)
Y                           :BPRA existence in assembly [Y or N]
1                           :Number of cycles containing BPRA
1 0                         :# BPRA designs, # BP materials other than Al2O3-B4C
3.147  1.177 0.5858 16 7 0 :BP Den. (g/cc), B4C wt%, BP cross-sectional area, # BPRs
in BPRA, BPR clad, BP #
8                           :Number of Zones in BPRA Larger Unit Cell
4       0.43180             :BPRA Larger Unit Cell
5       0.45970
7       0.54610
3       0.63245
7       0.67310
3       0.81397
500     2.89332
3       2.91607
3       0.20000             :Larger Unit Cell for Use with BPRA Larger Unit Cell
3       0.40000
3       0.50000
3       0.63245
7       0.67310
3       0.81397
500     2.96459
3       2.98790
6       0.43180             :BPRA Larger Unit Cell for Region Above Absorber Material
5       0.45970
2       0.54610
3       0.63245
2       0.67310
3       0.81397
500     2.89332
3       2.91607
AL2O3 6
1 1 1 1                     :BPRA rel. ins. cyc., BPRA rel. desc. #, BPRA top node,
BPRA bottom node
5                           :Number of Zones in Standard Larger Unit Cell
3       0.63245
2       0.67310
3       0.81397
500     2.96459
3       2.98790
1                           :Number of cross-section libraries per irradiation step
5                           :Print Level for SAS2H
0.5                         :FACMESH for XSDRNPMS
SKIP                        :Read Flag for XSDRNPMS Control Features
1                           :Number of cycles in which assembly is inserted
01                          :Insertion cycle ID
2                           :Number of statepoints in cycle including BOC
0                           :EFPD for statepoint
0                           :Cycle length to statepoint
0                           :Days of downtime at statepoint
205                         :EFPD for statepoint
210                         :Cycle length to statepoint
10                          :Days of downtime at statepoint
30                          :Days of downtime at EOC
```

```
410                         :Total cycle EFPD
430                         :Total cycle length in calendar days
18                          :Integer position of assembly in cycle
N                           :[N=Constant Irrad. Step Lengths, Y=Variable Irrad. Step
Lengths]
1                           :Relative cycle number for boron letdown data
1                           :BOC to statepoint 2
205                         :Irradiation step length in days
1                           :Number of irradiation steps
900                         :ppmb
2                           :Statepoint 2 to EOC
205                         :Irradiation step length in days
1                           :Number of irradiation steps
600                         :ppmb
1                           :Number of axial nodes for CRC
1       360.0
NO CRA                      :Flag for control rod assy input
NO APSRA                    :Flag for APSR assy input
1                           :# nodes with fuel temp input for BOC to stpt 2 of rel.
cyc. #1
1       360.0
990
1                           :# nodes with mod spec vol data for BOC to stpt 2 of rel.
cyc. #1
1       360.0
0.02239
1                           :# of axial nodes with BOC burnup input data for Cycle-1
1       360.0
0
1                           :# of axial nodes with stpt 2 burnup input data for Cycle-1
1       360.0
4.0

**********************************************************************
   CRAFT Version 1.0 Input Deck for QA Test Case Number 4
**********************************************************************

N                           :Continuation Case
QA Test Case 4              :This is an input deck for testing purposes
QA4                         :Input Deck Prefix
44group                     :Cross-Section Library
3.25                        :Weight Percent U-235 in Uranium of UO2
4.6360E5                    :Mass U/Assembly
208                         :Number of Fuel Rods per Assembly
1.44272                     :Fuel Rod Pitch
0.936244                    :Fuel Pellet OD
0.9576                      :Fuel Rod Clad ID
1.0922                      :Fuel Rod Clad OD
360.172                     :Active Fuel Length
N                           :Axial Blanket Fuel [Y or N]
SS316S                      :Spacer Grid Material
0.0002                      :Homogenized Spacer Vol. Frac. in Mod. of Unit Cell
SS304                       :Cladding Material
694.0                       :Cladding Temperature (K)
Y                           :Multiple cladding material specification flag [Y or N]
1                           :# of alternative cladding materials needed
7                           :SAS2H material mixture # for alternative cladding
SS316S                      :Alternative cladding material
2200.0                      :System Pressure (psia)
Y                           :BPRA existence in assembly [Y or N]
```

```
1                          :Number of cycles containing BPRA
1 0                        :# BPRA designs, # BP materials other than Al2O3-B4C
3.147  1.177 0.5858 16 7 0 :BP Den. (g/cc), B4C wt%, BP cross-sectional area, # BPRs
in BPRA, BPR clad, BP #
8                          :Number of Zones in BPRA Larger Unit Cell
4       0.43180            :BPRA Larger Unit Cell
5       0.45970
7       0.54610
3       0.63245
7       0.67310
3       0.81397
500     2.89332
3       2.91607
3       0.20000            :Larger Unit Cell for Use with BPRA Larger Unit Cell
3       0.40000
3       0.50000
3       0.63245
7       0.67310
3       0.81397
500     2.96459
3       2.98790
6       0.43180            :BPRA Larger Unit Cell for Region Above Absorber Material
5       0.45970
2       0.54610
3       0.63245
2       0.67310
3       0.81397
500     2.89332
3       2.91607
AL2O3 6
1 1 1 1                    :BPRA rel. ins. cyc., BPRA rel. desc. #, BPRA top node,
BPRA bottom node
5                          :Number of Zones in Standard Larger Unit Cell
3       0.63245
2       0.67310
3       0.81397
500     2.96459
3       2.98790
1                          :Number of cross-section libraries per irradiation step
5                          :Print Level for SAS2H
0.5                        :FACMESH for XSDRNPMS
SKIP                       :Read Flag for XSDRNPMS Control Features
1                          :Number of cycles in which assembly is inserted
01                         :Insertion cycle ID
2                          :Number of statepoints in cycle including BOC
0                          :EFPD for statepoint
0                          :Cycle length to statepoint
0                          :Days of downtime at statepoint
205                        :EFPD for statepoint
210                        :Cycle length to statepoint
10                         :Days of downtime at statepoint
30                         :Days of downtime at EOC
410                        :Total cycle EFPD
430                        :Total cycle length in calendar days
18                         :Integer position of assembly in cycle
N                          :[N=Constant Irrad. Step Lengths, Y=Variable Irrad. Step
Lengths]
1                          :Relative cycle number for boron letdown data
1                          :BOC to statepoint 2
205                        :Irradiation step length in days
```

```
1                       :Number of irradiation steps
900                     :ppmb
2                       :Statepoint 2 to EOC
205                     :Irradiation step length in days
1                       :Number of irradiation steps
600                     :ppmb
1                       :Number of axial nodes for CRC
1       360.0
NO CRA                  :Flag for control rod assy input
NO APSRA                :Flag for APSR assy input
1                       :# nodes with fuel temp input for BOC to stpt 2 of rel.
cyc. #1
1       360.0
990
1                       :# nodes with mod spec vol data for BOC to stpt 2 of rel.
cyc. #1
1       360.0
0.02239
1                       :# of axial nodes with BOC burnup input data for Cycle-1
1       360.0
0
1                       :# of axial nodes with stpt 2 burnup input data for Cycle-1
1       360.0
4.0

**********************************************************************
   CRAFT Version 1.0 Input Deck for QA Test Case Number 5
**********************************************************************

N                       :Continuation Case
QA Test Case 5          :This is an input deck for testing purposes
QA5                     :Input Deck Prefix
44group                 :Cross-Section Library
3.25                    :Weight Percent U-235 in Uranium of UO2
4.6360E5                :Mass U/Assembly
208                     :Number of Fuel Rods per Assembly
1.44272                 :Fuel Rod Pitch
0.936244                :Fuel Pellet OD
0.9576                  :Fuel Rod Clad ID
1.0922                  :Fuel Rod Clad OD
360.172                 :Active Fuel Length
N                       :Axial Blanket Fuel [Y or N]
SS304                   :Spacer Grid Material
0.0002                  :Homogenized Spacer Vol. Frac. in Mod. of Unit Cell
SS304S                  :Cladding Material
694.0                   :Cladding Temperature (K)
Y                       :Multiple cladding material specification flag [Y or N]
1                       :# of alternative cladding materials needed
7                       :SAS2H material mixture # for alternative cladding
SS304                   :Alternative cladding material
2200.0                  :System Pressure (psia)
Y                       :BPRA existence in assembly [Y or N]
1                       :Number of cycles containing BPRA
1 0                     :# BPRA designs, # BP materials other than Al2O3-B4C
3.147  1.177 0.5858 16 7 0 :BP Den. (g/cc), B4C wt%, BP cross-sectional area, # BPRs
in BPRA, BPR clad, BP #
8                       :Number of Zones in BPRA Larger Unit Cell
4       0.43180         :BPRA Larger Unit Cell
5       0.45970
7       0.54610
```

```
3       0.63245
7       0.67310
3       0.81397
500     2.89332
3       2.91607
3       0.20000          :Larger Unit Cell for Use with BPRA Larger Unit Cell
3       0.40000
3       0.50000
3       0.63245
7       0.67310
3       0.81397
500     2.96459
3       2.98790
6       0.43180          :BPRA Larger Unit Cell for Region Above Absorber Material
5       0.45970
2       0.54610
3       0.63245
2       0.67310
3       0.81397
500     2.89332
3       2.91607
AL2O3 6
1 1 1 1                  :BPRA rel. ins. cyc., BPRA rel. desc. #, BPRA top node,
BPRA bottom node
5                        :Number of Zones in Standard Larger Unit Cell
3       0.63245
2       0.67310
3       0.81397
500     2.96459
3       2.98790
1                        :Number of cross-section libraries per irradiation step
5                        :Print Level for SAS2H
0.5                      :FACMESH for XSDRNPMS
SKIP                     :Read Flag for XSDRNPMS Control Features
1                        :Number of cycles in which assembly is inserted
01                       :Insertion cycle ID
2                        :Number of statepoints in cycle including BOC
0                        :EFPD for statepoint
0                        :Cycle length to statepoint
0                        :Days of downtime at statepoint
205                      :EFPD for statepoint
210                      :Cycle length to statepoint
10                       :Days of downtime at statepoint
30                       :Days of downtime at EOC
410                      :Total cycle EFPD
430                      :Total cycle length in calendar days
18                       :Integer position of assembly in cycle
N                        :[N=Constant Irrad. Step Lengths, Y=Variable Irrad. Step
Lengths]
1                        :Relative cycle number for boron letdown data
1                        :BOC to statepoint 2
205                      :Irradiation step length in days
1                        :Number of irradiation steps
900                      :ppmb
2                        :Statepoint 2 to EOC
205                      :Irradiation step length in days
1                        :Number of irradiation steps
600                      :ppmb
1                        :Number of axial nodes for CRC
1       360.0
```

```
NO CRA                          :Flag for control rod assy input
NO APSRA                        :Flag for APSR assy input
1                               :# nodes with fuel temp input for BOC to stpt 2 of rel.
cyc. #1
1       360.0
990
1                               :# nodes with mod spec vol data for BOC to stpt 2 of rel.
cyc. #1
1       360.0
0.02239
1                               :# of axial nodes with BOC burnup input data for Cycle-1
1       360.0
0
1                               :# of axial nodes with stpt 2 burnup input data for Cycle-1
1       360.0
4.0

**********************************************************************
   CRAFT Version 1.0 Input Deck for QA Test Case Number 6
**********************************************************************

N                               :Continuation Case
QA Test Case 6                  :This is an input deck for testing purposes
QA6                             :Input Deck Prefix
44group                         :Cross-Section Library
3.25                            :Weight Percent U-235 in Uranium of UO2
4.6360E5                        :Mass U/Assembly
208                             :Number of Fuel Rods per Assembly
1.44272                         :Fuel Rod Pitch
0.936244                        :Fuel Pellet OD
0.9576                          :Fuel Rod Clad ID
1.0922                          :Fuel Rod Clad OD
360.172                         :Active Fuel Length
N                               :Axial Blanket Fuel [Y or N]
SS304S                          :Spacer Grid Material
0.0002                          :Homogenized Spacer Vol. Frac. in Mod. of Unit Cell
ZIRC-4                          :Cladding Material
694.0                           :Cladding Temperature (K)
Y                               :Multiple cladding material specification flag [Y or N]
1                               :# of alternative cladding materials needed
7                               :SAS2H material mixture # for alternative cladding
SS304S                          :Alternative cladding material
2200.0                          :System Pressure (psia)
Y                               :BPRA existence in assembly [Y or N]
1                               :Number of cycles containing BPRA
1 0                             :# BPRA designs, # BP materials other than Al2O3-B4C
3.147  1.177 0.5858 16 7 0 :BP Den. (g/cc), B4C wt%, BP cross-sectional area, # BPRs
in BPRA, BPR clad, BP #
8                               :Number of Zones in BPRA Larger Unit Cell
4       0.43180                 :BPRA Larger Unit Cell
5       0.45970
7       0.54610
3       0.63245
7       0.67310
3       0.81397
500     2.89332
3       2.91607
3       0.20000                 :Larger Unit Cell for Use with BPRA Larger Unit Cell
3       0.40000
3       0.50000
```

```
3       0.63245
7       0.67310
3       0.81397
500     2.96459
3       2.98790
6       0.43180          :BPRA Larger Unit Cell for Region Above Absorber Material
5       0.45970
2       0.54610
3       0.63245
2       0.67310
3       0.81397
500     2.89332
3       2.91607
AL2O3 6
1 1 1 1                  :BPRA rel. ins. cyc., BPRA rel. desc. #, BPRA top node,
BPRA bottom node
5                        :Number of Zones in Standard Larger Unit Cell
3       0.63245
2       0.67310
3       0.81397
500     2.96459
3       2.98790
1                        :Number of cross-section libraries per irradiation step
5                        :Print Level for SAS2H
0.5                      :FACMESH for XSDRNPMS
SKIP                     :Read Flag for XSDRNPMS Control Features
1                        :Number of cycles in which assembly is inserted
01                       :Insertion cycle ID
2                        :Number of statepoints in cycle including BOC
0                        :EFPD for statepoint
0                        :Cycle length to statepoint
0                        :Days of downtime at statepoint
205                      :EFPD for statepoint
210                      :Cycle length to statepoint
10                       :Days of downtime at statepoint
30                       :Days of downtime at EOC
410                      :Total cycle EFPD
430                      :Total cycle length in calendar days
18                       :Integer position of assembly in cycle
N                        :[N=Constant Irrad. Step Lengths, Y=Variable Irrad. Step
Lengths]
1                        :Relative cycle number for boron letdown data
1                        :BOC to statepoint 2
205                      :Irradiation step length in days
1                        :Number of irradiation steps
900                      :ppmb
2                        :Statepoint 2 to EOC
205                      :Irradiation step length in days
1                        :Number of irradiation steps
600                      :ppmb
1                        :Number of axial nodes for CRC
1       360.0
NO CRA                   :Flag for control rod assy input
NO APSRA                 :Flag for APSR assy input
1                        :# nodes with fuel temp input for BOC to stpt 2 of rel.
cyc. #1
1       360.0
990
1                        :# nodes with mod spec vol data for BOC to stpt 2 of rel.
cyc. #1
```

```
1       360.0
0.02239
1                          :# of axial nodes with BOC burnup input data for Cycle-1
1       360.0
0
1                          :# of axial nodes with stpt 2 burnup input data for Cycle-1
1       360.0
4.0

**********************************************************************
   CRAFT Version 1.0 Input Deck for QA Test Case Number 7
**********************************************************************

N                          :Continuation Case
QA Test Case 7             :This is an input deck for testing purposes
QA7                        :Input Deck Prefix
44group                    :Cross-Section Library
3.25                       :Weight Percent U-235 in Uranium of UO2
4.6360E5                   :Mass U/Assembly
208                        :Number of Fuel Rods per Assembly
1.44272                    :Fuel Rod Pitch
0.936244                   :Fuel Pellet OD
0.9576                     :Fuel Rod Clad ID
1.0922                     :Fuel Rod Clad OD
360.172                    :Active Fuel Length
N                          :Axial Blanket Fuel [Y or N]
ZIRC-4                     :Spacer Grid Material
0.0002                     :Homogenized Spacer Vol. Frac. in Mod. of Unit Cell
ZIRC-4                     :Cladding Material
694.0                      :Cladding Temperature (K)
N                          :Multiple cladding material specification flag [Y or N]
2200.0                     :System Pressure (psia)
N                          :BPRA existence in assembly [Y or N]
5                          :Number of Zones in Standard Larger Unit Cell
3       0.63245
2       0.67310
3       0.81397
500     2.96459
3       2.98790
1                          :Number of cross-section libraries per irradiation step
5                          :Print Level for SAS2H
0.5                        :FACMESH for XSDRNPMS
SKIP                       :Read Flag for XSDRNPMS Control Features
1                          :Number of cycles in which assembly is inserted
01                         :Insertion cycle ID
2                          :Number of statepoints in cycle including BOC
0                          :EFPD for statepoint
0                          :Cycle length to statepoint
0                          :Days of downtime at statepoint
205                        :EFPD for statepoint
210                        :Cycle length to statepoint
10                         :Days of downtime at statepoint
30                         :Days of downtime at EOC
410                        :Total cycle EFPD
430                        :Total cycle length in calendar days
18                         :Integer position of assembly in cycle
N                          :[N=Constant Irrad. Step Lengths, Y=Variable Irrad. Step
Lengths]
1                          :Relative cycle number for boron letdown data
1                          :BOC to statepoint 2
```

```
205                     :Irradiation step length in days
1                       :Number of irradiation steps
900                     :ppmb
2                       :Statepoint 2 to EOC
205                     :Irradiation step length in days
1                       :Number of irradiation steps
600                     :ppmb
1                       :Number of axial nodes for CRC
1       360.0
RODDED                  :Flag for control rod assy input
1                       :# of irradiation step in which CRA is inserted
1 1 1 1 1 9 1           :Input Card 47B
1                       :Input Card 47C
9                       :Input Card 47D
3                       :Input Card 47E
5010 12.0               :Input Card 47F
5011 48.0               :Input Card 47F
6012 40.0               :Input Card 47F
1                       :Input Card 47G
3.7 0                   :Input Card 47H
8                       :Input Card 47I
9 0.435                 :Input Card 47J
5 0.4597
2 0.5461
3 0.63245
2 0.6731
3 0.813968
500 2.893316
3 2.916069
3 0.435                 :Input Card 47K
3 0.4597
3 0.5461
3 0.63245
2 0.6731
3 0.813968
500 2.893316
3 2.916069
NO APSRA                :Flag for APSR assy input
1                       :# nodes with fuel temp input for BOC to stpt 2 of rel.
cyc. #1
1       360.0
990
1                       :# nodes with mod spec vol data for BOC to stpt 2 of rel.
cyc. #1
1       360.0
0.02239
1                       :# of axial nodes with BOC burnup input data for Cycle-1
1       360.0
0
1                       :# of axial nodes with stpt 2 burnup input data for Cycle-1
1       360.0
4.0

**********************************************************************
   CRAFT Version 1.0 Input Deck for QA Test Case Number 8
**********************************************************************

N                       :Continuation Case
QA Test Case 8          :This is an input deck for testing purposes
QA8                     :Input Deck Prefix
```

```
44group                    :Cross-Section Library
3.25                       :Weight Percent U-235 in Uranium of UO2
4.6360E5                   :Mass U/Assembly
208                        :Number of Fuel Rods per Assembly
1.44272                    :Fuel Rod Pitch
0.936244                   :Fuel Pellet OD
0.9576                     :Fuel Rod Clad ID
1.0922                     :Fuel Rod Clad OD
360.172                    :Active Fuel Length
N                          :Axial Blanket Fuel [Y or N]
ZIRC-4                     :Spacer Grid Material
0.0002                     :Homogenized Spacer Vol. Frac. in Mod. of Unit Cell
ZIRC-4                     :Cladding Material
694.0                      :Cladding Temperature (K)
Y                          :Multiple cladding material specification flag [Y or N]
1
7
INCONEL
2200.0                     :System Pressure (psia)
N                          :BPRA existence in assembly [Y or N]
5                          :Number of Zones in Standard Larger Unit Cell
3       0.63245
2       0.67310
3       0.81397
500     2.96459
3       2.98790
1                          :Number of cross-section libraries per irradiation step
5                          :Print Level for SAS2H
0.5                        :FACMESH for XSDRNPMS
SKIP                       :Read Flag for XSDRNPMS Control Features
1                          :Number of cycles in which assembly is inserted
01                         :Insertion cycle ID
2                          :Number of statepoints in cycle including BOC
0                          :EFPD for statepoint
0                          :Cycle length to statepoint
0                          :Days of downtime at statepoint
205                        :EFPD for statepoint
210                        :Cycle length to statepoint
10                         :Days of downtime at statepoint
30                         :Days of downtime at EOC
410                        :Total cycle EFPD
430                        :Total cycle length in calendar days
18                         :Integer position of assembly in cycle
N                          :[N=Constant Irrad. Step Lengths, Y=Variable Irrad. Step
Lengths]
1                          :Relative cycle number for boron letdown data
1                          :BOC to statepoint 2
205                        :Irradiation step length in days
1                          :Number of irradiation steps
900                        :ppmb
2                          :Statepoint 2 to EOC
205                        :Irradiation step length in days
1                          :Number of irradiation steps
600                        :ppmb
1                          :Number of axial nodes for CRC
1       360.0
RODDED                     :Flag for control rod assy input
1                          :# of irradiation step in which CRA is inserted
1 1 1 1 1 9 1              :Input Card 47B
1                          :Input Card 47C
```

```
9                       :Input Card 47D
3                       :Input Card 47E
5010 12.0               :Input Card 47F
5011 48.0               :Input Card 47F
6012 40.0               :Input Card 47F
1                       :Input Card 47G
3.7 0                   :Input Card 47H
8                       :Input Card 47I
9 0.435                 :Input Card 47J
5 0.4597
7 0.5461
3 0.63245
7 0.6731
3 0.813968
500 2.893316
3 2.916069
3 0.435                 :Input Card 47K
3 0.4597
3 0.5461
3 0.63245
7 0.6731
3 0.813968
500 2.893316
3 2.916069
NO APSRA                :Flag for APSR assy input
1                       :# nodes with fuel temp input for BOC to stpt 2 of rel.
cyc. #1
1      360.0
990
1                       :# nodes with mod spec vol data for BOC to stpt 2 of rel.
cyc. #1
1      360.0
0.02239
1                       :# of axial nodes with BOC burnup input data for Cycle-1
1      360.0
0
1                       :# of axial nodes with stpt 2 burnup input data for Cycle-1
1      360.0
4.0

**********************************************************************
   CRAFT Version 1.0 Input Deck for QA Test Case Number 9
**********************************************************************

N                       :Continuation Case
QA Test Case 9          :This is an input deck for testing purposes
QA9                     :Input Deck Prefix
44group                 :Cross-Section Library
3.25                    :Weight Percent U-235 in Uranium of UO2
4.6360E5                :Mass U/Assembly
208                     :Number of Fuel Rods per Assembly
1.44272                 :Fuel Rod Pitch
0.936244                :Fuel Pellet OD
0.9576                  :Fuel Rod Clad ID
1.0922                  :Fuel Rod Clad OD
360.172                 :Active Fuel Length
N                       :Axial Blanket Fuel [Y or N]
ZIRC-4                  :Spacer Grid Material
0.0002                  :Homogenized Spacer Vol. Frac. in Mod. of Unit Cell
ZIRC-4                  :Cladding Material
```

```
694.0                    :Cladding Temperature (K)
Y                        :Multiple cladding material specification flag [Y or N]
1
7
SS316
2200.0                   :System Pressure (psia)
N                        :BPRA existence in assembly [Y or N]
5                        :Number of Zones in Standard Larger Unit Cell
3       0.63245
2       0.67310
3       0.81397
500     2.96459
3       2.98790
1                        :Number of cross-section libraries per irradiation step
5                        :Print Level for SAS2H
0.5                      :FACMESH for XSDRNPMS
SKIP                     :Read Flag for XSDRNPMS Control Features
1                        :Number of cycles in which assembly is inserted
01                       :Insertion cycle ID
2                        :Number of statepoints in cycle including BOC
0                        :EFPD for statepoint
0                        :Cycle length to statepoint
0                        :Days of downtime at statepoint
205                      :EFPD for statepoint
210                      :Cycle length to statepoint
10                       :Days of downtime at statepoint
30                       :Days of downtime at EOC
410                      :Total cycle EFPD
430                      :Total cycle length in calendar days
18                       :Integer position of assembly in cycle
N                        :[N=Constant Irrad. Step Lengths, Y=Variable Irrad. Step
Lengths]
1                        :Relative cycle number for boron letdown data
1                        :BOC to statepoint 2
205                      :Irradiation step length in days
1                        :Number of irradiation steps
900                      :ppmb
2                        :Statepoint 2 to EOC
205                      :Irradiation step length in days
1                        :Number of irradiation steps
600                      :ppmb
1                        :Number of axial nodes for CRC
1       360.0
RODDED                   :Flag for control rod assy input
1                        :# of irradiation step in which CRA is inserted
1 1 1 1 1 9 1            :Input Card 47B
1                        :Input Card 47C
9                        :Input Card 47D
3                        :Input Card 47E
5010 12.0                :Input Card 47F
5011 48.0                :Input Card 47F
6012 40.0                :Input Card 47F
1                        :Input Card 47G
3.7 0                    :Input Card 47H
8                        :Input Card 47I
9 0.435                  :Input Card 47J
5 0.4597
7 0.5461
3 0.63245
7 0.6731
```

```
3 0.813968
500 2.893316
3 2.916069
3 0.435                    :Input Card 47K
3 0.4597
3 0.5461
3 0.63245
7 0.6731
3 0.813968
500 2.893316
3 2.916069
NO APSRA                   :Flag for APSR assy input
1                          :# nodes with fuel temp input for BOC to stpt 2 of rel.
cyc. #1
1       360.0
990
1                          :# nodes with mod spec vol data for BOC to stpt 2 of rel.
cyc. #1
1       360.0
0.02239
1                          :# of axial nodes with BOC burnup input data for Cycle-1
1       360.0
0
1                          :# of axial nodes with stpt 2 burnup input data for Cycle-1
1       360.0
4.0

**********************************************************************
   CRAFT Version 1.0 Input Deck for QA Test Case Number 10
**********************************************************************

N                          :Continuation Case
QA Test Case 10            :This is an input deck for testing purposes
Q10                        :Input Deck Prefix
44group                    :Cross-Section Library
3.25                       :Weight Percent U-235 in Uranium of UO2
4.6360E5                   :Mass U/Assembly
208                        :Number of Fuel Rods per Assembly
1.44272                    :Fuel Rod Pitch
0.936244                   :Fuel Pellet OD
0.9576                     :Fuel Rod Clad ID
1.0922                     :Fuel Rod Clad OD
360.172                    :Active Fuel Length
N                          :Axial Blanket Fuel [Y or N]
ZIRC-4                     :Spacer Grid Material
0.0002                     :Homogenized Spacer Vol. Frac. in Mod. of Unit Cell
ZIRC-4                     :Cladding Material
694.0                      :Cladding Temperature (K)
Y                          :Multiple cladding material specification flag [Y or N]
1
7
SS316S
2200.0                     :System Pressure (psia)
N                          :BPRA existence in assembly [Y or N]
5                          :Number of Zones in Standard Larger Unit Cell
3       0.63245
2       0.67310
3       0.81397
500     2.96459
3       2.98790
```

```
1                       :Number of cross-section libraries per irradiation step
5                       :Print Level for SAS2H
0.5                     :FACMESH for XSDRNPMS
SKIP                    :Read Flag for XSDRNPMS Control Features
1                       :Number of cycles in which assembly is inserted
01                      :Insertion cycle ID
2                       :Number of statepoints in cycle including BOC
0                       :EFPD for statepoint
0                       :Cycle length to statepoint
0                       :Days of downtime at statepoint
205                     :EFPD for statepoint
210                     :Cycle length to statepoint
10                      :Days of downtime at statepoint
30                      :Days of downtime at EOC
410                     :Total cycle EFPD
430                     :Total cycle length in calendar days
18                      :Integer position of assembly in cycle
N                       :[N=Constant Irrad. Step Lengths, Y=Variable Irrad. Step
Lengths]
1                       :Relative cycle number for boron letdown data
1                       :BOC to statepoint 2
205                     :Irradiation step length in days
1                       :Number of irradiation steps
900                     :ppmb
2                       :Statepoint 2 to EOC
205                     :Irradiation step length in days
1                       :Number of irradiation steps
600                     :ppmb
1                       :Number of axial nodes for CRC
1       360.0
RODDED                  :Flag for control rod assy input
1                       :# of irradiation step in which CRA is inserted
1 1 1 1 1 9 1           :Input Card 47B
1                       :Input Card 47C
9                       :Input Card 47D
3                       :Input Card 47E
5010 12.0               :Input Card 47F
5011 48.0               :Input Card 47F
6012 40.0               :Input Card 47F
1                       :Input Card 47G
3.7 0                   :Input Card 47H
8                       :Input Card 47I
9 0.435                 :Input Card 47J
5 0.4597
7 0.5461
3 0.63245
7 0.6731
3 0.813968
500 2.893316
3 2.916069
3 0.435                 :Input Card 47K
3 0.4597
3 0.5461
3 0.63245
7 0.6731
3 0.813968
500 2.893316
3 2.916069
NO APSRA                :Flag for APSR assy input
1                       :# nodes with fuel temp input for BOC to stpt 2 of rel.
```

```
cyc. #1
1       360.0
990
1                          :# nodes with mod spec vol data for BOC to stpt 2 of rel.
cyc. #1
1       360.0
0.02239
1                          :# of axial nodes with BOC burnup input data for Cycle-1
1       360.0
0
1                          :# of axial nodes with stpt 2 burnup input data for Cycle-1
1       360.0
4.0

**********************************************************************
   CRAFT Version 1.0 Input Deck for QA Test Case Number 11
**********************************************************************

N                          :Continuation Case
QA Test Case 11            :This is an input deck for testing purposes
Q11                        :Input Deck Prefix
44group                    :Cross-Section Library
3.25                       :Weight Percent U-235 in Uranium of UO2
4.6360E5                   :Mass U/Assembly
208                        :Number of Fuel Rods per Assembly
1.44272                    :Fuel Rod Pitch
0.936244                   :Fuel Pellet OD
0.9576                     :Fuel Rod Clad ID
1.0922                     :Fuel Rod Clad OD
360.172                    :Active Fuel Length
N                          :Axial Blanket Fuel [Y or N]
ZIRC-4                     :Spacer Grid Material
0.0002                     :Homogenized Spacer Vol. Frac. in Mod. of Unit Cell
ZIRC-4                     :Cladding Material
694.0                      :Cladding Temperature (K)
Y                          :Multiple cladding material specification flag [Y or N]
1
7
SS304
2200.0                     :System Pressure (psia)
N                          :BPRA existence in assembly [Y or N]
5                          :Number of Zones in Standard Larger Unit Cell
3       0.63245
2       0.67310
3       0.81397
500     2.96459
3       2.98790
1                          :Number of cross-section libraries per irradiation step
5                          :Print Level for SAS2H
0.5                        :FACMESH for XSDRNPMS
SKIP                       :Read Flag for XSDRNPMS Control Features
1                          :Number of cycles in which assembly is inserted
01                         :Insertion cycle ID
2                          :Number of statepoints in cycle including BOC
0                          :EFPD for statepoint
0                          :Cycle length to statepoint
0                          :Days of downtime at statepoint
205                        :EFPD for statepoint
210                        :Cycle length to statepoint
10                         :Days of downtime at statepoint
```

```
30                          :Days of downtime at EOC
410                         :Total cycle EFPD
430                         :Total cycle length in calendar days
18                          :Integer position of assembly in cycle
N                           :[N=Constant Irrad. Step Lengths, Y=Variable Irrad. Step
Lengths]
1                           :Relative cycle number for boron letdown data
1                           :BOC to statepoint 2
205                         :Irradiation step length in days
1                           :Number of irradiation steps
900                         :ppmb
2                           :Statepoint 2 to EOC
205                         :Irradiation step length in days
1                           :Number of irradiation steps
600                         :ppmb
1                           :Number of axial nodes for CRC
1       360.0
RODDED                      :Flag for control rod assy input
1                           :# of irradiation step in which CRA is inserted
1 1 1 1 1 9 1               :47B
1                           :47C
9                           :47D
3                           :47E
5010 12.0                   :47F
5011 48.0                   :47F
6012 40.0                   :47F
1                           :47G
3.7 0                       :47H
8                           :47I
9 0.435                     :47J
5 0.4597
7 0.5461
3 0.63245
7 0.6731
3 0.813968
500 2.893316
3 2.916069
3 0.435                     :47K
3 0.4597
3 0.5461
3 0.63245
7 0.6731
3 0.813968
500 2.893316
3 2.916069
NO APSRA                    :Flag for APSR assy input
1                           :# nodes with fuel temp input for BOC to stpt 2 of rel.
cyc. #1
1       360.0
990
1                           :# nodes with mod spec vol data for BOC to stpt 2 of rel.
cyc. #1
1       360.0
0.02239
1                           :# of axial nodes with BOC burnup input data for Cycle-1
1       360.0
0
1                           :# of axial nodes with stpt 2 burnup input data for Cycle-1
1       360.0
4.0
```

```
**********************************************************************
   CRAFT Version 1.0 Input Deck for QA Test Case Number 12
**********************************************************************

N                           :Continuation Case
QA Test Case 12             :This is an input deck for testing purposes
Q12                         :Input Deck Prefix
44group                     :Cross-Section Library
3.25                        :Weight Percent U-235 in Uranium of UO2
4.6360E5                    :Mass U/Assembly
208                         :Number of Fuel Rods per Assembly
1.44272                     :Fuel Rod Pitch
0.936244                    :Fuel Pellet OD
0.9576                      :Fuel Rod Clad ID
1.0922                      :Fuel Rod Clad OD
360.172                     :Active Fuel Length
N                           :Axial Blanket Fuel [Y or N]
ZIRC-4                      :Spacer Grid Material
0.0002                      :Homogenized Spacer Vol. Frac. in Mod. of Unit Cell
ZIRC-4                      :Cladding Material
694.0                       :Cladding Temperature (K)
Y                           :Multiple cladding material specification flag [Y or N]
1
7
SS304S
2200.0                      :System Pressure (psia)
N                           :BPRA existence in assembly [Y or N]
5                           :Number of Zones in Standard Larger Unit Cell
3       0.63245
2       0.67310
3       0.81397
500     2.96459
3       2.98790
1                           :Number of cross-section libraries per irradiation step
5                           :Print Level for SAS2H
0.5                         :FACMESH for XSDRNPMS
SKIP                        :Read Flag for XSDRNPMS Control Features
1                           :Number of cycles in which assembly is inserted
01                          :Insertion cycle ID
2                           :Number of statepoints in cycle including BOC
0                           :EFPD for statepoint
0                           :Cycle length to statepoint
0                           :Days of downtime at statepoint
205                         :EFPD for statepoint
210                         :Cycle length to statepoint
10                          :Days of downtime at statepoint
30                          :Days of downtime at EOC
410                         :Total cycle EFPD
430                         :Total cycle length in calendar days
18                          :Integer position of assembly in cycle
N                           :[N=Constant Irrad. Step Lengths, Y=Variable Irrad. Step
Lengths]
1                           :Relative cycle number for boron letdown data
1                           :BOC to statepoint 2
205                         :Irradiation step length in days
1                           :Number of irradiation steps
900                         :ppmb
2                           :Statepoint 2 to EOC
205                         :Irradiation step length in days
```

```
1                       :Number of irradiation steps
600                     :ppmb
1                       :Number of axial nodes for CRC
1       360.0
RODDED                  :Flag for control rod assy input
1                       :# of irradiation step in which CRA is inserted
1 1 1 1 1 9 1           :Input Card 47B
1                       :Input Card 47C
9                       :Input Card 47D
3                       :Input Card 47E
5010 12.0               :Input Card 47F
5011 48.0               :Input Card 47F
6012 40.0               :Input Card 47F
1                       :Input Card 47G
3.7 0                   :Input Card 47H
8                       :Input Card 47I
9 0.435                 :Input Card 47J
5 0.4597
7 0.5461
3 0.63245
7 0.6731
3 0.813968
500 2.893316
3 2.916069
3 0.435                 :Input Card 47K
3 0.4597
3 0.5461
3 0.63245
7 0.6731
3 0.813968
500 2.893316
3 2.916069
NO APSRA                :Flag for APSR assy input
1                       :# nodes with fuel temp input for BOC to stpt 2 of rel.
cyc. #1
1       360.0
990
1                       :# nodes with mod spec vol data for BOC to stpt 2 of rel.
cyc. #1
1       360.0
0.02239
1                       :# of axial nodes with BOC burnup input data for Cycle-1
1       360.0
0
1                       :# of axial nodes with stpt 2 burnup input data for Cycle-1
1       360.0
4.0

**********************************************************************
   CRAFT Version 1.0 Input Deck for QA Test Case Number 13
**********************************************************************

N                       :Continuation Case
QA Test Case 13         :This is an input deck for testing purposes
Q13                     :Input Deck Prefix
44group                 :Cross-Section Library
3.25                    :Weight Percent U-235 in Uranium of UO2
4.6360E5                :Mass U/Assembly
208                     :Number of Fuel Rods per Assembly
1.44272                 :Fuel Rod Pitch
```

```
0.936244                :Fuel Pellet OD
0.9576                  :Fuel Rod Clad ID
1.0922                  :Fuel Rod Clad OD
360.172                 :Active Fuel Length
N                       :Axial Blanket Fuel [Y or N]
ZIRC-4                  :Spacer Grid Material
0.0002                  :Homogenized Spacer Vol. Frac. in Mod. of Unit Cell
ZIRC-4                  :Cladding Material
694.0                   :Cladding Temperature (K)
Y                       :Multiple cladding material specification flag [Y or N]
1                       :Number of Cladding Material Other than ZIRC-4
8                       :SAS2H Material Mixture Number
INCONEL                 :Cladding Material
2200.0                  :System Pressure (psia)
N                       :BPRA existence in assembly [Y or N]
5                       :Number of Zones in Standard Larger Unit Cell
3       0.63245
2       0.67310
3       0.81397
500     2.96459
3       2.98790
1                       :Number of cross-section libraries per irradiation step
5                       :Print Level for SAS2H
0.5                     :FACMESH for XSDRNPMS
SKIP                    :Read Flag for XSDRNPMS Control Features
1                       :Number of cycles in which assembly is inserted
01                      :Insertion cycle ID
2                       :Number of statepoints in cycle including BOC
0                       :EFPD for statepoint
0                       :Cycle length to statepoint
0                       :Days of downtime at statepoint
205                     :EFPD for statepoint
210                     :Cycle length to statepoint
10                      :Days of downtime at statepoint
30                      :Days of downtime at EOC
410                     :Total cycle EFPD
430                     :Total cycle length in calendar days
18                      :Integer position of assembly in cycle
N                       :[N=Constant Irrad. Step Lengths, Y=Variable Irrad. Step
Lengths]
1                       :Relative cycle number for boron letdown data
1                       :BOC to statepoint 2
205                     :Irradiation step length in days
1                       :Number of irradiation steps
900                     :ppmb
2                       :Statepoint 2 to EOC
205                     :Irradiation step length in days
1                       :Number of irradiation steps
600                     :ppmb
1                       :Number of axial nodes for CRC
1       360.0
NO CRA INSERTION        :Input Card 47
RODDED                  :Flag for axial power shaping rod assy input
1                       :# of irradiation step in which CRA is inserted
1 1 1 1 1 9 1 8         :48B
1                       :48C
9                       :48D
3                       :48E
5010 12.0               :48F
5011 48.0               :48F
```

```
6012 40.0                   :48F
1                           :48G
3.7 0                       :48H
8                           :48I
9 0.435                     :48J
5 0.4597
2 0.5461
3 0.63245
2 0.6731
3 0.813968
500 2.893316
3 2.916069
3 0.435                     :48K
3 0.4597
3 0.5461
3 0.63245
2 0.6731
3 0.813968
500 2.893316
3 2.916069
3 0.435                     :48L
3 0.4597
8 0.5461
3 0.63245
2 0.6731
3 0.813968
500 2.893316
3 2.916069
1                           :# nodes with fuel temp input for BOC to stpt 2 of rel.
cyc. #1
1       360.0
990
1                           :# nodes with mod spec vol data for BOC to stpt 2 of rel.
cyc. #1
1       360.0
0.02239
1                           :# of axial nodes with BOC burnup input data for Cycle-1
1       360.0
0
1                           :# of axial nodes with stpt 2 burnup input data for Cycle-1
1       360.0
4.0

**********************************************************************
   CRAFT Version 1.0 Input Deck for QA Test Case Number 14
**********************************************************************

N                           :Continuation Case
QA Test Case 14             :This is an input deck for testing purposes
Q14                         :Input Deck Prefix
44group                     :Cross-Section Library
3.25                        :Weight Percent U-235 in Uranium of UO2
4.6360E5                    :Mass U/Assembly
208                         :Number of Fuel Rods per Assembly
1.44272                     :Fuel Rod Pitch
0.936244                    :Fuel Pellet OD
0.9576                      :Fuel Rod Clad ID
1.0922                      :Fuel Rod Clad OD
360.172                     :Active Fuel Length
N                           :Axial Blanket Fuel [Y or N]
```

```
ZIRC-4                  :Spacer Grid Material
0.0002                  :Homogenized Spacer Vol. Frac. in Mod. of Unit Cell
ZIRC-4                  :Cladding Material
694.0                   :Cladding Temperature (K)
Y                       :Multiple cladding material specification flag [Y or N]
1
7
INCONEL
2200.0                  :System Pressure (psia)
N                       :BPRA existence in assembly [Y or N]
5                       :Number of Zones in Standard Larger Unit Cell
3       0.63245
2       0.67310
3       0.81397
500     2.96459
3       2.98790
1                       :Number of cross-section libraries per irradiation step
5                       :Print Level for SAS2H
0.5                     :FACMESH for XSDRNPMS
SKIP                    :Read Flag for XSDRNPMS Control Features
1                       :Number of cycles in which assembly is inserted
01                      :Insertion cycle ID
2                       :Number of statepoints in cycle including BOC
0                       :EFPD for statepoint
0                       :Cycle length to statepoint
0                       :Days of downtime at statepoint
205                     :EFPD for statepoint
210                     :Cycle length to statepoint
10                      :Days of downtime at statepoint
30                      :Days of downtime at EOC
410                     :Total cycle EFPD
430                     :Total cycle length in calendar days
18                      :Integer position of assembly in cycle
N                       :[N=Constant Irrad. Step Lengths, Y=Variable Irrad. Step
Lengths]
1                       :Relative cycle number for boron letdown data
1                       :BOC to statepoint 2
205                     :Irradiation step length in days
1                       :Number of irradiation steps
900                     :ppmb
2                       :Statepoint 2 to EOC
205                     :Irradiation step length in days
1                       :Number of irradiation steps
600                     :ppmb
1                       :Number of axial nodes for CRC
1       360.0
NO CRA INSERTION        :Input Card 47
RODDED                  :Flag for axial power shaping rod assy input
1                       :# of irradiation step in which CRA is inserted
1 1 1 1 1 9 1 7         :48B
1                       :48C
9                       :48D
3                       :48E
5010 12.0               :48F
5011 48.0               :48F
6012 40.0               :48F
1                       :48G
3.7 0                   :48H
8                       :48I
9 0.435                 :48J
```

```
5 0.4597
7 0.5461
3 0.63245
7 0.6731
3 0.813968
500 2.893316
3 2.916069
3 0.435                    :48K
3 0.4597
3 0.5461
3 0.63245
7 0.6731
3 0.813968
500 2.893316
3 2.916069
3 0.435                    :48L
3 0.4597
7 0.5461
3 0.63245
2 0.6731
3 0.813968
500 2.893316
3 2.916069
1                          :# nodes with fuel temp input for BOC to stpt 2 of rel.
cyc. #1
1       360.0
990
1                          :# nodes with mod spec vol data for BOC to stpt 2 of rel.
cyc. #1
1       360.0
0.02239
1                          :# of axial nodes with BOC burnup input data for Cycle-1
1       360.0
0
1                          :# of axial nodes with stpt 2 burnup input data for Cycle-1
1       360.0
4.0

**********************************************************************
   CRAFT Version 1.0 Input Deck for QA Test Case Number 15
**********************************************************************

N                          :Continuation Case
QA Test Case 15            :This is an input deck for testing purposes
Q15                        :Input Deck Prefix
44group                    :Cross-Section Library
3.25                       :Weight Percent U-235 in Uranium of UO2
4.6360E5                   :Mass U/Assembly
208                        :Number of Fuel Rods per Assembly
1.44272                    :Fuel Rod Pitch
0.936244                   :Fuel Pellet OD
0.9576                     :Fuel Rod Clad ID
1.0922                     :Fuel Rod Clad OD
360.172                    :Active Fuel Length
N                          :Axial Blanket Fuel [Y or N]
ZIRC-4                     :Spacer Grid Material
0.0002                     :Homogenized Spacer Vol. Frac. in Mod. of Unit Cell
ZIRC-4                     :Cladding Material
694.0                      :Cladding Temperature (K)
Y                          :Multiple cladding material specification flag [Y or N]
```

```
2                       :Number of Cladding Material Other than ZIRC-4
7                       :SAS2H Material Mixture Number
SS316                   :Cladding Material
8                       :SAS2H Material Mixture Number
INCONEL                 :Cladding Material
2200.0                  :System Pressure (psia)
N                       :BPRA existence in assembly [Y or N]
5                       :Number of Zones in Standard Larger Unit Cell
3       0.63245
2       0.67310
3       0.81397
500     2.96459
3       2.98790
1                       :Number of cross-section libraries per irradiation step
5                       :Print Level for SAS2H
0.5                     :FACMESH for XSDRNPMS
SKIP                    :Read Flag for XSDRNPMS Control Features
1                       :Number of cycles in which assembly is inserted
01                      :Insertion cycle ID
2                       :Number of statepoints in cycle including BOC
0                       :EFPD for statepoint
0                       :Cycle length to statepoint
0                       :Days of downtime at statepoint
205                     :EFPD for statepoint
210                     :Cycle length to statepoint
10                      :Days of downtime at statepoint
30                      :Days of downtime at EOC
410                     :Total cycle EFPD
430                     :Total cycle length in calendar days
18                      :Integer position of assembly in cycle
N                       :[N=Constant Irrad. Step Lengths, Y=Variable Irrad. Step
Lengths]
1                       :Relative cycle number for boron letdown data
1                       :BOC to statepoint 2
205                     :Irradiation step length in days
1                       :Number of irradiation steps
900                     :ppmb
2                       :Statepoint 2 to EOC
205                     :Irradiation step length in days
1                       :Number of irradiation steps
600                     :ppmb
1                       :Number of axial nodes for CRC
1       360.0
NO CRA INSERTION        :Input Card 47
RODDED                  :Flag for axial power shaping rod assy input
1                       :# of irradiation step in which CRA is inserted
1 1 1 1 1 9 1 8         :48B
1                       :48C
9                       :48D
3                       :48E
5010 12.0               :48F
5011 48.0               :48F
6012 40.0               :48F
1                       :48G
3.7 0                   :48H
8                       :48I
9 0.435                 :48J
5 0.4597
7 0.5461
3 0.63245
```

```
7 0.6731
3 0.813968
500 2.893316
3 2.916069
3 0.435                    :48K
3 0.4597
3 0.5461
3 0.63245
7 0.6731
3 0.813968
500 2.893316
3 2.916069
3 0.435                    :48L
3 0.4597
8 0.5461
3 0.63245
2 0.6731
3 0.813968
500 2.893316
3 2.916069
1                          :# nodes with fuel temp input for BOC to stpt 2 of rel.
cyc. #1
1       360.0
990
1                          :# nodes with mod spec vol data for BOC to stpt 2 of rel.
cyc. #1
1       360.0
0.02239
1                          :# of axial nodes with BOC burnup input data for Cycle-1
1       360.0
0
1                          :# of axial nodes with stpt 2 burnup input data for Cycle-1
1       360.0
4.0

**********************************************************************
   CRAFT Version 1.0 Input Deck for QA Test Case Number 16
**********************************************************************

N                          :Continuation Case
QA Test Case 16            :This is an input deck for testing purposes
Q16                        :Input Deck Prefix
44group                    :Cross-Section Library
3.25                       :Weight Percent U-235 in Uranium of UO2
4.6360E5                   :Mass U/Assembly
208                        :Number of Fuel Rods per Assembly
1.44272                    :Fuel Rod Pitch
0.936244                   :Fuel Pellet OD
0.9576                     :Fuel Rod Clad ID
1.0922                     :Fuel Rod Clad OD
360.172                    :Active Fuel Length
N                          :Axial Blanket Fuel [Y or N]
ZIRC-4                     :Spacer Grid Material
0.0002                     :Homogenized Spacer Vol. Frac. in Mod. of Unit Cell
ZIRC-4                     :Cladding Material
694.0                      :Cladding Temperature (K)
Y                          :Multiple cladding material specification flag [Y or N]
2                          :Number of Cladding Material Other than ZIRC-4
7                          :SAS2H Material Mixture Number
SS316S                     :Cladding Material
```

```
8                       :SAS2H Material Mixture Number
INCONEL                 :Cladding Material
2200.0                  :System Pressure (psia)
N                       :BPRA existence in assembly [Y or N]
5                       :Number of Zones in Standard Larger Unit Cell
3       0.63245
2       0.67310
3       0.81397
500     2.96459
3       2.98790
1                       :Number of cross-section libraries per irradiation step
5                       :Print Level for SAS2H
0.5                     :FACMESH for XSDRNPMS
SKIP                    :Read Flag for XSDRNPMS Control Features
1                       :Number of cycles in which assembly is inserted
01                      :Insertion cycle ID
2                       :Number of statepoints in cycle including BOC
0                       :EFPD for statepoint
0                       :Cycle length to statepoint
0                       :Days of downtime at statepoint
205                     :EFPD for statepoint
210                     :Cycle length to statepoint
10                      :Days of downtime at statepoint
30                      :Days of downtime at EOC
410                     :Total cycle EFPD
430                     :Total cycle length in calendar days
18                      :Integer position of assembly in cycle
N                       :[N=Constant Irrad. Step Lengths, Y=Variable Irrad. Step
Lengths]
1                       :Relative cycle number for boron letdown data
1                       :BOC to statepoint 2
205                     :Irradiation step length in days
1                       :Number of irradiation steps
900                     :ppmb
2                       :Statepoint 2 to EOC
205                     :Irradiation step length in days
1                       :Number of irradiation steps
600                     :ppmb
1                       :Number of axial nodes for CRC
1       360.0
NO CRA INSERTION        :Input Card 47
RODDED                  :Flag for axial power shaping rod assy input
1                       :# of irradiation step in which CRA is inserted
1 1 1 1 1 9 1 8         :48B
1                       :48C
9                       :48D
3                       :48E
5010 12.0               :48F
5011 48.0               :48F
6012 40.0               :48F
1                       :48G
3.7 0                   :48H
8                       :48I
9 0.435                 :48J
5 0.4597
7 0.5461
3 0.63245
7 0.6731
3 0.813968
500 2.893316
```

```
3 2.916069
3 0.435                    :48K
3 0.4597
3 0.5461
3 0.63245
7 0.6731
3 0.813968
500 2.893316
3 2.916069
3 0.435                    :48L
3 0.4597
8 0.5461
3 0.63245
2 0.6731
3 0.813968
500 2.893316
3 2.916069
1                          :# nodes with fuel temp input for BOC to stpt 2 of rel.
cyc. #1
1       360.0
990
1                          :# nodes with mod spec vol data for BOC to stpt 2 of rel.
cyc. #1
1       360.0
0.02239
1                          :# of axial nodes with BOC burnup input data for Cycle-1
1       360.0
0
1                          :# of axial nodes with stpt 2 burnup input data for Cycle-1
1       360.0
4.0

**********************************************************************
   CRAFT Version 1.0 Input Deck for QA Test Case Number 17
**********************************************************************

N                          :Continuation Case
QA Test Case 17            :This is an input deck for testing purposes
Q17                        :Input Deck Prefix
44group                    :Cross-Section Library
3.25                       :Weight Percent U-235 in Uranium of UO2
4.6360E5                   :Mass U/Assembly
208                        :Number of Fuel Rods per Assembly
1.44272                    :Fuel Rod Pitch
0.936244                   :Fuel Pellet OD
0.9576                     :Fuel Rod Clad ID
1.0922                     :Fuel Rod Clad OD
360.172                    :Active Fuel Length
N                          :Axial Blanket Fuel [Y or N]
ZIRC-4                     :Spacer Grid Material
0.0002                     :Homogenized Spacer Vol. Frac. in Mod. of Unit Cell
ZIRC-4                     :Cladding Material
694.0                      :Cladding Temperature (K)
Y                          :Multiple cladding material specification flag [Y or N]
2                          :Number of Cladding Material Other than ZIRC-4
7                          :SAS2H Material Mixture Number
SS304                      :Cladding Material
8                          :SAS2H Material Mixture Number
INCONEL                    :Cladding Material
2200.0                     :System Pressure (psia)
```

```
N                       :BPRA existence in assembly [Y or N]
5                       :Number of Zones in Standard Larger Unit Cell
3       0.63245
2       0.67310
3       0.81397
500     2.96459
3       2.98790
1                       :Number of cross-section libraries per irradiation step
5                       :Print Level for SAS2H
0.5                     :FACMESH for XSDRNPMS
SKIP                    :Read Flag for XSDRNPMS Control Features
1                       :Number of cycles in which assembly is inserted
01                      :Insertion cycle ID
2                       :Number of statepoints in cycle including BOC
0                       :EFPD for statepoint
0                       :Cycle length to statepoint
0                       :Days of downtime at statepoint
205                     :EFPD for statepoint
210                     :Cycle length to statepoint
10                      :Days of downtime at statepoint
30                      :Days of downtime at EOC
410                     :Total cycle EFPD
430                     :Total cycle length in calendar days
18                      :Integer position of assembly in cycle
N                       :[N=Constant Irrad. Step Lengths, Y=Variable Irrad. Step
Lengths]
1                       :Relative cycle number for boron letdown data
1                       :BOC to statepoint 2
205                     :Irradiation step length in days
1                       :Number of irradiation steps
900                     :ppmb
2                       :Statepoint 2 to EOC
205                     :Irradiation step length in days
1                       :Number of irradiation steps
600                     :ppmb
1                       :Number of axial nodes for CRC
1       360.0
NO CRA INSERTION        :Input Card 47
RODDED                  :Flag for axial power shaping rod assy input
1                       :# of irradiation step in which CRA is inserted
1 1 1 1 1 9 1 8         :48B
1                       :48C
9                       :48D
3                       :48E
5010 12.0               :48F
5011 48.0               :48F
6012 40.0               :48F
1                       :48G
3.7 0                   :48H
8                       :48I
9 0.435                 :48J
5 0.4597
7 0.5461
3 0.63245
7 0.6731
3 0.813968
500 2.893316
3 2.916069
3 0.435                 :48K
3 0.4597
```

```
3 0.5461
3 0.63245
7 0.6731
3 0.813968
500 2.893316
3 2.916069
3 0.435                    :48L
3 0.4597
8 0.5461
3 0.63245
2 0.6731
3 0.813968
500 2.893316
3 2.916069
1                          :# nodes with fuel temp input for BOC to stpt 2 of rel.
cyc. #1
1       360.0
990
1                          :# nodes with mod spec vol data for BOC to stpt 2 of rel.
cyc. #1
1       360.0
0.02239
1                          :# of axial nodes with BOC burnup input data for Cycle-1
1       360.0
0
1                          :# of axial nodes with stpt 2 burnup input data for Cycle-1
1       360.0
4.0

**********************************************************************
   CRAFT Version 1.0 Input Deck for QA Test Case Number 18
**********************************************************************

N                          :Continuation Case
QA Test Case 18            :This is an input deck for testing purposes
Q18                        :Input Deck Prefix
44group                    :Cross-Section Library
3.25                       :Weight Percent U-235 in Uranium of UO2
4.6360E5                   :Mass U/Assembly
208                        :Number of Fuel Rods per Assembly
1.44272                    :Fuel Rod Pitch
0.936244                   :Fuel Pellet OD
0.9576                     :Fuel Rod Clad ID
1.0922                     :Fuel Rod Clad OD
360.172                    :Active Fuel Length
N                          :Axial Blanket Fuel [Y or N]
ZIRC-4                     :Spacer Grid Material
0.0002                     :Homogenized Spacer Vol. Frac. in Mod. of Unit Cell
ZIRC-4                     :Cladding Material
694.0                      :Cladding Temperature (K)
Y                          :Multiple cladding material specification flag [Y or N]
2                          :Number of Cladding Material Other than ZIRC-4
7                          :SAS2H Material Mixture Number
SS304S                     :Cladding Material
8                          :SAS2H Material Mixture Number
INCONEL                    :Cladding Material
2200.0                     :System Pressure (psia)
N                          :BPRA existence in assembly [Y or N]
5                          :Number of Zones in Standard Larger Unit Cell
3       0.63245
```

```
2       0.67310
3       0.81397
500     2.96459
3       2.98790
1                       :Number of cross-section libraries per irradiation step
5                       :Print Level for SAS2H
0.5                     :FACMESH for XSDRNPMS
SKIP                    :Read Flag for XSDRNPMS Control Features
1                       :Number of cycles in which assembly is inserted
01                      :Insertion cycle ID
2                       :Number of statepoints in cycle including BOC
0                       :EFPD for statepoint
0                       :Cycle length to statepoint
0                       :Days of downtime at statepoint
205                     :EFPD for statepoint
210                     :Cycle length to statepoint
10                      :Days of downtime at statepoint
30                      :Days of downtime at EOC
410                     :Total cycle EFPD
430                     :Total cycle length in calendar days
18                      :Integer position of assembly in cycle
N                       :[N=Constant Irrad. Step Lengths, Y=Variable Irrad. Step
Lengths]
1                       :Relative cycle number for boron letdown data
1                       :BOC to statepoint 2
205                     :Irradiation step length in days
1                       :Number of irradiation steps
900                     :ppmb
2                       :Statepoint 2 to EOC
205                     :Irradiation step length in days
1                       :Number of irradiation steps
600                     :ppmb
1                       :Number of axial nodes for CRC
1       360.0
NO CRA INSERTION        :Input Card 47
RODDED                  :Flag for axial power shaping rod assy input
1                       :# of irradiation step in which CRA is inserted
1 1 1 1 1 9 1 8         :48B
1                       :48C
9                       :48D
3                       :48E
5010 12.0               :48F
5011 48.0               :48F
6012 40.0               :48F
1                       :48G
3.7 0                   :48H
8                       :48I
9 0.435                 :48J
5 0.4597
7 0.5461
3 0.63245
7 0.6731
3 0.813968
500 2.893316
3 2.916069
3 0.435                 :48K
3 0.4597
3 0.5461
3 0.63245
7 0.6731
```

```
3 0.813968
500 2.893316
3 2.916069
3 0.435                    :48L
3 0.4597
8 0.5461
3 0.63245
2 0.6731
3 0.813968
500 2.893316
3 2.916069
1                          :# nodes with fuel temp input for BOC to stpt 2 of rel.
cyc. #1
1       360.0
990
1                          :# nodes with mod spec vol data for BOC to stpt 2 of rel.
cyc. #1
1       360.0
0.02239
1                          :# of axial nodes with BOC burnup input data for Cycle-1
1       360.0
0
1                          :# of axial nodes with stpt 2 burnup input data for Cycle-1
1       360.0
4.0

**********************************************************************
   CRAFT Version 1.0 Input Deck for QA Test Case Number 19
**********************************************************************

N                          :Continuation Case
QA Test Case 19            :This is an input deck for testing purposes
Q19                        :Input Deck Prefix
44group                    :Cross-Section Library
3.25                       :Weight Percent U-235 in UO2
4.6360E5                   :Mass U/Assembly
208                        :Number of Fuel Rods per Assembly
1.44272                    :Fuel Rod Pitch
0.936244                   :Fuel Pellet OD
0.9576                     :Fuel Rod Clad ID
1.0922                     :Fuel Rod Clad OD
360.172                    :Active Fuel Length
N                          :Axial Blanket Fuel [Y or N]
ZIRC-4                     :Spacer Grid Material
0.0002                     :Homogenized Spacer Vol. Frac. in Mod. of Unit Cell
ZIRC-4                     :Cladding Material
694.0                      :Cladding Temperature (K)
N                          :Multiple cladding material specification flag [Y or N]
2200.0                     :System Pressure (psia)
Y                          :BPRA existence in assembly [Y or N]
2                          :Number of cycles containing BPRA
2 1                        :Number of different BPRA designs utilized
3.147  1.177 0.5858 16 2 0 :BPR Pellet Density (g/cc), B4C wt%, cross-sectional area
of BP in BPR, # BPRs in BPRA, BPR cladding mat. mix. [0 is default]
8                          :Number of Zones in BPRA Larger Unit Cell
4       0.43180            :BPRA Larger Unit Cell
5       0.45970
2       0.54610
3       0.63245
2       0.67310
```

```
3       0.81397
500     2.89332
3       2.91607
3       0.20000             :Larger Unit Cell for Use with BPRA Larger Unit Cell
3       0.40000
3       0.50000
3       0.63245
2       0.67310
3       0.81397
500     2.96459
3       2.98790
6       0.43180             :BPRA Larger Unit Cell for Region Above Absorber Material
5       0.45970
2       0.54610
3       0.63245
2       0.67310
3       0.81397
500     2.89332
3       2.91607
AL2O3 6
2.23 0 0.5858 16 0 9 :BPR Pellet Density (g/cc), B4C wt%, cross-sectional area of BP
in BPR, # BPRs in BPRA, BPR cladding mat. mix. [0 is default]
8                           :Number of Zones in BPRA Larger Unit Cell
9       0.43180             :BPRA Larger Unit Cell
5       0.45970
2       0.54610
3       0.63245
2       0.67310
3       0.81397
500     2.89332
3       2.91607
3       0.20000             :Larger Unit Cell for Use with BPRA Larger Unit Cell
3       0.40000
3       0.50000
3       0.63245
2       0.67310
3       0.81397
500     2.96459
3       2.98790
6       0.43180             :BPRA Larger Unit Cell for Region Above Absorber Material
5       0.45970
2       0.54610
3       0.63245
2       0.67310
3       0.81397
500     2.89332
3       2.91607
AL2O3 6
9                           :SAS2H mat. mix. ID for BP
7                           :Number of isotopes in BP
 8016  53.58
 11000 2.82
 13000 1.16
 14000 37.63
 19000 0.33
 5010  0.7151
 5011  3.7649
1 1 2 3                     :BPRA relative insertion cycle, BPRA relative description
number, BPRA top node, BPRA bottom node
3 2 1 4                     :BPRA relative insertion cycle, BPRA relative description
```

```
number, BPRA top node, BPRA bottom node
5                          :Number of Zones in Standard Larger Unit Cell
3       0.63245
2       0.67310
3       0.81397
500     2.96459
3       2.98790
1                          :Number of cross-section libraries per irradiation step
5                          :Print Level for SAS2H
0.5                        :FACMESH for XSDRNPMS
SKIP                       :Read Flag for XSDRNPMS Control Features
3                          :Number of cycles in which assembly is inserted
01                         :Insertion cycle ID
2                          :Number of statepoints in cycle including BOC
0                          :EFPD for statepoint
0                          :Cycle length to statepoint
0                          :Days of downtime at statepoint
205                        :EFPD for statepoint
210                        :Cycle length to statepoint
10                         :Days of downtime at statepoint
30                         :Days of downtime at EOC
410                        :Total cycle EFPD
430                        :Total cycle length in calendar days
18                         :Integer position of assembly in cycle
02                         :Insertion cycle ID
1                          :Number of statepoints in cycle including BOC
0                          :EFPD for statepoint
0                          :Cycle length to statepoint
0                          :Days of downtime at statepoint
575                        :Days of downtime at EOC
430                        :Total cycle EFPD
500                        :Total cycle length in calendar days
13                         :Integer position of assembly in cycle
03                         :Insertion cycle ID
3                          :Number of statepoints in cycle including BOC
0                          :EFPD for statepoint
0.                         :Cycle length to statepoint
0                          :Days of downtime at statepoint
98                         :EFPD for statepoint
100                        :Cycle length to statepoint
10                         :Days of downtime at statepoint
196                        :EFPD for statepoint
200                        :Cycle length to statepoint
10                         :Days of downtime at statepoint
60                         :Days of downtime at EOC
335                        :Total cycle EFPD
400                        :Total cycle length in calendar days
02                         :Integer position of assembly in cycle
N                          :[N=Constant Irrad. Step Lengths, Y=Variable Irrad. Step
Lengths]
1                          :Relative cycle number for boron letdown data
1                          :BOC to statepoint 2
102.5                       :Irradiation step length in days
2                          :Number of irradiation steps
1000                       :ppmb
850                        :ppmb
2                          :Statepoint 2 to EOC
102.5                      :Irradiation step length in days
2                          :Number of irradiation steps
700                        :ppmb
```

```
400                         :ppmb
2                           :Relative cycle number for boron letdown data
1                           :BOC to EOC
215                         :Irradiation step length in days
2                           :Number of irradiation steps
1150                        :ppmb
700                         :ppmb
3                           :Relative cycle number for boron letdown data
1                           :BOC to statepoint 2
49                          :Irradiation step length in days
2                           :Number of irradiation steps
1100                        :ppmb
1000                        :ppmb
2                           :Statepoint 2 to statepoint 3
49                          :Irradiation step length in days
2                           :Number of irradiation steps
900                         :ppmb
850                         :ppmb
2                           :Statepoint 3 to EOC
69.5                        :Irradiation step length in days
2                           :Number of irradiation steps
700                         :ppmb
450                         :ppmb
4                           :Number of axial nodes for CRC
1       30.0
2       150.0
3       150.0
4       30.0
NO CRA                       :Flag for control rod assy input
NO APSRA                     :Flag for APSR assy input
6                            :# nodes with fuel temperature input for BOC to stpt 2 of
rel. cyc. #1
1       60.0
2       60.0
3       60.0
4       60.0
5       60.0
6       60.0
1000
1010
1020
1030
1040
1050
6                           :# nodes with fuel temperature input for stpt 2 to stpt EOC
of rel. cyc. #1
1       60.0
2       60.0
3       60.0
4       60.0
5       60.0
6       60.0
1100
1110
1120
1130
1140
1150
6                           :# nodes with fuel temperature input for BOC to EOC of rel.
cyc. #2
```

```
1       60.0
2       60.0
3       60.0
4       60.0
5       60.0
6       60.0
1000
1010
1020
1030
1040
1050
6                       :# nodes with fuel temperature input for BOC to stpt 2 of
rel. cyc. #3
1       60.0
2       60.0
3       60.0
4       60.0
5       60.0
6       60.0
1100
1110
1120
1130
1140
1150
6                       :# nodes with fuel temperature input for stpt 2 to stpt 3
of rel. cyc. #3
1       60.0
2       60.0
3       60.0
4       60.0
5       60.0
6       60.0
1000
1010
1020
1030
1040
1050
6                       :# nodes with moderator spec. vol. data for BOC to stpt 2,
Rel. Cyc #1
1       60.0
2       60.0
3       60.0
4       60.0
5       60.0
6       60.0
0.0228
0.02278
0.02274
0.02271
0.02268
0.02265
6                       :# nodes with moderator spec. vol. data for stpt 2 to EOC,
Rel. Cyc #1
1       60.0
2       60.0
3       60.0
4       60.0
```

```
5       60.0
6       60.0
0.02337
0.02334
0.0233
0.02324
0.02318
0.02312
6                       :# nodes with moderator spec. vol. data for BOC to EOC,
Rel. Cyc #2
1       60.0
2       60.0
3       60.0
4       60.0
5       60.0
6       60.0
0.02337
0.02334
0.0233
0.02324
0.02318
0.02312
6                       :# nodes with moderator spec. vol. data for BOC to stpt 2,
Rel. Cyc #3
1       60.0
2       60.0
3       60.0
4       60.0
5       60.0
6       60.0
0.0228
0.02278
0.02274
0.02271
0.02268
0.02265
6                       :# nodes with moderator spec. vol. data for stpt 2 to stpt
3, Rel. Cyc #3
1       60.0
2       60.0
3       60.0
4       60.0
5       60.0
6       60.0
0.02337
0.02334
0.0233
0.02324
0.02318
0.02312
18                      :Number of Axial Nodes Containing BOC Burnup Input Data for
Cycle-1
1       17.78
2       20.0025
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
```

```
9       20.0025
10       20.0025
11       20.0025
12       20.0025
13       20.0025
14       20.0025
15       20.0025
16       20.0025
17       20.0025
18       22.352
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
18                      :Number of Axial Nodes Containing stpt 2 Burnup Input Data
for Cycle-1
1       17.78
2       20.0025
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10       20.0025
11       20.0025
12       20.0025
13       20.0025
14       20.0025
15       20.0025
16       20.0025
17       20.0025
18       22.352
3.0
3.1
3.2
3.3
3.4
3.5
3.6
3.7
3.8
3.8
3.8
3.7
```

```
3.6
3.5
3.4
3.3
3.2
3.1
18                          :Number of Axial Nodes Containing BOC Burnup Input Data for
Cycle-2
1       17.78
2       20.0025
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10       20.0025
11       20.0025
12       20.0025
13       20.0025
14       20.0025
15       20.0025
16       20.0025
17       20.0025
18       22.352
4.0
4.1
4.2
4.3
4.4
4.5
4.6
4.7
4.8
4.8
4.8
4.7
4.6
4.5
4.4
4.3
4.2
4.1
18                          :Number of Axial Nodes Containing BOC Burnup Input Data for
Cycle-3
1       17.78
2       20.0025
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10       20.0025
11       20.0025
12       20.0025
13       20.0025
14       20.0025
```

```
15      20.0025
16      20.0025
17      20.0025
18      22.352
7.0
7.1
7.2
7.3
7.4
7.5
7.6
7.7
7.8
7.8
7.8
7.7
7.6
7.5
7.4
7.3
7.2
7.1
18                      :Number of Axial Nodes Containing stpt 2 Burnup Input Data
for Cycle-3
1       17.78
2       20.0025
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10       20.0025
11       20.0025
12       20.0025
13       20.0025
14       20.0025
15       20.0025
16       20.0025
17       20.0025
18      22.352
8.0
8.1
8.2
8.3
8.4
8.5
8.6
8.7
8.8
8.8
8.8
8.7
8.6
8.5
8.4
8.3
8.2
8.1
```

```
18                          :Number of Axial Nodes Containing stpt 3 Burnup Input Data
for Cycle-3
1       17.78
2       20.0025
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10       20.0025
11       20.0025
12       20.0025
13       20.0025
14       20.0025
15       20.0025
16       20.0025
17       20.0025
18       22.352
9.0
9.1
9.2
9.3
9.4
9.5
9.6
9.7
9.8
9.8
9.8
9.7
9.6
9.5
9.4
9.3
9.2
9.1

**********************************************************************
   CRAFT Version 1.0 Input Deck for QA Test Case Number 20
**********************************************************************

N                           :Continuation Case
QA Test Case 20             :This is an input deck for testing purposes
Q20                         :Input Deck Prefix
44group                     :Cross-Section Library
3.25                        :Weight Percent U-235 in UO2
4.6360E5                    :Mass U/Assembly
208                         :Number of Fuel Rods per Assembly
1.44272                     :Fuel Rod Pitch
0.936244                    :Fuel Pellet OD
0.9576                      :Fuel Rod Clad ID
1.0922                      :Fuel Rod Clad OD
360.172                     :Active Fuel Length
N                           :Axial Blanket Fuel [Y or N]
ZIRC-4                      :Spacer Grid Material
0.0002                      :Homogenized Spacer Vol. Frac. in Mod. of Unit Cell
ZIRC-4                      :Cladding Material
694.0                       :Cladding Temperature (K)
```

```
N                       :Multiple cladding material specification flag [Y or N]
2200.0                  :System Pressure (psia)
N                       :BPRA existence in assembly [Y or N]
5                       :Number of Zones in Standard Larger Unit Cell
3       0.63245
2       0.67310
3       0.81397
500     2.96459
3       2.98790
1                       :Number of cross-section libraries per irradiation step
5                       :Print Level for SAS2H
0.5                     :FACMESH for XSDRNPMS
SKIP                    :Read Flag for XSDRNPMS Control Features
3                       :Number of cycles in which assembly is inserted
01                      :Insertion cycle ID
2                       :Number of statepoints in cycle including BOC
0                       :EFPD for statepoint
0                       :Cycle length to statepoint
0                       :Days of downtime at statepoint
205                     :EFPD for statepoint
210                     :Cycle length to statepoint
10                      :Days of downtime at statepoint
30                      :Days of downtime at EOC
410                     :Total cycle EFPD
430                     :Total cycle length in calendar days
18                      :Integer position of assembly in cycle
02                      :Insertion cycle ID
1                       :Number of statepoints in cycle including BOC
0                       :EFPD for statepoint
0                       :Cycle length to statepoint
0                       :Days of downtime at statepoint
575                     :Days of downtime at EOC
430                     :Total cycle EFPD
500                     :Total cycle length in calendar days
13                      :Integer position of assembly in cycle
03                      :Insertion cycle ID
3                       :Number of statepoints in cycle including BOC
0                       :EFPD for statepoint
0                       :Cycle length to statepoint
0                       :Days of downtime at statepoint
98                      :EFPD for statepoint
100                     :Cycle length to statepoint
10                      :Days of downtime at statepoint
196                     :EFPD for statepoint
200                     :Cycle length to statepoint
10                      :Days of downtime at statepoint
60                      :Days of downtime at EOC
335                     :Total cycle EFPD
400                     :Total cycle length in calendar days
02                      :Integer position of assembly in cycle
Y                       :Signal for variable irradiation step history
1                       :Relative cycle number for boron letdown data
1                       :BOC to statepoint 2
2                       :Number of irradiation steps
80 1000                 :Irradiation step length in days, ppmb
125 850                 :Irradiation step length in days, ppmb
2                       :Statepoint 2 to EOC
2                       :Number of irradiation steps
100 700                 :Irradiation step length in days, ppmb
105 400                 :Irradiation step length in days, ppmb
```

```
2                       :Relative cycle number for boron letdown data
1                       :BOC to EOC
2                       :Number of irradiation steps
315 900                 :Irradiation step length in days, ppmb
115 700                 :Irradiation step length in days, ppmb
3                       :Relative cycle number for boron letdown data
1                       :BOC to statepoint 2
2                       :Number of irradiation steps
50 1100                 :Irradiation step length in days, ppmb
48 1000                 :Irradiation step length in days, ppmb
2                       :Statepoint 2 to statepoint 3
2                       :Number of irradiation steps
40 900                  :Irradiation step length in days, ppmb
58 850                  :Irradiation step length in days, ppmb
2                       :Statepoint 3 to EOC
2                       :Number of irradiation steps
90 700                  :Irradiation step length in days, ppmb
49 450                  :Irradiation step length in days, ppmb
5                       :Number of axial nodes for CRC
1       30.0
2       100.0
3       100.0
4       100.0
5       30.0
RODDED                   :Flag for control rod assy input
8                        :# of irradiation steps in which CRA is inserted
1 1 1 1 5 9 1            :Input Card 47B
1 1 2 1 4 9 1            :Input Card 47B
1 2 1 1 3 9 1            :Input Card 47B
1 2 2 1 2 9 1            :Input Card 47B
3 1 1 1 5 10 2           :Input Card 47B
3 1 2 1 4 10 2           :Input Card 47B
3 2 1 1 3 11 3           :Input Card 47B
3 2 2 1 2 11 3           :Input Card 47B
3                        :Input Card 47C
9                        :Input Card 47D
3                        :Input Card 47E
5010 12.0                :Input Card 47F
5011 48.0                :Input Card 47F
6012 40.0                :Input Card 47F
10                       :Input Card 47D
3                        :Input Card 47E
5010 16.0                :Input Card 47F
5011 64.0                :Input Card 47F
6012 20.0                :Input Card 47F
11                       :Input Card 47D
2                        :Input Card 47E
5010 20.0                :Input Card 47F
5011 80.0                :Input Card 47F
3                        :Input Card 47G
3.7 0                    :Input Card 47H
8                        :Input Card 47I
9 0.435                  :Input Card 47J
5 0.4597
2 0.5461
3 0.63245
2 0.6731
3 0.813968
500 2.893316
3 2.916069
```

```
3 0.435                    :Input Card 47K
3 0.4597
3 0.5461
3 0.63245
2 0.6731
3 0.813968
500 2.893316
3 2.916069
3.0 0                      :Input Card 47H
8                          :Input Card 47I
10 0.44                    :Input Card 47J
5 0.4597
2 0.5461
3 0.63245
2 0.6731
3 0.813968
500 2.313855
3 2.332051
3 0.44                    :Input Card 47K
3 0.4597
3 0.5461
3 0.63245
2 0.6731
3 0.813968
500 2.313855
3 2.332051
2.5 0                     :Input Card 47H
8                         :Input Card 47I
11 0.44                   :Input Card 47J
5 0.4597
2 0.5461
3 0.63245
2 0.6731
3 0.813968
500 2.461275
3 2.48063
3 0.44                    :Input Card 47K
3 0.4597
3 0.5461
3 0.63245
2 0.6731
3 0.813968
500 2.461275
3 2.48063
NO APSRA                   :Flag for APSR assy input
6                          :# nodes with fuel temperature input for BOC to stpt 2 of
rel. cyc. #1
1       60.0
2       60.0
3       60.0
4       60.0
5       60.0
6       60.0
1000
1010
1020
1030
1040
1050
6                         :# nodes with fuel temperature input for stpt 2 to stpt EOC
```

```
of rel. cyc. #1
1       60.0
2       60.0
3       60.0
4       60.0
5       60.0
6       60.0
1100
1110
1120
1130
1140
1150
6                       :# nodes with fuel temperature input for BOC to EOC of rel.
cyc. #2
1       60.0
2       60.0
3       60.0
4       60.0
5       60.0
6       60.0
1000
1010
1020
1030
1040
1050
6                       :# nodes with fuel temperature input for BOC to stpt 2 of
rel. cyc. #3
1       60.0
2       60.0
3       60.0
4       60.0
5       60.0
6       60.0
1100
1110
1120
1130
1140
1150
6                       :# nodes with fuel temperature input for stpt 2 to stpt 3
of rel. cyc. #3
1       60.0
2       60.0
3       60.0
4       60.0
5       60.0
6       60.0
1000
1010
1020
1030
1040
1050
6                       :# nodes with moderator spec. vol. data for BOC to stpt 2,
Rel. Cyc #1
1       60.0
2       60.0
3       60.0
```

```
4       60.0
5       60.0
6       60.0
0.0228
0.02278
0.02274
0.02271
0.02268
0.02265
6                       :# nodes with moderator spec. vol. data for stpt 2 to EOC,
Rel. Cyc #1
1       60.0
2       60.0
3       60.0
4       60.0
5       60.0
6       60.0
0.02337
0.02334
0.0233
0.02324
0.02318
0.02312
6                       :# nodes with moderator spec. vol. data for BOC to EOC,
Rel. Cyc #2
1       60.0
2       60.0
3       60.0
4       60.0
5       60.0
6       60.0
0.02337
0.02334
0.0233
0.02324
0.02318
0.02312
6                       :# nodes with moderator spec. vol. data for BOC to stpt 2,
Rel. Cyc #3
1       60.0
2       60.0
3       60.0
4       60.0
5       60.0
6       60.0
0.0228
0.02278
0.02274
0.02271
0.02268
0.02265
6                       :# nodes with moderator spec. vol. data for stpt 2 to stpt
3, Rel. Cyc #3
1       60.0
2       60.0
3       60.0
4       60.0
5       60.0
6       60.0
0.02337
```

```
0.02334
0.0233
0.02324
0.02318
0.02312
18                          :Number of Axial Nodes Containing BOC Burnup Input Data for
Cycle-1
1       17.78
2       20.0025
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10       20.0025
11       20.0025
12       20.0025
13       20.0025
14       20.0025
15       20.0025
16       20.0025
17       20.0025
18       22.352
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
18                          :Number of Axial Nodes Containing stpt 2 Burnup Input Data
for Cycle-1
1       17.78
2       20.0025
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10       20.0025
11       20.0025
12       20.0025
13       20.0025
14       20.0025
15       20.0025
```

```
16      20.0025
17      20.0025
18      22.352
3.0
3.1
3.2
3.3
3.4
3.5
3.6
3.7
3.8
3.8
3.8
3.7
3.6
3.5
3.4
3.3
3.2
3.1
18                      :Number of Axial Nodes Containing BOC Burnup Input Data for
Cycle-2
1       17.78
2       20.0025
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10       20.0025
11       20.0025
12       20.0025
13       20.0025
14       20.0025
15       20.0025
16       20.0025
17       20.0025
18       22.352
4.0
4.1
4.2
4.3
4.4
4.5
4.6
4.7
4.8
4.8
4.8
4.7
4.6
4.5
4.4
4.3
4.2
4.1
18                      :Number of Axial Nodes Containing BOC Burnup Input Data for
```

```
Cycle-3
1       17.78
2       20.0025
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10       20.0025
11       20.0025
12       20.0025
13       20.0025
14       20.0025
15       20.0025
16       20.0025
17       20.0025
18       22.352
7.0
7.1
7.2
7.3
7.4
7.5
7.6
7.7
7.8
7.8
7.8
7.7
7.6
7.5
7.4
7.3
7.2
7.1
18                          :Number of Axial Nodes Containing stpt 2 Burnup Input Data
for Cycle-3
1       17.78
2       20.0025
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10       20.0025
11       20.0025
12       20.0025
13       20.0025
14       20.0025
15       20.0025
16       20.0025
17       20.0025
18       22.352
8.0
8.1
8.2
```

```
8.3
8.4
8.5
8.6
8.7
8.8
8.8
8.8
8.7
8.6
8.5
8.4
8.3
8.2
8.1
18                          :Number of Axial Nodes Containing stpt 3 Burnup Input Data
for Cycle-3
1       17.78
2       20.0025
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10       20.0025
11       20.0025
12       20.0025
13       20.0025
14       20.0025
15       20.0025
16       20.0025
17       20.0025
18       22.352
9.0
9.1
9.2
9.3
9.4
9.5
9.6
9.7
9.8
9.8
9.8
9.7
9.6
9.5
9.4
9.3
9.2
9.1

**********************************************************************
   CRAFT Version 1.0 Input Deck for QA Test Case Number 21
**********************************************************************

N                           :Continuation Case
QA Test Case 21             :This is an input deck for testing purposes
```

```
Q21                     :Input Deck Prefix
44group                 :Cross-Section Library
3.25                    :Weight Percent U-235 in UO2
4.6360E5                :Mass U/Assembly
208                     :Number of Fuel Rods per Assembly
1.44272                 :Fuel Rod Pitch
0.936244                :Fuel Pellet OD
0.9576                  :Fuel Rod Clad ID
1.0922                  :Fuel Rod Clad OD
360.172                 :Active Fuel Length
N                       :Axial Blanket Fuel [Y or N]
ZIRC-4                  :Spacer Grid Material
0.0002                  :Homogenized Spacer Vol. Frac. in Mod. of Unit Cell
ZIRC-4                  :Cladding Material
694.0                   :Cladding Temperature (K)
Y                       :Multiple cladding material specification flag [Y or N]
1                       :Number of Cladding Material Other than ZIRC-4
8                       :SAS2H Material Mixture Number
INCONEL                 :Cladding Material
2200.0                  :System Pressure (psia)
N                       :BPRA existence in assembly [Y or N]
5                       :Number of Zones in Standard Larger Unit Cell
3       0.63245
2       0.67310
3       0.81397
500     2.96459
3       2.98790
1                       :Number of cross-section libraries per irradiation step
5                       :Print Level for SAS2H
0.5                     :FACMESH for XSDRNPMS
SKIP                    :Read Flag for XSDRNPMS Control Features
3                       :Number of cycles in which assembly is inserted
01                      :Insertion cycle ID
2                       :Number of statepoints in cycle including BOC
0                       :EFPD for statepoint
0                       :Cycle length to statepoint
0                       :Days of downtime at statepoint
205                     :EFPD for statepoint
210                     :Cycle length to statepoint
10                      :Days of downtime at statepoint
30                      :Days of downtime at EOC
410                     :Total cycle EFPD
430                     :Total cycle length in calendar days
18                      :Integer position of assembly in cycle
02                      :Insertion cycle ID
1                       :Number of statepoints in cycle including BOC
0                       :EFPD for statepoint
0                       :Cycle length to statepoint
0                       :Days of downtime at statepoint
575                     :Days of downtime at EOC
430                     :Total cycle EFPD
500                     :Total cycle length in calendar days
13                      :Integer position of assembly in cycle
03                      :Insertion cycle ID
3                       :Number of statepoints in cycle including BOC
0                       :EFPD for statepoint
0                       :Cycle length to statepoint
0                       :Days of downtime at statepoint
98                      :EFPD for statepoint
100                     :Cycle length to statepoint
```

```
10                          :Days of downtime at statepoint
196                         :EFPD for statepoint
200                         :Cycle length to statepoint
10                          :Days of downtime at statepoint
60                          :Days of downtime at EOC
335                         :Total cycle EFPD
400                         :Total cycle length in calendar days
02                          :Integer position of assembly in cycle
N                           :[N=Constant Irrad. Step Lengths, Y=Variable Irrad. Step
Lengths]
1                           :Relative cycle number for boron letdown data
1                           :BOC to statepoint 2
102.5                       :Irradiation step length in days
2                           :Number of irradiation steps
1000                        :ppmb
850                         :ppmb
2                           :Statepoint 2 to EOC
102.5                       :Irradiation step length in days
2                           :Number of irradiation steps
700                         :ppmb
400                         :ppmb
2                           :Relative cycle number for boron letdown data
1                           :BOC to EOC
215                         :Irradiation step length in days
2                           :Number of irradiation steps
1150                        :ppmb
700                         :ppmb
3                           :Relative cycle number for boron letdown data
1                           :BOC to statepoint 2
49                          :Irradiation step length in days
2                           :Number of irradiation steps
1100                        :ppmb
1000                        :ppmb
2                           :Statepoint 2 to statepoint 3
49                          :Irradiation step length in days
2                           :Number of irradiation steps
900                         :ppmb
850                         :ppmb
2                           :Statepoint 3 to EOC
69.5                        :Irradiation step length in days
2                           :Number of irradiation steps
700                         :ppmb
450                         :ppmb
5                           :Number of axial nodes for CRC
1       30.0
2       100.0
3       100.0
4       100.0
5       30.0
NO CRA INSERTION            :Input Card 47
RODDED                      :Flag for axial power shaping rod assy input
8                           :# of irradiation steps in which CRA is inserted
1 1 1 4 5 9 1 8             :48B
1 1 2 3 4 9 1 8             :48B
1 2 1 2 3 9 1 8             :48B
1 2 2 1 2 9 1 8             :48B
3 1 1 4 5 10 2 8            :48B
3 1 2 3 4 10 2 8            :48B
3 2 1 2 3 11 3 8            :48B
3 2 2 1 2 11 3 8            :48B
```

```
3                       :48C
9                       :48D
3                       :48E
5010 12.0               :48F
5011 48.0               :48F
6012 40.0               :48F
10                      :48G
3                       :48H
5010 16.0               :48F
5011 64.0               :48F
6012 20.0               :48F
11                      :48G
2                       :48H
5010 20.0               :48F
5011 80.0               :48F
3                       :48G
3.7 0                   :48H
8                       :48I
9 0.435                 :48J
5 0.4597
2 0.5461
3 0.63245
2 0.6731
3 0.813968
500 2.893316
3 2.916069
3 0.435                 :48K
3 0.4597
3 0.5461
3 0.63245
2 0.6731
3 0.813968
500 2.893316
3 2.916069
3 0.435                 :48L
3 0.4597
8 0.5461
3 0.63245
2 0.6731
3 0.813968
500 2.893316
3 2.916069
3.0 0                   :48H
8                       :48I
10 0.44                 :48J
5 0.4597
2 0.5461
3 0.63245
2 0.6731
3 0.813968
500 2.313855
3 2.332051
3 0.44                  :48K
3 0.4597
3 0.5461
3 0.63245
2 0.6731
3 0.813968
500 2.313855
3 2.332051
```

```
3 0.435                    :48L
3 0.4597
8 0.5461
3 0.63245
2 0.6731
3 0.813968
500 2.893316
3 2.916069
2.5 0                      :48H
8                          :48I
11 0.44                    :48J
5 0.4597
2 0.5461
3 0.63245
2 0.6731
3 0.813968
500 2.461275
3 2.48063
3 0.44                    :48K
3 0.4597
3 0.5461
3 0.63245
2 0.6731
3 0.813968
500 2.461275
3 2.48063
3 0.435                   :48L
3 0.4597
8 0.5461
3 0.63245
2 0.6731
3 0.813968
500 2.893316
3 2.916069
6                          :# nodes with fuel temperature input for BOC to stpt 2 of
rel. cyc. #1
1       60.0
2       60.0
3       60.0
4       60.0
5       60.0
6       60.0
1000
1010
1020
1030
1040
1050
6                         :# nodes with fuel temperature input for stpt 2 to stpt EOC
of rel. cyc. #1
1       60.0
2       60.0
3       60.0
4       60.0
5       60.0
6       60.0
1100
1110
1120
1130
```

```
1140
1150
6                       :# nodes with fuel temperature input for BOC to EOC of rel.
cyc. #2
1       60.0
2       60.0
3       60.0
4       60.0
5       60.0
6       60.0
1000
1010
1020
1030
1040
1050
6                       :# nodes with fuel temperature input for BOC to stpt 2 of
rel. cyc. #3
1       60.0
2       60.0
3       60.0
4       60.0
5       60.0
6       60.0
1100
1110
1120
1130
1140
1150
6                       :# nodes with fuel temperature input for stpt 2 to stpt 3
of rel. cyc. #3
1       60.0
2       60.0
3       60.0
4       60.0
5       60.0
6       60.0
1000
1010
1020
1030
1040
1050
6                       :# nodes with moderator spec. vol. data for BOC to stpt 2,
Rel. Cyc #1
1       60.0
2       60.0
3       60.0
4       60.0
5       60.0
6       60.0
0.0228
0.02278
0.02274
0.02271
0.02268
0.02265
6                       :# nodes with moderator spec. vol. data for stpt 2 to EOC,
Rel. Cyc #1
```

```
1       60.0
2       60.0
3       60.0
4       60.0
5       60.0
6       60.0
0.02337
0.02334
0.0233
0.02324
0.02318
0.02312
6                       :# nodes with moderator spec. vol. data for BOC to EOC,
Rel. Cyc #2
1       60.0
2       60.0
3       60.0
4       60.0
5       60.0
6       60.0
0.02337
0.02334
0.0233
0.02324
0.02318
0.02312
6                       :# nodes with moderator spec. vol. data for BOC to stpt 2,
Rel. Cyc #3
1       60.0
2       60.0
3       60.0
4       60.0
5       60.0
6       60.0
0.0228
0.02278
0.02274
0.02271
0.02268
0.02265
6                       :# nodes with moderator spec. vol. data for stpt 2 to stpt
3, Rel. Cyc #3
1       60.0
2       60.0
3       60.0
4       60.0
5       60.0
6       60.0
0.02337
0.02334
0.0233
0.02324
0.02318
0.02312
18                      :Number of Axial Nodes Containing BOC Burnup Input Data for
Cycle-1
1       17.78
2       20.0025
3       20.0025
4       20.0025
```

```
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10       20.0025
11       20.0025
12       20.0025
13       20.0025
14       20.0025
15       20.0025
16       20.0025
17       20.0025
18       22.352
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
18                      :Number of Axial Nodes Containing stpt 2 Burnup Input Data
for Cycle-1
1       17.78
2       20.0025
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10       20.0025
11       20.0025
12       20.0025
13       20.0025
14       20.0025
15       20.0025
16       20.0025
17       20.0025
18       22.352
3.0
3.1
3.2
3.3
3.4
3.5
3.6
3.7
```

```
3.8
3.8
3.8
3.7
3.6
3.5
3.4
3.3
3.2
3.1
18                          :Number of Axial Nodes Containing BOC Burnup Input Data for
Cycle-2
1       17.78
2       20.0025
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10       20.0025
11       20.0025
12       20.0025
13       20.0025
14       20.0025
15       20.0025
16       20.0025
17       20.0025
18       22.352
4.0
4.1
4.2
4.3
4.4
4.5
4.6
4.7
4.8
4.8
4.8
4.7
4.6
4.5
4.4
4.3
4.2
4.1
18                          :Number of Axial Nodes Containing BOC Burnup Input Data for
Cycle-3
1       17.78
2       20.0025
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10       20.0025
```

```
11       20.0025
12       20.0025
13       20.0025
14       20.0025
15       20.0025
16       20.0025
17       20.0025
18       22.352
7.0
7.1
7.2
7.3
7.4
7.5
7.6
7.7
7.8
7.8
7.8
7.7
7.6
7.5
7.4
7.3
7.2
7.1
18                          :Number of Axial Nodes Containing stpt 2 Burnup Input Data
for Cycle-3
1       17.78
2       20.0025
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10       20.0025
11       20.0025
12       20.0025
13       20.0025
14       20.0025
15       20.0025
16       20.0025
17       20.0025
18       22.352
8.0
8.1
8.2
8.3
8.4
8.5
8.6
8.7
8.8
8.8
8.8
8.7
8.6
8.5
```

```
8.4
8.3
8.2
8.1
18                          :Number of Axial Nodes Containing stpt 3 Burnup Input Data
for Cycle-3
1       17.78
2       20.0025
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10       20.0025
11       20.0025
12       20.0025
13       20.0025
14       20.0025
15       20.0025
16       20.0025
17       20.0025
18       22.352
9.0
9.1
9.2
9.3
9.4
9.5
9.6
9.7
9.8
9.8
9.8
9.7
9.6
9.5
9.4
9.3
9.2
9.1

**********************************************************************
   CRAFT Version 1.0 Input Deck for QA Test Case Number 22
**********************************************************************

N                           :Continuation Case
QA Test Case 22             :This is an input deck for testing purposes
Q22                         :Input Deck Prefix
44group                     :Cross-Section Library
3.25                        :Weight Percent U-235 in UO2
4.6360E5                    :Mass U/Assembly
208                         :Number of Fuel Rods per Assembly
1.44272                     :Fuel Rod Pitch
0.936244                    :Fuel Pellet OD
0.9576                      :Fuel Rod Clad ID
1.0922                      :Fuel Rod Clad OD
360.172                     :Active Fuel Length
Y                           :Axial Blanket Fuel [Y or N]
```

```
0.71
2
1
12
ZIRC-4                  :Spacer Grid Material
0.0002                  :Homogenized Spacer Vol. Frac. in Mod. of Unit Cell
ZIRC-4                  :Cladding Material
694.0                   :Cladding Temperature (K)
N                       :Multiple cladding material specification flag [Y or N]
2200.0                  :System Pressure (psia)
N                       :BPRA existence in assembly [Y or N]
5                       :Number of Zones in Standard Larger Unit Cell
3       0.63245
2       0.67310
3       0.81397
500     2.96459
3       2.98790
1                       :Number of cross-section libraries per irradiation step
5                       :Print Level for SAS2H
0.5                     :FACMESH for XSDRNPMS
SKIP                    :Read Flag for XSDRNPMS Control Features
1                       :Number of cycles in which assembly is inserted
01                      :Insertion cycle ID
2                       :Number of statepoints in cycle including BOC
0                       :EFPD for statepoint
0                       :Cycle length to statepoint
0                       :Days of downtime at statepoint
205                     :EFPD for statepoint
210                     :Cycle length to statepoint
10                      :Days of downtime at statepoint
30                      :Days of downtime at EOC
410                     :Total cycle EFPD
430                     :Total cycle length in calendar days
18                      :Integer position of assembly in cycle
N                       :Flag to signal variable irradiation step input
1                       :Relative cycle number for boron letdown data
1                       :BOC to statepoint 2
102.5                   :Irradiation step length in days
2                       :Number of irradiation steps
1000                    :ppmb
850                     :ppmb
2                       :Statepoint 2 to EOC
102.5                   :Irradiation step length in days
2                       :Number of irradiation steps
700                     :ppmb
400                     :ppmb
12                      :Number of axial nodes for CRC
1       10.0
2       15.0
3       20.0
4       25.0
5       55.0
6       55.0
7       55.0
8       55.0
9       25.0
10      20.0
11      15.0
12      10.0
NO CRA INSERTION        :Flag for axial power shaping rod assy input
```

```
NO APSRA INSERTION          :Flag for axial power shaping rod assy input
20                          :# nodes with fuel temperature input for BOC to stpt 2 of
rel. cyc. #1
1       18.05
2       18.05
3       18.05
4       18.05
5       18.05
6       18.05
7       18.05
8       18.05
9       18.05
10      18.05
11      18.05
12      18.05
13      18.05
14      18.05
15      18.05
16      18.05
17      18.05
18      18.05
19      18.05
20      18.05
933.3
1083.2
1148.6
1161.1
1152.5
1136.2
1119.8
1107.6
1101.2
1101.7
1110.3
1128.1
1156.7
1201.3
1251.1
1251.7
1188.5
1027.6
1024.3
1023.7
25                          :# nodes with moderator spec. vol. data for BOC to stpt 2,
Rel. Cyc #1
1       14.48
2       14.48
3       14.48
4       14.48
5       14.48
6       14.48
7       14.48
8       14.48
9       14.48
10      14.48
11      14.48
12      14.48
13      14.48
14      14.48
15      14.48
```

```
16      14.48
17      14.48
18      14.48
19      14.48
20      14.48
21      14.48
22      14.48
23      14.48
24      14.48
25      14.48
0.0232
0.0232
0.0231
0.023
0.0229
0.0228
0.0227
0.0226
0.0226
0.0225
0.0224
0.0223
0.0222
0.0221
0.022
0.0219
0.0219
0.0218
0.0217
0.0216
0.0215
0.0215
0.0214
0.0214
0.0213
18                      :Number of Axial Nodes Containing BOC Burnup Input Data for
Cycle-1
1       17.78
2       20.0025
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10       20.0025
11       20.0025
12       20.0025
13       20.0025
14       20.0025
15       20.0025
16       20.0025
17       20.0025
18       22.352
0
0
0
0
0
```

```
0
0
0
0
0
0
0
0
0
0
0
0
18                      :Number of Axial Nodes Containing stpt 2 Burnup Input Data
for Cycle-1
1       17.78
2       20.0025
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10       20.0025
11       20.0025
12       20.0025
13       20.0025
14       20.0025
15       20.0025
16       20.0025
17       20.0025
18       22.352
4.165
6.642
8.681
10.034
10.864
11.345
11.602
11.715
11.733
11.681
11.582
11.463
11.36
11.315
11.318
10.993
9.608
6.503

**********************************************************************
   CRAFT Version 1.0 Input Deck for QA Test Case Number 23
**********************************************************************

Y                       :Continuation Case
1                       :Relative cycle number for startup
2                       :Relative statepoint for startup
QA Test Case 23         :This is an input deck for testing purposes
```

```
Q22                     :Input Deck Prefix
44group                 :Cross-Section Library
3.25                    :Weight Percent U-235 in UO2
4.6360E5                :Mass U/Assembly
208                     :Number of Fuel Rods per Assembly
1.44272                 :Fuel Rod Pitch
0.936244                :Fuel Pellet OD
0.9576                  :Fuel Rod Clad ID
1.0922                  :Fuel Rod Clad OD
360.172                 :Active Fuel Length
Y                       :Axial Blanket Fuel [Y or N]
0.71
2
1
12
ZIRC-4                  :Spacer Grid Material
0.0002                  :Homogenized Spacer Vol. Frac. in Mod. of Unit Cell
ZIRC-4                  :Cladding Material
694.0                   :Cladding Temperature (K)
N                       :Multiple cladding material specification flag [Y or N]
2200.0                  :System Pressure (psia)
N                       :BPRA existence in assembly [Y or N]
5                       :Number of Zones in Standard Larger Unit Cell
3       0.63245
2       0.67310
3       0.81397
500     2.96459
3       2.98790
1                       :Number of cross-section libraries per irradiation step
5                       :Print Level for SAS2H
0.5                     :FACMESH for XSDRNPMS
SKIP                    :Read Flag for XSDRNPMS Control Features
2                       :Number of cycles in which assembly is inserted
01                      :Insertion cycle ID
2                       :Number of statepoints in cycle including BOC
0                       :EFPD for statepoint
0                       :Cycle length to statepoint
0                       :Days of downtime at statepoint
205                     :EFPD for statepoint
210                     :Cycle length to statepoint
10                      :Days of downtime at statepoint
30                      :Days of downtime at EOC
410                     :Total cycle EFPD
430                     :Total cycle length in calendar days
18                      :Integer position of assembly in cycle
02                      :Insertion cycle ID
2                       :Number of statepoints in cycle including BOC
0                       :EFPD for statepoint
0                       :Cycle length to statepoint
0                       :Days of downtime at statepoint
205                     :EFPD for statepoint
210                     :Cycle length to statepoint
10                      :Days of downtime at statepoint
30                      :Days of downtime at EOC
410                     :Total cycle EFPD
430                     :Total cycle length in calendar days
18                      :Integer position of assembly in cycle
N
1                       :Relative cycle number for boron letdown data
1                       :BOC to statepoint 2
```

```
102.5                    :Irradiation step length in days
2                        :Number of irradiation steps
1000                     :ppmb
850                      :ppmb
2                        :Statepoint 2 to EOC
102.5                    :Irradiation step length in days
2                        :Number of irradiation steps
700                      :ppmb
400                      :ppmb
2                        :Relative cycle number for boron letdown data
1                        :BOC to statepoint 2
102.5                    :Irradiation step length in days
2                        :Number of irradiation steps
1000                     :ppmb
850                      :ppmb
2                        :Statepoint 2 to EOC
102.5                    :Irradiation step length in days
2                        :Number of irradiation steps
700                      :ppmb
400                      :ppmb
12                       :Number of axial nodes for CRC
1       10.0
2       15.0
3       20.0
4       25.0
5       55.0
6       55.0
7       55.0
8       55.0
9       25.0
10      20.0
11      15.0
12      10.0
NO CRA INSERTION         :Flag for axial power shaping rod assy input
NO APSRA INSERTION       :Flag for axial power shaping rod assy input
20                       :# nodes with fuel temperature input for BOC to stpt 2 of
rel. cyc. #1
1       18.05
2       18.05
3       18.05
4       18.05
5       18.05
6       18.05
7       18.05
8       18.05
9       18.05
10      18.05
11      18.05
12      18.05
13      18.05
14      18.05
15      18.05
16      18.05
17      18.05
18      18.05
19      18.05
20      18.05
933.3
1083.2
1148.6
```

```
1161.1
1152.5
1136.2
1119.8
1107.6
1101.2
1101.7
1110.3
1128.1
1156.7
1201.3
1251.1
1251.7
1188.5
1027.6
1024.3
1023.7
20                          :# nodes with fuel temperature input for stpt 2 to EOC of
rel. cyc. #1
1       18.05
2       18.05
3       18.05
4       18.05
5       18.05
6       18.05
7       18.05
8       18.05
9       18.05
10      18.05
11      18.05
12      18.05
13      18.05
14      18.05
15      18.05
16      18.05
17      18.05
18      18.05
19      18.05
20      18.05
933.3
1083.2
1148.6
1161.1
1152.5
1136.2
1119.8
1107.6
1101.2
1101.7
1110.3
1128.1
1156.7
1201.3
1251.1
1251.7
1188.5
1027.6
1024.3
1023.7
20                          :# nodes with fuel temperature input for BOC to stpt 2 of
```

```
rel. cyc. #2
1       18.05
2       18.05
3       18.05
4       18.05
5       18.05
6       18.05
7       18.05
8       18.05
9       18.05
10      18.05
11      18.05
12      18.05
13      18.05
14      18.05
15      18.05
16      18.05
17      18.05
18      18.05
19      18.05
20      18.05
933.3
1083.2
1148.6
1161.1
1152.5
1136.2
1119.8
1107.6
1101.2
1101.7
1110.3
1128.1
1156.7
1201.3
1251.1
1251.7
1188.5
1027.6
1024.3
1023.7
25                          :# nodes with moderator spec. vol. data for BOC to stpt 2,
Rel. Cyc #1
1       14.48
2       14.48
3       14.48
4       14.48
5       14.48
6       14.48
7       14.48
8       14.48
9       14.48
10      14.48
11      14.48
12      14.48
13      14.48
14      14.48
15      14.48
16      14.48
17      14.48
```

```
18      14.48
19      14.48
20      14.48
21      14.48
22      14.48
23      14.48
24      14.48
25      14.48
0.0232
0.0232
0.0231
0.023
0.0229
0.0228
0.0227
0.0226
0.0226
0.0225
0.0224
0.0223
0.0222
0.0221
0.022
0.0219
0.0219
0.0218
0.0217
0.0216
0.0215
0.0215
0.0214
0.0214
0.0213
25                      :# nodes with moderator spec. vol. data for stpt 2 to EOC,
Rel. Cyc #1
1       14.48
2       14.48
3       14.48
4       14.48
5       14.48
6       14.48
7       14.48
8       14.48
9       14.48
10      14.48
11      14.48
12      14.48
13      14.48
14      14.48
15      14.48
16      14.48
17      14.48
18      14.48
19      14.48
20      14.48
21      14.48
22      14.48
23      14.48
24      14.48
25      14.48
```

```
0.0232
0.0232
0.0231
0.023
0.0229
0.0228
0.0227
0.0226
0.0226
0.0225
0.0224
0.0223
0.0222
0.0221
0.022
0.0219
0.0219
0.0218
0.0217
0.0216
0.0215
0.0215
0.0214
0.0214
0.0213
25                          :# nodes with moderator spec. vol. data for BOC to stpt 2,
Rel. Cyc #2
1       14.48
2       14.48
3       14.48
4       14.48
5       14.48
6       14.48
7       14.48
8       14.48
9       14.48
10      14.48
11      14.48
12      14.48
13      14.48
14      14.48
15      14.48
16      14.48
17      14.48
18      14.48
19      14.48
20      14.48
21      14.48
22      14.48
23      14.48
24      14.48
25      14.48
0.0232
0.0232
0.0231
0.023
0.0229
0.0228
0.0227
0.0226
```

```
0.0226
0.0225
0.0224
0.0223
0.0222
0.0221
0.022
0.0219
0.0219
0.0218
0.0217
0.0216
0.0215
0.0215
0.0214
0.0214
0.0213
18                          :Number of Axial Nodes Containing BOC Burnup Input Data for
Cycle-1
1       17.78
2       20.0025
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10       20.0025
11       20.0025
12       20.0025
13       20.0025
14       20.0025
15       20.0025
16       20.0025
17       20.0025
18       22.352
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
18                          :Number of Axial Nodes Containing stpt 2 Burnup Input Data
for Cycle-1
1       17.78
2       20.0025
3       20.0025
```

```
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10       20.0025
11       20.0025
12       20.0025
13       20.0025
14       20.0025
15       20.0025
16       20.0025
17       20.0025
18       22.352
4.165
6.642
8.681
10.034
10.864
11.345
11.602
11.715
11.733
11.681
11.582
11.463
11.36
11.315
11.318
10.993
9.608
6.503
18                      :Number of Axial Nodes Containing BOC Burnup Input Data for
Cycle-2
1       17.78
2       20.0025
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10       20.0025
11       20.0025
12       20.0025
13       20.0025
14       20.0025
15       20.0025
16       20.0025
17       20.0025
18       22.352
8.33
13.284
17.362
20.068
21.728
22.69
23.204
```

```
23.43
23.466
23.362
23.164
22.926
22.72
22.63
22.636
21.986
19.216
13.006
18                          :Number of Axial Nodes Containing stpt 2 Burnup Input Data
for Cycle-2
1       17.78
2       20.0025
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10       20.0025
11       20.0025
12       20.0025
13       20.0025
14       20.0025
15       20.0025
16       20.0025
17       20.0025
18       22.352
12.495
19.926
26.043
30.102
32.592
34.035
34.806
35.145
35.163
35.147
34.746
34.389
34.08
33.945
33.954
32.979
28.824
19.509
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Attachment V

CRC_DATA_TABULIZER Version 1.0 and 2.0 Program Descriptions

CRC_DATA_TABULIZER Versions 1.0 and 2.0

Commercial Reactor Critical Isotopic Results Tabulization Program

Developed by Kenneth D. Wright
Framatome Cogema Fuels
High-Level Waste Division

under contract with the

Management and Operating Contractor for the
Yucca Mountain High-Level Radioactive Waste Repository Project

Table of Contents

	Item	Page
1.	Purpose	4
2.	Objective	4
3.	Methodology	4
4.	Required CRC Results Database Structure	5
5.	Calculations Performed by the CRC_DATA_TABULIZER Program	6
6.	Example of a CRC_DATA_TABULIZER Isotopic Result Tabulization	7
7.	Modifications Made Between Versions 1.0 and 2.0	8
8.	CRC_DATA_TABULIZER Version 1.0 Fortran Source Code Listing	9
9.	CRC_DATA_TABULIZER Version 2.0 Fortran Source Code Listing	26

1. Purpose

The CRC_DATA_TABULIZER program was written to support Commercial Reactor Critical (CRC) evaluations. The CRC evaluations are performed as part of the disposal criticality methodology development for the proposed Yucca Mountain High-Level Radioactive Waste Repository.

2. Objective

The objective of the CRC_DATA_TABULIZER program is to retrieve and tabulate isotopic results and fuel assembly characterization parameter data that is generated and utilized in fuel assembly SAS2H depletion calculations generated by the CRAFT code which are relevant to CRC evaluations. The program is intended to be used without supporting documentation through the implementation of run-time user defined input prompts.

3. Methodology

The methodology employed by the CRC_DATA_TABULIZER program is to prompt the user for a minimum set of required assembly characterization data, and search through a database of CRC results to retrieve and tabulate relevant information. The structure of the CRC results database is pre-defined and must be implemented correctly for the CRC_DATA_TABULIZER program to function properly. If the CRC results database is established properly, the Tabulization program is capable of using the user defined assembly characterization input data to search through the database and retrieve relevant data. The relevant data that is retrieved includes the following for each of the principal isotopes listed in Table 3-1, for each CRC statepoint calculation to which the assembly pertains:

1) the fuel assembly axial node dimensions in units of cm
2) the SAS2H calculated spent fuel isotopic concentrations for each axial node in units of grams per node
3) the nodal burnup in units of GWD/MTU
4) the nodal fuel temperature input data used in the SAS2H calculations in units of degrees Kelvin
5) the nodal moderator density input data used in the SAS2H calculations in units of grams per cubic centimeter.

Table 3-1 Principal Isotope Set

Mo-95	Tc-99	Ru-101	Rh-103	Ag-109
Nd-143	Nd-145	Sm-147	Sm-149	Sm-150
Sm-151	Sm-152	Eu-151	Eu-153	Gd-155
U-233	U-234	U-235	U-236	U-238
Np-237	Pu-238	Pu-239	Pu-240	Pu-241
Pu-242	Am-241	Am-242m	Am-243	

The tabulization program performs simple calculations to convert the retrieved data into a form required for presentation in the generated data tables. The calculations performed by the Tabulization program include the following:

1) the calculation of the fuel assembly axial node center heights
2) the generation of a normalized profile for the isotopic results
3) the calculation of burnup-weighted nodal fuel temperature values
4) the calculation of burnup-weighted nodal moderator density values.

The tables generated by the Tabulization program for each of the principal isotopes of each CRC statepoint calculation containing spent fuel (to which the assembly pertains) contain the following information:

1) the CRAFT calculation identifier which contains the CRC assembly identifier followed by the "i.dat" suffix
2) the isotope for which the results are being tabulated
3) the reactor cycle identifier and CRC statepoint effective full-power day value for which the isotopic results are being tabulated
4) the initial enrichment of the fuel assembly
5) an integer value referring to the number of the axial node (node number 1 represents the top axial node of the fuel assembly)
6) the axial node height in unit of centimeters
7) the height at the center of the axial node in units of centimeters
8) the SAS2H isotopic results for the axial node in units of grams per node
9) the SAS2H isotopic results for the axial node normalized to the assembly average isotopic results
10) the nodal burnup in units of GWD/MTU
11) the nodal fuel temperature input values utilized in the SAS2H calculation weighted by the nodal burnup up to the statepoint calculation for which the Tabulization is being performed
12) the nodal moderator density input values utilized in the SAS2H calculation weighted by the nodal burnup up to the statepoint calculation for which the Tabulization is being performed.

All of the tables generated to present the principal isotope results for each CRC statepoint for an assembly are contained in a single file. The name of this file contains the CRC assembly identifier followed by the ".results" suffix.

4. Required CRC Results Database Structure

The CRC_DATA_TABULIZER program requires that certain files be present in the directory in which the program is executed. The files which must be present in this directory include the following:

1) the CRAFT input deck for the assembly depletion calculation

2) the consolidated output files ("*.cut" files) from the CRAFT calculation of the assembly.

A typical CRC database structure may consist of a directory identifying each assembly which contains all of the files relevant to the CRC depletion calculations for the assembly. Each of these assembly directories would contain at a minimum the CRAFT input deck for the assembly's CRC depletion calculations and all of the consolidated output files ("*.cut") resulting from the assembly's CRAFT calculation. The CRC_DATA_TABULIZER executable file must be copied into the assembly's CRC depletion directory due to the fact that the program's search for the appropriate consolidated SAS2H output files is limited to the directory in which the program is executed.

5. Calculations Performed by the CRC_DATA_TABULIZER Program

The CRC_DATA_TABULIZER program performs four calculations as previously identified in Section 3. Each of these calculations are performed for every axial node that is specified in each generated isotopic results table.

The first calculation performed is the calculation of the fuel assembly axial node center heights. This calculation utilizes the following equation to determine the height at the center of the axial node.

$$\textit{Axial Node Center Height} = \frac{\textit{Height at Top of Node} + \textit{Height at Bottom of Node}}{2}$$

The second calculation performed is the calculation of the isotopic concentration in the axial node normalized to the assembly average concentration of the corresponding isotope. The following equation is used to determine the normalized value of the nodal isotopic concentration.

$$\textit{Average Concentration of Isotope in Assembly Axial Node X} = \frac{\sum_{n=1}^{n=N} [\textit{Height of Node } n] * [\textit{Isotopic Concentration in Node } X]}{\sum_{n=1}^{n=N} [\textit{Isotopic Concentration in Node } n * \textit{Height of Node } n]}$$

where n represents an axial node, N represents the total number of axial nodes and X represents the axial node for which the normalized concentration is being determined.

The normalized concentration of an isotope in the node is only based on the isotope's average concentration in the assembly axial nodes which have a non-zero concentration for the isotope.

The third calculation performed is the calculation of the burnup-weighted nodal fuel temperature value. This value represents the average fuel temperature used in the SAS2H depletion calculation up to the statepoint calculation for which isotopic data is being tabulated. This average fuel temperature is calculated by weighting the contribution of the fuel temperature input values utilized in each SAS2H statepoint calculation for the node by the burnup of the node during that particular statepoint calculation.

The following equation is used to determine the burnup-weighted nodal fuel temperature value up to a statepoint calculation.

$$\textit{Burnup-Weighted Average Nodal Fuel Temperature Used for Generation of Nodal Isotopic Concentration} = \frac{\sum_{stpt=1}^{stpt=(N-1)} [(\textit{Nodal Fuel Temperature})_{stpt} * (\textit{Nodal Burnup})_{stpt}]}{\textit{Total Cumulative Nodal Burnup at Statepoint N}}$$

where stpt represents a CRC statepoint depletion calculation of the fuel assembly axial node, and N represents the total number of CRC statepoint SAS2H depletion calculations performed to reach the irradiation point where the burnup-weighted average fuel temperature is required.

The fourth calculation performed is the calculation of the burnup-weighted nodal moderator density value. This value represents the average moderator density used in the SAS2H depletion calculation up to the statepoint calculation for which isotopic data is being tabulated. This average moderator density is calculated by weighting the contribution of the moderator density input values utilized in each SAS2H statepoint calculation for the node by the burnup of the node during that particular statepoint calculation. The following equation is used to determine the burnup-weighted nodal moderator density value up to a statepoint calculation.

$$\textit{Burnup-Weighted Average Nodal Moderator Density Used for Generation of Nodal Isotopic Concentration} = \frac{\sum_{stpt=1}^{stpt=(N-1)} [(\textit{Nodal Moderator Density})_{stpt} * (\textit{Nodal Burnup})_{stpt}]}{\textit{Total Cumulative Nodal Burnup at Statepoint N}}$$

where stpt represents a CRC statepoint depletion calculation of the fuel assembly axial node, and N represents the total number of CRC statepoint SAS2H depletion calculations performed o reach the irradiation point where the burnup-weighted average moderator density is required

6. Example of a CRC_DATA_TABULIZER Isotopic Result Tabulization

CRAFT CALCULATION: A02i.dat

ISOTOPE: u235

CYCLE-02 .0 EFPD POSITION: 02 ENRICHMENT: 2.540

NODE NUMBER	NODE HEIGHT (cm)	NODE CENTER HEIGHT (cm)	SAS2H ISOTOPIC RESULTS (g/node)	NORMALIZED SAS2H ISOTOPIC PROFILE	NODAL BURNUP (GWD/MTU)	BURNUP WEIGHTED FUEL TEMP. (F)	BURNUP WEIGHTED MODERATOR DENSITY (g/cc)
1	17.78	8.89	406.000	1.29118	7.703	1065.8	.67853
2	20.00	27.78	381.000	1.21168	12.146	1263.3	.68138
3	20.00	47.78	328.000	1.04312	15.070	1361.5	.68412
4	20.00	67.79	308.000	.97952	16.635	1398.9	.68689
5	20.00	87.79	296.000	.94135	17.420	1409.7	.69066

6	20.00	107.79	293.000	.93181	17.783	1409.1	.69563
7	20.00	127.79	290.000	.92227	17.919	1406.3	.69861
8	20.00	147.80	290.000	.92227	17.948	1406.6	.70164
9	20.00	167.80	290.000	.92227	17.930	1411.7	.70783
10	20.00	187.80	290.000	.92227	17.898	1419.9	.71098
11	20.00	207.80	287.000	.91273	17.870	1429.4	.71625
12	20.00	227.81	290.000	.92227	17.864	1436.9	.71948
13	20.00	247.81	289.000	.91909	17.893	1440.0	.72275
14	20.00	267.81	287.000	.91273	17.976	1438.4	.72833
15	20.00	287.81	284.000	.90319	18.087	1438.6	.73165
16	20.00	307.82	288.000	.91591	17.769	1434.9	.73500
17	20.00	327.82	315.000	1.00178	15.824	1358.6	.73819
18	22.35	349.00	443.000	1.40885	10.594	1137.4	.74161

7. Modifications Made Between Versions 1.0 and 2.0

Some minor modifications were required for the CRC_DATA_TABULIZER Version 1.0 code to enable it to tabulate the CRC results for CRAFT calculations which pick-up from a previous CRAFT calculation. Some minor modifications were also required in the filename development for the tabulized results. Since the modifications to CRC_DATA_TABULIZER Version 1.0 were minor, the documentation for CRC_DATA_TABULIZER Version 2.0 is exactly the same as that for Version 1.0.

The Unix "diff" command was utilized to show the exact lines of source code for Version 2.0 which do not directly correspond to the source code for Version 1.0. Table 7-1, presents the results of the "diff" command between the source codes for Version 1.0 and 2.0.

Table 7-1 Source Code Differences Between CRC_DATA_TABULIZER Version 1.0 and 2.0

These are the fixes in Version 2 of the CRC_DATA_TABULIZER code.

```
283,284c283,289
<       CYCSTART=RESTARTCYC
<       STPTSTART=RESTARTSTPT
---
>       IF (RESTARTSTPT.EQ.NUMBEROFSTPTS(RESTARTCYC)) THEN
>         CYCSTART=RESTARTCYC+1
>         STPTSTART=1
>       ELSE
>         CYCSTART=RESTARTCYC
>         STPTSTART=RESTARTSTPT+1
>       ENDIF
665,666c670,671
<    RESULTSFILE((10-BLANKS-4):(10-BLANKS+4))='.results'
<    RESULTSFILE((10-BLANKS+5):14)=' '
---
>    RESULTSFILE((10-BLANKS-4):(10-BLANKS+3))='.results'
>    RESULTSFILE((10-BLANKS+4):14)=' '
676,677c681,682
```

```
<      DO 1010 CYC=1,NUMBEROFCYCLES
<        DO 1005 STPT=1,NUMBEROFSTPTS(CYC)
---
>      DO 1010 CYC=CYCSTART,NUMBEROFCYCLES
>        DO 1005 STPT=STPTSTART,NUMBEROFSTPTS(CYC)
```

The lines delineated by "<" are from the Version 1.0 source code. The lines delineated by ">" are from the Version 2.0 source code. The differences between corresponding sets of "<" lines and ">" lines identify the changes that were made to Version 1.0 in creating Version 2.0. The complete source code listings of both Version 1.0 and 2.0, are presented in Sections 8 and 9, respectively.

8. CRC_DATA_TABULIZER Version 1.0 Fortran Source Code Listing

```
      PROGRAM CRC_DATA_TABULIZER
************************************************************************
*   Subroutine to retrieve and tabularize various isotopic results *
*   and depletion parameter data from CRC depletion calculations.  *
************************************************************************
      INTEGER*4 GLOBALNUMBER, A, NUMBEROFCYCLES, NUMBEROFSTPTS(12),
     c B, C, NUMBEROFNODES, RESTARTCYC, RESTARTSTPT
*
      REAL EFPDVALUES(10,20), ENRICHMENT
*
      LOGICAL QUESTION1, SINGLE, GLOBAL, QUESTION2, MANUALLIST,
     c FILELIST, QUESTION4, QUESTION5, QUESTION6, PRINCIPALISOSET,
     c SPECIFICISO, UTOPURATIO, RESTART
*
      CHARACTER ANSWER1*1, CRAFTINPUTNM*10, ANSWER2*1,
     c ASSEMBLYARCHIVE(500)*5, ANSWER3*3, CYCLEINFO(2,12)*2,
     c ANSWER4*1, ANSWER5*1, ANSWER6*1, RESTARTANSWER*1
*
***** Get input parameters necessary to find the appropriate data
***** for tabulation.
*
      QUESTION1=.FALSE.
      DO 10 WHILE (QUESTION1.EQ..FALSE.)
         WRITE (*,*) 'Choose one of the following data',
     c   ' tabularization methods [1 or 2]:'
         WRITE (*,*)
         WRITE (*,*) '     1) Single Fuel Assembly Tabularization'
         WRITE (*,*) '     2) Global Fuel Assembly Tabularization',
     c   '[NOT AVAILABLE]'
         WRITE (*,*)
         READ (*,5) ANSWER1
    5    FORMAT(A1)
         IF (ANSWER1.EQ.'1') THEN
            SINGLE=.TRUE.
            GLOBAL=.FALSE.
            QUESTION1=.TRUE.
         ELSEIF (ANSWER1.EQ.'2') THEN
            SINGLE=.FALSE.
            GLOBAL=.TRUE.
            QUESTION1=.TRUE.
         ELSEIF ((ANSWER1.NE.'1').AND.(ANSWER1.NE.'2')) THEN
            WRITE (*,*) 'You must choose from available list.'
            QUESTION1=.FALSE.
```

```
      ENDIF
10 CONTINUE
   IF (SINGLE.EQ..TRUE.) THEN
      RESTART=.FALSE.
      WRITE (*,*) 'Is this tabulation for the results from a',
  c   ' continuation'
      WRITE (*,*) 'of an assembly depletion sequence? [Y or N]'
      READ (*,11) RESTARTANSWER
11    FORMAT (A1)
      IF (RESTARTANSWER.EQ.'Y') THEN
         RESTART=.TRUE.
         WRITE(*,*) 'Enter the restart relative cycle number',
  c      ' for the CRAFT calculation.'
         READ (*,*) RESTARTCYC
         WRITE(*,*) 'Enter the restart relative statepoint number',
  c      ' for the CRAFT calculation.'
         READ (*,*) RESTARTSTPT
      ENDIF
      WRITE (*,*) 'Enter the CRAFT input deck filename:'
      READ (*,*) CRAFTINPUTNM
   ELSEIF (GLOBAL.EQ..TRUE.) THEN
      QUESTION2=.FALSE.
      DO 25 WHILE (QUESTION2.EQ..FALSE.)
         WRITE (*,*) 'Choose one of the following methods for',
  c      ' entering the assembly archiving identifiers:'
         WRITE (*,*) '     1) List assembly archiving identifiers',
  c      ' manually'
         WRITE (*,*) '     2) Use a list of assembly archiving',
  c      ' identifiers in a file entitled "assylist"'
         READ (*,20) ANSWER2
20       FORMAT (A1)
         IF (ANSWER2.EQ.'1') THEN
            MANUALLIST=.TRUE.
            FILELIST=.FALSE.
            QUESTION2=.TRUE.
         ELSEIF (ANSWER2.EQ.'2') THEN
            MANUALLIST=.FALSE.
            FILELIST=.TRUE.
            QUESTION2=.TRUE.
         ELSEIF ((ANSWER2.NE.'1').AND.(ANSWER2.NE.'2')) THEN
            WRITE (*,*) 'You must choose from available list.'
            QUESTION2=.FALSE.
         ENDIF
25    CONTINUE
      IF (MANUALLIST.EQ..TRUE.) THEN
         WRITE (*,*) 'Enter the number of assemblies included',
  c      ' in the global tabularization:'
         READ (*,*) GLOBALNUMBER
         DO 35 A=1,GLOBALNUMBER
            READ (*,30) ASSEMBLYARCHIVE (A)
30          FORMAT (A5)
            WRITE (*,*) (GLOBALNUMBER-A),
  c         ' assembly identifiers left to go'
35       CONTINUE
      ELSEIF (FILELIST.EQ..TRUE.) THEN
         OPEN (UNIT=20,FILE='assylist',STATUS='OLD')
         REWIND (UNIT=20)
         DO 42 A=1,GLOBALNUMBER
********* Other data may need to be added to the input obtained from this file.
```

```
            READ (20,40) ASSEMBLYARCHIVE (A)
 40         FORMAT (A5)
 42         CONTINUE
       ENDIF
    ENDIF
    WRITE (*,*) 'Enter the number of axial nodes specified in the',
   c' CRAFT calculation.'
    READ (*,*) NUMBEROFNODES
    WRITE (*,*) 'Enter the initial U-235 enrichment:'
    READ (*,*) ENRICHMENT
    WRITE(*,*)
    WRITE (*,*) 'Enter the 3 character reactor prefix',
   c 'identifier used in the CRAFT calculation(s):'
    READ (*,45) ANSWER3
 45 FORMAT (A3)
    IF (SINGLE.EQ..TRUE.) THEN
       QUESTION4=.FALSE.
       DO 65 WHILE (QUESTION4.EQ..FALSE.)
          WRITE (*,*) 'Enter the number of reactor cycles in',
   c      ' which the assembly is inserted:'
          READ (*,*) NUMBEROFCYCLES
          WRITE (*,*) 'For each reactor cycle of insertion, enter',
   c      ' the following'
          WRITE (*,*) 'information delineated by a single space:'
          WRITE (*,*)
          WRITE (*,*) '    1) Reactor cycle identifier used',
   c      '       in the CRAFT calculation [2 CHARACTERS]'
          WRITE (*,*) '    2) Integer position of assembly in the',
   c      ' cycle [2 CHARACTERS]'
          WRITE (*,*) '    3) Number of CRC statepoints in the cycle',
   c      '       as defined in the CRAFT calculation [INTEGER]'
          WRITE (*,*)
          WRITE (*,*) 'Each line should contain information for one',
   c      ' insertion reactor cycle.'
          DO 55 A=1,NUMBEROFCYCLES
             READ (*,50) CYCLEINFO(1,A), CYCLEINFO(2,A),
   c         NUMBEROFSTPTS(A)
 50          FORMAT (A2,1X,A2,1X,I2)
 55       CONTINUE
          WRITE(*,*) 'Is the previous cycle information',
   c      ' correct? [Y or N]'
          READ(*,60) ANSWER4
 60       FORMAT (A1)
          IF (ANSWER4.NE.'Y') THEN
             WRITE (*,*) 'Re-enter the cycle information.'
             QUESTION4=.FALSE.
          ELSE
             QUESTION4=.TRUE.
          ENDIF
 65    CONTINUE
       DO 85 A=1,NUMBEROFCYCLES
          DO 80 WHILE (QUESTION5.EQ..FALSE.)
             WRITE(*,*) 'Enter the statepoint EFPD values as',
   c         ' designated in the CRAFT'
             WRITE(*,*) 'calculations for Cycle-',CYCLEINFO(1,A),
   c         ', delineated by carriage returns:'
             DO 70 B=1,NUMBEROFSTPTS(A)
                READ(*,*) EFPDVALUES(A,B)
 70          CONTINUE
             WRITE(*,*) 'Are you satisfied with the following EFPD',
```

```
     c          ' values for Cycle-',CYCLEINFO(1,A),'? [Y or N]'
                DO 75 C=1,NUMBEROFSTPTS(A)
                   WRITE(*,*) EFPDVALUES(A,C)
  75            CONTINUE
                READ(*,78) ANSWER5
  78            FORMAT(A1)
                IF (ANSWER5.NE.'Y') THEN
                   WRITE (*,*) 'Re-enter the statepoint information.'
                   QUESTION5=.FALSE.
                ELSE
                   QUESTION5=.TRUE.
                ENDIF
  80         CONTINUE
             IF (A.EQ.NUMBEROFCYCLES) THEN
                QUESTION5=.TRUE.
             ELSE
                QUESTION5=.FALSE.
             ENDIF
  85       CONTINUE
           QUESTION6=.FALSE.
           DO 95 WHILE (QUESTION6.EQ..FALSE.)
              WRITE(*,*) 'Choose of the following isotopic sets for',
     c        ' tabulation:'
              WRITE(*,*)
              WRITE(*,*) '     1) Principal isotope set (30 isotopes',
     c        ' total)'
              WRITE(*,*) '     2) A specific isotope [NOT AVAILABLE]'
              WRITE(*,*) '     3) The U/Pu ratio [NOT AVAILABLE]'
              WRITE(*,*)
              READ(*,90) ANSWER6
  90          FORMAT (A1)
              IF (ANSWER6.EQ.'1') THEN
                 PRINCIPALISOSET=.TRUE.
                 SPECIFICISO=.FALSE.
                 UTOPURATIO=.FALSE.
                 QUESTION6=.TRUE.
              ELSEIF (ANSWER6.EQ.'2') THEN
                 PRINCIPALISOSET=.FALSE.
                 SPECIFICISO=.TRUE.
                 UTOPURATIO=.FALSE.
                 QUESTION6=.TRUE.
              ELSEIF (ANSWER6.EQ.'3') THEN
                 PRINCIPALISOSET=.FALSE.
                 SPECIFICISO=.FALSE.
                 UTOPURATIO=.TRUE.
                 QUESTION6=.TRUE.
              ELSE
                 QUESTION6=.FALSE.
                 WRITE(*,*) 'You must choose from the following list.'
                 WRITE(*,*)
              ENDIF
  95       CONTINUE
        ELSEIF (GLOBAL.EQ..TRUE.) THEN
           STOP
        ENDIF
        IF (SINGLE.EQ..TRUE.) THEN
           CALL SINGLEDATA(CRAFTINPUTNM,CYCLEINFO,NUMBEROFSTPTS,
     c     EFPDVALUES,NUMBEROFCYCLES,ANSWER3,NUMBEROFNODES,
     c     ENRICHMENT, RESTART, RESTARTCYC, RESTARTSTPT)
        ENDIF
```

```
      WRITE(*,*) 'TABULATION COMPLETE!'
      END
************************************************************************
      SUBROUTINE SINGLEDATA(CRAFTINPUTNM,CYCLEINFO,NUMBEROFSTPTS,
     c EFPDVALUES,NUMBEROFCYCLES,ANSWER3,NUMBEROFNODES,ENRICHMENT,
     c RESTART, RESTARTCYC, RESTARTSTPT)
*
      INTEGER*4 PI, CYC, STPT, NODE, NUMSTPT1, NUMSTPT2, NUMSTPT3,
     c NUMBEROFSTPTS(10), NUMSTPT4, NUMSTPT5, NUMSTPT6, COLUMNSTART,
     c COLUMNEND, COUNT, CYCS, STPTS, NUMBEROFNODES, BLANKS, CY,
     c ST, ND, RESTARTCYC, RESTARTSTPT, NOTIN(29,10,20,50)
*
      REAL EFPDVALUES(10,20), CONCENTRATION, ISOVALUE(50),
     c MO95DATA(10,20,50), TC99DATA(10,20,50), RU101DATA(10,20,50),
     c RH103DATA(10,20,50), AG109DATA(10,20,50), ND143DATA(10,20,50),
     c ND145DATA(10,20,50), SM147DATA(10,20,50), SM149DATA(10,20,50),
     c SM150DATA(10,20,50), SM151DATA(10,20,50), SM152DATA(10,20,50),
     c EU151DATA(10,20,50), EU153DATA(10,20,50), GD155DATA(10,20,50),
     c U233DATA(10,20,50), U234DATA(10,20,50), U235DATA(10,20,50),
     c U236DATA(10,20,50), U238DATA(10,20,50), NP237DATA(10,20,50),
     c PU238DATA(10,20,50), PU239DATA(10,20,50), PU240DATA(10,20,50),
     c PU241DATA(10,20,50), PU242DATA(10,20,50), AM241DATA(10,20,50),
     c AM242MDATA(10,20,50), AM243DATA(10,20,50), NODEHEIGHT(50),
     c FUELTEMPDATA(10,20,50), MODSPECVOLDATA(10,20,50),
     c BURNUPDATA(10,20,50), TOTALHEIGHT, AVERAGE, RUNNINGTOTAL,
     c NORMALIZED(50), BURNUPLAST(50), FTBURN(50), MSVBURN(50),
     c ISOTOPICDATA(10,20,50), AVESUM1
*
      LOGICAL TRIP, ROWFLAGLOG, ACTINIDEFIND, FISSPRODFIND,
     c NODEDATAFOUND
*
      CHARACTER PIORIG(29)*6, FILENM*29, ANSWER3*3,
     c CYCLEINFO(2,10)*2, CH1*1, CH2*1, CHSTPT1*1, CHSTPT2*1,
     c CHSTPT3*1, CHSTPT4*1, CHSTPT5*1, CHSTPT6*1, COL1*8,
     c COL2*8, COL3*8, COL4*8, COL5*8, COL6*8, COL7*8, COL8*8,
     c ROWFLAG*7, ACTINIDELABEL*9, FORMATLABEL*29, ISOLABEL*6,
     c FISSPRODLABEL*16, CRAFTINPUTNM*10, SEARCH1*3, CONFIRM1*2,
     c CONFIRM2*2, CONFIRM3*2, RESULTSFILE*14
*
      LOGICAL RESTART, NOTPRESENT
*
      DATA (PIORIG(X),X=1,29) /'mo 95 ','tc 99 ','ru101 ','rh103 ',
     c'ag109 ','nd143 ','nd145 ','sm147 ','sm149 ','sm150 ',
     c'sm151 ','sm152 ','eu151 ','eu153 ','gd155 ',' u233 ',
     c' u234 ',' u235 ',' u236 ',' u238 ','np237 ','pu238 ',
     c'pu239 ','pu240 ','pu241 ','pu242 ','am241 ','am242m',
     c'am243 '/
*
***** Retrieve the principal isotope results.
      DO 8 X0=1,29
         DO 6 X1=1,10
            DO 4 X2=1,20
               DO 2 X3=1,50
                  NOTIN(X0,X1,X2,X3)=0
    2          CONTINUE
    4       CONTINUE
    6    CONTINUE
    8 CONTINUE
      DO 180 PI=1,29
         IF (RESTART.EQ..TRUE.) THEN
```

```
      CYCSTART=RESTARTCYC
      STPTSTART=RESTARTSTPT
   ELSE
      CYCSTART=1
      STPTSTART=1
   ENDIF
   DO 170 CYC=CYCSTART,NUMBEROFCYCLES
      DO 160 STPT=STPTSTART,NUMBEROFSTPTS(CYC)
         IF ((CYC.EQ.1).AND.(STPT.EQ.1)) THEN
            TRIP=.TRUE.
         ELSE
            TRIP=.FALSE.
         ENDIF
         IF (TRIP.EQ..FALSE.) THEN
            DO 150 NODE=1,NUMBEROFNODES
               FILENM(1:3)=ANSWER3
               FILENM(4:4)='A'
               IF (EFPDVALUES(CYC,STPT).EQ.0) THEN
                  FILENM(5:6)=CYCLEINFO(2,(CYC-1))
               ELSE
                  FILENM(5:6)=CYCLEINFO(2,CYC)
               ENDIF
               FILENM(7:7)='N'
               CH1=CHAR(INT(NODE/10.0)+48)
               CH2=CHAR(INT(NODE-(INT(NODE/10.0)*10))+48)
               FILENM(8:8)=CH1
               FILENM(9:9)=CH2
               FILENM(10:11)='DC'
               IF (EFPDVALUES(CYC,STPT).EQ.0) THEN
                  FILENM(12:13)=CYCLEINFO(1,(CYC-1))
               ELSE
                  FILENM(12:13)=CYCLEINFO(1,CYC)
               ENDIF
               FILENM(14:14)='T'
               IF (EFPDVALUES(CYC,STPT).EQ.0) THEN
                  NUMSTPT1=INT(EFPDVALUES((CYC-1),
c                 (NUMBEROFSTPTS(CYC-1)))/100.0)
                  CHSTPT1=CHAR(NUMSTPT1+48)
                  NUMSTPT2=INT((EFPDVALUES((CYC-1),
c                 (NUMBEROFSTPTS(CYC-1)))-
c                 (NUMSTPT1*100.0))/10.0)
                  CHSTPT2=CHAR(NUMSTPT2+48)
                  NUMSTPT3=INT(EFPDVALUES((CYC-1),
c                 (NUMBEROFSTPTS(CYC-1)))-
c                 (NUMSTPT1*100.0)-(NUMSTPT2*10.0))
                  CHSTPT3=CHAR(NUMSTPT3+48)
               ELSE
                  NUMSTPT1=INT(EFPDVALUES(CYC,
c                 (STPT-1))/100.0)
                  CHSTPT1=CHAR(NUMSTPT1+48)
                  NUMSTPT2=INT((EFPDVALUES(CYC,
c                 (STPT-1))-(NUMSTPT1*100.0))/10.0)
                  CHSTPT2=CHAR(NUMSTPT2+48)
                  NUMSTPT3=INT(EFPDVALUES(CYC,
c                 (STPT-1))-(NUMSTPT1*100.0)-
c                 (NUMSTPT2*10.0))
                  CHSTPT3=CHAR(NUMSTPT3+48)
               ENDIF
               NUMSTPT4=INT(EFPDVALUES(CYC,
c              STPT)/100.0)
```

```
                    CHSTPT4=CHAR(NUMSTPT4+48)
                    NUMSTPT5=INT((EFPDVALUES(CYC,
     c              STPT)-(NUMSTPT4*100.0))/10.0)
                    CHSTPT5=CHAR(NUMSTPT5+48)
                    NUMSTPT6=INT(EFPDVALUES(CYC,
     c              STPT)-(NUMSTPT4*100.0)-
     c              (NUMSTPT5*10.0))
                    CHSTPT6=CHAR(NUMSTPT6+48)
                    FILENM(15:15)=CHSTPT1
                    FILENM(16:16)=CHSTPT2
                    FILENM(17:17)=CHSTPT3
                    FILENM(18:19)='AC'
                    FILENM(20:21)=CYCLEINFO(1,CYC)
                    FILENM(22:22)='T'
                    FILENM(23:23)=CHSTPT4
                    FILENM(24:24)=CHSTPT5
                    FILENM(25:25)=CHSTPT6
                    FILENM(26:29)='.cut'
***** Open and rewind the '*.cut' file.
      OPEN(UNIT=300,FILE=FILENM,STATUS='OLD')
      REWIND(UNIT=300)
***** Determine the appropriate column containing the isotopic data.
      ROWFLAGLOG=.FALSE.
      DO 11 WHILE (ROWFLAGLOG.EQ..FALSE.)
         READ (300,10) ROWFLAG, COL1, COL2, COL3,
     c   COL4, COL5, COL6, COL7, COL8
   10    FORMAT (T15,A7,T24,A8,T34,A8,T44,A8,T54,A8,
     c   T64,A8,T74,A8,T84,A8,T94,A8)
         IF (ROWFLAG.EQ.'initial') THEN
            ROWFLAGLOG=.TRUE.
         ENDIF
   11 CONTINUE
      IF (COL1.NE.'         ') THEN
         COLUMNSTART=23
         COLUMNEND=32
      ENDIF
      IF (COL2.NE.'         ') THEN
         COLUMNSTART=33
         COLUMNEND=42
      ENDIF
      IF (COL3.NE.'         ') THEN
         COLUMNSTART=43
         COLUMNEND=52
      ENDIF
      IF (COL4.NE.'         ') THEN
         COLUMNSTART=53
         COLUMNEND=62
      ENDIF
      IF (COL5.NE.'         ') THEN
         COLUMNSTART=63
         COLUMNEND=72
      ENDIF
      IF (COL6.NE.'         ') THEN
         COLUMNSTART=73
         COLUMNEND=82
      ENDIF
      IF (COL7.NE.'         ') THEN
         COLUMNSTART=83
         COLUMNEND=92
      ENDIF
```

```
      IF (COL8.NE.'         ') THEN
         COLUMNSTART=93
         COLUMNEND=102
      ENDIF
***** Retrieve actinide isotopic data for tabulation.
      IF (PI.GE.16) THEN
      REWIND(300)
      ACTINIDEFIND=.FALSE.
      DO 50 WHILE (ACTINIDEFIND.EQ..FALSE.)
         READ(300,30) ACTINIDELABEL
   30    FORMAT (T103,A9)
         IF (ACTINIDELABEL.EQ.'actinides') THEN
            READ(300,*)
            READ(300,40) FORMATLABEL
   40       FORMAT (T46,A29)
            IF (FORMATLABEL.EQ.'nuclide concentrations, grams') THEN
               ACTINIDEFIND=.TRUE.
            ENDIF
         ENDIF
   50 CONTINUE
      READ(300,*)
      READ(300,*)
      ISOLABEL='      '
      NOTPRESENT=.FALSE.
      DO 70 WHILE ((ISOLABEL.NE.PIORIG(PI)).AND.
     c (NOTPRESENT.EQ..FALSE.))
         READ(300,60) ISOLABEL, CONCENTRATION
   60    FORMAT(T6,A6,T<COLUMNSTART>,G10.2)
         IF (ISOLABEL.EQ.PIORIG(PI)) THEN
            ISOVALUE(NODE)=CONCENTRATION
         ELSEIF (ISOLABEL.EQ.'tal    ') THEN
            NOTPRESENT=.TRUE.
            NOTIN(PI,CYC,STPT,NODE)=1
            ISOVALUE(NODE)=0
         ENDIF
   70 CONTINUE
***** Retrieve fission product isotopic data for tabulation.
      ELSE
      FISSPRODFIND=.FALSE.
      DO 110 WHILE (FISSPRODFIND.EQ..FALSE.)
         READ(300,90) FISSPRODLABEL
   90    FORMAT (T96,A16)
         IF (FISSPRODLABEL.EQ.'fission products') THEN
            READ(300,*)
            READ(300,100) FORMATLABEL
  100       FORMAT (T46,A29)
            IF (FORMATLABEL.EQ.'nuclide concentrations, grams') THEN
               FISSPRODFIND=.TRUE.
            ENDIF
         ENDIF
  110 CONTINUE
      READ(300,*)
      READ(300,*)
      ISOLABEL='      '
      NOTPRESENT=.FALSE.
      DO 130 WHILE ((ISOLABEL.NE.PIORIG(PI)).AND.
     c (NOTPRESENT.EQ..FALSE.))
         READ(300,120) ISOLABEL, CONCENTRATION
  120    FORMAT(T6,A6,T<COLUMNSTART>,G10.2)
         IF (ISOLABEL.EQ.'      ') THEN
```

```
            READ(300,*)
            READ(300,*)
            READ(300,*)
            READ(300,*)
            READ(300,*)
         ENDIF
         IF (ISOLABEL.EQ.PIORIG(PI)) THEN
            ISOVALUE(NODE)=CONCENTRATION
         ELSEIF (ISOLABEL.EQ.'tal    ') THEN
            NOTPRESENT=.TRUE.
            NOTIN(PI,CYC,STPT,NODE)=1
            ISOVALUE(NODE)=0
         ENDIF
  130 CONTINUE
      ENDIF
***** Record isotopic concentration retrieved.
      IF (PI.EQ.1) THEN
         MO95DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.2) THEN
         TC99DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.3) THEN
         RU101DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.4) THEN
         RH103DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.5) THEN
         AG109DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.6) THEN
         ND143DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.7) THEN
         ND145DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.8) THEN
         SM147DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.9) THEN
         SM149DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.10) THEN
         SM150DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.11) THEN
         SM151DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.12) THEN
         SM152DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.13) THEN
         EU151DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.14) THEN
         EU153DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.15) THEN
         GD155DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.16) THEN
         U233DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.17) THEN
         U234DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.18) THEN
         U235DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.19) THEN
         U236DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.20) THEN
         U238DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.21) THEN
         NP237DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.22) THEN
         PU238DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
```

```
      ELSEIF (PI.EQ.23) THEN
         PU239DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.24) THEN
         PU240DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.25) THEN
         PU241DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.26) THEN
         PU242DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.27) THEN
         AM241DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.28) THEN
         AM242MDATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.29) THEN
         AM243DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ENDIF
***** Close loops.
  150             CONTINUE
                ENDIF
  160         CONTINUE
  170       CONTINUE
  180 CONTINUE
***** Open and rewind the CRAFT input file.
      OPEN(UNIT=400,FILE=CRAFTINPUTNM,STATUS='OLD')
      REWIND(UNIT=400)
***** Get node height information.
      NODEDATAFOUND=.FALSE.
      DO 195 WHILE (NODEDATAFOUND.EQ..FALSE.)
         READ(400,185) SEARCH1
  185    FORMAT(A3)
         IF (SEARCH1.EQ.'18 ') THEN
            READ(400,190) CONFIRM1
            READ(400,190) CONFIRM2
            READ(400,190) CONFIRM3
  190       FORMAT(A2)
            IF ((CONFIRM1.EQ.'1 ').AND.(CONFIRM2.EQ.'2 ')
     c      .AND.(CONFIRM3.EQ.'3 ')) THEN
               BACKSPACE(400)
               BACKSPACE(400)
               BACKSPACE(400)
               NODEDATAFOUND=.TRUE.
            ENDIF
         ENDIF
  195 CONTINUE
      DO 205 COUNT=1,NUMBEROFNODES
         READ(400,200) NODEHEIGHT(COUNT)
  200    FORMAT(T4,G15.5)
  205 CONTINUE
      NODEDATAFOUND=.FALSE.
      DO 220 WHILE (NODEDATAFOUND.EQ..FALSE.)
         READ(400,210) SEARCH1
  210    FORMAT(T1,A3)
         IF (SEARCH1.EQ.'18 ') THEN
            READ(400,215) CONFIRM1
            READ(400,215) CONFIRM2
            READ(400,215) CONFIRM3
  215       FORMAT(T1,A2)
            IF ((CONFIRM1.EQ.'1 ').AND.(CONFIRM2.EQ.'2 ')
     c      .AND.(CONFIRM3.EQ.'3 ')) THEN
               BACKSPACE(400)
               BACKSPACE(400)
```

```
            BACKSPACE(400)
            NODEDATAFOUND=.TRUE.
         ENDIF
      ENDIF
220 CONTINUE
    DO 265 CYCS=1,NUMBEROFCYCLES
      IF (CYCS.LT.NUMBEROFCYCLES) THEN
      DO 240 STPTS=1,NUMBEROFSTPTS(CYCS)
         DO 225 COUNT=1,NUMBEROFNODES
            READ(400,*)
225      CONTINUE
         DO 235 COUNT=1,NUMBEROFNODES
            READ(400,230) FUELTEMPDATA(CYCS,STPTS,COUNT)
230         FORMAT(T1,G10.4)
235      CONTINUE
         READ(400,*)
240   CONTINUE
      ELSEIF (CYCS.EQ.NUMBEROFCYCLES) THEN
      DO 260 STPTS=1,(NUMBEROFSTPTS(CYCS)-1)
         DO 245 COUNT=1,NUMBEROFNODES
            READ(400,*)
245      CONTINUE
         DO 255 COUNT=1,NUMBEROFNODES
            READ(400,250) FUELTEMPDATA(CYCS,STPTS,COUNT)
250         FORMAT(T1,G10.4)
255      CONTINUE
         READ(400,*)
260   CONTINUE
      ENDIF
265 CONTINUE
    DO 310 CYCS=1,NUMBEROFCYCLES
      IF (CYCS.LT.NUMBEROFCYCLES) THEN
      DO 285 STPTS=1,NUMBEROFSTPTS(CYCS)
         DO 270 COUNT=1,NUMBEROFNODES
            READ(400,*)
270      CONTINUE
         DO 280 COUNT=1,NUMBEROFNODES
            READ(400,275) MODSPECVOLDATA(CYCS,STPTS,COUNT)
275         FORMAT(T1,G10.4)
280      CONTINUE
         READ(400,*)
285   CONTINUE
      ELSEIF (CYCS.EQ.NUMBEROFCYCLES) THEN
      DO 305 STPTS=1,(NUMBEROFSTPTS(CYCS)-1)
         DO 290 COUNT=1,NUMBEROFNODES
            READ(400,*)
290      CONTINUE
         DO 300 COUNT=1,NUMBEROFNODES
            READ(400,295) MODSPECVOLDATA(CYCS,STPTS,COUNT)
295         FORMAT(T1,G10.4)
300      CONTINUE
         READ(400,*)
305   CONTINUE
      ENDIF
310 CONTINUE
    DO 335 CYCS=1,NUMBEROFCYCLES
      DO 330 STPTS=1,NUMBEROFSTPTS(CYCS)
         DO 315 COUNT=1,NUMBEROFNODES
            READ(400,*)
315      CONTINUE
```

```
            DO 325 COUNT=1,NUMBEROFNODES
               READ(400,320) BURNUPDATA(CYCS,STPTS,COUNT)
 320           FORMAT(T1,G10.4)
 325        CONTINUE
            IF (CYCS.LT.NUMBEROFCYCLES) THEN
               READ(400,*)
            ELSEIF ((CYCS.EQ.NUMBEROFCYCLES).AND.
     c      (STPTS.LT.NUMBEROFSTPTS(CYCS))) THEN
               READ(400,*)
            ENDIF
 330     CONTINUE
 335  CONTINUE
***** Write the isotopic data tables to file.
***** Determine the filename and open the file.
      BLANKS=0
      DO 340 COUNT=1,10
         IF (CRAFTINPUTNM(COUNT:COUNT).EQ.' ') THEN
            BLANKS=BLANKS+1
         ENDIF
 340  CONTINUE
      RESULTSFILE(1:(10-BLANKS-5))=
     cCRAFTINPUTNM(1:(10-BLANKS-5))
      RESULTSFILE((10-BLANKS-4):(10-BLANKS+4))='.results'
      RESULTSFILE((10-BLANKS+5):14)=' '
      OPEN(UNIT=500,FILE=RESULTSFILE,STATUS='UNKNOWN')
      REWIND(UNIT=500)
*
      DO 1015 PI=1,29
         DO 341 N=1,NUMBEROFNODES
            FTBURN(N)=0.0
            MSVBURN(N)=0.0
            BURNUPLAST(N)=0.0
 341     CONTINUE
         DO 1010 CYC=1,NUMBEROFCYCLES
            DO 1005 STPT=1,NUMBEROFSTPTS(CYC)
               IF ((CYC.EQ.1).AND.(STPT.EQ.1)) THEN
                  TRIP=.TRUE.
               ELSE
                  TRIP=.FALSE.
               ENDIF
               IF (TRIP.EQ..FALSE.) THEN
                  WRITE(500,345) CRAFTINPUTNM
 345              FORMAT(T1,'CRAFT CALCULATION: ',A10)
                  WRITE(500,*)
                  WRITE(500,350) PIORIG(PI)
 350              FORMAT(T1,'ISOTOPE: ',A6)
                  WRITE(500,*)
                  WRITE(500,355) CYCLEINFO(1,CYC),
     c             EFPDVALUES(CYC,STPT),CYCLEINFO(2,CYC),
     c             ENRICHMENT
 355              FORMAT(T1,'CYCLE-',A2,2X,F5.1,1X,'EFPD',
     c             2X,'POSITION: ',A2,2X,'ENRICHMENT: ',F5.3)
                  WRITE(500,*)
                  WRITE(500,357)
 357              FORMAT(T1,56X,'BURNUP',3X,'BURNUP')
                  WRITE(500,360)
 360              FORMAT(T1,17X,'NODE',5X,'SAS2H',5X,
     c             'NORMALIZED',9X,'WEIGHTED',2X,'WEIGHTED')
                  WRITE(500,365)
 365              FORMAT(T1,9X,'NODE',3X,'CENTER',3X,'ISOTOPIC',5X,
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     c              'SAS2H',5X,'NODAL',4X,'FUEL',4X,'MODERATOR')
                   WRITE(500,370)
 370               FORMAT(T1,1X,'NODE',3X,'HEIGHT',2X,'HEIGHT',3X,
     c              'RESULTS',5X,'ISOTOPIC',2X,'BURNUP',4X,'TEMP.',
     c              3X,'DENSITY')
                   WRITE(500,375)
 375               FORMAT(T1,'NUMBER',3X,'(cm)',4X,'(cm)',4X,
     c              '(g/node)',4X,'PROFILE',2X,'(GWD/MTU)',3X,'(F)',
     c              5X,'(g/cc)')
                   WRITE(500,380)
 380               FORMAT(T1,'------------------------------------',
     c              '----------------------------------------')
      TOTALHEIGHT=0.0
      IF (PI.EQ.1) THEN
         DO 400 CY=1,10
            DO 395 ST=1,20
               DO 390 ND=1,50
                  ISOTOPICDATA(CY,ST,ND)=MO95DATA(CY,ST,ND)
 390           CONTINUE
 395        CONTINUE
 400     CONTINUE
      ELSEIF (PI.EQ.2) THEN
         DO 415 CY=1,10
            DO 410 ST=1,20
               DO 405 ND=1,50
                  ISOTOPICDATA(CY,ST,ND)=TC99DATA(CY,ST,ND)
 405           CONTINUE
 410        CONTINUE
 415     CONTINUE
      ELSEIF (PI.EQ.3) THEN
         DO 430 CY=1,10
            DO 425 ST=1,20
               DO 420 ND=1,50
                  ISOTOPICDATA(CY,ST,ND)=RU101DATA(CY,ST,ND)
 420           CONTINUE
 425        CONTINUE
 430     CONTINUE
      ELSEIF (PI.EQ.4) THEN
         DO 445 CY=1,10
            DO 440 ST=1,20
               DO 435 ND=1,50
                  ISOTOPICDATA(CY,ST,ND)=RH103DATA(CY,ST,ND)
 435           CONTINUE
 440        CONTINUE
 445     CONTINUE
      ELSEIF (PI.EQ.5) THEN
         DO 460 CY=1,10
            DO 455 ST=1,20
               DO 450 ND=1,50
                  ISOTOPICDATA(CY,ST,ND)=AG109DATA(CY,ST,ND)
 450           CONTINUE
 455        CONTINUE
 460     CONTINUE
      ELSEIF (PI.EQ.6) THEN
         DO 475 CY=1,10
            DO 470 ST=1,20
               DO 465 ND=1,50
                  ISOTOPICDATA(CY,ST,ND)=ND143DATA(CY,ST,ND)
 465           CONTINUE
 470        CONTINUE
```

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475     CONTINUE
      ELSEIF (PI.EQ.7) THEN
         DO 490 CY=1,10
            DO 485 ST=1,20
               DO 480 ND=1,50
                  ISOTOPICDATA(CY,ST,ND)=ND145DATA(CY,ST,ND)
480            CONTINUE
485         CONTINUE
490      CONTINUE
      ELSEIF (PI.EQ.8) THEN
         DO 505 CY=1,10
            DO 500 ST=1,20
               DO 495 ND=1,50
                  ISOTOPICDATA(CY,ST,ND)=SM147DATA(CY,ST,ND)
495            CONTINUE
500         CONTINUE
505      CONTINUE
      ELSEIF (PI.EQ.9) THEN
         DO 520 CY=1,10
            DO 515 ST=1,20
               DO 510 ND=1,50
                  ISOTOPICDATA(CY,ST,ND)=SM149DATA(CY,ST,ND)
510            CONTINUE
515         CONTINUE
520      CONTINUE
      ELSEIF (PI.EQ.10) THEN
         DO 535 CY=1,10
            DO 530 ST=1,20
               DO 525 ND=1,50
                  ISOTOPICDATA(CY,ST,ND)=SM150DATA(CY,ST,ND)
525            CONTINUE
530         CONTINUE
535      CONTINUE
      ELSEIF (PI.EQ.11) THEN
         DO 550 CY=1,10
            DO 545 ST=1,20
               DO 540 ND=1,50
                  ISOTOPICDATA(CY,ST,ND)=SM151DATA(CY,ST,ND)
540            CONTINUE
545         CONTINUE
550      CONTINUE
      ELSEIF (PI.EQ.12) THEN
         DO 565 CY=1,10
            DO 560 ST=1,20
               DO 555 ND=1,50
                  ISOTOPICDATA(CY,ST,ND)=SM152DATA(CY,ST,ND)
555            CONTINUE
560         CONTINUE
565      CONTINUE
      ELSEIF (PI.EQ.13) THEN
         DO 580 CY=1,10
            DO 575 ST=1,20
               DO 570 ND=1,50
                  ISOTOPICDATA(CY,ST,ND)=EU151DATA(CY,ST,ND)
570            CONTINUE
575         CONTINUE
580      CONTINUE
      ELSEIF (PI.EQ.14) THEN
         DO 595 CY=1,10
            DO 590 ST=1,20
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                DO 585 ND=1,50
                   ISOTOPICDATA(CY,ST,ND)=EU153DATA(CY,ST,ND)
 585            CONTINUE
 590         CONTINUE
 595      CONTINUE
       ELSEIF (PI.EQ.15) THEN
          DO 610 CY=1,10
             DO 605 ST=1,20
                DO 600 ND=1,50
                   ISOTOPICDATA(CY,ST,ND)=GD155DATA(CY,ST,ND)
 600            CONTINUE
 605         CONTINUE
 610      CONTINUE
       ELSEIF (PI.EQ.16) THEN
          DO 625 CY=1,10
             DO 620 ST=1,20
                DO 615 ND=1,50
                   ISOTOPICDATA(CY,ST,ND)=U233DATA(CY,ST,ND)
 615            CONTINUE
 620         CONTINUE
 625      CONTINUE
       ELSEIF (PI.EQ.17) THEN
          DO 640 CY=1,10
             DO 635 ST=1,20
                DO 630 ND=1,50
                   ISOTOPICDATA(CY,ST,ND)=U234DATA(CY,ST,ND)
 630            CONTINUE
 635         CONTINUE
 640      CONTINUE
       ELSEIF (PI.EQ.18) THEN
          DO 655 CY=1,10
             DO 650 ST=1,20
                DO 645 ND=1,50
                   ISOTOPICDATA(CY,ST,ND)=U235DATA(CY,ST,ND)
 645            CONTINUE
 650         CONTINUE
 655      CONTINUE
       ELSEIF (PI.EQ.19) THEN
          DO 670 CY=1,10
             DO 665 ST=1,20
                DO 660 ND=1,50
                   ISOTOPICDATA(CY,ST,ND)=U236DATA(CY,ST,ND)
 660            CONTINUE
 665         CONTINUE
 670      CONTINUE
       ELSEIF (PI.EQ.20) THEN
          DO 685 CY=1,10
             DO 680 ST=1,20
                DO 675 ND=1,50
                   ISOTOPICDATA(CY,ST,ND)=U238DATA(CY,ST,ND)
 675            CONTINUE
 680         CONTINUE
 685      CONTINUE
       ELSEIF (PI.EQ.21) THEN
          DO 700 CY=1,10
             DO 695 ST=1,20
                DO 690 ND=1,50
                   ISOTOPICDATA(CY,ST,ND)=NP237DATA(CY,ST,ND)
 690            CONTINUE
 695         CONTINUE
```

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700     CONTINUE
      ELSEIF (PI.EQ.22) THEN
         DO 715 CY=1,10
            DO 710 ST=1,20
               DO 705 ND=1,50
                  ISOTOPICDATA(CY,ST,ND)=PU238DATA(CY,ST,ND)
705            CONTINUE
710         CONTINUE
715      CONTINUE
      ELSEIF (PI.EQ.23) THEN
         DO 730 CY=1,10
            DO 725 ST=1,20
               DO 720 ND=1,50
                  ISOTOPICDATA(CY,ST,ND)=PU239DATA(CY,ST,ND)
720            CONTINUE
725         CONTINUE
730      CONTINUE
      ELSEIF (PI.EQ.24) THEN
         DO 745 CY=1,10
            DO 740 ST=1,20
               DO 735 ND=1,50
                  ISOTOPICDATA(CY,ST,ND)=PU240DATA(CY,ST,ND)
735            CONTINUE
740         CONTINUE
745      CONTINUE
      ELSEIF (PI.EQ.25) THEN
         DO 760 CY=1,10
            DO 755 ST=1,20
               DO 750 ND=1,50
                  ISOTOPICDATA(CY,ST,ND)=PU241DATA(CY,ST,ND)
750            CONTINUE
755         CONTINUE
760      CONTINUE
      ELSEIF (PI.EQ.26) THEN
         DO 775 CY=1,10
            DO 770 ST=1,20
               DO 765 ND=1,50
                  ISOTOPICDATA(CY,ST,ND)=PU242DATA(CY,ST,ND)
765            CONTINUE
770         CONTINUE
775      CONTINUE
      ELSEIF (PI.EQ.27) THEN
         DO 790 CY=1,10
            DO 785 ST=1,20
               DO 780 ND=1,50
                  ISOTOPICDATA(CY,ST,ND)=AM241DATA(CY,ST,ND)
780            CONTINUE
785         CONTINUE
790      CONTINUE
      ELSEIF (PI.EQ.28) THEN
         DO 805 CY=1,10
            DO 800 ST=1,20
               DO 795 ND=1,50
                  ISOTOPICDATA(CY,ST,ND)=AM242MDATA(CY,ST,ND)
795            CONTINUE
800         CONTINUE
805      CONTINUE
      ELSEIF (PI.EQ.29) THEN
         DO 820 CY=1,10
            DO 815 ST=1,20
```

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               DO 810 ND=1,50
                  ISOTOPICDATA(CY,ST,ND)=AM243DATA(CY,ST,ND)
 810           CONTINUE
 815        CONTINUE
 820     CONTINUE
      ENDIF
      DO 382 ND=1,50
         IF (ISOTOPICDATA(CYC,STPT,ND).NE.0) THEN
            TOTALHEIGHT=TOTALHEIGHT+NODEHEIGHT(ND)
         ELSE
            TOTALHEIGHT=TOTALHEIGHT
         ENDIF
 382  CONTINUE
        AVESUM1=0.0
        DO 822 ND=1,50
           AVESUM1=AVESUM1+(ISOTOPICDATA(CYC,STPT,ND)*
     c     NODEHEIGHT(ND))
 822    CONTINUE
        AVERAGE=AVESUM1/TOTALHEIGHT
        IF (STPT.EQ.1) THEN
           RUNNINGTOTAL=0.0
         DO 825 NODE=1,NUMBEROFNODES
               RUNNINGTOTAL=RUNNINGTOTAL+NODEHEIGHT(NODE)
               NORMALIZED(NODE)=(ISOTOPICDATA(CYC,STPT,NODE)/
     c         AVERAGE)
            IF (NOTIN(PI,CYC,STPT,NODE).EQ.0) THEN
               WRITE(500,1000) NODE,NODEHEIGHT(NODE),
     c         (RUNNINGTOTAL-(NODEHEIGHT(NODE)/2.0)),
     c         ISOTOPICDATA(CYC,STPT,NODE),NORMALIZED(NODE),
     c         BURNUPDATA(CYC,STPT,NODE),
     c         (((FUELTEMPDATA((CYC-1),NUMBEROFSTPTS(CYC-1),NODE)*
     c         (BURNUPDATA(CYC,STPT,NODE)-BURNUPLAST(NODE)))
     c         +FTBURN(NODE))/BURNUPDATA(CYC,STPT,NODE)),
     c         (1/((((MODSPECVOLDATA((CYC-1),NUMBEROFSTPTS(CYC-1)
     c         ,NODE)*(BURNUPDATA(CYC,STPT,NODE)-
     c         BURNUPLAST(NODE)))+MSVBURN(NODE))/
     c         BURNUPDATA(CYC,STPT,NODE))*62.42691))
            ELSEIF (NOTIN(PI,CYC,STPT,NODE).EQ.1) THEN
               WRITE(500,1002) NODE,NODEHEIGHT(NODE),
     c         (RUNNINGTOTAL-(NODEHEIGHT(NODE)/2.0)),
     c         BURNUPDATA(CYC,STPT,NODE),
     c         (((FUELTEMPDATA((CYC-1),NUMBEROFSTPTS(CYC-1),NODE)*
     c         (BURNUPDATA(CYC,STPT,NODE)-BURNUPLAST(NODE)))
     c         +FTBURN(NODE))/BURNUPDATA(CYC,STPT,NODE)),
     c         (1/((((MODSPECVOLDATA((CYC-1),NUMBEROFSTPTS(CYC-1)
     c         ,NODE)*(BURNUPDATA(CYC,STPT,NODE)-
     c         BURNUPLAST(NODE)))+MSVBURN(NODE))/
     c         BURNUPDATA(CYC,STPT,NODE))*62.42691))
            ENDIF
           FTBURN(NODE)=FTBURN(NODE)+
     c     (FUELTEMPDATA((CYC-1),NUMBEROFSTPTS(CYC-1),NODE)*
     c     (BURNUPDATA(CYC,STPT,NODE)-BURNUPLAST(NODE)))
           MSVBURN(NODE)=MSVBURN(NODE)+
     c     (MODSPECVOLDATA((CYC-1),NUMBEROFSTPTS(CYC-1),NODE)*
     c     (BURNUPDATA(CYC,STPT,NODE)-BURNUPLAST(NODE)))
           BURNUPLAST(NODE)=BURNUPDATA(CYC,STPT,NODE)
 825     CONTINUE
        ELSE
           RUNNINGTOTAL=0.0
        DO 830 NODE=1,NUMBEROFNODES
```

```
                RUNNINGTOTAL=RUNNINGTOTAL+NODEHEIGHT(NODE)
                NORMALIZED(NODE)=(ISOTOPICDATA(CYC,STPT,NODE)/
     c          AVERAGE)
              IF (NOTIN(PI,CYC,STPT,NODE).EQ.0) THEN
                WRITE(500,1000) NODE,NODEHEIGHT(NODE),
     c          (RUNNINGTOTAL-(NODEHEIGHT(NODE)/2.0)),
     c          ISOTOPICDATA(CYC,STPT,NODE),NORMALIZED(NODE),
     c          BURNUPDATA(CYC,STPT,NODE),
     c          (((FUELTEMPDATA(CYC,(STPT-1),NODE)*
     c          (BURNUPDATA(CYC,STPT,NODE)-BURNUPLAST(NODE)))
     c          +FTBURN(NODE))/BURNUPDATA(CYC,STPT,NODE)),
     c          (1/((((MODSPECVOLDATA(CYC,(STPT-1)
     c          ,NODE)*(BURNUPDATA(CYC,STPT,NODE)-
     c          BURNUPLAST(NODE)))+MSVBURN(NODE))/
     c          BURNUPDATA(CYC,STPT,NODE))*62.42691))
              ELSEIF (NOTIN(PI,CYC,STPT,NODE).EQ.1) THEN
                WRITE(500,1002) NODE,NODEHEIGHT(NODE),
     c          (RUNNINGTOTAL-(NODEHEIGHT(NODE)/2.0)),
     c          ISOTOPICDATA(CYC,STPT,NODE),NORMALIZED(NODE),
     c          BURNUPDATA(CYC,STPT,NODE),
     c          (((FUELTEMPDATA(CYC,(STPT-1),NODE)*
     c          (BURNUPDATA(CYC,STPT,NODE)-BURNUPLAST(NODE)))
     c          +FTBURN(NODE))/BURNUPDATA(CYC,STPT,NODE)),
     c          (1/((((MODSPECVOLDATA(CYC,(STPT-1)
     c          ,NODE)*(BURNUPDATA(CYC,STPT,NODE)-
     c          BURNUPLAST(NODE)))+MSVBURN(NODE))/
     c          BURNUPDATA(CYC,STPT,NODE))*62.42691))
              ENDIF
              FTBURN(NODE)=FTBURN(NODE)+
     c        (FUELTEMPDATA(CYC,(STPT-1),NODE)*
     c        (BURNUPDATA(CYC,STPT,NODE)-BURNUPLAST(NODE)))
              MSVBURN(NODE)=MSVBURN(NODE)+
     c        (MODSPECVOLDATA(CYC,(STPT-1),NODE)*
     c        (BURNUPDATA(CYC,STPT,NODE)-BURNUPLAST(NODE)))
              BURNUPLAST(NODE)=BURNUPDATA(CYC,STPT,NODE)
 830      CONTINUE
         ENDIF
          WRITE(500,*)
          WRITE(500,*)
1000  FORMAT(T1,2X,I2,3X,F6.2,3X,F6.2,4X,G11.6,1X,F7.5,
     c 3X,F6.3,3X,F6.1,3X,F6.5)
1002  FORMAT(T1,2X,I2,3X,F6.2,3X,F6.2,4X,'  NOT AVAILABLE   ',1X,
     c 3X,F6.3,3X,F6.1,3X,F6.5)
               ENDIF
1005        CONTINUE
1010     CONTINUE
1015  CONTINUE


      RETURN
      END
```

9. CRC_DATA_TABULIZER Version 2.0 Fortran Source Code Listing

```
      PROGRAM CRC_DATA_TABULIZER
*************************************************************
*   Subroutine to retrieve and tabularize various isotopic results *
*   and depletion parameter data from CRC depletion calculations.  *
```

```
************************************************************************
      INTEGER*4 GLOBALNUMBER, A, NUMBEROFCYCLES, NUMBEROFSTPTS(12),
     c B, C, NUMBEROFNODES, RESTARTCYC, RESTARTSTPT
*
      REAL EFPDVALUES(10,20), ENRICHMENT
*
      LOGICAL QUESTION1, SINGLE, GLOBAL, QUESTION2, MANUALLIST,
     c FILELIST, QUESTION4, QUESTION5, QUESTION6, PRINCIPALISOSET,
     c SPECIFICISO, UTOPURATIO, RESTART
*
      CHARACTER ANSWER1*1, CRAFTINPUTNM*10, ANSWER2*1,
     c ASSEMBLYARCHIVE(500)*5, ANSWER3*3, CYCLEINFO(2,12)*2,
     c ANSWER4*1, ANSWER5*1, ANSWER6*1, RESTARTANSWER*1
*
***** Get input parameters necessary to find the appropriate data
***** for tabulation.
*
      QUESTION1=.FALSE.
      DO 10 WHILE (QUESTION1.EQ..FALSE.)
         WRITE (*,*) 'Choose one of the following data',
     c   ' tabularization methods [1 or 2]:'
         WRITE (*,*)
         WRITE (*,*) '     1) Single Fuel Assembly Tabularization'
         WRITE (*,*) '     2) Global Fuel Assembly Tabularization',
     c   '[NOT AVAILABLE]'
         WRITE (*,*)
         READ (*,5) ANSWER1
    5    FORMAT(A1)
         IF (ANSWER1.EQ.'1') THEN
            SINGLE=.TRUE.
            GLOBAL=.FALSE.
            QUESTION1=.TRUE.
         ELSEIF (ANSWER1.EQ.'2') THEN
            SINGLE=.FALSE.
            GLOBAL=.TRUE.
            QUESTION1=.TRUE.
         ELSEIF ((ANSWER1.NE.'1').AND.(ANSWER1.NE.'2')) THEN
            WRITE (*,*) 'You must choose from available list.'
            QUESTION1=.FALSE.
         ENDIF
   10 CONTINUE
      IF (SINGLE.EQ..TRUE.) THEN
         RESTART=.FALSE.
         WRITE (*,*) 'Is this tabulation for the results from a',
     c   ' continuation'
         WRITE (*,*) 'of an assembly depletion sequence? [Y or N]'
         READ (*,11) RESTARTANSWER
   11    FORMAT (A1)
         IF (RESTARTANSWER.EQ.'Y') THEN
            RESTART=.TRUE.
            WRITE(*,*) 'Enter the restart relative cycle number',
     c      ' for the CRAFT calculation.'
            READ (*,*) RESTARTCYC
            WRITE(*,*) 'Enter the restart relative statepoint number',
     c      ' for the CRAFT calculation.'
            READ (*,*) RESTARTSTPT
         ENDIF
         WRITE (*,*) 'Enter the CRAFT input deck filename:'
         READ (*,*) CRAFTINPUTNM
      ELSEIF (GLOBAL.EQ..TRUE.) THEN
```

```
      QUESTION2=.FALSE.
      DO 25 WHILE (QUESTION2.EQ..FALSE.)
         WRITE (*,*) 'Choose one of the following methods for',
     c      ' entering the assembly archiving identifiers:'
         WRITE (*,*) '     1) List assembly archiving identifiers',
     c      ' manually'
         WRITE (*,*) '     2) Use a list of assembly archiving',
     c      ' identifiers in a file entitled "assylist"'
         READ (*,20) ANSWER2
  20     FORMAT (A1)
         IF (ANSWER2.EQ.'1') THEN
            MANUALLIST=.TRUE.
            FILELIST=.FALSE.
            QUESTION2=.TRUE.
         ELSEIF (ANSWER2.EQ.'2') THEN
            MANUALLIST=.FALSE.
            FILELIST=.TRUE.
            QUESTION2=.TRUE.
         ELSEIF ((ANSWER2.NE.'1').AND.(ANSWER2.NE.'2')) THEN
            WRITE (*,*) 'You must choose from available list.'
            QUESTION2=.FALSE.
         ENDIF
  25     CONTINUE
      IF (MANUALLIST.EQ..TRUE.) THEN
         WRITE (*,*) 'Enter the number of assemblies included',
     c      ' in the global tabularization:'
         READ (*,*) GLOBALNUMBER
         DO 35 A=1,GLOBALNUMBER
            READ (*,30) ASSEMBLYARCHIVE (A)
  30        FORMAT (A5)
            WRITE (*,*) (GLOBALNUMBER-A),
     c      ' assembly identifiers left to go'
  35     CONTINUE
      ELSEIF (FILELIST.EQ..TRUE.) THEN
         OPEN (UNIT=20,FILE='assylist',STATUS='OLD')
         REWIND (UNIT=20)
         DO 42 A=1,GLOBALNUMBER
********* Other data may need to be added to the input obtained from this file.

            READ (20,40) ASSEMBLYARCHIVE (A)
  40        FORMAT (A5)
  42        CONTINUE
      ENDIF
   ENDIF
   WRITE (*,*) 'Enter the number of axial nodes specified in the',
    c' CRAFT calculation.'
   READ (*,*) NUMBEROFNODES
   WRITE (*,*) 'Enter the initial U-235 enrichment:'
   READ (*,*) ENRICHMENT
   WRITE(*,*)
   WRITE (*,*) 'Enter the 3 character reactor prefix',
    c 'identifier used in the CRAFT calculation(s):'
   READ (*,45) ANSWER3
  45 FORMAT (A3)
   IF (SINGLE.EQ..TRUE.) THEN
      QUESTION4=.FALSE.
      DO 65 WHILE (QUESTION4.EQ..FALSE.)
         WRITE (*,*) 'Enter the number of reactor cycles in',
     c      ' which the assembly is inserted:'
         READ (*,*) NUMBEROFCYCLES
```

```
      WRITE (*,*) 'For each reactor cycle of insertion, enter',
     c ' the following'
      WRITE (*,*) 'information delineated by a single space:'
      WRITE (*,*)
      WRITE (*,*) '    1) Reactor cycle identifier used',
     c '       in the CRAFT calculation [2 CHARACTERS]'
      WRITE (*,*) '    2) Integer position of assembly in the',
     c ' cycle [2 CHARACTERS]'
      WRITE (*,*) '    3) Number of CRC statepoints in the cycle',
     c '       as defined in the CRAFT calculation [INTEGER]'
      WRITE (*,*)
      WRITE (*,*) 'Each line should contain information for one',
     c ' insertion reactor cycle.'
      DO 55 A=1,NUMBEROFCYCLES
         READ (*,50) CYCLEINFO(1,A), CYCLEINFO(2,A),
     c   NUMBEROFSTPTS(A)
50       FORMAT (A2,1X,A2,1X,I2)
55    CONTINUE
      WRITE(*,*) 'Is the previous cycle information',
     c ' correct? [Y or N]'
      READ(*,60) ANSWER4
60    FORMAT (A1)
      IF (ANSWER4.NE.'Y') THEN
         WRITE (*,*) 'Re-enter the cycle information.'
         QUESTION4=.FALSE.
      ELSE
         QUESTION4=.TRUE.
      ENDIF
65  CONTINUE
    DO 85 A=1,NUMBEROFCYCLES
       DO 80 WHILE (QUESTION5.EQ..FALSE.)
          WRITE(*,*) 'Enter the statepoint EFPD values as',
     c    ' designated in the CRAFT'
          WRITE(*,*) 'calculations for Cycle-',CYCLEINFO(1,A),
     c    ', delineated by carriage returns:'
          DO 70 B=1,NUMBEROFSTPTS(A)
             READ(*,*) EFPDVALUES(A,B)
70        CONTINUE
          WRITE(*,*) 'Are you satisfied with the following EFPD',
     c    ' values for Cycle-',CYCLEINFO(1,A),'? [Y or N]'
          DO 75 C=1,NUMBEROFSTPTS(A)
             WRITE(*,*) EFPDVALUES(A,C)
75        CONTINUE
          READ(*,78) ANSWER5
78        FORMAT(A1)
          IF (ANSWER5.NE.'Y') THEN
             WRITE (*,*) 'Re-enter the statepoint information.'
             QUESTION5=.FALSE.
          ELSE
             QUESTION5=.TRUE.
          ENDIF
80     CONTINUE
       IF (A.EQ.NUMBEROFCYCLES) THEN
          QUESTION5=.TRUE.
       ELSE
          QUESTION5=.FALSE.
       ENDIF
85  CONTINUE
    QUESTION6=.FALSE.
    DO 95 WHILE (QUESTION6.EQ..FALSE.)
```

```
            WRITE(*,*) 'Choose of the following isotopic sets for',
     c      ' tabulation:'
            WRITE(*,*)
            WRITE(*,*) '     1) Principal isotope set (30 isotopes',
     c      ' total)'
            WRITE(*,*) '     2) A specific isotope [NOT AVAILABLE]'
            WRITE(*,*) '     3) The U/Pu ratio [NOT AVAILABLE]'
            WRITE(*,*)
            READ(*,90) ANSWER6
   90       FORMAT (A1)
            IF (ANSWER6.EQ.'1') THEN
               PRINCIPALISOSET=.TRUE.
               SPECIFICISO=.FALSE.
               UTOPURATIO=.FALSE.
               QUESTION6=.TRUE.
            ELSEIF (ANSWER6.EQ.'2') THEN
               PRINCIPALISOSET=.FALSE.
               SPECIFICISO=.TRUE.
               UTOPURATIO=.FALSE.
               QUESTION6=.TRUE.
            ELSEIF (ANSWER6.EQ.'3') THEN
               PRINCIPALISOSET=.FALSE.
               SPECIFICISO=.FALSE.
               UTOPURATIO=.TRUE.
               QUESTION6=.TRUE.
            ELSE
               QUESTION6=.FALSE.
               WRITE(*,*) 'You must choose from the following list.'
               WRITE(*,*)
            ENDIF
   95    CONTINUE
      ELSEIF (GLOBAL.EQ..TRUE.) THEN
         STOP
      ENDIF
      IF (SINGLE.EQ..TRUE.) THEN
         CALL SINGLEDATA(CRAFTINPUTNM,CYCLEINFO,NUMBEROFSTPTS,
     c   EFPDVALUES,NUMBEROFCYCLES,ANSWER3,NUMBEROFNODES,
     c   ENRICHMENT, RESTART, RESTARTCYC, RESTARTSTPT)
      ENDIF
      WRITE(*,*) 'TABULATION COMPLETE!'
      END
*****************************************************************************
      SUBROUTINE SINGLEDATA(CRAFTINPUTNM,CYCLEINFO,NUMBEROFSTPTS,
     c EFPDVALUES,NUMBEROFCYCLES,ANSWER3,NUMBEROFNODES,ENRICHMENT,
     c RESTART, RESTARTCYC, RESTARTSTPT)
*
      INTEGER*4 PI, CYC, STPT, NODE, NUMSTPT1, NUMSTPT2, NUMSTPT3,
     c NUMBEROFSTPTS(10), NUMSTPT4, NUMSTPT5, NUMSTPT6, COLUMNSTART,
     c COLUMNEND, COUNT, CYCS, STPTS, NUMBEROFNODES, BLANKS, CY,
     c ST, ND, RESTARTCYC, RESTARTSTPT, NOTIN(29,10,20,50)
*
      REAL EFPDVALUES(10,20), CONCENTRATION, ISOVALUE(50),
     c MO95DATA(10,20,50), TC99DATA(10,20,50), RU101DATA(10,20,50),
     c RH103DATA(10,20,50), AG109DATA(10,20,50), ND143DATA(10,20,50),
     c ND145DATA(10,20,50), SM147DATA(10,20,50), SM149DATA(10,20,50),
     c SM150DATA(10,20,50), SM151DATA(10,20,50), SM152DATA(10,20,50),
     c EU151DATA(10,20,50), EU153DATA(10,20,50), GD155DATA(10,20,50),
     c U233DATA(10,20,50), U234DATA(10,20,50), U235DATA(10,20,50),
     c U236DATA(10,20,50), U238DATA(10,20,50), NP237DATA(10,20,50),
     c PU238DATA(10,20,50), PU239DATA(10,20,50), PU240DATA(10,20,50),
```

```
      c PU241DATA(10,20,50), PU242DATA(10,20,50), AM241DATA(10,20,50),
      c AM242MDATA(10,20,50), AM243DATA(10,20,50), NODEHEIGHT(50),
      c FUELTEMPDATA(10,20,50), MODSPECVOLDATA(10,20,50),
      c BURNUPDATA(10,20,50), TOTALHEIGHT, AVERAGE, RUNNINGTOTAL,
      c NORMALIZED(50), BURNUPLAST(50), FTBURN(50), MSVBURN(50),
      c ISOTOPICDATA(10,20,50), AVESUM1
*
       LOGICAL TRIP, ROWFLAGLOG, ACTINIDEFIND, FISSPRODFIND,
      c NODEDATAFOUND
*
       CHARACTER PIORIG(29)*6, FILENM*29, ANSWER3*3,
      c CYCLEINFO(2,10)*2, CH1*1, CH2*1, CHSTPT1*1, CHSTPT2*1,
      c CHSTPT3*1, CHSTPT4*1, CHSTPT5*1, CHSTPT6*1, COL1*8,
      c COL2*8, COL3*8, COL4*8, COL5*8, COL6*8, COL7*8, COL8*8,
      c ROWFLAG*7, ACTINIDELABEL*9, FORMATLABEL*29, ISOLABEL*6,
      c FISSPRODLABEL*16, CRAFTINPUTNM*10, SEARCH1*3, CONFIRM1*2,
      c CONFIRM2*2, CONFIRM3*2, RESULTSFILE*14
*
       LOGICAL RESTART, NOTPRESENT
*
       DATA (PIORIG(X),X=1,29) /'mo 95 ','tc 99 ','ru101 ','rh103 ',
      c'ag109 ','nd143 ','nd145 ','sm147 ','sm149 ','sm150 ',
      c'sm151 ','sm152 ','eu151 ','eu153 ','gd155 ',' u233 ',
      c' u234 ',' u235 ',' u236 ',' u238 ','np237 ','pu238 ',
      c'pu239 ','pu240 ','pu241 ','pu242 ','am241 ','am242m',
      c'am243 '/
*
***** Retrieve the principal isotope results.
       DO 8 X0=1,29
          DO 6 X1=1,10
             DO 4 X2=1,20
                DO 2 X3=1,50
                   NOTIN(X0,X1,X2,X3)=0
    2          CONTINUE
    4       CONTINUE
    6    CONTINUE
    8 CONTINUE
      DO 180 PI=1,29
         IF (RESTART.EQ..TRUE.) THEN
            IF (RESTARTSTPT.EQ.NUMBEROFSTPTS(RESTARTCYC)) THEN
               CYCSTART=RESTARTCYC+1
               STPTSTART=1
            ELSE
               CYCSTART=RESTARTCYC
               STPTSTART=RESTARTSTPT+1
            ENDIF
         ELSE
            CYCSTART=1
            STPTSTART=1
         ENDIF
         DO 170 CYC=CYCSTART,NUMBEROFCYCLES
            DO 160 STPT=STPTSTART,NUMBEROFSTPTS(CYC)
               IF ((CYC.EQ.1).AND.(STPT.EQ.1)) THEN
                  TRIP=.TRUE.
               ELSE
                  TRIP=.FALSE.
               ENDIF
               IF (TRIP.EQ..FALSE.) THEN
                  DO 150 NODE=1,NUMBEROFNODES
                     FILENM(1:3)=ANSWER3
```

```
                FILENM(4:4)='A'
                IF (EFPDVALUES(CYC,STPT).EQ.0) THEN
                   FILENM(5:6)=CYCLEINFO(2,(CYC-1))
                ELSE
                   FILENM(5:6)=CYCLEINFO(2,CYC)
                ENDIF
                FILENM(7:7)='N'
                CH1=CHAR(INT(NODE/10.0)+48)
                CH2=CHAR(INT(NODE-(INT(NODE/10.0)*10))+48)
                FILENM(8:8)=CH1
                FILENM(9:9)=CH2
                FILENM(10:11)='DC'
                IF (EFPDVALUES(CYC,STPT).EQ.0) THEN
                   FILENM(12:13)=CYCLEINFO(1,(CYC-1))
                ELSE
                   FILENM(12:13)=CYCLEINFO(1,CYC)
                ENDIF
                FILENM(14:14)='T'
                IF (EFPDVALUES(CYC,STPT).EQ.0) THEN
                   NUMSTPT1=INT(EFPDVALUES((CYC-1),
     c             (NUMBEROFSTPTS(CYC-1)))/100.0)
                   CHSTPT1=CHAR(NUMSTPT1+48)
                   NUMSTPT2=INT((EFPDVALUES((CYC-1),
     c             (NUMBEROFSTPTS(CYC-1)))-
     c             (NUMSTPT1*100.0))/10.0)
                   CHSTPT2=CHAR(NUMSTPT2+48)
                   NUMSTPT3=INT(EFPDVALUES((CYC-1),
     c             (NUMBEROFSTPTS(CYC-1)))-
     c             (NUMSTPT1*100.0)-(NUMSTPT2*10.0))
                   CHSTPT3=CHAR(NUMSTPT3+48)
                ELSE
                   NUMSTPT1=INT(EFPDVALUES(CYC,
     c             (STPT-1))/100.0)
                   CHSTPT1=CHAR(NUMSTPT1+48)
                   NUMSTPT2=INT((EFPDVALUES(CYC,
     c             (STPT-1))-(NUMSTPT1*100.0))/10.0)
                   CHSTPT2=CHAR(NUMSTPT2+48)
                   NUMSTPT3=INT(EFPDVALUES(CYC,
     c             (STPT-1))-(NUMSTPT1*100.0)-
     c             (NUMSTPT2*10.0))
                   CHSTPT3=CHAR(NUMSTPT3+48)
                ENDIF
                NUMSTPT4=INT(EFPDVALUES(CYC,
     c          STPT)/100.0)
                CHSTPT4=CHAR(NUMSTPT4+48)
                NUMSTPT5=INT((EFPDVALUES(CYC,
     c          STPT)-(NUMSTPT4*100.0))/10.0)
                CHSTPT5=CHAR(NUMSTPT5+48)
                NUMSTPT6=INT(EFPDVALUES(CYC,
     c          STPT)-(NUMSTPT4*100.0)-
     c          (NUMSTPT5*10.0))
                CHSTPT6=CHAR(NUMSTPT6+48)
                FILENM(15:15)=CHSTPT1
                FILENM(16:16)=CHSTPT2
                FILENM(17:17)=CHSTPT3
                FILENM(18:19)='AC'
                FILENM(20:21)=CYCLEINFO(1,CYC)
                FILENM(22:22)='T'
                FILENM(23:23)=CHSTPT4
                FILENM(24:24)=CHSTPT5
```

```
                    FILENM(25:25)=CHSTPT6
                    FILENM(26:29)='.cut'
***** Open and rewind the '*.cut' file.
      OPEN(UNIT=300,FILE=FILENM,STATUS='OLD')
      REWIND(UNIT=300)
***** Determine the appropriate column containing the isotopic data.
      ROWFLAGLOG=.FALSE.
      DO 11 WHILE (ROWFLAGLOG.EQ..FALSE.)
         READ (300,10) ROWFLAG, COL1, COL2, COL3,
     c   COL4, COL5, COL6, COL7, COL8
   10    FORMAT (T15,A7,T24,A8,T34,A8,T44,A8,T54,A8,
     c   T64,A8,T74,A8,T84,A8,T94,A8)
         IF (ROWFLAG.EQ.'initial') THEN
            ROWFLAGLOG=.TRUE.
         ENDIF
   11 CONTINUE
      IF (COL1.NE.'        ') THEN
         COLUMNSTART=23
         COLUMNEND=32
      ENDIF
      IF (COL2.NE.'        ') THEN
         COLUMNSTART=33
         COLUMNEND=42
      ENDIF
      IF (COL3.NE.'        ') THEN
         COLUMNSTART=43
         COLUMNEND=52
      ENDIF
      IF (COL4.NE.'        ') THEN
         COLUMNSTART=53
         COLUMNEND=62
      ENDIF
      IF (COL5.NE.'        ') THEN
         COLUMNSTART=63
         COLUMNEND=72
      ENDIF
      IF (COL6.NE.'        ') THEN
         COLUMNSTART=73
         COLUMNEND=82
      ENDIF
      IF (COL7.NE.'        ') THEN
         COLUMNSTART=83
         COLUMNEND=92
      ENDIF
      IF (COL8.NE.'        ') THEN
         COLUMNSTART=93
         COLUMNEND=102
      ENDIF
***** Retrieve actinide isotopic data for tabulation.
      IF (PI.GE.16) THEN
      REWIND(300)
      ACTINIDEFIND=.FALSE.
      DO 50 WHILE (ACTINIDEFIND.EQ..FALSE.)
         READ(300,30) ACTINIDELABEL
   30    FORMAT (T103,A9)
         IF (ACTINIDELABEL.EQ.'actinides') THEN
            READ(300,*)
            READ(300,40) FORMATLABEL
   40       FORMAT (T46,A29)
            IF (FORMATLABEL.EQ.'nuclide concentrations, grams') THEN
```

```
                ACTINIDEFIND=.TRUE.
              ENDIF
            ENDIF
     50 CONTINUE
        READ(300,*)
        READ(300,*)
        ISOLABEL='      '
        NOTPRESENT=.FALSE.
        DO 70 WHILE ((ISOLABEL.NE.PIORIG(PI)).AND.
       c (NOTPRESENT.EQ..FALSE.))
           READ(300,60) ISOLABEL, CONCENTRATION
     60    FORMAT(T6,A6,T<COLUMNSTART>,G10.2)
           IF (ISOLABEL.EQ.PIORIG(PI)) THEN
              ISOVALUE(NODE)=CONCENTRATION
           ELSEIF (ISOLABEL.EQ.'tal    ') THEN
              NOTPRESENT=.TRUE.
              NOTIN(PI,CYC,STPT,NODE)=1
              ISOVALUE(NODE)=0
           ENDIF
     70 CONTINUE
***** Retrieve fission product isotopic data for tabulation.
        ELSE
        FISSPRODFIND=.FALSE.
        DO 110 WHILE (FISSPRODFIND.EQ..FALSE.)
           READ(300,90) FISSPRODLABEL
     90    FORMAT (T96,A16)
           IF (FISSPRODLABEL.EQ.'fission products') THEN
              READ(300,*)
              READ(300,100) FORMATLABEL
    100       FORMAT (T46,A29)
              IF (FORMATLABEL.EQ.'nuclide concentrations, grams') THEN
                 FISSPRODFIND=.TRUE.
              ENDIF
           ENDIF
    110 CONTINUE
        READ(300,*)
        READ(300,*)
        ISOLABEL='      '
        NOTPRESENT=.FALSE.
        DO 130 WHILE ((ISOLABEL.NE.PIORIG(PI)).AND.
       c (NOTPRESENT.EQ..FALSE.))
           READ(300,120) ISOLABEL, CONCENTRATION
    120    FORMAT(T6,A6,T<COLUMNSTART>,G10.2)
           IF (ISOLABEL.EQ.'      ') THEN
              READ(300,*)
              READ(300,*)
              READ(300,*)
              READ(300,*)
              READ(300,*)
           ENDIF
           IF (ISOLABEL.EQ.PIORIG(PI)) THEN
              ISOVALUE(NODE)=CONCENTRATION
           ELSEIF (ISOLABEL.EQ.'tal    ') THEN
              NOTPRESENT=.TRUE.
              NOTIN(PI,CYC,STPT,NODE)=1
              ISOVALUE(NODE)=0
           ENDIF
    130 CONTINUE
        ENDIF
***** Record isotopic concentration retrieved.
```

```
      IF (PI.EQ.1) THEN
         MO95DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.2) THEN
         TC99DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.3) THEN
         RU101DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.4) THEN
         RH103DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.5) THEN
         AG109DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.6) THEN
         ND143DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.7) THEN
         ND145DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.8) THEN
         SM147DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.9) THEN
         SM149DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.10) THEN
         SM150DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.11) THEN
         SM151DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.12) THEN
         SM152DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.13) THEN
         EU151DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.14) THEN
         EU153DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.15) THEN
         GD155DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.16) THEN
         U233DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.17) THEN
         U234DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.18) THEN
         U235DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.19) THEN
         U236DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.20) THEN
         U238DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.21) THEN
         NP237DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.22) THEN
         PU238DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.23) THEN
         PU239DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.24) THEN
         PU240DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.25) THEN
         PU241DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.26) THEN
         PU242DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.27) THEN
         AM241DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.28) THEN
         AM242MDATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ELSEIF (PI.EQ.29) THEN
         AM243DATA(CYC,STPT,NODE)=ISOVALUE(NODE)
      ENDIF
***** Close loops.
```

```
  150             CONTINUE
                ENDIF
  160         CONTINUE
  170       CONTINUE
  180   CONTINUE
***** Open and rewind the CRAFT input file.
      OPEN(UNIT=400,FILE=CRAFTINPUTNM,STATUS='OLD')
      REWIND(UNIT=400)
***** Get node height information.
      NODEDATAFOUND=.FALSE.
      DO 195 WHILE (NODEDATAFOUND.EQ..FALSE.)
         READ(400,185) SEARCH1
  185    FORMAT(A3)
         IF (SEARCH1.EQ.'18 ') THEN
            READ(400,190) CONFIRM1
            READ(400,190) CONFIRM2
            READ(400,190) CONFIRM3
  190       FORMAT(A2)
            IF ((CONFIRM1.EQ.'1 ').AND.(CONFIRM2.EQ.'2 ')
     c      .AND.(CONFIRM3.EQ.'3 ')) THEN
               BACKSPACE(400)
               BACKSPACE(400)
               BACKSPACE(400)
               NODEDATAFOUND=.TRUE.
            ENDIF
         ENDIF
  195 CONTINUE
      DO 205 COUNT=1,NUMBEROFNODES
         READ(400,200) NODEHEIGHT(COUNT)
  200    FORMAT(T4,G15.5)
  205 CONTINUE
      NODEDATAFOUND=.FALSE.
      DO 220 WHILE (NODEDATAFOUND.EQ..FALSE.)
         READ(400,210) SEARCH1
  210    FORMAT(T1,A3)
         IF (SEARCH1.EQ.'18 ') THEN
            READ(400,215) CONFIRM1
            READ(400,215) CONFIRM2
            READ(400,215) CONFIRM3
  215       FORMAT(T1,A2)
            IF ((CONFIRM1.EQ.'1 ').AND.(CONFIRM2.EQ.'2 ')
     c      .AND.(CONFIRM3.EQ.'3 ')) THEN
               BACKSPACE(400)
               BACKSPACE(400)
               BACKSPACE(400)
               NODEDATAFOUND=.TRUE.
            ENDIF
         ENDIF
  220 CONTINUE
      DO 265 CYCS=1,NUMBEROFCYCLES
         IF (CYCS.LT.NUMBEROFCYCLES) THEN
         DO 240 STPTS=1,NUMBEROFSTPTS(CYCS)
            DO 225 COUNT=1,NUMBEROFNODES
               READ(400,*)
  225       CONTINUE
            DO 235 COUNT=1,NUMBEROFNODES
               READ(400,230) FUELTEMPDATA(CYCS,STPTS,COUNT)
  230          FORMAT(T1,G10.4)
  235       CONTINUE
            READ(400,*)
```

```
  240     CONTINUE
          ELSEIF (CYCS.EQ.NUMBEROFCYCLES) THEN
          DO 260 STPTS=1,(NUMBEROFSTPTS(CYCS)-1)
             DO 245 COUNT=1,NUMBEROFNODES
                READ(400,*)
  245        CONTINUE
             DO 255 COUNT=1,NUMBEROFNODES
                READ(400,250) FUELTEMPDATA(CYCS,STPTS,COUNT)
  250           FORMAT(T1,G10.4)
  255        CONTINUE
             READ(400,*)
  260     CONTINUE
          ENDIF
  265  CONTINUE
       DO 310 CYCS=1,NUMBEROFCYCLES
          IF (CYCS.LT.NUMBEROFCYCLES) THEN
          DO 285 STPTS=1,NUMBEROFSTPTS(CYCS)
             DO 270 COUNT=1,NUMBEROFNODES
                READ(400,*)
  270        CONTINUE
             DO 280 COUNT=1,NUMBEROFNODES
                READ(400,275) MODSPECVOLDATA(CYCS,STPTS,COUNT)
  275           FORMAT(T1,G10.4)
  280        CONTINUE
             READ(400,*)
  285     CONTINUE
          ELSEIF (CYCS.EQ.NUMBEROFCYCLES) THEN
          DO 305 STPTS=1,(NUMBEROFSTPTS(CYCS)-1)
             DO 290 COUNT=1,NUMBEROFNODES
                READ(400,*)
  290        CONTINUE
             DO 300 COUNT=1,NUMBEROFNODES
                READ(400,295) MODSPECVOLDATA(CYCS,STPTS,COUNT)
  295           FORMAT(T1,G10.4)
  300        CONTINUE
             READ(400,*)
  305     CONTINUE
          ENDIF
  310  CONTINUE
       DO 335 CYCS=1,NUMBEROFCYCLES
          DO 330 STPTS=1,NUMBEROFSTPTS(CYCS)
             DO 315 COUNT=1,NUMBEROFNODES
                READ(400,*)
  315        CONTINUE
             DO 325 COUNT=1,NUMBEROFNODES
                READ(400,320) BURNUPDATA(CYCS,STPTS,COUNT)
  320           FORMAT(T1,G10.4)
  325        CONTINUE
             IF (CYCS.LT.NUMBEROFCYCLES) THEN
                READ(400,*)
             ELSEIF ((CYCS.EQ.NUMBEROFCYCLES).AND.
     C       (STPTS.LT.NUMBEROFSTPTS(CYCS))) THEN
                READ(400,*)
             ENDIF
  330     CONTINUE
  335  CONTINUE
***** Write the isotopic data tables to file.
***** Determine the filename and open the file.
       BLANKS=0
       DO 340 COUNT=1,10
```

```
         IF (CRAFTINPUTNM(COUNT:COUNT).EQ.' ') THEN
            BLANKS=BLANKS+1
         ENDIF
  340 CONTINUE
      RESULTSFILE(1:(10-BLANKS-5))=
     cCRAFTINPUTNM(1:(10-BLANKS-5))
      RESULTSFILE((10-BLANKS-4):(10-BLANKS+3))='.results'
      RESULTSFILE((10-BLANKS+4):14)=' '
      OPEN(UNIT=500,FILE=RESULTSFILE,STATUS='UNKNOWN')
      REWIND(UNIT=500)
*
      DO 1015 PI=1,29
         DO 341 N=1,NUMBEROFNODES
            FTBURN(N)=0.0
            MSVBURN(N)=0.0
            BURNUPLAST(N)=0.0
  341    CONTINUE
         DO 1010 CYC=CYCSTART,NUMBEROFCYCLES
            DO 1005 STPT=STPTSTART,NUMBEROFSTPTS(CYC)
               IF ((CYC.EQ.1).AND.(STPT.EQ.1)) THEN
                  TRIP=.TRUE.
               ELSE
                  TRIP=.FALSE.
               ENDIF
               IF (TRIP.EQ..FALSE.) THEN
                  WRITE(500,345) CRAFTINPUTNM
  345             FORMAT(T1,'CRAFT CALCULATION: ',A10)
                  WRITE(500,*)
                  WRITE(500,350) PIORIG(PI)
  350             FORMAT(T1,'ISOTOPE: ',A6)
                  WRITE(500,*)
                  WRITE(500,355) CYCLEINFO(1,CYC),
     c             EFPDVALUES(CYC,STPT),CYCLEINFO(2,CYC),
     c             ENRICHMENT
  355             FORMAT(T1,'CYCLE-',A2,2X,F5.1,1X,'EFPD',
     c             2X,'POSITION: ',A2,2X,'ENRICHMENT: ',F5.3)
                  WRITE(500,*)
                  WRITE(500,357)
  357             FORMAT(T1,56X,'BURNUP',3X,'BURNUP')
                  WRITE(500,360)
  360             FORMAT(T1,17X,'NODE',5X,'SAS2H',5X,
     c             'NORMALIZED',9X,'WEIGHTED',2X,'WEIGHTED')
                  WRITE(500,365)
  365             FORMAT(T1,9X,'NODE',3X,'CENTER',3X,'ISOTOPIC',5X,
     c             'SAS2H',5X,'NODAL',4X,'FUEL',4X,'MODERATOR')
                  WRITE(500,370)
  370             FORMAT(T1,1X,'NODE',3X,'HEIGHT',2X,'HEIGHT',3X,
     c             'RESULTS',5X,'ISOTOPIC',2X,'BURNUP',4X,'TEMP.',
     c             3X,'DENSITY')
                  WRITE(500,375)
  375             FORMAT(T1,'NUMBER',3X,'(cm)',4X,'(cm)',4X,
     c             '(g/node)',4X,'PROFILE',2X,'(GWD/MTU)',3X,'(F)',
     c             5X,'(g/cc)')
                  WRITE(500,380)
  380             FORMAT(T1,'-----------------------------------',
     c             '-----------------------------------')
       TOTALHEIGHT=0.0
       IF (PI.EQ.1) THEN
          DO 400 CY=1,10
             DO 395 ST=1,20
```

```
                DO 390 ND=1,50
                   ISOTOPICDATA(CY,ST,ND)=MO95DATA(CY,ST,ND)
390             CONTINUE
395          CONTINUE
400       CONTINUE
       ELSEIF (PI.EQ.2) THEN
          DO 415 CY=1,10
             DO 410 ST=1,20
                DO 405 ND=1,50
                   ISOTOPICDATA(CY,ST,ND)=TC99DATA(CY,ST,ND)
405             CONTINUE
410          CONTINUE
415       CONTINUE
       ELSEIF (PI.EQ.3) THEN
          DO 430 CY=1,10
             DO 425 ST=1,20
                DO 420 ND=1,50
                   ISOTOPICDATA(CY,ST,ND)=RU101DATA(CY,ST,ND)
420             CONTINUE
425          CONTINUE
430       CONTINUE
       ELSEIF (PI.EQ.4) THEN
          DO 445 CY=1,10
             DO 440 ST=1,20
                DO 435 ND=1,50
                   ISOTOPICDATA(CY,ST,ND)=RH103DATA(CY,ST,ND)
435             CONTINUE
440          CONTINUE
445       CONTINUE
       ELSEIF (PI.EQ.5) THEN
          DO 460 CY=1,10
             DO 455 ST=1,20
                DO 450 ND=1,50
                   ISOTOPICDATA(CY,ST,ND)=AG109DATA(CY,ST,ND)
450             CONTINUE
455          CONTINUE
460       CONTINUE
       ELSEIF (PI.EQ.6) THEN
          DO 475 CY=1,10
             DO 470 ST=1,20
                DO 465 ND=1,50
                   ISOTOPICDATA(CY,ST,ND)=ND143DATA(CY,ST,ND)
465             CONTINUE
470          CONTINUE
475       CONTINUE
       ELSEIF (PI.EQ.7) THEN
          DO 490 CY=1,10
             DO 485 ST=1,20
                DO 480 ND=1,50
                   ISOTOPICDATA(CY,ST,ND)=ND145DATA(CY,ST,ND)
480             CONTINUE
485          CONTINUE
490       CONTINUE
       ELSEIF (PI.EQ.8) THEN
          DO 505 CY=1,10
             DO 500 ST=1,20
                DO 495 ND=1,50
                   ISOTOPICDATA(CY,ST,ND)=SM147DATA(CY,ST,ND)
495             CONTINUE
500          CONTINUE
```

```
505     CONTINUE
      ELSEIF (PI.EQ.9) THEN
         DO 520 CY=1,10
            DO 515 ST=1,20
               DO 510 ND=1,50
                  ISOTOPICDATA(CY,ST,ND)=SM149DATA(CY,ST,ND)
510            CONTINUE
515         CONTINUE
520      CONTINUE
      ELSEIF (PI.EQ.10) THEN
         DO 535 CY=1,10
            DO 530 ST=1,20
               DO 525 ND=1,50
                  ISOTOPICDATA(CY,ST,ND)=SM150DATA(CY,ST,ND)
525            CONTINUE
530         CONTINUE
535      CONTINUE
      ELSEIF (PI.EQ.11) THEN
         DO 550 CY=1,10
            DO 545 ST=1,20
               DO 540 ND=1,50
                  ISOTOPICDATA(CY,ST,ND)=SM151DATA(CY,ST,ND)
540            CONTINUE
545         CONTINUE
550      CONTINUE
      ELSEIF (PI.EQ.12) THEN
         DO 565 CY=1,10
            DO 560 ST=1,20
               DO 555 ND=1,50
                  ISOTOPICDATA(CY,ST,ND)=SM152DATA(CY,ST,ND)
555            CONTINUE
560         CONTINUE
565      CONTINUE
      ELSEIF (PI.EQ.13) THEN
         DO 580 CY=1,10
            DO 575 ST=1,20
               DO 570 ND=1,50
                  ISOTOPICDATA(CY,ST,ND)=EU151DATA(CY,ST,ND)
570            CONTINUE
575         CONTINUE
580      CONTINUE
      ELSEIF (PI.EQ.14) THEN
         DO 595 CY=1,10
            DO 590 ST=1,20
               DO 585 ND=1,50
                  ISOTOPICDATA(CY,ST,ND)=EU153DATA(CY,ST,ND)
585            CONTINUE
590         CONTINUE
595      CONTINUE
      ELSEIF (PI.EQ.15) THEN
         DO 610 CY=1,10
            DO 605 ST=1,20
               DO 600 ND=1,50
                  ISOTOPICDATA(CY,ST,ND)=GD155DATA(CY,ST,ND)
600            CONTINUE
605         CONTINUE
610      CONTINUE
      ELSEIF (PI.EQ.16) THEN
         DO 625 CY=1,10
            DO 620 ST=1,20
```

```
                DO 615 ND=1,50
                   ISOTOPICDATA(CY,ST,ND)=U233DATA(CY,ST,ND)
615             CONTINUE
620          CONTINUE
625       CONTINUE
       ELSEIF (PI.EQ.17) THEN
          DO 640 CY=1,10
             DO 635 ST=1,20
                DO 630 ND=1,50
                   ISOTOPICDATA(CY,ST,ND)=U234DATA(CY,ST,ND)
630             CONTINUE
635          CONTINUE
640       CONTINUE
       ELSEIF (PI.EQ.18) THEN
          DO 655 CY=1,10
             DO 650 ST=1,20
                DO 645 ND=1,50
                   ISOTOPICDATA(CY,ST,ND)=U235DATA(CY,ST,ND)
645             CONTINUE
650          CONTINUE
655       CONTINUE
       ELSEIF (PI.EQ.19) THEN
          DO 670 CY=1,10
             DO 665 ST=1,20
                DO 660 ND=1,50
                   ISOTOPICDATA(CY,ST,ND)=U236DATA(CY,ST,ND)
660             CONTINUE
665          CONTINUE
670       CONTINUE
       ELSEIF (PI.EQ.20) THEN
          DO 685 CY=1,10
             DO 680 ST=1,20
                DO 675 ND=1,50
                   ISOTOPICDATA(CY,ST,ND)=U238DATA(CY,ST,ND)
675             CONTINUE
680          CONTINUE
685       CONTINUE
       ELSEIF (PI.EQ.21) THEN
          DO 700 CY=1,10
             DO 695 ST=1,20
                DO 690 ND=1,50
                   ISOTOPICDATA(CY,ST,ND)=NP237DATA(CY,ST,ND)
690             CONTINUE
695          CONTINUE
700       CONTINUE
       ELSEIF (PI.EQ.22) THEN
          DO 715 CY=1,10
             DO 710 ST=1,20
                DO 705 ND=1,50
                   ISOTOPICDATA(CY,ST,ND)=PU238DATA(CY,ST,ND)
705             CONTINUE
710          CONTINUE
715       CONTINUE
       ELSEIF (PI.EQ.23) THEN
          DO 730 CY=1,10
             DO 725 ST=1,20
                DO 720 ND=1,50
                   ISOTOPICDATA(CY,ST,ND)=PU239DATA(CY,ST,ND)
720             CONTINUE
725          CONTINUE
```

```
730     CONTINUE
      ELSEIF (PI.EQ.24) THEN
         DO 745 CY=1,10
            DO 740 ST=1,20
               DO 735 ND=1,50
                  ISOTOPICDATA(CY,ST,ND)=PU240DATA(CY,ST,ND)
735            CONTINUE
740         CONTINUE
745      CONTINUE
      ELSEIF (PI.EQ.25) THEN
         DO 760 CY=1,10
            DO 755 ST=1,20
               DO 750 ND=1,50
                  ISOTOPICDATA(CY,ST,ND)=PU241DATA(CY,ST,ND)
750            CONTINUE
755         CONTINUE
760      CONTINUE
      ELSEIF (PI.EQ.26) THEN
         DO 775 CY=1,10
            DO 770 ST=1,20
               DO 765 ND=1,50
                  ISOTOPICDATA(CY,ST,ND)=PU242DATA(CY,ST,ND)
765            CONTINUE
770         CONTINUE
775      CONTINUE
      ELSEIF (PI.EQ.27) THEN
         DO 790 CY=1,10
            DO 785 ST=1,20
               DO 780 ND=1,50
                  ISOTOPICDATA(CY,ST,ND)=AM241DATA(CY,ST,ND)
780            CONTINUE
785         CONTINUE
790      CONTINUE
      ELSEIF (PI.EQ.28) THEN
         DO 805 CY=1,10
            DO 800 ST=1,20
               DO 795 ND=1,50
                  ISOTOPICDATA(CY,ST,ND)=AM242MDATA(CY,ST,ND)
795            CONTINUE
800         CONTINUE
805      CONTINUE
      ELSEIF (PI.EQ.29) THEN
         DO 820 CY=1,10
            DO 815 ST=1,20
               DO 810 ND=1,50
                  ISOTOPICDATA(CY,ST,ND)=AM243DATA(CY,ST,ND)
810            CONTINUE
815         CONTINUE
820      CONTINUE
      ENDIF
      DO 382 ND=1,50
         IF (ISOTOPICDATA(CYC,STPT,ND).NE.0) THEN
            TOTALHEIGHT=TOTALHEIGHT+NODEHEIGHT(ND)
         ELSE
            TOTALHEIGHT=TOTALHEIGHT
         ENDIF
382   CONTINUE
        AVESUM1=0.0
        DO 822 ND=1,50
           AVESUM1=AVESUM1+(ISOTOPICDATA(CYC,STPT,ND)*
```

```
     c      NODEHEIGHT(ND))
  822    CONTINUE
         AVERAGE=AVESUM1/TOTALHEIGHT
         IF (STPT.EQ.1) THEN
            RUNNINGTOTAL=0.0
          DO 825 NODE=1,NUMBEROFNODES
               RUNNINGTOTAL=RUNNINGTOTAL+NODEHEIGHT(NODE)
               NORMALIZED(NODE)=(ISOTOPICDATA(CYC,STPT,NODE)/
     c         AVERAGE)
           IF (NOTIN(PI,CYC,STPT,NODE).EQ.0) THEN
               WRITE(500,1000) NODE,NODEHEIGHT(NODE),
     c         (RUNNINGTOTAL-(NODEHEIGHT(NODE)/2.0)),
     c         ISOTOPICDATA(CYC,STPT,NODE),NORMALIZED(NODE),
     c         BURNUPDATA(CYC,STPT,NODE),
     c         (((FUELTEMPDATA((CYC-1),NUMBEROFSTPTS(CYC-1),NODE)*
     c         (BURNUPDATA(CYC,STPT,NODE)-BURNUPLAST(NODE)))
     c         +FTBURN(NODE))/BURNUPDATA(CYC,STPT,NODE)),
     c         (1/((((MODSPECVOLDATA((CYC-1),NUMBEROFSTPTS(CYC-1)
     c         ,NODE)*(BURNUPDATA(CYC,STPT,NODE)-
     c         BURNUPLAST(NODE)))+MSVBURN(NODE))/
     c         BURNUPDATA(CYC,STPT,NODE))*62.42691))
           ELSEIF (NOTIN(PI,CYC,STPT,NODE).EQ.1) THEN
               WRITE(500,1002) NODE,NODEHEIGHT(NODE),
     c         (RUNNINGTOTAL-(NODEHEIGHT(NODE)/2.0)),
     c         BURNUPDATA(CYC,STPT,NODE),
     c         (((FUELTEMPDATA((CYC-1),NUMBEROFSTPTS(CYC-1),NODE)*
     c         (BURNUPDATA(CYC,STPT,NODE)-BURNUPLAST(NODE)))
     c         +FTBURN(NODE))/BURNUPDATA(CYC,STPT,NODE)),
     c         (1/((((MODSPECVOLDATA((CYC-1),NUMBEROFSTPTS(CYC-1)
     c         ,NODE)*(BURNUPDATA(CYC,STPT,NODE)-
     c         BURNUPLAST(NODE)))+MSVBURN(NODE))/
     c         BURNUPDATA(CYC,STPT,NODE))*62.42691))
           ENDIF
         FTBURN(NODE)=FTBURN(NODE)+
     c   (FUELTEMPDATA((CYC-1),NUMBEROFSTPTS(CYC-1),NODE)*
     c   (BURNUPDATA(CYC,STPT,NODE)-BURNUPLAST(NODE)))
         MSVBURN(NODE)=MSVBURN(NODE)+
     c   (MODSPECVOLDATA((CYC-1),NUMBEROFSTPTS(CYC-1),NODE)*
     c   (BURNUPDATA(CYC,STPT,NODE)-BURNUPLAST(NODE)))
         BURNUPLAST(NODE)=BURNUPDATA(CYC,STPT,NODE)
  825    CONTINUE
        ELSE
           RUNNINGTOTAL=0.0
          DO 830 NODE=1,NUMBEROFNODES
               RUNNINGTOTAL=RUNNINGTOTAL+NODEHEIGHT(NODE)
               NORMALIZED(NODE)=(ISOTOPICDATA(CYC,STPT,NODE)/
     c         AVERAGE)
           IF (NOTIN(PI,CYC,STPT,NODE).EQ.0) THEN
               WRITE(500,1000) NODE,NODEHEIGHT(NODE),
     c         (RUNNINGTOTAL-(NODEHEIGHT(NODE)/2.0)),
     c         ISOTOPICDATA(CYC,STPT,NODE),NORMALIZED(NODE),
     c         BURNUPDATA(CYC,STPT,NODE),
     c         (((FUELTEMPDATA(CYC,(STPT-1),NODE)*
     c         (BURNUPDATA(CYC,STPT,NODE)-BURNUPLAST(NODE)))
     c         +FTBURN(NODE))/BURNUPDATA(CYC,STPT,NODE)),
     c         (1/((((MODSPECVOLDATA(CYC,(STPT-1)
     c         ,NODE)*(BURNUPDATA(CYC,STPT,NODE)-
     c         BURNUPLAST(NODE)))+MSVBURN(NODE))/
     c         BURNUPDATA(CYC,STPT,NODE))*62.42691))
           ELSEIF (NOTIN(PI,CYC,STPT,NODE).EQ.1) THEN
```

```
                WRITE(500,1002) NODE,NODEHEIGHT(NODE),
     c          (RUNNINGTOTAL-(NODEHEIGHT(NODE)/2.0)),
     c          ISOTOPICDATA(CYC,STPT,NODE),NORMALIZED(NODE),
     c          BURNUPDATA(CYC,STPT,NODE),
     c          (((FUELTEMPDATA(CYC,(STPT-1),NODE)*
     c          (BURNUPDATA(CYC,STPT,NODE)-BURNUPLAST(NODE)))
     c          +FTBURN(NODE))/BURNUPDATA(CYC,STPT,NODE)),
     c          (1/((((MODSPECVOLDATA(CYC,(STPT-1)
     c          ,NODE)*(BURNUPDATA(CYC,STPT,NODE)-
     c          BURNUPLAST(NODE)))+MSVBURN(NODE))/
     c          BURNUPDATA(CYC,STPT,NODE))*62.42691))
               ENDIF
               FTBURN(NODE)=FTBURN(NODE)+
     c         (FUELTEMPDATA(CYC,(STPT-1),NODE)*
     c         (BURNUPDATA(CYC,STPT,NODE)-BURNUPLAST(NODE)))
               MSVBURN(NODE)=MSVBURN(NODE)+
     c         (MODSPECVOLDATA(CYC,(STPT-1),NODE)*
     c         (BURNUPDATA(CYC,STPT,NODE)-BURNUPLAST(NODE)))
               BURNUPLAST(NODE)=BURNUPDATA(CYC,STPT,NODE)
 830     CONTINUE
        ENDIF
         WRITE(500,*)
         WRITE(500,*)
1000 FORMAT(T1,2X,I2,3X,F6.2,3X,F6.2,4X,G11.6,1X,F7.5,
    c 3X,F6.3,3X,F6.1,3X,F6.5)
1002 FORMAT(T1,2X,I2,3X,F6.2,3X,F6.2,4X,'  NOT AVAILABLE   ',1X,
    c 3X,F6.3,3X,F6.1,3X,F6.5)
               ENDIF
1005         CONTINUE
1010     CONTINUE
1015 CONTINUE


     RETURN
     END
```

```
N                          : This is not a pick-up case
Crystal River, Unit 3      : Reactor Identifier
CR3                        : Prefix Identifier for reactor
44group                    : Scale cross-section library
2.54                       : U-235 wt% enrichment in U of UO2
463630                     : Grams of U per assembly
208                        : Number of fuel rods in assembly
1.44272                    : Pin-pitch in assembly (cm)
0.9398                     : Fuel pellet diameter (cm)
0.95758                    : Fuel rod cladding ID (cm)
1.0922                     : Fuel rod cladding OD (cm)
360.172                    : Fuel stack height (cm)
N                          : No axial blanket fuel
INCONEL                    : Spacer grid material
0.005757609                : Vol. frac. of mod. displaced by grids
ZIRC-4                     : Fuel rod cladding material
640.0                      : Avg. fuel rod cladding temp. (K)
N                          : No cladding materials other than ZIRC-4
2200.0                     : System pressure (psi)
Y                          : Activate BPRA tracking
1                          : Number of reactor cycles with BPRA
1 0                        : # of BPRA designs, # of non-Al2O3B4C BP's
3.7 1.34 0.5857538 16 2 4    : Input Card 18C
8                          : # of radial zones in BPRA Path B model
4 0.43180                  : BPRA Path B model (Input Card 18E)
5 0.45720
2 0.54610
3 0.63246
2 0.67310
3 0.81397
500 2.91402
3 2.93693
3 0.43180                  : Path B model with BPRA removed (Input Card 18F)
3 0.45720
3 0.54610
3 0.63246
2 0.67310
3 0.81397
500 2.91402
3 2.93693
6 0.43180                  : BPRA Path B model above absorber (Input Card 18G)
5 0.45720
2 0.54610
3 0.63246
2 0.67310
3 0.81397
500 2.91402
3 2.93693
AL203 6                    : Mat. above absorber in BPR, SAS2H mat. mix. #
1 1 2 17                   : BPRA insertion history (Input Card 18N)
5                          : # of radial zones in the standard Path B model
3 0.63246                  : Standard Path B model (Input Card 20)
2 0.67310
3 0.81397
500 2.97599
3 2.99939
1                          : # of cross-section libraries per irradiation step
5                          : SAS2H output print level
0.5                        : Zone mesh factor for XSDRNPM
NO SPECIAL                 : No special XSDRNPM control parameter specs.
3                          : # of insertion reactor cycles
1A                         : Insertion reactor cycle identifier
1                          : # of stpts in cycle
0                          : Stpt EFPD
0                          : Length to stpt in calendar days
0                          : Downtime at stpt
195.292                    : Days of downtime at EOC
268.8                      : Total cycle EFPD
413                        : Total cycle length in calendar days
02                         : Integer position of assembly in cycle
```

```
1B                    : Insertion reactor cycle identifier
2                     : # of stpts in cycle
0                     : Stpt EFPD
0                     : Length to stpt in calendar days
0                     : Downtime at stpt
142.2                 : Stpt EFPD
166                   : Length to stpt in calendar days
14.792                : Downtime at stpt
97                    : Days of downtime at EOC
171.3                 : Total cycle EFPD
217                   : Total cycle length in calendar days
02                    : Integer position of assembly in cycle
02                    : Insertion reactor cycle identifier
1                     : # of stpts in cycle
0                     : Stpt EFPD
0                     : Length to stpt in calendar days
0                     : Downtime at stpt
164                   : Days of downtime at EOC
166.5                 : Total cycle EFPD
212                   : Total cycle length in calendar days
02                    : Integer position of assembly in cycle
N                     : Flag for variable or constant irradiation step specs
1                     : Relative insertion cycle #
1                     : Relative stpt # in insertion cycle
67.2                  : Irradiation step length in EFPD
4                     : # of irradiation steps to next stpt
921.02                : ppmb
872.24                : ppmb
738.29                : ppmb
608.17                : ppmb
2                     : Relative insertion cycle #
1                     : Relative stpt # in insertion cycle
71.1                  : Irradiation step length in EFPD
2                     : # of irradiation steps to next stpt
518.65                : ppmb
256.11                : ppmb
2                     : Relative stpt # in insertion cycle
29.1                  : Irradiation step length in EFPD
1                     : # of irradiation steps to next stpt
237.54                : ppmb
3                     : Relative insertion cycle #
1                     : Relative stpt # in insertion cycle
55.5                  : Irradiation step length in EFPD
3                     : # of irradiation steps to next stpt
688.93                : ppmb
527.51                : ppmb
353.48                : ppmb
18                    : # of axial nodes in CRC format
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
NO CRA INSERTION HISTORY
NO APSRA INSERTION HISTORY
18                    : # of fuel temp axial nodes (BOC-1A to EOC-1A)
1     17.7800         : Node #, node height (cm)
```

```
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
1017.4
1225.4
1356.1
1425.4
1456.5
1468.4
1473.9
1480.8
1492.4
1506.9
1522.1
1533.3
1536.7
1532.1
1528.2
1516.9
1415.1
1172.5
18                    : # of fuel temp axial nodes (BOC-1B to Stpt2-1B)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
1139.0
1331.9
1393.0
1377.7
1340.8
1304.8
1277.1
1258.7
1248.6
1245.5
1247.9
1254.9
1265.3
1278.1
1296.9
1320.8
```

```
1294.7
1100.3
18                      : # of fuel temp axial nodes (Stpt2-1B to EOC-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
1036.9
1184.3
1235.6
1256.4
1287.7
1303.9
1306.7
1306.4
1306.4
1307.2
1308.6
1308.4
1302.4
1284.0
1246.9
1196.5
1133.5
971.5
18                      : # of mod spec vol axial nodes (BOC-1A to EOC-1A)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0237
0.0236
0.0235
0.0234
0.0233
0.0231
0.0230
0.0229
0.0227
0.0226
0.0224
0.0223
```

```
0.0222
0.0220
0.0219
0.0218
0.0217
0.0216
18                      : # of mod spec vol axial nodes (BOC-1B to Stpt2-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0235
0.0234
0.0233
0.0232
0.0230
0.0229
0.0228
0.0227
0.0225
0.0224
0.0223
0.0222
0.0221
0.0220
0.0219
0.0218
0.0217
0.0216
18                      : # of mod spec vol axial nodes (Stpt2-1B to EOC-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0235
0.0234
0.0233
0.0232
0.0231
0.0229
0.0228
0.0227
```

```
0.0225
0.0224
0.0223
0.0222
0.0221
0.0219
0.0218
0.0217
0.0217
0.0216
18                      : # of burnup axial nodes (BOC-1A)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
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
18                      : # of burnup axial nodes (BOC-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
4.165
6.642
8.681
10.034
```

```
10.864
11.345
11.602
11.715
11.733
11.681
11.582
11.463
11.360
11.315
11.318
10.993
9.608
6.503
18                      : # of burnup axial nodes (Stpt2-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
7.139
11.297
14.093
15.601
16.355
16.695
16.824
16.853
16.835
16.796
16.754
16.731
16.749
16.838
16.988
16.743
14.923
10.001
18                      : # of burnup axial nodes (BOC-2)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
```

7.703
12.146
15.070
16.635
17.420
17.783
17.919
17.948
17.930
17.898
17.870
17.864
17.893
17.976
18.087
17.769
15.824
10.594

```
N                       : This is not a pick-up case
Crystal River, Unit 3   : Reactor Identifier
CR3                     : Prefix Identifier for reactor
44group                 : Scale cross-section library
1.93                    : U-235 wt% enrichment in U of UO2
463630                  : Grams of U per assembly
208                     : Number of fuel rods in assembly
1.44272                 : Pin-pitch in assembly (cm)
0.9398                  : Fuel pellet diameter (cm)
0.95758                 : Fuel rod cladding ID (cm)
1.0922                  : Fuel rod cladding OD (cm)
360.172                 : Fuel stack height (cm)
N                       : No axial blanket fuel
INCONEL                 : Spacer grid material
0.005757609             : Vol. frac. of mod. displaced by grids
ZIRC-4                  : Fuel rod cladding material
640.0                   : Avg. fuel rod cladding temp. (K)
N                       : No cladding materials other than ZIRC-4
2200.0                  : System pressure (psi)
N                       : Activate BPRA tracking
5                       : # of radial zones in the standard Path B model
3 0.63246               : Standard Path B model (Input Card 20)
2 0.67310
3 0.81397
500 2.97599
3 2.99939
1                       : # of cross-section libraries per irradiation step
5                       : SAS2H output print level
0.5                     : Zone mesh factor for XSDRNPM
NO SPECIAL              : No special XSDRNPM control parameter specs.
2                       : # of insertion reactor cycles
1A                      : Insertion reactor cycle identifier
1                       : # of stpts in cycle
0                       : Stpt EFPD
0                       : Length to stpt in calendar days
0                       : Downtime at stpt
195.292                 : Days of downtime at EOC
268.8                   : Total cycle EFPD
413                     : Total cycle length in calendar days
03                      : Integer position of assembly in cycle
1B                      : Insertion reactor cycle identifier
2                       : # of stpts in cycle
0                       : Stpt EFPD
0                       : Length to stpt in calendar days
0                       : Downtime at stpt
142.2                   : Stpt EFPD
166                     : Length to stpt in calendar days
14.792                  : Downtime at stpt
97                      : Days of downtime at EOC
171.3                   : Total cycle EFPD
217                     : Total cycle length in calendar days
03                      : Integer position of assembly in cycle
N                       : Flag for variable or constant irradiation step specs
1                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
67.2                    : Irradiation step length in EFPD
4                       : # of irradiation steps to next stpt
921.02                  : ppmb
872.24                  : ppmb
738.29                  : ppmb
608.17                  : ppmb
2                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
71.1                    : Irradiation step length in EFPD
2                       : # of irradiation steps to next stpt
518.65                  : ppmb
256.11                  : ppmb
2                       : Relative stpt # in insertion cycle
29.1                    : Irradiation step length in EFPD
1                       : # of irradiation steps to next stpt
```

```
237.54                  : ppmb
18                      : # of axial nodes in CRC format
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
NO CRA INSERTION HISTORY
NO APSRA INSERTION HISTORY
18                      : # of fuel temp axial nodes (BOC-1A to EOC-1A)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
1004.6
1235.8
1365.6
1431.7
1459.7
1468.5
1472.4
1479.0
1491.8
1510.3
1527.9
1539.5
1540.6
1530.2
1504.4
1451.5
1341.4
1086.8
18                      : # of fuel temp axial nodes (BOC-1B to Stpt2-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
```

```
11     20.0025
12     20.0025
13     20.0025
14     20.0025
15     20.0025
16     20.0025
17     20.0025
18     22.3520
1108.7
1286.1
1344.9
1330.3
1294.0
1258.7
1231.7
1213.9
1204.0
1200.5
1202.6
1209.5
1220.6
1235.2
1252.2
1261.6
1226.6
1060.3
18                      : # of mod spec vol axial nodes (BOC-1A to EOC-1A)
1      17.7800          : Node #, node height (cm)
2      20.0025
3      20.0025
4      20.0025
5      20.0025
6      20.0025
7      20.0025
8      20.0025
9      20.0025
10     20.0025
11     20.0025
12     20.0025
13     20.0025
14     20.0025
15     20.0025
16     20.0025
17     20.0025
18     22.3520
0.0237
0.0236
0.0235
0.0234
0.0232
0.0231
0.0230
0.0228
0.0227
0.0225
0.0224
0.0223
0.0221
0.0220
0.0219
0.0218
0.0217
0.0216
18                      : # of mod spec vol axial nodes (BOC-1B to Stpt2-1B)
1      17.7800          : Node #, node height (cm)
2      20.0025
3      20.0025
4      20.0025
5      20.0025
6      20.0025
```

```
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0234
0.0233
0.0232
0.0230
0.0229
0.0228
0.0227
0.0226
0.0225
0.0224
0.0223
0.0222
0.0221
0.0220
0.0219
0.0218
0.0217
0.0216
18                  : # of burnup axial nodes (BOC-1A)
1     17.7800       : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
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
18                  : # of burnup axial nodes (BOC-1B)
1     17.7800       : Node #, node height (cm)
2     20.0025
```

```
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10      20.0025
11      20.0025
12      20.0025
13      20.0025
14      20.0025
15      20.0025
16      20.0025
17      20.0025
18      22.3520
4.068
6.985
9.147
10.553
11.408
11.895
12.152
12.260
12.261
12.176
12.023
11.839
11.662
11.483
11.184
10.485
8.928
5.493
18                      : # of burnup axial nodes (Stpt2-1B)
1       17.7800         : Node #, node height (cm)
2       20.0025
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10      20.0025
11      20.0025
12      20.0025
13      20.0025
14      20.0025
15      20.0025
16      20.0025
17      20.0025
18      22.3520
6.835
11.317
14.188
15.741
16.520
16.872
17.005
17.028
16.989
16.905
16.798
16.703
16.648
16.607
16.425
15.702
13.667
```

8.599

```
N                          : This is not a pick-up case
Crystal River, Unit 3      : Reactor Identifier
CR3                        : Prefix Identifier for reactor
44group                    : Scale cross-section library
2.54                       : U-235 wt% enrichment in U of UO2
463630                     : Grams of U per assembly
208                        : Number of fuel rods in assembly
1.44272                    : Pin-pitch in assembly (cm)
0.9398                     : Fuel pellet diameter (cm)
0.95758                    : Fuel rod cladding ID (cm)
1.0922                     : Fuel rod cladding OD (cm)
360.172                    : Fuel stack height (cm)
N                          : No axial blanket fuel
INCONEL                    : Spacer grid material
0.005757609                : Vol. frac. of mod. displaced by grids
ZIRC-4                     : Fuel rod cladding material
640.0                      : Avg. fuel rod cladding temp. (K)
N                          : No cladding materials other than ZIRC-4
2200.0                     : System pressure (psi)
Y                          : Activate BPRA tracking
1                          : Number of reactor cycles with BPRA
1 0                        : # of BPRA designs, # of non-Al2O3B4C BP's
3.7 1.18 0.5857538 16 2 4    : Input Card 18C
8                          : # of radial zones in BPRA Path B model
4 0.43180                  : BPRA Path B model (Input Card 18E)
5 0.45720
2 0.54610
3 0.63246
2 0.67310
3 0.81397
500 2.91402
3 2.93693
3 0.43180                  : Path B model with BPRA removed (Input Card 18F)
3 0.45720
3 0.54610
3 0.63246
2 0.67310
3 0.81397
500 2.91402
3 2.93693
6 0.43180                  : BPRA Path B model above absorber (Input Card 18G)
5 0.45720
2 0.54610
3 0.63246
2 0.67310
3 0.81397
500 2.91402
3 2.93693
AL203 6                    : Mat. above absorber in BPR, SAS2H mat. mix. #
1 1 2 17                   : BPRA insertion history (Input Card 18N)
5                          : # of radial zones in the standard Path B model
3 0.63246                  : Standard Path B model (Input Card 20)
2 0.67310
3 0.81397
500 2.97599
3 2.99939
1                          : # of cross-section libraries per irradiation step
5                          : SAS2H output print level
0.5                        : Zone mesh factor for XSDRNPM
NO SPECIAL                 : No special XSDRNPM control parameter specs.
3                          : # of insertion reactor cycles
1A                         : Insertion reactor cycle identifier
1                          : # of stpts in cycle
0                          : Stpt EFPD
0                          : Length to stpt in calendar days
0                          : Downtime at stpt
195.292                    : Days of downtime at EOC
268.8                      : Total cycle EFPD
413                        : Total cycle length in calendar days
06                         : Integer position of assembly in cycle
```

```
1B                      : Insertion reactor cycle identifier
2                       : # of stpts in cycle
0                       : Stpt EFPD
0                       : Length to stpt in calendar days
0                       : Downtime at stpt
142.2                   : Stpt EFPD
166                     : Length to stpt in calendar days
14.792                  : Downtime at stpt
97                      : Days of downtime at EOC
171.3                   : Total cycle EFPD
217                     : Total cycle length in calendar days
06                      : Integer position of assembly in cycle
02                      : Insertion reactor cycle identifier
1                       : # of stpts in cycle
0                       : Stpt EFPD
0                       : Length to stpt in calendar days
0                       : Downtime at stpt
164                     : Days of downtime at EOC
166.5                   : Total cycle EFPD
212                     : Total cycle length in calendar days
06                      : Integer position of assembly in cycle
N                       : Flag for variable or constant irradiation step specs
1                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
67.2                    : Irradiation step length in EFPD
4                       : # of irradiation steps to next stpt
921.02                  : ppmb
872.24                  : ppmb
738.29                  : ppmb
608.17                  : ppmb
2                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
71.1                    : Irradiation step length in EFPD
2                       : # of irradiation steps to next stpt
518.65                  : ppmb
256.11                  : ppmb
2                       : Relative stpt # in insertion cycle
29.1                    : Irradiation step length in EFPD
1                       : # of irradiation steps to next stpt
237.54                  : ppmb
3                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
55.5                    : Irradiation step length in EFPD
3                       : # of irradiation steps to next stpt
688.93                  : ppmb
527.51                  : ppmb
353.48                  : ppmb
18                      : # of axial nodes in CRC format
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
NO CRA INSERTION HISTORY
NO APSRA INSERTION HISTORY
18                      : # of fuel temp axial nodes (BOC-1A to EOC-1A)
1     17.7800           : Node #, node height (cm)
```

```
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
957.1
1168.4
1322.1
1413.0
1454.4
1471.5
1480.9
1491.8
1508.5
1529.1
1549.2
1558.9
1551.7
1529.0
1492.1
1433.3
1321.9
1102.3
18                    : # of fuel temp axial nodes (BOC-1B to Stpt2-1B)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
1075.2
1275.7
1360.0
1358.1
1324.0
1290.0
1264.3
1247.8
1238.9
1235.7
1237.6
1244.9
1256.9
1273.8
1303.1
1341.4
```

```
1321.0
1120.7
18                      : # of fuel temp axial nodes (Stpt2-1B to EOC-1B)
1       17.7800         : Node #, node height (cm)
2       20.0025
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10      20.0025
11      20.0025
12      20.0025
13      20.0025
14      20.0025
15      20.0025
16      20.0025
17      20.0025
18      22.3520
1066.9
1219.1
1262.6
1272.7
1299.8
1318.1
1325.1
1328.3
1330.2
1332.6
1338.4
1346.7
1349.6
1339.5
1311.5
1266.6
1197.1
1017.1
18                      : # of mod spec vol axial nodes (BOC-1A to EOC-1A)
1       17.7800         : Node #, node height (cm)
2       20.0025
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10      20.0025
11      20.0025
12      20.0025
13      20.0025
14      20.0025
15      20.0025
16      20.0025
17      20.0025
18      22.3520
0.0237
0.0236
0.0235
0.0234
0.0232
0.0231
0.0230
0.0228
0.0227
0.0225
0.0224
0.0223
```

```
0.0221
0.0220
0.0219
0.0218
0.0217
0.0216
18                      : # of mod spec vol axial nodes (BOC-1B to Stpt2-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0235
0.0234
0.0233
0.0231
0.0230
0.0229
0.0228
0.0226
0.0225
0.0224
0.0223
0.0222
0.0221
0.0220
0.0219
0.0218
0.0217
0.0216
18                      : # of mod spec vol axial nodes (Stpt2-1B to EOC-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0236
0.0235
0.0234
0.0233
0.0231
0.0230
0.0229
0.0227
```

```
0.0226
0.0225
0.0224
0.0222
0.0221
0.0220
0.0219
0.0218
0.0217
0.0216
18                      : # of burnup axial nodes (BOC-1A)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
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
18                      : # of burnup axial nodes (BOC-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
3.654
6.130
8.399
9.932
```

```
10.847
11.372
11.656
11.778
11.774
11.648
11.411
11.136
10.925
10.811
10.674
10.155
8.760
5.876
18                      : # of burnup axial nodes (Stpt2-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
6.144
10.136
13.264
15.149
16.120
16.571
16.763
16.819
16.781
16.651
16.449
16.255
16.169
16.216
16.291
15.934
14.138
9.407
18                      : # of burnup axial nodes (BOC-2)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
```

6.728
11.018
14.265
16.196
17.196
17.672
17.873
17.928
17.887
17.763
17.582
17.423
17.371
17.434
17.487
17.059
15.123
10.050

```
N                       : This is not a pick-up case
Crystal River, Unit 3   : Reactor Identifier
CR3                     : Prefix Identifier for reactor
44group                 : Scale cross-section library
2.83                    : U-235 wt% enrichment in U of UO2
463630                  : Grams of U per assembly
208                     : Number of fuel rods in assembly
1.44272                 : Pin-pitch in assembly (cm)
0.9398                  : Fuel pellet diameter (cm)
0.95758                 : Fuel rod cladding ID (cm)
1.0922                  : Fuel rod cladding OD (cm)
360.172                 : Fuel stack height (cm)
N                       : No axial blanket fuel
INCONEL                 : Spacer grid material
0.005757609             : Vol. frac. of mod. displaced by grids
ZIRC-4                  : Fuel rod cladding material
640.0                   : Avg. fuel rod cladding temp. (K)
N                       : No cladding materials other than ZIRC-4
2200.0                  : System pressure (psi)
N                       : Activate BPRA tracking
5                       : # of radial zones in the standard Path B model
3 0.63246               : Standard Path B model (Input Card 20)
2 0.67310
3 0.81397
500 2.97599
3 2.99939
1                       : # of cross-section libraries per irradiation step
5                       : SAS2H output print level
0.5                     : Zone mesh factor for XSDRNPM
NO SPECIAL              : No special XSDRNPM control parameter specs.
4                       : # of insertion reactor cycles
1A                      : Insertion reactor cycle identifier
1                       : # of stpts in cycle
0                       : Stpt EFPD
0                       : Length to stpt in calendar days
0                       : Downtime at stpt
195.292                 : Days of downtime at EOC
268.8                   : Total cycle EFPD
413                     : Total cycle length in calendar days
08                      : Integer position of assembly in cycle
1B                      : Insertion reactor cycle identifier
2                       : # of stpts in cycle
0                       : Stpt EFPD
0                       : Length to stpt in calendar days
0                       : Downtime at stpt
142.2                   : Stpt EFPD
166                     : Length to stpt in calendar days
14.792                  : Downtime at stpt
97                      : Days of downtime at EOC
171.3                   : Total cycle EFPD
217                     : Total cycle length in calendar days
08                      : Integer position of assembly in cycle
02                      : Insertion reactor cycle identifier
1                       : # of stpts in cycle
0                       : Stpt EFPD
0                       : Length to stpt in calendar days
0                       : Downtime at stpt
164.0                   : Days of downtime at EOC
166.5                   : Total cycle EFPD
212                     : Total cycle length in calendar days
05                      : Integer position of assembly in cycle
03                      : Insertion reactor cycle identifier
3                       : # of stpts in cycle
0                       : Stpt EFPD
0                       : Length to stpt in calendar days
0                       : Downtime at stpt
168.5                   : Stpt EFPD
193                     : Length to stpt in calendar days
16.792                  : Downtime at stpt
250.0                   : Stpt EFPD
```

```
309                     : Length to stpt in calendar days
13.333                  : Downtime at stpt
73                      : Days of downtime at EOC
323.0                   : Total cycle EFPD
416                     : Total cycle length in calendar days
02                      : Integer position of assembly in cycle
N                       : Flag for variable or constant irradiation step specs
1                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
67.2                    : Irradiation step length in EFPD
4                       : # of irradiation steps to next stpt
921.02                  : ppmb
872.24                  : ppmb
738.29                  : ppmb
608.17                  : ppmb
2                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
71.1                    : Irradiation step length in EFPD
2                       : # of irradiation steps to next stpt
518.65                  : ppmb
256.11                  : ppmb
2                       : Relative stpt # in insertion cycle
29.1                    : Irradiation step length in EFPD
1                       : # of irradiation steps to next stpt
237.54                  : ppmb
3                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
55.5                    : Irradiation step length in EFPD
3                       : # of irradiation steps to next stpt
688.93                  : ppmb
527.51                  : ppmb
353.48                  : ppmb
4                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
56.167                  : Irradiation step length in EFPD
3                       : # of irradiation steps to next stpt
880.38                  : ppmb
694.68                  : ppmb
536.65                  : ppmb
2                       : Relative stpt # in insertion cycle
40.75                   : Irradiation step length in EFPD
2                       : # of irradiation steps to next stpt
382.60                  : ppmb
267.17                  : ppmb
3                       : Relative stpt # in insertion cycle
36.5                    : Irradiation step length in EFPD
2                       : # of irradiation steps to next stpt
234.64                  : ppmb
128.17                  : ppmb
18                      : # of axial nodes in CRC format
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
NO CRA INSERTION HISTORY
NO APSRA INSERTION HISTORY
```

```
18                      : # of fuel temp axial nodes (BOC-1A to EOC-1A)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
831.5
998.8
1100.7
1152.6
1178.3
1190.2
1197.3
1204.6
1214.5
1226.5
1237.7
1245.0
1246.2
1241.8
1231.6
1202.4
1122.0
915.0
18                      : # of fuel temp axial nodes (BOC-1B to Stpt2-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
884.1
1032.0
1084.2
1086.8
1073.2
1056.1
1041.7
1031.9
1026.8
1025.6
1027.5
1031.8
1038.0
1047.5
```

```
1069.8
1104.7
1092.1
948.1
18                    : # of fuel temp axial nodes (Stpt2-1B to EOC-1B)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
847.9
968.4
1026.9
1079.8
1145.2
1186.1
1204.7
1214.6
1221.5
1227.7
1233.0
1235.0
1228.6
1207.6
1168.0
1113.7
1042.4
897.3
18                    : # of fuel temp axial nodes (BOC-2 to EOC-2)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
1134.5
1314.3
1382.3
1393.7
1389.9
1385.9
1385.5
1386.6
1383.7
1368.6
```

```
1339.1
1305.1
1275.2
1254.0
1244.3
1240.3
1210.7
1058.2
18                    : # of fuel temp axial nodes (BOC-3 to Stpt2-3)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
975.9
1123.0
1175.9
1182.7
1171.9
1158.2
1148.0
1144.1
1148.9
1162.5
1181.0
1198.0
1207.8
1207.5
1196.1
1173.9
1131.9
1001.4
18                    : # of fuel temp axial nodes (Stpt2-3 to Stpt3-3)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
1013.2
1121.8
1144.6
1132.8
1115.7
1102.5
```

```
1094.5
1090.8
1090.7
1093.5
1097.2
1100.3
1102.4
1103.9
1102.9
1097.7
1081.7
999.0
18                      : # of mod spec vol axial nodes (BOC-1A to EOC-1A)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0228
0.0228
0.0227
0.0227
0.0226
0.0225
0.0224
0.0223
0.0223
0.0222
0.0221
0.0220
0.0219
0.0218
0.0218
0.0217
0.0216
0.0216
18                      : # of mod spec vol axial nodes (BOC-1B to Stpt2-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0227
0.0226
```

```
0.0226
0.0225
0.0224
0.0223
0.0223
0.0222
0.0221
0.0221
0.0220
0.0220
0.0219
0.0218
0.0218
0.0217
0.0216
0.0216
18                      : # of mod spec vol axial nodes (Stpt2-1B to EOC-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0230
0.0229
0.0229
0.0228
0.0227
0.0226
0.0225
0.0224
0.0223
0.0222
0.0221
0.0220
0.0219
0.0219
0.0218
0.0217
0.0216
0.0216
18                      : # of mod spec vol axial nodes (BOC-2 to EOC-2)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
```

```
17    20.0025
18    22.3520
0.0237
0.0236
0.0234
0.0233
0.0231
0.0230
0.0228
0.0227
0.0226
0.0224
0.0223
0.0222
0.0221
0.0220
0.0219
0.0218
0.0217
0.0216
18                    : # of mod spec vol axial nodes (BOC-3 to Stpt2-3)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0234
0.0233
0.0232
0.0231
0.0229
0.0228
0.0227
0.0226
0.0225
0.0224
0.0223
0.0222
0.0221
0.0220
0.0219
0.0218
0.0217
0.0216
18                    : # of mod spec vol axial nodes (Stpt2-3 to Stpt3-3)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
```

```
13     20.0025
14     20.0025
15     20.0025
16     20.0025
17     20.0025
18     22.3520
0.0233
0.0232
0.0231
0.0230
0.0229
0.0228
0.0227
0.0226
0.0225
0.0224
0.0223
0.0221
0.0221
0.0220
0.0219
0.0218
0.0217
0.0216
18                      : # of burnup axial nodes (BOC-1A)
1      17.7800          : Node #, node height (cm)
2      20.0025
3      20.0025
4      20.0025
5      20.0025
6      20.0025
7      20.0025
8      20.0025
9      20.0025
10     20.0025
11     20.0025
12     20.0025
13     20.0025
14     20.0025
15     20.0025
16     20.0025
17     20.0025
18     22.3520
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
18                      : # of burnup axial nodes (BOC-1B)
1      17.7800          : Node #, node height (cm)
2      20.0025
3      20.0025
4      20.0025
5      20.0025
6      20.0025
7      20.0025
8      20.0025
```

```
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
2.376
4.230
5.599
6.481
7.028
7.355
7.539
7.631
7.656
7.633
7.579
7.522
7.494
7.509
7.490
7.165
6.119
3.653
18                    : # of burnup axial nodes (Stpt2-1B)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
3.894
6.705
8.582
9.647
10.227
10.525
10.668
10.731
10.749
10.739
10.717
10.708
10.737
10.824
10.934
10.749
9.474
5.849
18                    : # of burnup axial nodes (BOC-2)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
```

```
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10      20.0025
11      20.0025
12      20.0025
13      20.0025
14      20.0025
15      20.0025
16      20.0025
17      20.0025
18      22.3520
4.202
7.197
9.186
10.333
10.980
11.330
11.502
11.578
11.605
11.606
11.600
11.606
11.642
11.718
11.787
11.531
10.144
6.276
18                      : # of burnup axial nodes (BOC-3)
1       17.7800         : Node #, node height (cm)
2       20.0025
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10      20.0025
11      20.0025
12      20.0025
13      20.0025
14      20.0025
15      20.0025
16      20.0025
17      20.0025
18      22.3520
7.971
12.979
15.872
17.259
17.908
18.197
18.296
18.288
18.207
18.080
17.962
17.915
17.965
18.100
18.218
17.871
15.941
10.186
18                      : # of burnup axial nodes (Stpt2-3)
```

```
1     17.7800          : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
10.717
17.322
21.146
22.931
23.721
24.043
24.145
24.151
24.123
24.100
24.115
24.185
24.300
24.420
24.406
23.765
21.200
13.734
18                     : # of burnup axial nodes (Stpt3-3)
1     17.7800          : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
12.299
19.680
23.822
25.656
26.413
26.697
26.777
26.780
26.768
26.779
26.839
26.957
27.120
27.284
27.285
```

26.591
23.819
15.601

```
N                       : This is not a pick-up case
Crystal River, Unit 3   : Reactor Identifier
CR3                     : Prefix Identifier for reactor
44group                 : Scale cross-section library
1.93                    : U-235 wt% enrichment in U of UO2
463630                  : Grams of U per assembly
208                     : Number of fuel rods in assembly
1.44272                 : Pin-pitch in assembly (cm)
0.9398                  : Fuel pellet diameter (cm)
0.95758                 : Fuel rod cladding ID (cm)
1.0922                  : Fuel rod cladding OD (cm)
360.172                 : Fuel stack height (cm)
N                       : No axial blanket fuel
INCONEL                 : Spacer grid material
0.005757609             : Vol. frac. of mod. displaced by grids
ZIRC-4                  : Fuel rod cladding material
640.0                   : Avg. fuel rod cladding temp. (K)
N                       : No cladding materials other than ZIRC-4
2200.0                  : System pressure (psi)
N                       : Activate BPRA tracking
5                       : # of radial zones in the standard Path B model
3 0.63246               : Standard Path B model (Input Card 20)
2 0.67310
3 0.81397
500 2.97599
3 2.99939
1                       : # of cross-section libraries per irradiation step
5                       : SAS2H output print level
0.5                     : Zone mesh factor for XSDRNPM
NO SPECIAL              : No special XSDRNPM control parameter specs.
2                       : # of insertion reactor cycles
1A                      : Insertion reactor cycle identifier
1                       : # of stpts in cycle
0                       : Stpt EFPD
0                       : Length to stpt in calendar days
0                       : Downtime at stpt
195.292                 : Days of downtime at EOC
268.8                   : Total cycle EFPD
413                     : Total cycle length in calendar days
09                      : Integer position of assembly in cycle
1B                      : Insertion reactor cycle identifier
2                       : # of stpts in cycle
0                       : Stpt EFPD
0                       : Length to stpt in calendar days
0                       : Downtime at stpt
142.2                   : Stpt EFPD
166                     : Length to stpt in calendar days
14.792                  : Downtime at stpt
97                      : Days of downtime at EOC
171.3                   : Total cycle EFPD
217                     : Total cycle length in calendar days
09                      : Integer position of assembly in cycle
N                       : Flag for variable or constant irradiation step specs
1                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
67.2                    : Irradiation step length in EFPD
4                       : # of irradiation steps to next stpt
921.02                  : ppmb
872.24                  : ppmb
738.29                  : ppmb
608.17                  : ppmb
2                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
71.1                    : Irradiation step length in EFPD
2                       : # of irradiation steps to next stpt
518.65                  : ppmb
256.11                  : ppmb
2                       : Relative stpt # in insertion cycle
29.1                    : Irradiation step length in EFPD
1                       : # of irradiation steps to next stpt
```

```
237.54                  : ppmb
18                      : # of axial nodes in CRC format
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
NO CRA INSERTION HISTORY
NO APSRA INSERTION HISTORY
18                      : # of fuel temp axial nodes (BOC-1A to EOC-1A)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
999.6
1227.4
1352.3
1415.3
1442.2
1451.1
1454.9
1461.0
1472.6
1489.3
1507.0
1519.3
1522.0
1514.8
1498.7
1461.8
1358.8
1102.7
18                      : # of fuel temp axial nodes (BOC-1B to Stpt2-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
```

```
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
1102.0
1277.9
1334.3
1320.4
1285.7
1251.7
1225.3
1207.8
1198.1
1194.7
1196.7
1203.2
1213.2
1226.3
1243.0
1255.6
1223.7
1059.0
18                    : # of mod spec vol axial nodes (BOC-1A to EOC-1A)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0237
0.0236
0.0235
0.0233
0.0232
0.0231
0.0229
0.0228
0.0227
0.0225
0.0224
0.0223
0.0221
0.0220
0.0219
0.0218
0.0217
0.0216
18                    : # of mod spec vol axial nodes (BOC-1B to Stpt2-1B)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
```

```
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0234
0.0233
0.0231
0.0230
0.0229
0.0228
0.0227
0.0226
0.0224
0.0223
0.0223
0.0222
0.0221
0.0220
0.0219
0.0218
0.0217
0.0216
18                    : # of burnup axial nodes (BOC-1A)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
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
18                    : # of burnup axial nodes (BOC-1B)
1     17.7800         : Node #, node height (cm)
2     20.0025
```

```
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10      20.0025
11      20.0025
12      20.0025
13      20.0025
14      20.0025
15      20.0025
16      20.0025
17      20.0025
18      22.3520
3.985
6.804
8.867
10.203
11.019
11.488
11.736
11.843
11.852
11.787
11.669
11.527
11.395
11.282
11.104
10.552
9.076
5.614
18                      : # of burnup axial nodes (Stpt2-1B)
1       17.7800         : Node #, node height (cm)
2       20.0025
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10      20.0025
11      20.0025
12      20.0025
13      20.0025
14      20.0025
15      20.0025
16      20.0025
17      20.0025
18      22.3520
6.728
11.097
13.855
15.328
16.064
16.397
16.523
16.547
16.519
16.460
16.390
16.334
16.315
16.328
16.268
15.717
13.792
```

8.718

```
N                          : This is not a pick-up case
Crystal River, Unit 3      : Reactor Identifier
CR3                        : Prefix Identifier for reactor
44group                    : Scale cross-section library
2.54                       : U-235 wt% enrichment in U of UO2
463630                     : Grams of U per assembly
208                        : Number of fuel rods in assembly
1.44272                    : Pin-pitch in assembly (cm)
0.9398                     : Fuel pellet diameter (cm)
0.95758                    : Fuel rod cladding ID (cm)
1.0922                     : Fuel rod cladding OD (cm)
360.172                    : Fuel stack height (cm)
N                          : No axial blanket fuel
INCONEL                    : Spacer grid material
0.005757609                : Vol. frac. of mod. displaced by grids
ZIRC-4                     : Fuel rod cladding material
640.0                      : Avg. fuel rod cladding temp. (K)
N                          : No cladding materials other than ZIRC-4
2200.0                     : System pressure (psi)
Y                          : Activate BPRA tracking
1                          : Number of reactor cycles with BPRA
1 0                        : # of BPRA designs, # of non-Al2O3B4C BP's
3.7 1.34 0.5857538 16 2 4    : Input Card 18C
8                          : # of radial zones in BPRA Path B model
4 0.43180                  : BPRA Path B model (Input Card 18E)
5 0.45720
2 0.54610
3 0.63246
2 0.67310
3 0.81397
500 2.91402
3 2.93693
3 0.43180                  : Path B model with BPRA removed (Input Card 18F)
3 0.45720
3 0.54610
3 0.63246
2 0.67310
3 0.81397
500 2.91402
3 2.93693
6 0.43180                  : BPRA Path B model above absorber (Input Card 18G)
5 0.45720
2 0.54610
3 0.63246
2 0.67310
3 0.81397
500 2.91402
3 2.93693
AL203 6                    : Mat. above absorber in BPR, SAS2H mat. mix. #
1 1 2 17                   : BPRA insertion history (Input Card 18N)
5                          : # of radial zones in the standard Path B model
3 0.63246                  : Standard Path B model (Input Card 20)
2 0.67310
3 0.81397
500 2.97599
3 2.99939
1                          : # of cross-section libraries per irradiation step
5                          : SAS2H output print level
0.5                        : Zone mesh factor for XSDRNPM
NO SPECIAL                 : No special XSDRNPM control parameter specs.
3                          : # of insertion reactor cycles
1A                         : Insertion reactor cycle identifier
1                          : # of stpts in cycle
0                          : Stpt EFPD
0                          : Length to stpt in calendar days
0                          : Downtime at stpt
195.292                    : Days of downtime at EOC
268.8                      : Total cycle EFPD
413                        : Total cycle length in calendar days
10                         : Integer position of assembly in cycle
```

```
1B                      : Insertion reactor cycle identifier
2                       : # of stpts in cycle
0                       : Stpt EFPD
0                       : Length to stpt in calendar days
0                       : Downtime at stpt
142.2                   : Stpt EFPD
166                     : Length to stpt in calendar days
14.792                  : Downtime at stpt
97                      : Days of downtime at EOC
171.3                   : Total cycle EFPD
217                     : Total cycle length in calendar days
10                      : Integer position of assembly in cycle
02                      : Insertion reactor cycle identifier
1                       : # of stpts in cycle
0                       : Stpt EFPD
0                       : Length to stpt in calendar days
0                       : Downtime at stpt
164                     : Days of downtime at EOC
166.5                   : Total cycle EFPD
212                     : Total cycle length in calendar days
24                      : Integer position of assembly in cycle
N                       : Flag for variable or constant irradiation step specs
1                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
67.2                    : Irradiation step length in EFPD
4                       : # of irradiation steps to next stpt
921.02                  : ppmb
872.24                  : ppmb
738.29                  : ppmb
608.17                  : ppmb
2                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
71.1                    : Irradiation step length in EFPD
2                       : # of irradiation steps to next stpt
518.65                  : ppmb
256.11                  : ppmb
2                       : Relative stpt # in insertion cycle
29.1                    : Irradiation step length in EFPD
1                       : # of irradiation steps to next stpt
237.54                  : ppmb
3                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
55.5                    : Irradiation step length in EFPD
3                       : # of irradiation steps to next stpt
688.93                  : ppmb
527.51                  : ppmb
353.48                  : ppmb
18                      : # of axial nodes in CRC format
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
NO CRA INSERTION HISTORY
NO APSRA INSERTION HISTORY
18                      : # of fuel temp axial nodes (BOC-1A to EOC-1A)
1     17.7800           : Node #, node height (cm)
```

```
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
1042.1
1260.6
1402.6
1478.2
1511.0
1522.4
1526.4
1531.9
1543.4
1560.8
1579.9
1592.3
1590.6
1574.7
1545.8
1486.6
1365.7
1134.8
18                    : # of fuel temp axial nodes (BOC-1B to Stpt2-1B)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
1162.6
1362.7
1424.9
1405.3
1363.8
1324.6
1295.0
1275.8
1265.3
1261.9
1264.4
1272.9
1286.3
1304.0
1324.5
1337.8
```

```
1302.5
1103.9
18                      : # of fuel temp axial nodes (Stpt2-1B to EOC-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
1077.7
1230.5
1263.7
1246.8
1227.1
1214.0
1205.8
1200.3
1196.3
1193.8
1194.5
1198.1
1200.6
1198.7
1190.9
1174.8
1131.8
975.1
18                      : # of mod spec vol axial nodes (BOC-1A to EOC-1A)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0239
0.0238
0.0237
0.0235
0.0234
0.0232
0.0231
0.0229
0.0228
0.0226
0.0225
0.0223
```

```
0.0222
0.0220
0.0219
0.0218
0.0217
0.0216
18                      : # of mod spec vol axial nodes (BOC-1B to Stpt2-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0236
0.0235
0.0234
0.0232
0.0231
0.0230
0.0228
0.0227
0.0226
0.0225
0.0224
0.0222
0.0221
0.0220
0.0219
0.0218
0.0217
0.0216
18                      : # of mod spec vol axial nodes (Stpt2-1B to EOC-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0233
0.0233
0.0231
0.0230
0.0229
0.0228
0.0227
0.0226
```

```
0.0224
0.0223
0.0222
0.0221
0.0220
0.0219
0.0218
0.0217
0.0217
0.0216
18                      : # of burnup axial nodes (BOC-1A)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
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
18                      : # of burnup axial nodes (BOC-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
4.480
7.222
9.503
11.023
```

```
11.950
12.481
12.761
12.879
12.874
12.763
12.560
12.314
12.088
11.875
11.546
10.797
9.199
6.173
18                      : # of burnup axial nodes (Stpt2-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
7.588
12.079
15.142
16.819
17.660
18.041
18.185
18.210
18.160
18.049
17.896
17.753
17.673
17.632
17.452
16.696
14.571
9.673
18                      : # of burnup axial nodes (BOC-2)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
```

8.214
13.010
16.177
17.855
18.672
19.031
19.158
19.169
19.110
18.999
18.860
18.742
18.692
18.670
18.490
17.700
15.471
10.269

```
N                       : This is not a pick-up case
Crystal River, Unit 3   : Reactor Identifier
CR3                     : Prefix Identifier for reactor
44group                 : Scale cross-section library
1.93                    : U-235 wt% enrichment in U of UO2
463630                  : Grams of U per assembly
208                     : Number of fuel rods in assembly
1.44272                 : Pin-pitch in assembly (cm)
0.9398                  : Fuel pellet diameter (cm)
0.95758                 : Fuel rod cladding ID (cm)
1.0922                  : Fuel rod cladding OD (cm)
360.172                 : Fuel stack height (cm)
N                       : No axial blanket fuel
INCONEL                 : Spacer grid material
0.005757609             : Vol. frac. of mod. displaced by grids
ZIRC-4                  : Fuel rod cladding material
640.0                   : Avg. fuel rod cladding temp. (K)
N                       : No cladding materials other than ZIRC-4
2200.0                  : System pressure (psi)
N                       : Activate BPRA tracking
5                       : # of radial zones in the standard Path B model
3 0.63246               : Standard Path B model (Input Card 20)
2 0.67310
3 0.81397
500 2.97599
3 2.99939
1                       : # of cross-section libraries per irradiation step
5                       : SAS2H output print level
0.5                     : Zone mesh factor for XSDRNPM
NO SPECIAL              : No special XSDRNPM control parameter specs.
2                       : # of insertion reactor cycles
1A                      : Insertion reactor cycle identifier
1                       : # of stpts in cycle
0                       : Stpt EFPD
0                       : Length to stpt in calendar days
0                       : Downtime at stpt
195.292                 : Days of downtime at EOC
268.8                   : Total cycle EFPD
413                     : Total cycle length in calendar days
11                      : Integer position of assembly in cycle
1B                      : Insertion reactor cycle identifier
2                       : # of stpts in cycle
0                       : Stpt EFPD
0                       : Length to stpt in calendar days
0                       : Downtime at stpt
142.2                   : Stpt EFPD
166                     : Length to stpt in calendar days
14.792                  : Downtime at stpt
97                      : Days of downtime at EOC
171.3                   : Total cycle EFPD
217                     : Total cycle length in calendar days
11                      : Integer position of assembly in cycle
N                       : Flag for variable or constant irradiation step specs
1                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
67.2                    : Irradiation step length in EFPD
4                       : # of irradiation steps to next stpt
921.02                  : ppmb
872.24                  : ppmb
738.29                  : ppmb
608.17                  : ppmb
2                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
71.1                    : Irradiation step length in EFPD
2                       : # of irradiation steps to next stpt
518.65                  : ppmb
256.11                  : ppmb
2                       : Relative stpt # in insertion cycle
29.1                    : Irradiation step length in EFPD
1                       : # of irradiation steps to next stpt
```

```
237.54                  : ppmb
18                      : # of axial nodes in CRC format
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
NO CRA INSERTION HISTORY
NO APSRA INSERTION HISTORY
18                      : # of fuel temp axial nodes (BOC-1A to EOC-1A)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
979.3
1211.4
1350.8
1426.2
1458.4
1469.0
1474.1
1482.6
1498.7
1521.9
1545.4
1558.4
1545.0
1508.0
1458.3
1390.2
1279.2
1040.3
18                      : # of fuel temp axial nodes (BOC-1B to Stpt2-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
```

```
11     20.0025
12     20.0025
13     20.0025
14     20.0025
15     20.0025
16     20.0025
17     20.0025
18     22.3520
1094.1
1277.8
1344.5
1333.8
1297.0
1261.0
1233.9
1216.3
1206.3
1200.8
1198.9
1204.4
1217.0
1234.6
1257.0
1273.0
1238.8
1068.5
18                      : # of mod spec vol axial nodes (BOC-1A to EOC-1A)
1      17.7800          : Node #, node height (cm)
2      20.0025
3      20.0025
4      20.0025
5      20.0025
6      20.0025
7      20.0025
8      20.0025
9      20.0025
10     20.0025
11     20.0025
12     20.0025
13     20.0025
14     20.0025
15     20.0025
16     20.0025
17     20.0025
18     22.3520
0.0237
0.0236
0.0235
0.0233
0.0232
0.0231
0.0229
0.0228
0.0226
0.0225
0.0224
0.0222
0.0221
0.0220
0.0219
0.0217
0.0217
0.0216
18                      : # of mod spec vol axial nodes (BOC-1B to Stpt2-1B)
1      17.7800          : Node #, node height (cm)
2      20.0025
3      20.0025
4      20.0025
5      20.0025
6      20.0025
```

```
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0234
0.0233
0.0232
0.0230
0.0229
0.0228
0.0227
0.0226
0.0225
0.0224
0.0223
0.0222
0.0221
0.0220
0.0219
0.0218
0.0217
0.0216
18                    : # of burnup axial nodes (BOC-1A)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
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
18                    : # of burnup axial nodes (BOC-1B)
1     17.7800         : Node #, node height (cm)
2     20.0025
```

```
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10      20.0025
11      20.0025
12      20.0025
13      20.0025
14      20.0025
15      20.0025
16      20.0025
17      20.0025
18      22.3520
3.886
6.799
9.069
10.564
11.459
11.961
12.220
12.317
12.281
12.100
11.748
11.307
10.965
10.729
10.461
9.895
8.520
5.265
18                      : # of burnup axial nodes (Stpt2-1B)
1       17.7800         : Node #, node height (cm)
2       20.0025
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10      20.0025
11      20.0025
12      20.0025
13      20.0025
14      20.0025
15      20.0025
16      20.0025
17      20.0025
18      22.3520
6.514
10.954
13.973
15.684
16.548
16.934
17.076
17.088
17.000
16.785
16.427
16.046
15.833
15.770
15.682
15.158
13.320
```

8.404

```
N                          : This is not a pick-up case
Crystal River, Unit 3      : Reactor Identifier
CR3                        : Prefix Identifier for reactor
44group                    : Scale cross-section library
2.54                       : U-235 wt% enrichment in U of UO2
463630                     : Grams of U per assembly
208                        : Number of fuel rods in assembly
1.44272                    : Pin-pitch in assembly (cm)
0.9398                     : Fuel pellet diameter (cm)
0.95758                    : Fuel rod cladding ID (cm)
1.0922                     : Fuel rod cladding OD (cm)
360.172                    : Fuel stack height (cm)
N                          : No axial blanket fuel
INCONEL                    : Spacer grid material
0.005757609                : Vol. frac. of mod. displaced by grids
ZIRC-4                     : Fuel rod cladding material
640.0                      : Avg. fuel rod cladding temp. (K)
N                          : No cladding materials other than ZIRC-4
2200.0                     : System pressure (psi)
Y                          : Activate BPRA tracking
1                          : Number of reactor cycles with BPRA
1 0                        : # of BPRA designs, # of non-Al2O3B4C BP's
3.7 1.18 0.5857538 16 2 4   : Input Card 18C
8                          : # of radial zones in BPRA Path B model
4 0.43180                  : BPRA Path B model (Input Card 18E)
5 0.45720
2 0.54610
3 0.63246
2 0.67310
3 0.81397
500 2.91402
3 2.93693
3 0.43180                  : Path B model with BPRA removed (Input Card 18F)
3 0.45720
3 0.54610
3 0.63246
2 0.67310
3 0.81397
500 2.91402
3 2.93693
6 0.43180                  : BPRA Path B model above absorber (Input Card 18G)
5 0.45720
2 0.54610
3 0.63246
2 0.67310
3 0.81397
500 2.91402
3 2.93693
AL203 6                    : Mat. above absorber in BPR, SAS2H mat. mix. #
1 1 2 17                   : BPRA insertion history (Input Card 18N)
5                          : # of radial zones in the standard Path B model
3 0.63246                  : Standard Path B model (Input Card 20)
2 0.67310
3 0.81397
500 2.97599
3 2.99939
1                          : # of cross-section libraries per irradiation step
5                          : SAS2H output print level
0.5                        : Zone mesh factor for XSDRNPM
NO SPECIAL                 : No special XSDRNPM control parameter specs.
3                          : # of insertion reactor cycles
1A                         : Insertion reactor cycle identifier
1                          : # of stpts in cycle
0                          : Stpt EFPD
0                          : Length to stpt in calendar days
0                          : Downtime at stpt
195.292                    : Days of downtime at EOC
268.8                      : Total cycle EFPD
413                        : Total cycle length in calendar days
12                         : Integer position of assembly in cycle
```

```
1B                      : Insertion reactor cycle identifier
2                       : # of stpts in cycle
0                       : Stpt EFPD
0                       : Length to stpt in calendar days
0                       : Downtime at stpt
142.2                   : Stpt EFPD
166                     : Length to stpt in calendar days
14.792                  : Downtime at stpt
97                      : Days of downtime at EOC
171.3                   : Total cycle EFPD
217                     : Total cycle length in calendar days
12                      : Integer position of assembly in cycle
02                      : Insertion reactor cycle identifier
1                       : # of stpts in cycle
0                       : Stpt EFPD
0                       : Length to stpt in calendar days
0                       : Downtime at stpt
164                     : Days of downtime at EOC
166.5                   : Total cycle EFPD
212                     : Total cycle length in calendar days
09                      : Integer position of assembly in cycle
N                       : Flag for variable or constant irradiation step specs
1                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
67.2                    : Irradiation step length in EFPD
4                       : # of irradiation steps to next stpt
921.02                  : ppmb
872.24                  : ppmb
738.29                  : ppmb
608.17                  : ppmb
2                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
71.1                    : Irradiation step length in EFPD
2                       : # of irradiation steps to next stpt
518.65                  : ppmb
256.11                  : ppmb
2                       : Relative stpt # in insertion cycle
29.1                    : Irradiation step length in EFPD
1                       : # of irradiation steps to next stpt
237.54                  : ppmb
3                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
55.5                    : Irradiation step length in EFPD
3                       : # of irradiation steps to next stpt
688.93                  : ppmb
527.51                  : ppmb
353.48                  : ppmb
18                      : # of axial nodes in CRC format
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
NO CRA INSERTION HISTORY
NO APSRA INSERTION HISTORY
18                      : # of fuel temp axial nodes (BOC-1A to EOC-1A)
1     17.7800           : Node #, node height (cm)
```

```
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
971.1
1187.3
1346.9
1440.1
1481.2
1496.7
1505.0
1515.3
1531.5
1554.4
1582.6
1595.7
1562.0
1499.9
1440.0
1367.5
1258.8
1064.1
18                    : # of fuel temp axial nodes (BOC-1B to Stpt2-1B)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
1125.7
1335.1
1422.5
1414.5
1374.1
1335.6
1307.0
1289.0
1279.1
1271.6
1263.1
1265.7
1279.4
1298.9
1327.8
1358.7
```

```
1325.4
1119.6
18                      : # of fuel temp axial nodes (Stpt2-1B to EOC-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
1113.1
1273.0
1300.7
1275.7
1254.7
1243.9
1238.5
1234.4
1226.9
1212.7
1204.6
1218.5
1232.9
1243.7
1254.1
1238.6
1178.6
1004.8
18                      : # of mod spec vol axial nodes (BOC-1A to EOC-1A)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0237
0.0236
0.0235
0.0234
0.0232
0.0231
0.0229
0.0228
0.0227
0.0225
0.0224
0.0222
```

```
0.0221
0.0220
0.0218
0.0217
0.0217
0.0216
18                      : # of mod spec vol axial nodes (BOC-1B to Stpt2-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0236
0.0235
0.0234
0.0232
0.0231
0.0229
0.0228
0.0227
0.0226
0.0224
0.0223
0.0222
0.0221
0.0220
0.0219
0.0218
0.0217
0.0216
18                      : # of mod spec vol axial nodes (Stpt2-1B to EOC-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0234
0.0233
0.0232
0.0231
0.0229
0.0228
0.0227
0.0226
```

```
0.0225
0.0224
0.0223
0.0222
0.0221
0.0220
0.0219
0.0218
0.0217
0.0216
18                      : # of burnup axial nodes (BOC-1A)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
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
18                      : # of burnup axial nodes (BOC-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
3.858
6.474
8.867
10.477
```

```
11.427
11.961
12.238
12.340
12.288
12.043
11.505
10.774
10.311
10.097
9.956
9.643
8.531
5.796
18                      : # of burnup axial nodes (Stpt2-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
6.629
10.901
14.191
16.133
17.104
17.534
17.697
17.716
17.608
17.296
16.676
15.962
15.634
15.622
15.743
15.584
13.991
9.347
18                      : # of burnup axial nodes (BOC-2)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
```

7.281
11.873
15.263
17.199
18.145
18.556
18.703
18.700
18.559
18.218
17.610
16.943
16.676
16.736
16.893
16.688
14.958
9.978

```
Y                          : This is a pick-up case from Assy A12, Stpt2-1B
2                          : Relative cycle number for pick-up
2                          : Relative statepoint number for pick-up
Crystal River, Unit 3      : Reactor Identifier
CR3                        : Prefix Identifier for reactor
44group                    : Scale cross-section library
2.54                       : U-235 wt% enrichment in U of UO2
463630                     : Grams of U per assembly
208                        : Number of fuel rods in assembly
1.44272                    : Pin-pitch in assembly (cm)
0.9398                     : Fuel pellet diameter (cm)
0.95758                    : Fuel rod cladding ID (cm)
1.0922                     : Fuel rod cladding OD (cm)
360.172                    : Fuel stack height (cm)
N                          : No axial blanket fuel
INCONEL                    : Spacer grid material
0.005757609                : Vol. frac. of mod. displaced by grids
ZIRC-4                     : Fuel rod cladding material
640.0                      : Avg. fuel rod cladding temp. (K)
N                          : No cladding materials other than ZIRC-4
2200.0                     : System pressure (psi)
Y                          : Activate BPRA tracking
1                          : Number of reactor cycles with BPRA
1 0                        : # of BPRA designs, # of non-Al2O3B4C BP's
3.7 1.18 0.5857538 16 2 4   : Input Card 18C
8                          : # of radial zones in BPRA Path B model
4 0.43180                  : BPRA Path B model (Input Card 18E)
5 0.45720
2 0.54610
3 0.63246
2 0.67310
3 0.81397
500 2.91402
3 2.93693
3 0.43180                  : Path B model with BPRA removed (Input Card 18F)
3 0.45720
3 0.54610
3 0.63246
2 0.67310
3 0.81397
500 2.91402
3 2.93693
6 0.43180                  : BPRA Path B model above absorber (Input Card 18G)
5 0.45720
2 0.54610
3 0.63246
2 0.67310
3 0.81397
500 2.91402
3 2.93693
AL2O3 6                    : Mat. above absorber in BPR, SAS2H mat. mix. #
1 1 2 17                   : BPRA insertion history (Input Card 18N)
5                          : # of radial zones in the standard Path B model
3 0.63246                  : Standard Path B model (Input Card 20)
2 0.67310
3 0.81397
500 2.97599
3 2.99939
1                          : # of cross-section libraries per irradiation step
5                          : SAS2H output print level
0.5                        : Zone mesh factor for XSDRNPM
NO SPECIAL                 : No special XSDRNPM control parameter specs.
3                          : # of insertion reactor cycles
1A                         : Insertion reactor cycle identifier
1                          : # of stpts in cycle
0                          : Stpt EFPD
0                          : Length to stpt in calendar days
0                          : Downtime at stpt
195.292                    : Days of downtime at EOC
268.8                      : Total cycle EFPD
```

```
413                     : Total cycle length in calendar days
12                      : Integer position of assembly in cycle
1B                      : Insertion reactor cycle identifier
2                       : # of stpts in cycle
0                       : Stpt EFPD
0                       : Length to stpt in calendar days
0                       : Downtime at stpt
142.2                   : Stpt EFPD
166                     : Length to stpt in calendar days
14.792                  : Downtime at stpt
97                      : Days of downtime at EOC
171.3                   : Total cycle EFPD
217                     : Total cycle length in calendar days
12                      : Integer position of assembly in cycle
02                      : Insertion reactor cycle identifier
1                       : # of stpts in cycle
0                       : Stpt EFPD
0                       : Length to stpt in calendar days
0                       : Downtime at stpt
164                     : Days of downtime at EOC
166.5                   : Total cycle EFPD
212                     : Total cycle length in calendar days
04                      : Integer position of assembly in cycle
N                       : Flag for variable or constant irradiation step specs
1                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
67.2                    : Irradiation step length in EFPD
4                       : # of irradiation steps to next stpt
921.02                  : ppmb
872.24                  : ppmb
738.29                  : ppmb
608.17                  : ppmb
2                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
71.1                    : Irradiation step length in EFPD
2                       : # of irradiation steps to next stpt
518.65                  : ppmb
256.11                  : ppmb
2                       : Relative stpt # in insertion cycle
29.1                    : Irradiation step length in EFPD
1                       : # of irradiation steps to next stpt
237.54                  : ppmb
3                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
55.5                    : Irradiation step length in EFPD
3                       : # of irradiation steps to next stpt
688.93                  : ppmb
527.51                  : ppmb
353.48                  : ppmb
18                      : # of axial nodes in CRC format
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
NO CRA INSERTION HISTORY
NO APSRA INSERTION HISTORY
```

```
18                      : # of fuel temp axial nodes (BOC-1A to EOC-1A)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
971.1
1187.3
1346.9
1440.1
1481.2
1496.7
1505.0
1515.3
1531.5
1554.4
1582.6
1595.7
1562.0
1499.9
1440.0
1367.5
1258.8
1064.1
18                      : # of fuel temp axial nodes (BOC-1B to Stpt2-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
1125.7
1335.1
1422.5
1414.5
1374.1
1335.6
1307.0
1289.0
1279.1
1271.6
1263.1
1265.7
1279.4
1298.9
```

```
1327.8
1358.7
1325.4
1119.6
18                      : # of fuel temp axial nodes (Stpt2-1B to EOC-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
1113.1
1273.0
1300.7
1275.7
1254.7
1243.9
1238.5
1234.4
1226.9
1212.7
1204.6
1218.5
1232.9
1243.7
1254.1
1238.6
1178.6
1004.8
18                      : # of mod spec vol axial nodes (BOC-1A to EOC-1A)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0237
0.0236
0.0235
0.0234
0.0232
0.0231
0.0229
0.0228
0.0227
0.0225
```

```
0.0224
0.0222
0.0221
0.0220
0.0218
0.0217
0.0217
0.0216
18                    : # of mod spec vol axial nodes (BOC-1B to Stpt2-1B)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0236
0.0235
0.0234
0.0232
0.0231
0.0229
0.0228
0.0227
0.0226
0.0224
0.0223
0.0222
0.0221
0.0220
0.0219
0.0218
0.0217
0.0216
18                    : # of mod spec vol axial nodes (Stpt2-1B to EOC-1B)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0234
0.0233
0.0232
0.0231
0.0229
0.0228
```

```
0.0227
0.0226
0.0225
0.0224
0.0223
0.0222
0.0221
0.0220
0.0219
0.0218
0.0217
0.0216
18                      : # of burnup axial nodes (BOC-1A)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
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
18                      : # of burnup axial nodes (BOC-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
3.858
6.474
```

```
8.867
10.477
11.427
11.961
12.238
12.340
12.288
12.043
11.505
10.774
10.311
10.097
9.956
9.643
8.531
5.796
18                      : # of burnup axial nodes (Stpt2-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
6.629
10.901
14.191
16.133
17.104
17.534
17.697
17.716
17.608
17.296
16.676
15.962
15.634
15.622
15.743
15.584
13.991
9.347
18                      : # of burnup axial nodes (BOC-2)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
```

17 20.0025
18 22.3520
7.305
11.915
15.317
17.257
18.205
18.616
18.762
18.755
18.606
18.247
17.602
16.892
16.599
16.647
16.807
16.634
14.948
9.986

```
N                       : This is not a pick-up case
Crystal River, Unit 3   : Reactor Identifier
CR3                     : Prefix Identifier for reactor
44group                 : Scale cross-section library
1.93                    : U-235 wt% enrichment in U of UO2
463630                  : Grams of U per assembly
208                     : Number of fuel rods in assembly
1.44272                 : Pin-pitch in assembly (cm)
0.9398                  : Fuel pellet diameter (cm)
0.95758                 : Fuel rod cladding ID (cm)
1.0922                  : Fuel rod cladding OD (cm)
360.172                 : Fuel stack height (cm)
N                       : No axial blanket fuel
INCONEL                 : Spacer grid material
0.005757609             : Vol. frac. of mod. displaced by grids
ZIRC-4                  : Fuel rod cladding material
640.0                   : Avg. fuel rod cladding temp. (K)
N                       : No cladding materials other than ZIRC-4
2200.0                  : System pressure (psi)
N                       : Activate BPRA tracking
5                       : # of radial zones in the standard Path B model
3 0.63246               : Standard Path B model (Input Card 20)
2 0.67310
3 0.81397
500 2.97599
3 2.99939
1                       : # of cross-section libraries per irradiation step
5                       : SAS2H output print level
0.5                     : Zone mesh factor for XSDRNPM
NO SPECIAL              : No special XSDRNPM control parameter specs.
2                       : # of insertion reactor cycles
1A                      : Insertion reactor cycle identifier
1                       : # of stpts in cycle
0                       : Stpt EFPD
0                       : Length to stpt in calendar days
0                       : Downtime at stpt
195.292                 : Days of downtime at EOC
268.8                   : Total cycle EFPD
413                     : Total cycle length in calendar days
13                      : Integer position of assembly in cycle
1B                      : Insertion reactor cycle identifier
2                       : # of stpts in cycle
0                       : Stpt EFPD
0                       : Length to stpt in calendar days
0                       : Downtime at stpt
142.2                   : Stpt EFPD
166                     : Length to stpt in calendar days
14.792                  : Downtime at stpt
97                      : Days of downtime at EOC
171.3                   : Total cycle EFPD
217                     : Total cycle length in calendar days
13                      : Integer position of assembly in cycle
N                       : Flag for variable or constant irradiation step specs
1                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
67.2                    : Irradiation step length in EFPD
4                       : # of irradiation steps to next stpt
921.02                  : ppmb
872.24                  : ppmb
738.29                  : ppmb
608.17                  : ppmb
2                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
71.1                    : Irradiation step length in EFPD
2                       : # of irradiation steps to next stpt
518.65                  : ppmb
256.11                  : ppmb
2                       : Relative stpt # in insertion cycle
29.1                    : Irradiation step length in EFPD
1                       : # of irradiation steps to next stpt
```

```
237.54                  : ppmb
18                      : # of axial nodes in CRC format
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
NO CRA INSERTION HISTORY
NO APSRA INSERTION HISTORY
18                      : # of fuel temp axial nodes (BOC-1A to EOC-1A)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
922.1
1137.8
1268.8
1342.4
1377.2
1391.9
1400.3
1410.2
1425.7
1447.2
1470.2
1479.3
1459.3
1422.3
1386.3
1340.6
1246.5
1017.0
18                      : # of fuel temp axial nodes (BOC-1B to Stpt2-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
```

```
11     20.0025
12     20.0025
13     20.0025
14     20.0025
15     20.0025
16     20.0025
17     20.0025
18     22.3520
1068.9
1261.5
1330.8
1330.2
1301.4
1271.0
1247.5
1232.4
1224.2
1219.9
1218.5
1223.6
1234.6
1249.0
1269.4
1286.9
1251.6
1076.1
18                      : # of mod spec vol axial nodes (BOC-1A to EOC-1A)
1      17.7800          : Node #, node height (cm)
2      20.0025
3      20.0025
4      20.0025
5      20.0025
6      20.0025
7      20.0025
8      20.0025
9      20.0025
10     20.0025
11     20.0025
12     20.0025
13     20.0025
14     20.0025
15     20.0025
16     20.0025
17     20.0025
18     22.3520
0.0234
0.0233
0.0232
0.0231
0.0230
0.0229
0.0228
0.0226
0.0225
0.0224
0.0223
0.0222
0.0220
0.0219
0.0218
0.0217
0.0216
0.0216
18                      : # of mod spec vol axial nodes (BOC-1B to Stpt2-1B)
1      17.7800          : Node #, node height (cm)
2      20.0025
3      20.0025
4      20.0025
5      20.0025
6      20.0025
```

```
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0234
0.0233
0.0232
0.0230
0.0229
0.0228
0.0227
0.0226
0.0225
0.0224
0.0223
0.0222
0.0221
0.0220
0.0219
0.0218
0.0217
0.0216
18                    : # of burnup axial nodes (BOC-1A)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
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
0.0
18                    : # of burnup axial nodes (BOC-1B)
1     17.7800         : Node #, node height (cm)
2     20.0025
```

```
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10      20.0025
11      20.0025
12      20.0025
13      20.0025
14      20.0025
15      20.0025
16      20.0025
17      20.0025
18      22.3520
3.288
5.786
7.754
9.071
9.872
10.330
10.571
10.666
10.639
10.475
10.152
9.756
9.488
9.394
9.373
9.113
8.002
4.988
18                      : # of burnup axial nodes (Stpt2-18)
1       17.7800         : Node #, node height (cm)
2       20.0025
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10      20.0025
11      20.0025
12      20.0025
13      20.0025
14      20.0025
15      20.0025
16      20.0025
17      20.0025
18      22.3520
5.740
9.726
12.470
14.054
14.875
15.258
15.415
15.449
15.387
15.203
14.878
14.538
14.382
14.431
14.567
14.352
12.786
```

8.108

```
N                          : This is not a pick-up case
Crystal River, Unit 3      : Reactor Identifier
CR3                        : Prefix Identifier for reactor
44group                    : Scale cross-section library
2.54                       : U-235 wt% enrichment in U of UO2
463630                     : Grams of U per assembly
208                        : Number of fuel rods in assembly
1.44272                    : Pin-pitch in assembly (cm)
0.9398                     : Fuel pellet diameter (cm)
0.95758                    : Fuel rod cladding ID (cm)
1.0922                     : Fuel rod cladding OD (cm)
360.172                    : Fuel stack height (cm)
N                          : No axial blanket fuel
INCONEL                    : Spacer grid material
0.005757609                : Vol. frac. of mod. displaced by grids
ZIRC-4                     : Fuel rod cladding material
640.0                      : Avg. fuel rod cladding temp. (K)
N                          : No cladding materials other than ZIRC-4
2200.0                     : System pressure (psi)
Y                          : Activate BPRA tracking
1                          : Number of reactor cycles with BPRA
1 0                        : # of BPRA designs, # of non-Al2O3B4C BP's
3.7 1.34 0.5857538 16 2 4    : Input Card 18C
8                          : # of radial zones in BPRA Path B model
4 0.43180                  : BPRA Path B model (Input Card 18E)
5 0.45720
2 0.54610
3 0.63246
2 0.67310
3 0.81397
500 2.91402
3 2.93693
3 0.43180                  : Path B model with BPRA removed (Input Card 18F)
3 0.45720
3 0.54610
3 0.63246
2 0.67310
3 0.81397
500 2.91402
3 2.93693
6 0.43180                  : BPRA Path B model above absorber (Input Card 18G)
5 0.45720
2 0.54610
3 0.63246
2 0.67310
3 0.81397
500 2.91402
3 2.93693
AL203 6                    : Mat. above absorber in BPR, SAS2H mat. mix. #
1 1 2 17                   : BPRA insertion history (Input Card 18N)
5                          : # of radial zones in the standard Path B model
3 0.63246                  : Standard Path B model (Input Card 20)
2 0.67310
3 0.81397
500 2.97599
3 2.99939
1                          : # of cross-section libraries per irradiation step
5                          : SAS2H output print level
0.5                        : Zone mesh factor for XSDRNPM
NO SPECIAL                 : No special XSDRNPM control parameter specs.
4                          : # of insertion reactor cycles
1A                         : Insertion reactor cycle identifier
1                          : # of stpts in cycle
0                          : Stpt EFPD
0                          : Length to stpt in calendar days
0                          : Downtime at stpt
195.292                    : Days of downtime at EOC
268.8                      : Total cycle EFPD
413                        : Total cycle length in calendar days
14                         : Integer position of assembly in cycle
```

```
1B                  : Insertion reactor cycle identifier
2                   : # of stpts in cycle
0                   : Stpt EFPD
0                   : Length to stpt in calendar days
0                   : Downtime at stpt
142.2               : Stpt EFPD
166                 : Length to stpt in calendar days
14.792              : Downtime at stpt
97                  : Days of downtime at EOC
171.3               : Total cycle EFPD
217                 : Total cycle length in calendar days
14                  : Integer position of assembly in cycle
02                  : Insertion reactor cycle identifier
1                   : # of stpts in cycle
0                   : Stpt EFPD
0                   : Length to stpt in calendar days
0                   : Downtime at stpt
2874.0              : Days of downtime at EOC
166.5               : Total cycle EFPD
212                 : Total cycle length in calendar days
14                  : Integer position of assembly in cycle
07                  : Insertion reactor cycle identifier
6                   : # of stpts in cycle
0                   : Stpt EFPD
0                   : Length to stpt in calendar days
0                   : Downtime at stpt
260.3               : Stpt EFPD
275.0               : Length to stpt in calendar days
18.875              : Downtime at stpt
291.0               : Stpt EFPD
319.175             : Length to stpt in calendar days
39.5                : Downtime at stpt
319.0               : Stpt EFPD
414.375             : Length to stpt in calendar days
109.5               : Downtime at stpt
462.3               : Stpt EFPD
743.875             : Length to stpt in calendar days
2.229               : Downtime at stpt
479.0               : Stpt EFPD
765.104             : Length to stpt in calendar days
7.208               : Downtime at stpt
99.0                : Days of downtime at EOC
497.9               : Total cycle EFPD
796                 : Total cycle length in calendar days
16                  : Integer position of assembly in cycle
N                   : Flag for variable or constant irradiation step specs
1                   : Relative insertion cycle #
1                   : Relative stpt # in insertion cycle
67.2                : Irradiation step length in EFPD
4                   : # of irradiation steps to next stpt
921.02              : ppmb
872.24              : ppmb
738.29              : ppmb
608.17              : ppmb
2                   : Relative insertion cycle #
1                   : Relative stpt # in insertion cycle
71.1                : Irradiation step length in EFPD
2                   : # of irradiation steps to next stpt
518.65              : ppmb
256.11              : ppmb
2                   : Relative stpt # in insertion cycle
29.1                : Irradiation step length in EFPD
1                   : # of irradiation steps to next stpt
237.54              : ppmb
3                   : Relative insertion cycle #
1                   : Relative stpt # in insertion cycle
55.5                : Irradiation step length in EFPD
3                   : # of irradiation steps to next stpt
688.93              : ppmb
527.51              : ppmb
```

```
353.48                  : ppmb
4                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
65.075                  : Irradiation step length in EFPD
4                       : # of irradiation steps to next stpt
1424.17                 : ppmb
1300.75                 : ppmb
1159.96                 : ppmb
971.50                  : ppmb
2                       : Relative stpt # in insertion cycle
30.7                    : Irradiation step length in EFPD
1                       : # of irradiation steps to next stpt
856.06                  : ppmb
3                       : Relative stpt # in insertion cycle
28.0                    : Irradiation step length in EFPD
1                       : # of irradiation steps to next stpt
805.91                  : ppmb
4                       : Relative stpt # in insertion cycle
71.65                   : Irradiation step length in EFPD
2                       : # of irradiation steps to next stpt
565.35                  : ppmb
356.75                  : ppmb
5                       : Relative stpt # in insertion cycle
16.7                    : Irradiation step length in EFPD
1                       : # of irradiation steps to next stpt
231.02                  : ppmb
6                       : Relative stpt # in insertion cycle
18.9                    : Irradiation step length in EFPD
1                       : # of irradiation steps to next stpt
183.83                  : ppmb
18                      : # of axial nodes in CRC format
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
NO CRA INSERTION HISTORY
NO APSRA INSERTION HISTORY
18                      : # of fuel temp axial nodes (BOC-1A to EOC-1A)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
```

```
898.5
1070.7
1193.8
1260.2
1294.1
1310.7
1320.6
1330.3
1342.9
1358.2
1372.4
1378.6
1372.7
1358.8
1348.7
1334.6
1251.7
1049.6
18                      : # of fuel temp axial nodes (BOC-1B to Stpt2-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
1066.3
1268.6
1338.5
1340.7
1318.5
1292.8
1272.1
1258.7
1252.1
1250.9
1254.2
1261.6
1271.6
1282.7
1299.2
1319.4
1284.6
1088.6
18                      : # of fuel temp axial nodes (Stpt2-1B to EOC-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
```

```
15     20.0025
16     20.0025
17     20.0025
18     22.3520
1002.2
1160.9
1226.2
1270.2
1323.1
1357.9
1374.9
1384.7
1391.5
1397.8
1405.1
1410.8
1407.9
1386.9
1340.3
1273.1
1186.3
1002.4
18                      : # of fuel temp axial nodes (BOC-2 to EOC-2)
1      17.7800          : Node #, node height (cm)
2      20.0025
3      20.0025
4      20.0025
5      20.0025
6      20.0025
7      20.0025
8      20.0025
9      20.0025
10     20.0025
11     20.0025
12     20.0025
13     20.0025
14     20.0025
15     20.0025
16     20.0025
17     20.0025
18     22.3520
927.3
1061.1
1115.0
1126.9
1127.2
1126.4
1126.8
1127.4
1125.5
1118.0
1104.3
1087.2
1069.7
1053.7
1041.6
1035.0
1013.6
889.8
18                      : # of fuel temp axial nodes (BOC-7 to Stpt2-7)
1      17.7800          : Node #, node height (cm)
2      20.0025
3      20.0025
4      20.0025
5      20.0025
6      20.0025
7      20.0025
8      20.0025
9      20.0025
10     20.0025
```

```
11     20.0025
12     20.0025
13     20.0025
14     20.0025
15     20.0025
16     20.0025
17     20.0025
18     22.3520
963.7
1083.6
1114.1
1119.2
1114.4
1107.7
1102.0
1097.8
1095.0
1093.1
1091.6
1089.7
1085.9
1078.0
1062.7
1039.2
1004.7
906.4
18                      : # of fuel temp axial nodes (Stpt2-7 to Stpt3-7)
1      17.7800          : Node #, node height (cm)
2      20.0025
3      20.0025
4      20.0025
5      20.0025
6      20.0025
7      20.0025
8      20.0025
9      20.0025
10     20.0025
11     20.0025
12     20.0025
13     20.0025
14     20.0025
15     20.0025
16     20.0025
17     20.0025
18     22.3520
981.5
1064.9
1077.2
1065.2
1053.7
1044.5
1039.2
1037.4
1038.3
1041.3
1045.8
1051.6
1058.1
1064.2
1067.2
1064.0
1049.8
966.8
18                      : # of fuel temp axial nodes (Stpt3-7 to Stpt4-7)
1      17.7800          : Node #, node height (cm)
2      20.0025
3      20.0025
4      20.0025
5      20.0025
6      20.0025
```

```
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
981.5
1064.9
1077.2
1065.2
1053.7
1044.5
1039.2
1037.4
1038.3
1041.3
1045.8
1051.6
1058.1
1064.2
1067.2
1064.0
1049.8
966.8
18                    : # of fuel temp axial nodes (Stpt4-7 to Stpt5-7)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
993.9
1069.3
1074.7
1063.2
1051.5
1041.7
1035.4
1032.0
1030.9
1031.3
1033.1
1036.0
1039.9
1044.3
1047.5
1045.5
1031.6
960.0
18                    : # of fuel temp axial nodes (Stpt5-7 to Stpt6-7)
1     17.7800         : Node #, node height (cm)
2     20.0025
```

```
3      20.0025
4      20.0025
5      20.0025
6      20.0025
7      20.0025
8      20.0025
9      20.0025
10     20.0025
11     20.0025
12     20.0025
13     20.0025
14     20.0025
15     20.0025
16     20.0025
17     20.0025
18     22.3520
993.9
1069.3
1074.7
1063.2
1051.5
1041.7
1035.4
1032.0
1030.9
1031.3
1033.1
1036.0
1039.9
1044.3
1047.5
1045.5
1031.6
960.0
18                      : # of mod spec vol axial nodes (BOC-1A to EOC-1A)
1      17.7800          : Node #, node height (cm)
2      20.0025
3      20.0025
4      20.0025
5      20.0025
6      20.0025
7      20.0025
8      20.0025
9      20.0025
10     20.0025
11     20.0025
12     20.0025
13     20.0025
14     20.0025
15     20.0025
16     20.0025
17     20.0025
18     22.3520
0.0232
0.0231
0.0230
0.0230
0.0229
0.0228
0.0226
0.0225
0.0224
0.0223
0.0222
0.0221
0.0220
0.0219
0.0218
0.0217
0.0217
```

```
0.0216
18                          : # of mod spec vol axial nodes (BOC-1B to Stpt2-1B)
1      17.7800              : Node #, node height (cm)
2      20.0025
3      20.0025
4      20.0025
5      20.0025
6      20.0025
7      20.0025
8      20.0025
9      20.0025
10     20.0025
11     20.0025
12     20.0025
13     20.0025
14     20.0025
15     20.0025
16     20.0025
17     20.0025
18     22.3520
0.0234
0.0233
0.0232
0.0231
0.0229
0.0228
0.0227
0.0226
0.0225
0.0224
0.0223
0.0222
0.0221
0.0220
0.0219
0.0218
0.0217
0.0216
18                          : # of mod spec vol axial nodes (Stpt2-1B to EOC-1B)
1      17.7800              : Node #, node height (cm)
2      20.0025
3      20.0025
4      20.0025
5      20.0025
6      20.0025
7      20.0025
8      20.0025
9      20.0025
10     20.0025
11     20.0025
12     20.0025
13     20.0025
14     20.0025
15     20.0025
16     20.0025
17     20.0025
18     22.3520
0.0236
0.0235
0.0234
0.0233
0.0232
0.0230
0.0229
0.0228
0.0226
0.0225
0.0224
0.0222
0.0221
```

```
0.0220
0.0219
0.0218
0.0217
0.0216
18                      : # of mod spec vol axial nodes (BOC-2 to EOC-2)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0230
0.0229
0.0228
0.0227
0.0226
0.0225
0.0225
0.0224
0.0223
0.0222
0.0221
0.0220
0.0219
0.0218
0.0218
0.0217
0.0216
0.0216
18                      : # of mod spec vol axial nodes (BOC-7 to Stpt2-7)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0232
0.0231
0.0230
0.0229
0.0228
0.0227
0.0226
0.0225
0.0224
```

```
0.0223
0.0222
0.0221
0.0220
0.0219
0.0218
0.0217
0.0216
0.0216
18                      : # of mod spec vol axial nodes (Stpt2-7 to Stpt3-7)
1       17.7800         : Node #, node height (cm)
2       20.0025
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10      20.0025
11      20.0025
12      20.0025
13      20.0025
14      20.0025
15      20.0025
16      20.0025
17      20.0025
18      22.3520
0.0232
0.0231
0.0230
0.0229
0.0228
0.0227
0.0226
0.0225
0.0224
0.0223
0.0222
0.0221
0.0220
0.0219
0.0218
0.0218
0.0217
0.0216
18                      : # of mod spec vol axial nodes (Stpt3-7 to Stpt4-7)
1       17.7800         : Node #, node height (cm)
2       20.0025
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10      20.0025
11      20.0025
12      20.0025
13      20.0025
14      20.0025
15      20.0025
16      20.0025
17      20.0025
18      22.3520
0.0232
0.0231
0.0230
0.0229
0.0228
```

```
0.0227
0.0226
0.0225
0.0224
0.0223
0.0222
0.0221
0.0220
0.0219
0.0218
0.0218
0.0217
0.0216
18                    : # of mod spec vol axial nodes (Stpt4-7 to Stpt5-7)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0232
0.0231
0.0230
0.0229
0.0228
0.0227
0.0226
0.0225
0.0224
0.0223
0.0222
0.0221
0.0220
0.0219
0.0218
0.0218
0.0217
0.0216
18                    : # of mod spec vol axial nodes (Stpt5-7 to Stpt6-7)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0232
```

```
0.0231
0.0230
0.0229
0.0228
0.0227
0.0226
0.0225
0.0224
0.0223
0.0222
0.0221
0.0220
0.0219
0.0218
0.0218
0.0217
0.0216
18                      : # of burnup axial nodes (BOC-1A)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
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
18                      : # of burnup axial nodes (BOC-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
```

```
16    20.0025
17    20.0025
18    22.3520
3.042
4.939
6.561
7.668
8.361
8.770
8.995
9.097
9.105
9.030
8.888
8.731
8.635
8.663
8.790
8.660
7.628
5.173
18                    : # of burnup axial nodes (Stpt2-1B)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
5.483
8.892
11.299
12.673
13.401
13.759
13.920
13.980
13.977
13.922
13.831
13.759
13.768
13.903
14.142
14.055
12.572
8.373
18                    : # of burnup axial nodes (BOC-2)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
```

```
12     20.0025
13     20.0025
14     20.0025
15     20.0025
16     20.0025
17     20.0025
18     22.3520
5.980
9.666
12.216
13.671
14.457
14.858
15.044
15.113
15.116
15.072
15.005
14.962
14.994
15.127
15.321
15.142
13.506
8.974
18                      : # of burnup axial nodes (BOC-7)
1      17.7800          : Node #, node height (cm)
2      20.0025
3      20.0025
4      20.0025
5      20.0025
6      20.0025
7      20.0025
8      20.0025
9      20.0025
10     20.0025
11     20.0025
12     20.0025
13     20.0025
14     20.0025
15     20.0025
16     20.0025
17     20.0025
18     22.3520
8.381
13.468
16.719
18.422
19.272
19.674
19.836
19.869
19.822
19.717
19.595
19.516
19.536
19.676
19.881
19.636
17.591
11.651
18                      : # of burnup axial nodes (Stpt2-7)
1      17.7800          : Node #, node height (cm)
2      20.0025
3      20.0025
4      20.0025
5      20.0025
6      20.0025
7      20.0025
```

```
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
12.578
19.862
24.178
26.326
27.358
27.834
28.034
28.092
28.062
27.967
27.842
27.741
27.700
27.709
27.660
26.978
24.130
16.089
18                    : # of burnup axial nodes (Stpt3-7)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
13.161
20.719
25.146
27.322
28.351
28.818
29.010
29.063
29.032
28.939
28.817
28.722
28.688
28.700
28.647
27.938
25.010
16.703
18                    : # of burnup axial nodes (Stpt4-7)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
```

```
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10      20.0025
11      20.0025
12      20.0025
13      20.0025
14      20.0025
15      20.0025
16      20.0025
17      20.0025
18      22.3520
13.725
21.540
26.064
28.256
29.276
29.727
29.907
29.951
29.914
29.818
29.695
29.601
29.570
29.584
29.526
28.795
25.797
17.256
18                      : # of burnup axial nodes (Stpt5-7)
1       17.7800         : Node #, node height (cm)
2       20.0025
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10      20.0025
11      20.0025
12      20.0025
13      20.0025
14      20.0025
15      20.0025
16      20.0025
17      20.0025
18      22.3520
16.648
25.684
30.625
32.859
33.820
34.209
34.348
34.375
34.339
34.257
34.161
34.105
34.124
34.190
34.167
33.402
30.126
20.386
```

```
18                      : # of burnup axial nodes (Stpt6-7)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
17.005
26.176
31.158
33.391
34.343
34.724
34.858
34.883
34.847
34.767
34.674
34.622
34.646
34.720
34.703
33.939
30.639
20.766
```

```
N                       : This is not a pick-up case
Crystal River, Unit 3   : Reactor Identifier
CR3                     : Prefix Identifier for reactor
44group                 : Scale cross-section library
2.83                    : U-235 wt% enrichment in U of UO2
463630                  : Grams of U per assembly
208                     : Number of fuel rods in assembly
1.44272                 : Pin-pitch in assembly (cm)
0.9398                  : Fuel pellet diameter (cm)
0.95758                 : Fuel rod cladding ID (cm)
1.0922                  : Fuel rod cladding OD (cm)
360.172                 : Fuel stack height (cm)
N                       : No axial blanket fuel
INCONEL                 : Spacer grid material
0.005757609             : Vol. frac. of mod. displaced by grids
ZIRC-4                  : Fuel rod cladding material
640.0                   : Avg. fuel rod cladding temp. (K)
N                       : No cladding materials other than ZIRC-4
2200.0                  : System pressure (psi)
N                       : Activate BPRA tracking
5                       : # of radial zones in the standard Path B model
3 0.63246               : Standard Path B model (Input Card 20)
2 0.67310
3 0.81397
500 2.97599
3 2.99939
1                       : # of cross-section libraries per irradiation step
5                       : SAS2H output print level
0.5                     : Zone mesh factor for XSDRNPM
NO SPECIAL              : No special XSDRNPM control parameter specs.
4                       : # of insertion reactor cycles
1A                      : Insertion reactor cycle identifier
1                       : # of stpts in cycle
0                       : Stpt EFPD
0                       : Length to stpt in calendar days
0                       : Downtime at stpt
195.292                 : Days of downtime at EOC
268.8                   : Total cycle EFPD
413                     : Total cycle length in calendar days
15                      : Integer position of assembly in cycle
1B                      : Insertion reactor cycle identifier
2                       : # of stpts in cycle
0                       : Stpt EFPD
0                       : Length to stpt in calendar days
0                       : Downtime at stpt
142.2                   : Stpt EFPD
166                     : Length to stpt in calendar days
14.792                  : Downtime at stpt
97                      : Days of downtime at EOC
171.3                   : Total cycle EFPD
217                     : Total cycle length in calendar days
15                      : Integer position of assembly in cycle
02                      : Insertion reactor cycle identifier
1                       : # of stpts in cycle
0                       : Stpt EFPD
0                       : Length to stpt in calendar days
0                       : Downtime at stpt
164.0                   : Days of downtime at EOC
166.5                   : Total cycle EFPD
212                     : Total cycle length in calendar days
10                      : Integer position of assembly in cycle
03                      : Insertion reactor cycle identifier
3                       : # of stpts in cycle
0                       : Stpt EFPD
0                       : Length to stpt in calendar days
0                       : Downtime at stpt
168.5                   : Stpt EFPD
193                     : Length to stpt in calendar days
16.792                  : Downtime at stpt
250.0                   : Stpt EFPD
```

```
309                     : Length to stpt in calendar days
13.333                  : Downtime at stpt
73                      : Days of downtime at EOC
323.0                   : Total cycle EFPD
416                     : Total cycle length in calendar days
14                      : Integer position of assembly in cycle
N                       : Flag for variable or constant irradiation step specs
1                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
67.2                    : Irradiation step length in EFPD
4                       : # of irradiation steps to next stpt
921.02                  : ppmb
872.24                  : ppmb
738.29                  : ppmb
608.17                  : ppmb
2                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
71.1                    : Irradiation step length in EFPD
2                       : # of irradiation steps to next stpt
518.65                  : ppmb
256.11                  : ppmb
2                       : Relative stpt # in insertion cycle
29.1                    : Irradiation step length in EFPD
1                       : # of irradiation steps to next stpt
237.54                  : ppmb
3                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
55.5                    : Irradiation step length in EFPD
3                       : # of irradiation steps to next stpt
688.93                  : ppmb
527.51                  : ppmb
353.48                  : ppmb
4                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
56.167                  : Irradiation step length in EFPD
3                       : # of irradiation steps to next stpt
880.38                  : ppmb
694.68                  : ppmb
536.65                  : ppmb
2                       : Relative stpt # in insertion cycle
40.75                   : Irradiation step length in EFPD
2                       : # of irradiation steps to next stpt
382.60                  : ppmb
267.17                  : ppmb
3                       : Relative stpt # in insertion cycle
36.5                    : Irradiation step length in EFPD
2                       : # of irradiation steps to next stpt
234.64                  : ppmb
128.17                  : ppmb
18                      : # of axial nodes in CRC format
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
NO CRA INSERTION HISTORY
NO APSRA INSERTION HISTORY
```

```
18                      : # of fuel temp axial nodes (BOC-1A to EOC-1A)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
797.4
945.2
1042.2
1093.0
1118.2
1130.7
1138.2
1145.4
1154.2
1164.7
1174.4
1179.9
1179.4
1175.1
1171.3
1156.1
1086.5
890.8
18                      : # of fuel temp axial nodes (BOC-1B to Stpt2-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
911.8
1076.0
1137.8
1143.5
1129.7
1112.0
1097.4
1087.6
1082.7
1082.0
1084.6
1089.6
1096.1
1103.4
```

```
1113.5
1120.1
1088.1
935.6
18                      : # of fuel temp axial nodes (Stpt2-1B to EOC-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
868.2
1001.9
1061.8
1103.0
1144.2
1173.6
1189.4
1198.5
1205.0
1210.5
1215.2
1216.9
1210.6
1190.3
1152.6
1100.1
1029.4
885.4
18                      : # of fuel temp axial nodes (BOC-2 to EOC-2)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
1013.1
1172.9
1255.2
1295.8
1306.7
1305.5
1303.8
1303.0
1299.8
1290.1
```

```
1272.8
1251.3
1229.2
1210.1
1199.9
1203.6
1189.4
1047.4
18                    : # of fuel temp axial nodes (BOC-3 to Stpt2-3)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
896.4
1016.5
1064.3
1074.9
1072.7
1064.8
1054.3
1044.4
1039.7
1043.8
1056.4
1074.4
1092.3
1103.9
1108.7
1103.2
1061.1
925.1
18                    : # of fuel temp axial nodes (Stpt2-3 to Stpt3-3)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
946.1
1048.6
1067.6
1063.3
1054.8
1047.6
```

```
1042.5
1038.7
1036.4
1036.7
1039.6
1044.6
1052.3
1066.7
1086.1
1087.7
1063.7
968.2
18                      : # of mod spec vol axial nodes (BOC-1A to EOC-1A)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0227
0.0226
0.0226
0.0225
0.0225
0.0224
0.0223
0.0223
0.0222
0.0221
0.0220
0.0220
0.0219
0.0218
0.0217
0.0217
0.0216
0.0216
18                      : # of mod spec vol axial nodes (BOC-1B to Stpt2-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0228
0.0227
```

```
0.0226
0.0226
0.0225
0.0224
0.0223
0.0223
0.0222
0.0221
0.0220
0.0220
0.0219
0.0218
0.0218
0.0217
0.0216
0.0216
18                      : # of mod spec vol axial nodes (Stpt2-1B to EOC-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0229
0.0229
0.0228
0.0227
0.0227
0.0226
0.0225
0.0224
0.0223
0.0222
0.0221
0.0220
0.0219
0.0218
0.0218
0.0217
0.0216
0.0216
18                      : # of mod spec vol axial nodes (BOC-2 to EOC-2)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
```

```
17    20.0025
18    22.3520
0.0234
0.0233
0.0232
0.0231
0.0230
0.0228
0.0227
0.0226
0.0225
0.0224
0.0222
0.0221
0.0220
0.0219
0.0218
0.0218
0.0217
0.0216
18                    : # of mod spec vol axial nodes (BOC-3 to Stpt2-3)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0230
0.0229
0.0228
0.0227
0.0226
0.0226
0.0225
0.0224
0.0223
0.0222
0.0221
0.0221
0.0220
0.0219
0.0218
0.0217
0.0216
0.0216
18                    : # of mod spec vol axial nodes (Stpt2-3 to Stpt3-3)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
```

```
13     20.0025
14     20.0025
15     20.0025
16     20.0025
17     20.0025
18     22.3520
0.0230
0.0230
0.0229
0.0228
0.0227
0.0226
0.0225
0.0224
0.0223
0.0223
0.0222
0.0221
0.0220
0.0219
0.0218
0.0217
0.0217
0.0216
18                      : # of burnup axial nodes (BOC-1A)
1      17.7800          : Node #, node height (cm)
2      20.0025
3      20.0025
4      20.0025
5      20.0025
6      20.0025
7      20.0025
8      20.0025
9      20.0025
10     20.0025
11     20.0025
12     20.0025
13     20.0025
14     20.0025
15     20.0025
16     20.0025
17     20.0025
18     22.3520
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
18                      : # of burnup axial nodes (BOC-1B)
1      17.7800          : Node #, node height (cm)
2      20.0025
3      20.0025
4      20.0025
5      20.0025
6      20.0025
7      20.0025
8      20.0025
```

```
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
2.089
3.709
4.917
5.701
6.188
6.476
6.636
6.712
6.728
6.698
6.640
6.580
6.555
6.595
6.652
6.475
5.604
3.380
18                    : # of burnup axial nodes (Stpt2-1B)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
3.735
6.410
8.182
9.165
9.685
9.943
10.063
10.113
10.124
10.112
10.092
10.088
10.125
10.222
10.328
10.123
8.899
5.493
18                    : # of burnup axial nodes (BOC-2)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
```

```
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10      20.0025
11      20.0025
12      20.0025
13      20.0025
14      20.0025
15      20.0025
16      20.0025
17      20.0025
18      22.3520
4.068
6.942
8.824
9.871
10.436
10.728
10.868
10.928
10.947
10.946
10.941
10.952
10.997
11.083
11.151
10.878
9.544
5.902
18                      : # of burnup axial nodes (BOC-3)
1       17.7800         : Node #, node height (cm)
2       20.0025
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10      20.0025
11      20.0025
12      20.0025
13      20.0025
14      20.0025
15      20.0025
16      20.0025
17      20.0025
18      22.3520
7.023
11.611
14.464
15.888
16.533
16.798
16.883
16.883
16.838
16.778
16.733
16.733
16.791
16.913
17.041
16.782
15.055
9.654
18                      : # of burnup axial nodes (Stpt2-3)
```

```
1     17.7800          : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
9.290
15.210
18.778
20.505
21.264
21.552
21.608
21.540
21.417
21.309
21.277
21.353
21.530
21.783
22.004
21.660
19.386
12.470
18                     : # of burnup axial nodes (Stpt3-3)
1     17.7800          : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
10.571
17.128
20.970
22.771
23.537
23.817
23.864
23.787
23.657
23.553
23.543
23.661
23.910
24.281
24.637
```

24.288
21.783
14.116

```
N                       : This is not a pick-up case
Crystal River, Unit 3   : Reactor Identifier
CR3                     : Prefix Identifier for reactor
44group                 : Scale cross-section library
1.93                    : U-235 wt% enrichment in U of UO2
463630                  : Grams of U per assembly
208                     : Number of fuel rods in assembly
1.44272                 : Pin-pitch in assembly (cm)
0.9398                  : Fuel pellet diameter (cm)
0.95758                 : Fuel rod cladding ID (cm)
1.0922                  : Fuel rod cladding OD (cm)
360.172                 : Fuel stack height (cm)
N                       : No axial blanket fuel
INCONEL                 : Spacer grid material
0.005757609             : Vol. frac. of mod. displaced by grids
ZIRC-4                  : Fuel rod cladding material
640.0                   : Avg. fuel rod cladding temp. (K)
N                       : No cladding materials other than ZIRC-4
2200.0                  : System pressure (psi)
N                       : Activate BPRA tracking
5                       : # of radial zones in the standard Path B model
3 0.63246               : Standard Path B model (Input Card 20)
2 0.67310
3 0.81397
500 2.97599
3 2.99939
1                       : # of cross-section libraries per irradiation step
5                       : SAS2H output print level
0.5                     : Zone mesh factor for XSDRNPM
NO SPECIAL              : No special XSDRNPM control parameter specs.
2                       : # of insertion reactor cycles
1A                      : Insertion reactor cycle identifier
1                       : # of stpts in cycle
0                       : Stpt EFPD
0                       : Length to stpt in calendar days
0                       : Downtime at stpt
195.292                 : Days of downtime at EOC
268.8                   : Total cycle EFPD
413                     : Total cycle length in calendar days
16                      : Integer position of assembly in cycle
1B                      : Insertion reactor cycle identifier
2                       : # of stpts in cycle
0                       : Stpt EFPD
0                       : Length to stpt in calendar days
0                       : Downtime at stpt
142.2                   : Stpt EFPD
166                     : Length to stpt in calendar days
14.792                  : Downtime at stpt
97                      : Days of downtime at EOC
171.3                   : Total cycle EFPD
217                     : Total cycle length in calendar days
16                      : Integer position of assembly in cycle
N                       : Flag for variable or constant irradiation step specs
1                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
67.2                    : Irradiation step length in EFPD
4                       : # of irradiation steps to next stpt
921.02                  : ppmb
872.24                  : ppmb
738.29                  : ppmb
608.17                  : ppmb
2                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
71.1                    : Irradiation step length in EFPD
2                       : # of irradiation steps to next stpt
518.65                  : ppmb
256.11                  : ppmb
2                       : Relative stpt # in insertion cycle
29.1                    : Irradiation step length in EFPD
1                       : # of irradiation steps to next stpt
```

```
237.54                  : ppmb
18                      : # of axial nodes in CRC format
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
NO CRA INSERTION HISTORY
NO APSRA INSERTION HISTORY
18                      : # of fuel temp axial nodes (BOC-1A to EOC-1A)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
989.1
1221.8
1359.2
1431.9
1462.4
1472.1
1476.7
1484.9
1500.8
1522.9
1545.0
1557.7
1549.6
1521.6
1475.2
1408.0
1294.8
1049.4
18                      : # of fuel temp axial nodes (BOC-1B to Stpt2-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
```

```
11     20.0025
12     20.0025
13     20.0025
14     20.0025
15     20.0025
16     20.0025
17     20.0025
18     22.3520
1096.5
1277.2
1341.2
1329.0
1292.0
1256.0
1228.8
1211.0
1200.8
1195.9
1195.8
1202.1
1214.8
1232.7
1254.3
1268.1
1234.3
1066.0
18                      : # of mod spec vol axial nodes (BOC-1A to EOC-1A)
1      17.7800          : Node #, node height (cm)
2      20.0025
3      20.0025
4      20.0025
5      20.0025
6      20.0025
7      20.0025
8      20.0025
9      20.0025
10     20.0025
11     20.0025
12     20.0025
13     20.0025
14     20.0025
15     20.0025
16     20.0025
17     20.0025
18     22.3520
0.0237
0.0236
0.0235
0.0234
0.0232
0.0231
0.0229
0.0228
0.0227
0.0225
0.0224
0.0222
0.0221
0.0220
0.0219
0.0217
0.0217
0.0216
18                      : # of mod spec vol axial nodes (BOC-1B to Stpt2-1B)
1      17.7800          : Node #, node height (cm)
2      20.0025
3      20.0025
4      20.0025
5      20.0025
6      20.0025
```

```
7       20.0025
8       20.0025
9       20.0025
10      20.0025
11      20.0025
12      20.0025
13      20.0025
14      20.0025
15      20.0025
16      20.0025
17      20.0025
18      22.3520
0.0234
0.0233
0.0232
0.0230
0.0229
0.0228
0.0227
0.0226
0.0225
0.0224
0.0223
0.0222
0.0221
0.0220
0.0219
0.0218
0.0217
0.0216
18                      : # of burnup axial nodes (BOC-1A)
1       17.7800         : Node #, node height (cm)
2       20.0025
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10      20.0025
11      20.0025
12      20.0025
13      20.0025
14      20.0025
15      20.0025
16      20.0025
17      20.0025
18      22.3520
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
18                      : # of burnup axial nodes (BOC-1B)
1       17.7800         : Node #, node height (cm)
2       20.0025
```

```
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10      20.0025
11      20.0025
12      20.0025
13      20.0025
14      20.0025
15      20.0025
16      20.0025
17      20.0025
18      22.3520
3.967
6.909
9.171
10.653
11.540
12.040
12.298
12.395
12.363
12.197
11.898
11.535
11.229
10.992
10.695
10.060
8.605
5.300
18                      : # of burnup axial nodes (Stpt2-1B)
1       17.7800         : Node #, node height (cm)
2       20.0025
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10      20.0025
11      20.0025
12      20.0025
13      20.0025
14      20.0025
15      20.0025
16      20.0025
17      20.0025
18      22.3520
6.627
11.100
14.094
15.768
16.609
16.983
17.119
17.129
17.044
16.855
16.567
16.276
16.101
16.035
15.904
15.292
13.376
```

8.424

```
N                          : This is not a pick-up case
Crystal River, Unit 3      : Reactor Identifier
CR3                        : Prefix Identifier for reactor
44group                    : Scale cross-section library
2.54                       : U-235 wt% enrichment in U of UO2
463630                     : Grams of U per assembly
208                        : Number of fuel rods in assembly
1.44272                    : Pin-pitch in assembly (cm)
0.9398                     : Fuel pellet diameter (cm)
0.95758                    : Fuel rod cladding ID (cm)
1.0922                     : Fuel rod cladding OD (cm)
360.172                    : Fuel stack height (cm)
N                          : No axial blanket fuel
INCONEL                    : Spacer grid material
0.005757609                : Vol. frac. of mod. displaced by grids
ZIRC-4                     : Fuel rod cladding material
640.0                      : Avg. fuel rod cladding temp. (K)
N                          : No cladding materials other than ZIRC-4
2200.0                     : System pressure (psi)
Y                          : Activate BPRA tracking
1                          : Number of reactor cycles with BPRA
1 0                        : # of BPRA designs, # of non-Al2O3B4C BP's
3.7 1.01 0.5857538 16 2 4    : Input Card 18C
8                          : # of radial zones in BPRA Path B model
4 0.43180                  : BPRA Path B model (Input Card 18E)
5 0.45720
2 0.54610
3 0.63246
2 0.67310
3 0.81397
500 2.91402
3 2.93693
3 0.43180                  : Path B model with BPRA removed (Input Card 18F)
3 0.45720
3 0.54610
3 0.63246
2 0.67310
3 0.81397
500 2.91402
3 2.93693
6 0.43180                  : BPRA Path B model above absorber (Input Card 18G)
5 0.45720
2 0.54610
3 0.63246
2 0.67310
3 0.81397
500 2.91402
3 2.93693
AL203 6                    : Mat. above absorber in BPR, SAS2H mat. mix. #
1 1 2 17                   : BPRA insertion history (Input Card 18N)
5                          : # of radial zones in the standard Path B model
3 0.63246                  : Standard Path B model (Input Card 20)
2 0.67310
3 0.81397
500 2.97599
3 2.99939
1                          : # of cross-section libraries per irradiation step
5                          : SAS2H output print level
0.5                        : Zone mesh factor for XSDRNPM
NO SPECIAL                 : No special XSDRNPM control parameter specs.
3                          : # of insertion reactor cycles
1A                         : Insertion reactor cycle identifier
1                          : # of stpts in cycle
0                          : Stpt EFPD
0                          : Length to stpt in calendar days
0                          : Downtime at stpt
195.292                    : Days of downtime at EOC
268.8                      : Total cycle EFPD
413                        : Total cycle length in calendar days
17                         : Integer position of assembly in cycle
```

```
1B                      : Insertion reactor cycle identifier
2                       : # of stpts in cycle
0                       : Stpt EFPD
0                       : Length to stpt in calendar days
0                       : Downtime at stpt
142.2                   : Stpt EFPD
166                     : Length to stpt in calendar days
14.792                  : Downtime at stpt
97                      : Days of downtime at EOC
171.3                   : Total cycle EFPD
217                     : Total cycle length in calendar days
17                      : Integer position of assembly in cycle
02                      : Insertion reactor cycle identifier
1                       : # of stpts in cycle
0                       : Stpt EFPD
0                       : Length to stpt in calendar days
0                       : Downtime at stpt
164                     : Days of downtime at EOC
166.5                   : Total cycle EFPD
212                     : Total cycle length in calendar days
17                      : Integer position of assembly in cycle
N                       : Flag for variable or constant irradiation step specs
1                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
67.2                    : Irradiation step length in EFPD
4                       : # of irradiation steps to next stpt
921.02                  : ppmb
872.24                  : ppmb
738.29                  : ppmb
608.17                  : ppmb
2                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
71.1                    : Irradiation step length in EFPD
2                       : # of irradiation steps to next stpt
518.65                  : ppmb
256.11                  : ppmb
2                       : Relative stpt # in insertion cycle
29.1                    : Irradiation step length in EFPD
1                       : # of irradiation steps to next stpt
237.54                  : ppmb
3                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
55.5                    : Irradiation step length in EFPD
3                       : # of irradiation steps to next stpt
688.93                  : ppmb
527.51                  : ppmb
353.48                  : ppmb
18                      : # of axial nodes in CRC format
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
NO CRA INSERTION HISTORY
NO APSRA INSERTION HISTORY
18                      : # of fuel temp axial nodes (BOC-1A to EOC-1A)
1     17.7800           : Node #, node height (cm)
```

```
2      20.0025
3      20.0025
4      20.0025
5      20.0025
6      20.0025
7      20.0025
8      20.0025
9      20.0025
10     20.0025
11     20.0025
12     20.0025
13     20.0025
14     20.0025
15     20.0025
16     20.0025
17     20.0025
18     22.3520
987.6
1210.5
1371.6
1462.5
1500.7
1514.0
1520.3
1528.4
1544.1
1569.4
1601.4
1617.5
1582.8
1516.8
1449.1
1368.5
1255.6
1057.5
18                    : # of fuel temp axial nodes (BOC-1B to Stpt2-1B)
1      17.7800        : Node #, node height (cm)
2      20.0025
3      20.0025
4      20.0025
5      20.0025
6      20.0025
7      20.0025
8      20.0025
9      20.0025
10     20.0025
11     20.0025
12     20.0025
13     20.0025
14     20.0025
15     20.0025
16     20.0025
17     20.0025
18     22.3520
1122.0
1324.2
1407.1
1395.8
1353.9
1314.2
1285.0
1266.4
1255.9
1247.2
1237.5
1239.4
1253.9
1275.8
1308.8
1344.6
```

```
1315.6
1115.4
18                      : # of fuel temp axial nodes (Stpt2-1B to EOC-1B)
1       17.7800         : Node #, node height (cm)
2       20.0025
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10      20.0025
11      20.0025
12      20.0025
13      20.0025
14      20.0025
15      20.0025
16      20.0025
17      20.0025
18      22.3520
1106.5
1261.5
1284.2
1254.6
1228.6
1213.1
1204.1
1197.1
1186.8
1169.8
1159.9
1174.3
1192.5
1210.0
1228.8
1220.7
1166.1
997.9
18                      : # of mod spec vol axial nodes (BOC-1A to EOC-1A)
1       17.7800         : Node #, node height (cm)
2       20.0025
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10      20.0025
11      20.0025
12      20.0025
13      20.0025
14      20.0025
15      20.0025
16      20.0025
17      20.0025
18      22.3520
0.0237
0.0237
0.0236
0.0234
0.0233
0.0231
0.0230
0.0228
0.0227
0.0225
0.0224
0.0222
```

```
0.0221
0.0220
0.0218
0.0217
0.0217
0.0216
18                      : # of mod spec vol axial nodes (BOC-1B to Stpt2-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0236
0.0235
0.0233
0.0232
0.0230
0.0229
0.0228
0.0227
0.0225
0.0224
0.0223
0.0222
0.0221
0.0220
0.0219
0.0218
0.0217
0.0216
18                      : # of mod spec vol axial nodes (Stpt2-1B to EOC-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0233
0.0232
0.0231
0.0230
0.0229
0.0228
0.0226
0.0225
```

```
0.0224
0.0223
0.0222
0.0221
0.0220
0.0219
0.0218
0.0217
0.0217
0.0216
18                      : # of burnup axial nodes (BOC-1A)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
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
18                      : # of burnup axial nodes (BOC-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
4.023
6.795
9.272
10.920
```

```
11.888
12.429
12.707
12.804
12.738
12.461
11.866
11.060
10.532
10.267
10.088
9.751
8.616
5.801
18                      : # of burnup axial nodes (Stpt2-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
6.794
11.197
14.536
16.484
17.448
17.870
18.022
18.026
17.893
17.533
16.838
16.040
15.652
15.613
15.735
15.596
14.017
9.328
18                      : # of burnup axial nodes (BOC-2)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
```

7.442
12.158
15.590
17.526
18.458
18.852
18.982
18.959
18.787
18.394
17.709
16.961
16.643
16.688
16.858
16.682
14.971
9.952

```
N                          : This is not a pick-up case
Crystal River, Unit 3      : Reactor Identifier
CR3                        : Prefix Identifier for reactor
44group                    : Scale cross-section library
2.54                       : U-235 wt% enrichment in U of UO2
463630                     : Grams of U per assembly
208                        : Number of fuel rods in assembly
1.44272                    : Pin-pitch in assembly (cm)
0.9398                     : Fuel pellet diameter (cm)
0.95758                    : Fuel rod cladding ID (cm)
1.0922                     : Fuel rod cladding OD (cm)
360.172                    : Fuel stack height (cm)
N                          : No axial blanket fuel
INCONEL                    : Spacer grid material
0.005757609                : Vol. frac. of mod. displaced by grids
ZIRC-4                     : Fuel rod cladding material
640.0                      : Avg. fuel rod cladding temp. (K)
N                          : No cladding materials other than ZIRC-4
2200.0                     : System pressure (psi)
Y                          : Activate BPRA tracking
1                          : Number of reactor cycles with BPRA
1 0                        : # of BPRA designs, # of non-Al2O3B4C BP's
3.7 1.18 0.5857538 16 2 4    : Input Card 18C
8                          : # of radial zones in BPRA Path B model
4 0.43180                  : BPRA Path B model (Input Card 18E)
5 0.45720
2 0.54610
3 0.63246
2 0.67310
3 0.81397
500 2.91402
3 2.93693
3 0.43180                  : Path B model with BPRA removed (Input Card 18F)
3 0.45720
3 0.54610
3 0.63246
2 0.67310
3 0.81397
500 2.91402
3 2.93693
6 0.43180                  : BPRA Path B model above absorber (Input Card 18G)
5 0.45720
2 0.54610
3 0.63246
2 0.67310
3 0.81397
500 2.91402
3 2.93693
AL203 6                    : Mat. above absorber in BPR, SAS2H mat. mix. #
1 1 2 17                   : BPRA insertion history (Input Card 18N)
5                          : # of radial zones in the standard Path B model
3 0.63246                  : Standard Path B model (Input Card 20)
2 0.67310
3 0.81397
500 2.97599
3 2.99939
1                          : # of cross-section libraries per irradiation step
5                          : SAS2H output print level
0.5                        : Zone mesh factor for XSDRNPM
NO SPECIAL                 : No special XSDRNPM control parameter specs.
3                          : # of insertion reactor cycles
1A                         : Insertion reactor cycle identifier
1                          : # of stpts in cycle
0                          : Stpt EFPD
0                          : Length to stpt in calendar days
0                          : Downtime at stpt
195.292                    : Days of downtime at EOC
268.8                      : Total cycle EFPD
413                        : Total cycle length in calendar days
19                         : Integer position of assembly in cycle
```

```
1B                      : Insertion reactor cycle identifier
2                       : # of stpts in cycle
0                       : Stpt EFPD
0                       : Length to stpt in calendar days
0                       : Downtime at stpt
142.2                   : Stpt EFPD
166                     : Length to stpt in calendar days
14.792                  : Downtime at stpt
97                      : Days of downtime at EOC
171.3                   : Total cycle EFPD
217                     : Total cycle length in calendar days
19                      : Integer position of assembly in cycle
02                      : Insertion reactor cycle identifier
1                       : # of stpts in cycle
0                       : Stpt EFPD
0                       : Length to stpt in calendar days
0                       : Downtime at stpt
164                     : Days of downtime at EOC
166.5                   : Total cycle EFPD
212                     : Total cycle length in calendar days
19                      : Integer position of assembly in cycle
N                       : Flag for variable or constant irradiation step specs
1                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
67.2                    : Irradiation step length in EFPD
4                       : # of irradiation steps to next stpt
921.02                  : ppmb
872.24                  : ppmb
738.29                  : ppmb
608.17                  : ppmb
2                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
71.1                    : Irradiation step length in EFPD
2                       : # of irradiation steps to next stpt
518.65                  : ppmb
256.11                  : ppmb
2                       : Relative stpt # in insertion cycle
29.1                    : Irradiation step length in EFPD
1                       : # of irradiation steps to next stpt
237.54                  : ppmb
3                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
55.5                    : Irradiation step length in EFPD
3                       : # of irradiation steps to next stpt
688.93                  : ppmb
527.51                  : ppmb
353.48                  : ppmb
18                      : # of axial nodes in CRC format
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
NO CRA INSERTION HISTORY
NO APSRA INSERTION HISTORY
18                      : # of fuel temp axial nodes (BOC-1A to EOC-1A)
1     17.7800           : Node #, node height (cm)
```

```
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
922.5
1112.1
1242.2
1315.0
1352.2
1369.7
1380.3
1391.7
1408.3
1430.9
1455.9
1460.5
1414.1
1350.8
1312.2
1282.9
1202.0
1020.2
18                    : # of fuel temp axial nodes (BOC-1B to Stpt2-1B)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
1144.8
1362.2
1438.7
1437.7
1407.7
1375.4
1350.7
1335.3
1327.5
1321.5
1313.7
1316.6
1329.5
1344.3
1361.6
1375.1
```

```
1326.0
1114.5
18                      : # of fuel temp axial nodes (Stpt2-1B to EOC-1B)
1       17.7800         : Node #, node height (cm)
2       20.0025
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10      20.0025
11      20.0025
12      20.0025
13      20.0025
14      20.0025
15      20.0025
16      20.0025
17      20.0025
18      22.3520
1073.6
1239.6
1299.0
1308.1
1311.3
1316.0
1320.1
1322.1
1318.7
1307.2
1301.5
1317.8
1330.8
1333.3
1325.6
1284.8
1202.6
1016.0
18                      : # of mod spec vol axial nodes (BOC-1A to EOC-1A)
1       17.7800         : Node #, node height (cm)
2       20.0025
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10      20.0025
11      20.0025
12      20.0025
13      20.0025
14      20.0025
15      20.0025
16      20.0025
17      20.0025
18      22.3520
0.0233
0.0232
0.0231
0.0230
0.0229
0.0228
0.0227
0.0226
0.0225
0.0223
0.0222
0.0221
```

```
0.0220
0.0219
0.0218
0.0217
0.0216
0.0216
18                      : # of mod spec vol axial nodes (BOC-1B to Stpt2-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0236
0.0235
0.0234
0.0233
0.0231
0.0230
0.0228
0.0227
0.0226
0.0225
0.0223
0.0222
0.0221
0.0220
0.0219
0.0218
0.0217
0.0216
18                      : # of mod spec vol axial nodes (Stpt2-1B to EOC-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0235
0.0234
0.0233
0.0232
0.0231
0.0229
0.0228
0.0227
```

```
0.0226
0.0224
0.0223
0.0222
0.0221
0.0220
0.0219
0.0218
0.0217
0.0216
18                      : # of burnup axial nodes (BOC-1A)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
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
0.0
18                      : # of burnup axial nodes (BOC-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
3.311
5.425
7.233
8.467
```

```
9.230
9.670
9.899
9.979
9.923
9.688
9.174
8.484
8.089
8.019
8.197
8.350
7.639
5.251
18                      : # of burnup axial nodes (Stpt2-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
6.174
10.024
12.703
14.203
14.969
15.322
15.462
15.481
15.387
15.100
14.514
13.843
13.572
13.666
14.022
14.220
12.954
8.668
18                      : # of burnup axial nodes (BOC-2)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
```

6.770
10.934
13.746
15.279
16.050
16.404
16.540
16.546
16.425
16.114
15.543
14.923
14.713
14.869
15.241
15.363
13.935
9.298

```
N                       : This is not a pick-up case
Crystal River, Unit 3   : Reactor Identifier
CR3                     : Prefix Identifier for reactor
44group                 : Scale cross-section library
2.83                    : U-235 wt% enrichment in U of UO2
463630                  : Grams of U per assembly
208                     : Number of fuel rods in assembly
1.44272                 : Pin-pitch in assembly (cm)
0.9398                  : Fuel pellet diameter (cm)
0.95758                 : Fuel rod cladding ID (cm)
1.0922                  : Fuel rod cladding OD (cm)
360.172                 : Fuel stack height (cm)
N                       : No axial blanket fuel
INCONEL                 : Spacer grid material
0.005757609             : Vol. frac. of mod. displaced by grids
ZIRC-4                  : Fuel rod cladding material
640.0                   : Avg. fuel rod cladding temp. (K)
N                       : No cladding materials other than ZIRC-4
2200.0                  : System pressure (psi)
N                       : Activate BPRA tracking
5                       : # of radial zones in the standard Path B model
3 0.63246               : Standard Path B model (Input Card 20)
2 0.67310
3 0.81397
500 2.97599
3 2.99939
1                       : # of cross-section libraries per irradiation step
5                       : SAS2H output print level
0.5                     : Zone mesh factor for XSDRNPM
NO SPECIAL              : No special XSDRNPM control parameter specs.
4                       : # of insertion reactor cycles
1A                      : Insertion reactor cycle identifier
1                       : # of stpts in cycle
0                       : Stpt EFPD
0                       : Length to stpt in calendar days
0                       : Downtime at stpt
195.292                 : Days of downtime at EOC
268.8                   : Total cycle EFPD
413                     : Total cycle length in calendar days
21                      : Integer position of assembly in cycle
1B                      : Insertion reactor cycle identifier
2                       : # of stpts in cycle
0                       : Stpt EFPD
0                       : Length to stpt in calendar days
0                       : Downtime at stpt
142.2                   : Stpt EFPD
166                     : Length to stpt in calendar days
14.792                  : Downtime at stpt
97                      : Days of downtime at EOC
171.3                   : Total cycle EFPD
217                     : Total cycle length in calendar days
21                      : Integer position of assembly in cycle
02                      : Insertion reactor cycle identifier
1                       : # of stpts in cycle
0                       : Stpt EFPD
0                       : Length to stpt in calendar days
0                       : Downtime at stpt
164.0                   : Days of downtime at EOC
166.5                   : Total cycle EFPD
212                     : Total cycle length in calendar days
11                      : Integer position of assembly in cycle
03                      : Insertion reactor cycle identifier
3                       : # of stpts in cycle
0                       : Stpt EFPD
0                       : Length to stpt in calendar days
0                       : Downtime at stpt
168.5                   : Stpt EFPD
193                     : Length to stpt in calendar days
16.792                  : Downtime at stpt
250.0                   : Stpt EFPD
```

```
309                     : Length to stpt in calendar days
13.333                  : Downtime at stpt
73                      : Days of downtime at EOC
323.0                   : Total cycle EFPD
416                     : Total cycle length in calendar days
17                      : Integer position of assembly in cycle
N                       : Flag for variable or constant irradiation step specs
1                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
67.2                    : Irradiation step length in EFPD
4                       : # of irradiation steps to next stpt
921.02                  : ppmb
872.24                  : ppmb
738.29                  : ppmb
608.17                  : ppmb
2                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
71.1                    : Irradiation step length in EFPD
2                       : # of irradiation steps to next stpt
518.65                  : ppmb
256.11                  : ppmb
2                       : Relative stpt # in insertion cycle
29.1                    : Irradiation step length in EFPD
1                       : # of irradiation steps to next stpt
237.54                  : ppmb
3                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
55.5                    : Irradiation step length in EFPD
3                       : # of irradiation steps to next stpt
688.93                  : ppmb
527.51                  : ppmb
353.48                  : ppmb
4                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
56.167                  : Irradiation step length in EFPD
3                       : # of irradiation steps to next stpt
880.38                  : ppmb
694.68                  : ppmb
536.65                  : ppmb
2                       : Relative stpt # in insertion cycle
40.75                   : Irradiation step length in EFPD
2                       : # of irradiation steps to next stpt
382.60                  : ppmb
267.17                  : ppmb
3                       : Relative stpt # in insertion cycle
36.5                    : Irradiation step length in EFPD
2                       : # of irradiation steps to next stpt
234.64                  : ppmb
128.17                  : ppmb
18                      : # of axial nodes in CRC format
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
NO CRA INSERTION HISTORY
NO APSRA INSERTION HISTORY
```

```
18                      : # of fuel temp axial nodes (BOC-1A to EOC-1A)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
708.6
807.4
876.5
916.6
938.4
949.8
956.5
962.3
968.6
975.3
980.8
982.6
979.9
976.4
984.9
1000.7
955.3
800.1
18                      : # of fuel temp axial nodes (BOC-1B to Stpt2-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
864.6
1023.9
1091.3
1104.1
1095.5
1081.6
1069.4
1061.2
1057.1
1056.6
1059.0
1063.5
1068.6
1071.2
```

```
1066.0
1047.0
998.8
854.6
18                      : # of fuel temp axial nodes (Stpt2-1B to EOC-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
825.6
955.5
1016.0
1043.9
1063.4
1078.8
1089.4
1096.3
1101.0
1104.8
1108.1
1109.3
1104.4
1087.7
1054.7
1007.6
944.5
815.8
18                      : # of fuel temp axial nodes (BOC-2 to EOC-2)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
1125.3
1324.4
1415.5
1450.3
1460.7
1463.2
1466.2
1469.9
1468.4
1451.1
```

```
1412.4
1370.5
1336.8
1314.1
1308.4
1315.9
1288.9
1112.6
18                      : # of fuel temp axial nodes (BOC-3 to Stpt2-3)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
1004.0
1148.7
1202.1
1209.5
1200.8
1183.9
1157.2
1120.5
1093.9
1095.4
1118.4
1160.5
1217.5
1253.5
1264.0
1260.8
1215.2
1051.1
18                      : # of fuel temp axial nodes (Stpt2-3 to Stpt3-3)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
1025.4
1132.0
1151.0
1142.2
1129.1
1118.3
```

```
1108.3
1092.6
1070.0
1060.8
1064.4
1075.5
1098.0
1133.4
1161.3
1162.6
1139.4
1038.6
18                      : # of mod spec vol axial nodes (BOC-1A to EOC-1A)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0223
0.0222
0.0222
0.0222
0.0221
0.0221
0.0221
0.0220
0.0220
0.0219
0.0219
0.0218
0.0218
0.0217
0.0217
0.0216
0.0216
0.0216
18                      : # of mod spec vol axial nodes (BOC-1B to Stpt2-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0226
0.0226
```

```
0.0225
0.0224
0.0224
0.0223
0.0222
0.0222
0.0221
0.0220
0.0220
0.0219
0.0218
0.0218
0.0217
0.0217
0.0216
0.0216
18                      : # of mod spec vol axial nodes (Stpt2-1B to EOC-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0226
0.0226
0.0225
0.0225
0.0224
0.0223
0.0223
0.0222
0.0221
0.0221
0.0220
0.0219
0.0218
0.0218
0.0217
0.0217
0.0216
0.0216
18                      : # of mod spec vol axial nodes (BOC-2 to EOC-2)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
```

```
17    20.0025
18    22.3520
0.0237
0.0236
0.0235
0.0233
0.0232
0.0230
0.0229
0.0227
0.0226
0.0225
0.0223
0.0222
0.0221
0.0220
0.0219
0.0218
0.0217
0.0216
18                    : # of mod spec vol axial nodes (BOC-3 to Stpt2-3)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0233
0.0232
0.0231
0.0230
0.0229
0.0228
0.0227
0.0226
0.0225
0.0224
0.0223
0.0222
0.0221
0.0220
0.0219
0.0218
0.0217
0.0216
18                    : # of mod spec vol axial nodes (Stpt2-3 to Stpt3-3)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
```

```
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0233
0.0232
0.0231
0.0229
0.0228
0.0227
0.0226
0.0225
0.0224
0.0223
0.0223
0.0222
0.0221
0.0220
0.0219
0.0218
0.0217
0.0216
18                    : # of burnup axial nodes (BOC-1A)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
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
18                    : # of burnup axial nodes (BOC-1B)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
```

```
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
1.326
2.386
3.186
3.703
4.021
4.206
4.305
4.347
4.347
4.313
4.258
4.203
4.184
4.251
4.435
4.538
4.040
2.427
18                    : # of burnup axial nodes (Stpt2-1B)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
2.726
4.724
6.040
6.746
7.099
7.263
7.330
7.351
7.348
7.329
7.306
7.299
7.330
7.424
7.573
7.522
6.633
4.040
18                    : # of burnup axial nodes (BOC-2)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
```

```
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10      20.0025
11      20.0025
12      20.0025
13      20.0025
14      20.0025
15      20.0025
16      20.0025
17      20.0025
18      22.3520
3.009
5.183
6.591
7.338
7.714
7.892
7.969
7.995
7.996
7.985
7.974
7.979
8.018
8.105
8.224
8.116
7.135
4.353
18                      : # of burnup axial nodes (BOC-3)
1       17.7800         : Node #, node height (cm)
2       20.0025
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10      20.0025
11      20.0025
12      20.0025
13      20.0025
14      20.0025
15      20.0025
16      20.0025
17      20.0025
18      22.3520
6.609
10.829
13.276
14.387
14.839
14.992
15.009
14.952
14.830
14.656
14.498
14.434
14.499
14.690
14.939
14.829
13.319
8.491
18                      : # of burnup axial nodes (Stpt2-3)
```

```
1      17.7800          : Node #, node height (cm)
2      20.0025
3      20.0025
4      20.0025
5      20.0025
6      20.0025
7      20.0025
8      20.0025
9      20.0025
10     20.0025
11     20.0025
12     20.0025
13     20.0025
14     20.0025
15     20.0025
16     20.0025
17     20.0025
18     22.3520
9.583
15.451
18.742
20.186
20.744
20.894
20.819
20.534
20.067
19.666
19.501
19.606
20.012
20.661
21.208
21.082
18.971
12.261
18                      : # of burnup axial nodes (Stpt3-3)
1      17.7800          : Node #, node height (cm)
2      20.0025
3      20.0025
4      20.0025
5      20.0025
6      20.0025
7      20.0025
8      20.0025
9      20.0025
10     20.0025
11     20.0025
12     20.0025
13     20.0025
14     20.0025
15     20.0025
16     20.0025
17     20.0025
18     22.3520
11.187
17.792
21.372
22.866
23.406
23.526
23.417
23.066
22.482
22.002
21.840
22.009
22.562
23.470
24.242
```

24.134
21.793
14.248

```
N                       : This is not a pick-up case
Crystal River, Unit 3   : Reactor Identifier
CR3                     : Prefix Identifier for reactor
44group                 : Scale cross-section library
1.93                    : U-235 wt% enrichment in U of UO2
463630                  : Grams of U per assembly
208                     : Number of fuel rods in assembly
1.44272                 : Pin-pitch in assembly (cm)
0.9398                  : Fuel pellet diameter (cm)
0.95758                 : Fuel rod cladding ID (cm)
1.0922                  : Fuel rod cladding OD (cm)
360.172                 : Fuel stack height (cm)
N                       : No axial blanket fuel
INCONEL                 : Spacer grid material
0.005757609             : Vol. frac. of mod. displaced by grids
ZIRC-4                  : Fuel rod cladding material
640.0                   : Avg. fuel rod cladding temp. (K)
N                       : No cladding materials other than ZIRC-4
2200.0                  : System pressure (psi)
N                       : Activate BPRA tracking
5                       : # of radial zones in the standard Path B model
3 0.63246               : Standard Path B model (Input Card 20)
2 0.67310
3 0.81397
500 2.97599
3 2.99939
1                       : # of cross-section libraries per irradiation step
5                       : SAS2H output print level
0.5                     : Zone mesh factor for XSDRNPM
NO SPECIAL              : No special XSDRNPM control parameter specs.
2                       : # of insertion reactor cycles
1A                      : Insertion reactor cycle identifier
1                       : # of stpts in cycle
0                       : Stpt EFPD
0                       : Length to stpt in calendar days
0                       : Downtime at stpt
195.292                 : Days of downtime at EOC
268.8                   : Total cycle EFPD
413                     : Total cycle length in calendar days
24                      : Integer position of assembly in cycle
1B                      : Insertion reactor cycle identifier
2                       : # of stpts in cycle
0                       : Stpt EFPD
0                       : Length to stpt in calendar days
0                       : Downtime at stpt
142.2                   : Stpt EFPD
166                     : Length to stpt in calendar days
14.792                  : Downtime at stpt
97                      : Days of downtime at EOC
171.3                   : Total cycle EFPD
217                     : Total cycle length in calendar days
24                      : Integer position of assembly in cycle
N                       : Flag for variable or constant irradiation step specs
1                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
67.2                    : Irradiation step length in EFPD
4                       : # of irradiation steps to next stpt
921.02                  : ppmb
872.24                  : ppmb
738.29                  : ppmb
608.17                  : ppmb
2                       : Relative insertion cycle #
1                       : Relative stpt # in insertion cycle
71.1                    : Irradiation step length in EFPD
2                       : # of irradiation steps to next stpt
518.65                  : ppmb
256.11                  : ppmb
2                       : Relative stpt # in insertion cycle
29.1                    : Irradiation step length in EFPD
1                       : # of irradiation steps to next stpt
```

```
237.54                  : ppmb
18                      : # of axial nodes in CRC format
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
NO CRA INSERTION HISTORY
NO APSRA INSERTION HISTORY
18                      : # of fuel temp axial nodes (BOC-1A to EOC-1A)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
878.2
1073.1
1197.5
1261.1
1293.4
1308.8
1318.5
1329.3
1345.0
1365.7
1386.8
1392.1
1366.5
1323.7
1283.8
1238.3
1152.2
936.2
18                      : # of fuel temp axial nodes (BOC-1B to Stpt2-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
```

```
11     20.0025
12     20.0025
13     20.0025
14     20.0025
15     20.0025
16     20.0025
17     20.0025
18     22.3520
1026.1
1215.2
1278.3
1277.4
1252.8
1225.3
1204.1
1190.8
1183.9
1180.3
1179.0
1184.2
1195.9
1211.2
1231.8
1247.6
1212.7
1038.8
18                      : # of mod spec vol axial nodes (BOC-1A to EOC-1A)
1      17.7800          : Node #, node height (cm)
2      20.0025
3      20.0025
4      20.0025
5      20.0025
6      20.0025
7      20.0025
8      20.0025
9      20.0025
10     20.0025
11     20.0025
12     20.0025
13     20.0025
14     20.0025
15     20.0025
16     20.0025
17     20.0025
18     22.3520
0.0231
0.0230
0.0230
0.0229
0.0228
0.0227
0.0226
0.0225
0.0224
0.0223
0.0222
0.0221
0.0220
0.0219
0.0218
0.0217
0.0216
0.0216
18                      : # of mod spec vol axial nodes (BOC-1B to Stpt2-1B)
1      17.7800          : Node #, node height (cm)
2      20.0025
3      20.0025
4      20.0025
5      20.0025
6      20.0025
```

```
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0232
0.0231
0.0230
0.0229
0.0228
0.0227
0.0226
0.0225
0.0224
0.0223
0.0222
0.0221
0.0220
0.0219
0.0218
0.0217
0.0217
0.0216
18                    : # of burnup axial nodes (BOC-1A)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
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
18                    : # of burnup axial nodes (BOC-1B)
1     17.7800         : Node #, node height (cm)
2     20.0025
```

```
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10      20.0025
11      20.0025
12      20.0025
13      20.0025
14      20.0025
15      20.0025
16      20.0025
17      20.0025
18      22.3520
2.805
4.961
6.609
7.706
8.384
8.775
8.978
9.049
9.002
8.818
8.469
8.045
7.757
7.662
7.676
7.519
6.618
4.080
18                      : # of burnup axial nodes (Stpt2-1B)
1       17.7800         : Node #, node height (cm)
2       20.0025
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10      20.0025
11      20.0025
12      20.0025
13      20.0025
14      20.0025
15      20.0025
16      20.0025
17      20.0025
18      22.3520
5.017
8.547
10.902
12.219
12.890
13.199
13.322
13.339
13.262
13.056
12.701
12.328
12.148
12.195
12.363
12.247
10.915
```

6.848

```
N                          : This is not a pick-up case
Crystal River, Unit 3      : Reactor Identifier
CR3                        : Prefix Identifier for reactor
44group                    : Scale cross-section library
2.83                       : U-235 wt% enrichment in U of UO2
463630                     : Grams of U per assembly
208                        : Number of fuel rods in assembly
1.44272                    : Pin-pitch in assembly (cm)
0.9398                     : Fuel pellet diameter (cm)
0.95758                    : Fuel rod cladding ID (cm)
1.0922                     : Fuel rod cladding OD (cm)
360.172                    : Fuel stack height (cm)
N                          : No axial blanket fuel
INCONEL                    : Spacer grid material
0.005757609                : Vol. frac. of mod. displaced by grids
ZIRC-4                     : Fuel rod cladding material
640.0                      : Avg. fuel rod cladding temp. (K)
N                          : No cladding materials other than ZIRC-4
2200.0                     : System pressure (psi)
Y                          : Activate BPRA tracking
1                          : Number of reactor cycles with BPRA
1 0                        : # of BPRA designs, # of non-Al2O3B4C BP's
3.7 1.18 0.5857538 16 2 4    : Input Card 18C
8                          : # of radial zones in BPRA Path B model
4 0.43180                  : BPRA Path B model (Input Card 18E)
5 0.45720
2 0.54610
3 0.63246
2 0.67310
3 0.81397
500 2.91402
3 2.93693
3 0.43180                  : Path B model with BPRA removed (Input Card 18F)
3 0.45720
3 0.54610
3 0.63246
2 0.67310
3 0.81397
500 2.91402
3 2.93693
6 0.43180                  : BPRA Path B model above absorber (Input Card 18G)
5 0.45720
2 0.54610
3 0.63246
2 0.67310
3 0.81397
500 2.91402
3 2.93693
AL203 6                    : Mat. above absorber in BPR, SAS2H mat. mix. #
1 1 2 17                   : BPRA insertion history (Input Card 18N)
5                          : # of radial zones in the standard Path B model
3 0.63246                  : Standard Path B model (Input Card 20)
2 0.67310
3 0.81397
500 2.97599
3 2.99939
1                          : # of cross-section libraries per irradiation step
5                          : SAS2H output print level
0.5                        : Zone mesh factor for XSDRNPM
NO SPECIAL                 : No special XSDRNPM control parameter specs.
4                          : # of insertion reactor cycles
1A                         : Insertion reactor cycle identifier
1                          : # of stpts in cycle
0                          : Stpt EFPD
0                          : Length to stpt in calendar days
0                          : Downtime at stpt
195.292                    : Days of downtime at EOC
268.8                      : Total cycle EFPD
413                        : Total cycle length in calendar days
27                         : Integer position of assembly in cycle
```

```
1B                  : Insertion reactor cycle identifier
2                   : # of stpts in cycle
0                   : Stpt EFPD
0                   : Length to stpt in calendar days
0                   : Downtime at stpt
142.2               : Stpt EFPD
166                 : Length to stpt in calendar days
14.792              : Downtime at stpt
97                  : Days of downtime at EOC
171.3               : Total cycle EFPD
217                 : Total cycle length in calendar days
27                  : Integer position of assembly in cycle
02                  : Insertion reactor cycle identifier
1                   : # of stpts in cycle
0                   : Stpt EFPD
0                   : Length to stpt in calendar days
0                   : Downtime at stpt
164                 : Days of downtime at EOC
166.5               : Total cycle EFPD
212                 : Total cycle length in calendar days
12                  : Integer position of assembly in cycle
03                  : Insertion reactor cycle identifier
3                   : # of stpts in cycle
0                   : Stpt EFPD
0                   : Length to stpt in calendar days
0                   : Downtime at stpt
168.5               : Stpt EFPD
193                 : Length to stpt in calendar days
16.792              : Downtime at stpt
250.0               : Stpt EFPD
309                 : Length to stpt in calendar days
13.333              : Downtime at stpt
73                  : Days of downtime at EOC
323.0               : Total cycle EFPD
416                 : Total cycle length in calendar days
24                  : Integer position of assembly in cycle
N                   : Flag for variable or constant irradiation step specs
1                   : Relative insertion cycle #
1                   : Relative stpt # in insertion cycle
67.2                : Irradiation step length in EFPD
4                   : # of irradiation steps to next stpt
921.02              : ppmb
872.24              : ppmb
738.29              : ppmb
608.17              : ppmb
2                   : Relative insertion cycle #
1                   : Relative stpt # in insertion cycle
71.1                : Irradiation step length in EFPD
2                   : # of irradiation steps to next stpt
518.65              : ppmb
256.11              : ppmb
2                   : Relative stpt # in insertion cycle
29.1                : Irradiation step length in EFPD
1                   : # of irradiation steps to next stpt
237.54              : ppmb
3                   : Relative insertion cycle #
1                   : Relative stpt # in insertion cycle
55.5                : Irradiation step length in EFPD
3                   : # of irradiation steps to next stpt
688.93              : ppmb
527.51              : ppmb
353.48              : ppmb
4                   : Relative insertion cycle #
1                   : Relative stpt # in insertion cycle
56.167              : Irradiation step length in EFPD
3                   : # of irradiation steps to next stpt
880.38              : ppmb
694.68              : ppmb
536.65              : ppmb
2                   : Relative stpt # in insertion cycle
```

```
40.75                   : Irradiation step length in EFPD
2                       : # of irradiation steps to next stpt
382.60                  : ppmb
267.17                  : ppmb
3                       : Relative stpt # in insertion cycle
36.5                    : Irradiation step length in EFPD
2                       : # of irradiation steps to next stpt
234.64                  : ppmb
128.17                  : ppmb
18                      : # of axial nodes in CRC format
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
NO CRA INSERTION HISTORY
NO APSRA INSERTION HISTORY
18                      : # of fuel temp axial nodes (BOC-1A to EOC-1A)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
875.4
1041.9
1164.5
1232.2
1267.0
1285.0
1296.5
1308.0
1322.8
1340.3
1355.5
1359.2
1344.7
1315.0
1274.8
1217.6
1121.7
939.2
18                      : # of fuel temp axial nodes (BOC-1B to Stpt2-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
```

```
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
981.0
1167.7
1230.7
1229.1
1203.3
1175.5
1154.7
1142.1
1136.2
1135.2
1138.8
1147.3
1160.5
1179.2
1210.2
1248.5
1227.9
1039.2
18                    : # of fuel temp axial nodes (Stpt2-1B to EOC-1B)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
937.6
1088.9
1148.1
1188.2
1232.7
1256.8
1265.3
1269.3
1272.0
1275.5
1282.7
1293.0
1299.7
1294.6
1270.7
1225.1
1148.0
```

```
971.1
18                      : # of fuel temp axial nodes (BOC-2 to EOC-2)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
1120.7
1299.5
1365.2
1374.6
1372.1
1370.5
1372.6
1376.9
1376.9
1356.5
1304.5
1255.4
1222.2
1201.9
1203.4
1226.3
1210.6
1049.9
18                      : # of fuel temp axial nodes (BOC-3 to Stpt2-3)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
945.1
1088.0
1141.2
1157.2
1155.5
1144.8
1127.6
1107.5
1095.9
1102.3
1124.5
1157.9
1192.7
```

```
1210.1
1200.7
1167.8
1108.2
962.0
18                      : # of fuel temp axial nodes (Stpt2-3 to Stpt3-3)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
990.1
1091.2
1116.0
1109.4
1097.7
1088.3
1081.2
1073.5
1066.0
1066.1
1073.1
1082.8
1093.9
1103.1
1103.0
1095.0
1072.4
976.8
18                      : # of mod spec vol axial nodes (BOC-1A to EOC-1A)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0230
0.0230
0.0229
0.0228
0.0227
0.0226
0.0225
0.0224
0.0223
```

```
0.0222
0.0221
0.0220
0.0219
0.0219
0.0218
0.0217
0.0216
0.0216
18                      : # of mod spec vol axial nodes (BOC-1B to Stpt2-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0230
0.0230
0.0229
0.0228
0.0227
0.0226
0.0225
0.0224
0.0223
0.0222
0.0222
0.0221
0.0220
0.0219
0.0218
0.0217
0.0217
0.0216
18                      : # of mod spec vol axial nodes (Stpt2-1B to EOC-1B)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0232
0.0232
0.0231
0.0230
0.0229
```

```
0.0228
0.0227
0.0226
0.0224
0.0223
0.0222
0.0221
0.0220
0.0219
0.0218
0.0217
0.0216
0.0216
18                      : # of mod spec vol axial nodes (BOC-2 to EOC-2)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0236
0.0235
0.0234
0.0233
0.0231
0.0230
0.0228
0.0227
0.0225
0.0224
0.0223
0.0222
0.0221
0.0220
0.0219
0.0218
0.0217
0.0216
18                      : # of mod spec vol axial nodes (BOC-3 to Stpt2-3)
1     17.7800           : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0233
```

```
0.0232
0.0231
0.0230
0.0229
0.0228
0.0227
0.0226
0.0225
0.0224
0.0223
0.0222
0.0221
0.0220
0.0219
0.0218
0.0217
0.0216
18                    : # of mod spec vol axial nodes (Stpt2-3 to Stpt3-3)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
0.0233
0.0232
0.0231
0.0230
0.0229
0.0227
0.0226
0.0225
0.0224
0.0223
0.0222
0.0221
0.0220
0.0219
0.0219
0.0218
0.0217
0.0216
18                    : # of burnup axial nodes (BOC-1A)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
```

```
16    20.0025
17    20.0025
18    22.3520
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
18                    : # of burnup axial nodes (BOC-1B)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
12    20.0025
13    20.0025
14    20.0025
15    20.0025
16    20.0025
17    20.0025
18    22.3520
2.734
4.492
5.988
7.017
7.664
8.044
8.246
8.322
8.292
8.159
7.935
7.680
7.477
7.359
7.241
6.856
5.875
3.941
18                    : # of burnup axial nodes (Stpt2-1B)
1     17.7800         : Node #, node height (cm)
2     20.0025
3     20.0025
4     20.0025
5     20.0025
6     20.0025
7     20.0025
8     20.0025
9     20.0025
10    20.0025
11    20.0025
```

```
12     20.0025
13     20.0025
14     20.0025
15     20.0025
16     20.0025
17     20.0025
18     22.3520
4.711
7.726
9.885
11.123
11.754
12.044
12.165
12.191
12.142
12.016
11.829
11.648
11.557
11.589
11.671
11.443
10.126
6.676
18                      : # of burnup axial nodes (BOC-2)
1      17.7800          : Node #, node height (cm)
2      20.0025
3      20.0025
4      20.0025
5      20.0025
6      20.0025
7      20.0025
8      20.0025
9      20.0025
10     20.0025
11     20.0025
12     20.0025
13     20.0025
14     20.0025
15     20.0025
16     20.0025
17     20.0025
18     22.3520
5.127
8.383
10.673
11.985
12.658
12.976
13.107
13.133
13.083
12.964
12.800
12.655
12.602
12.653
12.719
12.426
10.975
7.214
18                      : # of burnup axial nodes (BOC-3)
1      17.7800          : Node #, node height (cm)
2      20.0025
3      20.0025
4      20.0025
5      20.0025
6      20.0025
7      20.0025
```

```
8       20.0025
9       20.0025
10      20.0025
11      20.0025
12      20.0025
13      20.0025
14      20.0025
15      20.0025
16      20.0025
17      20.0025
18      22.3520
8.896
14.190
17.401
18.972
19.670
19.943
20.003
19.925
19.705
19.329
18.913
18.640
18.614
18.814
19.083
18.840
16.893
11.178
18                      : # of burnup axial nodes (Stpt2-3)
1       17.7800         : Node #, node height (cm)
2       20.0025
3       20.0025
4       20.0025
5       20.0025
6       20.0025
7       20.0025
8       20.0025
9       20.0025
10      20.0025
11      20.0025
12      20.0025
13      20.0025
14      20.0025
15      20.0025
16      20.0025
17      20.0025
18      22.3520
11.580
18.500
22.655
24.667
25.549
25.870
25.884
25.668
25.258
24.762
24.360
24.220
24.411
24.823
25.114
24.589
21.902
14.397
18                      : # of burnup axial nodes (Stpt3-3)
1       17.7800         : Node #, node height (cm)
2       20.0025
3       20.0025
```

4	20.0025
5	20.0025
6	20.0025
7	20.0025
8	20.0025
9	20.0025
10	20.0025
11	20.0025
12	20.0025
13	20.0025
14	20.0025
15	20.0025
16	20.0025
17	20.0025
18	22.3520

13.090
20.768
25.255
27.354
28.240
28.547
28.543
28.298
27.845
27.328
26.946
26.859
27.133
27.641
27.976
27.397
24.467
16.163

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A11/CR3A11N17DC1AT000AC1BT000.cut	aXLIIf.375	30	Dec 21 1996	139030	ASCII
A11/CR3A11N17DC1BT000AC1BT142.cut	aXLIIf.376	32	Dec 21 1996	152017	ASCII
A11/CR3A11N18DC1AT000AC1BT000.cut	aXLIIf.377	30	Dec 21 1996	137702	ASCII
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A12/CR3A12N01DC1BT000AC1BT142.cut	aXLIIf.380	31	Dec 21 1996	148108	ASCII

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A12/CR3A12N02DC1AT000AC1BT000.cut	aXLIIf.382	31	Dec 21 1996	140137	ASCII
A12/CR3A12N02DC1BT000AC1BT142.cut	aXLIIf.383	32	Dec 21 1996	150021	ASCII
A12/CR3A12N02DC1BT142AC02T000.cut	aXLIIf.384	28	Dec 21 1996	134397	ASCII
A12/CR3A12N03DC1AT000AC1BT000.cut	aXLIIf.385	31	Dec 21 1996	141382	ASCII
A12/CR3A12N03DC1BT000AC1BT142.cut	aXLIIf.386	32	Dec 21 1996	151851	ASCII
A12/CR3A12N03DC1BT142AC02T000.cut	aXLIIf.387	29	Dec 21 1996	135227	ASCII
A12/CR3A12N04DC1AT000AC1BT000.cut	aXLIIf.388	31	Dec 21 1996	141780	ASCII
A12/CR3A12N04DC1BT000AC1BT142.cut	aXLIIf.389	32	Dec 21 1996	152410	ASCII
A12/CR3A12N04DC1BT142AC02T000.cut	aXLIIf.390	29	Dec 21 1996	135476	ASCII
A12/CR3A12N05DC1AT000AC1BT000.cut	aXLIIf.391	31	Dec 21 1996	141946	ASCII
A12/CR3A12N05DC1BT000AC1BT142.cut	aXLIIf.392	32	Dec 21 1996	153388	ASCII
A12/CR3A12N05DC1BT142AC02T000.cut	aXLIIf.393	29	Dec 21 1996	135812	ASCII
A12/CR3A12N06DC1AT000AC1BT000.cut	aXLIIf.394	31	Dec 21 1996	142195	ASCII
A12/CR3A12N06DC1BT000AC1BT142.cut	aXLIIf.395	33	Dec 21 1996	153641	ASCII
A12/CR3A12N06DC1BT142AC02T000.cut	aXLIIf.396	29	Dec 21 1996	135895	ASCII
A12/CR3A12N07DC1AT000AC1BT000.cut	aXLIIf.397	31	Dec 21 1996	142444	ASCII
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A12/CR3A12N09DC1AT000AC1BT000.cut	aXLIIf.403	31	Dec 22 1996	142444	ASCII
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A12/CR3A12N10DC1BT000AC1BT142.cut	aXLIIf.407	32	Dec 22 1996	152893	ASCII
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A12/CR3A12N11DC1AT000AC1BT000.cut	aXLIIf.409	31	Dec 22 1996	141946	ASCII
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A12/CR3A12N11DC1BT142AC02T000.cut	aXLIIf.411	29	Dec 22 1996	135476	ASCII
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A12/CR3A12N14DC1BT000AC1BT142.cut	aXLIIf.419	32	Dec 22 1996	152244	ASCII
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A12/CR3A12N16DC1BT142AC02T000.cut	aXLIIf.426	29	Dec 22 1996	135227	ASCII
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A12/CR3A12N18DC1AT000AC1BT000.cut	aXLIIf.430	30	Dec 22 1996	137702	ASCII
A12/CR3A12N18DC1BT000AC1BT142.cut	aXLIIf.431	32	Dec 22 1996	149191	ASCII
A12/CR3A12N18DC1BT142AC02T000.cut	aXLIIf.432	28	Dec 22 1996	133729	ASCII

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A12a/CR3A12N02DC1BT142AC02T000.cut	aXLIIf.436	28	Jan 17 1997	134563	ASCII
A12a/CR3A12N03DC1BT000AC1BT142.cut	aXLIIf.437	32	Jan 16 1997	151851	ASCII
A12a/CR3A12N03DC1BT142AC02T000.cut	aXLIIf.438	29	Jan 17 1997	135227	ASCII
A12a/CR3A12N04DC1BT000AC1BT142.cut	aXLIIf.439	32	Jan 16 1997	152410	ASCII
A12a/CR3A12N04DC1BT142AC02T000.cut	aXLIIf.440	29	Jan 17 1997	135476	ASCII
A12a/CR3A12N05DC1BT000AC1BT142.cut	aXLIIf.441	32	Jan 16 1997	153388	ASCII
A12a/CR3A12N05DC1BT142AC02T000.cut	aXLIIf.442	29	Jan 17 1997	135812	ASCII
A12a/CR3A12N06DC1BT000AC1BT142.cut	aXLIIf.443	33	Jan 16 1997	153641	ASCII
A12a/CR3A12N06DC1BT142AC02T000.cut	aXLIIf.444	29	Jan 17 1997	135978	ASCII
A12a/CR3A12N07DC1BT000AC1BT142.cut	aXLIIf.445	33	Jan 16 1997	153668	ASCII

A12a/CR3A12N07DC1BT142AC02T000.cut	aXLIIf.446	29	Jan 17 1997	135978	ASCII
A12a/CR3A12N08DC1BT000AC1BT142.cut	aXLIIf.447	33	Jan 16 1997	153668	ASCII
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A12a/CR3A12N10DC1BT000AC1BT142.cut	aXLIIf.451	32	Jan 16 1997	152893	ASCII
A12a/CR3A12N10DC1BT142AC02T000.cut	aXLIIf.452	29	Jan 17 1997	135476	ASCII
A12a/CR3A12N11DC1BT000AC1BT142.cut	aXLIIf.453	32	Jan 16 1997	152727	ASCII
A12a/CR3A12N11DC1BT142AC02T000.cut	aXLIIf.454	29	Jan 17 1997	135476	ASCII
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A12a/CR3A12N12DC1BT142AC02T000.cut	aXLIIf.456	29	Jan 17 1997	135476	ASCII
A12a/CR3A12N13DC1BT000AC1BT142.cut	aXLIIf.457	32	Jan 16 1997	152349	ASCII
A12a/CR3A12N13DC1BT142AC02T000.cut	aXLIIf.458	29	Jan 17 1997	135310	ASCII
A12a/CR3A12N14DC1BT000AC1BT142.cut	aXLIIf.459	32	Jan 16 1997	152244	ASCII
A12a/CR3A12N14DC1BT142AC02T000.cut	aXLIIf.460	29	Jan 17 1997	135393	ASCII
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A12a/CR3A12N15DC1BT142AC02T000.cut	aXLIIf.462	29	Jan 17 1997	135393	ASCII
A12a/CR3A12N16DC1BT000AC1BT142.cut	aXLIIf.463	32	Jan 16 1997	152161	ASCII
A12a/CR3A12N16DC1BT142AC02T000.cut	aXLIIf.464	29	Jan 17 1997	135310	ASCII
A12a/CR3A12N17DC1BT000AC1BT142.cut	aXLIIf.465	32	Jan 16 1997	151685	ASCII
A12a/CR3A12N17DC1BT142AC02T000.cut	aXLIIf.466	28	Jan 17 1997	134978	ASCII
A12a/CR3A12N18DC1BT000AC1BT142.cut	aXLIIf.467	32	Jan 16 1997	149191	ASCII
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A13/CR3A13N02DC1BT000AC1BT142.cut	aXLIIf.472	32	Dec 22 1996	150104	ASCII
A13/CR3A13N03DC1AT000AC1BT000.cut	aXLIIf.473	30	Dec 22 1996	139030	ASCII
A13/CR3A13N03DC1BT000AC1BT142.cut	aXLIIf.474	32	Dec 22 1996	151851	ASCII
A13/CR3A13N04DC1AT000AC1BT000.cut	aXLIIf.475	30	Dec 22 1996	139362	ASCII
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A13/CR3A13N08DC1AT000AC1BT000.cut	aXLIIf.483	30	Dec 22 1996	139926	ASCII
A13/CR3A13N08DC1BT000AC1BT142.cut	aXLIIf.484	32	Dec 22 1996	152893	ASCII
A13/CR3A13N09DC1AT000AC1BT000.cut	aXLIIf.485	30	Dec 22 1996	139926	ASCII
A13/CR3A13N09DC1BT000AC1BT142.cut	aXLIIf.486	32	Dec 22 1996	152893	ASCII
A13/CR3A13N10DC1AT000AC1BT000.cut	aXLIIf.487	30	Dec 22 1996	139843	ASCII
A13/CR3A13N10DC1BT000AC1BT142.cut	aXLIIf.488	32	Dec 22 1996	152727	ASCII
A13/CR3A13N11DC1AT000AC1BT000.cut	aXLIIf.489	30	Dec 22 1996	139860	ASCII
A13/CR3A13N11DC1BT000AC1BT142.cut	aXLIIf.490	32	Dec 22 1996	152561	ASCII
A13/CR3A13N12DC1AT000AC1BT000.cut	aXLIIf.491	30	Dec 22 1996	139528	ASCII
A13/CR3A13N12DC1BT000AC1BT142.cut	aXLIIf.492	32	Dec 22 1996	152561	ASCII
A13/CR3A13N13DC1AT000AC1BT000.cut	aXLIIf.493	30	Dec 22 1996	139445	ASCII
A13/CR3A13N13DC1BT000AC1BT142.cut	aXLIIf.494	32	Dec 22 1996	152478	ASCII
A13/CR3A13N14DC1AT000AC1BT000.cut	aXLIIf.495	30	Dec 22 1996	139445	ASCII
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A13/CR3A13N15DC1AT000AC1BT000.cut	aXLIIf.497	30	Dec 22 1996	139362	ASCII
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A13/CR3A13N16DC1AT000AC1BT000.cut	aXLIIf.499	30	Dec 22 1996	139279	ASCII
A13/CR3A13N16DC1BT000AC1BT142.cut	aXLIIf.500	32	Dec 22 1996	152561	ASCII
A13/CR3A13N17DC1AT000AC1BT000.cut	aXLIIf.501	30	Dec 22 1996	139030	ASCII
A13/CR3A13N17DC1BT000AC1BT142.cut	aXLIIf.502	32	Dec 22 1996	151768	ASCII
A13/CR3A13N18DC1AT000AC1BT000.cut	aXLIIf.503	30	Dec 22 1996	137453	ASCII
A13/CR3A13N18DC1BT000AC1BT142.cut	aXLIIf.504	32	Dec 22 1996	149274	ASCII

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A14a/CR3A14N01DC1BT142AC02T000.cut	aXLIIf.508	28	Jan 22 1997	131567	ASCII
A14a/CR3A14N02DC02T000AC07T000.cut	aXLIIf.509	27	Jan 22 1997	126094	ASCII
A14a/CR3A14N02DC1AT000AC1BT000.cut	aXLIIf.510	30	Jan 22 1997	139058	ASCII
A14a/CR3A14N02DC1BT000AC1BT142.cut	aXLIIf.511	32	Jan 22 1997	149191	ASCII
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A14a/CR3A14N03DC1BT000AC1BT142.cut	aXLIIf.515	32	Jan 22 1997	150270	ASCII
A14a/CR3A14N03DC1BT142AC02T000.cut	aXLIIf.516	28	Jan 22 1997	134646	ASCII
A14a/CR3A14N04DC02T000AC07T000.cut	aXLIIf.517	28	Jan 22 1997	126928	ASCII
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A14a/CR3A14N06DC1BT142AC02T000.cut	aXLIIf.528	28	Jan 23 1997	135144	ASCII
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A14a/CR3A14N13DC1BT142AC02T000.cut	aXLIIf.556	28	Jan 23 1997	135044	ASCII
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A27/CR3A27N15DC1AT000AC1BT000.cut	aXLIIf1.159	31	Dec 22 1996	140303	ASCII
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A27/CR3A27N16DC1AT000AC1BT000.cut	aXLIIf1.162	31	Dec 22 1996	140137	ASCII
A27/CR3A27N16DC1BT000AC1BT142.cut	aXLIIf1.163	32	Dec 22 1996	150021	ASCII
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A27/CR3A27N17DC1AT000AC1BT000.cut	aXLIIf1.165	30	Dec 22 1996	139473	ASCII
A27/CR3A27N17DC1BT000AC1BT142.cut	aXLIIf1.166	32	Dec 22 1996	149606	ASCII
A27/CR3A27N17DC1BT142AC02T000.cut	aXLIIf1.167	28	Dec 22 1996	133982	ASCII
A27/CR3A27N18DC1AT000AC1BT000.cut	aXLIIf1.168	30	Dec 22 1996	136208	ASCII
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A03/CR3A03N13DC1BT000AC1BT142.notes	aXLIII.f49	7	Dec 19 1996	9153	ASCII
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A03/CR3A03N15DC1BT000AC1BT142.notes	aXLIII.f51	7	Dec 19 1996	9103	ASCII
A03/CR3A03N16DC1BT000AC1BT142.notes	aXLIII.f52	7	Dec 19 1996	9153	ASCII
A03/CR3A03N17DC1BT000AC1BT142.notes	aXLIII.f53	7	Dec 19 1996	9111	ASCII
A03/CR3A03N18DC1BT000AC1BT142.notes	aXLIII.f54	7	Dec 19 1996	8795	ASCII

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A08/CR3A08N11DC1BT142AC02T000.notes	aXLIIIf.166	8	Dec 20 1996	10103	ASCII
A08/CR3A08N12DC1BT000AC1BT142.notes	aXLIIIf.167	7	Dec 20 1996	8906	ASCII
A08/CR3A08N12DC1BT142AC02T000.notes	aXLIIIf.168	8	Dec 20 1996	10121	ASCII
A08/CR3A08N13DC1BT000AC1BT142.notes	aXLIIIf.169	7	Dec 20 1996	8960	ASCII
A08/CR3A08N13DC1BT142AC02T000.notes	aXLIIIf.170	8	Dec 20 1996	10111	ASCII
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A08/CR3A08N15DC1BT000AC1BT142.notes	aXLIIIf.173	7	Dec 20 1996	8946	ASCII
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A08/CR3A08N16DC1BT000AC1BT142.notes	aXLIIIf.175	7	Dec 20 1996	8905	ASCII
A08/CR3A08N16DC1BT142AC02T000.notes	aXLIIIf.176	8	Dec 20 1996	10121	ASCII
A08/CR3A08N17DC1BT000AC1BT142.notes	aXLIIIf.177	7	Dec 20 1996	8813	ASCII
A08/CR3A08N17DC1BT142AC02T000.notes	aXLIIIf.178	8	Dec 20 1996	10022	ASCII
A08/CR3A08N18DC1BT000AC1BT142.notes	aXLIIIf.179	7	Dec 20 1996	8499	ASCII
A08/CR3A08N18DC1BT142AC02T000.notes	aXLIIIf.180	8	Dec 20 1996	9963	ASCII

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A09/CR3A09N01DC1BT000AC1BT142.notes	aXLIIIf.181	7	Dec 20 1996	8506	ASCII
A09/CR3A09N02DC1BT000AC1BT142.notes	aXLIIIf.182	7	Dec 20 1996	8800	ASCII
A09/CR3A09N03DC1BT000AC1BT142.notes	aXLIIIf.183	7	Dec 20 1996	9145	ASCII
A09/CR3A09N04DC1BT000AC1BT142.notes	aXLIIIf.184	7	Dec 20 1996	9115	ASCII
A09/CR3A09N05DC1BT000AC1BT142.notes	aXLIIIf.185	7	Dec 20 1996	9159	ASCII
A09/CR3A09N06DC1BT000AC1BT142.notes	aXLIIIf.186	7	Dec 20 1996	9177	ASCII
A09/CR3A09N07DC1BT000AC1BT142.notes	aXLIIIf.187	7	Dec 20 1996	9107	ASCII

A09/CR3A09N08DC1BT000AC1BT142.notes	aXLIIIf.188	7	Dec 20 1996	9153	ASCII
A09/CR3A09N09DC1BT000AC1BT142.notes	aXLIIIf.189	7	Dec 20 1996	9141	ASCII
A09/CR3A09N10DC1BT000AC1BT142.notes	aXLIIIf.190	7	Dec 21 1996	9119	ASCII
A09/CR3A09N11DC1BT000AC1BT142.notes	aXLIIIf.191	7	Dec 21 1996	9151	ASCII
A09/CR3A09N12DC1BT000AC1BT142.notes	aXLIIIf.192	7	Dec 21 1996	9151	ASCII
A09/CR3A09N13DC1BT000AC1BT142.notes	aXLIIIf.193	7	Dec 21 1996	9093	ASCII
A09/CR3A09N14DC1BT000AC1BT142.notes	aXLIIIf.194	7	Dec 21 1996	9113	ASCII
A09/CR3A09N15DC1BT000AC1BT142.notes	aXLIIIf.195	7	Dec 21 1996	9195	ASCII
A09/CR3A09N16DC1BT000AC1BT142.notes	aXLIIIf.196	7	Dec 21 1996	9181	ASCII
A09/CR3A09N17DC1BT000AC1BT142.notes	aXLIIIf.197	7	Dec 21 1996	9127	ASCII
A09/CR3A09N18DC1BT000AC1BT142.notes	aXLIIIf.198	7	Dec 21 1996	8839	ASCII

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A10/CR3A10N01DC1BT000AC1BT142.notes	aXLIIIf.199	7	Dec 21 1996	8542	ASCII
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A10/CR3A10N02DC1BT000AC1BT142.notes	aXLIIIf.201	7	Dec 21 1996	8921	ASCII
A10/CR3A10N02DC1BT142AC02T000.notes	aXLIIIf.202	8	Dec 21 1996	10284	ASCII
A10/CR3A10N03DC1BT000AC1BT142.notes	aXLIIIf.203	7	Dec 21 1996	9207	ASCII
A10/CR3A10N03DC1BT142AC02T000.notes	aXLIIIf.204	8	Dec 21 1996	10345	ASCII
A10/CR3A10N04DC1BT000AC1BT142.notes	aXLIIIf.205	7	Dec 21 1996	9139	ASCII
A10/CR3A10N04DC1BT142AC02T000.notes	aXLIIIf.206	8	Dec 21 1996	10478	ASCII
A10/CR3A10N05DC1BT000AC1BT142.notes	aXLIIIf.207	7	Dec 21 1996	9244	ASCII
A10/CR3A10N05DC1BT142AC02T000.notes	aXLIIIf.208	9	Dec 21 1996	10617	ASCII
A10/CR3A10N06DC1BT000AC1BT142.notes	aXLIIIf.209	7	Dec 21 1996	9232	ASCII
A10/CR3A10N06DC1BT142AC02T000.notes	aXLIIIf.210	9	Dec 21 1996	10669	ASCII
A10/CR3A10N07DC1BT000AC1BT142.notes	aXLIIIf.211	8	Dec 21 1996	9270	ASCII
A10/CR3A10N07DC1BT142AC02T000.notes	aXLIIIf.212	9	Dec 21 1996	10621	ASCII
A10/CR3A10N08DC1BT000AC1BT142.notes	aXLIIIf.213	8	Dec 21 1996	9252	ASCII
A10/CR3A10N08DC1BT142AC02T000.notes	aXLIIIf.214	9	Dec 21 1996	10661	ASCII
A10/CR3A10N09DC1BT000AC1BT142.notes	aXLIIIf.215	8	Dec 21 1996	9260	ASCII
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A10/CR3A10N10DC1BT000AC1BT142.notes	aXLIIIf.217	7	Dec 21 1996	9236	ASCII
A10/CR3A10N10DC1BT142AC02T000.notes	aXLIIIf.218	8	Dec 21 1996	10617	ASCII
A10/CR3A10N11DC1BT000AC1BT142.notes	aXLIIIf.219	7	Dec 21 1996	9214	ASCII
A10/CR3A10N11DC1BT142AC02T000.notes	aXLIIIf.220	8	Dec 21 1996	10541	ASCII
A10/CR3A10N12DC1BT000AC1BT142.notes	aXLIIIf.221	7	Dec 21 1996	9194	ASCII
A10/CR3A10N12DC1BT142AC02T000.notes	aXLIIIf.222	8	Dec 21 1996	10605	ASCII
A10/CR3A10N13DC1BT000AC1BT142.notes	aXLIIIf.223	7	Dec 21 1996	9188	ASCII
A10/CR3A10N13DC1BT142AC02T000.notes	aXLIIIf.224	8	Dec 21 1996	10619	ASCII
A10/CR3A10N14DC1BT000AC1BT142.notes	aXLIIIf.225	7	Dec 21 1996	9197	ASCII
A10/CR3A10N14DC1BT142AC02T000.notes	aXLIIIf.226	8	Dec 21 1996	10605	ASCII
A10/CR3A10N15DC1BT000AC1BT142.notes	aXLIIIf.227	7	Dec 21 1996	9167	ASCII
A10/CR3A10N15DC1BT142AC02T000.notes	aXLIIIf.228	8	Dec 21 1996	10619	ASCII
A10/CR3A10N16DC1BT000AC1BT142.notes	aXLIIIf.229	7	Dec 21 1996	9181	ASCII
A10/CR3A10N16DC1BT142AC02T000.notes	aXLIIIf.230	8	Dec 21 1996	10379	ASCII
A10/CR3A10N17DC1BT000AC1BT142.notes	aXLIIIf.231	7	Dec 21 1996	9137	ASCII
A10/CR3A10N17DC1BT142AC02T000.notes	aXLIIIf.232	8	Dec 21 1996	10375	ASCII
A10/CR3A10N18DC1BT000AC1BT142.notes	aXLIIIf.233	7	Dec 21 1996	8921	ASCII
A10/CR3A10N18DC1BT142AC02T000.notes	aXLIIIf.234	8	Dec 21 1996	10032	ASCII

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A11/CR3A11N01DC1BT000AC1BT142.notes	aXLIIIf.235	7	Dec 21 1996	8560	ASCII
A11/CR3A11N02DC1BT000AC1BT142.notes	aXLIIIf.236	7	Dec 21 1996	8820	ASCII
A11/CR3A11N03DC1BT000AC1BT142.notes	aXLIIIf.237	7	Dec 21 1996	9109	ASCII
A11/CR3A11N04DC1BT000AC1BT142.notes	aXLIIIf.238	7	Dec 21 1996	9163	ASCII
A11/CR3A11N05DC1BT000AC1BT142.notes	aXLIIIf.239	7	Dec 21 1996	9101	ASCII
A11/CR3A11N06DC1BT000AC1BT142.notes	aXLIIIf.240	7	Dec 21 1996	9179	ASCII
A11/CR3A11N07DC1BT000AC1BT142.notes	aXLIIIf.241	7	Dec 21 1996	9195	ASCII
A11/CR3A11N08DC1BT000AC1BT142.notes	aXLIIIf.242	7	Dec 21 1996	9215	ASCII
A11/CR3A11N09DC1BT000AC1BT142.notes	aXLIIIf.243	7	Dec 21 1996	9111	ASCII
A11/CR3A11N10DC1BT000AC1BT142.notes	aXLIIIf.244	7	Dec 21 1996	9195	ASCII
A11/CR3A11N11DC1BT000AC1BT142.notes	aXLIIIf.245	7	Dec 21 1996	9105	ASCII
A11/CR3A11N12DC1BT000AC1BT142.notes	aXLIIIf.246	7	Dec 21 1996	9171	ASCII
A11/CR3A11N13DC1BT000AC1BT142.notes	aXLIIIf.247	7	Dec 21 1996	9149	ASCII

A11/CR3A11N14DC1BT000AC1BT142.notes	aXLIIIf.248	7	Dec 21 1996	9123	ASCII
A11/CR3A11N15DC1BT000AC1BT142.notes	aXLIIIf.249	7	Dec 21 1996	9175	ASCII
A11/CR3A11N16DC1BT000AC1BT142.notes	aXLIIIf.250	7	Dec 21 1996	9151	ASCII
A11/CR3A11N17DC1BT000AC1BT142.notes	aXLIIIf.251	7	Dec 21 1996	9082	ASCII
A11/CR3A11N18DC1BT000AC1BT142.notes	aXLIIIf.252	7	Dec 21 1996	8747	ASCII

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A12/CR3A12N01DC1BT000AC1BT142.notes	aXLIIIf.253	7	Dec 21 1996	8554	ASCII
A12/CR3A12N01DC1BT142AC02T000.notes	aXLIIIf.254	8	Dec 21 1996	9895	ASCII
A12/CR3A12N02DC1BT000AC1BT142.notes	aXLIIIf.255	7	Dec 21 1996	8835	ASCII
A12/CR3A12N02DC1BT142AC02T000.notes	aXLIIIf.256	8	Dec 21 1996	10204	ASCII
A12/CR3A12N03DC1BT000AC1BT142.notes	aXLIIIf.257	7	Dec 21 1996	9083	ASCII
A12/CR3A12N03DC1BT142AC02T000.notes	aXLIIIf.258	8	Dec 21 1996	10371	ASCII
A12/CR3A12N04DC1BT000AC1BT142.notes	aXLIIIf.259	7	Dec 21 1996	9169	ASCII
A12/CR3A12N04DC1BT142AC02T000.notes	aXLIIIf.260	8	Dec 21 1996	10451	ASCII
A12/CR3A12N05DC1BT000AC1BT142.notes	aXLIIIf.261	7	Dec 21 1996	9139	ASCII
A12/CR3A12N05DC1BT142AC02T000.notes	aXLIIIf.262	8	Dec 21 1996	10527	ASCII
A12/CR3A12N06DC1BT000AC1BT142.notes	aXLIIIf.263	7	Dec 21 1996	9228	ASCII
A12/CR3A12N06DC1BT142AC02T000.notes	aXLIIIf.264	8	Dec 21 1996	10603	ASCII
A12/CR3A12N07DC1BT000AC1BT142.notes	aXLIIIf.265	7	Dec 21 1996	9160	ASCII
A12/CR3A12N07DC1BT142AC02T000.notes	aXLIIIf.266	8	Dec 21 1996	10597	ASCII
A12/CR3A12N08DC1BT000AC1BT142.notes	aXLIIIf.267	7	Dec 22 1996	9168	ASCII
A12/CR3A12N08DC1BT142AC02T000.notes	aXLIIIf.268	8	Dec 22 1996	10593	ASCII
A12/CR3A12N09DC1BT000AC1BT142.notes	aXLIIIf.269	7	Dec 22 1996	9186	ASCII
A12/CR3A12N09DC1BT142AC02T000.notes	aXLIIIf.270	8	Dec 22 1996	10551	ASCII
A12/CR3A12N10DC1BT000AC1BT142.notes	aXLIIIf.271	7	Dec 22 1996	9169	ASCII
A12/CR3A12N10DC1BT142AC02T000.notes	aXLIIIf.272	8	Dec 22 1996	10482	ASCII
A12/CR3A12N11DC1BT000AC1BT142.notes	aXLIIIf.273	7	Dec 22 1996	9215	ASCII
A12/CR3A12N11DC1BT142AC02T000.notes	aXLIIIf.274	8	Dec 22 1996	10434	ASCII
A12/CR3A12N12DC1BT000AC1BT142.notes	aXLIIIf.275	7	Dec 22 1996	9141	ASCII
A12/CR3A12N12DC1BT142AC02T000.notes	aXLIIIf.276	8	Dec 22 1996	10363	ASCII
A12/CR3A12N13DC1BT000AC1BT142.notes	aXLIIIf.277	7	Dec 22 1996	9171	ASCII
A12/CR3A12N13DC1BT142AC02T000.notes	aXLIIIf.278	8	Dec 22 1996	10371	ASCII
A12/CR3A12N14DC1BT000AC1BT142.notes	aXLIIIf.279	7	Dec 22 1996	9207	ASCII
A12/CR3A12N14DC1BT142AC02T000.notes	aXLIIIf.280	8	Dec 22 1996	10379	ASCII
A12/CR3A12N15DC1BT000AC1BT142.notes	aXLIIIf.281	7	Dec 22 1996	9163	ASCII
A12/CR3A12N15DC1BT142AC02T000.notes	aXLIIIf.282	8	Dec 22 1996	10355	ASCII
A12/CR3A12N16DC1BT000AC1BT142.notes	aXLIIIf.283	7	Dec 22 1996	9215	ASCII
A12/CR3A12N16DC1BT142AC02T000.notes	aXLIIIf.284	8	Dec 22 1996	10345	ASCII
A12/CR3A12N17DC1BT000AC1BT142.notes	aXLIIIf.285	7	Dec 22 1996	9027	ASCII
A12/CR3A12N17DC1BT142AC02T000.notes	aXLIIIf.286	8	Dec 22 1996	10337	ASCII
A12/CR3A12N18DC1BT000AC1BT142.notes	aXLIIIf.287	7	Dec 22 1996	8829	ASCII
A12/CR3A12N18DC1BT142AC02T000.notes	aXLIIIf.288	8	Dec 22 1996	10010	ASCII

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A12a/CR3A12N01DC1BT142AC02T000.notes	aXLIIIf.289	8	Jan 17 1997	9895	ASCII
A12a/CR3A12N02DC1BT142AC02T000.notes	aXLIIIf.290	8	Jan 17 1997	10204	ASCII
A12a/CR3A12N03DC1BT142AC02T000.notes	aXLIIIf.291	8	Jan 17 1997	10371	ASCII
A12a/CR3A12N04DC1BT142AC02T000.notes	aXLIIIf.292	8	Jan 17 1997	10451	ASCII
A12a/CR3A12N05DC1BT142AC02T000.notes	aXLIIIf.293	8	Jan 17 1997	10527	ASCII
A12a/CR3A12N06DC1BT142AC02T000.notes	aXLIIIf.294	8	Jan 17 1997	10603	ASCII
A12a/CR3A12N07DC1BT142AC02T000.notes	aXLIIIf.295	8	Jan 17 1997	10597	ASCII
A12a/CR3A12N08DC1BT142AC02T000.notes	aXLIIIf.296	8	Jan 17 1997	10593	ASCII
A12a/CR3A12N09DC1BT142AC02T000.notes	aXLIIIf.297	8	Jan 17 1997	10551	ASCII
A12a/CR3A12N10DC1BT142AC02T000.notes	aXLIIIf.298	8	Jan 17 1997	10482	ASCII
A12a/CR3A12N11DC1BT142AC02T000.notes	aXLIIIf.299	8	Jan 17 1997	10434	ASCII
A12a/CR3A12N12DC1BT142AC02T000.notes	aXLIIIf.300	8	Jan 17 1997	10363	ASCII
A12a/CR3A12N13DC1BT142AC02T000.notes	aXLIIIf.301	8	Jan 17 1997	10371	ASCII
A12a/CR3A12N14DC1BT142AC02T000.notes	aXLIIIf.302	8	Jan 17 1997	10379	ASCII
A12a/CR3A12N15DC1BT142AC02T000.notes	aXLIIIf.303	8	Jan 17 1997	10355	ASCII
A12a/CR3A12N16DC1BT142AC02T000.notes	aXLIIIf.304	8	Jan 17 1997	10345	ASCII
A12a/CR3A12N17DC1BT142AC02T000.notes	aXLIIIf.305	8	Jan 17 1997	10337	ASCII
A12a/CR3A12N18DC1BT142AC02T000.notes	aXLIIIf.306	8	Jan 17 1997	10010	ASCII

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A13/CR3A13N01DC1BT000AC1BT142.notes	aXLIIIf.307	7	Dec 22 1996	8552	ASCII
A13/CR3A13N02DC1BT000AC1BT142.notes	aXLIIIf.308	7	Dec 22 1996	8806	ASCII
A13/CR3A13N03DC1BT000AC1BT142.notes	aXLIIIf.309	7	Dec 22 1996	9090	ASCII
A13/CR3A13N04DC1BT000AC1BT142.notes	aXLIIIf.310	7	Dec 22 1996	9091	ASCII
A13/CR3A13N05DC1BT000AC1BT142.notes	aXLIIIf.311	7	Dec 22 1996	9185	ASCII
A13/CR3A13N06DC1BT000AC1BT142.notes	aXLIIIf.312	7	Dec 22 1996	9135	ASCII
A13/CR3A13N07DC1BT000AC1BT142.notes	aXLIIIf.313	7	Dec 22 1996	9131	ASCII
A13/CR3A13N08DC1BT000AC1BT142.notes	aXLIIIf.314	7	Dec 22 1996	9171	ASCII
A13/CR3A13N09DC1BT000AC1BT142.notes	aXLIIIf.315	7	Dec 22 1996	9181	ASCII
A13/CR3A13N10DC1BT000AC1BT142.notes	aXLIIIf.316	7	Dec 22 1996	9175	ASCII
A13/CR3A13N11DC1BT000AC1BT142.notes	aXLIIIf.317	7	Dec 22 1996	9171	ASCII
A13/CR3A13N12DC1BT000AC1BT142.notes	aXLIIIf.318	7	Dec 22 1996	9137	ASCII
A13/CR3A13N13DC1BT000AC1BT142.notes	aXLIIIf.319	7	Dec 22 1996	9197	ASCII
A13/CR3A13N14DC1BT000AC1BT142.notes	aXLIIIf.320	7	Dec 22 1996	9153	ASCII
A13/CR3A13N15DC1BT000AC1BT142.notes	aXLIIIf.321	7	Dec 22 1996	9057	ASCII
A13/CR3A13N16DC1BT000AC1BT142.notes	aXLIIIf.322	7	Dec 22 1996	9137	ASCII
A13/CR3A13N17DC1BT000AC1BT142.notes	aXLIIIf.323	7	Dec 22 1996	9064	ASCII
A13/CR3A13N18DC1BT000AC1BT142.notes	aXLIIIf.324	7	Dec 22 1996	8768	ASCII

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A14a/CR3A14N01DC02T000AC07T000.notes	aXLIIIf.325	7	Jan 22 1997	8543	ASCII
A14a/CR3A14N01DC1BT000AC1BT142.notes	aXLIIIf.326	7	Jan 22 1997	8484	ASCII
A14a/CR3A14N01DC1BT142AC02T000.notes	aXLIIIf.327	8	Jan 22 1997	9861	ASCII
A14a/CR3A14N02DC02T000AC07T000.notes	aXLIIIf.328	7	Jan 22 1997	8857	ASCII
A14a/CR3A14N02DC1BT000AC1BT142.notes	aXLIIIf.329	7	Jan 22 1997	8750	ASCII
A14a/CR3A14N02DC1BT142AC02T000.notes	aXLIIIf.330	8	Jan 22 1997	10010	ASCII
A14a/CR3A14N03DC02T000AC07T000.notes	aXLIIIf.331	7	Jan 22 1997	8939	ASCII
A14a/CR3A14N03DC1BT000AC1BT142.notes	aXLIIIf.332	7	Jan 22 1997	8757	ASCII
A14a/CR3A14N03DC1BT142AC02T000.notes	aXLIIIf.333	8	Jan 22 1997	10298	ASCII
A14a/CR3A14N04DC02T000AC07T000.notes	aXLIIIf.334	7	Jan 22 1997	9079	ASCII
A14a/CR3A14N04DC1BT000AC1BT142.notes	aXLIIIf.335	7	Jan 22 1997	8961	ASCII
A14a/CR3A14N04DC1BT142AC02T000.notes	aXLIIIf.336	8	Jan 22 1997	10317	ASCII
A14a/CR3A14N05DC02T000AC07T000.notes	aXLIIIf.337	7	Jan 22 1997	9019	ASCII
A14a/CR3A14N05DC1BT000AC1BT142.notes	aXLIIIf.338	7	Jan 22 1997	9063	ASCII
A14a/CR3A14N05DC1BT142AC02T000.notes	aXLIIIf.339	8	Jan 22 1997	10233	ASCII
A14a/CR3A14N06DC02T000AC07T000.notes	aXLIIIf.340	7	Jan 23 1997	9027	ASCII
A14a/CR3A14N06DC1BT000AC1BT142.notes	aXLIIIf.341	7	Jan 23 1997	9075	ASCII
A14a/CR3A14N06DC1BT142AC02T000.notes	aXLIIIf.342	8	Jan 23 1997	10307	ASCII
A14a/CR3A14N07DC02T000AC07T000.notes	aXLIIIf.343	7	Jan 23 1997	9041	ASCII
A14a/CR3A14N07DC1BT000AC1BT142.notes	aXLIIIf.344	7	Jan 23 1997	9131	ASCII
A14a/CR3A14N07DC1BT142AC02T000.notes	aXLIIIf.345	8	Jan 23 1997	10229	ASCII
A14a/CR3A14N08DC02T000AC07T000.notes	aXLIIIf.346	7	Jan 23 1997	9051	ASCII
A14a/CR3A14N08DC1BT000AC1BT142.notes	aXLIIIf.347	7	Jan 23 1997	9201	ASCII
A14a/CR3A14N08DC1BT142AC02T000.notes	aXLIIIf.348	8	Jan 23 1997	10265	ASCII
A14a/CR3A14N09DC02T000AC07T000.notes	aXLIIIf.349	7	Jan 23 1997	9039	ASCII
A14a/CR3A14N09DC1BT000AC1BT142.notes	aXLIIIf.350	7	Jan 23 1997	9201	ASCII
A14a/CR3A14N09DC1BT142AC02T000.notes	aXLIIIf.351	8	Jan 23 1997	10319	ASCII
A14a/CR3A14N10DC02T000AC07T000.notes	aXLIIIf.352	7	Jan 23 1997	9093	ASCII
A14a/CR3A14N10DC1BT000AC1BT142.notes	aXLIIIf.353	7	Jan 23 1997	9117	ASCII
A14a/CR3A14N10DC1BT142AC02T000.notes	aXLIIIf.354	8	Jan 23 1997	10265	ASCII
A14a/CR3A14N11DC02T000AC07T000.notes	aXLIIIf.355	7	Jan 23 1997	9029	ASCII
A14a/CR3A14N11DC1BT000AC1BT142.notes	aXLIIIf.356	7	Jan 23 1997	9129	ASCII
A14a/CR3A14N11DC1BT142AC02T000.notes	aXLIIIf.357	8	Jan 23 1997	10299	ASCII
A14a/CR3A14N12DC02T000AC07T000.notes	aXLIIIf.358	7	Jan 23 1997	9037	ASCII
A14a/CR3A14N12DC1BT000AC1BT142.notes	aXLIIIf.359	7	Jan 23 1997	9076	ASCII
A14a/CR3A14N12DC1BT142AC02T000.notes	aXLIIIf.360	8	Jan 23 1997	10335	ASCII
A14a/CR3A14N13DC02T000AC07T000.notes	aXLIIIf.361	7	Jan 23 1997	9017	ASCII
A14a/CR3A14N13DC1BT000AC1BT142.notes	aXLIIIf.362	7	Jan 23 1997	9015	ASCII
A14a/CR3A14N13DC1BT142AC02T000.notes	aXLIIIf.363	8	Jan 23 1997	10289	ASCII
A14a/CR3A14N14DC02T000AC07T000.notes	aXLIIIf.364	7	Jan 23 1997	9021	ASCII
A14a/CR3A14N14DC1BT000AC1BT142.notes	aXLIIIf.365	7	Jan 23 1997	9013	ASCII
A14a/CR3A14N14DC1BT142AC02T000.notes	aXLIIIf.366	8	Jan 23 1997	10315	ASCII
A14a/CR3A14N15DC02T000AC07T000.notes	aXLIIIf.367	7	Jan 23 1997	9021	ASCII

A14a/CR3A14N15DC1BT000AC1BT142.notes	aXLIIIf.368	7	Jan 23 1997	9100	ASCII
A14a/CR3A14N15DC1BT142AC02T000.notes	aXLIIIf.369	8	Jan 23 1997	10321	ASCII
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A17/CR3A17N03DC1BT000AC1BT142.notes	aXLIIIf.581	7	Dec 19 1996	9141	ASCII
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A17/CR3A17N06DC1BT000AC1BT142.notes	aXLIIIf.587	7	Dec 19 1996	9230	ASCII
A17/CR3A17N06DC1BT142AC02T000.notes	aXLIIIf.588	8	Dec 19 1996	10627	ASCII
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A17/CR3A17N17DC1BT142AC02T000.notes	aXLIIIf.610	8	Dec 20 1996	10361	ASCII
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A19/CR3A19N02DC1BT142AC02T000.notes	aXLIIIf.616	8	Dec 20 1996	10126	ASCII
A19/CR3A19N03DC1BT000AC1BT142.notes	aXLIIIf.617	7	Dec 20 1996	8991	ASCII
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A19/CR3A19N04DC1BT000AC1BT142.notes	aXLIIIf.619	7	Dec 20 1996	9029	ASCII
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A19/CR3A19N05DC1BT000AC1BT142.notes	aXLIIIf.621	7	Dec 20 1996	9153	ASCII
A19/CR3A19N05DC1BT142AC02T000.notes	aXLIIIf.622	8	Dec 20 1996	10401	ASCII
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A19/CR3A19N11DC1BT142AC02T000.notes	aXLIIIf.634	8	Dec 20 1996	10321	ASCII
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A19/CR3A19N13DC1BT000AC1BT142.notes	aXLIIIf.637	7	Dec 20 1996	8987	ASCII
A19/CR3A19N13DC1BT142AC02T000.notes	aXLIIIf.638	8	Dec 20 1996	10315	ASCII
A19/CR3A19N14DC1BT000AC1BT142.notes	aXLIIIf.639	7	Dec 20 1996	8989	ASCII
A19/CR3A19N14DC1BT142AC02T000.notes	aXLIIIf.640	8	Dec 20 1996	10345	ASCII
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A19/CR3A19N15DC1BT142AC02T000.notes	aXLIIIf.642	8	Dec 20 1996	10365	ASCII
A19/CR3A19N16DC1BT000AC1BT142.notes	aXLIIIf.643	7	Dec 20 1996	9023	ASCII
A19/CR3A19N16DC1BT142AC02T000.notes	aXLIIIf.644	8	Dec 20 1996	10413	ASCII
A19/CR3A19N17DC1BT000AC1BT142.notes	aXLIIIf.645	7	Dec 20 1996	8965	ASCII
A19/CR3A19N17DC1BT142AC02T000.notes	aXLIIIf.646	8	Dec 20 1996	10287	ASCII
A19/CR3A19N18DC1BT000AC1BT142.notes	aXLIIIf.647	7	Dec 20 1996	8746	ASCII
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A21/CR3A11N03DC02T000AC03T000.notes	aXLIIIf.651	7	Dec 20 1996	8647	ASCII
A21/CR3A11N04DC02T000AC03T000.notes	aXLIIIf.652	7	Dec 20 1996	8599	ASCII
A21/CR3A11N05DC02T000AC03T000.notes	aXLIIIf.653	7	Dec 20 1996	8766	ASCII
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A21/CR3A11N18DC02T000AC03T000.notes	aXLIIIf.666	7	Dec 21 1996	8499	ASCII
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A21/CR3A17N17DC03T000AC03T168.notes	aXLIIIf.699	7	Dec 21 1996	9156	ASCII
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A21/CR3A21N11DC1BT142AC02T000.notes	aXLIIIf.724	8	Dec 20 1996	9989	ASCII
A21/CR3A21N12DC1BT000AC1BT142.notes	aXLIIIf.725	7	Dec 20 1996	8552	ASCII
A21/CR3A21N12DC1BT142AC02T000.notes	aXLIIIf.726	8	Dec 20 1996	10013	ASCII
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A21/CR3A21N16DC1BT000AC1BT142.notes	aXLIIIf.733	7	Dec 21 1996	8572	ASCII
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A21/CR3A21N18DC1BT000AC1BT142.notes	aXLIIIf.737	7	Dec 21 1996	8421	ASCII
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A24/CR3A24N04DC1BT000AC1BT142.notes	aXLIIIf.742	7	Dec 21 1996	9005	ASCII
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A24/CR3A24N06DC1BT000AC1BT142.notes	aXLIIIf.744	7	Dec 21 1996	9111	ASCII
A24/CR3A24N07DC1BT000AC1BT142.notes	aXLIIIf.745	7	Dec 21 1996	9175	ASCII
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A24/CR3A24N13DC1BT000AC1BT142.notes	aXLIIIf.751	7	Dec 21 1996	9011	ASCII
A24/CR3A24N14DC1BT000AC1BT142.notes	aXLIIIf.752	7	Dec 21 1996	9021	ASCII
A24/CR3A24N15DC1BT000AC1BT142.notes	aXLIIIf.753	7	Dec 21 1996	9035	ASCII
A24/CR3A24N16DC1BT000AC1BT142.notes	aXLIIIf.754	7	Dec 21 1996	8989	ASCII
A24/CR3A24N17DC1BT000AC1BT142.notes	aXLIIIf.755	7	Dec 21 1996	8777	ASCII
A24/CR3A24N18DC1BT000AC1BT142.notes	aXLIIIf.756	7	Dec 21 1996	8598	ASCII

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A27/CR3A12N03DC02T000AC03T000.notes	aXLIIIf.759	7	Dec 21 1996	8855	ASCII
A27/CR3A12N04DC02T000AC03T000.notes	aXLIIIf.760	7	Dec 21 1996	8965	ASCII
A27/CR3A12N05DC02T000AC03T000.notes	aXLIIIf.761	7	Dec 21 1996	8901	ASCII
A27/CR3A12N06DC02T000AC03T000.notes	aXLIIIf.762	7	Dec 21 1996	8967	ASCII
A27/CR3A12N07DC02T000AC03T000.notes	aXLIIIf.763	7	Dec 21 1996	8951	ASCII
A27/CR3A12N08DC02T000AC03T000.notes	aXLIIIf.764	7	Dec 21 1996	8975	ASCII
A27/CR3A12N09DC02T000AC03T000.notes	aXLIIIf.765	7	Dec 21 1996	8947	ASCII
A27/CR3A12N10DC02T000AC03T000.notes	aXLIIIf.766	7	Dec 21 1996	8987	ASCII
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A27/CR3A12N14DC02T000AC03T000.notes	aXLIIIf.770	7	Dec 22 1996	8919	ASCII
A27/CR3A12N15DC02T000AC03T000.notes	aXLIIIf.771	7	Dec 22 1996	8911	ASCII
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A27/CR3A12N17DC02T000AC03T000.notes	aXLIIIf.773	7	Dec 22 1996	8901	ASCII
A27/CR3A12N18DC02T000AC03T000.notes	aXLIIIf.774	7	Dec 22 1996	8609	ASCII
A27/CR3A24N01DC03T000AC03T168.notes	aXLIIIf.775	7	Dec 21 1996	8923	ASCII
A27/CR3A24N01DC03T168AC03T250.notes	aXLIIIf.776	8	Dec 21 1996	9992	ASCII
A27/CR3A24N02DC03T000AC03T168.notes	aXLIIIf.777	7	Dec 21 1996	9110	ASCII
A27/CR3A24N02DC03T168AC03T250.notes	aXLIIIf.778	8	Dec 21 1996	10238	ASCII
A27/CR3A24N03DC03T000AC03T168.notes	aXLIIIf.779	8	Dec 21 1996	9245	ASCII
A27/CR3A24N03DC03T168AC03T250.notes	aXLIIIf.780	8	Dec 21 1996	10572	ASCII
A27/CR3A24N04DC03T000AC03T168.notes	aXLIIIf.781	8	Dec 21 1996	9402	ASCII
A27/CR3A24N04DC03T168AC03T250.notes	aXLIIIf.782	9	Dec 21 1996	10607	ASCII
A27/CR3A24N05DC03T000AC03T168.notes	aXLIIIf.783	8	Dec 21 1996	9468	ASCII
A27/CR3A24N05DC03T168AC03T250.notes	aXLIIIf.784	9	Dec 21 1996	10613	ASCII
A27/CR3A24N06DC03T000AC03T168.notes	aXLIIIf.785	8	Dec 21 1996	9461	ASCII
A27/CR3A24N06DC03T168AC03T250.notes	aXLIIIf.786	9	Dec 21 1996	10597	ASCII
A27/CR3A24N07DC03T000AC03T168.notes	aXLIIIf.787	8	Dec 21 1996	9304	ASCII
A27/CR3A24N07DC03T168AC03T250.notes	aXLIIIf.788	9	Dec 21 1996	10603	ASCII
A27/CR3A24N08DC03T000AC03T168.notes	aXLIIIf.789	8	Dec 21 1996	9312	ASCII
A27/CR3A24N08DC03T168AC03T250.notes	aXLIIIf.790	9	Dec 21 1996	10569	ASCII
A27/CR3A24N09DC03T000AC03T168.notes	aXLIIIf.791	8	Dec 21 1996	9406	ASCII
A27/CR3A24N09DC03T168AC03T250.notes	aXLIIIf.792	9	Dec 21 1996	10683	ASCII
A27/CR3A24N10DC03T000AC03T168.notes	aXLIIIf.793	8	Dec 21 1996	9330	ASCII
A27/CR3A24N10DC03T168AC03T250.notes	aXLIIIf.794	9	Dec 21 1996	10609	ASCII
A27/CR3A24N11DC03T000AC03T168.notes	aXLIIIf.795	8	Dec 21 1996	9289	ASCII
A27/CR3A24N11DC03T168AC03T250.notes	aXLIIIf.796	9	Dec 22 1996	10619	ASCII
A27/CR3A24N12DC03T000AC03T168.notes	aXLIIIf.797	8	Dec 22 1996	9239	ASCII
A27/CR3A24N12DC03T168AC03T250.notes	aXLIIIf.798	9	Dec 22 1996	10657	ASCII
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A27/CR3A24N14DC03T000AC03T168.notes	aXLIIIf.801	8	Dec 22 1996	9267	ASCII
A27/CR3A24N14DC03T168AC03T250.notes	aXLIIIf.802	9	Dec 22 1996	10583	ASCII
A27/CR3A24N15DC03T000AC03T168.notes	aXLIIIf.803	8	Dec 22 1996	9281	ASCII
A27/CR3A24N15DC03T168AC03T250.notes	aXLIIIf.804	9	Dec 22 1996	10597	ASCII
A27/CR3A24N16DC03T000AC03T168.notes	aXLIIIf.805	8	Dec 22 1996	9273	ASCII
A27/CR3A24N16DC03T168AC03T250.notes	aXLIIIf.806	9	Dec 22 1996	10629	ASCII
A27/CR3A24N17DC03T000AC03T168.notes	aXLIIIf.807	7	Dec 22 1996	9216	ASCII
A27/CR3A24N17DC03T168AC03T250.notes	aXLIIIf.808	8	Dec 22 1996	10493	ASCII
A27/CR3A24N18DC03T000AC03T168.notes	aXLIIIf.809	7	Dec 22 1996	9130	ASCII
A27/CR3A24N18DC03T168AC03T250.notes	aXLIIIf.810	8	Dec 22 1996	10145	ASCII
A27/CR3A27N01DC1BT000AC1BT142.notes	aXLIIIf.811	7	Dec 21 1996	8459	ASCII
A27/CR3A27N01DC1BT142AC02T000.notes	aXLIIIf.812	8	Dec 21 1996	9787	ASCII
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A27/CR3A27N02DC1BT142AC02T000.notes	aXLIIIf.814	8	Dec 21 1996	9993	ASCII
A27/CR3A27N03DC1BT000AC1BT142.notes	aXLIIIf.815	7	Dec 21 1996	8833	ASCII
A27/CR3A27N03DC1BT142AC02T000.notes	aXLIIIf.816	8	Dec 21 1996	10016	ASCII
A27/CR3A27N04DC1BT000AC1BT142.notes	aXLIIIf.817	7	Dec 21 1996	8904	ASCII
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A27/CR3A27N08DC1BT000AC1BT142.notes	aXLIIIf.825	7	Dec 21 1996	8949	ASCII
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A27/CR3A27N09DC1BT000AC1BT142.notes	aXLIIIf.827	7	Dec 21 1996	8945	ASCII
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A27/CR3A27N10DC1BT000AC1BT142.notes	aXLIIIf.829	7	Dec 21 1996	9001	ASCII
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