NRC FORM 464 Part I
(6-1998)

U.S. NUCLEAR REGULATORY COMMISSION

RESPONSE TO FREEDOM OF INFORMATION ACT (FOIA) / PRIVACY ACT (PA) REQUEST

FOIA/PA	RESPONSE NUMBER
2000-0312	1

RESPONSE TYPE ☐ FINAL ☑ PARTIAL

REQUESTER: John D. McCann

DATE: OCT 13 2000

PART I. – INFORMATION RELEASED

- ☐ No additional agency records subject to the request have been located.
- ☐ Requested records are available through another public distribution program. See Comments section.
- ☑ APPENDICES A — Agency records subject to the request that are identified in the listed appendices are already available for public inspection and copying at the NRC Public Document Room.
- ☑ APPENDICES B — Agency records subject to the request that are identified in the listed appendices are being made available for public inspection and copying at the NRC Public Document Room.
- ☑ Enclosed is information on how you may obtain access to and the charges for copying records located at the NRC Public Document Room, 2120 L Street, NW, Washington, DC.
- ☑ APPENDICES B — Agency records subject to the request are enclosed.
- ☐ Records subject to the request that contain information originated by or of interest to another Federal agency have been referred to that agency (see comments section) for a disclosure determination and direct response to you.
- ☑ We are continuing to process your request.
- ☐ See Comments.

PART I.A – FEES

AMOUNT * $

* See comments for details

- ☐ You will be billed by NRC for the amount listed.
- ☐ You will receive a refund for the amount listed.
- ☐ None. Minimum fee threshold not met.
- ☐ Fees waived.

PART I.B – INFORMATION NOT LOCATED OR WITHHELD FROM DISCLOSURE

- ☐ No agency records subject to the request have been located.
- ☐ Certain information in the requested records is being withheld from disclosure pursuant to the exemptions described in and for the reasons stated in Part II.
- ☐ This determination may be appealed within 30 days by writing to the FOIA/PA Officer, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001. Clearly state on the envelope and in the letter that it is a "FOIA/PA Appeal."

PART I.C COMMENTS (Use attached Comments continuation page if required)

The records identified on enclosed Appendix A are already publicly available. Records with an ML Accession No. are publicly available in the NRC's Public Electronic Reading Room at http://www.nrc.gov/NRC/ADAMS/index.html. If you need assistance in obtaining these records, please contact the NRC Public Document Room (PDR) at (301) 415-4737, or 1-800-397-4209. We have enclosed notices which provide information on the new location of the PDR, and procedures for obtaining records from the PDR.

SIGNATURE - FREEDOM OF INFORMATION ACT AND PRIVACY ACT OFFICER

Carol Ann Reed

Re: FOIA-2000-0312

APPENDIX A
RECORDS ALREADY PUBLICLY AVAILABLE

NO.	DATE	ACCESSION NUMBER	DESCRIPTION/(PAGE COUNT)
1.	-------		Computer printouts of 39 records already publicly available in ADAMS.

Re: FOIA-00-0312

APPENDIX B
RECORDS BEING RELEASED IN THEIR ENTIRETY

NO.	DATE	DESCRIPTION/(PAGE COUNT)
1	09/20/00	NAC Casework (2)
2	08/18/00	NAC Proposed Schedules (2)
3	08/00/00	Notes on August 2000, SAR-UMS, Rev UMSS-00G, p 4.4.3-15 (1)
4	08/07/00	E-mail TMcGinty to SShankman, Request Meeting with you to Discuss Maine Yankee Direct Final (9)
5	08/07/00	E-mail TMcGinty to ELeeds, Pro's & Con's of Direct Final (8)
6	08/07/00	E-mail CJackson to TMcGinty, Draft write-up (4)
7	08/07/00	E-mail TMcGinty to CJackson, Fwd: Action Plan for Direct Final Rulemaking for CoC Amendments (3)
8	08/04/00	E-mail MHorn to AHowe, et al., CoC Process (2)
9	08/02/00	E-mail TMcGinty to CJackson & PBrochman, Fwd: Re: Action Items as a result of Maine Yankee Meeting on 7/28 (4)
10	08/02/00	E-mail JGuttmann to PBrochman, EEaston, DGauch, et al., Re: Action Items as a result of Maine Yankee Meeting on 7/28 (3)
11	07/28/00	E-mail CJackson to TMcGinty, Re: Exemption Path Handout for Bill Kane briefing (2)
12	07/00/00	Notes on July 2000, SAR-UMS, Rev UMSS-00F, p 4.4.3-12 (1)
13	07/28/00	Talking points for NAC public meeting on 07/28/00 (1)
14	07/27/00	E-mail SLewis to AHowe, CJackson, et al., Re: Bill Kane Briefing - Friday, 7/28 @ 9:00 a.m. (2)
15	07/27/00	E-mail PHolahan to AHowe, et al., Re: Bill Kane Briefing - Friday, 7/28 @ 9:00 a.m. (2)
16	07/26/00	E-mail TMcGinty to AHowe, et al., NAC-UMS Maine Yankee Amendment (7)
17	07/26/00	E-mail TMcGinty to CJackson, Exemption Schedule (7)

NO.	DATE	DESCRIPTION/(PAGE COUNT)
18	07/26/00	E-mail HThompson to AHowe, et al., 07/25/00 Note to EWBrach RE (3)
19	07/26/00	E-mail SLewis to AHowe, et al., Re: Bill Kane Briefing - Friday, 7/28 @ 9:00 a.m. (2)
20	07/25/00	Fax TMcGinty to EWBrach (5)
21	07/24/00	Fax TMcGinty to EWBrach (20)
22	07/21/00	E-mail DDamiano to CJackson, et al., Fwd: 07/20/00 Ltr to TCThompson, NAC re Dual-Purpose Casework Review Schedule (4)
23	07/20/00	Project Scheduling Control Sheet (2)
24	07/20/00	E-Mail TMcGinty to DTang, et al., McGinty's NAC Weekly Team Meetings Suspended (1)
25	07/19/00	E-mail TMcGinty to EEaston, NAC Schedule Letter (2)
26	07/14/00	E-mail TMcGinty to RParkhill, Fwd: NAC/Maine Yankee Needs-Important (1)
27	07/14/00	E-mail ELeeds to EWBrach, WKane, NAC/Maine Yankee Needs-Important (1)
28	07/11/00	E-mail DTang to EWBrach, et al., Re: Analysis of NAC-UMS RAI's (1)
29	07/10/00	E-mail TMcGinty to EEaston, WHodges, et al., FWD: Electronic Copy of the NAC-UMS Maine Yankee RAI's (1)
30	07/10/00	E-mail TMcGinty to EWBrach, EEaston, et al., Analysis of NAC-UMS RAI's (9)
31	07/10/00	E-mail TMcGinty to RParkhill, Fwd: Re: MY RAI 4-9 (1)
32	07/10/00	E-mail TThompson to TMcGinty, Re: MY RAI 4-9 (3)
33	07/06/00	E-mail TMcGinty to EKeegan, Re: SER input (1)
34	07/06/00	E-mail TMcGinty to ELeeds, Your request for MY RAI's (7)
35	06/30/00	E-mail TMcGinty to JGuttmann, RParkhill, Initial NAC reaction to our Maine Yankee RAI's (1)
36	06/29/00	NAC-UMS Maine Yankee RAI#2 (6/29/00) Summary (8)
37	06/29/00	NAC-UMS Maine Yankee RAI#2 (6/29/00) Summary (8)

NO.	DATE	DESCRIPTION/(PAGE COUNT)
38	06/29/00	NAC-UMS Maine Yankee RAI#2 (6/29/00) Summary (3)
39	06/23/00	Final from RParkhill 6/23/00 (3)
40	06/23/00	E-mail RParkhill to LKokajko, et al., Thermal Comments on MY Amdt (4)
41	06/23/00	E-mail RParkhill to EEaston, et al., Thermal RAIs for NAC-UMS MY Amdmt-Reduced Heat Loads for Transfer Operations (4)
42	06/15/00	E-mail TMcGinty to RParkhill, Maine Yankee TS 3.1.1 (1)
43	06/08/00	E-mail RParkhill to DTang, et al., Fwd: Re: Drawings changes for NAC-UMS per NUTUG comments (Revised 6/7/00) (1)
44	06/08/00	E-mail TMcGinty to DTang, DCarlson, et al., NAC-UMS Maine Yankee Issues (1)
45	06/07/00	E-mail TMcGinty to SBaggett, TMCGinty, NAC-UMS Maine Yankee Issue on Lower Heat Loads (1)
46	06/06/00	E-mail RParkhill to TMcGinty, Re: OK, I'm ready to talk to NAC on the Maine Yankee thermal issue (1)
47	05/31/00	E-mail KGruss to TMcGinty, RParkhill, NAC-UMS MY SER staff (3)
48	05/04/00	E-mail TMcGinty to DTang, DCarlson, et al., Fwd: Schedule for NAC Activities (2)
49	04/00/00	Notes on April 2000, SAR-UMS, Rev UMSS-00C, pp 2.1.3-9, 4.4.3-2, 4.4.3-11, 4.4.3-12, 4.5-8, 4.5-9, 12A3-4, 12A3-5 (8)
50	04/26/00	E-mail DTang to SBaggett, UMS & UMS/MY conference call (1)
51	04/21/00	E-mail KGruss to TMcGinty, et al., SER Section NAC-UMS MY (3)
52	04/20/00	Memo DCool to EWBrach, Schedule for Rulemaking to REvise 10 CFR 72.214 to Support...(3)
53	04/17/00	E-mail TMcGinty to KGruss, RParkhill, Re: NAC-UMS MY Thermal & Confinement Draft SER (1)
54	04/17/00	E-mail TMcGinty to DTang, DCarlson, et al., Fwd: One Day Delay in Submittal of responses to UMS-MY Telecon RAIS (1)
55	04/17/00	E-mail TThompson,/NAC to OWFN_DO.owf, One Day Delay in Submittal of Responses to UMS-MY Telecon RAIs (2)

NO.	DATE	DESCRIPTION/(PAGE COUNT)
56	04/10/00	Unscheduled Casework Sheet (2)
57	04/10/00	Part 72 Casework Sheet (1)
58	04/10/00	E-mail RParkhill to DTang, et al, NAC-UMS MY Thermal & Confinement Draft SER (7)
59	04/06/00	E-mail TMcGinty to RParkhill, Fwd: ANSYS input/output files for the model depicted in Fig. 4.5.1.1-2... (1)
60	03/00	Notes on March 2000, SAR-UMS, Rev UMSS-00B, pp 1-4, 2.1.3-9, 4.5-1, 4.5-8, 4.5-10, (5)
61	03/31/00	E-mail TMcGinty to Internet:SWhitsett@nacintl., Various Issues on NAC reviews (1)
62	03/30/00	E-mail LKokajko to EEaston, et al., Re: NAC-UMS (Maine Yankee) & NAC-LWT High Burnup Review Schedules (1)
63	03/29/00	E-mail TMcGinty to Internet: "Clindner @ nacintl, NAC MY Fuel Specs (1)
64	03/28/00	E-mail RParkhill to KGruss, MY Cladding Temperature Limits (2)
65	03/27/00	E-mail RParkhill to TThompson, Re: Call (1)
66	03/27/00	E-mail TMcGinty to GHornseth, et al., Re: Call NAC (1)
67	03/21/00	E-mail DTang to JHall, Young's modulus for high burnup clads (1)
68	02/24/00	E-mail RParkhill to DTang, et al., Re: Mike Meisner of Maine Yankee called Bill Brach (1)
69	02/14/00	Handwritten notes/DTang [portions are O/S] (1)
70	02/00/00	Notes on February 2000, SAR-UMS, Rev UMSS-00A, pp 4.5-9, 8-ii, 12B2-13, 12B2-14, 12B2-16, 12B2-17, 12B2-18 (7)
71	Undated	NAC-UMS Amend 1 Schedule (Direct Final Route) (2)
72	Undated	NAC-UMS Amend 1 Schedule (Proposed Rule Route) (2)
73	Undated	NAC-UMS Amend 1 Schedule (Direct Final Route) (2)
74	Undated	NAC-UMS Amend 1 Schedule (Proposed Rule Route) (2)
75	Undated	NAC-UMS Maine Yankee Issue on Lower Heat Loads

NO.	DATE	DESCRIPTION/(PAGE COUNT)
76	Undated	Ltr TMcGinty to TThompson, NAC, Conference Call Concerning the Review of the NAC-UMS Maine Yankee Amendment... (4)
77	Undated	Handwritten notes (7)
78	Undated	Calculations ce 14x14 45gwd/mtu pwr 1.9 wt%: 7 year cooled (11)
79	Undated	Calculations ce 14x14 45gwd/mtu pwr 1.9 wt%: 20 year cooled (11)
80	Undated	Calculations ce 14x14 40gwd/mtu pwr 2.9 wt%: 5 year cooled (11)
81	Undated	Calculations ce 14x14 40gwd/mtu pwr 2.9 wt%: 6 year cooled (12)
82	Undated	Calculations ce 14x14 40gwd/mtu pwr 2.3 wt%: 5 year cooled (11)
83	Undated	Calculations ce 14x14 40gwd/mtu pwr 2.3 wt%: 14 year cooled (11)
84	Undated	Calculations ce 14x14 45gwd/mtu pwr 2.1 wt%: 7 year cooled (11)
85	Undated	Calculations ce 14x14 45gwd/mtu pwr 2.1 wt%: 15 year cooled (11)
86	Undated	Calculations ce 14x14 45gwd/mtu pwr 2.7 wt%: 6 year cooled (22)
87	Undated	Calculations ce 14x14 45gwd/mtu pwr 2.7 wt%: 14 year cooled. (11)

Accession Number	ML003739855
Estimated Page Count	2
Document Date	08/08/2000
Availability	Publicly Available
Title	08/08/00 Letter Thomas C. Thompson, NAC International, Inc., RE Revised Schedule for Review of NAC-UMS Maine Yankee Amendment (TAC Nos. L22452, L22979, L23095) 003739855
Author Name	McGinty T J
Author Affiliation	NRC/NMSS/SFPO/SFL
Addressee Name	Thompson T C
Addressee Affiliation	NAC International Inc
Docket Number	07109270, 07201015, 07201025
License Number	
Case/Reference Number	L22979, L23095, Tac Nos. L22452
Document/Report Number	
Media Type	Electronic
Physical File Location	ADAMS
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Accession Number	ML003738112
Estimated Page Count	22
Document Date	08/02/2000
Availability	Publicly Available
Title	Submittal of changed pages for Revision 4 of the NAC-UMS Universal Storage System Safety Analysis Report.
Author Name	Thompson T C
Author Affiliation	NAC International
Addressee Name	
Addressee Affiliation	NRC/OCIO/IMD/RMB
Docket Number	07201015
License Number	
Case/Reference Number	L22511
Document/Report Number	
Media Type	Electronic
Physical File Location	ADAMS
Microform Addresses	

Accession Number	ML003739634
Estimated Page Count	1
Document Date	08/01/2000
Availability	Publicly Available
Title	Intention to respond to USNRC Letter, "Schedule for Review of Dual-Purpose Casework."
Author Name	Thompson T C
Author Affiliation	NAC International
Addressee Name	Jackson C P, McGinty T J
Addressee Affiliation	NRC
Docket Number	05000309, 07109270, 07201015, 07201025
License Number	
Case/Reference Number	
Document/Report Number	
Media Type	Electronic
Physical File Location	ADAMS
Microform Addresses	

Accession Number	ML003737634
Estimated Page Count	1
Document Date	07/31/2000
Availability	Publicly Available
Title	Submittal of One Additional Copy of Responses to RAI-2 for NAC-UMS Universal Storage System Amendment for Maine Yankee Atomic Power Co Site Specific Spent Fuel
Author Name	Thompson T C
Author Affiliation	NAC International
Addressee Name	McGinty T J
Addressee Affiliation	NRC/NMSS/SFPO/SLID
Docket Number	07201015
License Number	
Case/Reference Number	L22979
Document/Report Number	
Media Type	Electronic
Physical File Location	ADAMS
Microform Addresses	

Accession Number	ML003735440
Estimated Page Count	2
Document Date	07/26/2000
Availability	Publicly Available
Title	07/28/00 - Mtg Notice - NAC Int'l & Maine Yankee on 7/28 to discuss possible options regarding the NAC-UMS Main Yankee amendment review and rulemaking schedules (TAC No. L22979) - ML003735440
Author Name	Brach E W
Author Affiliation	NRC/NMSS/SFPO
Addressee Name	Davis E M
Addressee Affiliation	NAC International Inc
Docket Number	07201015
License Number	
Case/Reference Number	Tac No. L22979
Document/Report Number	NAC-UMS
Media Type	Electronic
Physical File Location	ADAMS
Microform Addresses	

Accession Number	ML003735562
Estimated Page Count	1
Document Date	07/25/2000
Availability	Publicly Available
Title	07/25/00 Letter Thomas C. Thompson, NAC International, Inc., RE Clarify Request for Additional Information for the UMS Universal Storage System 003735562
Author Name	McGinty T J
Author Affiliation	NRC/NMSS/SFPO/SFL
Addressee Name	Thompson T C
Addressee Affiliation	NAC International Inc
Docket Number	07201015
License Number	
Case/Reference Number	
Document/Report Number	
Media Type	Electronic
Physical File Location	ADAMS
Microform Addresses	

Accession Number	ML003736792
Estimated Page Count	4
Document Date	07/20/2000
Availability	Publicly Available
Title	Supplemental Information to Support Development of the NRC Schedule for Completion of the Review of the UMS-MY Amendment to the NAC-UMS Certificate of Compliance.
Author Name	Thompson T C
Author Affiliation	NAC International
Addressee Name	
Addressee Affiliation	NRC/OCIO/IMD/RMB
Docket Number	07109225, 07201015, 07201025
License Number	
Case/Reference Number	
Document/Report Number	
Media Type	Electronic
Physical File Location	ADAMS
Microform Addresses	

Accession Number	ML003734405
Estimated Page Count	5
Document Date	07/20/2000
Availability	Publicly Available
Title	07/20/00 - Ltr to TC Thompson, NAC Int'l Inc. fr TJ McGinty & Cjackson re: Schedule for Review of Dual-Purpose Casework (NAC-UMS MY Amendment; NAC-UMS Transport Application; NAC-MPC Conn Yankee Amendment; NAC-MPC Yankee Rowe Amendment) - ML003734405
Author Name	Jackson C P, McGinty T J
Author Affiliation	NRC/NMSS/SFPO
Addressee Name	Thompson T
Addressee Affiliation	NAC International Inc
Docket Number	07109270, 07201015, 07201025
License Number	
Case/Reference Number	TAC NO. L22452, Tac No. L22979, TAC No. L23095
Document/Report Number	
Media Type	Electronic
Physical File Location	ADAMS
Microform Addresses	

Accession Number	ML003734294
Estimated Page Count	1
Document Date	07/13/2000
Availability	Publicly Available
Title	Letter informing that NAC International plans to submit responses to RAI on or before 07/31/2000, and requests that review and rulemaking activities be completed on a priority basis with goal of supporting Maine Yankee's published fuel loading schedule.
Author Name	Lee W J
Author Affiliation	NAC International
Addressee Name	
Addressee Affiliation	NRC/OCIO/IMD/RMB
Docket Number	07201015
License Number	
Case/Reference Number	L22979
Document/Report Number	
Media Type	Electronic
Physical File Location	ADAMS
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Accession Number	ML003736795
Estimated Page Count	1
Document Date	07/13/2000
Availability	Publicly Available
Title	NRC Review of NAC-UMS Universal Storage System Submittals (TAC No. L22979)
Author Name	Lee W J
Author Affiliation	NAC International
Addressee Name	
Addressee Affiliation	NRC/OCIO/IMD/RMB
Docket Number	07201015
License Number	
Case/Reference Number	L22979
Document/Report Number	
Media Type	Electronic
Physical File Location	ADAMS
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Accession Number	ML003728570
Estimated Page Count	5
Document Date	06/29/2000
Availability	Publicly Available
Title	06/29/00 Letter Thomas C. Thompson, NAC International, Inc., RE Request for Additional Information for the UMS Universal Storage System 003728570
Author Name	McGinty T
Author Affiliation	NRC/NMSS/SFPO/SFL
Addressee Name	Thompson T C
Addressee Affiliation	NAC International Inc
Docket Number	07201015
License Number	
Case/Reference Number	Tac No. L22979
Document/Report Number	
Media Type	Electronic
Physical File Location	ADAMS
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Accession Number	ML003727630
Estimated Page Count	2
Document Date	06/26/2000
Availability	Publicly Available
Title	Submittal of additional changed pages for Revision 3 of the NAC-UMS Universal Safety Analysis Report
Author Name	Thompson T C
Author Affiliation	NAC International
Addressee Name	
Addressee Affiliation	NRC/OCIO/IMD/RMB
Docket Number	07201015
License Number	
Case/Reference Number	ED20000885, L22511
Document/Report Number	
Media Type	Electronic
Physical File Location	ADAMS
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Accession Number	ML003727579
Estimated Page Count	143
Document Date	06/23/2000
Availability	Publicly Available
Title	Submittal of changed pages for Revision 3 of the NAC-UMS Universal Safety Analysis Report
Author Name	Thompson T C
Author Affiliation	NAC International
Addressee Name	
Addressee Affiliation	NRC/OCIO/IMD/RMB
Docket Number	07201015
License Number	
Case/Reference Number	L22511
Document/Report Number	
Media Type	Electronic
Physical File Location	ADAMS
Microform Addresses	

Accession Number	ML003726253
Estimated Page Count	73
Document Date	06/19/2000
Availability	Publicly Available
Title	Submittal of Responses to June 11, 2000 Telecon RAIs (Structural) As Supplemental Information for the UMS Universal Storage System Amendment for Maine Yankee Atomic Power Company Site Specific Spent Fuel
Author Name	Thompson T C
Author Affiliation	NAC International
Addressee Name	
Addressee Affiliation	NRC/OCIO/IMD/RMB
Docket Number	07201015
License Number	
Case/Reference Number	L22979
Document/Report Number	
Media Type	Electronic
Physical File Location	ADAMS
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Accession Number	ML003726133
Estimated Page Count	1
Document Date	06/16/2000
Availability	Publicly Available
Title	U.S. NRC Review of NAC-UMS Universal Storage System Submittals.
Author Name	Thompson T C
Author Affiliation	NAC International
Addressee Name	
Addressee Affiliation	NRC/OCIO/IMD/RMB
Docket Number	07201015
License Number	
Case/Reference Number	L22979
Document/Report Number	
Media Type	Electronic
Physical File Location	ADAMS
Microform Addresses	

Accession Number	ML003724247
Estimated Page Count	5
Document Date	06/12/2000
Availability	Publicly Available
Title	06/12/00 - Memo from T. McGinty to S. Shankman re: Summary of 6/8 mtg w/ NAC Int'l re planned submittal of NAC-UMS stoarge & Transp. Amendment Applications - Attach. 1. Attendance List, 2. Agenda - ML003724247
Author Name	McGinty T
Author Affiliation	NRC/NMSS/SFPO
Addressee Name	Shankman S
Addressee Affiliation	NRC/NMSS/SFPO
Docket Number	07109270, 07201015
License Number	Review No. 050S, TAC No. L23094
Case/Reference Number	
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Media Type	Electronic
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Accession Number	ML003720303
Estimated Page Count	23
Document Date	06/01/2000
Availability	Publicly Available
Title	6/1/00 - Ltr. to EM Davis, NAC International From: E.W. Brach Subject: Part 21 Report Regarding NS-4-FR Material Supplied by NAC International Enclosure: Holtec ltr dtd 5/26/00
Author Name	Brach E W
Author Affiliation	NRC/NMSS/SFPO
Addressee Name	Davis E M
Addressee Affiliation	NAC International
Docket Number	07001025, 07100018, 07109235, 07201015, 07201020
License Number	
Case/Reference Number	
Document/Report Number	
Media Type	Electronic
Physical File Location	ADAMS
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Accession Number	ML003722546
Estimated Page Count	95
Document Date	05/31/2000
Availability	Publicly Available
Title	Submittal of Responses to Telecon RAIs as Supplemental Information for the UMS Universal Storage System Amendment for Maine Yankee Atomic Power Company Site Specific Spent Fuel
Author Name	Thompson T C
Author Affiliation	NAC International
Addressee Name	
Addressee Affiliation	NRC/OCIO/IMD/RMB
Docket Number	05000309, 07201015
License Number	
Case/Reference Number	L22979
Document/Report Number	
Media Type	Electronic
Physical File Location	ADAMS
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Accession Number	ML003718681
Estimated Page Count	3
Document Date	05/25/2000
Availability	Publicly Available
Title	06/08/00 - Meeting Notice - NAC Int'l re changes to NAC-UMS design. Attachment: Agenda - ML003718681
Author Name	Brach E W
Author Affiliation	NRC/NMSS/SFPO
Addressee Name	Thompson T
Addressee Affiliation	NAC International
Docket Number	07109270, 07201015
License Number	
Case/Reference Number	TAC No. L23094, Review 050S
Document/Report Number	
Media Type	Electronic
Physical File Location	ADAMS
Microform Addresses	

Accession Number	ML003716088
Estimated Page Count	3
Document Date	05/10/2000
Availability	Publicly Available
Title	05/10/00 Ltr to TC Thompson, NAC Int'l, fr EW Brach re NAC-UMS Public Disclosure Determination - ML003716088
Author Name	Brach E W
Author Affiliation	NRC/NMSS/SFPO
Addressee Name	Thompson T C
Addressee Affiliation	NAC International
Docket Number	07201015
License Number	
Case/Reference Number	
Document/Report Number	
Media Type	Electronic
Physical File Location	ADAMS
Microform Addresses	

Accession Number	ML003709499
Estimated Page Count	907
Document Date	04/18/2000
Availability	Publicly Available
Title	Submittal of Responses to Telecon RAIs as Supplemental Information for the UMS Universal Storage System Amendment for Maine Yankee Atomic Power Co Site Specific Spent Fuel
Author Name	Thompson T C
Author Affiliation	NAC International
Addressee Name	
Addressee Affiliation	NRC/OCIO/IMD/RMB
Docket Number	07201015
License Number	
Case/Reference Number	L22979
Document/Report Number	
Media Type	Electronic
Physical File Location	ADAMS
Microform Addresses	

Accession Number	ML003700544
Estimated Page Count	11
Document Date	04/05/2000
Availability	Publicly Available
Title	Comments submitted by David C. Jones on behalf of NAC Nuclear Technology Users Group (NUTUG) on the proposed rule PR-72 - List of Approved Spent Fuel Storage Casks: NAC UMS Addition
Author Name	Jones D C
Author Affiliation	NAC Nuclear Technology Users Group (NUTUG)
Addressee Name	Secretary
Addressee Affiliation	NRC/SECY/RAS
Docket Number	07201015
License Number	
Case/Reference Number	65FR3397 00003 , PR-72
Document/Report Number	
Media Type	Electronic
Physical File Location	ADAMS
Microform Addresses	

Accession Number	ML003694745
Estimated Page Count	101
Document Date	03/31/2000
Availability	Publicly Available
Title	Safety Analysis Report for UMS Universal Storage Cask
Author Name	
Author Affiliation	NAC International
Addressee Name	
Addressee Affiliation	
Docket Number	07201015
License Number	
Case/Reference Number	12412-SAR-002
Document/Report Number	
Media Type	Electronic
Physical File Location	ADAMS
Microform Addresses	

Accession Number	ML003697877
Estimated Page Count	4
Document Date	03/30/2000
Availability	Publicly Available
Title	3/30/00 Memo to DACool RE Request fr Rulemaking to revise 72.214 RE amendment of CoC 1015 fr NAC-UMS Universal Storage System 003697877
Author Name	Brach E W
Author Affiliation	NRC/NMSS/SFPO
Addressee Name	Cool D A
Addressee Affiliation	NRC/NMSS/SFPO
Docket Number	07201015
License Number	
Case/Reference Number	
Document/Report Number	
Media Type	Electronic
Physical File Location	ADAMS
Microform Addresses	

Accession Number	ML003698638
Estimated Page Count	6
Document Date	03/30/2000
Availability	Publicly Available
Title	REQUEST FOR RULEMAKING TO REVISE 10 CFR 72.214 TO SUPPORT THE AMENDMENT OF THE CERTIFICATE OF,COMPLIANCE NO.1015 FOR THE NAC-UMS@ UNIVERSAL STORAGE SYSTEM
Author Name	Brach E W
Author Affiliation	NRC/NMSS/SFPO
Addressee Name	Cool D A
Addressee Affiliation	NRC/NMSS/IMNS
Docket Number	07201015
License Number	
Case/Reference Number	
Document/Report Number	
Media Type	Electronic
Physical File Location	ADAMS
Microform Addresses	

Accession Number	ML003704475
Estimated Page Count	2
Document Date	03/28/2000
Availability	Publicly Available
Title	Comments submitted by George A. Zinke on behalf of Maine Yankee Atomic Power company supporting Proposed Rule PR-72 - Addition of NAC UMS Universal Storage System to the list of approved spent fuel storage casks.
Author Name	Zinke G A
Author Affiliation	Maine Yankee Atomic Power Co
Addressee Name	
Addressee Affiliation	NRC/SECY/RAS
Docket Number	05000309, 07201015
License Number	DPR-36
Case/Reference Number	65FR3397 00005, PR-72
Document/Report Number	
Media Type	Electronic
Physical File Location	ADAMS
Microform Addresses	

Accession Number	ML003694254
Estimated Page Count	1
Document Date	03/17/2000
Availability	Publicly Available
Title	Submittal of the paper copy of a reference report for the Maine Yankee Site Specific Spent Fuel Amendment to the NAC-UMS CoC
Author Name	Thompson T C
Author Affiliation	NAC International
Addressee Name	
Addressee Affiliation	NRC/OCIO/IMD/RMB
Docket Number	05000309, 07201015
License Number	
Case/Reference Number	
Document/Report Number	BAW-1874, DOE/ET/34212-50
Media Type	Electronic
Physical File Location	ADAMS
Microform Addresses	

Accession Number	ML003694719
Estimated Page Count	19
Document Date	03/17/2000
Availability	Publicly Available
Title	Submittal of Supplemental Information to RAI-1 Responses for the UMS Universal Storage System Amendment for Maine Yankee Atomic Power Company Site Specific Spent Fuel
Author Name	Thompson T C
Author Affiliation	NAC International
Addressee Name	
Addressee Affiliation	NRC/OCIO/IMD/RMB
Docket Number	07201015
License Number	
Case/Reference Number	L22979
Document/Report Number	
Media Type	Electronic
Physical File Location	ADAMS
Microform Addresses	

Accession Number	ML003683894
Estimated Page Count	470
Document Date	02/29/2000
Availability	Non-Publicly Available
Title	NAC INTERNATIONAL RESPONSES TO THE NRC REQUEST FOR ADDITIONAL INFORMATION (RAI-1 DECEMBER 21, 1999) MAC UNIVERSAL STORAGE SYSTEM (NAC-UMS) MAINE YANKEE AMENDMENT.
Author Name	
Author Affiliation	NAC International
Addressee Name	
Addressee Affiliation	
Docket Number	07201015
License Number	
Case/Reference Number	TAC L22979
Document/Report Number	
Media Type	Electronic
Physical File Location	ADAMS
Microform Addresses	

Accession Number	ML003683350
Estimated Page Count	89
Document Date	02/29/2000
Availability	Publicly Available
Title	NAC INTERNATIONAL RESPONSES TO THE NRC REQUEST FOR ADDITIONAL INFORMATION (RAI-1 DECEMBER 21, 1999) NAC UNIVERSAL STORAGE SYSTEM (NAC-UMS) MAINE YANKEE AMENDMENT.
Author Name	
Author Affiliation	NAC International
Addressee Name	
Addressee Affiliation	
Docket Number	07201015
License Number	
Case/Reference Number	TAC L22979
Document/Report Number	
Media Type	Electronic
Physical File Location	ADAMS
Microform Addresses	

Accession Number	ML003683264
Estimated Page Count	175
Document Date	02/29/2000
Availability	Publicly Available
Title	Revision UMSS-00A to "UMS Safety Analysis Report for the UMS Universal Storage Cask Amendment for Maine Yankee Atomic Power Company Site Specific Spent Fuel."
Author Name	
Author Affiliation	NAC International
Addressee Name	
Addressee Affiliation	
Docket Number	07201015
License Number	
Case/Reference Number	
Document/Report Number	12412-SAR-002
Media Type	Electronic
Physical File Location	ADAMS
Microform Addresses	

Accession Number	ML003685118
Estimated Page Count	3
Document Date	02/16/2000
Availability	Publicly Available
Title	Submittal of Supplemental Information for the UMS Universal Storage System Amendment for Maine Yankee Atomic Power Company Site Specific Spent Fuel.
Author Name	Thompson T C
Author Affiliation	NAC International
Addressee Name	
Addressee Affiliation	
Docket Number	07201015
License Number	
Case/Reference Number	
Document/Report Number	
Media Type	Electronic
Physical File Location	ADAMS
Microform Addresses	

Accession Number	ML003683418
Estimated Page Count	5
Document Date	02/07/2000
Availability	Publicly Available
Title	Submittal of supplemental information to the response to the request for additional information for the UMS Universal Storage System Amendment for Maine Yankee Atomic Power Company Site Specific Spent Fuel.
Author Name	Thompson T C
Author Affiliation	NAC International
Addressee Name	
Addressee Affiliation	NRC/OCIO/IMD/RMB
Docket Number	07201015
License Number	
Case/Reference Number	TAC L22979
Document/Report Number	
Media Type	Electronic
Physical File Location	ADAMS
Microform Addresses	

Accession Number	ML003682196
Estimated Page Count	24
Document Date	02/04/2000
Availability	Publicly Available
Title	SUMMARY OF JANUARY 18,2000, MEETING WITH NAC INTERNATIONAL AND MAINE YANKEE REGARDING THE NAC-UMS STORAGE AMENDMENT APPLICATION
Author Name	McGinty T J
Author Affiliation	NRC/NMSS/SFPO/SLID
Addressee Name	Shankman S F
Addressee Affiliation	NRC/NMSS/SFPO/SLID
Docket Number	07200030, 07201015
License Number	
Case/Reference Number	TAC L22979
Document/Report Number	
Media Type	Electronic
Physical File Location	ADAMS
Microform Addresses	

Accession Number	ML003683194
Estimated Page Count	5
Document Date	02/04/2000
Availability	Publicly Available
Title	Submittal of Responses to the Request for Additional Information (RAI-1) for the UMS Universal Storage System Amendment for Maine Yankee Atomic Power Company Site Specific Spent Fuel. Proprietary information is enclosed.
Author Name	Thompson T C
Author Affiliation	NAC International
Addressee Name	
Addressee Affiliation	NRC/OCIO/IMD/RMB
Docket Number	07201015
License Number	
Case/Reference Number	TAC L22979
Document/Report Number	
Media Type	Electronic
Physical File Location	ADAMS
Microform Addresses	

Accession Number	ML003710116
Estimated Page Count	21
Document Date	01/19/2000
Availability	Publicly Available
Title	Transmittal of Meeting Handout Materials for 01/18/00 Meeting with NAC International to discuss RAI related to NAC-UMS Amend Request
Author Name	McGinty T
Author Affiliation	NRC/NMSS/SFPO
Addressee Name	
Addressee Affiliation	
Docket Number	07201015
License Number	
Case/Reference Number	TAC L22979
Document/Report Number	
Media Type	Electronic
Physical File Location	ADAMS
Microform Addresses	

Accession Number	ML003677179
Estimated Page Count	2
Document Date	01/11/2000
Availability	Publicly Available
Title	Meeting notice of January 11, 2000 meeting with NAC International,Stone & Webster Engineering & Construction & Maine Yankee in Rockville, MD regarding RAI related to NAC-UMS amendment request to incorporate Maine Yankee contents.
Author Name	
Author Affiliation	NRC
Addressee Name	
Addressee Affiliation	
Docket Number	07201015
License Number	
Case/Reference Number	TAC L22979
Document/Report Number	
Media Type	Paper
Physical File Location	ADAMS
Microform Addresses	

Accession Number	ML003673619
Estimated Page Count	2
Document Date	01/11/2000
Availability	Publicly Available
Title	01/18/2000 - Meeting Notice: NRC (SFPO) to meet with Stone & Webster and Maine Yankee re: NAC-UMS amendment
Author Name	McGinty T J
Author Affiliation	NRC/NMSS/SFPO
Addressee Name	
Addressee Affiliation	
Docket Number	07201015
License Number	
Case/Reference Number	
Document/Report Number	
Media Type	Electronic
Physical File Location	ADAMS
Microform Addresses	

Accession Number	ML003675530
Estimated Page Count	3
Document Date	01/10/2000
Availability	Publicly Available
Title	TRANSPORTABLE SPENT FUEL STORAGE CASKS.
Author Name	O'Connor S C
Author Affiliation	NRC/NMSS/SFPO
Addressee Name	Slade C
Addressee Affiliation	- No Known Affiliation
Docket Number	07109235, 07109255, 07109268, 07109270, 07109276, 07109283, 07201008, 07201015, 07201023, 07201026
License Number	
Case/Reference Number	
Document/Report Number	
Media Type	Electronic
Physical File Location	ADAMS
Microform Addresses	

NAC CASEWORK

Wed 09/20/00
3:26 PM

ID	Docket	TAC	Task Name	Type	Prior	Date	Finish	Duration	PM	Schd	Grp
83	71-9225		NAC LWT Foreign Fuel (Chil	Amend	2	Fri 09/01/00	Tue 10/31/00	61 days	Waters	Yes	TRB
84			Application Received		0	Fri 09/01/00	Fri 09/01/00	1 day		No	
85			Complete Acceptance Re		0	Wed 09/06/00	Wed 09/06/00	1 day		No	
86			Start Initial Review		0	Fri 09/01/00	Fri 09/01/00	1 day		No	
87			Tech Review		0	Fri 09/01/00	Fri 09/29/00	29 days		No	
88			TI		0	Fri 09/29/00	Fri 09/29/00	1 day		No	
89			Prepare RAI		0	Mon 10/02/00	Tue 10/03/00	2 days		No	
90			Issue RAI		0	Thu 10/05/00	Thu 10/05/00	1 day		No	
91			Applicant Responding		0	Fri 10/06/00	Fri 10/13/00	8 days		No	
92			Receive Response		0	Fri 10/13/00	Fri 10/13/00	1 day		No	
93			Tech Review		0	Fri 10/13/00	Tue 10/24/00	12 days		No	
94			TI		0	Tue 10/24/00	Tue 10/24/00	1 day		No	
95			Prepare CoC		0	Wed 10/25/00	Fri 10/27/00	3 days		No	
96			Issue CoC		0	Tue 10/31/00	Tue 10/31/00	1 day		No	
377	71-9270	L22452	NAC UMS Transport Applica	New	4	Wed 04/30/97	Thu 05/03/01	1465 days	McGinty	Yes	TRA
378			Application Received		0	Wed 04/30/97	Wed 04/30/97	1 day		No	
379			Complete Acceptance Re		0	Fri 08/13/99	Fri 08/13/99	1 day		No	
380			Start Initial Review		0	Fri 06/18/99	Fri 06/18/99	1 day		No	
381			Tech Review		0	Fri 06/18/99	Fri 08/13/99	57 days		No	
382			TI		0	Fri 08/13/99	Fri 08/13/99	1 day		No	
383			Prepare RAI		0	Fri 08/13/99	Fri 08/20/99	8 days		No	
384			Issue RAI		0	Mon 08/30/99	Mon 08/30/99	1 day		No	
385			Applicant Responding		0	Mon 08/30/99	Thu 06/29/00	305 days		No	
386			Receive Response		0	Thu 06/29/00	Thu 06/29/00	1 day		No	
387			Tech Review		0	Mon 09/11/00	Thu 11/09/00	60 days		No	
388			TI		0	Thu 11/09/00	Thu 11/09/00	1 day		No	
389			Prepare RAI		0	Thu 11/09/00	Thu 11/23/00	15 days		No	
390			Issue RAI		0	Fri 12/08/00	Fri 12/08/00	1 day		No	
391			Applicant Responding		0	Fri 12/08/00	Wed 01/31/01	55 days		No	
392			Receive Response		0	Wed 01/31/01	Wed 01/31/01	1 day		No	
393			Tech Review		0	Thu 02/01/01	Fri 03/16/01	44 days		No	
394			TI		0	Fri 03/16/01	Fri 03/16/01	1 day		No	
395			Prepare CoC		0	Fri 03/16/01	Fri 04/06/01	22 days		No	
396			Issue CoC		0	Thu 05/03/01	Thu 05/03/01	1 day		No	
102	72-1015	L22979	NAC UMS	New	2	Fri 08/29/97	Mon 11/01/99	795 days	McGinty	Yes	TRA
103			Receive Application		0	Fri 08/29/97	Fri 08/29/97	0 days		No	
104			Issue 1st RAI		0	Fri 10/30/98	Fri 10/30/98	0 days		No	
105			Applicant Responding		0	Sat 10/31/98	Fri 01/29/99	91 days		No	
106			Receive Response to 1st		0	Fri 01/29/99	Fri 01/29/99	0 days		No	
107			Tech Review		0	Sat 01/30/99	Thu 05/13/99	104 days		No	
108			TI		0	Thu 05/13/99	Thu 05/13/99	0 days		No	
109			Prepare RAI		0	Fri 05/14/99	Thu 05/27/99	14 days		No	
110			Issue 2nd RAI		0	Thu 05/27/99	Thu 05/27/99	0 days		No	
111			Applicant Responding		0	Fri 05/28/99	Mon 08/16/99	81 days		No	
112			Receive Response to 2nc		0	Mon 08/16/99	Mon 08/16/99	0 days		No	
113			Issue User Need Memo		0	Mon 08/30/99	Mon 08/30/99	0 days		No	
114			Tech Review		0	Tue 08/17/99	Thu 09/30/99	45 days		No	
115			TI		0	Thu 09/30/99	Thu 09/30/99	0 days		No	
116			Prepare SER/COC		0	Thu 09/30/99	Mon 11/01/99	33 days		No	
117			Issue Draft SER/COC		0	Mon 11/01/99	Mon 11/01/99	0 days		No	
118	72-1015	L23005	NAC UMS	Rule	2	Mon 11/01/99	Thu 08/31/00	304 days	McGinty	Yes	TRA
119			Issue Draft SER/COC		0	Mon 11/01/99	Mon 11/01/99	0 days		No	

NAC CASEWORK

Wed 09/20/00
3:26 PM

ID	Docket	TAC	Task Name	Type	Prior	Date	Finish	Duration	PM	Schd	Grp
120			Issue for Public Comment		0	Tue 02/29/00	Tue 02/29/00	0 days		No	
121			Receive Comments		0	Wed 04/05/00	Wed 04/05/00	0 days		No	
122			Resolve Public Comment		0	Wed 04/05/00	Fri 07/21/00	108 days		No	
123			Submit Responses		0	Fri 07/21/00	Fri 07/21/00	0 days		No	
124			Publish FRN		0	Thu 08/31/00	Thu 08/31/00	0 days		No	
337	72-1025	L23095	NAC MPC (Conn Yankee)	Amend	3	Thu 06/22/00	Mon 05/07/01	319 days	Jackson	Yes	TRA
338			Receive Application		0	Thu 06/22/00	Thu 06/22/00	0 days		No	
339			Complete Acceptance Re		0	Wed 07/26/00	Wed 07/26/00	0 days		No	
340			Start Review		0	Wed 07/26/00	Wed 07/26/00	0 days		No	
341			Tech Review		0	Wed 07/26/00	Mon 10/16/00	83 days		No	
342			TI		0	Mon 10/16/00	Mon 10/16/00	0 days		No	
343			Prepare RAI		0	Wed 10/25/00	Mon 10/30/00	6 days		No	
344			Issue RAI		0	Mon 10/30/00	Mon 10/30/00	0 days		No	
345			Applicant Responding		0	Mon 10/30/00	Mon 01/29/01	92 days		No	
346			Receive Response		0	Mon 01/29/01	Mon 01/29/01	0 days		No	
347			Tech Review		0	Mon 01/29/01	Thu 03/15/01	46 days		No	
348			TI		0	Thu 03/15/01	Thu 03/15/01	0 days		No	
349			Issue User Need Memo		0	Wed 03/07/01	Wed 03/07/01	1 day		No	
350			Prepare COC		0	Sat 04/07/01	Tue 04/17/01	11 days		No	
351			Issue COC		0	Mon 05/07/01	Mon 05/07/01	0 days		No	
352	72-1025		NAC MPC (Yankee Rowe)	Amend	4	Fri 09/29/00	Tue 06/12/01	256 days	Tiktinsky	Yes	TRA
353			Complete Acceptance Re		0	Fri 10/27/00	Fri 10/27/00	0 days		No	
354			Start Review		0	Fri 09/29/00	Fri 09/29/00	0 days		No	
355			Tech Review		0	Fri 09/29/00	Fri 12/15/00	78 days		No	
356			TI		0	Fri 12/15/00	Fri 12/15/00	0 days		No	
357			Prepare RAI		0	Fri 12/15/00	Sat 01/06/01	23 days		No	
358			Issue RAI		0	Tue 01/16/01	Tue 01/16/01	0 days		No	
359			Applicant Responding		0	Sat 01/06/01	Mon 03/26/01	80 days		No	
360			Receive Response		0	Mon 03/26/01	Mon 03/26/01	0 days		No	
361			Tech Review		0	Mon 03/26/01	Tue 05/01/01	37 days		No	
362			TI		0	Tue 05/01/01	Tue 05/01/01	0 days		No	
363			Prepare COC		0	Tue 05/01/01	Tue 05/22/01	22 days		No	
364			Issue COC		0	Tue 06/12/01	Tue 06/12/01	0 days		No	
384	72-1015	L22979	NAC UMS Storage, MY Revi	Amend	3	Fri 07/16/99	Fri 09/15/00	427 days	McGinty	Yes	TRA
385			Receive Application		0	Fri 07/16/99	Fri 07/16/99	0 days		No	
386			Start Review		0	Thu 09/23/99	Thu 09/23/99	0 days		No	
387			Tech Review		0	Thu 09/23/99	Tue 11/30/99	69 days		No	
388			TI		0	Tue 11/30/99	Tue 11/30/99	0 days		No	
389			Prepare RAI		0	Tue 11/30/99	Wed 12/08/99	9 days		No	
390			Issue RAI		0	Tue 12/21/99	Tue 12/21/99	0 days		No	
391			Applicant Responding		0	Tue 12/21/99	Fri 02/04/00	46 days		No	
392			Receive Response		0	Fri 02/04/00	Fri 02/04/00	0 days		No	
393			Tech Review		0	Mon 02/07/00	Wed 03/08/00	31 days		No	
394			TI		0	Wed 03/08/00	Wed 03/08/00	0 days		No	
395			Prepare RAI		0	Wed 03/08/00	Wed 06/21/00	106 days		No	
396			Issue RAI		0	Thu 06/29/00	Thu 06/29/00	0 days		No	
397			Applicant Responding		0	Thu 06/29/00	Thu 07/27/00	29 days		No	
398			Receive Response		0	Thu 07/27/00	Fri 07/28/00	2 days		No	
399			Tech Review		0	Mon 08/07/00	Fri 08/18/00	12 days		No	
400			TI		0	Fri 08/18/00	Fri 08/18/00	0 days		No	
401			Prepare CoC		0	Fri 08/18/00	Tue 09/05/00	19 days		No	
402			Issue CoC		0	Fri 09/15/00	Fri 09/15/00	0 days		No	

NAC Proposed Schedules

08/18/00

Amendments	Qtr 1, 2000	Qtr 2, 2000	Qtr 3, 2000	Qtr 4, 2000	Qtr 1, 2001	Qtr 2, 2001	Qtr 3, 2001	Qtr 4, 2001	Qtr 1, 2002	Qtr 2, 2002	Qtr 3, 2002
Advanced NAC-UMS Storage Amendment 1				Dec 31 '00							Jun 01 '02
Advanced NAC-UMS Storage Amendment 2				Dec 31 '00							Jun 01 '02
Advanced NAC-UMS Storage Amendment 3				Dec 31 '00							Jun 01 '02
Advanced NAC-UMS Storage Amendment 4				Dec 31 '00							Jun 01 '02
Advanced NAC-UMS Storage Amendment 5				Dec 31 '00							Jun 01 '02
Advanced NAC-UMS Storage Amendment 6				Dec 31 '00							Jun 01 '02
Advanced NAC-UMS Storage Amendment 7				Dec 31 '00							Jun 01 '02
Advanced NAC-UMS Transport Amendment 1					Feb 28 '01						Jun 01 '02
Advanced NAC-UMS Transport Amendment 2					Feb 28 '01						Jun 01 '02
Advanced NAC-UMS Transport Amendment 3					Feb 28 '01						Jun 01 '02
Advanced NAC-UMS Transport Amendment 4					Feb 28 '01						Jun 01 '02
Advanced NAC-UMS Transport Amendment 5					Feb 28 '01						Jun 01 '02
Advanced NAC-UMS Transport Amendment 6					Feb 28 '01						Jun 01 '02
Enhanced NAC-UMS Storage Amendment 1			Sep 30 '00			Apr 15 '01					
Enhanced NAC-UMS Storage Amendment 2			Sep 30 '00			Apr 15 '01					
Enhanced NAC-UMS Storage Amendment 3			Sep 30 '00			Apr 15 '01					
Enhanced NAC-UMS Storage Amendment 4			Sep 30 '00			Apr 15 '01					
Enhanced NAC-UMS Transport Amendment 1				Nov 30 '00		Apr 15 '01					
Enhanced NAC-UMS Transport Amendment 2				Nov 30 '00		Apr 15 '01					
Enhanced NAC-UMS Transport Amendment 3				Nov 30 '00		Apr 15 '01					
NAC-LWT Transport Cask Amendment 1			Aug 20 '00		Oct 31 '00						
NAC-LWT Transport Cask Amendment 2			Aug 31 '00		Oct 20 '00						
NAC-LWT Transport Cask Amendment 3			Sep 08 '00		Oct 20 '00						
NAC-LWT Transport Cask Amendment 4				Nov 30 '00		Feb 28 '01					
NAC-LWT Transport Cask Amendment 5			Sep 30 '00		Dec 31 '00						

Project: Complete
Date: 08/18/00

Advanced-UMS — LWT — NAC-UMS

Enhanced-UMS — NAC-MPC

NAC Proposed Schedules

08/18/00

Amendments	Qtr 1, 2000	Qtr 2, 2000	Qtr 3, 2000	Qtr 4, 2000	Qtr 1, 2001	Qtr 2, 2001	Qtr 3, 2001	Qtr 4, 2001	Qtr 1, 2002	Qtr 2, 2002	Qtr 3, 2002
NAC-LWT Transport Cask Amendment 6					Mar 31 '01	Jun 30 '01					
NAC-MPC Amendment 1			Sep 20 '00			Apr 01 '01					
NAC-MPC Amendment 2		May 19 '00					Sep 01 '01				
NAC-MPC Amendment 3			Sep 15 '00				Sep 01 '01				
NAC-UMS Storage Amendment 1				Dec 31 '00	Dec 31 '00						
NAC-UMS Storage Amendment 2			Aug 28 '00	Sep 15 '00							
NAC-UMS Storage Amendment 3			Sep 10 '00	Sep 15 '00							
NAC-UMS Storage Amendment 4					Mar 21 '01	Apr 15 '01					
NAC-UMS Storage Amendment 5			Sep 08 '00			Apr 15 '01					
NAC-UMS Transport Amendment 1				Jan 31 '01		Apr 15 '01					
NAC-UMS Transport Amendment 2			Sep 08 '00			Apr 15 '01					

Project: Complete
Date: 08/18/00

Advanced-UMS
Enhanced-UMS
LWT
NAC-MPC
NAC-UMS

Table 4.4.3-6 Maximum Limiting Component Temperatures in Transient Operations for the Reduced Heat Load Cases for PWR Fuel after In-Pool Cooling

Canister Total Heat Load (kW)	Helium (In-Pool)			Vacuum			Helium		
		Temperature at End of Duration in Pool (°F)			Maximum Temperature (°F)			Max. Temp./ Temp. at End of Duration (°F)	
	Duration (hours)	Fuel	Heat Transfer Disk	Duration (hours)	Fuel	Heat Transfer Disk	Duration (hours)	Fuel	Heat Transfer Disk
20	24	490	407	10	714 +40	543	20	714/703[1]	650/650[1]
17.6	24	478	392	10	700 +30	509	48	700/693[1]	637/637[1]
14	24	456	365	14	731	521	No Limit[2]	731/645[2]	622/583[2]
11	24	431	337	14	706 +12	465	No Limit[2]	706/586[2]	577/518[2]
8	24	391	296	14	675	390	No Limit[2]	675/509[2]	509/431[2]

Notes:

1. Temperature at the end of helium duration.
2. Based on the steady state analysis performed for the 14 kW, 11 kW and 8 kW cases for the helium condition, the maximum calculated steady state fuel cladding temperatures are 645°F, 586°F and 509°F, respectively. The maximum calculated steady state heat transfer disk temperatures are 583°F, 518°F and 431°F, respectively. Since these temperatures are well below the allowable material temperatures, there is no time limit for the helium condition for these load cases.

Exceeds 686F for 23KW

omits the additional ~~[illegible]~~ two lowers in the action statement - from my estimate and temperature could be +40°F for 20KW +30F for 17.6KW +12F for 11KW

C/3

From: Tim McGinty
To: Susan Shankman > nmss
Date: Mon, Aug 7, 2000 5:37 PM
Subject: Request Meeting with You to Discuss Maine Yankee Direct Final

Susan:

SFPO staff (Tim, Eric, Chris Jackson, Phil Brochman and Wayne (and/or Earl or Jack)) would like to meet with you, tomorrow (8/8) if possible, to discuss the attached with respect to the need to make a decision on pursuing direct final rulemaking for the NAC-UMS Maine Yankee amendment.

The **first attachment** is an IMNS Action Plan to resolve issues identified 1) at a public meeting with NAC/Maine Yankee on 7/28, and 2) through interactions with Bill Kane.

The **second attachment** is why we need to meet with you, and deals with Phase 1 of the IMNS Action Plan, i.e., the development of Pro's and Con's with pursuing direct final rulemaking for Maine Yankee. These are intended to be suitable for discussions with Trish Holahan and a briefing of Bill Kane.

Please note that **I am also forwarding this e-mail to IMNS.** The SFPO licensing section recommendation to pursue direct final rulemaking for the Maine Yankee amendment does **not** represent a consensus. However, I wanted to let IMNS know our recommendation, and basis, to facilitate future discussions with Trish and yourself, and then Bill Kane.

Thanks, Tim McGinty

CC: Allen Howe, Catherine Jensen, Christopher Jackso...

C/4

August 4, 2000

Action Plan on Direct Final Approach for CoC Amendments

BACKGROUND

As a result of the Maine Yankee public meeting on July 28, 2000, and additional discussions between Wayne Hodges, SFPO, and Bill Kane, Director NMSS, 3 action items were identified for the near term. A working group consisting of representatives from IMNS, SFPO, ADM, and OGC met on August 3, 2000, to examine the action items. The primary focus of the discussion was on the staff approach to rulemaking for the NAC-UMS amendment, also called the Maine Yankee Amendment, because of the near term implications of this decision.

The action items identified by SFPO prior to the meeting were:

(1) Develop, and post on the NRC web-site, a generic "rulemaking" template that would be applicable to a) normal rulemaking, and b) direct final rulemaking. This is in response to the Maine Yankee observation that once the staff has forwarded a proposed SER and CoC on a cask for rulemaking, the remaining time to complete the action appears to be a "black box"... industry does not understand why it takes so long.

(2) Develop criteria to be used for a decision as to whether a Part 72 amendment can and should be processed via direct final or the normal rulemaking process. This is an action item from the Kane pre-brief of the Maine Yankee meeting on July 28, 2000. This is also related to a Maine Yankee request to be apprized, as soon as possible, if the staff will pursue direct final rulemaking for the NAC-UMS Maine Yankee amendment. Upon identifying the appropriate criteria, this would also be useful to post on the web-site for all to see. A separate letter to NAC/Maine Yankee on this topic would appear to be warranted.

(3) NAC International has two requests that are related: (a) That the normal 75 day NAFTA public comment period be reduced to 30 days for Part 72 cask amendments, and (b) that the 30 day delay in effectiveness of a normal final rule be changed to be effective immediately.

INITIAL STRATEGY

The general consensus at the August 3, 2000, meeting was to deal with the decision for direct final rulemaking (DFR) of the NAC-UMS amendment 1 separately from the generic issues related to developing general criteria for use of a direct final rulemaking, a 30 vs. 75 day comment period, and posting a "rulemaking" template for CoC additions to 10 CFR 72 on the NRC web-site. As a result of this decision it is proposed that a two phased approach be used with the lead office for the actions as identified below.

PHASE 1: ACTIONS ON NAC-UMS AMENDMENT 1 (SFPO/IMNS)

1. Examine DFR option against existing criteria e.g. routine <u>and</u> noncontroversial.

   At the conclusion of the meeting on August 3, 2000, the general consensus of the members present was that this amendment was likely to draw substantial comment, and thus was controversial, based on general CoC comment history and the specific history for the initial NAC-UMS rulemaking. In that process, a comment (#I-31) from a member

of the public resulted in a change to the SER. On the test of routine, there was not as strong an agreement at the meeting as there was for the controversial test, but there was agreement that both tests should be satisfied to use a DFR. Additionally, the SFPO " user need" memo dated March 30, 2000, requesting IMNS support for the amendment recommended use of the proposed rulemaking process on this amendment. The idea that a "trial period" was in effect to use the DFR approach as a result of SECY-00-018 was discussed. However, upon subsequent review of the SECY, the language does not support use of a DFR if the tests of routine and noncontroversial are not met.

2. Develop a recommendation on the DFR approach for the NAC-UMS Amendment 1. The recommendation will include the pros and cons on use of the DFR approach for this amendment and a basis.

3. Schedule a briefing of NMSS, SFPO, IMNS management on the results of the August 3, 2000, discussion and the staff's recommendation. Briefing to be held during the first part of the week of August 7, 2000.

PHASE II: ACTIONS ON GENERIC ISSUES (IMNS-RGB)

At the August 3, meeting the generic issues, e.g. actions to develop general criteria for use of a direct final rulemaking, a 30 vs. 75 day comment period, and posting a "rulemaking" template for CoC additions to 10 CFR 72 on the NRC web-site, were only discussed to a limited extent. In general, the members present believed that these issues had broad agency implications and therefore decisions on these issues should include broad agency participation. The view was also expressed that the narrow application of these concepts to only CoC amendments would misunderstood by the industry.

1. A working group (WG) will be formed to address the issues. Working group membership will include:

   Merri Horn, RGB, Chairperson
   Neil Jensen, OGC
   Mike Lesar, ADM
   Raj Auluck, NRR

2. The working group will address the following actions:

   a. Develop criteria to be used for a decision as to whether a Part 72 amendment can and should be processed via direct final or the normal rulemaking process.

   b. Evaluate the possibility of Developing and posting on the NRC web-site, a generic "rulemaking" template that would be applicable to (i) normal rulemaking, and (ii) direct final rulemaking.

   c. (i) Determine if the normal 75 day NAFTA public comment period can be reduced to 30 days for Part 72 cask amendments, and (ii) determine if the 30 day delay in effectiveness of a normal final rule be can be changed to be effective immediately.

Factors for WG consideration:

- The working group will examine the feasibility of each of the above actions considering the legal authority to take the action, the administrative policy implications, and implementation issues.
- The working group will consider the pros and cons of each of the above actions relative to NRC's four strategic goals, e.g. maintain safety, increase public confidence, improve efficiency and effectiveness, and reduce regulatory burden.

Time line:

- August 9, 2000 - IMNS-RGB brief for Director-NMSS on Phase II Action 2.c
- Week of September 10, 2000 - WG briefs the Rulemaking Coordinating Committee
- By September 29, 2000 - WG briefs NRC management on final recommendations

Decision to Pursue Direct Final Rulemaking for NAC-UMS Maine Yankee Amendment

Pro's:

1. Supported by staff position in SECY-00-0018, "Simplification of the Rulemaking Process for 10 CFR Part 72 Certificate of Compliance Rulemakings."

Basis: Staff position was that it would not use the direct final rulemaking approach for first time certificate approvals, however the staff would use a direct final rule approach for amendments to the existing cask systems **unless** there is reason to believe that the particular amendment will be controversial. The bases for this is that the staff did not anticipate routinely receiving significant adverse comments on amendments. The SECY stated that the policy would be re-evaluated after obtaining more experience with the process. Pursuit of a direct final rulemaking in this case would provide a unique data point for evaluation of the policy.

2. Consistent with July 20, 2000, schedule issued to NAC which states that the staff plans to pursue direct final rulemaking for NAC's scheduled amendments, which may reduce the 11 months it takes to complete a proposed rulemaking.

Basis: Stated intent in the schedule is to pursue direct final for amendments consistent with staff position in SECY-00-0018.

3. Maine Yankee amendment will not be "controversial" from a staff safety perspective, as it will necessarily have to be supported for approval via the staff's SER.

Basis: "Controversial", as a threshold, is difficult to measure in advance from a public interest standpoint. When examined from a safety perspective, this and any other amendment are not controversial in staff opinion.

4. A decision to pursue direct final rulemaking may temper accusations of an unnecessary burden on Maine Yankee due to unnecessary costly delays for both the review and the rulemaking.

Basis: If significant adverse comments are not received, approval of the amendment will meet Maine Yankee's loading schedule. Completion of the amendment in time to support Maine Yankee's schedule would be precluded by not choosing to pursue direct final.

5. The staff has successfully pursued the direct final approach for more significant and " controversial" rulemakings.

Basis: For example, the amendment to 50.54(a) with respect to Part 50 emergency plans is clearly more significant from a public interest and controversial perspective.

6. An unsuccessful direct final would still result in the amendment being effective 45 days earlier than a normal proposed rulemaking.

Basis: The public has 30 days, vice 75 days, to comment.

Con's:

1. Not supported by staff position in SECY-00-0018, "Simplification of the Rulemaking Process for 10 CFR Part 72 Certificate of Compliance Rulemakings."

Basis: Staff position was that it would not use the direct final rulemaking approach for first time certificate approvals, however the staff would use a direct final rule approach for amendments (thereby addressing "routine") to the existing cask systems **unless** there is reason to believe that the particular amendment will be controversial. This amendment is likely to draw substantial comment based on general CoC comment history and the specific history for the initial NAC-UMS rulemaking (adverse comments were received from Governor's of Maine and Connecticut, and a member of the public).

2. A decision to pursue the direct final approach may adversely impact public confidence and would be inconsistent with the publicly available SFPO "user need" memo dated March 30, 2000, which requested IMNS support and recommended use of the **proposed** rulemaking process on this amendment.

Basis: Staff planned normal proposed rulemaking prior to knowing that technical issues would render the time frames for completion of this process detrimental to Maine Yankee. Initial decision was based both on technical aspects (high burnup) and known public comments on the original NAC-UMS.

3. Pursuing direct final for this amendment would set a precedent that would make it difficult not choosing to pursue direct final for any other amendment during the trial period under the SECY.

Basis: Clearly a complex Part 72 amendment, with high burnup and preferential loading of particular note. Strong indication of likely political controversy from State governments.

4. An unsuccessful direct final rulemaking, the likely outcome based on staff judgement of the potential for significant adverse comments, would not result in the amendment becoming effective in time to meet Maine Yankee's April 2001 schedule. It may also erode public confidence as it is effectively results in a smaller public comment period by 45 days.

Recommendation:

With respect to the strategic goals, the staff considers a decision to pursue direct final:

1. Safety - neutral
2. Effective and efficient - neutral (utilizes choice of existing options)
3. Reduce unnecessary burden - positive
4. Increase public confidence - negative

The **SFPO staff recommends pursuing the direct final approach**, primarily based on the neutral safety impact from the decision. Additionally, the Commission policy stated in

SECY-00-0018 indicated that the staff would pursue the direct final approach for amendments to CoCs unless the amendment is controversial. Although we expect comments on this (and almost all) rulemakings, there is no technical issue in the amendment that we consider truly controversial.

Mail Envelope Properties (398F2C18.C1F : 20 : 49649)

Subject: Request Meeting with You to Discuss Maine Yankee Direct Final
Creation Date: Mon, Aug 7, 2000 5:37 PM
From: Tim McGinty

Created By: OWFN_DO.OWF1_PO:TJM1

Recipients
Post Office OWFN_DO.owf1_po
AGH1 CC (Allen Howe)
DMD1 CC (Debra Damiano)
EJL CC (Eric Leeds)
EXE CC (Earl Easton)
JPH1 CC (James Hennigan)
JXG CC (Jack Guttmann)
MWH CC (M. Wayne Hodges)
PLE CC (Patricia Eng)
SFS (Susan Shankman)

Post Office OWFN_DO.owf2_po
CPJ CC (Christopher Jackson)

Post Office TWFN_DO.twf4_po
CLJ CC (Catherine Jensen)
HET1 CC (Hester Thompson)
MLH1 CC (Merri Horn)
PGB CC (Philip Brochman)
SPB CC (Stephanie Bush)

Domain.Post Office	Route
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OWFN_DO.owf2_po	OWFN_DO.owf2_po
TWFN_DO.twf4_po	TWFN_DO.twf4_po

Files	Size	Date & Time
Action Plan on DFR.wpd	11805	Monday, August 7, 2000 9:48 AM
DFRBrief.wpd	8016	Monday, August 7, 2000 3:49 PM
MESSAGE	2339	Monday, August 7, 2000 5:37 PM

Options
Expiration Date: None
Priority: Standard
Reply Requested: No
Return Notification: None

Concealed Subject: No
Security: Standard

From: Tim McGinty
To: Eric Leeds
Date: Mon, Aug 7, 2000 1:36 PM
Subject: Pro's and Con's of Direct Final

NMSS

Eric,

Attached are Pro's and Con's of the pursuit of Direct Final rulemaking for the Maine Yankee amendment, worked on by Chris and Tim. Would like to discuss with you and Chris, and then get in Susan's office to discuss with her.

The bottom line recommendation, to pursue direct final, we do not think will be agreed upon by IMNS, which is why we want to talk to you first before providing to IMNS for feedback in preparation for a Kane brief (per Allen Howe's action plan, the second attached file).

Tim

CC: Christopher Jackson

C/5

Mail Envelope Properties (398EF3AC.C1F : 20 : 49649)

Subject: Pro's and Con's of Direct Final
Creation Date: Mon, Aug 7, 2000 1:36 PM
From: Tim McGinty

Created By: OWFN_DO.OWF1_PO:TJM1

Recipients
Post Office OWFN_DO.owf1_po
EJL (Eric Leeds)

Post Office OWFN_DO.owf2_po
CPJ CC (Christopher Jackson)

Domain.Post Office	Route
OWFN_DO.owf1_po	OWFN_DO.owf1_po
OWFN_DO.owf2_po	OWFN_DO.owf2_po

Files	Size	Date & Time
DFRBrief.wpd	8612	Monday, August 7, 2000 1:30 PM
Action Plan on DFR.wpd	11805	Monday, August 7, 2000 9:48 AM
MESSAGE	1244	Monday, August 7, 2000 1:36 PM

Options

Expiration Date:	None
Priority:	High
Reply Requested:	No
Return Notification:	None
Concealed Subject:	No
Security:	Standard

Decision to Pursue Direct Final Rulemaking for NAC-UMS Maine Yankee Amendment

Pro's:

1. Supported by staff position in SECY-00-0018, "Simplification of the Rulemaking Process for 10 CFR Part 72 Certificate of Compliance Rulemakings."

Basis: Staff position was that it would not use the direct final rulemaking approach for first time certificate approvals, however the staff would use a direct final rule approach for amendments to the existing cask systems **unless** there is reason to believe that the particular amendment will be controversial. The bases for this is that the staff did not anticipate routinely receiving significant adverse comments on amendments. The SECY stated that the policy would be re-evaluated after obtaining more experience with the process. Pursuit of a direct final rulemaking in this case would provide a unique data point for evaluation of the policy.

2. Consistent with July 20, 2000 schedule issued to NAC which states that the staff plans to pursue direct final rulemaking for NAC's scheduled amendments, which may reduce the 11 months it takes to complete a proposed rulemaking.

Basis: Stated intent in the schedule is to pursue direct final for amendments consistent with staff position in SECY-00-0018.

3. Maine Yankee amendment will not be "controversial" from a staff safety perspective, as it will necessarily have to be supported for approval via the staff's SER.

Basis: "Controversial", as a threshold, is difficult to measure in advance from a public interest standpoint. When examined from a safety perspective, this and any other amendment are not controversial in staff opinion.

4. A decision to pursue direct final rulemaking may temper accusations of an unnecessary burden on Maine Yankee due to unnecessary costly delays for both the review and the rulemaking.

Basis: If significant adverse comments are not received, approval of the amendment will meet Maine Yankee's loading schedule. Completion of the amendment in time to support Maine Yankee's schedule would be precluded by not choosing to pursue direct final.

5. The staff has successfully pursued the direct final approach for more significant and " controversial" rulemakings.

Basis: For example, the amendment to 50.54(a) with respect to Part 50 emergency plans is clearly more significant from a public interest and controversial perspective.

6. An unsuccessful direct final would still result in the amendment being effective 45 days earlier than a normal proposed rulemaking.

Basis: The public has 30 days, vice 75 days, to comment.

Con's:

1. Not supported by staff position in SECY-00-0018, "Simplification of the Rulemaking Process for 10 CFR Part 72 Certificate of Compliance Rulemakings."

Basis: Staff position was that it would not use the direct final rulemaking approach for first time certificate approvals, however the staff would use a direct final rule approach for amendments (thereby addressing "routine") to the existing cask systems **unless** there is reason to believe that the particular amendment will be controversial. This amendment is likely to draw substantial comment based on general CoC comment history and the specific history for the initial NAC-UMS rulemaking (adverse comments were received from Governor's of Maine and Connecticut, and a member of the public).

2. A decision to pursue the direct final approach may adversely impact public confidence and would be inconsistent with the publicly available SFPO "user need" memo dated March 30, 2000, which requested IMNS support and recommended use of the **proposed** rulemaking process on this amendment.

Basis: Staff planned normal proposed rulemaking prior to knowing that technical issues would render the time frames for completion of this process detrimental to Maine Yankee. Initial decision was based both on technical aspects (high burnup) and known public comments on the original NAC-UMS.

3. Inconsistent with July 20, 2000 schedule issued to NAC that states that the staff plans to pursue direct final rulemaking for NAC's scheduled amendments, which may reduce the 11 months it takes to complete a proposed rulemaking.

Basis: Stated intent in the schedule is to pursue direct final for amendments consistent with staff position in SECY-00-0018 unless known to be "controversial."

4. A decision to not pursue direct final rulemaking may represent an unnecessary burden on Maine Yankee due to unnecessary costly delays.

Basis: If significant adverse comments are not received, then successful completion of a direct final rulemaking would be precluded by not choosing to pursue direct final.

5. Pursuing direct final for this amendment would set a precedent that would make it difficult not choosing to pursue direct final for any other amendment during the trial period under the SECY.

Basis: Clearly a complex Part 72 amendment, with high burnup and preferential loading of particular note. Strong indication of likely political controversy from State governments.

6. An unsuccessful direct final rulemaking, the likely outcome based on staff judgement of the potential for significant adverse comments, would not result in the amendment

becoming effective in time to meet Maine Yankee's April 2001 schedule. It may also erode public confidence as it is effectively results in a smaller public comment period by 45 days.

Recommendation:

With regard to a recommendation, it has been difficult to reach a consensus among the affected parties. However, the **SFPO staff recommends pursuing the direct final approach.** This is based primarily on the fact that there is no safety impact from the decision. Additionally, the Commission policy stated in SECY-00-0018 indicated that the staff would pursue the direct final approach for amendments to CoCs unless the amendment is controversial. Although we expect comments on this (and almost all) rulemakings, there is no technical issue in the amendment that we consider truly controversial.

August 4, 2000

Action Plan on Direct Final Approach for CoC Amendments

BACKGROUND

As a result of the Maine Yankee public meeting on July 28, 2000, and additional discussions between Wayne Hodges, SFPO, and Bill Kane, Director NMSS, 3 action items were identified for the near term. A working group consisting of representatives from IMNS, SFPO, ADM, and OGC met on August 3, 2000, to examine the action items. The primary focus of the discussion was on the staff approach to rulemaking for the NAC-UMS amendment, also called the Maine Yankee Amendment, because of the near term implications of this decision.

The action items identified by SFPO prior to the meeting were:

(1) Develop, and post on the NRC web-site, a generic "rulemaking" template that would be applicable to a) normal rulemaking, and b) direct final rulemaking. This is in response to the Maine Yankee observation that once the staff has forwarded a proposed SER and CoC on a cask for rulemaking, the remaining time to complete the action appears to be a "black box"... industry does not understand why it takes so long.

(2) Develop criteria to be used for a decision as to whether a Part 72 amendment can and should be processed via direct final or the normal rulemaking process. This is an action item from the Kane pre-brief of the Maine Yankee meeting on July 28, 2000. This is also related to a Maine Yankee request to be apprized, as soon as possible, if the staff will pursue direct final rulemaking for the NAC-UMS Maine Yankee amendment. Upon identifying the appropriate criteria, this would also be useful to post on the web-site for all to see. A separate letter to NAC/Maine Yankee on this topic would appear to be warranted.

(3) NAC International has two requests that are related: (a) That the normal 75 day NAFTA public comment period be reduced to 30 days for Part 72 cask amendments, and (b) that the 30 day delay in effectiveness of a normal final rule be changed to be effective immediately.

INITIAL STRATEGY

The general consensus at the August 3, 2000, meeting was to deal with the decision for direct final rulemaking (DFR) of the NAC-UMS amendment 1 separately from the generic issues related to developing general criteria for use of a direct final rulemaking, a 30 vs. 75 day comment period, and posting a "rulemaking" template for CoC additions to 10 CFR 72 on the NRC web-site. As a result of this decision it is proposed that a two phased approach be used with the lead office for the actions as identified below.

PHASE 1: ACTIONS ON NAC-UMS AMENDMENT 1 (SFPO/IMNS)

1. Examine DFR option against existing criteria e.g. routine <u>and</u> noncontroversial.

   At the conclusion of the meeting on August 3, 2000, the general consensus of the members present was that this amendment was likely to draw substantial comment, and thus was controversial, based on general CoC comment history and the specific history for the initial NAC-UMS rulemaking. In that process, a comment (#I-31) from a member

of the public resulted in a change to the SER. On the test of routine, there was not as strong an agreement at the meeting as there was for the controversial test, but there was agreement that both tests should be satisfied to use a DFR. Additionally, the SFPO " user need" memo dated March 30, 2000, requesting IMNS support for the amendment recommended use of the proposed rulemaking process on this amendment. The idea that a "trial period" was in effect to use the DFR approach as a result of SECY-00-018 was discussed. However, upon subsequent review of the SECY, the language does not support use of a DFR if the tests of routine and noncontroversial are not met.

2. Develop a recommendation on the DFR approach for the NAC-UMS Amendment 1. The recommendation will include the pros and cons on use of the DFR approach for this amendment and a basis.

3. Schedule a briefing of NMSS, SFPO, IMNS management on the results of the August 3, 2000, discussion and the staff's recommendation. Briefing to be held during the first part of the week of August 7, 2000.

PHASE II: ACTIONS ON GENERIC ISSUES (IMNS-RGB)

At the August 3, meeting the generic issues, e.g. actions to develop general criteria for use of a direct final rulemaking, a 30 vs. 75 day comment period, and posting a "rulemaking" template for CoC additions to 10 CFR 72 on the NRC web-site, were only discussed to a limited extent. In general, the members present believed that these issues had broad agency implications and therefore decisions on these issues should include broad agency participation. The view was also expressed that the narrow application of these concepts to only CoC amendments would misunderstood by the industry.

1. A working group (WG) will be formed to address the issues. Working group membership will include:

   Merri Horn, RGB, Chairperson
   Neil Jensen, OGC
   Mike Lesar, ADM
   Raj Auluck, NRR

2. The working group will address the following actions:

   a. Develop criteria to be used for a decision as to whether a Part 72 amendment can and should be processed via direct final or the normal rulemaking process.

   b. Evaluate the possibility of Developing and posting on the NRC web-site, a generic "rulemaking" template that would be applicable to (i) normal rulemaking, and (ii) direct final rulemaking.

   c. (i) Determine if the normal 75 day NAFTA public comment period can be reduced to 30 days for Part 72 cask amendments, and (ii) determine if the 30 day delay in effectiveness of a normal final rule be can be changed to be effective immediately.

Factors for WG consideration:

- The working group will examine the feasibility of each of the above actions considering the legal authority to take the action, the administrative policy implications, and implementation issues.
- The working group will consider the pros and cons of each of the above actions relative to NRC's four strategic goals, e.g. maintain safety, increase public confidence, improve efficiency and effectiveness, and reduce regulatory burden.

Time line:

- August 9, 2000 - IMNS-RGB brief for Director-NMSS on Phase II Action 2.c
- Week of September 10, 2000 - WG briefs the Rulemaking Coordinating Committee
- By September 29, 2000 - WG briefs NRC management on final recommendations

From: Christopher Jackson — NRR
To: McGinty, Tim NMSS
Date: Mon, Aug 7, 2000 9:19 AM
Subject: Draft write-up

C/6

Based on recent discussions with Maine Yankee and NAC we have been asked to develop a number of integrated agency positions regarding 10 CFR 72.214 amendments associated with the approval of dry cask storage designs. This provides a summary of where we are in terms of three of these decisions.

1. Develop a position regarding the use of the direct final rule approach for 10 CFR 72.214 amendments.

In SECY-00-0018, "Simplification of the Rulemaking Process for 10 CFR Part 72 Certificate of Compliance Rulemakings," the staff stated a position regarding the use of the direct final rulemaking approach. The staff position was that it would not use the direct final rulemaking approach for first time certificate approvals, however the staff would use a direct final rule approach for amendments to the existing cask systems unless there is reason to believe that the particular amendment will be controversial. The bases for this is that the staff did not anticipate routinely receiving significant adverse comments on amendments. The SECY stated that the policy would be reevaluated after obtaining more experience with the process.

2. Develop a generic position regarding the use of the direct final rule approach for all agency rulemakings.

In an internal meeting on the subject, with SFPO, OGC, IMNS, and ADM we discussed this topic and concluded that developing an overall policy decision on the subject would take significant coordination with other affected offices (particularly NRR and RES). Additionally, the direct final approach was seen by some as an approach to be used only under special circumstances and defining those special circumstances may limit the benefit of the approach in the future.

3. Based on the previous discussion, develop a position with a rationale to be used for Maine Yankee NAC-UMS amendment with regard to the use of the direct final rule approach.

For background, the current staff position documented in a publically available user need memorandum states that we will be pursuing the proposed rulemaking approach. The rationale for this was that the nature of the changes to the NAC-UMS were reasonably significant and comments were submitted by the governors of the states of Maine and Connecticut for the initial NAC-UMS proposed rulemaking (showing evidence of some controversy). On July 20, 2000 the staff issued a letter to NAC discussing schedules for four applications. That letter stated that the rulemaking process would take approximately eleven months, however, the staff planed to take the direct final rulemaking approach for the NAC amendments.

There was no real consensus on the subject at the internal meeting and views were expressed strongly on both sides of the issue. There was general agreement on a few basic facts.

1. The decision has no impact on nuclear safety or safeguards.
2. A decision to pursue the direct final approach may adversely impact public confidence.
3. A decision to pursue the proposed rule approach will may represent an unnecessary burden on MY due to unnecessary costly delays.
4. The staff has pursued the direct final approach for more significant rulemakings (from a technical or safety standpoint).
5. Realistically, based on the location of MY and the political implications, the staff expects to receive a number of comments on the rulemaking. However, the staff does not think the

decision to pursue the direct final approach should be based solely on these types of predictions.

With regard to a recommendation, there was no real consensus among the affected parties. However, the SFPO staff recommends pursuing the direct final approach. This is based primarily on the fact that there is no safety impact from the decision. Additionally, the Commission policy stated in SECY-00-0018 indicated that the staff would pursue the direct final approach for amendments to CoCs unless the amendment is controversial. Although we expect comments on the rulemaking, there is really nothing in the amendment that we can point to as being really controversial.

Mail Envelope Properties (398EB77A.925 : 16 : 37466)

Subject: Draft write-up
Creation Date: Mon, Aug 7, 2000 9:19 AM
From: Christopher Jackson

Created By: OWFN_DO.OWF2_PO:CPJ

Recipients	Action	Date & Time
Post Office OWFN_DO.owf1_po	Delivered	08/07 9:20 AM
TJM1 (McGinty, Tim)	Opened	08/07 9:46 AM

Domain.Post Office	Delivered	Route
OWFN_DO.owf1_po	08/07 9:20 AM	OWFN_DO.owf1_po

Files	Size	Date & Time
directfi	5568	Monday, August 7, 2000 9:19 AM
MESSAGE	497	Monday, August 7, 2000 9:19 AM

Options

Auto Delete:	No
Expiration Date:	None
Notify Recipients:	No
Priority:	Standard
Reply Requested:	No
Return Notification:	None
Concealed Subject:	No
Security:	Standard
To Be Delivered:	Immediate
Status Tracking:	Delivered & Opened

From: Tim McGinty nmss
To: Christopher Jackson – nrr
Date: Mon, Aug 7, 2000 9:16 AM
Subject: Fwd: Action Plan for Direct Final Rulemaking for CoC Amendments

I haven't read this yet, forwarding FYI

c/7

From: Allen Howe
To: Auluck, Rajender, Brach, E. William, Bush, Steph...
Date: Fri, Aug 4, 2000 5:31 PM
Subject: Action Plan for Direct Final Rulemaking for CoC Amendments

Attached is an action plan for examining options related to the rulemaking process for amendments to CoCs for spent fuel storage systems approved under 10CFR72. Part 72 grants part 50 licensees a general license for spent fuel storage, provided the storage cask is approved by a certificate of compliance (CoC) and the storage cask is added to 72.214 via rulemaking. If the certificate needs to be changed, a rulemaking amendment to 72.214 is required. Industry feels that the current process takes too long. Bill Kane, Dir. NMSS, has tasked the staff to look at ways to address industry's concerns as further discussed in the attached action plan.
Please contact Merri Horn or me if you have any questions regarding the plan.

CC: Holahan, Patricia, Piccone, Josephine

Mail Envelope Properties (398EB6C2.C1F : 20 : 49649)

Subject: Fwd: Action Plan for Direct Final Rulemaking for CoC Amendments
Creation Date: Mon, Aug 7, 2000 9:16 AM
From: Tim McGinty

Created By: OWFN_DO.OWF1_PO:TJM1

Recipients
Post Office OWFN_DO.owf2_po
CPJ (Christopher Jackson)

Domain.Post Office	Route
OWFN_DO.owf2_po	OWFN_DO.owf2_po

Files	Size	Date & Time
Mail		
MESSAGE	588	Monday, August 7, 2000 9:16 AM

Options

Expiration Date:	None
Priority:	Standard
Reply Requested:	No
Return Notification:	None
Concealed Subject:	No
Security:	Standard

nmss nrr ADM

From: Merri Horn
To: Allen Howe, Christopher Jackson, David Meyer, E...
Date: Fri, Aug 4, 2000 7:10 AM
Subject: CoC Process

The Comission Paper on simplification of the CoC process was issued 1/24/00 as SECY-00-0018. There was no SRM as this was an information paper. What we said in the paper is that we would use a DFR for amendments unless we have a reason to believe that a particular amendment will be controversial.

Merri

018

Mail Envelope Properties (398AA4A9.4E2 : 24 : 20003)

Subject: CoC Process
Creation Date: Fri, Aug 4, 2000 7:10 AM
From: Merri Horn

Created By: TWFN_DO.TWF4_PO:MLH1

Recipients
Post Office OWFN_DO.owf1_po
AGH1 (Allen Howe)
EXE (Earl Easton)
TJM1 (Tim McGinty)

Post Office OWFN_DO.owf2_po
CPJ (Christopher Jackson)

Post Office OWFN_DO.owf5_po
SHL (Stephen Lewis)

Post Office TWFN_DO.twf4_po
DLM1 (David Meyer)
PGB (Philip Brochman)
SPB (Stephanie Bush)

Domain.Post Office	Route
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OWFN_DO.owf5_po	OWFN_DO.owf5_po
TWFN_DO.twf4_po	TWFN_DO.twf4_po

Files	Size	Date & Time
MESSAGE	863	Friday, August 4, 2000 7:10 AM

Options

Expiration Date:	None
Priority:	Standard
Reply Requested:	No
Return Notification:	None
Concealed Subject:	No
Security:	Standard

-nms
-nll - nms

From: Tim McGinty
To: Christopher Jackson, Philip Brochman
Date: Wed, Aug 2, 2000 1:00 PM
Subject: Fwd: Re: Action Items as a result of Maine Yankee Meeting on 7/28

I intend to talk to you two about the attached, if you don't mind thinking for a minute about what Earl has suggested.

Tim

C/9

From: Earl Easton
To: Allen Howe, Dorothy Gauch, Jack Guttmann, Phili...
Date: Wed, Aug 2, 2000 8:44 AM
Subject: Re: Action Items as a result of Maine Yankee Meeting on 7/28

Great! Love to participate.

An initial thought. I believe one of the main intentions of the NWPA was to get away from a "separate hearing" on each ISFSI application or amendment, while at the same time preserving the right of the public to participate. This was accomplished by substituting a rulemaking process (public comment) in lieu of a public hearing. Perhaps an initial starting point for a SFPO "direct final" determination would be the threshold (suitably modified) for which a party would be entitled to a public hearing . For example, if an application meets the "threshold" for which the public could require a hearing, a proposed rule would be used. Below that threshold, a direct final would be used.

Earl

>>> Tim McGinty 08/01 4:43 PM >>>
Allen (IMNS), Dorothy (OGC), Earl, Jack and Phil (SFPO) - or Working Group:

As a result of the Maine Yankee public meeting on 7/28, and additional discussions between Wayne Hodges and Bill Kane, we have 3 action items in the near term. **I propose that** we form a working group (with IMNS, SFPO and OGC representatives) to develop a strategy to complete the action items, and that the group **meet on 8/3, from 10-11 a.m., in O11-B-2.**

I am just trying to get the ball rolling here, and I'm certainly open to any ideas. However, I think the NMSS Office Director is expecting us to take action in the near term on these issues. **I have CC'd your managers** so they are aware that I am invading your time and proposing a working group on these issues (see below).

The action items are:

(1) Develop, and post on the NRC web-site, a **generic** "rulemaking" template that would be applicable to a) normal rulemaking, and b) direct final rulemaking. This is in response to the Maine Yankee observation that once the staff has forwarded a proposed SER and CoC on a cask for rulemaking, the remaining time to complete the action appears to be a "black box"...they do not understand why it takes so long.

(2) **Develop criteria** to be used for a decision as to whether a Part 72 amendment can and should be processed via **direct final or the normal rulemaking process.** This is an action item from the Kane pre-brief of the Maine Yankee meeting on 7/28...SFPO has the lead. This is also related to a Maine Yankee request to be apprized, as soon as possible, if the staff will pursue direct final rulemaking for the NAC-UMS Maine Yankee amendment. I think that upon identifying the appropriate criteria, this would also be useful to post on the web-site for all to see. A separate letter to NAC/Maine Yankee on this topic would appear to be warranted.

(3) NAC International has two requests that are related: (a) That the normal 75 day NAFTA public comment period be reduced to 30 days for Part 72 cask amendments, and (b) that the 30 day delay in effectiveness of a normal final rule be changed to be effective immediately. It would seem to me that in developing the information for the web-site, we may be able to communicate the basis of these time periods, although a separate letter to NAC is also probably warranted.

Thanks in advance for your time.

Tim McGinty

CC: Chester Poslusny, Christopher Jackson, Eric Leed...

Mail Envelope Properties (398853A7.C1F : 20 : 49649)

Subject: Fwd: Re: Action Items as a result of Maine Yankee Meeting on 7/28
Creation Date: Wed, Aug 2, 2000 1:00 PM
From: Tim McGinty

Created By: OWFN_DO.OWF1_PO:TJM1

Recipients
Post Office OWFN_DO.owf2_po
CPJ (Christopher Jackson)

Post Office TWFN_DO.twf4_po
PGB (Philip Brochman)

Domain.Post Office	Route
OWFN_DO.owf2_po	OWFN_DO.owf2_po
TWFN_DO.twf4_po	TWFN_DO.twf4_po

Files	Size	Date & Time
Mail		
MESSAGE	734	Wednesday, August 2, 2000 1:00 PM

Options

Expiration Date:	None
Priority:	Standard
Reply Requested:	No
Return Notification:	None
Concealed Subject:	No
Security:	Standard

NMSS

From: Jack Guttmann
To: Brochman, Philip, Easton, Earl, Gauch, Dorothy, ... OGC
Date: Wed, Aug 2, 2000 7:55 AM
Subject: Re: Action Items as a result of Maine Yankee Meeting on 7/28

Earl and I have meetings scheduled between 9:00 am through 2:00 pm.

2:30 would be good.

Jack.

>>> Tim McGinty 08/01/2000 4:43:10 PM >>>
Allen (IMNS), Dorothy (OGC), Earl, Jack and Phil (SFPO) - or Working Group:

As a result of the Maine Yankee public meeting on 7/28, and additional discussions between Wayne Hodges and Bill Kane, we have 3 action items in the near term. **I propose that we** form a working group (with IMNS, SFPO and OGC representatives) to develop a strategy to complete the action items, and that the group **meet on 8/3, from 10-11 a.m., in O11-B-2.**

I am just trying to get the ball rolling here, and I'm certainly open to any ideas. However, I think the NMSS Office Director is expecting us to take action in the near term on these issues. **I have CC'd your managers** so they are aware that I am invading your time and proposing a working group on these issues (see below).

The action items are:

(1) Develop, and post on the NRC web-site, a **generic** "rulemaking" template that would be applicable to a) normal rulemaking, and b) direct final rulemaking. This is in response to the Maine Yankee observation that once the staff has forwarded a proposed SER and CoC on a cask for rulemaking, the remaining time to complete the action appears to be a "black box"...they do not understand why it takes so long.

(2) **Develop criteria** to be used for a decision as to whether a Part 72 amendment can and should be processed via **direct final or the normal rulemaking process**. This is an action item from the Kane pre-brief of the Maine Yankee meeting on 7/28...SFPO has the lead. This is also related to a Maine Yankee request to be apprized, as soon as possible, if the staff will pursue direct final rulemaking for the NAC-UMS Maine Yankee amendment. I think that upon identifying the appropriate criteria, this would also be useful to post on the web-site for all to see. A separate letter to NAC/Maine Yankee on this topic would appear to be warranted.

(3) NAC International has two requests that are related: (a) That the normal 75 day NAFTA public comment period be reduced to 30 days for Part 72 cask amendments, and (b) that the 30 day delay in effectiveness of a normal final rule be changed to be effective immediately. It would seem to me that in developing the information for the web-site, we may be able to communicate the basis of these time periods, although a separate letter to NAC is also probably warranted.

Thanks in advance for your time.

Tim McGinty

CC: Bailey, Marissa, Bush, Stephanie, Holahan, Patri...

C/10

Mail Envelope Properties (39880C3A.F32 : 15 : 62240)

Subject: Re: Action Items as a result of Maine Yankee Meeting on 7/28
Creation Date: Wed, Aug 2, 2000 7:55 AM
From: Jack Guttmann

Created By: OWFN_DO.OWF1_PO:JXG

Recipients
Post Office OWFN_DO.owf1_po
AGH1 (Howe, Allen)
CXP1 CC (Poslusny, Chester)
EJL CC (Leeds, Eric)
EXE (Easton, Earl)
MGB CC (Bailey, Marissa)
SFS CC (Shankman, Susan)
TJM1 (McGinty, Tim)

Post Office OWFN_DO.owf2_po
CPJ CC (Jackson, Christopher)

Post Office OWFN_DO.owf5_po
DMG5 (Gauch, Dorothy)
SAT CC (Treby, Stuart)

Post Office TWFN_DO.twf4_po
PGB (Brochman, Philip)
PKH CC (Holahan, Patricia)
RXL1 CC (Lewis, Robert)
SPB CC (Bush, Stephanie)

Domain.Post Office	Route
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Files	Size	Date & Time
MESSAGE	4559	Wednesday, August 2, 2000 7:55 AM

Options

Expiration Date:	None
Priority:	Standard
Reply Requested:	No
Return Notification:	None

Concealed Subject: No
Security: Standard

From: Christopher Jackson — NRR
To: McGinty, Tim — NMSS
Date: Fri, Jul 28, 2000 7:15 AM
Subject: Re: Exemption Path Handout for Bill Kane briefing

Building a Commission paper into the exemption schedule is a good idea, however, 95 days is ambitious.

CPJ

>>> Tim McGinty 07/27 5:50 PM >>>
Is attached.

Steve Lewis: IMNS is putting together the rulemaking flowpath's for tomorrow's briefing. This e-mail represents a request to include Steve Lewis (OGC) on those handouts when they are e-mailed.

Tim McGinty

c/11

Mail Envelope Properties (39816B5F.925 : 16 : 37466)

Subject: Re: Exemption Path Handout for Bill Kane briefing
Creation Date: Fri, Jul 28, 2000 7:15 AM
From: Christopher Jackson

Created By: OWFN_DO.OWF2_PO:CPJ

Recipients	Action	Date & Time
Post Office OWFN_DO.OWF1_PO	Delivered	07/28 7:16 AM
TJM1 (McGinty, Tim)	Opened	07/28 8:21 AM

Domain.Post Office	Delivered	Route
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Files	Size	Date & Time
MESSAGE	1228	Friday, July 28, 2000 7:15 AM

Options

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Expiration Date:	None
Notify Recipients:	No
Priority:	Standard
Reply Requested:	No
Return Notification:	None
Concealed Subject:	No
Security:	Standard
To Be Delivered:	Immediate
Status Tracking:	Delivered & Opened

Table 4.4.3-5 Maximum Limiting Component Temperatures in Transient Operations for PWR Fuel

Heat Load (kW)	Water		Vacuum		Helium		
	Duration (hours)	Max. Temp. (°F)	Duration (hours)	Max. Temp. (°F)	Duration (hours)	Max. Temp. (°F)	
23	17	195	10	538	16	586	
20	20	202 ↑	15	538 ↑	20 ↓9	578 -7	↓
17.6 ↑	22 ↓-2	203 ↑	19 ↑1	577 ↑	11 ↓∞	585 +40	↑
14	26 ↓-4	202 ↑	24	574 ↑	Not Limited	574 (606)	↑+105
11	32 ↓-7	203 ↑	33 ↓-4	574 ↑	Not Limited	574 (531)	↑+188
8	44 ↓-14	204 ↑	60 ↓∞	566 ↑	Not Limited	566 (444)	↑+274

Notes:

1. PWR design basis heat load (See Figure 4.4.3-5 and Table 4.4.3-3)
2. The temperatures shown are the maximum fuel temperatures that occur during the indicated time duration. As shown in Figure 4.4.3-5, for the 23 kW heat load condition, the time durations are considered sequentially and the temperatures represent the cumulative effect of heat up. The maximum heat transfer disk and support disk temperatures are conservatively considered to be equal to the maximum fuel cladding temperature. These temperatures are less than the corresponding allowable material temperatures for short-term conditions as presented in Table 4.1-3.
3. Based on the steady state analysis performed for the 14 kW, 11 kW and 8 kW cases for the helium condition, the maximum calculated steady state fuel cladding/basket temperatures are 606°F, 531°F and 444°F, respectively. Since these temperatures are well below the allowable material temperatures, there is no time limit for the helium condition for these load cases. The maximum temperatures shown for these load cases (674°F, 674°F and 666°F) occur at the beginning of the helium condition and are based on the transient analysis.

D

Talking Points
NAC/Maine Yankee
Public Meeting 7/28/00

NAC - UMS Amendment 1
- discussion responds to NAC/MY request different alternatives
- schedule predicated on 7/31 complete/accurate response, no more questions

Proposed Rule

SFPO completes draft SER/CoC	09/15/00
FRN proposed rule (75 day comments)	01/11/01
(await UMS FRN issuance)	
FRN publication of final rule	09/05
effective date 30 days	10/04

Direct Final Rule

SFPO completes draft SER/CoC	09/15/00
FRN direct final rule	01/11/01
(await UMS FRN issuance)	
No Significant Adverse Comments 75 days	03/28/01

If yes on comments

• Withdraw FR Direct Final	03/28/01
• Address comments	
• FR publication of Final Rule	07/20/01
effective date 30 days	08/20/01

Exemption - using AND-1 operational safety
- from date of request to NRC action ~ 90 days

hmss

From: Stephen Lewis — NRR — OGC
To: Allen Howe, Christopher Jackson, Dorothy Gauch, ...
Date: Thu, Jul 27, 2000 2:47 PM
Subject: Re: Bill Kane Briefing - Friday, 7/28 @ 9:00 a.m.

07/27/00

Tim:

I will attend the briefing for OGC. I am also checking with Janice Moore to see if she wants to have someone from OGC-Reactor Programs also attend. Please send me a copy of the slides or other handouts you plan to use for the briefing.

Janice: I do not know if someone in Reactor Programs has been following the ISFSI apects of Maine Yankee. If so, you may want to have that attorney also attend the referenced briefing.

Steve

CC: E. William Brach, Eric Leeds, M. Wayne Hodges

C/14

Mail Envelope Properties (398083D1.709 : 17 : 28822)

Subject: Re: Bill Kane Briefing - Friday, 7/28 @ 9:00 a.m.
Creation Date: Thu, Jul 27, 2000 2:47 PM
From: Stephen Lewis

Created By: OWFN_DO.OWF5_PO:SHL

Recipients
Post Office OWFN_DO.owf1_po
AGH1 (Allen Howe)
EJL CC (Eric Leeds)
EWB CC (E. William Brach)
MWH CC (M. Wayne Hodges)
TJM1 (Tim McGinty)

Post Office OWFN_DO.owf2_po
CPJ (Christopher Jackson)

Post Office OWFN_DO.owf5_po
DMG5 (Dorothy Gauch)

Post Office TWFN_DO.twf4_po
PGB (Philip Brochman)
PKH (Patricia Holahan)
SPB (Stephanie Bush)

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Files	Size	Date & Time
MESSAGE	1285	Thursday, July 27, 2000 2:47 PM

Options

Expiration Date:	None
Priority:	Standard
Reply Requested:	No
Return Notification:	None
Concealed Subject:	No
Security:	Standard

NMSS

From: Patricia Holahan
To: Allen Howe, Christopher Jackson, Dorothy Gauch, ... NRR OGC
Date: Thu, Jul 27, 2000 9:36 AM
Subject: Re: Bill Kane Briefing - Friday, 7/28 @ 9:00 a.m.

Tim

Allen and I will attend the meeting. I think we need to be very careful in considering a direct final rule if we believe that either: 1) it is not routine and non-controversial; and 2) there is a potential of significant adverse comments.

Thanks, Trish

>>> Tim McGinty 07/26 2:50 PM >>>
Allen and Trish (IMNS):
Wayne, Bill, Eric and Phil (SFPO):

We are on Bill Kane's calendar for Friday morning at 9:00 a.m. in his office.

Bill Kane and Bill Brach have directed us (SFPO) to look into various options for approving the NAC-UMS Maine Yankee amendment request in order to support their April 16, 2001 initial loading schedule.

I have been directed to prepare detailed schedules that show milestones for the completion of the technical review, and also milestones associated with 1) a successful direct final rulemaking, 2) a failed direct final rulemaking which leads to a normal proposed rulemaking, and 3) acting on a potential future exemption request to 72.212 and 72.214 to allow Maine Yankee use of the amendment before rulemaking is completed.

Dorothy or Steve (OGC): You are cordially invited to attend the briefing of Bill Kane. Please respond to me re: whether you will be attending. Primary reason is to discuss the viability of approving an exemption for a rather detailed amendment (authorized contents changes, high-burnup fuel, damaged fuel) before the rulemaking is complete (the staff's preliminary SER/CoC will be sent for rulemaking in September, but Maine Yankee wants to use it in April, 2001. Hence, all the discussion about direct final rulemaking and exemptions).

Tim McGinty

CC: E. William Brach, Eric Leeds, M. Wayne Hodges

C/15

Mail Envelope Properties (39803AF2.500 : 18 : 20488)

Subject: Re: Bill Kane Briefing - Friday, 7/28 @ 9:00 a.m.
Creation Date: Thu, Jul 27, 2000 9:36 AM
From: Patricia Holahan

Created By: TWFN_DO.TWF4_PO:PKH

Recipients
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AGH1 (Allen Howe)
EJL CC (Eric Leeds)
EWB CC (E. William Brach)
MWH CC (M. Wayne Hodges)
TJM1 (Tim McGinty)

Post Office OWFN_DO.owf2_po
CPJ (Christopher Jackson)

Post Office OWFN_DO.owf5_po
DMG5 (Dorothy Gauch)
SHL (Stephen Lewis)

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PGB (Philip Brochman)
SPB (Stephanie Bush)

Domain.Post Office	Route
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TWFN_DO.twf4_po	TWFN_DO.twf4_po

Files	Size	Date & Time
MESSAGE	2952	Thursday, July 27, 2000 9:36 AM

Options

Expiration Date:	None
Priority:	Standard
Reply Requested:	No
Return Notification:	None
Concealed Subject:	No
Security:	Standard

-hmss -hmss -pbl -hmss

From: Tim McGinty
To: Allen Howe, Christopher Jackson, Patricia Holaha...
Date: Wed, Jul 26, 2000 1:20 PM
Subject: NAC-UMS Maine Yankee Amendment

Allen, Trish, Stephanie, Phil and Chris:

As you may be aware, we (SFPO) are under criticism for our schedule for completing the review of the Maine Yankee amendment for the NAC-UMS. We recently (7/20/00) issued a schedule showing completion of the review. The schedule we issued is now under re-consideration.

Bill Kane and Bill Brach have directed us (SFPO) to look into various options for approving this amendment request. Attached (rulesmemo) is a note I faxed to Bill Brach yesterday regarding the completion of the review, pursuing direct final rulemaking, normal proposed rulemaking (if direct final fails) and granting an exemption...to support the Maine Yankee schedule.

Also attached (intsched), and **more importantly,** is my current task, which I need your timely help on. Bill Brach and IMNS need to sit down with Bill Kane on Friday morning to go over potential detailed schedules for completing the amendment approval under the 3 options. I need your help in 1) establishing the appropriate milestones, and 2) filling in the committment dates. The dates I have filled in are based on yesterdays note to Brach.

I am also publishing a public meeting notice today, for a meeting with NAC and Maine Yankee on Friday at 11:00 a.m. The objective is to discuss the attached possibilities.

Please give this your attention as soon as possible. Bill Brach returns to the office tomorrow morning, but he asked me to convey that developing such a schedule is at the direction of Bill Kane. I need the appropriate milestones and dates to be filled in by **COB today** in order to discuss it with Bill Brach first thing in the morning. IMNS should be prepared to support both the briefing with Kane (I am getting on his calendar as you read this), and the public meeting.

Sorry for the short notice, but as you can tell, this has been rather dynamic.

Tim McGinty

CC: E. William Brach, Eric Leeds, M. Wayne Hodges

C/16

July 26, 2000

NOTE TO: E. William Brach, Director
Spent Fuel Project Office

FROM: Timothy J. McGinty, Project Manager
Spent Fuel Project Office

DETAILED INTERNAL SCHEDULE FOR NAC-UMS MAINE YANKEE AMENDMENT REVIEW AND RULEMAKING OPTIONS

In response to your July 26, 2000, request, we have developed a detailed schedule regarding the staff approval and rulemaking options and alternatives for the subject review. The enclosed schedule is based upon and supplements my July 25, 2000, note to you regarding action items for the NAC-UMS Maine Yankee amendment review schedule. The enclosed schedule assumes that NAC meets its commitment to provide a full and complete response to RAI-2 by July 31, 2000, and that no other significant technical issues arise as a result of the completion of the staff's review.

Please contact me if you have any additional questions.

Enclosure: Detailed Schedules

cc: S. Shankman
R. Parkhill
C. Jackson
P. Eng
A. Howe, IMNS
P. Holohan, IMNS
F. Jacobs
S. Turel, IMNS

July 26, 2000

NOTE TO: E. William Brach, Director
Spent Fuel Project Office

FROM: Timothy J. McGinty, Project Manager
Spent Fuel Project Office

DETAILED INTERNAL SCHEDULE FOR NAC-UMS MAINE YANKEE AMENDMENT REVIEW AND RULEMAKING OPTIONS

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Please contact me if you have any additional questions.

Enclosure: Detailed Schedules

cc: S. Shankman
R. Parkhill
C. Jackson
P. Eng
A. Howe, IMNS
P. Holohan, IMNS
F. Jacobs
S. Turel, IMNS

Distribution:
SFPO R/F

C:\WINDOWS\TEMP\gwprint\intschedmemo.WPD

OFC	SFPO	C	SFPO		SFPO	C	SFPO	C	SFPO	C
NAME	TJMcGinty		VTharpe		PBrochman		EEaston		EJLeeds	
DATE	7/25/00		7/ /00		7/ /00		7/ /00		7/ /00	

OFC	SFPO	C	SFPO	C	IMNS	C	SFPO		SFPO	
NAME	SFShankman		MWHodges		PHolohan					
DATE	7/ /00		7/ /00		7/ /00					

C = Cover E = Cover & Enclosure N = No copy OFFICIAL RECORD COPY

DIRECT FINAL NAC-UMS MAINE YANKEE AMENDMENT SCHEDULE

ACTION	DIRECT FINAL TASK	DATE
SFPO	Review RAI-2 Response, submit SER to PM	8/18/00
SFPO	Provide revised rulemaking memo to IMNS (seeking concurrent direct final/normal proposed)	8/18/00
SFPO	PM Prepare proposed SER/CoC	8/31/00
SFPO	Management Review - provide PM comments	9/6/00
SFPO	Issue proposed SER/CoC to IMNS	9/8/00
IMNS	Prepare Rulemaking Package	
IMNS	RGB Chief Concurrence	
IMNS/ SFPO	Obtain SFPO and IMNS Divisions Concurrence	
IMNS	Issue for Office Concurrence	
IMNS/ SFPO	Resolve Office Comments, complete IMNS/SFPO concurrence	
NMSS	NMSS concurrence	
EDO	EDO approval	
IMNS	Publication in FRN	
	Complete 30-day public comment period	
IMNS/ SFPO	Determine if significant adverse comments received, coordinate with OGC	
SFPO	Issue amendment to NAC	2/02/01
	No adverse comments, amendment effective	2/19/01

ENCLOSURE

IF DIRECT FINAL FAILS, NORMAL PROPOSED PROCESS

ACTION	DIRECT FINAL FAILED, NORMAL PROPOSED TASK	DATE
SFPO	Review RAI-2 Response, submit SER to PM	8/18/00
SFPO	Provide revised rulemaking memo to IMNS (seeking concurrent direct final/normal proposed)	8/18/00
SFPO	PM Prepare proposed SER/CoC	8/31/00
SFPO	Management Review - provide PM comments	9/6/00
SFPO	Issue proposed SER/CoC to IMNS	9/8/00
IMNS	Prepare Rulemaking Package	
IMNS	RGB Chief Concurrence	
IMNS/SFPO	Obtain SFPO and IMNS Divisions Concurrence	
IMNS	Issue for Office Concurrence	
IMNS/SFPO	Resolve Office Comments, complete IMNS/SFPO concurrence	
NMSS	NMSS concurrence	
EDO	EDO approval	
IMNS	Publication in FRN as proposed	
IMNS/OGC	Determine if direct final fails (significant adverse comments)	1/02/01
	Complete 75-day public comment period	
IMNS/SFPO	Resolve public comments	
SFPO/IMNS	SFPO/IMNS Division Concurrence	
IMNS	Office Concurrence	
NMSS	NMSS Concurrence	
EDO	EDO Approval	
	Publication in FRN	
	Effective Date	7/2/01

ENCLOSURE

EXEMPTION TO 72.212 AND 72.214 PROCESS

ACTION	EXEMPTION TASK	DATE
Maine Yankee	Request Exemption from 72.212 and 72.214	2/1/01
SFPO	Prepare EA	2/22/01
SFPO	Management Concurrences, send FRN for publishing	3/1/01
SFPO	FRN Published	3/8/01
SFPO	Prepare Exemption Letter to Maine Yankee	3/15/01
SFPO	Obtain concurrences for Exemption Letter (SFPO/OGC)	3/22/01
SFPO	Issue letter granting exemption to Maine Yankee	3/29/01
NRC		
NRC		
NRC		
NRC		
NRC		

Mail Envelope Properties (397F1DF7.C1F : 20 : 49649)

Subject: NAC-UMS Maine Yankee Amendment
Creation Date: Wed, Jul 26, 2000 1:20 PM
From: Tim McGinty

Created By: OWFN_DO.OWF1_PO:TJM1

Recipients
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EJL CC (Eric Leeds)
EWB CC (E. William Brach)
MWH CC (M. Wayne Hodges)

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CPJ (Christopher Jackson)

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PGB (Philip Brochman)
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Files	Size	Date & Time
Intschedmemo.WPD	36733	Wednesday, July 26, 2000 1:04 PM
Rulesmemo.WPD	17926	Tuesday, July 25, 2000 4:15 PM
MESSAGE	3057	Wednesday, July 26, 2000 1:20 PM

Options
Expiration Date: None
Priority: High
Reply Requested: No
Return Notification: None

Concealed Subject: No
Security: Standard

From: Tim McGinty - nmss
To: Christopher Jackson - N&L
Date: Wed, Jul 26, 2000 12:31 PM
Subject: Exemption schedule

see attached, last table

c/17

July 26, 2000

NOTE TO: E. William Brach, Director
Spent Fuel Project Office

THRU: Susan F. Shankman, Deputy Director
Spent Fuel Project Office

FROM: Timothy J. McGinty, Project Manager
Spent Fuel Project Office

DETAILED INTERNAL SCHEDULE FOR NAC-UMS MAINE YANKEE AMENDMENT REVIEW AND RULEMAKING OPTIONS

In response to your July 26, 2000, request, we have developed a detailed schedule regarding the staff approval and rulemaking options and alternatives for the subject review. The enclosed schedule is based upon and supplements my July 25, 2000, note to you regarding action items for the NAC-UMS Maine Yankee amendment review schedule. The enclosed schedule assumes that NAC meets its commitment to provide a full and complete response to RAI-2 by July 31, 2000, and that no other significant technical issues arise as a result of the completion of the staff's review.

Please contact me if you have any additional questions.

Enclosure: Detailed Schedules

cc: S. Shankman
R. Parkhill
C. Jackson
P. Eng
A. Howe, IMNS
P. Holohan, IMNS
F. Jacobs
S. Turel, IMNS

July 26, 2000

NOTE TO: E. William Brach, Director
Spent Fuel Project Office

THRU: Susan F. Shankman, Deputy Director
Spent Fuel Project Office

FROM: Timothy J. McGinty, Project Manager
Spent Fuel Project Office

DETAILED INTERNAL SCHEDULE FOR NAC-UMS MAINE YANKEE AMENDMENT REVIEW AND RULEMAKING OPTIONS

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Please contact me if you have any additional questions.

Enclosure: Detailed Schedules

cc: S. Shankman
R. Parkhill
C. Jackson
P. Eng
A. Howe, IMNS
P. Holohan, IMNS
F. Jacobs
S. Turel, IMNS

Distribution:
SFPO R/F

C:\WINDOWS\TEMP\gwprint\Intschedmemo_1.WPD

OFC	SFPO	C	SFPO		SFPO	C	SFPO	C	SFPO	C
NAME	TJMcGinty		VTharpe		PBrochman		EEaston		EJLeeds	
DATE	7/25/00		7/ /00		7/ /00		7/ /00		7/ /00	

OFC	SFPO	C	SFPO	C	IMNS	C	SFPO		SFPO	
NAME	SFShankman		MWHodges		PHolohan					
DATE	7/ /00		7/ /00		7/ /00					

C = Cover E = Cover & Enclosure N = No copy OFFICIAL RECORD COPY

DIRECT FINAL NAC-UMS MAINE YANKEE AMENDMENT SCHEDULE

ACTION	DIRECT FINAL TASK	DATE
SFPO	Review RAI-2 Response, submit SER to PM	8/18/00
SFPO	Provide revised rulemaking	
SFPO	PM Prepare proposed SER/CoC	8/31/00
SFPO	Management Review - provide PM comments	9/6/01
SFPO	Issue proposed SER/CoC to IMNS	9/8/01
IMNS		Issue RAI - 2
NRC		
NAC		
NAC		Response to RAI - 2
NAC		
NRC		Issue SER & CoC
NRC		
NRC	(If Proposed) Resolve Public Comments	
NRC		
NRC		
NRC		

ENCLOSURE

IF DIRECT FINAL FAILS, NORMAL PROPOSED PROCESS

ACTION	DIRECT FINAL TASK	DATE
NAC	Response to RAI - 2	
NAC		
NRC	Issue Draft SER & CoC	
NRC		
NRC		Issue RAI - 2
NRC		
NAC		
NAC		Response to RAI - 2
NAC		
NRC		Issue SER & CoC
NRC		
NRC	(If Proposed) Resolve Public Comments	
NRC		
NRC		
NRC		

EXEMPTION TO 72.212 AND 72.214 PROCESS

ACTION	EXEMPTION TASK	DATE
Maine Yankee	Request Exemption from 72.212 and 72.214	2/1/01
SFPO	Prepare EA	2/22/01
SFPO	Management Concurrences, send FRN for publishing	3/1/01
SFPO	FRN Published	3/8/01
SFPO	Prepare Exemption Letter to Maine Yankee	3/15/01
SFPO	Obtain concurrences for Exemption Letter (SFPO/OGC)	3/22/01
SFPO	Issue letter granting exemption to Maine Yankee	3/29/01
NRC		
NRC		
NRC		
NRC		
NRC		

Mail Envelope Properties (397F127A.C1F : 20 : 49649)

Subject: Exemption schedule
Creation Date: Wed, Jul 26, 2000 12:31 PM
From: Tim McGinty

Created By: OWFN_DO.OWF1_PO:TJM1

Recipients
Post Office OWFN_DO.owf2_po
CPJ (Christopher Jackson)

Domain.Post Office	Route
OWFN_DO.owf2_po	OWFN_DO.owf2_po

Files	Size	Date & Time
Intschedmemo.WPD	31194	Wednesday, July 26, 2000 12:30 PM
MESSAGE	573	Wednesday, July 26, 2000 12:31 PM

Options

Expiration Date:	None
Priority:	Standard
Reply Requested:	No
Return Notification:	None
Concealed Subject:	No
Security:	Standard

NMSS NMSS NRR NMSS

From: Hester Thompson
To: Allen Howe, Christopher Jackson, Earl Easton, E...
Date: Wed, Jul 26, 2000 3:29 PM
Subject: 07/25/00 Note to EWBrach RE

Action Items fr NAC-UMS Maine Yankee Amendment Review Schedule

Accession No. ML003735447

Originator - pls check profile before document is Declared Official Record

thanks

C/18

Mail Envelope Properties (397F3C1F.4D6 : 24 : 19811)

Subject: 07/25/00 Note to EWBrach RE
Creation Date: Wed, Jul 26, 2000 3:29 PM
From: Hester Thompson

Created By: TWFN_DO.TWF4_PO:HET1

Recipients
Post Office OWFN_DO.owf1_po
AGH1 (Allen Howe)
EJL (Eric Leeds)
EXE (Earl Easton)
FXJ2 (Frank Jacobs)
MWH (M. Wayne Hodges)
PLE (Patricia Eng)
RWP (Ron Parkhill)
SFS (Susan Shankman)
TJM1 (Tim McGinty)
VLT (Virginia Tharpe)

Post Office OWFN_DO.owf2_po
CPJ (Christopher Jackson)

Post Office TWFN_DO.twf4_po
PGB (Philip Brochman)
PKH (Patricia Holahan)

Post Office TWFN_DO.twf5_po
SPT (Stanley Turel)

Domain.Post Office	Route
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TWFN_DO.twf4_po	TWFN_DO.twf4_po
TWFN_DO.twf5_po	TWFN_DO.twf5_po

Files	Size	Date & Time
ML003724.ADC	107	Wednesday, July 26, 2000 2:52 PM
MESSAGE	925	Wednesday, July 26, 2000 3:29 PM

Options
Expiration Date: None
Priority: Standard
Reply Requested: No

Return Notification: None

Concealed Subject: No
Security: Standard

-NMSS -NMSS -NRR -OGC

From: Stephen Lewis
To: Allen Howe, Christopher Jackson, Dorothy Gauch, ...
Date: Wed, Jul 26, 2000 4:22 PM
Subject: Re: Bill Kane Briefing - Friday, 7/28 @ 9:00 a.m.

Tim:

OGC will attend the briefing. I will attend, and I am checking with OGC management. One other person from OGC may attend.

Steve Lewis

>>> Tim McGinty 07/26 2:50 PM >>>
Allen and Trish (IMNS):
Wayne, Bill, Eric and Phil (SFPO):

We are on Bill Kane's calendar for Friday morning at 9:00 a.m. in his office.

Bill Kane and Bill Brach have directed us (SFPO) to look into various options for approving the NAC-UMS Maine Yankee amendment request in order to support their April 16, 2001 initial loading schedule.

I have been directed to prepare detailed schedules that show milestones for the completion of the technical review, and also milestones associated with 1) a successful direct final rulemaking, 2) a failed direct final rulemaking which leads to a normal proposed rulemaking, and 3) acting on a potential future exemption request to 72.212 and 72.214 to allow Maine Yankee use of the amendment before rulemaking is completed.

Dorothy or Steve (OGC): You are cordially invited to attend the briefing of Bill Kane. Please respond to me re: whether you will be attending. Primary reason is to discuss the viability of approving an exemption for a rather detailed amendment (authorized contents changes, high-burnup fuel, damaged fuel) before the rulemaking is complete (the staff's preliminary SER/CoC will be sent for rulemaking in September, but Maine Yankee wants to use it in April, 2001. Hence, all the discussion about direct final rulemaking and exemptions).

Tim McGinty

CC: E. William Brach, Eric Leeds, Joseph Gray, M. W...

C/19

Mail Envelope Properties (397F4894.709 : 17 : 28822)

Subject: Re: Bill Kane Briefing - Friday, 7/28 @ 9:00 a.m.
Creation Date: Wed, Jul 26, 2000 4:22 PM
From: Stephen Lewis

Created By: OWFN_DO.OWF5_PO:SHL

Recipients
Post Office OWFN_DO.owf1_po
AGH1 (Allen Howe)
EJL CC (Eric Leeds)
EWB CC (E. William Brach)
MWH CC (M. Wayne Hodges)
TJM1 (Tim McGinty)

Post Office OWFN_DO.owf2_po
CPJ (Christopher Jackson)

Post Office OWFN_DO.owf5_po
DMG5 (Dorothy Gauch)
JRG CC (Joseph Gray)

Post Office TWFN_DO.twf4_po
PGB (Philip Brochman)
PKH (Patricia Holahan)
SPB (Stephanie Bush)

Domain.Post Office	Route
OWFN_DO.owf1_po	OWFN_DO.owf1_po
OWFN_DO.owf2_po	OWFN_DO.owf2_po
OWFN_DO.owf5_po	OWFN_DO.owf5_po
TWFN_DO.twf4_po	TWFN_DO.twf4_po

Files	Size	Date & Time
MESSAGE	2886	Wednesday, July 26, 2000 4:22 PM

Options

Expiration Date:	None
Priority:	Standard
Reply Requested:	No
Return Notification:	None
Concealed Subject:	No
Security:	Standard

7/25/00

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For: William Brach

Msg# 440

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PLEASE DELIVER TO: E. William Brach

PHONE: (949) 640-4000

FAX: (949) 640-5055

MESSAGE:

Bill:

Per your and Chet's request, a note on what draft or preliminary schedules may look like.

Tim

PLEASE DELIVER TO Newport Beach Marriott guest E. W. Brach of the USNRC

FROM: Timothy J. McGinty
Spent Fuel Project Office
US Nuclear Regulatory Commission
M/S O-13D13
Washington, DC 20555-0001

PHONE: 301-415-8580
FAX: 301-415-8555
AUTOS: TJM1
INTERNET: tjm1@nrc.gov

TOTAL _____ PAGE(S) INCLUDING COVER SHEET

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

DRAFT

July 25, 2000

NOTE TO: E. William Brach, Director
Spent Fuel Project Office

FROM: Timothy J. McGinty, Project Manager
Spent Fuel Project Office

ACTION ITEMS FOR NAC-UMS MAINE YANKEE AMENDMENT REVIEW SCHEDULE

In response to your July 24, 2000, note, I have developed the following information regarding the staff approval options and alternatives for the subject review. The following assumes that NAC meets its commitment to provide a full and complete response to RAI-2 by July 31, 2000, and that no other significant technical issues arise as a result of the completion of the staff's review.

#5: Whether the staff can accelerate the date of issuance of the draft SER and CoC.

By letter dated July 20, 2000, the staff issued a schedule to NAC which established issuing the preliminary SER and CoC to IMNS for rulemaking activities by October 3, 2000. This schedule accommodated 2 weeks of previously scheduled annual leave for the primary technical reviewer. The SFPO standard template for conducting the final review of a moderately complex Part 72 amendment lists 4 weeks to complete the review and 5 additional weeks to issue the preliminary SER and CoC. I have consulted with Earl Easton and Wayne Hodges and propose the following alternative to the issued schedule:

- no change to leave schedule
- impact on other case work review schedule

- Complete review and provide SER input to PM by August 18, 2000 (the key technical reviewer has the following week off).

- PM prepare CoC/SER by August 31, 2000.

- Issue proposed CoC/SER to IMNS by September 8, 2000.

#1: Schedule for approval of the design using a direct final rulemaking (DFR).

Phil Brochman coordinated with IMNS to establish a DFR schedule. A successful DFR will be effective 5 months after the proposed CoC/SER is issued. Assuming the September 8 date, the amendment would become effective on February 8, 2001.

- need intermediate dates
- eg Imns date to circulate
- Imns date to NMSS
- Date to EDO
- Date FRN issued (11/31)

Note: Since the NAC-UMS is not yet listed in 10 CFR 72.214 as an approved design, the staff cannot proceed beyond 1.5 months into the direct final rulemaking process (i.e., until the final rule is published). The publishing of the final rule for the NAC-UMS is scheduled by October 31, 2000. If this date is not accelerated, it means that a successful DFR for the Maine Yankee amendment could not be effective until February 19, 2001.

DRAFT

DRAFT

#2: Schedule for amendment approval using a concurrent proposed rulemaking (taking credit for the DFR comment period and assuming that significant adverse comments were received).

- Imns date for interoffice review
- date to Kane
- date to EDO
- date published

A decision on whether significant adverse comments were received can be made 3.5 months after delivery of the preliminary SER/CoC to IMNS or by January 2, 2001 (i.e., 2 week after the close of the 30-day comment period). The subsequent normal proposed final rule would be effective 6 months later or July 2001.

#3: Schedule for evaluating and approving an exemption to Part 72 to allow use of the Maine Yankee amendment before completion of a proposed rulemaking:

- date of receipt
- date of paper to Kane EDO Comm
- Comm response
- staff action

Chris Jackson evaluated this aspect. The recent ANO BPRA exemption is the most applicable example. We would need to issue to Maine Yankee an exemption to 10 CFR 72.212(a)(2), which limits general licensees to approved cask designs, and 10 CFR 72.214, which lists the approved cask designs. Based on past cases, the turnaround appears to be about 2 months and includes the publication of an EA in the FR. The past cases have been limited to small amendments like permitting fuel inserts or minor changes to CoC conditions. There have been no cases of an exemption being granted for something as large as the Maine Yankee amendment. However, there is no reason to believe that the same process that was used before cannot be used for Maine Yankee. It appears that the bases for the need for exemptions have all been to maintain the ability to fully offload the core. This is not the case for Maine Yankee, however, we expect that they would be able to identify the need for the exemption in the request.

We believe that if the DFR approach fails due to significant adverse comments and we are left with resolution of comments and issuance of a final rule approach, an exemption is an option that is available to Maine Yankee. If Maine Yankee requests an exemption, with the bases for the need and effective only if DFR fails, in close proximity to when the NRC issues the draft SER/CoC (but no later than February 1, 2001), the staff could reasonably approve the exemption by April 1, 2001.

#4: Information on whether an amendment can be processed with a proposed rule comment period of less than 75 days.

The standard minium comment period for a proposed rule is 75 days. This period was chosen to meet the U.S. Government's commitments under NAFTA to permit our international trading partners sufficient time to comment on a proposed rule. We do not believe that a shorter public comment period for a proposed rule is a viable option.

#6: Letter to NAC confirming that it is not necessary to respond to RAI 4-2.

The letter is ready for SFPO licensing management concurrence.

DRAFT

DRAFT

11:00

#7: Public meeting with NAC and Maine Yankee on July 28, 2000, to be confirmed with Bill Brach prior to being scheduled/noticed.

Conference room O-13-B-4 has been reserved for all day July 28, 2000. Issuance of a meeting notice awaits your confirmation.

cc: S. Shankman
E. Easton
R. Parkhill
C. Jackson
P. Eng
A. Howe, IMNS
P. Holohan, IMNS
F. Jacobs
S. Turel, IMNS

DRAFT

7/24/00

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For: E. William Brach

Msg# 274

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PLEASE DELIVER TO: E. William BRACH

PHONE: (949) 640-4000

FAX: (949) 640-5055

MESSAGE:

Please deliver to Newport BEACH MARRIOTT
guest E William BRACH of the U.S. NRC.

Thank You,

Tim McGinty 7/24/00

FROM: Timothy J. McGinty
Spent Fuel Project Office
US Nuclear Regulatory Commission
M/S O-13D13
Washington, DC 20555-0001

PHONE: 301-415-8580
FAX: 301-415-8555
AUTOS: TJM1
INTERNET: tjm1@nrc.gov

TOTAL 19 PAGE(S) INCLUDING COVER SHEET

NAC INTERNATIONAL

Atlanta Corporate Headquarters
655 Engineering Drive
Norcross, Georgia 30092
770-447-1144
Fax 770-447-1797
www.nacintl.com

June 16, 2000

U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, MD 20852-2738

Attn: Document Control Desk

Subject: Docket No. 72-1015

U.S. NRC Review of NAC-UMS® Universal Storage System Submittals
(TAC No. L22979)

References:
1. Telecon Discussion of the Technical Review of NAC Responses to Telecon RAIs on the UMS® Universal Storage System Amendment for Maine Yankee Atomic Power Company Site Specific Spent Fuel, June 13 & 15, 2000
2. Telecon Discussion of Incorporation of the Responses to the Rulemaking Public Comments on the Draft CoC and SER for the NAC-UMS® Storage System, June 7, 2000

In response to Reference 1, NAC International (NAC) herewith requests that the U.S. NRC Spent Fuel Projects Office continue the review of the NAC-UMS® Universal Storage System Amendment for Maine Yankee Atomic Power Company site specific spent fuel, including the NAC Responses to Telecon RAIs that have been submitted, except that the Assembly 98 VCC Shield Plug configuration, which includes NS-3 neutron shielding material, on NAC Licensing drawing 790-564, Revision 3, is withdrawn. Please note that NAC and Maine Yankee intend to pursue this alternate shield plug configuration via the 10 CFR 72.48 regulatory process. NAC respectfully requests that the review and rulemaking activities be completed on a priority basis with the goal of supporting Maine Yankee's published fuel loading schedule.

In accordance with Reference 2, NAC is completing preparation of the changed pages for the NAC-UMS® SAR that incorporate the responses to the Rulemaking Public Comments on the draft Certificate of Compliance and Safety Evaluation Report as published in the Federal Register. This submittal will be shipped to the NRC on or before June 23, 2000.

If you have any comments or questions, please contact me at (770) 447-1144.

Sincerely,

T. C. Thompson

Thomas C. Thompson
Director, Licensing and Competitive Assessment
Engineering & Design Services

cc:	P. Bemis	(SWEC)	G. Zinke	(MY)
	E. Washer	(SWEC)	P. Plante	(MY)
	M. Meisner	(MY)		

ED20000820

6/14/00 Mike Nicholas, Wayne Hodges, Bill Brach:

1600: Bill: Have discussed internal, your concern focusing on the one issue if only issue, how was it looked @ in other reviews & probabilities.
Again, the ID of that, as told to you earlier, the thermal loading & cladding T limits, data was concerning us to look close as limits are being approached and margins reduced.
- The example discussed is an initial concern, may result (or not) in an RAI, and there may be other Q's which get asked.
I know there may be other info in the submittal, and NRC says there is, and the NWS preliminary loading. Have not heard from NRC, I will note, but time is marching by.

Mike: will talk to NRC right after.
Points: 1) Temp. margin -> still 80°F of margin
2) There is a limit of what reviewers can dig into, needs to be in SER, mere-looking analysis not appropriate

Mike: under vac. drying conditions was 427, now 647, fairly significant.

Mike 3) Postulating new loading gets into safety significant

MWH: clearly stated, if it takes more than one error, not required to analyze. One error, not a problem. that is a way of disposing of the issue.

Mike: A short submittal on loading appropriately

Bill: We need to finish that review. Wait until I was there. Otherwise, we starting over in the middle of a review.

427
047

Bill: 30 rules of engagement, changes to the checkerboard are not week for week. Mixed dates can be multimonth, but here we can fit it in, two months or better.

2-3 weeks NRC
2 weeks get back
two weeks to Issue (8/31)

Mike: Stretches credibility, for us to pre-answer it makes it worse.

Bill: Nothing precludes NRC from making an amendment to an amendment. Honestly, it is not the most efficient staff use of review time to interrupt that.

Mike - If you permit to postulate, single failure approach
- Have you applied a deal

June 29, 2000

Mr. Thomas C. Thompson, Director
Licensing & Competitive Assessment
NAC International, Inc.
655 Engineering Drive
Norcross, GA 30092

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION FOR THE UMS UNIVERSAL STORAGE SYSTEM (TAC NO. L22979)

Dear Mr. Thompson:

By application dated July 16, 1999, as supplemented, NAC International, Inc. (NAC) requested approval of an amendment, under the provisions of 10 CFR Part 72, Subpart K, to the proposed Certificate of Compliance for the UMS Universal Storage System. By letter dated June 16, 2000, NAC requested that the Nuclear Regulatory Commission (NRC) continue its review of the Maine Yankee amendment, including NAC's April 18, 2000, revised application to accommodate longer allowable time limits during loading operations. Enclosed is the staff's request for additional information (RAI) for the continued review of the amendment request.

Your full and complete response to the enclosed RAI is necessary for the staff to complete its review. Upon receipt of your RAI responses, we will perform an acceptance review to determine if sufficient information has been provided to allow completion of the review and inform you the NRC's revised schedule to complete the anticipated rulemaking.

If you have any comments or questions concerning this request, you may contact me at (301) 415-8580. Please refer to Docket No. 72-1015 and TAC No. L22979 in future correspondence related to this request.

Sincerely,
/S/
Timothy J. McGinty, Project Manager
Spent Fuel Licensing Section
Spent Fuel Project Office
Office of Nuclear Material Safety
and Safeguards

Docket No. 72-1015

Enclosure: RAI on NAC-UMS Storage System

cc: Mr. David C. Jones
Duke Power

Mr. Scott Bauer
Arizona Public Service Company

Mr. George Zinke
Maine Yankee Atomic Power Company

Mr. Paul Bemis
Stone and Webster Eng. & Construction

Distribution:

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ML003728570

*See previous concurrence

OFC	SFPO	E	SFPO	E	SFPO	E	SFPO	E	SFPO	E
NAME	TJMcGinty		WHarris		RParkhill		EEaston		EJLeeds	
DATE	6/29/00		06/29/00		6/28/00		6/29/00		6/29/00	

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

June 29, 2000

Mr. Thomas C. Thompson, Director
Licensing & Competitive Assessment
NAC International, Inc.
655 Engineering Drive
Norcross, GA 30092

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Sincerely,

Timothy J. McGinty, Project Manager
Spent Fuel Licensing Section
Spent Fuel Project Office
Office of Nuclear Material Safety
and Safeguards

Docket No. 72-1015

Enclosure: RAI on NAC-UMS Storage System

cc: Mr. David C. Jones
Duke Power

Mr. Scott Bauer
Arizona Public Service Company

Mr. George Zinke
Maine Yankee Atomic Power Company

Mr. Paul Bemis
Stone and Webster Eng. & Construction

NAC UMS UNIVERSAL STORAGE SYSTEM
DOCKET NO. 72-1015
TAC NO. L22979

REQUEST FOR ADDITIONAL INFORMATION

This document titled Request for Additional Information (RAI), contains a compilation of additional information requirements identified to-date by the U.S. Nuclear Regulatory Commission (NRC) staff, during its review of NAC International's revised application for approval of an amendment to the proposed Certificate of Compliance (CoC) for the NAC UMS Universal Storage System (NAC-UMS) under 10 CFR Part 72. This RAI follows the same format as NAC's Safety Analysis Report (SAR).

Each individual RAI describes information needed by the staff for it to complete its review of the application and the SAR and to determine whether NAC has demonstrated compliance with the regulatory requirements.

ENCLOSURE

CHAPTER 4 THERMAL

4-1 Establish the design basis in the SAR, for reduced heat loads under transfer conditions (water, vacuum and helium backfill), for spent fuel cladding and components important to safety.

For each reduced heat load category, provide a discussion and graphical representation of the peak cladding and component temperatures as a function of time. Provide tables that summarize the transfer condition, reduced heat load, time duration, and maximum calculated temperatures with respect to the associated component temperature limit. The regulations require that sufficient information be provided in the SAR to support a finding that the design bases are related to the design criteria [10 CFR 72.24(c)(2)] and are satisfied with an adequate margin of safety [10 CFR 72.24(c)(3)].

4-2 Provide a detailed explanation of the administrative and operational controls that assure that the canister loading is within the analyzed constraints of the SAR. The controls discussed should be sufficient to preclude the possibility of a single human error leading to a mis-loading. Alternatively, demonstrate by analysis that fuel cladding and component temperature limits will not be exceeded in the event of mis-loading one 0.958 kW fuel assembly in the worst location.

The staff seeks assurance that the design and operation of the NAC-UMS preserves an adequate margin of safety for the proposed reduced heat load vacuum drying operations. Extensive canister loading options exist for preferential loading, reduced heat loads, and Maine Yankee site-specific fuel. With the reduced heat load option, the population of assemblies which could result in a postulated mis-loading has also increased. Due to the complexity of the various loading options, administrative and operational controls are increasingly relied upon to ensure that a loading pattern outside of the analyzed design basis envelope does not occur. Compared to the design basis heat load, higher component temperatures are reached under vacuum drying conditions, thus the staff is not assured that the temperature limits will not be exceeded if a mis-loading occurs. Section 72.24(d)(2) requires that sufficient information be provided in the SAR to evaluate the adequacy of structures, systems, and components (SSCs) important to safety to mitigate the consequences of accidents, including manmade events.

4-3 Revise Figures 4.4.3-5 and 4.4.3-6 to account for the higher temperatures associated with reduced heat loads.

Since these figures represent the "maximum" temperatures of various components during transfer operations, the higher temperatures associated with the lower heat loads should be represented or noted (See related RAI 4-1). For the PWR curves, the vacuum drying cladding temperature can be significantly higher by 80°F even though the final temperature is about the same for the 20 kW loading with helium. For the BWR curves, the vacuum drying cladding temperature can be significantly higher by 143°F and the final temperature would be 31°F higher for the 20 kW loading with helium. Section 10 CFR 72.11(a) requires the SAR to be complete and accurate in all material respects.

4-4 Explain the apparent inconsistency between Section 4.4.3.1 which states that steady-state evaluations are performed for heat loads of 20, 17, 14, 11 and 8 kW and Tables 4.4.3-5 and 4.4.3-6. These tables state, via Note 2, that steady-state conditions are for only heat loads with no time duration.

Specifically, Tables 4.4.3-5 and 4.4.3-6 only identify steady-state conditions for the vacuum heat load of 8kW and for the helium heat load of 17, 14, 11 and 8 kW. Section 72.11(a) requires the SAR to be complete and accurate in all material respects.

4-5 State in the SAR that the maximum temperature values listed in Tables 4.4.3-5 and 4.4.3-6 are indeed the maximum calculated values or identify the higher peak temperatures calculated from the design basis analyses.

As written, Note 2 at the bottom of these tables implies that, for conditions prior to reaching steady-state, the temperature may be higher than the listed values. If the temperatures listed for the "Not Limited" time duration are indeed the maximum, then Note 2 can be eliminated since it would be redundant. Section 72.11(a) requires the SAR to be complete and accurate in all material respects.

4-6 Explain how preferential loading arrangements are bounded by the values shown in Tables 4.4.3-5 and 4.4.3-6 and include an explanation in Section 4.4.3.1, "Maximum Temperatures at Reduced Heat Loads."

As stated in Section 4.4.3.1, the configuration and model used to analyze the reduced heat load is referenced to be in accordance with Section 4.4.1.3, "Two Dimensional Axisymmetric Transfer Cask Models," which states that the heat load is applied as a volumetric heat generation in the active fuel region. No explanation is provided in the SAR which explains how preferential loading for a given basket heat load with hotter fuel in the center was considered in the calculation of reduced heat load temperatures. From the current description, it is implied that a uniform heat distribution was used, and it is not apparent to the staff how this would be a bounding configuration for a preferential loading with higher than average heat load at the center of the basket. For completeness, describe other permissible preferential loading arrangements and how they are bounded by the reduced heat load values shown in the subject tables. Section 72.11(a) requires the SAR to be complete and accurate in all material respects.

4-7 Correct the first sentence in the second paragraph of Section 4.4.3.1, "Maximum Temperatures at Reduced Heat Loads," to reflect the data in Table 4.4.3-6 .

The sentence states that the maximum temperatures reached by components are less than those resulting from design basis heat load in the helium backfill condition. Contrary to this statement, Table 4.4.3-6 clearly shows that the BWR 20 kW reduced heat load cladding temperature exceeds the design basis heat load temperature. Section 72.11(a) requires the SAR to be complete and accurate in all material respects.

4-8 Submit the calculations which demonstrate that for PWR heat loads below 8 kW (for vacuum conditions) and PWR heat loads below 17kW (for helium filled canister conditions) that there is no time limit on the duration at which they can remain in these conditions.

Section 72.24(c)(3) states the application must provide information on the design in sufficient detail to support staff findings that the Independent Spent Fuel Storage Installation will satisfy the design bases with an adequate margin of safety.

4-9 Provide an explanation in the SAR of how assemblies with a variable radial enrichment, as described in Section 4.5.1.1.6, determine the assembly enrichment for use in Technical Specification Tables 12B2-8 and 12B2-9.

The aforementioned technical specification tables are used to determine the spent fuel cooling time requirements and loading arrangements. Enrichment is used as an input for this determination. For thermal considerations regarding variable radial enrichments, the lower enrichment should be used for the cooling time determination, rather than an average enrichment, to ensure enough cooling time for the larger decay heat values associated with lower enrichments. Section 72.24(c)(3) states the application must provide information on the design in sufficient detail to support staff findings that the ISFSI will satisfy the design bases with an adequate margin of safety.

4-10 Add a statement to Section 4.5.1.1.9, "Standard Fuel Assemblies With Damaged Lattices," to the effect that the damaged fuel assemblies have been analyzed to retain their configuration for all design basis events.

The thermal analysis assumes that the fuel assemblies remain in their as built configuration, except for those that are canned. Since these lattices are damaged and are not canned, it is important to explain their impact in the thermal section where damaged lattices are being discussed. Section 72.11(a) requires the SAR to be complete and accurate in all material respects.

CHAPTER 12 TECHNICAL SPECIFICATIONS

12-1 (a) Provide the design basis information on the type of water cooling suggested in Action Statement A.2.1 in LCO 3.1.1.

(b) State and justify the maximum water temperature necessary to adequately cool the canister for 24 hours such that vacuum drying operations can resume.

(c) State the maximum temperature of the spent fuel cladding and heat transfer disk after 24 hours of in-pool cooling and the proposed water cooling, prior to the resumption of vacuum drying operations, using the worst case preferential loading arrangement.

The staff considers that insufficient information has been provided to describe the alternative to in-pool cooling. Spent fuel pools are maintained in a specific temperature range, whereas the proposed alternative appears not to be limited in either temperature, coolant quantity or configuration. No details have been provided which describe how this water cooling would be accomplished or reasonable assurance that it would be controlled in accordance with the design basis. Section 72.24(c) states the application must provide information on the design in sufficient detail to support staff findings that the ISFSI will satisfy the design bases with an adequate margin of safety.

NAC-UMS Maine Yankee Amendment Review Timeline

7/16/99 NAC-UMS Maine Yankee Amendment submitted. Aggressive one RAI schedule established to support April 16, 2001, desired loading date.

12/21/99 RAI #1 issued, response requested within 45 days (2/4/00) in order to meet the Maine Yankee loading schedule.

2/4/00 RAI #1 responses received.

3/17/00 NAC response to identified final cleanup issues received.

3/27/00 NAC informed NRC of NUTUG (User's Group) NAC-UMS public comment to allow longer cask vacuum drying times via lower heat loads.

3/29/00 NAC/SFPO Management conference call - NRC cannot make such significant changes to the NAC-UMS via the rulemaking process without going back out for public comment. Gave NAC the option to:

(1) retain the existing schedule to support Maine Yankee's (MY) published loading date, or

(2) accept review and schedule implications of a late-stage modification to the MY amendment request. - staff contends 6/30 was discussed, before submittal and before any review

4/7/00 NAC informed NRC of choice to pursue changes to MY amendment.

4/18/00 Received revised amendment request (< 1 year from published loading date)

6/5/00 NAC team completes initial NAC-UMS public comment responses. Thermal reviewer initially identifies MY amendment concerns for a higher probability of a mis-load and an apparent decrease in the existing margins to component temperature limits. - no indication of late review/reviewer, main element of amendment review was thermal

6/7/00 NAC/SFPO Management initial conference call on potential thermal issues with revised request, review and schedule implications.

6/14/00 MY/NAC/SFPO Management conference call: Discussed potential thermal issues, NRC to complete thermal review of modified request and issue RAI in 2 - 3 weeks, schedule impact and requested NAC letter to confirm desired continuation of the review.

- 4-6 wks 2 wks to issue RAI
- 30 days off RAI final rule

6/16/00 NAC letter received requesting continued review on a priority basis of supporting Maine Yankee's published 4/16/2001 loading schedule.

6/29/00 Issued RAI #2 (see attached summary) on MY NAC-UMS amendment request, noting that a revised schedule will be issued pending acceptance review of the RAI responses.

need to lay down calendar - do dual rule path

07/11/00 NAC/NRC conf call, reviewed tech basis of RAI questions, confirmed no response to RAI-2 necessary

07/21/00 NRC letter to NAC with review schedule

- need to lay down description of request
- 75 days or other shorter period for comment

From: William Kane
To: Tim McGinty
Date: Wed, Jul 12, 2000 7:05 AM
Subject: Re: Results of SFPO/NAC Maine Yankee RAI call

Thanks Tim.

>>> Tim McGinty 07/11 5:22 PM >>>
Bill(s),

The call with NAC went very well. Representatives of Maine Yankee listened in on the call (not Mike Meisner).

We conveyed that question 4-2 is already satisfactorily addressed by the committment in the existing SAR.

Every question was discussed. I believe NAC recognized the technical validity of each question, in particular 4-6 and 4-1. A lot of time was spent on 4-6 today, including a lot of NAC time on mute discussing the ramifications. They recognize their responsibility to provide a bounding analysis for the various requested configurations, and also recognize that what they have submitted thus far has not thermally bound their requested contents.

NAC will inform me tomorrow of when RAI responses will be received. I will develop and issue the schedule.

Tim McGinty

From: Tim McGinty
To: E. William Brach
Date: Wed, Jul 12, 2000 5:17 PM
Subject: NAC-UMS RAI response and staff SER schedule

Bill: NAC has committed to responding to our RAI's by **July 31, 2000.** Details follow on pertinent aspects of developing a schedule from here, with key dates in bold. The intent of this e-mail is to provide you information that you could discuss with IMNS regarding a rulemaking schedule, as you had asked:

Conference call was held with NAC today. They discussed their intention to limit the scope of the changes necessary by: (1) Eliminating the BWR contents aspect from the reduced heat loads request, and (2) establish the 23 kw case as the case for PWR which provides the bounding temperatures for all components, even for reduced heat loads.

NAC still has their hands full dealing with question 4-6, and the results of that analysis, we suspect, will have an impact on the component temperatures (and hence vacuum drying times and helium backfill times). In general, however, their planned approach appears to be a good effort to simplify the bounding cases.

NAC thus **verbally committed** to providing responses to our 6/29/00 RAI's by **July 31, 2000.**

I then discussed the SFPO schedule with Earl, Eric and Jack.

The SFPO template for conducting a "moderate complexity" Part 72 review alots 30 days to complete the final review and provide SER input to the PM. Ron will be on leave for 2 weeks in August, after the RAI response is received. Thus, Ron has agreed to provide the **SER input to me (PM) by September 11, 2000** (4 weeks review time and 2 weeks of leave). Assuming a PM prep time of 1.5 weeks, and a 1.5 week issuance of Proposed CoC/SER time, I propose **a date of 9/29/00 for forwarding the Proposed SER/CoC to IMNS for rulemaking.** Using the standard "IMNS rulemaking" time frames, assuming SFPO and IMNS division concurrence one week (10/6/00) after the proposed SER is forwarded; the 75 day public comment process would start mid-Feb, 2001, and end at the end of April, 2001; SFPO resolution of public comments would be completed by the end of June, 2001; **EDO approval would be end of August, 2001;** Publication in the Federal Register would be end of September, 2001.

CC: Earl Easton, Eric Leeds, Jack Guttmann, Ron Par...

NAC INTERNATIONAL

Atlanta Corporate Headquarters
655 Engineering Drive
Norcross, Georgia 30092
770-447-1144
Fax 770-447-1797
www.nacintl.com

July 13, 2000

U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, MD 20852-2738

Attn: Document Control Desk

Subject: Docket No. 72-1015

U.S. NRC Review of NAC-UMS® Universal Storage System Submittals
(TAC No. L22979)

References:
1. Request for Additional information for the UMS Universal Storage System (TAC No. L22979)
2. Telecon Discussion of the Technical Review of NAC Responses to Telecon RAIs on the UMS® Universal Storage System Amendment for Maine Yankee Atomic Power Company Site Specific Spent Fuel, July 11 & 12, 2000

In response to References 1 and 2, NAC International (NAC) herewith plans to submit responses to the RAI on or before July 31, 2000. NAC respectfully requests that the review and rulemaking activities be completed on a priority basis with the goal of supporting Maine Yankee's published fuel loading schedule.

If you have any comments or questions, please contact Mr. Tom Thompson or me at (770) 447-1144.

Sincerely,

Willington J. Lee
Vice President and Chief Engineer
Engineering & Design Services

cc:	P. Bemis	(SWEC)	G. Zinke	(MY)
	E. Washer	(SWEC)	P. Plante	(MY)
	M. Meisner	(MY)		

ED20000987

Maine Yankee Loading Scheme

Summary:

- Maine Yankee needs to load 60 casks to empty the spent fuel pool.
- 33 of those 60 casks are dependent on the amendment for authorized contents.
- 27 casks are available to be loaded when the NAC-UMS is approved in Fall of 2000, which supports the April 2001 loading date.
- Reduced heat loads were part of a revised amendment request in April, 2000, to extend the allowable loading time frames. MY will still have to load some casks with high heat loads and within the existing time frames, even if the amendment is approved.

Supporting Data:

Maine Yankee has 1,434 spent fuel assemblies in the pool.

At 24 assemblies per cask, MY needs 60 casks

Maine Yankee's amendment sought specific approval for 661 assemblies, or 46% percent of their spent fuel pool. The request covers consolidated fuels, fuel with CEA's and thimble plugs, fuel rods removed, variable enrichments, damaged fuel, high burnup, etc.

The remaining 54% of the MY pool (CE 14 x 14's) will be authorized under the basic NAC-UMS, which will be approved in October of 2000.

Maine Yankee has 168 assemblies with CEA's, which require a longer canister, which equals 7 casks. These 7 casks are amendment dependent.

Maine Yankee needs a known 104 corner positions, with 4 corner positions per cask, or 26 casks, for special fuel types (including damaged fuel). These 26 casks will accommodate the remainder of the MY contents (periphery positions and assemblies eligible for any position) with 131 slots left for standard 14 x 14 fuel assemblies.

Therefore, since MY needs to load 60 casks, and (26 + 7) 33 casks are known to need approval of the Maine Yankee amendment for loading, 27 casks could be loaded when the NAC-UMS is approved in Fall of 2000. This supports the Maine Yankee loading schedule of April, 2001.

The Maine Yankee amendment is scheduled to be approved and through rulemaking by August of 2001, when the remaining 33 casks would be authorized.

The Maine Yankee amendment also seeks additional time to vacuum dry and helium backfill, which will not be approved until the amendment is approved. This was identified and requested in April of 2000. The current loading times that are about to approved for the NAC-UMS are consistent with the existing approved NAC-MPC. The cask user's will be loading some casks with heat loads approaching the design bases, and will have to do so in accordance with the existing time frames.

NAC INTERNATIONAL

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FYI: Beach
Shoultman
Leeds
Hodges
Easton
Nesbit
Jackson
O'Connor
Eng

July 20, 2000

U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, MD 20852-2738

Attn: Document Control Desk

Subject: Dockets No. 72-1015, 72-1025, 71-9225

Supplemental Information to Support Development of the NRC Schedule for Completion of the Review of the UMS-MY Amendment to the NAC-UMS® Certificate of Compliance

References: 1. Telecon Discussion of the Schedule for Completion of the Review of the UMS® Universal Storage System Amendment for Maine Yankee Atomic Power Company Site Specific Spent Fuel, July 17, 2000

In response to Reference 1, NAC International (NAC) herewith provides details of the fabrication of NAC transport and storage cask system components – fabricator, contact information, scope of supply and scheduled delivery dates. Specific information is also provided on the Maine Yankee fuel loading schedule, as discussed.

The initial fuel loading at Maine Yankee is scheduled to begin on April 20, 2001. The fuel loading campaign is scheduled to continue at the rate of one system every 8 days on a 24 hours/day, 7 days/week basis until August 20, 2002. The current fuel loading plan for Maine Yankee shows that the first Maine Yankee fuel can will be used in the seventh canister to be loaded. For your information, Maine Yankee is scheduled to load the four GTCC waste canisters and place them in storage during the 4Q2000. The storage of GTCC waste is not regulated by 10 CFR 72 certification.

The detailed component fabrication information for the NAC-UMS® System for Maine Yankee, for the NAC-MPC System for Yankee Rowe, and for the NAC-LWT are provided in Attachments 1, 2, and 3, respectively. As shown in Attachment 1, 16 NAC-UMS® Storage Systems – transportable storage canisters and vertical concrete casks – along with the associated transfer cask, lifting yoke and adapter will be onsite at Maine Yankee prior to April 20, 2001. The remaining systems are scheduled to be delivered at the rate of approximately one per week. Note: fabrication of Maine Yankee Fuel Cans will be initiated at a later date, but since the cans are relatively short lead-time components, delivery of the number of cans required to support the Maine Yankee fuel loading schedule will be completed on time.

If you have any comments or questions, please contact me at (770) 447-1144.

Sincerely,

T.C. Thompson

Thomas C. Thompson
Director, Licensing and Competitive Assessment
Engineering & Design Services

Attachments

cc:	M. Meisner	(MY)	P. Bemis	(SWEC)
	G. Zinke	(MY)	E. Washer	(SWEC)
	P. Plante	(MY)	D. Jones	(NUTUG)

ED20001012

U.S. Nuclear Regulatory Commission
July 20, 2000

ATTACHMENT 1

MAINE YANKEE COMPONENT FABRICATION (NAC-UMS® System)

- **Ionics, Incorporated**
  P.O. Box 99
  3039 Washington Pike
  Bridgeville, Pennsylvania 15017
  Telephone: 412-257-2029
  Contact: Roy Milliren
  Scope: 60 spent fuel canisters and 48 concrete cask liners
  Delivery: 1st liner complete 7/00, final liner delivery 7/01
  1st canister 11/00, final canister 7/02

- **Ranor, Inc**
  P.O. Box 458
  Bella Drive
  Westminster, Massachusetts 01473
  Telephone: 978-874-0591
  Contact: Dennis Jolicoeur
  Scope: 16 concrete cask liners
  Delivery: 1st liner 8/00, final liner delivery 10/00

- **HiTech Manufacturing, Inc.**
  1802 Fairfax Road
  Greensboro, North Carolina 27407
  Telephone: 336-852-5679
  Contact: Don Olson
  Scope: Transfer cask, yoke, adapter and four GTCC canisters
  Delivery: Transfer cask 10/00, GTCC canisters 11/00

- **Power Maintenance Resources, Inc.**
  5635 NE Elam Young Parkway, Building 200
  Hillsboro, Oregon 97124
  Telephone: 503-681-4664
  Contact: John Stender
  Scope: On-site construction of concrete casks
  Delivery: 1st cask 9/00, final cask 9/01

- **April 16, 2001 Delivery Forecast:**
  12 spent fuel canisters
  4 GTCC canisters
  40 concrete cask liners
  16 concrete casks constructed on site
  Transfer cask, lifting yoke and adapter

U.S. Nuclear Regulatory Commission
July 20, 2000

ATTACHMENT 2

YANKEE ROWE COMPONENT FABRICATION (NAC-MPC System)

- **Hitachi Zozen Diesel & Engineering Co., Ltd.**
  Nagasu-Machi, Tamana-Gun
  Kumamoto-Pref, 869-0193
  Japan
  Telephone: 011-81-968-78-2177
  Contact: Takeshi Aboshi
  Scope: 15 spent fuel canisters and 1 GTCC canister
  Delivery: 1st canister 10/00, final GTCC 6/01

- **HiTech Manufacturing, Inc.**
  1802 Fairfax Road
  Greensboro, North Carolina 27407
  Telephone: 336-852-5679
  Contact: Don Olson
  Scope: Transfer cask, yoke, adapter and 16 concrete cask liners
  Delivery: Transfer cask 11/00, 1st liner 9/00, final liner 12/00

- **Power Maintenance Resources, Inc.**
  5635 NE Elam Young Parkway, Building 200
  Hillsboro, Oregon 97124
  Telephone: 503-681-4664
  Contact: John Stender
  Scope: On-site construction of concrete casks
  Delivery: 1st cask 3/01, final cask 5/01

U.S. Nuclear Regulatory Commission
July 20, 2000

ATTACHMENT 3

NAC-LWT CASK FABRICATION

- **Hitachi Zozen Diesel & Engineering Co., Ltd.**
  Nagasu-Machi, Tamana-Gun
  Kumamoto-Pref, 869-0193
  Japan

  Telephone: 011-81-968-78-2177
  Contact: Takeshi Aboshi

Scope:	3 NAC-LWT Spent Fuel Shipping Casks
Delivery:	1st cask 11/00, third cask 01/01
Current Status of Fabrication:	85% complete

-NMSS -NRR -NMSS

From: Debra Damiano
To: Christopher Jackson, Tim McGinty
Date: Fri, Jul 21, 2000 5:41 PM
Subject: Fwd: 07/20/00 Ltr to TC Thompson, NAC re Dual-Purpose casework review schedule

07/20/00 Ltr to TC Thompson @ NAC International Inc. fr TMcGinty & CJackson re Schedule for Review of Dual-Purpose casework - declared official agency record.

ADAMS Accession No. ML003734405

(as a workaround to problem with ADAMS-send to feature this document is being forwarded.
To view ADAMS document open attachment, right click on that attachment and click on "open")

Debra Damiano NMSS/SFPO x2385 dmd1

CC: Allen Howe, David Tang, Donald Carlson, E. Will...

C/22

From: Debra Damiano
To: Debra Damiano
Date: Fri, Jul 21, 2000 5:33 PM
Subject: 07/20/00 Ltr to TC Thompson, NAC re Dual-Purpose casework review schedule

Debra Damiano NMSS/SFPO x2385 dmd1

Mail Envelope Properties (3978C38F.C95 : 0 : 51545)

Subject: Fwd: 07/20/00 Ltr to TC Thompson, NAC re Dual-Purpose casework review schedule
Creation Date: Fri, Jul 21, 2000 5:41 PM
From: Debra Damiano

Created By: OWFN_DO.OWF1_PO:DMD1

Recipients
Post Office OWFN_DO.owf1_po
AGH1 CC (Allen Howe)
DEC1 CC (Donald Carlson)
DTT CC (David Tang)
EJL CC (Eric Leeds)
ENK CC (Elaine Keegan)
EWB CC (E. William Brach)
EXE CC (Earl Easton)
GPH CC (Geoffrey Hornseth)
JXG CC (Jack Guttman)
KAG1 CC (Kimberly Gruss)
MWH CC (M. Wayne Hodges)
PPN CC (Paul Narbut)
RWP CC (Ron Parkhill)
SCO CC (Steve O'Connor)
SFS CC (Susan Shankman)
TJM1 (Tim McGinty)
VLT CC (Virginia Tharpe)

Post Office OWFN_DO.owf2_po
CPJ (Christopher Jackson)

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Mail		
MESSAGE	1266	Friday, July 21, 2000 5:41 PM

Options

Expiration Date:	None
Priority:	Standard
Reply Requested:	No
Return Notification:	None

Concealed Subject: No
Security: Standard

Date: 20Jul00

PROJECT SCHEDULING CONTROL SHEET

PROJECT NAME:		NAC-UMS Storage, MY Review and Rulemaking, Rev.1	
APPLICANT:		NAC	
DATE OF APPLICATION:		7/16/99, RAI-2 issued 6/29/00	
DOCKET NO.	72-1015	TAC NO.	L22979
ACTION TYPE:	☐ NEW ☒ AMENDMENT ☐ RENEWAL ☐ EXEMPTION ☒ RULEMAKING ☐ SCHEDULE REVISION		
DESCRIPTION:		Respond to public comments. Comment period should end ~ May 1, 2001	
APPLICANTS NEED DATE:		April, 2001 - not attainable unless direct final	
PRIORITY:		☐ 1. MAINTAIN OPERATIONAL SAFETY ☐ 2. MAINTAIN OPERATIONAL CAPABILITY ☒ 3. SUPPORT NEEDS OF DECOMMISSIONING ☐ 4. OTHER IF BUDGETED ☐ 5. NOT BUDGETED - NO ACTION AT THIS TIME	
PROJECT MANAGER:		McGinty	
BACKUP PROJECT MANAGER:		O'Connor	
LICENSING ASSISTANT:		Tharpe	
TECHNICAL DISCIPLINES NEEDED		TECHNICAL REVIEWER	
☐ Project Manager Only			
☒ Structural		Tang	
☒ Criticality		Carlson	
☒ Shielding		Keegan	
☒ Thermal		Parkhill	
☒ Confinement		Parkhill (was Colpo)	
☒ Materials		Gruss (High Burnup)/Hornseth	
☐ Quality Assurance		n/a	
CONTRACT SUPPORT:	☐ YES ☒ NO	CONTRACTOR NAME:	
TECHNICAL REVIEW SECTION:		☒ A Earl Easton ☐ B Eric Leeds	
NOTES:		Based on attached schedule, which finalizes the review and captures rulemaking efforts, the team would need to be able to respond to public comments in May and June of 2001.	
Copies to PM, Backup PM, LA, Scheduling	Data Entry:	Initials:	Date

C/23

Date: 20Jul00

PART 72
PROJECT SCHEDULE

PROJECT NAME:		NAC-UMS Storage Maine Yankee Amendment, Rev. 1	
APPLICANT:		NAC	
DATE OF APPLICATION:		7/16/99	
DOCKET NO.	72-1015	TAC NO.	L22979
ACTION TYPE:		☐ NEW ☒ AMENDMENT ☐ RENEWAL ☐ EXEMPTION ☐ SCHEDULE REVISION #	
		Date	
Receive Application		7/16/99, Supplemented 10/20/99 -C	
Complete Acceptance Review		n/a	
2.790 Determination (if needed)		n/a	
FRN Notice of Docketing		n/a	
Start Initial Review		9/23/99 - C	
Request Technical Assistance, if needed, e.g. Safeguards, Decommissioning, Environmental		n/a	
Complete Initial Review/Tech Review Input		11/30/99 - C	
PM Prepare RAI (if needed)		12/8/99 - C	
Issue RAI (if needed)		12/17/99 - C (12/21/99)	
Receive Response to RAI		1/29/00 - C (2/4/00)	
Start Review		2/7/00	
2.790 Determination (if needed)		TBD	
Request Technical Assistance, if needed, e.g. Safeguards, Decommissioning, Environmental		n/a	
Complete Review/Tech Review Input		3/8/00 - C (with exception of thermal and confinement), NAC modified application on 4/18/00	
PM Prepare 2nd RAI (if needed)		6/21/00 - C	
Issue 2nd RAI (if needed)		6/29/00 - C	
Receive Response to RAI		7/31/00	
Start Final Review		8/7/00 (thermal only)	
2.790 Determination (if needed)		n/a	
Request Technical Assistance, if needed, e.g. Safeguards, Decommissioning, Environmental		n/a	
Complete Final Review/Tech Review Input		9/11/00 (thermal and confinement only)	
Issue User Need Memo		Change to Direct Final and Proposed, via management direction 8/3/00	
PM Prepare CoC/SER/FRN		09/21/00	
Issue Proposed CoC/SER/FRN		10/3/00	
Notes:			
APPROVED: DATE:	8/10/00	MGT INITIALS:	SD

From: Tim McGinty
To: David Tang, Donald Carlson, Elaine Keegan, Geof... } nmss
Date: Thu, Jul 20, 2000 9:48 AM
Subject: McGinty's NAC Weekly Team Meetings Suspended

You may have noticed that I have not scheduled you for weekly meetings on your calendars lately. For the time being, our weekly meetings are suspended (from my perspective).

As an update, we are attempting to issue an NAC schedule letter in the near future, and get the tech review section chiefs to concur on it. The schedule looks at 4 reviews: 1) completion of the Maine Yankee review, 2) completion of the UMS Transport review, 3) NAC-MPC Connecticut Yankee review and 4) an NAC-MPC Yankee Rowe review coming in at the end of September.

I am not attaching the draft schedule letter to this e-mail mostly to avoid confusing you (if you are interested, the draft is on the G:\ drive under NAC\7-00schedltr.wpd). It's not out yet, and it could change, and we don't know who is going to be assigned to it. In general, I plan to complete the UMS Transport review, and have forwarded my opinion that I think the team that wrote the first round RAI's should pretty much complete the review. I have no idea who will be completing the 2 NAC-MPC reviews yet.

For the UMS Transport, I have proposed commencing a team acceptance review in August to mid-September, and the 2nd round review from mid-Sep to the end of October, where the second round RAI's would be due. NAC is to respond by Jan 29, team completes the final review and provides me the completed SER mid-March, and it gets issued in April, 2001. The reason for the team acceptance review is suspicion on my part of the applicant. I think it would be worthwhile to ascertain if they were responsive to round 1, and what new things they have "snuck" into the application. I know you may have a lot of conflicts, for instance, I know that Ron is saddled with completing the Maine Yankee review in August and early September (which is why the UMS Transport 2nd round will not commence until mid-Sep), but that is my thinking and I wanted to let you know.

Chris Jackson is the PM for the NAC-MPC reviews. He will set up the appropriate team meeting schedule once a team has been identified. I plan on going to meeting once every 2 weeks or so on the second round NAC-UMS Transport, rather than weekly, unless you have strong objections to that.

Tim

CC: Christopher Jackson, Earl Easton

C/24

From: Tim McGinty
To: Earl Easton, Eric Leeds } nmss
Date: Wed, Jul 19, 2000 9:04 AM
Subject: NAC Schedule Letter

Earl, then Eric:

You have a schedule letter for upcoming NAC reviews in your in-box.

This is a high-priority letter, and will also be indicated on schedules submitted for the Thursday scheduling meeting. Chris and I would like to sign it out as soon as possible. Your earliest attention would be appreciated.

Tim and Chris

CC: Christopher Jackson

C/25

Mail Envelope Properties (3975A75D.C1F : 20 : 49649)

Subject: NAC Schedule Letter
Creation Date: Wed, Jul 19, 2000 9:04 AM
From: Tim McGinty

Created By: OWFN_DO.OWF1_PO:TJM1

Recipients
Post Office OWFN_DO.owf1_po
EJL (Eric Leeds)
EXE (Earl Easton)

Post Office OWFN_DO.owf2_po
CPJ CC (Christopher Jackson)

Domain.Post Office	Route
OWFN_DO.owf1_po	OWFN_DO.owf1_po
OWFN_DO.owf2_po	OWFN_DO.owf2_po

Files	Size	Date & Time
MESSAGE	1008	Wednesday, July 19, 2000 9:04 AM

Options

Expiration Date:	None
Priority:	High
Reply Requested:	No
Return Notification:	None
Concealed Subject:	No
Security:	Standard

From: Tim McGinty
To: Ron Parkhill
Date: Fri, Jul 14, 2000 1:46 PM
Subject: Fwd: NAC/MAINE YANKEE NEEDS - IMPORTANT!

nmss

Ron, FYI attached

B/26

From: Eric Leeds
To: E. William Brach, William Kane
Date: Fri, Jul 14, 2000 1:41 PM
Subject: NAC/MAINE YANKEE NEEDS - IMPORTANT!

nmss

Gentlemen -

Let's not forget, Maine Yankee will not have a problem loading casks next April, whether or not the current amendment gets approved. Almost 50% of Maine Yankee fuel will be loaded into casks that do not need the amendment. When Tim and I discussed the amendment schedule this morning, Tim reminded me of the current status. He prepared the attached, and I clipped the summary for your information. Of course we still want to get the work done as timely as possible, however, I do not believe that we will impact Maine Yankee's true loading schedule, even with a September 2001 amendment completion date. Please see below:

Summary:

- Maine Yankee needs to load 60 casks to empty the spent fuel pool.
- 33 of those 60 casks are dependent on the amendment for authorized contents.
- 27 casks are available to be loaded when the NAC-UMS is approved in Fall of 2000, which supports the April 2001 loading date.
- Reduced heat loads were part of a revised amendment request in April, 2000, to extend the allowable loading time frames. MY will still have to load some casks with high heat loads and within the existing time frames, even if the amendment is approved.

More info is attached.

Eric

CC: Earl Easton, M. Wayne Hodges, Susan Shankman, T...

B/27

From: David Tang
To: E. William Brach, Earl Easton, Eric Leeds, Jack...
Date: Tue, Jul 11, 2000 8:46 AM
Subject: Re: Analysis of NAC-UMS RAI's

YMSS

Tim, On 4-10, Subsection 4.5.1.1.9 makes reference to a "steel cage," which could have been an editorial/omission/oversight.

Please note the following: (1) in Subsection 2.1.3.1.1, "Damaged Fuel Lattices," the SAR is very clear to require: "[T]he CF1 and CA3 lattices are placed in a Maine Yankee fuel can for storage," and (2) in Subsection 11.2.16, "Damaged Fuel Assembly Hardware Evaluation," the SAR is very specific: "...an assembly with one or more missing support grids up to an unsupported length of fuel rod of 60 inches."

In other words, the term "Standard Fuel Assemblies with Damaged Lattices," is not defined in Subsection 2.1.3.1, "Maine Yankee Site Specif Spent Fuel, " and it shows up mysteriously in Subsection 4.5.1.1.9. However, Subsection 3.4 of the draft SER has made a safety finding of the "Maine Yankee Intact Spent Fuel with Damaged Assembly Hardware."

You may want to expand your clarifications to reflect the above.

David

>>> Tim McGinty 07/10 4:32 PM >>>
Interested SFPO parties:

Attached is the MY RAI, as issued. Each RAI has an italicized discussion as to why the information is appropriate to be asked, and how it is consistent with the SRP. Also, each RAI has a discussion pertinent to whether or not we already have the information.

I believe it is accurate, but Ron and David (for 4-10 in particular), I need you to look it over.

This information is intended for our use in briefing Bill Kane tomorrow, I will gladly incorporate comments.

Tim

B/28

From: Tim McGinty
To: Earl Easton, M. Wayne Hodges, Ron Parkhill
Date: Mon, Jul 10, 2000 10:56 AM
Subject: Fwd: Electronic Copy of the NAC-UMS Maine Yankee RAI's

nmss

See attached for your convenience.

B/29

From: Tim McGinty
To: E. William Brach, Earl Easton, Eric Leeds, Jack... NMSS
Date: Mon, Jul 10, 2000 4:32 PM
Subject: Analysis of NAC-UMS RAI's

Interested SFPO parties:

Attached is the MY RAI, as issued. Each RAI has an italicized discussion as to why the information is appropriate to be asked, and how it is consistent with the SRP. Also, each RAI has a discussion pertinent to whether or not we already have the information.

I believe it is accurate, but Ron and David (for 4-10 in particular), I need you to look it over.

This information is intended for our use in briefing Bill Kane tomorrow, I will gladly incorporate comments.

Tim

CC: David Tang

B/30

NAC-UMS Maine Yankee RAI #2 (6/29/00) Summary

CHAPTER 4 THERMAL

4-1 Establish the design basis in the SAR, for reduced heat loads under transfer conditions (water, vacuum and helium backfill), for spent fuel cladding and components important to safety.

For each reduced heat load category, provide a discussion and graphical representation of the peak cladding and component temperatures as a function of time. Provide tables that summarize the transfer condition, reduced heat load, time duration, and maximum calculated temperatures with respect to the associated component temperature limit. The regulations require that sufficient information be provided in the SAR to support a finding that the design bases are related to the design criteria [10 CFR 72.24(c)(2)] and are satisfied with an adequate margin of safety [10 CFR 72.24(c)(3)].

Why appropriate/consistent with SRP: Design basis needs to be established to demonstrate basis for acceptance, for future 72.48 changes, and future NRC reviews of amendments. SRP Section IV, acceptance criteria, states that "cask and fuel materials should be maintained within their acceptance criteria...", and "the thermal performance of the cask should be within the allowable design criteria ***specified in SAR Sections 2 and 3....*** *" Section V.3 of the SRP states " If the fuel cladding temperature calculation is based on heatup over a limited time period for cask drying operations, verify that limiting conditions for the operations have been imposed in the technical specifications...to ensure that the temperature will remain acceptable during the operations." This RAI is predicated on the staff reaching reasonable assurance, as documented in the SAR, with respect to the applicant's statements, noting that the original 4/18/00 submittal had an erroneous conclusion, and the 5/31/00 supplement also had errors on the same topic.*

Do we already have the information: The original 4/18/00 submittal erroneously stated that "at heat loads less than the design basis heat load, the rate of component heat up and the maximum temperature reached by a component are less than those resulting from the design basis heat load." The staff saw a potential inconsistency with that statement, and asked for a summary of the temperature changes for reduced heat loads. In a May 31 SAR supplement and answer to our telephone conference call, NAC acknowledged in Response #7 that "there is an increase in the maximum content temperature at the lower heat loads, and that the increased temperatures are a function of length of time that the canister and contents are allowed to remain in the vacuum/helium conditions, not just the heat load." NAC provide temperature information which compared the design basis maximum heat load to all of the reduced heat load configurations for cladding and heat transfer disks. The ***SAR Itself*** *was only revised to note that reduced heat loads can yield higher temperatures under vacuum conditions, and did not establish a limiting component temperature design basis for reduced heat loads. Subsequent RAI's clarified the SAR inconsistencies identified by the staff in this area.*

4-2 Provide a detailed explanation of the administrative and operational controls that assure that the canister loading is within the analyzed constraints of the SAR. The controls

discussed should be sufficient to preclude the possibility of a single human error leading to a mis-loading. Alternatively, demonstrate by analysis that fuel cladding and component temperature limits will not be exceeded in the event of mis-loading one 0.958 kW fuel assembly in the worst location.

The staff seeks assurance that the design and operation of the NAC-UMS preserves an adequate margin of safety for the proposed reduced heat load vacuum drying operations. Extensive canister loading options exist for preferential loading, reduced heat loads, and Maine Yankee site-specific fuel. With the reduced heat load option, the population of assemblies which could result in a postulated mis-loading has also increased. Due to the complexity of the various loading options, administrative and operational controls are increasingly relied upon to ensure that a loading pattern outside of the analyzed design basis envelope does not occur. Compared to the design basis heat load, higher component temperatures are reached under vacuum drying conditions, thus the staff is not assured that the temperature limits will not be exceeded if a mis-loading occurs. Section 72.24(d)(2) requires that sufficient information be provided in the SAR to evaluate the adequacy of structures, systems, and components (SSCs) important to safety to mitigate the consequences of accidents, including manmade events.

<u>Why appropriate/consistent with SRP</u>: Most complicated loading pattern and scheme that SFPO has reviewed, including preferential loading slots, reduced heat load specifications and specifications tailored for MY fuel. Increased probability of a mis-load, lower margins to component temperature limits and no analysis of the likely consequences of a mis-load in the current application. The VSC-24 CoC has technical specifications requiring double verification of both fuel assembly selection and spent fuel pool ppm boron specs. The Transtor at Trojan included an evaluation of why, considering the available contents at Trojan and the design bases analysis, a mis-loading event is not credible. SRP Chapter 8 "Operating Procedures - Acceptance Criteria", states that "Operating procedures descriptions should identify measures to control processes and mitigate potential hazards that may be present during normal operations. Also, SRP 8.V.1, "Review Procedures - Cask Loading" states "Review the generic procedures ...to verify that tests, inspections, ***verifications,*** *....are specified. "Depending on the types and specifications of fuel assemblies stored in the reactor spent fuel pool, detailed site-specific procedures may be necessary to ensure that all fuel loaded in the cask meets the fuel specifications for the cask design. These procedures can be evaluated only on a site-specific basis, and will generally be evaluated through inspections rather than during the licensing review.* ***The SAR should indicate, however, that such procedures may be necessary."***

<u>Do we already have the information:</u> The application does not contain a mis-loading analysis. As the RAI states, the option of either analyzing the mis-load or demonstrating why the administrative and operational controls are adequate to "preclude" a single-human error from causing a mis-load was presented. The level of commitment to the administrative and operational controls necessary are the same for both the base UMS design and the Maine Yankee amendment. The SAR does specify the development of site-specific procedures, and states that "The procedures shall incorporate spent fuel assembly selection and verification requirements to ensure that the spent fuel assemblies loaded into the UMS are as authorized by the CoC."

4-3 Revise Figures 4.4.3-5 and 4.4.3-6 to account for the higher temperatures associated with reduced heat loads.

Since these figures represent the "maximum" temperatures of various components during transfer operations, the higher temperatures associated with the lower heat loads should be represented or noted (See related RAI 4-1). For the PWR curves, the vacuum drying cladding temperature can be significantly higher by 80°F even though the final temperature is about the same for the 20 kW loading with helium. For the BWR curves, the vacuum drying cladding temperature can be significantly higher by 143°F and the final temperature would be 31°F higher for the 20 kW loading with helium. Section 10 CFR 72.11(a) requires the SAR to be complete and accurate in all material respects.

Why appropriate/consistent with SRP: See reference to RAI 4-1. The applicant provides curves entitled "Maximum component temperatures in Transient Operations." Our initial review indicated that these may not be the maximum, and NAC responded on 5/31 acknowledging that, but did not update the curves by either modification or noting it. Furthermore, there remain an error in the 5/31 conclusion about maximum temperatures in the helium backfill condition for BWR fuel types. This type of question is consistent with a round 1 RAI question which identifies inconsistencies in the SAR.

Do we already have the information: This is an editorial/omission/oversight. Yes, we have enough information to have been able to determine that the SAR is erroneous. For completeness, and because of the history of inaccuracies already identified, it is included as an item that can be clarified as a result of the first round review.

4-4 Explain the apparent inconsistency between Section 4.4.3.1 which states that steady-state evaluations are performed for heat loads of 20, 17, 14, 11 and 8 kW and Tables 4.4.3-5 and 4.4.3-6. These tables state, via Note 2, that steady-state conditions are for only heat loads with no time duration.

Specifically, Tables 4.4.3-5 and 4.4.3-6 only identify steady-state conditions for the vacuum heat load of 8kW and for the helium heat load of 17, 14, 11 and 8 kW. Section 72.11(a) requires the SAR to be complete and accurate in all material respects.

Why appropriate/consistent with SRP: This type of question is consistent with a round 1 RAI question which identifies inconsistencies in the SAR. It is related to the several inconsistencies already identified in this RAI.

Do we already have the information: This is an editorial/omission/oversight. Yes, we have enough information to have been able to determine that the SAR is erroneous. For completeness, and because of the history of inaccuracies already identified, it is included as an item that can be clarified as a result of the first round review.

4-5 State in the SAR that the maximum temperature values listed in Tables 4.4.3-5 and 4.4.3-6 are indeed the maximum calculated values or identify the higher peak temperatures calculated from the design basis analyses.

As written, Note 2 at the bottom of these tables implies that, for conditions prior to reaching steady-state, the temperature may be higher than the listed values. If the temperatures listed for the "Not Limited" time duration are indeed the maximum, then Note 2 can be eliminated since it would be redundant. Section 72.11(a) requires the SAR to be complete and accurate in all material respects.

Why appropriate/consistent with SRP: See related RAI 4-4. This question is attempting to ascertain the context of the Tables note with respect to actual component temperatures reached. The note indeed would not be necessary if the steady-state temperatures reached are the maximum, and since the margin to component temperature limit for the heat transfer disks is now much reduced, we are attempting to determine if component temperature limits are exceeded during the transient. This question is consistent with a round 1 RAI question and seeks to clarify information presented in the SAR. Concluding whether component temperature limits are exceeded under both steady-state or transient conditions is worthwhile.

Do we already have the information: This is an editorial improvement. We do not have enough information to make a conclusion regarding the maximum temperatures presented under the transient conditions. Indeed, the SAR information appears to contradict such a conclusion by having such a note in the first place. For completeness, and because of the history of inaccuracies already identified, it is included as an item that can be clarified as a result of the first round review.

4-6 Explain how preferential loading arrangements are bounded by the values shown in Tables 4.4.3-5 and 4.4.3-6 and include an explanation in Section 4.4.3.1, "Maximum Temperatures at Reduced Heat Loads."

As stated in Section 4.4.3.1, the configuration and model used to analyze the reduced heat load is referenced to be in accordance with Section 4.4.1.3, "Two Dimensional Axisymmetric Transfer Cask Models," which states that the heat load is applied as a volumetric heat generation in the active fuel region. No explanation is provided in the SAR which explains how preferential loading for a given basket heat load with hotter fuel in the center was considered in the calculation of reduced heat load temperatures. From the current description, it is implied that a uniform heat distribution was used, and it is not apparent to the staff how this would be a bounding configuration for a preferential loading with higher than average heat load at the center of the basket. For completeness, describe other permissible preferential loading arrangements and how they are bounded by the reduced heat load values shown in the subject tables. Section 72.11(a) requires the SAR to be complete and accurate in all material respects.

Why appropriate/consistent with SRP: The applicant has implied that the resulting temperature calculations for reduced heat loads, in combination with the preferential loading of hotter fuel assemblies in the "middle ring", assumes a uniform "smearing" of the heat generation throughout the basket. The preferential heat loading is clearly not uniform, and margins to component temperature limits are narrower with the revised application. This is a highly complex loading arrangement, and preferential loading is not currently not directly addressed in the SRP. As such, and with any topic that deviates from the guidance of the SRP, it is subject to close review and is potentially time consuming. Documenting the staff concerns in such occasions, via RAI's, is particularly important since existing SRP review guidance and acceptance criteria do not exist.

Do we already have the information: *No. The applicant does not appear to have considered the effects of preferential loading at reduced heat loads on the component temperature determinations, with respect to the material limits. This may be very simply resolved and already considered, but it is not evident from the analysis presented. For completeness, and because this aspect is not addressed within the SRP, it is included as an important item that is necessary for the staff to make a safety conclusion, and is appropriate as a first round review question on the docket.*

4-7 Correct the first sentence in the second paragraph of Section 4.4.3.1, "Maximum Temperatures at Reduced Heat Loads," to reflect the data in Table 4.4.3-6 .

The sentence states that the maximum temperatures reached by components are less than those resulting from design basis heat load in the helium backfill condition. Contrary to this statement, Table 4.4.3-6 clearly shows that the BWR 20 kW reduced heat load cladding temperature exceeds the design basis heat load temperature. Section 72.11(a) requires the SAR to be complete and accurate in all material respects.

Why appropriate/consistent with SRP: *This type of question is consistent with a round 1 RAI question which identifies inconsistencies in the SAR. It is related to the several inconsistencies already identified in this RAI (see 4-1, 4-3 and 4-4).*

Do we already have the information: *This is a likely editorial/omission/oversight. Yes, we have enough information to have been able to determine that the SAR is erroneous. For completeness, and because of the history of inaccuracies already identified, it is included as an item that can be clarified as a result of the first round review.*

4-8 Submit the calculations which demonstrate that for PWR heat loads below 8 kW (for vacuum conditions) and PWR heat loads below 17kW (for helium filled canister conditions) that there is no time limit on the duration at which they can remain in these conditions.

Section 72.24(c)(3) states the application must provide information on the design in sufficient detail to support staff findings that the Independent Spent Fuel Storage Installation will satisfy the design bases with an adequate margin of safety.

Why appropriate/consistent with SRP: *This question is more important than it may seem on the surface. As stated previously, the margins are narrower and there have been several errors identified regarding the conclusions presented versus the data presented. For higher heat loads, there is a tech spec limit to the amount of time in transient conditions, in other words, if the calculations are off, it can only be "so bad". However, this analysis identifies the conditions under which no time limits are necessary, and thus, there is no limit to the amount of time in the transient condition. Meanwhile, the component temperature analysis, as one might expect, is still fairly aggressive with respect to the material limits, especially the heat transfer disks under vacuum conditions. This question is consistent with a round 1 RAI question which seeks the key calculations related to the safety conclusions, and also in the context of a compressed review with limited NRC review time to perform independent verification.*

Do we already have the information: *No. An unlimited time frame, of course, is desirable from both an operational and regulatory perspective. But again, the margins are already narrow, and*

as described previously, there is no LCO protection to limit the consequences of an error.

4-9 Provide an explanation in the SAR of how assemblies with a variable radial enrichment, as described in Section 4.5.1.1.6, determine the assembly enrichment for use in Technical Specification Tables 12B2-8 and 12B2-9.

The aforementioned technical specification tables are used to determine the spent fuel cooling time requirements and loading arrangements. Enrichment is used as an input for this determination. For thermal considerations regarding variable radial enrichments, the lower enrichment should be used for the cooling time determination, rather than an average enrichment, to ensure enough cooling time for the larger decay heat values associated with lower enrichments. Section 72.24(c)(3) states the application must provide information on the design in sufficient detail to support staff findings that the ISFSI will satisfy the design bases with an adequate margin of safety.

Why appropriate/consistent with SRP: Lower enriched fuels of same burnup yield a higher decay heat. Current loading tables specify use of the maximum planar average enrichment of such assemblies for selecting the appropriate cooling time for variably enriched fuel assemblies. The treatment of variable radial enrichments is not specifically addressed in the SRP for thermal calculations, although there is extensive experience for BWR applications. This is a unique PWR fuel assembly in our experience. In fact, the SRP states that "Decay is generally calculated using the same computer codes as those used to determine the radiation source terms." The treatment of variably radially enriched assemblies, whether BWR or PWR, does not appear to be addressed in the shielding section of the SRP. Applicant has not provided any justification as to why the use of an average enrichment for such assemblies ensures that the decay heat load per assembly limits are met. Using the minimum enrichment of fuel rods in such assemblies would clearly be bounding and clearly acceptable without additional technical review.

Do we already have the information: NAC maintains that we already have the appropriate information. Staff has been unable to confirm that. Our SRP basis may be contained deeper within other regulatory guidance.

4-10 Add a statement to Section 4.5.1.1.9, "Standard Fuel Assemblies With Damaged Lattices," to the effect that the damaged fuel assemblies have been analyzed to retain their configuration for all design basis events.

The thermal analysis assumes that the fuel assemblies remain in their as built configuration, except for those that are canned. Since these lattices are damaged and are not canned, it is important to explain their impact in the thermal section where damaged lattices are being discussed. Section 72.11(a) requires the SAR to be complete and accurate in all material respects.

Why appropriate/consistent with SRP: This type of question is consistent with a round 1 RAI question which identifies the necessary conclusions by the applicant in the technical review area under consideration.

Do we already have the information: This conclusion is likely presented adequately elsewhere in the SAR and SER, and thus the staff can probably make a thermal conclusion on that basis.

I believe these assemblies are a specific subject of the structural evaluation of intact assemblies with one or more damaged grid spacers with an unsupported span not to exceed 60 inches.

CHAPTER 12 TECHNICAL SPECIFICATIONS

12-1 (a) Provide the design basis information on the type of water cooling suggested in Action Statement A.2.1 in LCO 3.1.1.

(b) State and justify the maximum water temperature necessary to adequately cool the canister for 24 hours such that vacuum drying operations can resume.

(c) State the maximum temperature of the spent fuel cladding and heat transfer disk after 24 hours of in-pool cooling and the proposed water cooling, prior to the resumption of vacuum drying operations, using the worst case preferential loading arrangement.

The staff considers that insufficient information has been provided to describe the alternative to in-pool cooling. Spent fuel pools are maintained in a specific temperature range, whereas the proposed alternative appears not to be limited in either temperature, coolant quantity or configuration. No details have been provided which describe how this water cooling would be accomplished or reasonable assurance that it would be controlled in accordance with the design basis. Section 72.24(c) states the application must provide information on the design in sufficient detail to support staff findings that the ISFSI will satisfy the design bases with an adequate margin of safety.

<u>Why appropriate/consistent with SRP</u>: This is another example of an issue that NAC/NUTUG tried to invoke via the rulemaking process (there were several others to) that the staff did not agree to. Because this issue is related to the Part 50/72 overlap, and not clearly addressed in the SRP, we felt that establishing on the docket some of the initial staff concerns is warranted. We understand that NAC does not intend to pursue this for this amendment, but none the less, it is also a potential ISG type of issue for those facilities who intend to decommission the spent fuel pool. Thus, is it consistent with a round 1 RAI question, and important for establishing the staff's position lacking SRP guidance.

<u>Do we already have the information:</u> No. There was no information provided on alternative water cooling specifications.

NAC-UMS Maine Yankee Amendment Review Timeline

7/16/99 NAC-UMS Maine Yankee Amendment submitted. Aggressive one RAI schedule established to support April 16, 2001, desired loading date.

12/21/99 RAI #1 issued, response requested within 45 days (2/4/00) in order to meet the Maine Yankee loading schedule.

2/4/00 RAI #1 responses received.

3/17/00 NAC response to identified final cleanup issues received.

3/27/00 NAC informed NRC of NUTUG (User's Group) NAC-UMS public comment to allow longer cask vacuum drying times via lower heat loads.

3/29/00 NAC/SFPO Management conference call - NRC cannot make such significant changes to the NAC-UMS via the rulemaking process without going back out for public comment. Gave NAC the option to:

(1) retain the existing schedule to support Maine Yankee's (MY) published loading date, or

(2) accept review and schedule implications of a late-stage modification to the MY amendment request.

4/7/00 NAC informed NRC of choice to pursue changes to MY amendment.

4/18/00 Received revised amendment request (< 1 year from published loading date)

6/5/00 NAC team completes initial NAC-UMS public comment responses. Thermal reviewer initially identifies MY amendment concerns for a higher probability of a mis-load and an apparent decrease in the existing margins to component temperature limits.

6/7/00 NAC/SFPO Management initial conference call on potential thermal issues with revised request, review and schedule implications.

6/14/00 MY/NAC/SFPO Management conference call: Discussed potential thermal issues, NRC to complete thermal review of modified request and issue RAI in 2 - 3 weeks, schedule impact and requested NAC letter to confirm desired continuation of the review.

6/16/00 NAC letter received requesting continued review on a priority basis of supporting Maine Yankee's published 4/16/2001 loading schedule.

6/29/00 Issued RAI #2 (see attached summary) on MY NAC-UMS amendment request, noting that a revised schedule will be issued pending acceptance review of the RAI responses.

From: Tim McGinty
To: Ron Parkhill
Date: Mon, Jul 10, 2000 4:00 PM
Subject: Fwd: Re: MY RAI 4-9

nmss

B/31

From: "Tom Thompson" <TThompson@nacintl.com>
To: Tim McGinty <TJM1@nrc.gov> ~hm55
Date: Mon, Jul 10, 2000 3:52 PM
Subject: Re: MY RAI 4-9

Tim,

The Response referred to is Response No. 13 that was transmitted to the NRC by NAC letter ED20000505 on April 18, 2000. (This is the same letter that transmitted the SAR Revision UMSS-00C changed pages.) Specifically, the fourth and fifth paragraphs of the NAC Response address the topic of the current RAI 4-9.

Additional information based on NAC's understanding that the 6/29/00 RAI applies to MY site specific spent fuel:

Maine Yankee variably enriched fuel assemblies are limited to two batches of fuel. These two batches were exposed to a maximum burnup less than 30,000 MWd/MTU, with neither of the batches being burned more than two cycles. Based on the data provided in the SAR, fuel at burnups less than or equal to 30,000 MWd/MTU may be loaded at 5 years cool time at any enrichment greater or equal to 1.9 w/o 235U. The variably enriched rods in the Maine Yankee fuel assembly are enriched over 3.4 w/o 235U (with axial blankets on one of the variably enriched batches of 2.6w/o). Therefore, the minimum allowable cool time for the variably enriched Maine Yankee fuel assemblies is not dependent upon the enrichment considered, average or minimum.

I hope this is helpful.

Tom

Tim McGinty <TJM1@nrc.gov>
07/10/00 11:13 AM

To: TThompson@nacintl.com
cc:
Subject: MY RAI 4-9

Tom:

On a 7/7 conference call with NAC and Maine Yankee, NAC indicated that you have already responded with the necessary information to make a conclusion for RAI 4-9 that was recently issued. Charley/Bill mentioned RAI supplemental response #1, issue #13, as drawing the necessary nexus/conclusion for us.

Please point out how this has already been answered for me, I am having trouble finding it.

B/32

Tim

CC: "Licensing Task Force" <Licensing_Task_Force@nacin...

Tim,

The Response referred to is Response No. 13 that was transmitted to the NRC by NAC letter ED20000505 on April 18, 2000. (This is the same letter that transmitted the SAR Revision UMSS-00C changed pages.) Specifically, the fourth and fifth paragraphs of the NAC Response address the topic of the current RAI 4-9.

Additional information based on NAC's understanding that the 6/29/00 RAI applies to MY site specific spent fuel:

Maine Yankee variably enriched fuel assemblies are limited to two batches of fuel. These two batches were exposed to a maximum burnup less than 30,000 MWd/MTU, with neither of the batches being burned more than two cycles. Based on the data provided in the SAR, fuel at burnups less than or equal to 30,000 MWd/MTU may be loaded at 5 years cool time at any enrichment greater or equal to 1.9 w/o 235U. The variably enriched rods in the Maine Yankee fuel assembly are enriched over 3.4 w/o 235U (with axial blankets on one of the variably enriched batches of 2.6w/o). Therefore, the minimum allowable cool time for the variably enriched Maine Yankee fuel assemblies is not dependent upon the enrichment considered, average or minimum.

I hope this is helpful.

Tom

<table width=100%>
<tr valign=top>
<td>
<td>Tim McGinty <TJM1@nrc.gov>
<p>07/10/00 11:13 AM

<td>

   To: TThompson@nacintl.com

   cc:

   Subject: MY RAI 4-9</table>

<font size=2 face="Courier New">Tom:

On a 7/7 conference call with NAC and Maine Yankee, NAC indicated that you have already responded with the necessary information to make a conclusion for RAI 4-9 that was recently issued. Charley/Bill mentioned RAI supplemental response #1, issue #13, as drawing the necessary nexus/conclusion for us.

Please point out how this has already been answered for me, I am having trouble finding it.

Tim

From: Tim McGinty
To: Elaine Keegan
Date: Thu, Jul 6, 2000 3:18 PM
Subject: Re: ser input

NMSS

I cannot imagine any connection to Ron's thermal section.

If you can tell me where some of the other "optional walk-through" daily inspections are referenced in the SAR, I would contact them to address the inconsistency. Why did they do this? I would say to not get "locked in" to a daily inspection via a SAR inference. Seems like no big deal to me. Lower operational doses are good, in my opinion. **I would be interested primarily if their calculations are incorrect, that is, deletion of the daily walk through visual would not significantly reduce their operational doses, as they claim.** In general, though, I would think that we should be able to simply state in our MY SER that 1) the deleted all references to a daily walk through visual inspection, 2) thus, operational doses are revised downward, and maybe 3) the tech specs stipulate obtaining the daily thermal information remotely.

I cc'd Ron in case there is something I have not thought of.

>>> Elaine Keegan 07/06 3:01 PM >>>
I just looked through NACs April 18 submittal and you are absolutely correct that they have deleted the visual inspections. But it doesn't appear that they have removed all references to the optional walkthrough in the SAR. I haven't looked at this indepth but will soon. I guess we need to talk about this. Why do they do this? Does this have any impact on Ron's thermal section?

>>> Tim McGinty 06/29 5:49 PM >>>
Laney,

The SER you sent me appears to be incomplete in Chapter 10. Which has me interested, since with the April 18 submittal, NAC removed the Chapter 10 reference to a daily inspection of the VCC vents. Since this means they will always "remote" monitor temperatures, this resulted in significantly lower operational doses reported in Tables 4, 5, 6 & 7 in Chapter 10.

You may not have been aware of this (I was not), so we need to figure out pronto if this will have RAI type issues with it, or if it is acceptable as is and can be addressed in the SER.

Tim

>>> Elaine Keegan 05/02 7:08 AM >>>
see attached

CC: Ron Parkhill

B/33

From: Tim McGinty
To: Eric Leeds
Date: Thu, Jul 6, 2000 9:18 AM
Subject: Your request for MY RAI's

NMSS

You asked for a copy yesterday (see attached). I'm working on a briefing.

B/34

NAC UMS UNIVERSAL STORAGE SYSTEM
DOCKET NO. 72-1015
TAC NO. L22979

REQUEST FOR ADDITIONAL INFORMATION

This document titled Request for Additional Information (RAI), contains a compilation of additional information requirements identified to-date by the U.S. Nuclear Regulatory Commission (NRC) staff, during its review of NAC International's revised application for approval of an amendment to the proposed Certificate of Compliance (CoC) for the NAC UMS Universal Storage System (NAC-UMS) under 10 CFR Part 72. This RAI follows the same format as NAC's Safety Analysis Report (SAR).

Each individual RAI describes information needed by the staff for it to complete its review of the application and the SAR and to determine whether NAC has demonstrated compliance with the regulatory requirements.

ENCLOSURE

CHAPTER 4 THERMAL

4-1 Establish the design basis in the SAR, for reduced heat loads under transfer conditions (water, vacuum and helium backfill), for spent fuel cladding and components important to safety.

For each reduced heat load category, provide a discussion and graphical representation of the peak cladding and component temperatures as a function of time. Provide tables that summarize the transfer condition, reduced heat load, time duration, and maximum calculated temperatures with respect to the associated component temperature limit. The regulations require that sufficient information be provided in the SAR to support a finding that the design bases are related to the design criteria [10 CFR 72.24(c)(2)] and are satisfied with an adequate margin of safety [10 CFR 72.24(c)(3)].

4-2 Provide a detailed explanation of the administrative and operational controls that assure that the canister loading is within the analyzed constraints of the SAR. The controls discussed should be sufficient to preclude the possibility of a single human error leading to a mis-loading. Alternatively, demonstrate by analysis that fuel cladding and component temperature limits will not be exceeded in the event of mis-loading one 0.958 kW fuel assembly in the worst location.

The staff seeks assurance that the design and operation of the NAC-UMS preserves an adequate margin of safety for the proposed reduced heat load vacuum drying operations. Extensive canister loading options exist for preferential loading, reduced heat loads, and Maine Yankee site-specific fuel. With the reduced heat load option, the population of assemblies which could result in a postulated mis-loading has also increased. Due to the complexity of the various loading options, administrative and operational controls are increasingly relied upon to ensure that a loading pattern outside of the analyzed design basis envelope does not occur. Compared to the design basis heat load, higher component temperatures are reached under vacuum drying conditions, thus the staff is not assured that the temperature limits will not be exceeded if a mis-loading occurs. Section 72.24(d)(2) requires that sufficient information be provided in the SAR to evaluate the adequacy of structures, systems, and components (SSCs) important to safety to mitigate the consequences of accidents, including manmade events.

4-3 Revise Figures 4.4.3-5 and 4.4.3-6 to account for the higher temperatures associated with reduced heat loads.

Since these figures represent the "maximum" temperatures of various components during transfer operations, the higher temperatures associated with the lower heat loads should be represented or noted (See related RAI 4-1). For the PWR curves, the vacuum drying cladding temperature can be significantly higher by 80^{0}F even though the final temperature is about the same for the 20 kW loading with helium. For the BWR curves, the vacuum drying cladding temperature can be significantly higher by 143^{0}F and the final temperature would be 31^{0}F higher for the 20 kW loading with helium.

Section 10 CFR 72.11(a) requires the SAR to be complete and accurate in all material respects.

4-4 Explain the apparent inconsistency between Section 4.4.3.1 which states that steady-state evaluations are performed for heat loads of 20, 17, 14, 11 and 8 kW and Tables 4.4.3-5 and 4.4.3-6. These tables state, via Note 2, that steady-state conditions are for only heat loads with no time duration.

Specifically, Tables 4.4.3-5 and 4.4.3-6 only identify steady-state conditions for the vacuum heat load of 8kW and for the helium heat load of 17, 14, 11 and 8 kW. Section 72.11(a) requires the SAR to be complete and accurate in all material respects.

4-5 State in the SAR that the maximum temperature values listed in Tables 4.4.3-5 and 4.4.3-6 are indeed the maximum calculated values or identify the higher peak temperatures calculated from the design basis analyses.

As written, Note 2 at the bottom of these tables implies that, for conditions prior to reaching steady-state, the temperature may be higher than the listed values. If the temperatures listed for the "Not Limited" time duration are indeed the maximum, then Note 2 can be eliminated since it would be redundant. Section 72.11(a) requires the SAR to be complete and accurate in all material respects.

4-6 Explain how preferential loading arrangements are bounded by the values shown in Tables 4.4.3-5 and 4.4.3-6 and include an explanation in Section 4.4.3.1, "Maximum Temperatures at Reduced Heat Loads."

As stated in Section 4.4.3.1, the configuration and model used to analyze the reduced heat load is referenced to be in accordance with Section 4.4.1.3, "Two Dimensional Axisymmetric Transfer Cask Models," which states that the heat load is applied as a volumetric heat generation in the active fuel region. No explanation is provided in the SAR which explains how preferential loading for a given basket heat load with hotter fuel in the center was considered in the calculation of reduced heat load temperatures. From the current description, it is implied that a uniform heat distribution was used, and it is not apparent to the staff how this would be a bounding configuration for a preferential loading with higher than average heat load at the center of the basket. For completeness, describe other permissible preferential loading arrangements and how they are bounded by the reduced heat load values shown in the subject tables. Section 72.11(a) requires the SAR to be complete and accurate in all material respects.

4-7 Correct the first sentence in the second paragraph of Section 4.4.3.1, "Maximum Temperatures at Reduced Heat Loads," to reflect the data in Table 4.4.3-6 .

The sentence states that the maximum temperatures reached by components are less than those resulting from design basis heat load in the helium backfill condition. Contrary to this statement, Table 4.4.3-6 clearly shows that the BWR 20 kW reduced heat load cladding temperature exceeds the design basis heat load temperature.

Section 72.11(a) requires the SAR to be complete and accurate in all material respects.

4-8 Submit the calculations which demonstrate that for PWR heat loads below 8 kW (for vacuum conditions) and PWR heat loads below 17kW (for helium filled canister conditions) that there is no time limit on the duration at which they can remain in these conditions.

Section 72.24(c)(3) states the application must provide information on the design in sufficient detail to support staff findings that the Independent Spent Fuel Storage Installation will satisfy the design bases with an adequate margin of safety.

4-9 Provide an explanation in the SAR of how assemblies with a variable radial enrichment, as described in Section 4.5.1.1.6, determine the assembly enrichment for use in Technical Specification Tables 12B2-8 and 12B2-9.

The aforementioned technical specification tables are used to determine the spent fuel cooling time requirements and loading arrangements. Enrichment is used as an input for this determination. For thermal considerations regarding variable radial enrichments, the lower enrichment should be used for the cooling time determination, rather than an average enrichment, to ensure enough cooling time for the larger decay heat values associated with lower enrichments. Section 72.24(c)(3) states the application must provide information on the design in sufficient detail to support staff findings that the ISFSI will satisfy the design bases with an adequate margin of safety.

4-10 Add a statement to Section 4.5.1.1.9, "Standard Fuel Assemblies With Damaged Lattices," to the effect that the damaged fuel assemblies have been analyzed to retain their configuration for all design basis events.

The thermal analysis assumes that the fuel assemblies remain in their as built configuration, except for those that are canned. Since these lattices are damaged and are not canned, it is important to explain their impact in the thermal section where damaged lattices are being discussed. Section 72.11(a) requires the SAR to be complete and accurate in all material respects.

CHAPTER 12 TECHNICAL SPECIFICATIONS

12-1 (a) Provide the design basis information on the type of water cooling suggested in Action Statement A.2.1 in LCO 3.1.1.

(b) State and justify the maximum water temperature necessary to adequately cool the canister for 24 hours such that vacuum drying operations can resume.

(c) State the maximum temperature of the spent fuel cladding and heat transfer disk after 24 hours of in-pool cooling and the proposed water cooling, prior to the resumption of vacuum drying operations, using the worst case preferential loading arrangement.

The staff considers that insufficient information has been provided to describe the

alternative to in-pool cooling. Spent fuel pools are maintained in a specific temperature range, whereas the proposed alternative appears not to be limited in either temperature, coolant quantity or configuration. No details have been provided which describe how this water cooling would be accomplished or reasonable assurance that it would be controlled in accordance with the design basis. Section 72.24(c) states the application must provide information on the design in sufficient detail to support staff findings that the ISFSI will satisfy the design bases with an adequate margin of safety.

From: Tim McGinty
To: Jack Guttmann, Ron Parkhill
Date: Fri, Jun 30, 2000 3:08 PM
Subject: Initial NAC reaction to our Maine Yankee RAI's

nm55

Ron and Jack: As a data point-

NAC called me to confirm that they got our RAI's. The questions that got their attention were, as expected, 4-2 (demonstrate controls or analyze a mis-load) and 4-9. The reaction to 4-2 was typical..."we the applicant consider the fuel handling and selecting capabilities to be a Part 50 responsibility...they use the same provisions for loading a reactor....this is precedent setting."

More interesting, they also called 4-9 precedent setting. 4-9 is below:

4-9 Provide an explanation in the SAR of how assemblies with a variable radial enrichment, as described in Section 4.5.1.1.6, determine the assembly enrichment for use in Technical Specification Tables 12B2-8 and 12B2-9.

The aforementioned technical specification tables are used to determine the spent fuel cooling time requirements and loading arrangements. Enrichment is used as an input for this determination. For thermal considerations regarding variable radial enrichments, the lower enrichment should be used for the cooling time determination, rather than an average enrichment, to ensure enough cooling time for the larger decay heat values associated with lower enrichments. Section 72.24(c)(3) states the application must provide information on the design in sufficient detail to support staff findings that the ISFSI will satisfy the design bases with an adequate margin of safety.

They did not think other applicants were expected to look at variable radial enrichments on a "pin by pin" basis, thereby the "precedent" comment.

I just simply asked them whether the source term/thermal heat load for a given assembly, when chosen based on average enrichment, is in fact bounding for variably radially enriched assemblies. If so, then there shouldn't be a problem. He was not able to answer that.

CC: Eric Leeds

B/35

NAC-UMS Maine Yankee RAI #2 (6/29/00) Summary

Eleven RAI's, with three key issues identified, as follows:

1 Establish the design basis in the SAR, for reduced heat loads under transfer conditions (water, vacuum and helium backfill), for spent fuel cladding and components important to safety.

For each reduced heat load category, provide a discussion and graphical representation of the peak cladding and component temperatures as a function of time. Provide tables that summarize the transfer condition, reduced heat load, time duration, and maximum calculated temperatures with respect to the associated component temperature limit. The regulations require that sufficient information be provided in the SAR to support a finding that the design bases are related to the design criteria [10 CFR 72.24(c)(2)] and are satisfied with an adequate margin of safety [10 CFR 72.24(c)(3)].

Why appropriate: Design basis needs to be established to demonstrate basis for acceptance, for future 72.48 changes, and future NRC reviews of amendments.

2 Provide a detailed explanation of the administrative and operational controls that assure that the canister loading is within the analyzed constraints of the SAR. The controls discussed should be sufficient to preclude the possibility of a single human error leading to a mis-loading. Alternatively, demonstrate by analysis that fuel cladding and component temperature limits will not be exceeded in the event of mis-loading one 0.958 kW fuel assembly in the worst location.

The staff seeks assurance that the design and operation of the NAC-UMS preserves an adequate margin of safety for the proposed reduced heat load vacuum drying operations. Extensive canister loading options exist for preferential loading, reduced heat loads, and Maine Yankee site-specific fuel. With the reduced heat load option, the population of assemblies which could result in a postulated mis-loading has also increased. Due to the complexity of the various loading options, administrative and operational controls are increasingly relied upon to ensure that a loading pattern outside of the analyzed design basis envelope does not occur. Compared to the design basis heat load, higher component temperatures are reached under vacuum drying conditions, thus the staff is not assured that the temperature limits will not be exceeded if a mis-loading occurs. Section 72.24(d)(2) requires that sufficient information be provided in the SAR to evaluate the adequacy of structures, systems, and components (SSCs) important to safety to mitigate the consequences of accidents, including manmade events.

Why appropriate: Most complicated loading pattern and scheme that SFPO has reviewed, including preferential loading slots, reduced heat load specifications and specifications tailored for MY fuel. Increased probability of a mis-load, lower margins to component temperature limits and no analysis of the likely consequences of a mis-load.

3 Provide an explanation in the SAR of how assemblies with a variable radial enrichment, as described in Section 4.5.1.1.6, determine the assembly enrichment for use in Technical Specification Tables 12B2-8 and 12B2-9.

B/36

The aforementioned technical specification tables are used to determine the spent fuel cooling time requirements and loading arrangements. Enrichment is used as an input for this determination. For thermal considerations regarding variable radial enrichments, the lower enrichment should be used for the cooling time determination, rather than an average enrichment, to ensure enough cooling time for the larger decay heat values associated with lower enrichments. Section 72.24(c)(3) states the application must provide information on the design in sufficient detail to support staff findings that the ISFSI will satisfy the design bases with an adequate margin of safety.

Why appropriate: Lower enriched fuels of same burnup yield a higher decay heat. Current loading tables specify use of the maximum planar average enrichment of such assemblies for selecting the appropriate cooling time for variably enriched fuel assemblies. Applicant has not provided any justification as to why the use of an average enrichment for such assemblies ensures that the decay heat load per assembly limits are met. Using the minimum enrichment of fuel rods in such assemblies would clearly be bounding and clearly acceptable without additional technical review.

NAC-UMS Maine Yankee Amendment Review Timeline

7/16/99	NAC-UMS Maine Yankee Amendment submitted. Aggressive one RAI schedule established to support April 16, 2001, desired loading date.
12/21/99	RAI #1 issued, response requested within 45 days (2/4/00) in order to meet the Maine Yankee loading schedule.
2/4/00	RAI #1 responses received.
3/17/00	NAC response to identified final cleanup issues received.
3/27/00	NAC informed NRC of NUTUG (User's Group) NAC-UMS public comment to allow longer cask vacuum drying times via lower heat loads.
3/29/00	NAC/SFPO Management conference call - NRC cannot make such significant changes to the NAC-UMS via the rulemaking process without going back out for public comment. Gave NAC the option to: (1) retain the existing schedule to support Maine Yankee's (MY) published loading date, or (2) accept review and schedule implications of a late-stage modification to the MY amendment request.
4/7/00	NAC informed NRC of choice to pursue changes to MY amendment.
4/18/00	Received revised amendment request (< 1 year from published loading date)
6/5/00	NAC team completes initial NAC-UMS public comment responses. Thermal reviewer initially identifies MY amendment concerns for a higher probability of a mis-load and an apparent decrease in the existing margins to component temperature limits.
6/7/00	NAC/SFPO Management initial conference call on potential thermal issues with revised request, review and schedule implications.
6/14/00	MY/NAC/SFPO Management conference call: Discussed potential thermal issues, NRC to complete thermal review of modified request and issue RAI in 2 - 3 weeks, schedule impact and requested NAC letter to confirm desired continuation of the review.
6/16/00	NAC letter received requesting continued review on a priority basis of supporting Maine Yankee's published 4/16/2001 loading schedule.
6/29/00	Issued RAI #2 (see attached summary) on MY NAC-UMS amendment request, noting that a revised schedule will be issued pending acceptance review of the RAI responses.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

June 29, 2000

Mr. Thomas C. Thompson, Director
Licensing & Competitive Assessment
NAC International, Inc.
655 Engineering Drive
Norcross, GA 30092

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION FOR THE UMS UNIVERSAL STORAGE SYSTEM (TAC NO. L22979)

Dear Mr. Thompson:

By application dated July 16, 1999, as supplemented, NAC International, Inc. (NAC) requested approval of an amendment, under the provisions of 10 CFR Part 72, Subpart K, to the proposed Certificate of Compliance for the UMS Universal Storage System. By letter dated June 16, 2000, NAC requested that the Nuclear Regulatory Commission (NRC) continue its review of the Maine Yankee amendment, including NAC's April 18, 2000, revised application to accommodate longer allowable time limits during loading operations. Enclosed is the staff's request for additional information (RAI) for the continued review of the amendment request.

Your full and complete response to the enclosed RAI is necessary for the staff to complete its review. Upon receipt of your RAI responses, we will perform an acceptance review to determine if sufficient information has been provided to allow completion of the review and inform you the NRC's revised schedule to complete the anticipated rulemaking.

If you have any comments or questions concerning this request, you may contact me at (301) 415-8580. Please refer to Docket No. 72-1015 and TAC No. L22979 in future correspondence related to this request.

Sincerely,
/S/
Timothy J. McGinty, Project Manager
Spent Fuel Licensing Section
Spent Fuel Project Office
Office of Nuclear Material Safety
and Safeguards

Docket No. 72-1015

Enclosure: RAI on NAC-UMS Storage System

cc: Mr. David C. Jones
Duke Power

Mr. George Zinke
Maine Yankee Atomic Power Company

Mr. Scott Bauer
Arizona Public Service Company

Mr. Paul Bemis
Stone and Webster Eng. & Construction

NAC UMS UNIVERSAL STORAGE SYSTEM
DOCKET NO. 72-1015
TAC NO. L22979

REQUEST FOR ADDITIONAL INFORMATION

This document titled Request for Additional Information (RAI), contains a compilation of additional information requirements identified to-date by the U.S. Nuclear Regulatory Commission (NRC) staff, during its review of NAC International's revised application for approval of an amendment to the proposed Certificate of Compliance (CoC) for the NAC UMS Universal Storage System (NAC-UMS) under 10 CFR Part 72. This RAI follows the same format as NAC's Safety Analysis Report (SAR).

Each individual RAI describes information needed by the staff for it to complete its review of the application and the SAR and to determine whether NAC has demonstrated compliance with the regulatory requirements.

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4-2 Provide a detailed explanation of the administrative and operational controls that assure that the canister loading is within the analyzed constraints of the SAR. The controls discussed should be sufficient to preclude the possibility of a single human error leading to a mis-loading. Alternatively, demonstrate by analysis that fuel cladding and component temperature limits will not be exceeded in the event of mis-loading one 0.958 kW fuel assembly in the worst location.

• Pt 50 is adequate
• potential hole in guidance that PSD controls for loading + mis-load fuel is adequate

The staff seeks assurance that the design and operation of the NAC-UMS preserves an adequate margin of safety for the proposed reduced heat load vacuum drying operations. Extensive canister loading options exist for preferential loading, reduced heat loads, and Maine Yankee site-specific fuel. With the reduced heat load option, the population of assemblies which could result in a postulated mis-loading has also increased. Due to the complexity of the various loading options, administrative and operational controls are increasingly relied upon to ensure that a loading pattern outside of the analyzed design basis envelope does not occur. Compared to the design basis heat load, higher component temperatures are reached under vacuum drying conditions, thus the staff is not assured that the temperature limits will not be exceeded if a mis-loading occurs. Section 72.24(d)(2) requires that sufficient information be provided in the SAR to evaluate the adequacy of structures, systems, and components (SSCs) important to safety to mitigate the consequences of accidents, including manmade events.

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As stated in Section 4.4.3.1, the configuration and model used to analyze the reduced heat load is referenced to be in accordance with Section 4.4.1.3, "Two Dimensional Axisymmetric Transfer Cask Models," which states that the heat load is applied as a volumetric heat generation in the active fuel region. No explanation is provided in the SAR which explains how preferential loading for a given basket heat load with hotter fuel in the center was considered in the calculation of reduced heat load temperatures. From the current description, it is implied that a uniform heat distribution was used, and it is not apparent to the staff how this would be a bounding configuration for a preferential loading with higher than average heat load at the center of the basket. For completeness, describe other permissible preferential loading arrangements and how they are bounded by the reduced heat load values shown in the subject tables. Section 72.11(a) requires the SAR to be complete and accurate in all material respects.

4-7 Correct the first sentence in the second paragraph of Section 4.4.3.1, "Maximum Temperatures at Reduced Heat Loads," to reflect the data in Table 4.4.3-6 .

The sentence states that the maximum temperatures reached by components are less than those resulting from design basis heat load in the helium backfill condition. Contrary to this statement, Table 4.4.3-6 clearly shows that the BWR 20 kW reduced heat load cladding temperature exceeds the design basis heat load temperature. Section 72.11(a) requires the SAR to be complete and accurate in all material respects.

4-8 Submit the calculations which demonstrate that for PWR heat loads below 8 kW (for vacuum conditions) and PWR heat loads below 17kW (for helium filled canister conditions) that there is no time limit on the duration at which they can remain in these conditions.

Section 72.24(c)(3) states the application must provide information on the design in sufficient detail to support staff findings that the Independent Spent Fuel Storage Installation will satisfy the design bases with an adequate margin of safety.

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in 4/00 Question 13 response to RAI

The aforementioned technical specification tables are used to determine the spent fuel cooling time requirements and loading arrangements. Enrichment is used as an input for this determination. For thermal considerations regarding variable radial enrichments, the lower enrichment should be used for the cooling time determination, rather than an average enrichment, to ensure enough cooling time for the larger decay heat values associated with lower enrichments. Section 72.24(c)(3) states the application must provide information on the design in sufficient detail to support staff findings that the ISFSI will satisfy the design bases with an adequate margin of safety.

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The thermal analysis assumes that the fuel assemblies remain in their as built configuration, except for those that are canned. Since these lattices are damaged and are not canned, it is important to explain their impact in the thermal section where damaged lattices are being discussed. Section 72.11(a) requires the SAR to be complete and accurate in all material respects.

CHAPTER 12 TECHNICAL SPECIFICATIONS

12-1 (a) Provide the design basis information on the type of water cooling suggested in Action Statement A.2.1 in LCO 3.1.1.

(b) State and justify the maximum water temperature necessary to adequately cool the canister for 24 hours such that vacuum drying operations can resume.

(c) State the maximum temperature of the spent fuel cladding and heat transfer disk after 24 hours of in-pool cooling and the proposed water cooling, prior to the resumption of vacuum drying operations, using the worst case preferential loading arrangement.

The staff considers that insufficient information has been provided to describe the alternative to in-pool cooling. Spent fuel pools are maintained in a specific temperature range, whereas the proposed alternative appears not to be limited in either temperature, coolant quantity or configuration. No details have been provided which describe how this water cooling would be accomplished or reasonable assurance that it would be controlled in accordance with the design basis. Section 72.24(c) states the application must provide information on the design in sufficient detail to support staff findings that the ISFSI will satisfy the design bases with an adequate margin of safety.

NAC-UMS Maine Yankee RAI #2 (6/29/00) Summary

CHAPTER 4 THERMAL

4-1 Establish the design basis in the SAR, for reduced heat loads under transfer conditions (water, vacuum and helium backfill), for spent fuel cladding and components important to safety.

For each reduced heat load category, provide a discussion and graphical representation of the peak cladding and component temperatures as a function of time. Provide tables that summarize the transfer condition, reduced heat load, time duration, and maximum calculated temperatures with respect to the associated component temperature limit. The regulations require that sufficient information be provided in the SAR to support a finding that the design bases are related to the design criteria [10 CFR 72.24(c)(2)] and are satisfied with an adequate margin of safety [10 CFR 72.24(c)(3)].

Why appropriate/consistent with SRP: Design basis needs to be established to demonstrate basis for acceptance, for future 72.48 changes, and future NRC reviews of amendments. SRP Section IV, acceptance criteria, states that "cask and fuel materials should be maintained within their acceptance criteria...", and "the thermal performance of the cask should be within the allowable design criteria specified in SAR Sections 2 and 3...." Section V.3 of the SRP states " If the fuel cladding temperature calculation is based on heatup over a limited time period for cask drying operations, verify that limiting conditions for the operations have been imposed in the technical specifications...to ensure that the temperature will remain acceptable during the operations." This RAI is predicated on the staff reaching reasonable assurance, as documented in the SAR, with respect to the applicant's statements, noting that the original 4/18/00 submittal had an erroneous conclusion, and the 5/31/00 supplement also had errors on the same topic.

Do we already have the information: The original 4/18/00 submittal erroneously stated that "at heat loads less than the design basis heat load, the rate of component heat up and the maximum temperature reached by a component are less than those resulting from the design basis heat load." The staff saw a potential inconsistency with that statement, and asked for a summary of the temperature changes for reduced heat loads. In a May 31 SAR supplement and answer to our telephone conference call, NAC acknowledged in Response #7 that "there is an increase in the maximum content temperature at the lower heat loads, and that the increased temperatures are a function of length of time that the canister and contents are allowed to remain in the vacuum/helium conditions, not just the heat load." NAC provide temperature information which compared the design basis maximum heat load to all of the reduced heat load configurations for cladding and heat transfer disks. The SAR itself was only revised to note that reduced heat loads can yield higher temperatures under vacuum conditions, and did not establish a limiting component temperature design basis for reduced heat loads. Subsequent RAI's clarified the SAR inconsistencies identified by the staff in this area.

4-2 Provide a detailed explanation of the administrative and operational controls that assure that the canister loading is within the analyzed constraints of the SAR. The controls discussed should be sufficient to preclude the possibility of a single human error leading to a mis-loading. Alternatively, demonstrate by analysis that fuel cladding and component temperature limits will not be exceeded in the event of mis-loading one 0.958

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kW fuel assembly in the worst location.

The staff seeks assurance that the design and operation of the NAC-UMS preserves an adequate margin of safety for the proposed reduced heat load vacuum drying operations. Extensive canister loading options exist for preferential loading, reduced heat loads, and Maine Yankee site-specific fuel. With the reduced heat load option, the population of assemblies which could result in a postulated mis-loading has also increased. Due to the complexity of the various loading options, administrative and operational controls are increasingly relied upon to ensure that a loading pattern outside of the analyzed design basis envelope does not occur. Compared to the design basis heat load, higher component temperatures are reached under vacuum drying conditions, thus the staff is not assured that the temperature limits will not be exceeded if a mis-loading occurs. Section 72.24(d)(2) requires that sufficient information be provided in the SAR to evaluate the adequacy of structures, systems, and components (SSCs) important to safety to mitigate the consequences of accidents, including manmade events.

*<u>Why appropriate/consistent with SRP</u>: Most complicated loading pattern and scheme that SFPO has reviewed, including preferential loading slots, reduced heat load specifications and specifications tailored for MY fuel. Increased probability of a mis-load, lower margins to component temperature limits and no analysis of the likely consequences of a mis-load in the current application. The VSC-24 CoC has technical specifications requiring double verification of both fuel assembly selection and spent fuel pool ppm boron specs. The Transtor at Trojan included an evaluation of why, considering the available contents at Trojan and the design bases analysis, a mis-loading event is not credible. SRP Chapter 8 "Operating Procedures - Acceptance Criteria", states that "Operating procedures descriptions should identify measures to control processes and mitigate potential hazards that may be present during normal operations. Also, SRP 8.V.1, "Review Procedures - Cask Loading" states "Review the generic procedures ...to verify that tests, inspections, **verifications**, ...are specified. "Depending on the types and specifications of fuel assemblies stored in the reactor spent fuel pool, detailed site-specific procedures may be necessary to ensure that all fuel loaded in the cask meets the fuel specifications for the cask design. These procedures can be evaluated only on a site-specific basis, and will generally be evaluated through inspections rather than during the licensing review. **The SAR should indicate, however, that such procedures may be necessary.**"*

<u>Do we already have the information:</u> The application does not contain a mis-loading analysis. As the RAI states, the option of either analyzing the mis-load or demonstrating why the administrative and operational controls are adequate to "preclude" a single-human error from causing a mis-load was presented. The level of commitment to the administrative and operational controls necessary are the same for both the base UMS design and the Maine Yankee amendment. The SAR does specify the development of site-specific procedures, and states that "The procedures shall incorporate spent fuel assembly selection and verification requirements to ensure that the spent fuel assemblies loaded into the UMS are as authorized by the CoC."

4-3 Revise Figures 4.4.3-5 and 4.4.3-6 to account for the higher temperatures associated

with reduced heat loads.

Since these figures represent the "maximum" temperatures of various components during transfer operations, the higher temperatures associated with the lower heat loads should be represented or noted (See related RAI 4-1). For the PWR curves, the vacuum drying cladding temperature can be significantly higher by 80°F even though the final temperature is about the same for the 20 kW loading with helium. For the BWR curves, the vacuum drying cladding temperature can be significantly higher by 143°F and the final temperature would be 31°F higher for the 20 kW loading with helium. Section 10 CFR 72.11(a) requires the SAR to be complete and accurate in all material respects.

Why appropriate/consistent with SRP: See reference to RAI 4-1. The applicant provides curves entitled "Maximum component temperatures in Transient Operations." Our initial review indicated that these may not be the maximum, and NAC responded on 5/31 acknowledging that, but did not update the curves by either modification or noting it. Furthermore, there remain an error in the 5/31 conclusion about maximum temperatures in the helium backfill condition for BWR fuel types. This type of question is consistent with a round 1 RAI question which identifies inconsistencies in the SAR.

Do we already have the information: This is an editorial/omission/oversight. Yes, we have enough information to have been able to determine that the SAR is erroneous. For completeness, and because of the history of inaccuracies already identified, it is included as an item that can be clarified as a result of the first round review.

4-4 Explain the apparent inconsistency between Section 4.4.3.1 which states that steady-state evaluations are performed for heat loads of 20, 17, 14, 11 and 8 kW and Tables 4.4.3-5 and 4.4.3-6. These tables state, via Note 2, that steady-state conditions are for only heat loads with no time duration.

Specifically, Tables 4.4.3-5 and 4.4.3-6 only identify steady-state conditions for the vacuum heat load of 8kW and for the helium heat load of 17, 14, 11 and 8 kW. Section 72.11(a) requires the SAR to be complete and accurate in all material respects.

Why appropriate/consistent with SRP: This type of question is consistent with a round 1 RAI question which identifies inconsistencies in the SAR. It is related to the several inconsistencies already identified in this RAI.

Do we already have the information: This is an editorial/omission/oversight. Yes, we have enough information to have been able to determine that the SAR is erroneous. For completeness, and because of the history of inaccuracies already identified, it is included as an item that can be clarified as a result of the first round review.

4-5 State in the SAR that the maximum temperature values listed in Tables 4.4.3-5 and 4.4.3-6 are indeed the maximum calculated values or identify the higher peak temperatures calculated from the design basis analyses.

As written, Note 2 at the bottom of these tables implies that, for conditions prior to reaching steady-state, the temperature may be higher than the listed values. If the temperatures listed for the "Not Limited" time duration are indeed the maximum, then Note 2 can be eliminated since it would be redundant. Section 72.11(a) requires the

SAR to be complete and accurate in all material respects.

Why appropriate/consistent with SRP: See related RAI 4-4. This question is attempting to ascertain the context of the Tables note with respect to actual component temperatures reached. The note indeed would not be necessary if the steady-state temperatures reached are the maximum, and since the margin to component temperature limit for the heat transfer disks is now much reduced, we are attempting to determine if component temperature limits are exceeded during the transient. This question is consistent with a round 1 RAI question and seeks to clarify information presented in the SAR. Concluding whether component temperature limits are exceeded under both steady-state or transient conditions is worthwhile.

Do we already have the information: This is an editorial improvement. We do not have enough information to make a conclusion regarding the maximum temperatures presented under the transient conditions. Indeed, the SAR information appears to contradict such a conclusion by having such a note in the first place. For completeness, and because of the history of inaccuracies already identified, it is included as an item that can be clarified as a result of the first round review. ?

4-6 Explain how preferential loading arrangements are bounded by the values shown in Tables 4.4.3-5 and 4.4.3-6 and include an explanation in Section 4.4.3.1, "Maximum Temperatures at Reduced Heat Loads."

As stated in Section 4.4.3.1, the configuration and model used to analyze the reduced heat load is referenced to be in accordance with Section 4.4.1.3, "Two Dimensional Axisymmetric Transfer Cask Models," which states that the heat load is applied as a volumetric heat generation in the active fuel region. No explanation is provided in the SAR which explains how preferential loading for a given basket heat load with hotter fuel in the center was considered in the calculation of reduced heat load temperatures. From the current description, it is implied that a uniform heat distribution was used, and it is not apparent to the staff how this would be a bounding configuration for a preferential loading with higher than average heat load at the center of the basket. For completeness, describe other permissible preferential loading arrangements and how they are bounded by the reduced heat load values shown in the subject tables. Section 72.11(a) requires the SAR to be complete and accurate in all material respects.

Why appropriate/consistent with SRP: The applicant has implied that the resulting temperature calculations for reduced heat loads, in combination with the preferential loading of hotter fuel assemblies in the "middle ring", assumes a uniform "smearing" of the heat generation throughout the basket. The preferential heat loading is clearly not uniform, and margins to component temperature limits are narrower with the revised application. This is a highly complex loading arrangement, and preferential loading is not currently not directly addressed in the SRP. As such, and with any topic that deviates from the guidance of the SRP, it is subject to close review and is potentially time consuming. Documenting the staff concerns in such occasions, via RAI's, is particularly important since existing SRP review guidance and acceptance criteria do not exist.

Do we already have the information: No. The applicant does not appear to have considered the effects of preferential loading at reduced heat loads on the component temperature determinations, with respect to the material limits. This may be very simply resolved and already considered, but it is not evident from the analysis presented. For completeness, and

because this aspect is not addressed within the SRP, it is included as an important item that is necessary for the staff to make a safety conclusion, and is appropriate as a first round review question on the docket.

4-7 Correct the first sentence in the second paragraph of Section 4.4.3.1, "Maximum Temperatures at Reduced Heat Loads," to reflect the data in Table 4.4.3-6 .

The sentence states that the maximum temperatures reached by components are less than those resulting from design basis heat load in the helium backfill condition. Contrary to this statement, Table 4.4.3-6 clearly shows that the BWR 20 kW reduced heat load cladding temperature exceeds the design basis heat load temperature. Section 72.11(a) requires the SAR to be complete and accurate in all material respects.

Why appropriate/consistent with SRP: This type of question is consistent with a round 1 RAI question which identifies inconsistencies in the SAR. It is related to the several inconsistencies already identified in this RAI (see 4-1, 4-3 and 4-4).

Do we already have the information: This is a likely editorial/omission/oversight. Yes, we have enough information to have been able to determine that the SAR is erroneous. For completeness, and because of the history of inaccuracies already identified, it is included as an item that can be clarified as a result of the first round review.

4-8 Submit the calculations which demonstrate that for PWR heat loads below 8 kW (for vacuum conditions) and PWR heat loads below 17kW (for helium filled canister conditions) that there is no time limit on the duration at which they can remain in these conditions.

Section 72.24(c)(3) states the application must provide information on the design in sufficient detail to support staff findings that the Independent Spent Fuel Storage Installation will satisfy the design bases with an adequate margin of safety.

Why appropriate/consistent with SRP: This question is more important than it may seem on the surface. As stated previously, the margins are narrower and there have been several errors identified regarding the conclusions presented versus the data presented. For higher heat loads, there is a tech spec limit to the amount of time in transient conditions, in other words, if the calculations are off, it can only be "so bad". However, this analysis identifies the conditions under which no time limits are necessary, and thus, there is no limit to the amount of time in the transient condition. Meanwhile, the component temperature analysis, as one might expect, is still fairly aggressive with respect to the material limits, especially the heat transfer disks under vacuum conditions. This question is consistent with a round 1 RAI question which seeks the key calculations related to the safety conclusions, and also in the context of a compressed review with limited NRC review time to perform independent verification.

Do we already have the information: No. An unlimited time frame, of course, is desirable from both an operational and regulatory perspective. But again, the margins are already narrow, and as described previously, there is no LCO protection to limit the consequences of an error.

4-9 Provide an explanation in the SAR of how assemblies with a variable radial enrichment, as described in Section 4.5.1.1.6, determine the assembly enrichment for use in Technical Specification Tables 12B2-8 and 12B2-9.

The aforementioned technical specification tables are used to determine the spent fuel cooling time requirements and loading arrangements. Enrichment is used as an input for this determination. For thermal considerations regarding variable radial enrichments, the lower enrichment should be used for the cooling time determination, rather than an average enrichment, to ensure enough cooling time for the larger decay heat values associated with lower enrichments. Section 72.24(c)(3) states the application must provide information on the design in sufficient detail to support staff findings that the ISFSI will satisfy the design bases with an adequate margin of safety.

Why appropriate/consistent with SRP: Lower enriched fuels of same burnup yield a higher decay heat. Current loading tables specify use of the maximum planar average enrichment of such assemblies for selecting the appropriate cooling time for variably enriched fuel assemblies. The treatment of variable radial enrichments is not specifically addressed in the SRP for thermal calculations, although there is extensive experience for BWR applications. This is a unique PWR fuel assembly in our experience. In fact, the SRP states that "Decay is generally calculated using the same computer codes as those used to determine the radiation source terms." The treatment of variably radially enriched assemblies, whether BWR or PWR, does not appear to be addressed in the shielding section of the SRP. Applicant has not provided any justification as to why the use of an average enrichment for such assemblies ensures that the decay heat load per assembly limits are met. Using the minimum enrichment of fuel rods in such assemblies would clearly be bounding and clearly acceptable without additional technical review.

Do we already have the information: NAC maintains that we already have the appropriate information. Staff has been unable to confirm that. Our SRP basis may be contained deeper within other regulatory guidance. ?

4-10 Add a statement to Section 4.5.1.1.9, "Standard Fuel Assemblies With Damaged Lattices," to the effect that the damaged fuel assemblies have been analyzed to retain their configuration for all design basis events.

The thermal analysis assumes that the fuel assemblies remain in their as built configuration, except for those that are canned. Since these lattices are damaged and are not canned, it is important to explain their impact in the thermal section where damaged lattices are being discussed. Section 72.11(a) requires the SAR to be complete and accurate in all material respects.

Why appropriate/consistent with SRP: This type of question is consistent with a round 1 RAI question which identifies the necessary conclusions by the applicant in the technical review area under consideration. ?

Do we already have the information: This conclusion is likely presented adequately elsewhere in the SAR and SER, and thus the staff can probably make a thermal conclusion on that basis. I believe these assemblies are a specific subject of the structural evaluation of intact assemblies with one or more damaged grid spacers with an unsupported span not to exceed 60 inches.

CHAPTER 12 TECHNICAL SPECIFICATIONS

12-1 (a) Provide the design basis information on the type of water cooling suggested in Action Statement A.2.1 in LCO 3.1.1.

(b) State and justify the maximum water temperature necessary to adequately cool the canister for 24 hours such that vacuum drying operations can resume.

(c) State the maximum temperature of the spent fuel cladding and heat transfer disk after 24 hours of in-pool cooling and the proposed water cooling, prior to the resumption of vacuum drying operations, using the worst case preferential loading arrangement.

The staff considers that insufficient information has been provided to describe the alternative to in-pool cooling. Spent fuel pools are maintained in a specific temperature range, whereas the proposed alternative appears not to be limited in either temperature, coolant quantity or configuration. No details have been provided which describe how this water cooling would be accomplished or reasonable assurance that it would be controlled in accordance with the design basis. Section 72.24(c) states the application must provide information on the design in sufficient detail to support staff findings that the ISFSI will satisfy the design bases with an adequate margin of safety.

<u>Why appropriate/consistent with SRP</u>: This is another example of an issue that NAC/NUTUG tried to invoke via the rulemaking process (there were several others to) that the staff did not agree to. Because this issue is related to the Part 50/72 overlap, and not clearly addressed in the SRP, we felt that establishing on the docket some of the initial staff concerns is warranted. We understand that NAC does not intend to pursue this for this amendment, but none the less, it is also a potential ISG type of issue for those facilities who intend to decommission the spent fuel pool. Thus, is it consistent with a round 1 RAI question, and important for establishing the staff's position lacking SRP guidance.

<u>Do we already have the information:</u> No. There was no information provided on alternative water cooling specifications.

NAC-UMS Maine Yankee Amendment Review Timeline

7/16/99 NAC-UMS Maine Yankee Amendment submitted. Aggressive one RAI schedule established to support April 16, 2001, desired loading date.

12/21/99 RAI #1 issued, response requested within 45 days (2/4/00) in order to meet the Maine Yankee loading schedule.

2/4/00 RAI #1 responses received.

3/17/00 NAC response to identified final cleanup issues received.

3/27/00 NAC informed NRC of NUTUG (User's Group) NAC-UMS public comment to allow longer cask vacuum drying times via lower heat loads.

3/29/00 NAC/SFPO Management conference call - NRC cannot make such significant changes to the NAC-UMS via the rulemaking process without going back out for public comment. Gave NAC the option to:

(1) retain the existing schedule to support Maine Yankee's (MY) published loading date, or

(2) accept review and schedule implications of a late-stage modification to the MY amendment request.

4/7/00 NAC informed NRC of choice to pursue changes to MY amendment.

4/18/00 Received revised amendment request (< 1 year from published loading date)

6/5/00 NAC team completes initial NAC-UMS public comment responses. Thermal reviewer initially identifies MY amendment concerns for a higher probability of a mis-load and an apparent decrease in the existing margins to component temperature limits.

6/7/00 NAC/SFPO Management initial conference call on potential thermal issues with revised request, review and schedule implications.

6/14/00 MY/NAC/SFPO Management conference call: Discussed potential thermal issues, NRC to complete thermal review of modified request and issue RAI in 2 - 3 weeks, schedule impact and requested NAC letter to confirm desired continuation of the review.

6/16/00 NAC letter received requesting continued review on a priority basis of supporting Maine Yankee's published 4/16/2001 loading schedule.

6/29/00 Issued RAI #2 (see attached summary) on MY NAC-UMS amendment request, noting that a revised schedule will be issued pending acceptance review of the RAI responses.

Bill,
Sent via e-mail also.
Tim

NAC-UMS Maine Yankee RAI #2 (6/29/00) Summary

Eleven RAI's, with three key issues identified, as follows:

1 Establish the design basis in the SAR, for reduced heat loads under transfer conditions (water, vacuum and helium backfill), for spent fuel cladding and components important to safety.

in agreement with MY

For each reduced heat load category, provide a discussion and graphical representation of the peak cladding and component temperatures as a function of time. Provide tables that summarize the transfer condition, reduced heat load, time duration, and maximum calculated temperatures with respect to the associated component temperature limit. The regulations require that sufficient information be provided in the SAR to support a finding that the design bases are related to the design criteria [10 CFR 72.24(c)(2)] and are satisfied with an adequate margin of safety [10 CFR 72.24(c)(3)].

Why appropriate: Design basis needs to be established to demonstrate basis for acceptance, for future 72.48 changes, and future NRC reviews of amendments.

2 Provide a detailed explanation of the administrative and operational controls that assure that the canister loading is within the analyzed constraints of the SAR. The controls discussed should be sufficient to preclude the possibility of a single human error leading to a mis-loading. Alternatively, demonstrate by analysis that fuel cladding and component temperature limits will not be exceeded in the event of mis-loading one 0.958 kW fuel assembly in the worst location.

• S/R operation requiring double verification of loading
- note this is not in the SRP to review loading
do we rely on existing Part 50 controls

The staff seeks assurance that the design and operation of the NAC-UMS preserves an adequate margin of safety for the proposed reduced heat load vacuum drying operations. Extensive canister loading options exist for preferential loading, reduced heat loads, and Maine Yankee site-specific fuel. With the reduced heat load option, the population of assemblies which could result in a postulated mis-loading has also increased. Due to the complexity of the various loading options, administrative and operational controls are increasingly relied upon to ensure that a loading pattern outside of the analyzed design basis envelope does not occur. Compared to the design basis heat load, higher component temperatures are reached under vacuum drying conditions, thus the staff is not assured that the temperature limits will not be exceeded if a mis-loading occurs. Section 72.24(d)(2) requires that sufficient information be provided in the SAR to evaluate the adequacy of structures, systems, and components (SSCs) important to safety to mitigate the consequences of accidents, including manmade events.

Why appropriate: Most complicated loading pattern and scheme that SFPO has reviewed, including preferential loading slots, reduced heat load specifications and specifications tailored for MY fuel. Increased probability of a mis-load, lower margins to component temperature limits and no analysis of the likely consequences of a mis-load.

3 Provide an explanation in the SAR of how assemblies with a variable radial enrichment, as described in Section 4.5.1.1.6, determine the assembly enrichment for use in Technical Specification Tables 12B2-8 and 12B2-9.

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The aforementioned technical specification tables are used to determine the spent fuel cooling time requirements and loading arrangements. Enrichment is used as an input for this determination. For thermal considerations regarding variable radial enrichments, the lower enrichment should be used for the cooling time determination, rather than an average enrichment, to ensure enough cooling time for the larger decay heat values associated with lower enrichments. Section 72.24(c)(3) states the application must provide information on the design in sufficient detail to support staff findings that the ISFSI will satisfy the design bases with an adequate margin of safety.

Why appropriate: Lower enriched fuels of same burnup yield a higher decay heat. Current loading tables specify use of the maximum planar average enrichment of such assemblies for selecting the appropriate cooling time for variably enriched fuel assemblies. Applicant has not provided any justification as to why the use of an average enrichment for such assemblies ensures that the decay heat load per assembly limits are met. Using the minimum enrichment of fuel rods in such assemblies would clearly be bounding and clearly acceptable without additional technical review.

Q13 response in April 2000 in Table 12.B with contents

MY claims the lowest enrichment is the average enrichment

Kane conference call with NAC + MY

- position RAI is not necessary
- 2 questions to be beyond past practices
- other questions not needed

Cell phone 404-229-5661

3:00 or mid afternoon

NAC-UMS Maine Yankee Amendment Review Timeline

7/16/99	NAC-UMS Maine Yankee Amendment submitted. Aggressive one RAI schedule established to support April 16, 2001, desired loading date.
12/21/99	RAI #1 issued, response requested within 45 days (2/4/00) in order to meet the Maine Yankee loading schedule.
2/4/00	RAI #1 responses received.
3/17/00	NAC response to identified final cleanup issues received.
3/27/00	NAC informed NRC of NUTUG (User's Group) NAC-UMS public comment to allow longer cask vacuum drying times via lower heat loads.
3/29/00	NAC/SFPO Management conference call - NRC cannot make such significant changes to the NAC-UMS via the rulemaking process without going back out for public comment. Gave NAC the option to: (1) retain the existing schedule to support Maine Yankee's (MY) published loading date, or (2) accept review and schedule implications of a late-stage modification to the MY amendment request.
4/7/00	NAC informed NRC of choice to pursue changes to MY amendment.
4/18/00	Received revised amendment request (< 1 year from published loading date)
6/5/00	NAC team completes initial NAC-UMS public comment responses. Thermal reviewer initially identifies MY amendment concerns for a higher probability of a mis-load and an apparent decrease in the existing margins to component temperature limits.
6/7/00	NAC/SFPO Management initial conference call on potential thermal issues with revised request, review and schedule implications.
6/14/00	MY/NAC/SFPO Management conference call: Discussed potential thermal issues, NRC to complete thermal review of modified request and issue RAI in 2 - 3 weeks, schedule impact and requested NAC letter to confirm desired continuation of the review.
6/16/00	NAC letter received requesting continued review on a priority basis of supporting Maine Yankee's published 4/16/2001 loading schedule.
6/29/00	Issued RAI #2 (see attached summary) on MY NAC-UMS amendment request, noting that a revised schedule will be issued pending acceptance review of the RAI responses.

check on UMS-MY amendment original schedule & slippages to other schedules

D

-NMSS

Final from R.Parkhill 6/23/2000

RAI's associated with MY Thermal Amendment to Increase Vacuum/ Transfer Operation Times

4-1 Explain why the maximum cladding temperature of the design basis heat load is not utilized as an upper bound temperature value for the cladding temperatures associated with calculating the vacuum drying times for reduced heat loads.

The design basis heat load should result in the most severe temperatures within the canister. Instead, the method utilized to calculate the vacuum drying times for reduced heat loads, produces cladding temperatures during the vacuum drying and transfer operations, well above the cladding temperatures associated with the design basis heat load (i.e 80°F for PWR and 143°F for BWR), just to arbitrarily lengthen the times associated with these operations. The design basis heat load should result in the highest temperatures in the canister, not the lesser heat loadings. The regulations require that sufficient information be provided in the SAR to support a finding that: the design bases are related to the design criteria [10CFR72.24(c)(2)], and the design bases are satisfied with an adequate margin of safety [10CFR72.24(c)(3)].

4-2 Explain how the design of the NAC-UMS for Maine Yankee preserves an adequate margin of safety for reduced heat load vacuum drying operations. Note that these operations result in higher basket temperatures, since the time in vacuum conditions has significantly increased. The explanation should include consideration of a postulated misloaded of one fuel assembly at a heat load of .958 kW located in the worst location.

Previously the staff had approved a vacuum drying time associated with the maximum heat load in the basket. For this amendment the vacuum drying times have been increased to account not only for reduced heat loads but also as a result of letting the maximum cladding temperatures increase as much as 80°F for PWR and 143°F for BWR beyond the design basis heat load case. Since the population of assemblies which could result in a postulated misloading has also increased, the staff feels that consideration of this event is warranted. 10CFR72.24 (d) (2) requires that sufficient information shall be provided in the SAR to evaluate the adequacy of SSCs important to safety to mitigate the consequences of accidents, including manmade events.

4-3 Revise Figures 4.4.3-5 and 4.4.3-6, "History of Maximum Component Temperature (°F) for Transfer Conditions of PWR and BWR Fuels", respectively, to account for the higher temperatures associated with reduced heat loads.

Since these figures are suppose to represent the "maximum" temperatures of various components during transfer operations, the higher temperatures associated with the lower heat loads should be represented or noted. For the PWR curves the vacuum drying cladding temperature can be significantly higher by 80°F even though the final temperature is about the same for the 20 kW loading with helium. For the BWR curves the vacuum drying cladding temperature can be significantly higher by 143°F and the final temperature would be 31°F higher for the 20 kW loading with helium. 10CFR72.11(a) requires that the SAR be complete and accurate in all material respects.

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4-4 Explain the apparent inconsistency between Section 4.4.3.1 which states that steady-state evaluations are performed for heat loads of 20,17,14,11 & 8 kW, and Tables 4.4.3-5 & 4.4.3-6. These tables state, via Note 2, that steady-state conditions are for only heat loads with no time duration.

Specifically, Tables 4.4.3-5 & 4.4.3-6 only identify steady-state conditions for the vacuum heat load of 8kW and for the helium heat load of 17,14,11 and 8 kW. 10CFR72.11(a) requires that the SAR be complete and accurate in all material respects.

4-5 State in the SAR that the maximum temperature values listed in Tables 4.4.3-5 & 4.4.3-6 are indeed the maximum calculated values or identify the higher peak temperatures calculated from the design basis analyses.

As written, Note 2 at the bottom of these tables implies that for conditions prior to reaching steady-state the temperature may be higher than the listed values. If the temperatures listed for the "Not Limited" time duration are indeed the maximum, then Note 2 can be eliminated since it would be redundant. 10CFR72.11(a) requires that the SAR be complete and accurate in all material respects.

4-6 Explain how preferential loading arrangements are bounded by the values shown in Tables 4.4.3-5 & 4.4.3-6 and include an explanation in SAR Section 4.4.3.1 "Maximum Temperatures at Reduced Heat loads".

As stated in Section 4.4.3.1, the configuration and model used to analyze the reduced heat load is referenced to be in accordance with Section 4.4.1.3 "Two Dimensional Axisymmetric Transfer Cask Models" which just states that the heat load is applied as a volumetric heat generation in the active fuel region. No explanation is provided in the current SAR which explains how preferential loading for a given basket heat load with hotter fuel in the center was considered in the calculation of reduced heat load temperatures. From the current description it is implied that a uniform heat distribution was used and it is not apparent to the staff how this would be a bounding configuration for a preferential loading with higher than average heat load at the center of the basket. For completeness describe other permissible preferential loading arrangements and how they are bounded by the reduced heat load values shown in the subject tables. 10CFR72.11(a) requires that the SAR be complete and accurate in all material respects.

4-7 Correct the first sentence in the second paragraph of Section 4.4.3.1 "Maximum Temperatures at Reduced Heat loads" to reflect the data in Tables 4.4.3-5 & 4.4.3-6 .

The second sentence states that the maximum temperature reached by a component is less than the design basis heat load. Contrary this statement Tables 4.4.3-5 & 4.4.3-6 clearly show that the reduced heat load cladding temperatures exceed the design basis heat load temperatures. 10CFR72.11(a) requires that the SAR be complete and accurate in all material respects.

4-8 Submit for the staff's review the calculations which demonstrate that for PWR heat loads below 8 kW for vacuum conditions and PWR heat loads below 17kW for helium filled canister,

that there is no time limit on the duration at which they can stay in these conditions. Per 10CFR 72.24(c), the application must provide information on the design in sufficient detail to support staff findings that the ISFSI will satisfy the design bases with an adequate margin of safety.

4-9 (a) Provide the design basis information on the type of water cooling suggested in Action Statement A.2.1 in LCO 3.1.1. (b) State and justify the maximum water temperature necessary to adequately cool the canister for 24 hours such that vacuum dry operations can resume. (c) State the maximum temperature of the spent fuel cladding and heat transfer disk after 24 hours of in-pool cooling and the proposed water cooling, prior to the resumption of vacuum drying operations using the worst case preferential loading arrangement.

The staff is concerned that insufficient information has been provided to describe the alternative to in-pool cooling. Spent fuel pools are maintained in a specific temperature range whereas the proposed alternative appears not to be limited in either temperature, coolant quantity or configuration. No details have been provided which describe how this water cooling would be accomplished or reasonable assurance that it would be controlled in accordance with the design basis. Per 10CFR 72.24(c), the application must provide information on the design in sufficient detail to support staff findings that the ISFSI will satisfy the design bases with an adequate margin of safety.

4-10 Provide an explanation in the SAR of how assemblies with a variable radial enrichment, as described in Section 4.5.1.1.6, determine the assembly enrichment for use in Technical Specification Tables 12B2-8 and 12B2-9.

The aforementioned technical specification tables are used to determine the spent fuel cooling time requirements and loading arrangements. Enrichment is used as an input for this determination. For thermal considerations regarding variable radial enrichments, the lower enrichment should be used for the cooling time determination rather than an average enrichment to ensure that the enough cooling time for the larger decay heat values associated with lower enrichments. Per 10CFR 72.24(c), the application must provide information on the design in sufficient detail to support staff findings that the ISFSI will satisfy the design bases with an adequate margin of safety.

4-11 Add a statement to SAR Section 4.5.1.1.9 "Standard Fuel Assemblies With Damaged Lattices" to the effect that the damaged fuel assemblies have been analyzed to retain their configuration for all design basis events.

The thermal analysis assumes that the fuel assemblies remain in their as built configuration, except for those that are canned. Since these lattices are damaged and are not canned, it is important to explain its impact in the thermal section where damaged lattices are being discussed. 10CFR72.11(a) requires that the SAR be complete and accurate in all material respects.

From: Ron Parkhill
To: Earl Easton, M. Wayne Hodges, Tim McGinty } nmss
Date: Fri, Jun 23, 2000 2:44 PM
Subject: Thermal RAIs for NAC-UMS MY Amdmt- Reduced Heat Loads for Transfer Operations

Attached are 11 Rais associated with the subject review.

The last two were previously asked in April as open items in my draft SER but no response was submitted.

If anything comes about in the next two weeks where I can help, give a call at home 607-6670

CC: David Tang, Donald E. Carlson, Elaine Keegan, G...

B/40

From: Ron Parkhill
To: Lawrence Kokajko, Tim McGinty
Date: Fri, Jun 23, 2000 8:59 AM
Subject: Thermal Comments on MY Amdt

nmss

This is not a final Product butis about 95%. To expedit our meeting you may want to resd over these.

B/41

RAI's associated with MY Thermal Amendment to Increase Vacuum/ Transfer Operation Times

4-1 Explain why the maximum cladding temperature of the design basis heat load is not utilized as an upper bound temperature limit for the cladding temperatures associated with calculating the vacuum drying times for reduced heat loads.

The design basis heat load should result in the most severe temperatures within the canister. Instead, the method utilized to calculate the vacuum drying times for reduced heat loads, produces cladding temperatures during the vacuum drying and transfer operations, well above the cladding temperatures associated with the design basis heat load (i.e 80°F for PWR and 143°F for BWR), just to arbitrarily lengthen the times associated with these operations. The design basis heat load should result in the highest temperatures in the canister, not the lesser heat loadings. The regulations require that sufficient information be provided in the SAR to support a finding that: the design bases are related to the design criteria [10CFR72.24(c)(2)], and the design bases are satisfied with an adequate margin of safety [10CFR72.24(c)(3)].

4-2 Explain how the design of the NAC-UMS for Maine Yankee preserves an adequate margin of safety for reduced heat load vacuum drying operations. Note that these operations result in higher basket temperatures, since the time in vacuum conditions has significantly increased. The explanation should include consideration of a postulated misloaded of one fuel assembly at a heat load of .958 kW located in the worst location.

Previously the staff had approved a vacuum drying time associated with the maximum heat load in the basket. For this amendment the vacuum drying times have been increased to account not only for reduced heat loads but also as a result of letting the maximum cladding temperatures increase as much as 80°F for PWR and 143°F for BWR beyond the design basis heat load case. Since the population of assemblies which could result in a postulated misloading has also increased, the staff feels that consideration of this event is warranted. 10CFR72.24 (d) (2) requires that sufficient information shall be provided in the SAR to evaluate the adequacy of SSCs important to safety to mitigate the consequences of accidents, including manmade events.

4-3 Revise Figures 4.4.3-5 and 4.4.4-5, "History of Maximum Component Temperature (°F) for Transfer Conditions of PWR and BWR Fuels", respectively, to account for the higher temperatures associated with reduced heat loads.

Since these figures are suppose to represent the "maximum" temperatures of various components during transfer operations, the higher temperatures associated with the lower heat loads should be represented or noted. For the PWR curves the vacuum drying cladding temperature can be significantly higher by 80°F even though the final temperature is about the same for the 20 kW loading with helium. For the BWR curves the vacuum drying cladding temperature can be significantly higher by 143°F and the final temperature would be 31°F higher for the 20 kW loading with helium. 10CFR72.11(a) requires that the SAR be complete and accurate in all material respects.

4-4 Explain the apparent inconsistency between Section 4.4.3.1 which states that steady-state

evaluations are performed for heat loads of 20,17,14,11 & 8 kW, and Tables 4.4.3-5 & 4.4.3-6. These tables state, via Note 2, that steady-state conditions are for only heat loads with no time duration.

Specifically, Tables 4.4.3-5 & 4.4.3-6 only identify steady-state conditions for the vacuum heat load of 8kW and for the helium heat load of 17,14,11 and 8 kW. 10CFR72.11(a) requires that the SAR be complete and accurate in all material respects.

4-5 State in the SAR that the maximum temperature values listed in Tables 4.4.3-5 & 4.4.3-6 are indeed the maximum calculated values or identify the higher peak temperatures calculated from the design basis analyses.

As written, Note 2 at the bottom of these tables implies that for conditions prior to reaching steady-state the temperature may be higher than the listed values. If the temperatures listed for the "Not Limited" time duration are indeed the maximum, then Note 2 can be eliminated since it would be redundant. 10CFR72.11(a) requires that the SAR be complete and accurate in all material respects.

4-6 Explain how preferential loading arrangements are bounded by the values shown in Tables 4.4.3-5 & 4.4.3-6 and include an explanation in SAR Section 4.4.3.1 "Maximum Temperatures at Reduced Heat loads".

As stated in Section 4.4.3.1, the configuration and model used to analyze the reduced heat load is referenced to be in accordance with Section 4.4.1.3 "Two Dimensional Axisymmetric Transfer Cask Models" which just states that the heat load is applied as a volumetric heat generation in the active fuel region. No explanation is provided in the current SAR which explains how preferential loading for a given basket heat load with hotter fuel in the center was considered in the calculation of reduced heat load temperatures. From the current description it is implied that a uniform heat distribution was used and it is not apparent to the staff how this would be a bounding configuration for a preferential loading with higher than average heat load at the center of the basket. For completeness describe other permissible preferential loading arrangements and how they are bounded by the reduced heat load values shown in the subject tables. 10CFR72.11(a) requires that the SAR be complete and accurate in all material respects.

4-7 Correct the first sentence in the second paragraph of Section 4.4.3.1 "Maximum Temperatures at Reduced Heat loads" to reflect the data in Tables 4.4.3-5 & 4.4.3-6 .

The second sentence states that the maximum temperature reached by a component is less than the design basis heat load. Contrary this statement Tables 4.4.3-5 & 4.4.3-6 clearly show that the reduced heat load cladding temperatures exceed the design basis heat load temperatures.10CFR72.11(a) requires that the SAR be complete and accurate in all material respects.

4-8 Submit for the staff's review the calculations which demonstrate that for PWR heat loads below 8 kW for vacuum conditions and PWR heat loads below 17kW for helium filled canister, that there is no time limit on the duration at which they can stay in these conditions.

Per 10CFR 72.24(c), the application must provide information on the design in sufficient detail to support staff findings that the ISFSI will satisfy the design bases with an adequate margin of safety.

4-9 (a) Provide the design basis information on the type of water cooling suggested in Action Statement A.2.1 in LCO 3.1.1. (b) State and justify the maximum water temperature necessary to adequately cool the canister for 24 hours such that vacuum dry operations can resume. (c) State the maximum temperature of the spent fuel cladding and heat transfer disk after 24 hours of in-pool cooling and the proposed water cooling, prior to the resumption of vacuum drying operations using the worst case preferential loading arrangement.

The staff is concerned that insufficient information has been provided to describe the alternative to in-pool cooling. Spent fuel pools are maintained in a specific temperature range whereas the proposed alternative appears not to be limited in either temperature, coolant quantity or configuration. The staff is not opposed to the request, but no details have been provided which describe how this water cooling would be accomplished or reasonable assurance that it would be controlled in accordance with the design basis.

From: Tim McGinty
To: Ron Parkhill
Date: Thu, Jun 15, 2000 1:20 PM
Subject: Maine Yankee TS 3.1.1

NMSS

Reminder:

This TS, NAC tried to change from "spent fuel pool water" to any old unanalyzed water that happens to be laying around. We are not accepting this comment in UMS, and we should not accept it in MY without the proper demonstration by the applicant. We should question this change.

Tim

B/42

nmss

From: Ron Parkhill
To: David Tang, Donald Carlson, Elaine Keegan, Geof...
Date: Thu, Jun 8, 2000 7:30 AM
Subject: Fwd: Re: Drawings changes for NAC-UMS per NUTUG comments [REVISED 6/7/00]

There are no thermal properties of this material in the SAR. When you say "extra ½ inch of NS-3" does this mean that the shielding radial thickness has increased? I need confirmation that the thermal analyses for the **transfer** cask have been evaluated for this additional/new material (and this includes all the times for reduced heat loads for vacuum drying and time in transfer cask).

>>> Tim McGinty 06/07 10:51 AM >>>
NAC Team and SFPO Management:

Please see the attached. With respect to drawing changes requested by NUTUG as a public comment, I asked NAC to capture if they think any of the drawing changes affect our SER. They came back with only one, and an interesting one at that.

The attached describes an alternate configuration for the shield plug. They put in an extra half-inch of NS-3, instead of NS-4-FR, as a new material. They also included this in the April 18 NAC-UMS Maine Yankee submittal as an alternative.

This is news to me. I have no idea to what extent NS-3 has been evaluated by the applicant and us as a material. Am I missing something? It seems like this type of change should not be accepted in either the public comment process, or for that matter, in the Maine Yankee application, unless I have missed that we have evaluated this as a material already.

Geoff, I know Kim is not here, and I am just not familiar with NS-3. Something is not right here, I suspect.

CC: Earl Easton, James Randall Hall, M. Wayne Hodges...

B/43

From: Tim McGinty
To: David Tang, Donald Carlson, Elaine Keegan, Geof... IMNSS
Date: Thu, Jun 8, 2000 12:56 PM
Subject: NAC-UMS Maine Yankee Issues

Review Team and other interested parties:

Regarding the NAC-UMS Maine Yankee (Amendment No. 1) review, we have identified 2 issues that appear to warrant a response by the applicant:

1) Evaluation of a possible mis-load for the lower than design bases heat load patterns, and

2) The ability of the failed fuel can lid to stay attached and maintain configuration control under TRANSPORT conditions.

Item 1 has been conveyed to NAC, and they are considering whether to pull the lower than design bases heat load aspects from the application, or to accept and respond to a staff RAI on the topic (which will impact the schedule)

Item 2 is not a storage licensing impediment, except it would be a transport impediment and they want this to be a dual-purpose design, so I suspect they would also prefer to address this issue at this time (issue has not been conveyed to NAC yet, but will be shortly).

The purpose of this e-mail is to keep IMNS and TSIS informed of the current status of this casework item and the potential for a delay.

Also, I have received a few other minor comments from technical reviewers on Maine Yankee, that are not a significant impediment (cleanup issues). Team, if you have any other cleanup issues, or for that matter, issues of safety significance, please convey them to me. They may become part of a formal RAI in the near future, depending on the course of action selected by NAC.

Tim

CC: Earl Easton, Francis Young, James Randall Hall, ...

B/44

D

From: Steven Baggett Tim McGinty Tim McGinty NMSS
To: slb, tjm1
Date: Wed, Jun 7, 2000 2:30 PM
Subject: NAC-UMS Maine Yankee Issue on Lower Heat Loads

NAC-UMS Maine Yankee Issue on Lower Heat Loads

Background:

Notified in late-March that NUTUG intended to make a public comment for NAC-UMS rulemaking asking for lower heat loads, and thus longer times allowed in the transfer cask for vacuum drying, helium back-fill and cask loading.

3/29/00: Conference Call (Hodges, Kokajko, Easton, Hall, McGinty with NAC (Pennington, Bill Lee) where we conveyed that NRC will likely not agree to make such changes to the NAC-UMS via the rulemaking process. Gave NAC the option to consider putting such a change into the Maine Yankee amendment with the understanding that it could impact the schedule if our review identified any significant issues.

4/7/00: Informed by NAC that they would like to pursue these changes for the Maine Yankee amendment.

4/18/00: Received revised amendment request.

Early June: We identified the need for a mis-loading analysis due to the higher probability of a mis-load, and a potential decrease in the existing margins to component temperature limits (needs further review).

6/7/00: Also identified that NAC is seeking a change to use NS-3 material in the shield lid via the 4/18/00 submittal, without any additional analysis (shielding or materials).

Options: Inform NAC to consider the following

1) Continue to pursue the lower heat load aspects of this amendment. Staff to complete review of all aspects and generate formal RAI. RAI issued by 6/23/00. Assuming a two-week turnaround (July 7), technical staff to complete review and final SER by 7/21/00, complete package preparation and office concurrence in 2 weeks (August 4). Assuming about 10 months for rulemaking, this would push the ultimate approval of the Maine Yankee amendment to about June 2001. Maine Yankee has expressed a desired approval date of April 2001.

2) Pull the lower heat load aspects of this amendment. Staff has already provided SER input, although a few cleanup issues have been identified recently for NAC to act on. Tech staff to complete final SER's by June 16. Complete package preparation and office concurrence in 2 weeks, June 30. Assuming about 10 months for rulemaking, this would result in the ultimate approval of the Maine Yankee amendment by late April 2001.

B/45

From: Ron Parkhill
To: Tim McGinty
Date: Tue, Jun 6, 2000 10:48 AM
Subject: Re: OK, I'm ready to talk to NAC on the Maine Yankee thermal issue

Or we could do nothing , accept the proposed amendment, and just live with the increased risk of a misloading for the lower heat loads. What is your basis for living with that increased risk?

>>> Tim McGinty 06/06 9:58 AM >>>
I don't consider it completely arbitrary. Adequate margin has already been established by the design basis analysis, and the use of the same methodology for lower heat loads. It's just more margin.

Now, we are essentially saying that we consider mis-loadings to be credible, but limited to one fuel assembly. Why is it OK to assume that they only mis-load one fuel assembly in the worst location.... if they mis-load one, what is the probability that they will mis-load two? Or three?

Maybe we should develope an ISG that requires all cask designs to analyze some sort of mis-loading event, including design basis heat loads. I am unclear, and I would imagine that applicants will be too, as to when (and to what extent) the NRC is going to expect a mis-loading analysis.

I'll set up an appointment with Wayne.

>>> Ron Parkhill 06/06 7:40 AM >>>
Per your write-up we don't want to just "pick a number" for additional margin. As previously stated to you, I want the margin tied to a potential real occurance (ie a misloaded fuel assembly - the max that they are allowed to load in the worst location) and then have NAC evaluate the consequenses on time constraints (vacuum drying and in transfer conditions).
That way we can say to the public that we have granted more time for these LCO operations, but have considered in the design the misloading of the hottest shippable assembly located in the worst location. Arbitrary margins may or may not bound the misloading event.

>>> Tim McGinty 06/05 5:46 PM >>>
I talked to Randy Hall about it. I think you, Wayne and Randy understand my points, and I think I've understood yours.

I would like to talk to Wayne once more before we call NAC. I would like to be able to settle on "how much" margin would suffice, and he we go about conveying it. I could envision (at Randy's prompting) it being relatively straightforward, maybe not even needing a NAC submittal. Something along the lines of:

"The applicant provided an analysis for a series of lower decay heat loads, using the same methodology as the design basis heat load, to establish allowable times in the transfer cask during vacuum drying, helium backfill, and during the loading operations. The staff has granted (pick a number, any number) 50% of the additional time supported in the analysis to ascertain, with reasonable assurance, that the preferential loading of assemblies in lower overall cask heatload configurations will not result in exceeding any component temperature limits. The staff considers that the probability of a mis-loading and the probability of exceeding component temperture limits due to a mis-loading, increases when loading less than the design basis heat load, and thus has established greater margin in the allowable time frames."

What do you think? I know its not really quantitative to any great extent, but it would simply be more margin. If not, I guess we would have to go into the "pick a design bases assembly and put it in the worst place, and see what times come out" scenario.

I'll bother you tomorrow, and we'll see if we can catch Wayne.

B/46

From: Kimberly Gruss
To: McGinty, Tim, Parkhill, Ron
Date: Wed, May 31, 2000 4:10 PM
Subject: NAC-UMS MY SER stuff

NMSS

B/47

4.2 Spent Fuel Cladding

The staff verified that the cladding temperatures for storage of the Maine Yankee fuel are below the temperature which would preclude cladding damage that could lead to gross rupture by either a direct review of the calculated temperature or verification that the Maine Yankee heat load was bounded by that of the NAC-UMS.

The NAC-UMS temperature limits for dry storage of Zircaloy fuels are based on the technical justification provided in PNL-6189, entitled "Recommended Temperature Limits for Dry Storage of Spent Light-Water Zircaloy Clad Rods in Inert Gas," and remain unchanged for the Maine Yankee fuel for burnups up to 45 GWd/MTU.

The staff has recently evaluated the impact of storage conditions on the cladding integrity of fuels with average assembly burnups exceeding 45 GWd/MTU and documented the acceptance criteria for fuels with burnups exceeding 45 GWd/MTU in Revision 1 of Interim Staff Guidance No. 11 (ISG-11). The staff has reasonable assurance that the Maine Yankee fuels having average assembly burnups up to 50 GWd/MTU can be safely stored since the following criteria will be met:

Maine Yankee high burnup fuel assemblies may be treated as intact if both of the following conditions are met:

A1. No more than 1% of the rods in the assembly have peak cladding oxide thicknesses greater than 80 micrometers.

A2. No more than 3% of the rods in the assembly have peak cladding oxide thicknesses greater than 70 micrometers.

Maine Yankee high burnup fuel assemblies must be handled in accordance with ISG-1, " Damaged Fuel" if either of the following conditions are met:

B1. The fuel assembly does not meet both criteria A1 and A2; or

B2. The fuel assembly contains fuel rods with oxide that has become detached or spalled from the cladding.

The administrative controls section of the SAR TS (i.e., Section A 5.0) specifies a program to be implemented by the cask licensee to assure the criteria described above are met prior to loading the cask with high burnup fuel.

Using the CSFM methodology as described in PNL-6189, NAC established fuel clad temperature limits that are also applicable to Maine Yankee fuels with burnups between 45 and 50 GWd/MTU because a 5% margin is imposed on the calculated value of the cladding temperature limits. This 5% margin accounts for the reduction in cladding temperature limit that corresponds to using a 1% creep strain limit in the PNL-6189 methodology.

For purpose of performing a bounding thermal analysis, the spent fuel was assumed to be rubblized if the cladding damage was more than hairline cracks or pinhole leaks or, for high burnup fuel, if the cladding oxide layer was more than 80 microns thick. Any rod whose

cladding exceeded either of the aforementioned conditions would have its entire assembly placed into a can to contain any loose debris. For bounding analysis purposes, the entire assembly in the can was assumed to become rubblized. As an alternative, the applicant could have chosen to demonstrate that the damaged spent fuel would have retained its structural integrity during all design basis conditions. This approach follows the interim staff guidance of ISG-1.

From: Tim McGinty
To: David Tang, Donald Carlson, Elaine Keegan, Geof... NMSS
Date: Thu, May 4, 2000 1:44 PM
Subject: Fwd: Schedule for NAC Activities

Attached update on NAC activities. David Tang has the LWT activities too...

Tim

B148

Tim,

1.   Please provide status of NRC staff's ability to support the requested NAC telecon tomorrow (Thursday), i.e. you, Wayne, Don, and others as appropriate; the topic of discussion is the considerations of fuel shifting in the basket relative to the poison location.

NAC participants will include Holger Pfeifer, Mark Dodds, Bill Lee, Jim Ballowe and possibly others. (I will be out of the office after 3:30 PM today and all day tomorrow.)

Please contact Jim Ballowe (x-202) as the NAC licensing interface during my absence.

The 2 currently known telecon RAIs on UMS-MY will be submitted after completion of the noted telecon, in case some further SAR changes result from that call - (1) SAR text revision to describe the free flow of water out of or into the baskets; and (2) Presentation of a separate SAR section for the evaluation of fuel assemblies with missing grid straps that includes both fuel rod buckling (end impact) and fuel rod bending (side impact).

2.   Based on yesterday's telecon, a separate amendment request will be submitted in the very near future for the LWT Ball-Lok pin specification change. Likely, that submittal will also include drawing revisions to add two welds on the impact limiter shells to permit fabrication using 2 pieces of available width material, since the required width is not available for 1-piece construction. (This one came up yesterday from our fabricator.)

3.   The structural revisions for the LWT High Burnup Rods can/basket design are in progress. Based on completion, checking, engineering review, and QA review schedules, NAC plans to ship the revised SAR pages out on Friday, 5/5.

Table 2.1.3.1-1 Maine Yankee Site Specific Fuel Population

Site Specific Spent Fuel Configuration	Est. Number of Assemblies[1,2]	Canister Loading Position[3]
Inserted Control Element Assembly (CEA)[4,5,6]	168	Any
Inserted In-Core Instrument (ICI) Thimble	138	Any
Consolidated Fuel Canned	5	Corner[7,8,9]
Fuel Rod Replaced by Rod Enriched to 1.95 wt %	1	Any
Fuel Rod Replaced by Stainless Steel Rod or Zircaloy Rod	18	Any
Fuel Rods Removed	10	Corner
Variable Enrichment	72	Any
Variable Enrichment and Axial Blanket	68	Any
Burnable Poison Rod Replaced by Hollow Zircaloy Rod	80	Corner
Damaged Fuel[10,11] Canned	12	Corner
Burnup between 45,000 and 50,000 MWD/MTU	90	Periphery[12]

Canned if > 80 microns

1. The total number of fuel assemblies in inventory, including these site specific spent fuel configurations and standard spent fuel assemblies, is approximately 1,434.
2. The number of fuel assemblies in some categories may vary depending on future fuel inspections.
3. Standard fuel assemblies may be loaded in any position.
4. A fuel assembly with an inserted CEA must be loaded in a Class 2 canister.
5. A fuel assembly without an inserted CEA must not be loaded in a Class 2 canister.
6. CEAs may not be inserted in damaged fuel assemblies, consolidated fuel assemblies or assemblies with irradiated stainless steel replacement rods.
7. Basket corner positions are positions 3, 6, 19, and 22 in Figure 12B2-1. Corner positions are also periphery positions.
8. Only one Consolidated Fuel lattice may be loaded in any Transportable Storage Canister.
9. Consolidated Fuel must be loaded in a Maine Yankee fuel can.
10. All fuel classified as damaged must be placed in a Maine Yankee fuel can, including fuel assemblies with damaged fuel rods or poison rods inserted in guide tubes.
11. All spent fuel, including that held in a Maine Yankee fuel can, must conform to the loading limits presented in Tables 12B2-8 and 12B2-9 for cool time. The fuel maximum planar average enrichment should be used for variable enriched assemblies when determining minimum cool time.
12. Basket periphery positions are positions 1, 2, 3, 6, 7, 12, 13, 18, 19, 22, 23, and 24 in Figure 12B2-1. Periphery positions include the corner positions.

temperature is 195°F and 204°F for PWR and BWR fuels, respectively, at the end of 17 hours based on an initial water temperature of 100°F. For the maximum temperatures shown in Tables 4.4.3-3 and 4.4.3-4 for the transfer conditions of vacuum and helium, the maximum basket temperatures (support disk and aluminum disk) are conservatively determined by using the maximum temperature in the canister content region of the two-dimensional axisymmetric transfer cask and canister models.

4.4.3.1 Maximum Temperatures at ReducedTotal Heat Loads

This section provides the evaluation of component temperatures at PWR fuel heat loads less than the design basis heat load of 23 kW. Steady state evaluations are performed for heat loads of 20, 17, 14, 11 and 8 kW to establish the allowable time limits for the various conditions described in the Technical Specifications (Chapter 12) for the Limiting Conditions of Operation (LCO), LCOs 3.1.1 and 3.1.4. These LCOs control the amount of time that the loaded canister can be in a vacuum condition and the amount of time the loaded canister can remain in the transfer cask after being filled with helium. The time limits ensure that the allowable temperatures of heat transfer disks, support disks and fuel cladding are not exceeded.

At heat loads less than the design basis heat load, the rate of component heat up and the maximum temperature reached by a component are less than those resulting from design basis heat load. The reduced heat load configurations are evaluated using the ANSYS models described in Section 4.4.1.3.

The analysis results for the PWR fuel configuration are shown in Table 4.4.3-5 with a comparison to the results for the design basis heat load case (23 kW). The maximum basket temperature is conservatively assumed to be the same as the maximum fuel temperature. As shown in Table 4.4.3-5, there is no time limit for the cases with heat load less than 17 kW after the canister is filled with helium. For heat loads less than 17 kW, the maximum fuel/basket temperatures for the steady state condition are well below the allowable temperatures of the fuel cladding and the fuel basket.

The analysis results for the BWR fuel configuration are shown in Table 4.4.3-6. These results are also compared to the results for the design basis heat load case (23 kW), with the maximum basket temperature conservatively assumed to be the same as the maximum fuel temperature. As shown in Table 4.4.3-6, and similar to the PWR fuel evaluation, there is no time limit for cases

Table 4.4.3-3 Maximum Component Temperatures for the Transfer Condition - PWR

Component	Maximum Temperature (°F)		Allowable Temperature (°F)
	Vacuum	Helium	
Fuel	538	686	1,058
Lead	119	199	600
Neutron Shield	128	195	300
Heat Transfer Disk	538*	686*	700
Support Disk	538*	686*	800
Canister	244	416	800
Transfer Cask Shells	136	237	700

* Conservatively, the maximum fuel cladding temperature is used.

What are the effects of

Table 4.4.3-4 Maximum Component Temperatures for the Transfer Condition - BWR

Component	Maximum Temperature (°F)		Allowable Temperature (°F)
	Vacuum	Helium	
Fuel	447	654	1,058
Lead	117	210	600
Neutron Shield	116	206	300
Heat Transfer Disk	447*	654*	700
Support Disk	447*	654*	700
Canister	235	432	800
Transfer Cask Shells	133	251	700

* Conservatively, the maximum fuel cladding temperature is used.

Table 4.4.3-5 PWR Fuel Maximum Temperature in Transient Operations

Heat Load (kW)	Water		Vacuum		Helium	
	Duration (hours)	Max. Temp. (°F)	Duration (hours)	Max. Temp. (°F)	Duration (hours)	Max. Temp. (°F)
23[1]	17	195	10	538	16	686
20	20	197	15	618	29	685
17	24	198	18	612	Not Limited	645[2]
14	30	199	24	617	Not Limited	569[2]
11	39	199	37	618	Not Limited	486[2]
8	58	199	Not Limited	609[2]	Not Limited	392[2]

what are peak boundary

Notes:
1. PWR design basis heat load.
2. Maximum temperatures reported are for steady-state conditions.

Incorrect time and increased for pure Helium or vacuum

Kim say okay

Table 4.4.3-6 BWR Fuel Maximum Temperature in Transient Operations

Heat Load (kW)	Water		Vacuum		Helium	
	Duration (hours)	Max. Temp. (°F)	Duration (hours)	Max. Temp. (°F)	Duration (hours)	Max. Temp. (°F)
23[1]	17	204	10	477	24	654
20	18	195	22	620	57	685
17	22	198	27	618	Not Limited	627[2]
14	27	197	36	618	Not Limited	551[2]
11	36	198	57	620	Not Limited	469[2]
8	55	200	Not Limited	599[2]	Not Limited	380[2]

other is steady state

Notes:
1. BWR design basis heat load.
2. Maximum temperatures reported are for steady-state conditions.

How does this compare

602°F CRAD STOP

positions at the periphery of the fuel basket as shown in Figure 12B2-1. The heat load for each damaged fuel assembly is limited to the design basis heat load 0.958 kW (23 kW/24).

A steady-state thermal analysis is performed using the three-dimensional canister model described in Section 4.4.1.2 simulating 100% failure of the fuel rods, fuel cladding, and guide tubes of the damaged fuel held in the Maine Yankee fuel can. The canister is assumed to contain twenty (20) design basis PWR fuel assemblies and damaged fuel assemblies in fuel cans in each of the four corner positions.

Two debris compaction levels are considered for the 100% failure condition: (Case 1) 100% compaction of the fuel rod, fuel cladding, and guide tube debris resulting in a 52-inch debris level in the bottom of each fuel can, and (Case 2) 50% compaction of the fuel rod, fuel cladding, and guide tube debris resulting in a 104-inch debris level in the bottom of each fuel can. The entire heat generation rate for a single fuel assembly (i.e., 0.958 kW) is concentrated in the debris region with the remainder of the active fuel region having no heat generation rate applied. To ensure the analysis is bounding, the debris region is located at the lower part of the active fuel region in lieu of the bottom of the fuel can. This location is closer to the center of the basket where the maximum fuel cladding temperature occurs. The effective thermal conductivities for the design basis PWR fuel assembly (Section 4.4.1.5) are used for the debris region. This is conservative since the debris (100% failed rods) is expected to have higher density (better conduction) and more surface area (better radiation) than an intact fuel assembly. In addition, the thermal conductivity of helium is used for the remainder of the active fuel length. Boundary conditions corresponding to the normal condition of storage are used at the outer surface of the canister model (see Section 4.4.1.2). A steady-state thermal analysis is performed. The results of the thermal analyses performed for 100% fuel rod, fuel cladding, and guide tube failure are:

What's the change?

Description	Maximum Temperature (°F)			
	Fuel Cladding	Damaged Fuel	Support Disk	Heat Transfer Disk
Case 1 (100% Compaction)	654	672	598	594
Case 2 (50% Compaction)	674	594	620	616
Design Basis PWR Fuel	670	N/A	615	612
Allowable	716	N/A	650	650

As demonstrated, the extreme case of 100% fuel rod, fuel cladding, and guide tube failure with 50% compaction of the debris results in temperatures that are less than 1% higher than those calculated for the design basis PWR fuel. The maximum temperatures for the fuel cladding, damaged fuel assembly, support disks, and heat transfer disks remain within the allowable temperature range for both 100% failure cases. Additionally, the temperatures used in the structural analyses of the fuel basket envelope those calculated for both 100% failure cases.

OK open Thm 6

Additionally, the above analysis has been repeated to consider a maximum heat load of 1.05 kW/assembly (maximum heat load for the 50,000 MWD/MTU fuel, see Section 4.5.1.2.1) in the Maine Yankee fuel cans. To maintain the 23 kW total heat load per canister, the model considers a heat load of 1.05 kW/assembly in the four (4) Maine Yankee fuel cans and 0.94 kW/assembly in the rest of the twenty (20) basket locations. The analysis results indicate that the maximum temperatures for the fuel cladding and basket components are slightly lower than those for the case with a heat load of 0.958 kW in the damaged fuel can, as presented above. The maximum fuel cladding temperature is 650°F (< 654°F) and 672°F (< 674°F) for 100% and 50% compaction ratio cases, respectively. Therefore, the case with 1.05 kW/assembly in the Maine Yankee fuel can is bounded by the case with 0.958 kW/assembly in the fuel cans.

4.5.1.1.9 Standard Fuel Assemblies with Damaged Lattice

Certain standard fuel assemblies may have damage or physical alteration to the lattice or cage that holds the fuel rods, but not exhibit damage to the fuel rods.

The effective thermal conductivity for the fuel assembly used in the thermal analyses in Section 4.4 is determined by the two-dimensional fuel model (Section 4.4.1.5). The model conservatively ignores the conductance of the steel cage of the fuel assembly. Therefore, damage or physical alteration to the cage has no effect on the thermal conductivity of the fuel assembly used in the thermal models. The thermal performance of these fuel assemblies is bounded by that of the standard fuel assemblies.

The damage has been structurally evaluated and determined not to result in any reconfigurations of fuel, that

4.5.1.1.10 Damaged Fuel Rod Holders

The Maine Yankee site specific fuel inventory includes two (2) damaged fuel rod holders designated CF1 and CA3. CF1 is a 9 x 9 array of tubes having roughly the same dimensions as a fuel assembly. Some of the tubes hold damaged fuel rods. CA3 is a previously used fuel

design basis conditions

and ~~the~~ configuration such that the configuration control goal for all

A 3.1 NAC-UMS® SYSTEM Integrity

A 3.1.1 CANISTER Maximum Time in Vacuum Drying

2 cycles
~~[illegible]~~ of vacuum drying

LCO 3.1.1 The following limits for vacuum drying time shall be met, as appropriate:

1. The time duration from completion of draining the CANISTER through completion of vacuum dryness testing and the introduction of helium backfill shall not exceed the time shown for a specified heat load:

Total Heat Load (L) (kW)	PWR Time Limit (Hours)	BWR Time Limit (Hours)
$20 < L \leq 23$	10	10
$17 < L \leq 20$	15	22
$14 < L \leq 17$	18	27
$11 < L \leq 14$	24	36
$8 < L \leq 11$	37	57
$L \leq 8$	Not Limited	Not Limited

2. The time duration from the end of in-water cooling or of forced air cooling of the CANISTER through completion of vacuum dryness testing and the introduction of helium backfill shall not exceed 6 hours for either the PWR or BWR configuration.

APPLICABILITY: During LOADING OPERATIONS

ACTIONS

----------NOTE----------
Separate Condition entry is allowed for each NAC-UMS® SYSTEM.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. LCO time limits not met	A.1 Commence filling CANISTER with helium	2 hours

(continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. LCO time limits not met (continued)	AND A.2.1 Submerge TRANSFER CASK with helium filled loaded CANISTER in water. AND A.2.2 Maintain TRANSFER CASK and CANISTER in water for a minimum of 24 hours OR A.3.1 Commence supplying air to the TRANSFER CASK annulus fill/drain lines at a rate of 375 CFM and a maximum temperature of 75°F AND A.3.2 Maintain airflow for a minimum of 24 hours	2 hours Prior to restart of LOADING OPERATIONS 2 hours Prior to restart of LOADING OPERATIONS

No WAY Jose

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.1.1	Monitor elapsed time from completion of CANISTER draining operations until start of helium backfill	Once after completion of CANISTER draining AND As required to meet LCO time limits.
SR 3.1.1.2	Monitor elapsed time from the end of in-pool cooling or of forced-air cooling until restart of helium backfill	Once at end of in-pool cooling or of forced-air cooling AND As required to meet LCO time limits.

D

From: David Tang
To: Steven Baggett
Date: Wed, Apr 26, 2000 2:23 PM
Subject: UMS and UMS/MY conference call

NMSS

Steve, As a result of the conference call yesterday, I have reviewed SAR page 11.2.15-25, "Buckling Evaluation for Fuel Assemblies with Missing Grid Strap(s)." Since this evaluation summary is folded under Subsection 11.2.15.1.5, "Buckling Evaluation for High Burnup Fuel Rods," the analysis bases and results are confusing. We should tell NAC to rewrite this evaluation by appropriately reflecting it in a separate subsection that has nothing to do with high burnup fuel rods. Also, because of a much larger upsupported rod span of 60 inches, anther potential structural failure mode begins to come to light. That is,.the rod bending stress should be shown to be acceptable under lateral impact conditions. In the Part 72 space, the lateral impact associated only with cask tipover is not an design basis and needs not be addressed. However, if the emerging licensing philosophy is to ask duel purpose canister vendors to demonstrate that the stored fuel is eventually transportable, NAC should also analyze this configuration for a 30-ft drop hypothetical accident condition.

On the subject of removed pad/soil site parameters for UMS and UMS/MY, in TS Sections B3.4.1 and 3.4.2, respectively, we shall have an office position soon to support the UMS rulemaking UMS/MY safety evaluation.

David

CC: Donald Carlson, Earl Easton, Elaine Keegan, Geo...

B/50

From: Kimberly Gruss
To: McGinty, Tim, Parkhill, Ron
Date: Fri, Apr 21, 2000 7:47 AM
Subject: SER section NAC-UMS MY

nmss

Tim, Ron-
I just wanted to give you guys an update on my progress developing my section of the NAC-UMS MY SER. Attached is a copy of the latest version of the SER. Tim, I did not refer to NAC's approach to justify high burnup fuels. Instead, I referred to the draft ISG 11, Rev.1. Once the ISG has gone out public, I will insert the acceptance criteria. NAC may then have to add language to the SAR. W/r.t. the status of the ISG, we had a long meeting yesterday to discuss part of the criteria. We still have not come to a decision about the oxide thickness measurement program. We will be working on it very hard next week and will hopefully discuss it at the NEI workshop.
Kim

B/51

ISG-11, Rev. 1

4.2 Spent Fuel Cladding

The staff verified that the cladding temperatures for storage of the Maine Yankee fuel are below the temperature which would preclude cladding damage that could lead to gross rupture by either a direct review of the calculated temperature or verification that the Maine Yankee heat load was bounded by that of the NAC-UMS.

The NAC-UMS temperature limits for dry storage of Zircaloy fuels are based on the technical justification provided in PNL-6189, entitled "Recommended Temperature Limits for Dry Storage of Spent Light-Water Zircaloy Clad Rods in Inert Gas," and remain unchanged for the Maine Yankee fuel for burnups up to 45 GWd/MTU.

The staff has recently evaluated the impact of storage conditions on the cladding integrity of fuels with average assembly burnups exceeding 45 GWd/MTU and documented the acceptance criteria for fuels with burnups exceeding 45 GWd/MTU in Revision 1 of Interim Staff Guidance No. 11 (ISG-11, Rev. 1). The staff has determined that Zircaloy cladding can withstand uniform creep strains (i.e., creep prior to tertiary or accelerating creep strain rates) of about 1 percent without perforations if the average cladding hydrogen concentrations in the cladding are less than about 400 to 500 parts per million (ppm) (Gilbert, et al., 2000). The staff has also determined that the strength and ductility of irradiated Zircaloy do not appear to be significantly affected by corrosion-induced hydrides at hydrogen concentration levels up to about 400 ppm. The staff notes that one of the creep mechanisms of the Center for Spent Fuel Management (CSFM) methodology for calculating cladding temperature limits as described in PNL-6189 and PNL-6364, namely, grain boundary sliding, provides a theoretical basis to expect . Therefore, the staff has reasonable assurance that the Maine Yankee fuels having average assembly burnups up to 50 GWd/MTU can be safely stored if the following criteria are met:

acceptance criteria...

Using the CSFM methodology as described in PNL-6189, NAC established fuel clad temperature limits that are also applicable to Maine Yankee fuels with burnups between 45 and 50 GWd/MTU because a 5% margin is imposed on the calculated value of the cladding temperature limits. This 5% margin accounts for the reduction in cladding temperature limit that corresponds to using a 1% creep strain limit in the PNL-6189 methodology.

The Maine Yankee fuel assemblies with burnups between 45 and 50 GWD/MTU are allowed to be stored in the NAC-UMS canister if the criteria described above are met. The licensee is responsible for required establishing a program to measure the cladding oxide thickness in accordance with the requirements of TS section A 1.1. The licensee is also required to load high burnup fuels into the TSC in accordance with the administrative controls of TS section B 2.1.3. Fuel assemblies that do not meet these criteria are considered damaged fuel and must be treated like damaged fuel.

For purpose of performing a bounding thermal analysis, the spent fuel was assumed to be rubblized if the cladding damage was more than hairline cracks or pinhole leaks or, for high burnup fuel, if the cladding oxide layer was more than 80 microns thick. Any rod whose cladding exceeded either of the aforementioned conditions would have its entire assembly placed into a can to contain any loose debris. For bounding analysis purposes, the entire

ISG-11, Rev. 1

assembly in the can was assumed to become rubblized. As an alternative, the applicant could have chosen to demonstrate that the damaged spent fuel would have retained its structural integrity during all design basis conditions. This approach follows the interim staff guidance of ISG-1.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

April 20, 2000

MEMORANDUM TO: E. William Brach, Director
Spent Fuel Project Office, NMSS

FROM: for Donald A. Cool, Director
Division of Industrial and
Medical Nuclear Safety, NMSS

SUBJECT: SCHEDULE FOR RULEMAKING TO REVISE 10 CFR 72.214 TO SUPPORT THE AMENDMENT OF CERTIFICATE OF COMPLIANCE NO. 1015 FOR THE NAC-UMS CASK SYSTEM

The schedule for completing the rulemaking to revise the NAC-UMS listing in 10 CFR 72.214 is attached. Please note that the final rule for adding the NAC-UMS cask to the approved list has not been published. We will prepare the proposed rule for the amendment but we will not send the amendment package to the EDO for approval until the final rule is published. The schedule is based on the final rule being published by September 1, 2000. If the rule is published before that date, we will revise the schedule accordingly. Please inform my staff of any changes to your schedule.

Time expended on rulemaking for Amendment 1 to the NAC-UMS cask system should be charged to TAC No. L20643.

Attachment:
NAC-UMS-1 Schedule

CONTACT: Merri Horn, NMSS/IMNS
(301) 415-8126

B/52

NAC-UMS Amendment 1 Schedule

TASK	DURATION	DATE
Prepare Rule Package	6 wk	5/19/00
Provide to RGB Section Leader for concurrence	1 wk	5/22/00
Provide to RGB Chief for concurrence	1 wk	5/29/00
SFPO Division concurrence	3 days	6/5/00
IMNS concurrence	1 wk	6/8/00
Issue for Office concurrence	3 wk	6/15/00 - 7/5/00
Resolve Office comments	1 wk	7/12/00
RGB Branch concurrence	3 days	7/13/00
SFPO Division concurrence	2 days	7/18/00
HOLD FOR NAC-UMS FINAL RULE TO BE PUBLISHED		9/1/00
IMNS Division concurrence	1 wk	9/4/00
NMSS concurrence	1 wk	9/11/00
EDO approval	1 wk	9/18/00
Forward proposed rule package to ADM	5 days	9/25/00
Publication in FR	2 wk	10/13/00
Public Comment Period	75 days	end 12/28/00
Resolve Public Comments	8 wk	12/28/00 - 2/22/01
Provide to RGB Section and SFPO management for comment	1 wk	2/1/01
Provide to RGB Chief	1 wk	2/15/01
SFPO Division concurrence	2 days	2/22/01
IMNS Division concurrence	1 wk	2/26/01
Office Concurrence	3 wk	3/05 - 3/26/01
Resolve Office comments	2 wk	3/26 - 4/9/01
RGB Concurrence	1wk	4/9/01

SFPO Division concurrence	2 days	4/16/01
IMNS Division concurrence	1 wk	4/18/01
NMSS concurence	1 wk	4/25/01
EDO Approval	1 wk	5/02/01
Forward final rule package to ADM	5 days	5/9/01
Publication in FR	2 wk	5/30/01

From: Tim McGinty
To: Kimberly Gruss, Ron Parkhill
Date: Mon, Apr 17, 2000 9:45 AM
Subject: Re: NAC-UMS MY Thermal & Confinement Draft SER

NMSS

They are late again. I think they will ship it today, for receipt tomorrow.

Tim

>>> Kimberly Gruss 04/17 7:44 AM >>>
Ron, Tim-
I guess we will be getting the NAC submittal that addresses high burnup fuel today. Once I get it, I will insert a paragraph or two into Ron's thermal chapter. I am expecting to give you my paragraphs within the next few days.
Kim

>>> Ron Parkhill 04/10 3:16 PM >>>
Attached is the draft SER with open items identified for thermal.

B/53

nm55

From: Tim McGinty
To: David Tang, Donald Carlson, Elaine Keegan, Kimb...
Date: Mon, Apr 17, 2000 5:43 PM
Subject: Fwd: One Day Delay in Submittal of Responses to UMS-MY Telecon RAIs

see attached.

Tim

CC: Earl Easton, James Randall Hall

B/54

From: "Tom Thompson/NAC_Intl" <TThompson@nacintl.com>
To: OWFN_DO.owf1_po(TJM1) — NMSS
Date: Mon, Apr 17, 2000 5:37 PM
Subject: One Day Delay in Submittal of Responses to UMS-MY Telecon RAIs

Tim,

NAC appreciated the input in the telecon earlier this afternoon. After review, we concurred that we could improve the submittal, so we undertook to do so.

We have addressed the hold-down spring concern in the Tech Specs (2 places).

The revision of Chapter 6 turned out to be more involved than initially thought. Holger provided some additional text to address the clarifications discussed with Dr. Carlson. The changes involve Chapter 6 text, as well as the List of Effective Pages. Together with QA (Howard Smith) we have determined that we need to make sure the changed pages and LOEP are properly done rather than rush it out of here tonight. Therefore, we will FED-X it out tomorrow for delivery on Wednesday morning. I hope that this will not be a problem for you and the staff.

Tom

CC: "Jim Ballowe/NAC_Intl" <JBallowe@nacintl.com>, "Da...

B/55

Tim,

NAC appreciated the input in the telecon earlier this afternoon. After review, we concurred that we could improve the submittal, so we undertook to do so.

We have addressed the hold-down spring concern in the Tech Specs (2 places).

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Tom

File: G:\newprint.mpp [Microsoft Project 98]
Date: 4/10/00

Print Date
Sep 26 '00
10:02 AM

UNSCHEDULED CASEWORK

ID	Docket	TAC	Task Name	Type	Prior	Date	Finish	Completed	Duration	PM	Schd
2			Part 72		0	Oct 30 '96	Sep 30 '01	No	1797 days		Yes
102	72-1015	L22979	NAC UMS	New	2	Aug 29 '97	Nov 01 '99	No	795 days	McGinty	Yes
103			Receive Application		0	Aug 29 '97	Aug 29 '97	Yes	0 days		No
104			Issue 1st RAI		0	Oct 30 '98	Oct 30 '98	Yes	0 days		No
105			Applicant Respondir		0	Oct 31 '98	Jan 29 '99	Yes	91 days		No
106			Receive Response t		0	Jan 29 '99	Jan 29 '99	Yes	0 days		No
107			Tech Review		0	Jan 30 '99	May 13 '99	Yes	104 days		No
108			TI		0	May 13 '99	May 13 '99	Yes	0 days		No
109			Prepare RAI		0	May 14 '99	May 27 '99	Yes	14 days		No
110			Issue 2nd RAI		0	May 27 '99	May 27 '99	Yes	0 days		No
111			Applicant Respondir		0	May 28 '99	Aug 16 '99	Yes	81 days		No
112			Receive Response t		0	Aug 16 '99	Aug 16 '99	Yes	0 days		No
113			Issue User Need Me		0	Aug 30 '99	Aug 30 '99	Yes	0 days		No
114			Tech Review		0	Aug 17 '99	Sep 30 '99	Yes	45 days		No
115			TI		0	Sep 30 '99	Sep 30 '99	Yes	0 days		No
116			Prepare SER/COC		0	Sep 30 '99	Nov 01 '99	Yes	33 days		No
117			Issue Draft SER/CO		0	Nov 01 '99	Nov 01 '99	Yes	0 days		No
398	72-1015	L22979	NAC UMS Storage, MY I	Amend	3	Jul 16 '99	Sep 15 '00	No	427 days	McGinty	Yes
399			Receive Application		0	Jul 16 '99	Jul 16 '99	No	0 days		No
400			Start Review		0	Sep 23 '99	Sep 23 '99	No	0 days		No
401			Tech Review		0	Sep 23 '99	Nov 30 '99	No	69 days		No
402			TI		0	Nov 30 '99	Nov 30 '99	No	0 days		No
403			Prepare RAI		0	Nov 30 '99	Dec 08 '99	No	9 days		No
404			Issue RAI		0	Dec 21 '99	Dec 21 '99	No	0 days		No
405			Applicant Respondir		0	Dec 21 '99	Feb 04 '00	No	46 days		No
406			Receive Response		0	Feb 04 '00	Feb 04 '00	No	0 days		No
407			Tech Review		0	Feb 07 '00	Mar 08 '00	No	31 days		No
408			TI		0	Mar 08 '00	Mar 08 '00	No	0 days		No
409			Prepare RAI		0	Mar 08 '00	Jun 21 '00	No	106 days		No
410			Issue RAI		0	Jun 29 '00	Jun 29 '00	No	0 days		No
411			Applicant Respondir		0	Jun 29 '00	Jul 27 '00	No	29 days		No
412			Receive Response		0	Jul 27 '00	Jul 28 '00	No	2 days		No
413			Tech Review		0	Aug 07 '00	Aug 18 '00	No	12 days		No
414			TI		0	Aug 18 '00	Aug 18 '00	No	0 days		No
415			Prepare CoC		0	Aug 18 '00	Sep 05 '00	No	19 days		No
416			Issue CoC		0	Sep 15 '00	Sep 15 '00	No	0 days		No

W/25

-Give to Tech Review

Sorted by Priority, Receipt Date and Name

-Need Signature
-On Hold
-Need Schedule

Print Date

UNSCHEDULED CASEWORK

Sep 26 '00
10:02 AM

Grp	Str	Crit	Shield	Therm	Cont	Mat	Notes	Backup
TRA	Tang	Carlson	Keegan	Parkhill	Parkhill	Gruss/Hornseth		O'Connor
TRA	Tang	Carlson	Keegan	Parkhill	Parkhill	Gruss		O'Connor

-Give to Tech Review

Sorted by Priority, Receipt Date and Name

-Need Signature
-On Hold
-Need Schedule

File: C:\Project98\Part72.mpp [Microsoft Project 98]
Date: 4\10\2000

PART 72 CASEWORK

Sep 26 '00

Docket	Case	TAC	Type	Finish	PM	Strt	Crit	Shield	Therm	Cont	Mat
72-1015	NAC UMS	L22979	New	Nov 01 '99	McGinty	Tang	Carlson	Keegan	Parkhill.	Gruss	Gruss
	Receive Applicatio			Aug 29 '97							
	Issue 1st RAI			Oct 30 '98							
	Applicant Respond			Jan 29 '99							
	Receive Response			Jan 29 '99							
	Tech Review			May 13 '99							
	TI			May 13 '99							
	Prepare RAI			May 27 '99							
	Issue 2nd RAI			May 27 '99							
	Applicant Respond			Aug 16 '99							
	Receive Response			Aug 16 '99							
	Issue User Need M			Aug 30 '99							
	Tech Review			Sep 30 '99							
	TI			Sep 30 '99							
	Prepare SER/COC			Nov 01 '99							
	Issue Draft SER/C(			Nov 01 '99							

Sorted by Name

B/53

From: Ron Parkhill
To: David Tang, Donald Carlson, Earl Easton, Elaine. NMSS
Date: Mon, Apr 10, 2000 3:16 PM
Subject: NAC-UMS MY Thermal & Confinement Draft SER

Attached is the draft SER with open items identified for thermal.

B/58

4.0 Thermal Evaluation

The thermal review verifies that the cask and fuel material temperatures of the NAC-UMS system for the Maine Yankee site specific spent fuel will remain within the allowable values or criteria for all design conditions.

4.1 Maine Yankee Site Specific Fuel (MYSSF)

The maximum decay heat load of the MYSSF is limited to 23 kW per canister which is the same as the NAC-UMS design basis. Besides the standard 14 X 14 Combustion Engineering fuel assembly composed of intact fuel rods and non-stardard variations thereof, the MYSSF includes non-standard arrangements of damaged fuel (with defects greater than hairline cracks or pinholes), consolidated fuel, and high burnup (>45<50 GWD/MTU) fuel. The aforementioned non-standard damaged and high burnup fuels are loaded in the perimeter of the canister's basket with damaged and consolidated fuel assemblies being canned and located in any one of four perimeter corner locations, respectively. The Maine Yankee specific fuel configurations that were analyzed include:

1) Two consolidated fuel assemblies consisting of a 17 X 17 lattice with 4 stainless steel support rods. One has 283 fuel rods and the other has 172 fuel rods. Remaining locations are either empty or contain stainless steel dummy rods.

2) Standard MYSSF with a control element assembly inserted.

3) Standard MYSSF with damaged rods removed and replaced with stainless steel rods, solid zirconium, or 1.95% enriched fuel rods.

4) Standard MYSSF with removed burnable poison rod and replaced with hollow Zircaloy tubes.

5) Standard MYSSF with in-core instrument thimbles stored in the center guide tube.

6) Standard MYSSF that has variable radial enrichment and axial blankets.

7) Standard MYSSF that has some fuel rods removed.

8) Standard MYSSF that has damaged fuel rods.

9) Standard MYSSF that has damage to the cage (fuel rods not damaged).

10) Two failed fuel rod latices, one being a 9 X 9 array having the same dimensions as a standard fuel assembly and the other being a previously used fuel assembly lattice which contains damaged fuel rods.

11) Standard MYSSF that has damaged fuel rods stored in their guide tubes.

12) Standard MYSSF that has a burnup greater than 45 GWD/MTU but less than 50 GWD/MTU.

It should be noted that the Maine Yankee spent fuel inventory is approximately 1434 assemblies and that in addition to the above configurations, the inventory includes a large percentage of intact fuel assemblies.

4.2 Spent Fuel Cladding

The staff verified that the cladding temperatures for storage of the Maine Yankee fuel are below the temperature which would preclude cladding damage that could lead to gross rupture by either a direct review of the calculated temperature or verification that the Maine Yankee heat load was bounded by that of the NAC-UMS.

The NAC-UMS temperature limits for dry storage of zircaloy fuels are based on the technical justification provided in PNL-6189 entitled Recommended Temperature Limits for Dry Storage of Spent Light-Water Zircalloy Clad Rods in Inert Gas and remain unchanged for the Maine Yankee fuel from the values determined with burnups from 45 GWD/MTU and below. Using the same methodology, NAC established fuel clad temperature limits for a burnup to 50 GWD/MTU, and similarly imposed a 5% margin on the calculated value to establish the cladding temperature limit.

For purpose of performing a bounding thermal analysis, the spent fuel was assumed to be rubblized if the cladding damage was more than hairline cracks or pinhole leaks or, for high burnup fuel, if the cladding oxide layer was more than 80 microns thick. Any rod whose cladding exceeded either of the aforementioned conditions would have its entire assembly placed into a can to contain any loose debris. For bounding analysis purposes, the entire assembly in the can was assumed to become rubblized. As an alternative, the applicant could have chosen to demonstrate that the damaged spent fuel would have retained its structural integrity during all design basis conditions. This approach follows the interium staff guidance of ISG-1, Rev. 0 and ISG-11, Rev.1.

PLACE HOLDER FOR KIM's Writeup on HIGH BURNUP FUEL CLADDING

4.3 Maine Yankee Storage Cask Thermal Design Verification

Regarding the Maine Yankee spent fuel configurations as described in the above Paragraph 4.1, the staff confirmed that for the following configurations their associated decay heat load was bounded by that of the standard fuel assemblies, the heat transfer mechanisms were sufficient to keep the various material temperatures below the allowable temperature limits, and their location within the basket:

4.1.1 Consolidated Fuel (must be canned and loaded in any one of the four perimeter corner positions; only one loaded per canister);
4.1.2 Standard Fuel Assembly with CEA (must be loaded into a longer Class 2 canister; all other non-CEA must <u>not</u> be loaded in a Class 2 canister);
4.1.3 Standard Fuel Assembly with damaged rods removed and replaced with either stainless steel dummy rods, solid zirconium rods, or 1.95% enriched rods (can be loaded in any location);

> ***OPEN ITEM 1:*** *For the 1.95% enriched rods, Section 4.5.1.1.3 needs to clearly identify that the heat load of these added rods does not add more heat to the*

assembly. This can be done implicitly by indicating the relative burnups and enrichments between the assembly and the added fuel rods.

4.1.4 Use of Hollow Zircaloy Tubes to Replace Removed Burnable Poison Rods (must be located in corner positions of the basket's perimeter);
4.1.5 Standard Fuel with In-core Instrument Thimbles in Center Guide Tube (can be loaded in any location);
4.1.6 Standard Fuel with Variable Enrichment and Axial Blankets (can be loaded in any location);

OPEN ITEM 2: *Since these fuels have a variable radial enrichment, NAC needs to clarify what enrichment would be used to determine the cooling time from technical specification Tables 12B2-8 AND 12B2-9.*

4.1.7 Standard Fuel with Removed Fuel Rods (must be canned and located in the corner perimeter positions of the basket);
4.1.9 Standard Fuel with Damaged Lattice (NAC is proposing that this fuel can be loaded in any location);

OPEN ITEM 3: *the damage needs to be quantified in Section 4.5.1.1.9 and the terminology of "damaged fuel lattices" needs to be clarified in Sections 4.5.1.1.9 & 4.5.1.1.10 to describe exactly what parts of the fuel assembly are damaged, e.g. grid assembly.*

OPEN ITEM 4: *The heat transfer evaluation for intact fuel is only applicable for a fuel assembly whose configuration is maintained for all design basis loadings. NAC needs to quantify the extent of damage to the lattices and provide assurance that the configuration of the assembly is maintained with DAMAGED lattices or analyze the deformed configuration. Structural reviewer needs to ensure that buckling evaluation remains valid when considering condition of lattices. Note that NAC is currently classifying these assemblies as intact fuel.*

4.1.10 Two Failed Fuel Lattices with some Damaged Fuel Rods (must be canned and located in four corner positions of basket's perimeter);
4.1.11 Assemblies with Damaged Fuel Rods Inserted in Guide Tubes (must be canned and located in four corner positions of basket's perimeter);

OPEN ITEM 5: *Section 4.5.1.1.11 needs to be revised to state that the damaged rods that are inserted in the guide tubes come from the same assembly, such that the final reconfigured assembly has no more rods than the original assembly and consequently no additional heat load.*

4.1.12 High Burnup Fuel, greater than 45 but less than 50 GWD/MTU, is to be loaded in any one of the basket perimeter positions providing the cladding oxide layer thickness is equal to or less than 80 microns. If greater than 80 microns the fuel must be canned and located in the four corner perimeter positions.

For standard fuel assemblies with damaged fuel rods (Item 4.1.8 from above), the applicant chose to do a bounding analysis assuming rubblization of the entire assembly in the can. In

lieu of this approach, the applicant could have attempted to demonstrate the structural integrity of the entire fuel assembly or the structural integrity of the assembly with rubblization of only the damaged rods. The applicant analyzed the consequences of two rubblization schemes, one with 50% compaction of the debris in the can and another with 100% compaction of the debris in the can for normal conditions of storage. To be conservative, the debris was assumed begin at the bottom of the active fuel region rather than the bottom of the fuel can. For the 100% compaction case, the results indicate a reduction in maximum material temperatures because the compacted debris is located below the radial centerline of the canister where the maximum temperatures occur. For the 50% compaction case, only a 4°F increase above the normal condition temperature of the fuel cladding and heat transfer disks was calculated. Similarly, only a 5°F increase was determined for the structural support disks for the normal conditions of transport. Since the margin of safety between the calculated temperature and the material temperature limit for each of these components is greater than 35°F for the normal condition of storage, the staff finds this minor temperature increase acceptable. For the other design conditions of off-normal and accident, the margins of safety are larger because of higher allowable temperatures for short term events, and consequently the staff finds that a small rise in temperature of the aforementioned components will have no significant impact. For storage, the cask/canister is designed not to tip over, eventhough it is analyzed to withstand the associated structural loadings. Since the canister is designed to prevent tip over for all design basis conditions, the staff finds that the assumption of rubblizied fuel only falling to the bottom of the canister is justified for storage.

***OPEN ITEM 6:** NAC needs to justify using an assembly heat load of 0.958kW when the maximum heat load for a canned assemby is 1.05kW which coincides for a high burnup assembly with a cladding oxide layer greater than 80 microns.*

To ensure that rubblization of the spent fuel is not a problem during transport, the staff requested the applicant to evaluate the consequences of transporting the rubblized damaged spent fuel. The staff was concerned with the possible adverse impact that the rubblized fuel would have if it were located at the radial centerline of the canister or if were located at the end of the canister near the seals of the transportation cask. This issue could possibly result in a minimum storage time prior to transport. Also, loose fuel could impose additional dynamic loadings during transport.

***OPEN ITEM 7:** NAC has been requested to evaluate the consequences of transporting the rubblized damaged spent fuel and identify any adverse impact that they may have on storage, such as requiring a minimum storage time prior to transport.*

4.4 Maine Yankee Storage Canister Loading Arrangement

The Maine Yankee spent fuel storage cask can be loaded with <u>standard</u> fuel which has a preferential loading of hotter assemblies in the center for spent fuel with cooling times of 7 years or less, and no restriction for standard fuel cooled more than 7 years. This configuration is in agreement with that approved via review of the NAC-UMS application.

***OPEN ITEM 8:** For Tables 12B2-8 and 12B2-9 for "Standard" configuration, NAC*

needs to clarify that preferential loading is applicable for fuel cooled 7 years or less, with the hottest fuel located in the center of the basket.

Also, the Maine Yankee spent fuel storage cask can be preferentially loaded with canned assemblies located in the four perimeter corner positions of the basket, and/or preferentially loaded with assembly heat loads of 0.958 kW or 1.05 kW located in the 12 perimeter positions of the basket. To compensate for the higher assembly heat loads on the perimeter, the interior heat loads are limited to preserve the overall heat load rating of the canister and to meet the spent fuel cladding temperature limits. The applicant provided the results of a parametric study which compared a loading configuration with all fuel assemblies having the same heat load, to a loading configuration with the same total basket heat load but a larger perimeter heat load. The results of this parametric study demonstrate that maximum cladding temperature in the basket for the higher perimeter heat load configuration was less than the uniformly loaded basket. The loading configurations for Maine Yankee are identified and controlled via Technical Table 12B2-6, Maine Yankee Site Specific Fuel Population; Table 12B2-7, Maine Yankee Site Specific Fuel Limits; Table 12B2-8, Loading Table for Maine Yankee CE 14 X 14 Fuel With No Non-Fuel Material; and Table 12B2-9, Loading Table for Maine Yankee CE 14 X 14 Fuel Containing CEA Cooled to Indicated Time. For Table 12B2-8 the staff derived the heat loads associated with various fuel burnups, enrichments and cooling times to ensure the resulting heat loads did not exceed the limits established in SAR Chapter 4.

***OPEN ITEM 9**: For Table 12B2-6 the identification of what fuels are required by the design basis to be canned should be added as a column to this table. For example, "canned" should be added next to consolidated fuel, damaged fuel, and burnups between 45 and 50 GWD/MTU with cladding oxidation greater than 80 microns.*

***OPEN ITEM 10**: Regarding Table 12B2-8 additional information on how this table is to be utilized needs to be added;*

(a) The columns for Standard, Pref(0.958) and Pref(1.05) appear to be mutually exclusive, meaning that fuel from one cannot be loaded with the fuel cooled in accordance with the other column, however there is no note documenting this limitation.

(b) Equal to or less than signs need to preface the burnup headings

(c) Cooling times for Standard, 50 GWD/MTU fuel should not be allowed

***OPEN ITEM 11**: Table 12B2-9 just contains redundant information and should be replaced with a note on Table 12B2-8, that the Standard fuel cooling times also apply to fuel with CEAs inserted.*

With appropriate resolution of the aforementioned open items, the staff finds that the thermal evaluation supports a conclusion that the Maine Yankee site specific spent fuel can be stored such that all material temperature limits are not exceeded for normal, off-normal and accident conditions.

7.0 Confinement Evaluation

The pressure evaluation of the standard NAC-UMS storage canister was determined to be bounding since the original confinement evaluation assumed a burnup of 55 GWD/MTU and since some of the fuel being stored for Maine Yankee is damaged those damaged rods would be depressurized prior to storage. Also, since the confinement boundary is leak tested to leak tight criteria, no additional release from the Maine Yankee site specific fuel needs to be considered. Therefore, the original confinement evaluation is bounding for the Maine Yankee site specific fuel.

From: Tim McGinty
To: Ron Parkhill
NMSS
Date: Thu, Apr 6, 2000 11:18 AM
Subject: Fwd: ANSYS input/output files for the model depicted in Figure 4.5.1.1-2 (Maine Yankee Three-Dimensional Periodic Canister Internal Model)

Ron,

Attached is the model that you requested me to get from NAC last night. I hope you can handle "zipped" files. I know we can do that here, but if it were me I would probably have to see Bill Ward for some help in unzipping them (the files, that is).

Also, the other thermal calculations are the supporting information on the loading of lower heat loads. This I did not mention at our morning meeting, they are asking for the partial heat loads in order to get longer time frames in the specs. This will be in the 4/17 submittal, and will need a long hard look from us. I asked them to get us the actual thermal calcs to us as soon as possible, in order to look at that as much as we can before we have to consider how it has been addressed in the SAR and Tech Specs.

Tim

B/59

Table 1-1 Terminology (Continued)

Damaged Fuel (Failed Fuel)	A fuel assembly or fuel rod with known or suspected cladding defects greater than pinhole leaks or hairline cracks. Damaged Fuel must be placed in a Maine Yankee Fuel Can.
High Burnup Fuel	A fuel assembly having a burnup between 45,000 and 50,000 MWD/MTU, which must be preferentially loaded in periphery positions of the basket. Intact High Burnup Fuel having a cladding oxide layer thickness of 80 microns or less, as determined by measurement and statistical analysis, may be stored as intact fuel. High Burnup Fuel having a cladding oxide layer thickness greater than 80 microns is stored as damaged fuel. - What about accidents?
Site Specific Fuel	Spent fuel configurations that are unique to a site or reactor due to the addition of other components or reconfiguration of the fuel assembly at the site. It includes fuel assemblies which hold nonfuel-bearing components, such as control components or instrument and plug thimbles, or which are modified as required by expediency in reactor operations, research and development or testing. Modification may consist of individual fuel rod removal, fuel rod replacement of similar or dissimilar material or enrichment, the installation, removal or replacement of burnable poison rods, or containerizing damaged (failed) fuel. Site specific fuel includes irradiated fuel assemblies designed with variable enrichments and/or axial blankets, fuel that is consolidated and fuel that exceeds design basis fuel parameters.

B/60

Table 2.1.3.1-1 Maine Yankee Site Specific Fuel Population

Site Specific Spent Fuel Configuration[1]	Number of Assemblies[2]	Canister Loading Position
Inserted Control Element Assembly (CEA)[3,4,5]	168	Any
Inserted In-Core Instrument (ICI) Thimble	138	Any
Consolidated Fuel CANNED	1	Corner[6,7,8]
Fuel Rod Replaced by Rod Enriched to 1.95 wt.%	8	Any
Fuel Rod Replaced by Stainless Steel Rod or Zircaloy Rod	18	Any
Fuel Rods Removed	10	Corner
Variable Enrichment	72	Any
Variable Enrichment and Axial Blanket	68	Any
Burnable Poison Rod Replaced by Hollow Zircaloy Rod	80	Corner
Damaged Fuel[9,10] CANNED	12	Corner
Burnup between 45,000 and 50,000 MWD/MTU CANNED IF > 80 MICRONS	90	Periphery[11]

1. The total number of fuel assemblies in inventory is approximately 1,434.
2. The number of fuel assemblies in some categories may vary depending on future fuel inspections and/or Engineering Evaluations.
3. A fuel assembly with an inserted CEA must be loaded in a Class 2 canister.
4. A fuel assembly without an inserted CEA must not be loaded in a Class 2 canister.
5. CEAs may not be inserted in damaged fuel assemblies, consolidated fuel assemblies or assemblies with irradiated stainless steel replacement rods.
6. Basket corner positions are positions 3, 6, 19, and 22 in Figure 12B2-1. Corner positions are also periphery positions.
7. Only one Consolidated Fuel lattice may be loaded in any Transportable Storage Canister.
8. Consolidated Fuel must be loaded in a Maine Yankee fuel can.
9. All fuel classified as damaged must be placed in a Maine Yankee fuel can, including fuel assemblies with damaged fuel rods or poison rods inserted in guide tubes.
10. All spent fuel, including that held in a Maine Yankee fuel can, must conform to the loading limits presented in Tables 12B2-8 and 12B2-9 for cool time.
11. Basket periphery positions are positions 1, 2, 3, 6, 7, 12, 13, 18, 19, 22, 23, and 24 in Figure 12B2-1. Periphery positions include the corner positions.

4.5 Thermal Evaluation for Site Specific Spent Fuel

This section presents the thermal evaluation of fuel assemblies or configurations, which are unique to specific reactor sites or which differ from the UMS® Storage System design basis fuel. These site specific configurations result from conditions that occurred during reactor operations, participation in research and development programs, and from testing programs intended to improve reactor operations. Site specific fuel includes fuel assemblies that are uniquely designed to accommodate reactor physics, such as axial fuel blanket and variable enrichment assemblies, and fuel that is classified as damaged. Damaged fuel includes fuel rods with cladding that exhibit defects greater than pinhole leaks or hairline cracks.

Site specific fuel assembly configurations are either shown to be bounded by the analysis of the standard design basis fuel assembly configuration of the same type (PWR or BWR), or are shown to be acceptable contents by specific evaluation.

4.5.1 Maine Yankee Site Specific Spent Fuel

The standard spent fuel assembly for the Maine Yankee site is the Combustion Engineering (CE) 14 x 14 fuel assembly. Fuel of the same design has also been supplied by Westinghouse and by Exxon. The standard 14 x 14 fuel assembly is included in the population of the design basis PWR fuel assemblies for the Universal Storage System (See Table 2.1.1-1). The maximum decay heat for the standard Maine Yankee fuel is the design basis heat load for the PWR fuels (23 kW total, or 0.958 kW per assembly). This heat load is bounded by the thermal evaluations in Sections 4.4 for the normal conditions of storage and Chapter 11 for off-normal and accident conditions.

Some Maine Yankee site specific fuel has a burnup greater than 45,000 MWD/MTU, but less than 50,000 MWD/MTU. This fuel is evaluated in Section 4.5.1.2. As shown in that section, loading of fuel assemblies in this burnup range is subject to preferential loading in designated basket positions in the Transportable Storage Canister and certain fuel assemblies in this burnup range must be loaded in a Maine Yankee fuel can.

The site specific fuels included in this evaluation are:

1. Consolidated fuel rod lattices consisting of a 17 x 17 lattice fabricated with 17 x 17 grids, 4 stainless steel support rods and stainless steel end

positions at the periphery of the fuel basket as shown in Figure 12B2-1. The heat load for each damaged fuel assembly is limited to the design basis heat load 0.958 kW (23 kW/24).

A steady-state, thermal analysis is performed using the three-dimensional canister model described in Section 4.4.1.2 simulating 100% failure of the fuel rods, fuel cladding, and guide tubes of the damaged fuel held in the Maine Yankee fuel can. The canister is assumed to contain twenty (20) design basis PWR fuel assemblies and damaged fuel assemblies in fuel cans in each of the four corner positions.

Two debris compaction levels are considered for the 100% failure condition: (Case 1) 100% compaction of the fuel rod, fuel cladding, and guide tube debris resulting in a 52-inch debris level in the bottom of each fuel can, and (Case 2) 50% compaction of the fuel rod, fuel cladding, and guide tube debris resulting in a 104-inch debris level in the bottom of each fuel can. The entire heat generation rate for a single fuel assembly (i.e., 0.958 W) is concentrated in the debris region with the remainder of the active fuel region having no heat generation rate applied. To ensure the analysis is bounding, the debris region is located at the lower part of the active fuel region in lieu of the bottom of the fuel can. This location is closer to the center of the basket where the maximum fuel cladding temperature occurs. The effective thermal conductivities for the design basis PWR fuel assembly (Section 4.4.1.5) are used for the debris region. This is conservative since the debris (100% failed rods) is expected to have higher density (better conduction) and more surface area (better radiation) than an intact fuel assembly. In addition, the thermal conductivity of helium is used for the remainder of the active fuel length. The results of the thermal analyses performed for 100% fuel rod, fuel cladding, and guide tube failure are:

Description	Maximum Temperature (°F)			
	Fuel Cladding	Damaged Fuel	Support Disk	Heat Transfer Disk
Case 1 (100% Compaction)	654	672	598	594
Case 2 (50% Compaction)	674	594	620	616
Design Basis PWR Fuel	670 46	N/A	615 35	612 38
Allowable	716	N/A	650	650

Boundary conditions corresponding to the normal condition of storage are used at the outer surface of the canister model (see Section 4.4.1.2). A steady-state thermal analysis is performed.

4.5.1.1.11 Assemblies with Damaged Fuel Rods Inserted in Guide Tubes

Similar to fuel assemblies that have damaged fuel rods, the fuel assemblies that have their damaged fuel rods stored in their guide tubes are placed in Maine Yankee fuel cans and their loading positions ~~are restricted~~ to the four corner fuel tubes in the basket. Storing their fuel rods in the guide tubes of ~~a~~ the same fuel assembly slightly increases the axial conductance of the fuel assembly (helium replaced by solid material). ~~The design basis heat load bounds the heat load for these assemblies.~~ Therefore, the thermal performance of these fuel assemblies is bounded by that of the standard fuel assemblies.

Rods from same assembly?

As needed it implies rods could come from another assembly.

Also for fuels with ~~radial~~ variable (4.5.1.1.6) radial enrichments – what enrichment is to be used in Table 12.B2-8, & 12.B2-9?

From: Tim McGinty —NMSS
To: internet:SWhitsett@nacintl.com, internet:TThompso...
Date: Fri, Mar 31, 2000 1:56 PM
Subject: Various Issues on NAC reviews

1) As a follow-up to the many issues discussed during our conversation on 3/29, pertaining to fuel assemblies with damaged or missing hardware components: The reason why we were surprised when it was mentioned that there were many of these assemblies that you did not intend to can, at least according to what we heard, is Tech Spec Table 12B2-7, item B.5.c. If your intent was otherwise than what was submitted, or you intend to move that provision to specify that you did not intend to can these types of assemblies, we will need to communicate amongst the staff, and again with you.

2) Kim Gruss will be out of the office for a week starting next Friday. While you mentioned that you would send in the NAC-MPC for submittal for morning arrival on April 5, any additional time we can get it to her for review would be appreciated. I suggest a fax that I can docket and provide to Kim prior to the QA review, if at all possible.

3) Have you decided if you are going to supplement the current NAC Maine Yankee amendment application to allow partial heat loadings (and thus longer times in the tech specs)? If so, when will you forward the early info that I can docket and get to Ron regarding the analysis you have done on this?

4) On the NAC-LWT high burnup submittal, a 4/10 submittal jeopardizes our ability to approve it by the end of April. When I put the schedule together, without a formal RAI and the time that takes, I allotted and informed you that we would need a response in one week in order to meet your requested approval date. Based on your response date (and I know there is a lot of work you are doing, and it will also result in a lot of work here after we get it), it looks like the best we can do is move our approval date back two weeks also. So, we plan on trying to meet an approval date of May 12. I have spoken to my management about this. If May 12 is something that you cannot live with, then we'll have to have a conference call with my management.

5) I am getting questions for scheduling purposes on both the NAC-UMS transport review, and the NAC-MPC CY amendment. Please look into providing me your latest submittal schedule for these, and how they fit into your desired prioritization (like which one do you want us to work first with the NAC team). Please note that the team has a near-term large scale, but relatively short-length (one month, not full time) effort to resolve public comments on the NAC-UMS also coming up.

That's about it. No real new issues over the last couple of days, which I'm sure you are glad of. If you want to talk, I'm here.

Tim

CC: David Tang, Donald Carlson, Kimberly Gruss, Ron...

B/61

From: Lawrence Kokajko
To: Earl Easton, James Randall Hall, Tim McGinty NMSS
Date: Thu, Mar 30, 2000 7:01 AM
Subject: Re: NAC-UMS (Maine Yankee) and NAC-LWT High Burnup Review Schedules

As I indicated earlier, I am in agreement with the delay on both matters. LEK

>>> Tim McGinty 03/29 2:28 PM >>>
Section Chiefs:

NAC has just informed my of their projected response times for issues outstanding for the subject reviews. Their projected response time is longer than I had hoped:

1) Maine Yankee Fuel Amendment for the NAC-UMS:
April 4 for morning delivery on April 5, 2000.

Our Op Plan committment for the Maine Yankee Review is April, 2000. Considering one week for a final review and finalized SER from the reviewers, one week to prep it and one week to get it out, meeting the Op Plan date is still possible. But, I think we should move the Op Plan date back one month (May) now.

Justification: Original schedule was based on a one-RAI review with response due by 1/29/00. The response was one week later. After a mid-February public meeting and some hand-wringing, a March 17th submittal was received primarily to address High Burnup fuel issues and returning to the current ISG-1 definition of damaged fuel. Now, after the team has identified their final issues, there is another submittal coming on April 5th. While we can still meet the Op Plan, I don't see a down-side to moving the Op Plan date (other than going to the alter to move the Op Plan date). An approval date has not been committed to on the public record, beyond that we anticipate completing rulemaking in time to support an April 16, 2001 initial loading date at Maine Yankee. This, we would still meet.

There have just been enough issues late in this review to justify taking a little more time to make sure that it is right.

2) HB Robinson High Burnup Fuel Rod Amendment for the NAC-LWT:
April 7 for morning delivery on April 10, 2000.

Push back approval date two weeks, to May 12, 2000.

Justification: This has been an expedited review from the word go (submittal on 2/11/00). There has been no formal RAI because of the tight schedule. The staff communicated their issues to NAC, on-time, in accordance with the established internal schedule (3/24). NAC is taking 11 days longer to respond than the one week Randy and I originally notified them that they would have to meet in order to get it out by the end of April (per their request). While the original schedule remains attainable, I think a corresponding delay is warranted. There were some major thermal issues identified, and Chris Bajwa will need at least a week or 2 to make sure everything is right (including the strong possibility of eliciting another NAC response). From the completion of technical review, taking two weeks to get the product out is not unreasonable.

I would like to discuss these two topics at your earliest convenience.

Tim

CC: Bernard White, Charles Interrante, Christopher B...

B/62

From: Tim McGinty - NMSS
To: internet:"CLindner@nacintl.com", internet:"SWhits...
Date: Wed, Mar 29, 2000 1:22 PM
Subject: NAC MY Fuel Specs

Curt, Tom and/or Steve:

Another two topics to discuss and ponder for Maine Yankee:

1) Page 4.5-10 discusses damaged fuel rods inserted in guide tubes. Ron observed that it does not state whether the rods that are placed in guide tubes are those that are removed from that same assembly (he thought he remembered that, but you have not stated that). If not, how do we know how to treat the assembly in terms of the loading Tables 8 and 9. How do we know, or how important is it, if you take rods from a thermally hotter assembly and place them in the guide tubes of another assembly.

I note that the paragraph starts out with the statement "Similar to fuel assemblies that have damaged fuel rods." I also note that these are to be canned. And, when I went to your damaged fuel rod analysis (Section 4.5.1.1.8), it also appears that you took into account the placement of damaged fuel rods in guide tubes in terms of that "rubbilization" thermal analysis.

I read somewhere that "up to two damaged fuel rods" will be placed in guide tubes, but I see no such limitation in the tech specs.

2) How do Tables 12B2-8 and -9 apply to assemblies that have variable enrichments or annular axial end blankets? They have enrichments greater than 3.7, and thus go beyond the tables. I see that your criticality analysis showed, with respect to design bases fuel assemblies, why these are OK from a keff perspective when compared to the contents listed in Tables 12B2-1, -2 and -4. But I'm confused where these assemblies fit in. Are they site-specific Maine Yankee assemblies, or original UMS assemblies, or a combination of both?

Please cogitate on these two points, and plan on discussing with Ron, Don and I at your earliest convenience.

We are on for a 2:30 call. Myself, Earl Easton, Randy Hall, Jim Lyons (acting Wayne Hodges) and Wayne Hodges (acting Bill Brach). Purpose: to give you feedback on what you can expect from us with regards to UMS public comment responses for increasing corner position sizes and loading times. You won't be surprised there. Then, if your serious about wanting to get this done, we are willing to discuss how these types of changes may in fact be entertained. Anyhow, in fairness, I felt that it is important to give you some quick feedback on this topic to help lay out the overall roadmap.

Tim

CC: Donald Carlson, Ron Parkhill

B/63

From: Ron Parkhill
To: Kimberly Gruss
Date: Tue, Mar 28, 2000 4:01 PM
Subject: MY Cladding Temperature Limits

nmss

You ask, I obey. See Attached

B/64

4.2 Spent Fuel Cladding

The staff verified that the cladding temperatures for storage of the Maine Yankee fuel are below the temperature which would preclude cladding damage that could lead to gross rupture by either a direct review of the calculated temperature or verification that the Maine Yankee heat load was bounded by that of the NAC-UMS.

The NAC-UMS temperature limits for dry storage of zircaloy fuels are based on the technical justification provided in PNL-6189 entitled Recommended Temperature Limits for Dry Storage of Spent Light-Water Zircalloy Clad Rods in Inert Gas and remain unchanged for the Maine Yankee fuel from the values determined with burnups from 45 GWD/MTU and below. Using the same methodology, NAC established fuel clad temperature limits for a burnup to 50 GWD/MTU, and similarly imposed a 5% margin on the calculated value to establish the cladding temperature limit.

For purpose of performing a bounding thermal analysis, the spent fuel was assumed to be rubblized if the cladding damage was more than hairline cracks or pinhole leaks or, for high burnup fuel, if the cladding oxide layer was more than 80 microns thick. Any rod whose cladding exceeded either of the aforementioned conditions would have its entire assembly placed into a can to contain any loose debris. For bounding analysis purposes, the entire assembly in the can was assumed to become rubblized. As an alternative, the applicant could have chosen to demonstrate that the damaged spent fuel would have retained its structural integrity during all design basis conditions. This approach follows the interium staff guidance of ISG-1, Rev. 0 and ISG-11, Rev.1.

From: Ron Parkhill - NMSS
To: "TThompson@nacintl.com"@GATED.nrcsmtp
Date: Mon, Mar 27, 2000 1:05 PM
Subject: Re: Call

OK by me

>>> "Tom Thompson/NAC_Intl" <TThompson@nacintl.com> 03/27 10:39 AM >>>
Let's make it tomorrow morning, say 9:00 AM if that meets your schedule? That's for the MY fuel can lid discussion and for the preferential loading discussion.

I'll have Steve call you today, since his discussion is separate from any of this, i.e. Public Comments on the UMS Rulemaking which closes on 4/5/00.

Tim McGinty <TJM1@nrc.gov>
03/27/00 09:50 AM

To: TThompson@nacintl.com
cc:
Subject: Call

Ron Parkhill has to leave today by 1:45. So, we can either try to talk at 1:00 today, or sometime tomorrow. Please let me know which you prefer.

Tim McGinty

B/65

From: Tim McGinty
To: Geoffrey Hornseth, Ron Parkhill
Date: Mon, Mar 27, 2000 9:51 AM
Subject: Re: Call NAC

nmss

Ok. I asked NAC to either move it up to 1:00 today, or hold off until tomorrow. I'll let you know when they get back to me.

>>> Ron Parkhill 03/27 6:13 AM >>>
Leaving at 1:45 today.

>>> Tim McGinty 03/26 9:38 AM >>>
Ron and Geoff,

NAC wasn't ready to talk on Friday, T. Thompson was too swamped. Meanwhile, Ron, I went through the tech specs and tables and came up with some Questions and scenarios to talk through with them to verify how they work.

How about talking to NAC Monday at 1:30?

Tim

B/64

D

From: David Tang
To: James Randall Hall
Date: Tue, Mar 21, 2000 10:47 AM
Subject: Re: Fwd: RE: Young's modulus for high burnup clads

Randy, I just talked to Tom Thompson and got the numbers I want to put in the SER input. I don't need the SAR change pages at this moment. Tom said that he would incorporate those values together with other change pages, if any, later on in a single submittal.

David

>>> James Randall Hall 03/21 9:48 AM >>>
David,

Tom Thompson from NAC called to say they have run the revised numbers and they look acceptable. He wanted to review them with you on the phone. I will be on another call and not available until about noon, but I think you can call him on your own if you want (770) 447-1144. As far as revising the SAR, I would like to see if any other team members have any additional questions before we ask NAC to submit a revised SAR with the new value for Young's modulus.

Randy

>>> David Tang 03/21 7:08 AM >>>
Thanks, Kim. We informed NAC of this value yesterday, which happens to coincide with the one used in the ISG-12 example problem (no temperature mentioned, though). As a result, NAC is revising its buckling analysis of the high burnup fuels. According to the message they left to Randy, their new results would still look good and should be conveyed to us sometime this morning.

David

>>> Kimberly Gruss 03/20 4:28 PM >>>
See attached email...

CC: Earl Easton, Steve O'Connor, Tim McGinty

B/67

From: Ron Parkhill
To: David Tang, Donald Carlson, Earl Easton, Elaine...
Subject: Re: Mike Meisner of Maine Yankee called Bill Brach

I believe that an engineering analysis for the MY 2A damaged fuel assemblies (this is refered to in the amendment as intact fuel with defects greater than pin hole leaks and hair line cracks) needs to be completed as part of our licensing review and not delayed, as proposed by Mr. Meisner, until after licensing is completed and performed under the 72.48 process by the utility for the following reasons:

1) 10CFR72.24 "Contents of an application" defines minimum information in a SAR to include an analysis and evaluation of the design and performance of structures, systems and components important to safety.... . With the proposed approach these analyses would not be performed until after the licensing action is completed.

2) Without these analyses performed as part of the licensing review I have no reasonable assurance that the fuel will remain in the configuration analyzed for the thermal review.

3) As proposed the utility would be responsibe for performing the engineering evaluation. The utility is not in possession of the storage canister design basis nor do I consider them to be compotent to do a valid evaluation without the assistance of the storage cask vendor.
This was discussed with Mr. Meisnor with the NAC team on Wed. and he said that he was opposed to commiting to obtaining NAC's involvement because he was concerned about excessive costs. Has anyone pointed out to him the costs associated with improper evaluations? (As I recall MY had some problems with an evaluation they and YAEC did in support

>>> Tim McGinty 02/24 5:17 PM >>>
Not long after we hung up with NAC, Mike Meisner of Maine Yankee called Bill Brach. Wayne Hodges, Bill and I spoke to him. He was distressed that we suggested a pin failure analysis, up front, for dealing with the 2A damaged fuel assemblies, and got away from the 50.59 approach discussed yesterday.

He understands the high burnup fuel criteria that we forwarded, and that will still be approached the same way that we discussed earlier today.

However, for damaged fuel, he made the pitch that a rigorous 50.59-like type analysis should be adequate if they commit to that (for determining whether an assembly must be canned or not). Wayne and Bill did not say no to this approach, although we did discuss the risks we feel are associated with this approach, at this point in time.

I wanted to inform you. See Wayne for more information, I just don't have the time to type it all in.

Kim/Steve/Ginny: Regarding: The ISG-11 Rev for the future information that we provided today to NAC. Bill Brach wants that docketed for the public. Kim, please provide a hard copy to Steve or Ginny, for docketing under the NAC-MPC, 72-1025 (it is a one page sheet of information).

Tim

CC: Virginia Tharpe

B/68

D. Tang 9/15/00

~~• Report~~
~~staff mtg 2.00~~
~~PAL/post 6~~
~~MY Amend 28~~
~~36~~

~~• RPS update~~
~~• Planning training course~~
~~• training/travel planning~~

Ginty, I missed the 2/14 entries

David Tang

2/14/00
~~• Revise training request~~
• mtg w/ Wayne Kim Ron, Tim & Earl on High Burnup fuel
• Discussion with Kim on high burnup fuel
• Discussion with Henry on high burnup
~~• Planning telecon with Mary Jane's Westflex call~~

2/15/00
• Discussed high burnup fuel issues w/ Ron & Kim
• Reviewed NAC-MY RAI responses
• Discussions with Henry on high burnup fuel
  - Will consider reduced wall thickness
  - Will ask vendors to recalculate buckling stress
~~• Staff mtg, Dave, Automation plan~~
~~- GPI & TI - 14/18 issues Rick Roll~~

B/69

As demonstrated, the extreme case of 100% fuel rod, fuel cladding, and guide tube failure with 50% compaction of the debris results in temperatures that are less than 1% higher than those calculated for the design basis PWR fuel. The maximum temperatures for the fuel cladding, damaged fuel assembly, support disks, and heat transfer disks remain within the allowable temperature range for both 100% failure cases. Additionally, the temperatures used in the structural analyses of the fuel basket envelope those calculated for both 100% failure cases.

4.5.1.1.9 Standard Fuel Assemblies with Damaged Lattice How Many?

Certain standard fuel assemblies may have damage or physical alteration to the lattice or cage that holds the fuel rods, but not exhibit damage to the fuel rods.

The effective thermal conductivity for the fuel assembly used in the thermal analyses in Section 4.4 is determined by the two-dimensional fuel model (Section 4.4.1.5). The model conservatively ignores the conductance of the steel cage of the fuel assembly. Therefore, damage or physical alteration to the cage has no effect on the thermal conductivity of the fuel assembly used in the thermal models. The thermal performance of these fuel assemblies is bounded by that of the standard fuel assemblies.

4.5.1.1.10 Failed Fuel Rod Holders #2

The Maine Yankee site specific fuel inventory includes two (2) damaged fuel lattices designated CF1 and CA3. CF1 is a 9 x 9 array of tubes having roughly the same dimensions as a fuel assembly. Some of the tubes hold damaged fuel rods. CA3 is a previously used fuel assembly cage, into which damaged fuel rods have been inserted. ?

Similar to the fuel assemblies that have damaged fuel rods, the damaged fuel lattices will be placed in Maine Yankee fuel cans and their location in the basket is restricted to one of the four corner fuel tube positions of the basket. The decay heat generated by the fuel in each of these lattices is less than one-fourth of the design basis heat load of 0.958 kW. Therefore, the thermal performance of the damaged fuel lattices is bounded by that of the standard fuel assemblies.

B170

Proprietary Loading

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In tech specs

Table 12B2-6 Maine Yankee Site Specific Fuel Population

Site Specific Spent Fuel Configuration[1]	Number of Assemblies[2]	Canister Loading Position
Inserted Control Element Assembly (CEA)[3,4,5]	168	Any
Inserted In-Core Instrument (ICI)Thimble	138	Any
Consolidated Fuel CANNED (note 8)	5	Corner[6,7,8]
Fuel Rod Replaced by Rod Enriched to 1.95 wt %	5	Any
Fuel Rod Replaced by Stainless Steel Rod or Zircaloy Rod	18	Any
Fuel Rods Removed NOT Canned (See next Page -B1)	10	Corner
Variable Enrichment	72	Any
Variable Enrichment and Axial Blanket	68	Any
Burnable Poison Rod Replaced by Hollow Zircaloy Rod NOT canned	80	Corner
Damaged Fuel[9,10] CANNED	12	Corner
Burnup between 45,000 and 50,000 MWD/MTU canned 7 80 micrian	90	Periphery[11]

1. The total number of fuel assemblies in inventory is approximately 1,434.
2. The number of fuel assemblies in some categories may vary depending on future fuel inspections and/or Engineering Evaluation.
3. A fuel assembly with an inserted CEA must be loaded in a Class 2 canister.
4. A fuel assembly without an inserted CEA must not be loaded in a Class 2 canister.
5. CEAs may not be inserted in damaged fuel assemblies, consolidated fuel assemblies or assemblies with irradiated stainless steel replacement rods.
6. Basket corner positions are positions 3, 6, 19, and 22 in Figure 12B2-1. Corner positions are also periphery positions.
7. Only one Consolidated Fuel lattice may be loaded in any Transportable Storage Canister.
8. Consolidated Fuel must be loaded in a Maine Yankee fuel can.
9. All fuel classified as damaged must be placed in a Maine Yankee fuel can, including fuel assemblies with damaged fuel rods or poison rods inserted in guide tubes.
10. All spent fuel, including that held in a Maine Yankee fuel can, must conform to the loading limits presented in Tables 12B2-8 and 12B2-9 for cool time.
11. Basket periphery positions are positions 1, 2, 3, 6, 7, 12, 13, 18, 19, 22, 23, and 24 in Figure 12B2-1. Periphery positions include the corner positions.

Max Enrich

Table 12B2-7 Maine Yankee Site Specific Fuel Limits

A. Allowable Contents

1. Combustion Engineering 14 x 14 PWR INTACT FUEL ASSEMBLIES meeting the specifications presented in Tables 12B2-1, 12B2-2 and 12B2-4.
2. PWR INTACT FUEL ASSEMBLIES may contain inserted Control Component Assemblies (CEA) or inserted In-Core Instrument (ICI) Thimbles.
3. PWR INTACT FUEL ASSEMBLIES with fuel rods replaced with stainless steel or Zircaloy rods or with Uranium oxide rods nominally enriched to 1.95 wt %.
4. PWR INTACT FUEL ASSEMBLIES with fuel rods having variable enrichments with a maximum fuel rod enrichment of 4.21 wt % ^{235}U and that also have a maximum planar average enrichment of 3.99 wt % ^{235}U.
5. PWR INTACT FUEL ASSEMBLIES with annular axial end blankets. The axial end blanket enrichment is nominally 2.6 wt % ^{235}U.
6. PWR INTACT FUEL ASSEMBLIES with up to two fuel rods inserted in each fuel assembly guide tube or with poison rods inserted in guide tubes.

B. Allowable Contents requiring preferential loading based on shielding, criticality or thermal constraints. The preferential loading requirement for these fuel configurations is described in Table 12B2-6.

1. PWR INTACT FUEL ASSEMBLIES with up to 176 fuel rods missing from the fuel assembly lattice.
2. PWR INTACT FUEL ASSEMBLIES with a burnup between 45,000 and 50,000 MWD/MTU.
3. PWR INTACT FUEL ASSEMBLIES with a burnable poison rod replaced by a hollow Zircaloy rod.

Table 12B2-8 Loading Table for Maine Yankee CE 14 x 14 Fuel with No Non-Fuel Material – Required Cool Time in Years Before Assembly is Acceptable

30 GWD/MTU Burnup		Minimum Cool Time [years] for[1]			
Enrichment	Standard	Pref(0.958i)	Pref(0.958p)	Pref(1.05i)	Pref(1.05p)
1.9	5	5	5	5	5
2.1	5	5	5	5	5
2.3	5	5	5	5	5
2.5	5	5	5	5	5
2.7	5	5	5	5	5
2.9	5	5	5	5	5
3.1	5	5	5	5	5
3.3	5	5	5	5 .632	5
3.5	5	5	5	5	5
3.7	5	5	5	5	5

35 GWD/MTU Burnup		Minimum Cool Time [years] for			
Enrichment	Standard	Pref(0.958i)	Pref(0.958p)	Pref(1.05i)	Pref(1.05p)
1.9	5	5	5	5	5
2.1	5	5	5	5	5
2.3	5	5	5	5	5
2.5	5	5	5	5	5
2.7	5	5	5	5	5
2.9	5	5	5	5	5
3.1	5	5	5	5	5
3.3	5	5	5	5	5
3.5	5	5	5	5	5
3.7	5	5	5	5	5

40 GWD/MTU Burnup		Minimum Cool Time [years] for			
Enrichment	Standard	Pref(0.958i)	Pref(0.958p)	Pref(1.05i)	Pref(1.05p)
1.9	7	7	6	15	5
2.1	6	6	6	15	5
2.3	6	6	5	14	5
2.5	5	5	5	14	5
2.7	5	5	5	14	5
2.9	5	5	5	6	5
3.1	5	5	5	6	5
3.3	5	5	5	6	5
3.5	5	5	5	6	5
3.7	5	5	5	6	5

1. Cool times for preferential loading of fuel assemblies with a decay heat of either 0.958 or 1.05 kw per assembly, loaded in either interior (i) or periphery (p) basket positions.

Table 12B2-8 Loading Table for Maine Yankee CE 14 x 14 Fuel with No Non-Fuel Material – Required Cool Time in Years Before Assembly is Acceptable (continued)

45 GWD/MTU Burnup		Minimum Cool Time [years] for[1]			
Enrichment	Standard	Pref(0.958i)	Pref(0.958p)	Pref(1.05i)	Pref(1.05p)
1.9	11	20	7	Not Allowed	6
2.1	9	15	7	Not Allowed	6
2.3	8	15	6	Not Allowed	6
2.5	8	15	6	Not Allowed	6
2.7	8	14	6	Not Allowed	6
2.9	8	14	6	Not Allowed	6
3.1	7	14	6	Not Allowed	6
3.3	6	14	6	Not Allowed	5
3.5	6	13	6	Not Allowed	5
3.7	6	13	6	Not Allowed	5
50 GWD/MTU Burnup		**Minimum Cool Time [years] for**			
Enrichment	Standard	Pref(0.958i)	Pref(0.958p)	Pref(1.05i)	Pref(1.05p)
1.9	18	Not Allowed	8	Not Allowed	7
2.1	15	Not Allowed	8	Not Allowed	7
2.3	14	Not Allowed	8	Not Allowed	7
2.5	12	Not Allowed	8	Not Allowed	7
2.7	12	Not Allowed	8	Not Allowed	7
2.9	11	Not Allowed	8	Not Allowed	7
3.1	10	Not Allowed	7	Not Allowed	7
3.3	10	Not Allowed	7	Not Allowed	6
3.5	10	Not Allowed	7	Not Allowed	6
3.7	10	Not Allowed	7	Not Allowed	6

1. Cool times for preferential loading of fuel assemblies with a decay heat of either 0.958 or 1.05 kw per assembly, loaded in either interior (i) or periphery (p) basket positions.

replace with note on table 12B2-8

Table 12B2-9 Loading Table for Maine Yankee CE 14 x 14 Fuel Containing CEA Cooled to Indicated Time

30,000 MWD/MTU Burnup – Minimum Cool Time in Years for						
Enrichment	No CEA (Class 1)	5 Year CEA	10 Year CEA	15 Year CEA	20 Year CEA	
1.9	5	5	5	5	5	
2.1	5	5	5	5	5	
2.3	5	5	5	5	5	
2.5	5	5	5	5	5	
2.7	5	5	5	5	5	
2.9	5	5	5	5	5	
3.1	5	5	5	5	5	
3.3	5	5	5	5	5	
3.5	5	5	5	5	5	
3.7	5	5	5	5	5	

35,000 MWD/MTU Burnup – Minimum Cool Time in Years for						
Enrichment	No CEA (Class 1)	5 Year CEA	10 Year CEA	15 Year CEA	20 Year CEA	
1.9	5	5	5	5	5	
2.1	5	5	5	5	5	
2.3	5	5	5	5	5	
2.5	5	5	5	5	5	
2.7	5	5	5	5	5	
2.9	5	5	5	5	5	
3.1	5	5	5	5	5	
3.3	5	5	5	5	5	
3.5	5	5	5	5	5	
3.7	5	5	5	5	5	

40,000 MWD/MTU Burnup – Minimum Cool Time in Years for						
Enrichment	No CEA (Class 1)	5 Year CEA	10 Year CEA	15 Year CEA	20 Year CEA	
1.9	7	7	7	7	7	
2.1	6	6	6	6	6	
2.3	6	6	6	6	6	
2.5	5	5	5	5	5	
2.7	5	5	5	5	5	
2.9	5	5	5	5	5	
3.1	5	5	5	5	5	
3.3	5	5	5	5	5	
3.5	5	5	5	5	5	
3.7	5	5	5	5	5	

45,000 MWD/MTU Burnup – Minimum Cool Time in Years for						
Enrichment	No CEA (Class 1)	5 Year CEA	10 Year CEA	15 Year CEA	20 Year CEA	
1.9	11	11	11	11	11	
2.1	9	9	9	9	9	
2.3	8	8	8	8	8	
2.5	8	8	8	8	8	
2.7	8	8	8	8	8	
2.9	8	8	8	8	8	
3.1	7	7	8	8	8	
3.3	6	6	7	7	7	
3.5	6	6	6	6	6	
3.7	6	6	6	6	6	

50,000 MWD/MTU Burnup – Minimum Cool Time in Years for						
Enrichment	No CEA (Class 1)	5 Year CEA	10 Year CEA	15 Year CEA	20 Year CEA	
1.9	18	18	18	18	18	
2.1	16	16	16	16	16	
2.3	14	14	14	14	14	
2.5	12	12	12	12	12	
2.7	12	12	12	12	12	
2.9	11	11	12	12	12	
3.1	10	10	12	12	12	
3.3	10	10	11	11	11	
3.5	10	10	10	10	10	
3.7	10	10	10	10	10	

Not All Old

Use as limit the Enriched Uranium

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NAC-UMS Amendment 1 Schedule (Direct Final Route)

TASK	DURATION	DUE DATE
IMNS/RGB Prepare Rule Package		9/08/2000
IMNS/RGB Section concurrence	2 days	09/11-09/12/2000
Receive CoC/SER from SFPO	1 day	09/15/2000
IMNS/RGB Chief for concurrence	3 days	09/13-09/15/2000
SFPO Division concurrence	2 days	09/18-09/19/2000
IMNS concurrence	1 wk	09/20-09/26/2000
Issue for Office concurrence	3 wks	09/27-10/17/2000
Resolve Office comments	2 wks	10/18-10/31/2000
RGB Branch concurrence	1 wk	11/1-11/07/2000
SFPO Division concurrence	2 days	11/08-11/09/2000
IMNS Division concurrence	1 wk	11/13-11/17/2000
NMSS concurrence	1 wk	11/20-11/24/2000
HOLD FOR NAC-UMS FINAL RULE TO BE PUBLISHED		11/30/2000
EDO approval	2 wks	12/01-12/14/2000
Forward proposed rule package to ADM	5 days	12/15-12/21/2000
Publication in FR	**3 wks**	**01/11/2001**
Public Comment Period	30 days	01/12-02/12/2001
WG Analyze Comments	3 wks	02/13-03/05/2001
Effective Date if no significant adverse comments	**75 days**	**3/28/2001(75 days after publication in Federal Register)**
If significant adverse comments see next table		

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NAC-UMS Amendment 1 Schedule (Direct Final Route)
Significant Adverse Comments

TASK	DURATION	DUE DATE
Working Group Analyze Comments	3 wks	02/13-03/05/2001
Management Decision on withdrawal	3 days	03/6-03/08/2001
Withdrawal published in FR	**3 wks**	**03/28/2001**
Resolve Public Comments	8 wks	02/13-04/09/2001
RGB Branch Concurrence	1 wk	4/10-04/16/2001
SPFO Branch Concurrence	2 days	04/17-04/18/2001
IMNS Division Concurrence	1 wk	04/19-04/25/2001
NRC's Office Concurrence	3 wks	04/26-05/16/2001
Resolve Office comments	1 wk	05/17-05/23/2001
RGB Concurrence	1wk	05/24-05/30/2001
SFPO Division concurrence	2 days	05/31-06/01/2001
IMNS Division concurrence	1 wk	06/02-06/8/2001
NMSS concurence	1 wk	06/9-06/15/2001
EDO Approval	1 wk	06/16-06/22/2001
Forward final rule package to ADM	5 days	06/23-06/29/2001
Publication in FR	**3 wks**	**07/20/2001**
Effective Date of Rule	**30 days**	**08/20/2001**

Undated D

NAC-UMS Amendment 1 Schedule (Proposed Rule Route)

TASK	DURATION	DUE DATE
Prepare Rule Package		9/11/00
Provide to RGB Section Leader for concurrence	2 days	9/12/00
Receive SER/CoC	1 day	9/15/2000 *
Provide to RGB Chief for concurrence	3 days	9/15/2000
SFPO Division concurrence	2 days	9/19/2000
IMNS concurrence	1 wk	9/26/2000
Issue for Office concurrence	3 wk	9/27/00- 10/17/2000
Resolve Office comments	1 wk	10/24/2000
RGB Branch concurrence	1 wk	10/31/2001
SFPO Division concurrence	2 days	11/02/2000
* HOLD FOR NAC-UMS FINAL RULE TO BE PUBLISHED		11/30/2000
IMNS Division concurrence	1 wk	11/09/00 ~~12/07~~/00
NMSS concurrence	1 wk	11/16/00 ~~12/14~~/00
EDO approval	2 wk	12/~~28~~ 14/00
Forward proposed rule package to ADM	5 days	12/28/00 ~~01/04/2001~~
Publication in FR	~~2~~ 3 wk	01/18/2001 *
Public Comment Period	75 days	04/04/2001
Resolve Public Comments	8 wk	05/30/2001
Provide to RGB Branch	1 wk	06/06/2001
SPFO Branch	2 days	06/08/2001
IMNS Division concurrence	1 wk	06/15/2001
Office Concurrence	3 wk	07/06/2001
Resolve Office comments	1 wk	07/13/2001
RGB Concurrence	1wk	07/20/2001
SFPO Division concurrence	2 days	07/24/2001
IMNS Division concurrence	1 wk	07/31/2001

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NMSS concurence	1 wk	08/07/2001
EDO Approval	1 wk	08/14/2001
Forward final rule package to ADM	5 days	08/21/2001
Publication in FR	3 wk	09/~~11~~ 04/2001 *

Undated D

NAC-UMS Amendment 1 Schedule (Direct Final Route)

TASK	DURATION	DUE DATE
Prepare Rule Package		9/11/00
Provide to RGB Section Leader for concurrence	2 days	9/12/00
Receive CoC/SER	1 day	9/15/2000
Provide to RGB Chief for concurrence	3 days	9/15/2000
SFPO Division concurrence	2 days	9/19/2000
IMNS concurrence	1 wk	9/26/2000
Issue for Office concurrence	3 wk	10/17/2000
Resolve Office comments	1 wk	10/24/2000
RGB Branch concurrence	1 wk	10/31/2000
SFPO Division concurrence	2 days	11/02/2000
HOLD FOR NAC-UMS FINAL RULE TO BE PUBLISHED		11/30/2000
IMNS Division concurrence	1 wk	12/07/00
NMSS concurrence	1 wk	12/14/00
EDO approval	2 wk	12/28/00
Forward proposed rule package to ADM	5 days	01/04/2001
Publication in FR	~~2~~ 3 wk	01/~~18~~ 11/2001
Public Comment Period	4.3 wk	02/19/2001
WG Analyze Comments	3 wk	03/12/2001
Management Decision on withdrawal	3 days	03/15/2001
If withdrawn FRN in concurrence FRN withdrawn DF	1 wk	3/22/2001 *
Resolve Public Comments	8 wk	04/16/2001
Provide to RGB Branch	1 wk	04/23/2001
SPFO ~~Branch~~	2 days	04/25/2001
IMNS Division concurrence	1 wk	05/02/2001
Office Concurrence	3 wk	05/23/2001

FR effective 75 days after 1/18/01 3/27

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Resolve Office comments	1 wk	05/30/2001
RGB Concurrence	1wk	06/06/2001
SFPO Division concurrence	2 days	06/08/2001
IMNS Division concurrence	1 wk	06/15/2001
NMSS concurence	1 wk	06/22/2001
EDO Approval	1 wk	06/29/2001
Forward final rule package to ADM	5 days	07/06/2001
Publication in FR	3 wk	07/27/2001

Updated D

NAC-UMS Amendment 1 Schedule (Proposed Rule Route)

TASK	DURATION	DUE DATE
IMNS/RGB Prepare Rule Package		09/08/2000
IMNS/Section Leader for concurrence	2 days	09/11-09/12/2000
Receive CoC/SER from SFPO	1 day	09/15/2000
IMNS/RGB Chief for concurrence	3 days	9/13-9/15/2000
SFPO Division concurrence	2 days	9/16-9/19/2000
IMNS concurrence	1 wk	9/20-9/26/2000
Issue for NRC Office concurrence	3 wks	9/27-10/17/2000
Resolve Office comments	2 wks	10/18-10/31/2000
RGB Branch concurrence	1 wk	11/1-11/07/2000
SFPO Division concurrence	2 days	11/08-11/09/2000
IMNS Division concurrence	1 wk	11/13-11/17/2000
NMSS concurrence	1 wk	11/20-11/24/2000
HOLD FOR NAC-UMS FINAL RULE TO BE PUBLISHED		11/30/2000
EDO approval	2 wks	12/01-12/14/00
Forward proposed rule package to ADM	5 days	12/15-12/21/2000
Publication in FR	**3 wks**	**01/11/2001**
Public Comment Period	75 days	01/12-03/28/2001
Resolve Public Comments	8 wks	03/29-5/24/2001
RGB Branch Concurrence	1 wk	05/25-05/31/2001
SFPO Concurrence	2 days	06/01-06/04/2001
IMNS Division Concurrence	1 wk	06/05-06/11/2001
NRC's Office Concurrence	3 wks	06/12-07/02/2001
Resolve Office Comments	1 wk	07/03-07/09/2001
RGB Concurrence	1 wk	07/10-07/16/2001
SFPO Division Concurrence	2 days	07/17-07/18/2001
IMNS Division Concurrence	1 wk	07/19-07/25/2001
NMSS Concurrence	1 wk	07/26-08/01/2001

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EDO Approval	1 wk	08/02-08/08/2001
Forward final rule package to ADM	5 days	08/09-08/15/2001
Publication in Federal Register	**3 wks**	**09/05/2001**
Effective Date of Rule	**30 days**	**10/04/2001**

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undated

NAC-UMS Maine Yankee Issue on Lower Heat Loads

Background:

Notified in late-March that NUTUG intended to make a public comment for NAC-UMS rulemaking asking for lower heat loads, and thus longer times allowed in the transfer cask for vacuum drying, helium back-fill and cask loading.

3/29/00: Conference Call (Hodges, Kokajko, Easton, Hall, McGinty with NAC (Pennington, Bill Lee) where we conveyed that NRC will likely not agree to make such changes to the NAC-UMS via the rulemaking process. Gave NAC the option to consider putting such a change into the Maine Yankee amendment with the understanding that it could impact the schedule if our review identified any significant issues.

4/7/00: Informed by NAC that they would like to pursue these changes for the Maine Yankee amendment.

4/18/00: Received revised amendment request.

Early June: We identified the need for a mis-loading analysis due to the higher probability of a mis-load, and a potential decrease in the existing margins to component temperature limits (needs further review).

6/7/00: Also identified that NAC is seeking a change to use NS-3 material in the shield lid via the 4/18/00 submittal, without any additional analysis (shielding or materials).

Options: Inform NAC to consider the following

1) Continue to pursue the lower heat load aspects of this amendment. Staff to complete review of all aspects and generate formal RAI. RAI issued by 6/23/00. Assuming a two-week turnaround (July 7), technical staff to complete review and final SER by 7/21/00, complete package preparation and office concurrence in 2 weeks (August 4). Assuming about 10 months for rulemaking, this would push the ultimate approval of the Maine Yankee amendment to about June 2001. Maine Yankee has expressed a desired approval date of April 2001.

2) Pull the lower heat load aspects of this amendment. Staff has already provided SER input, although a few cleanup issues have been identified recently for NAC to act on. Tech staff to complete final SER's by June 16. Complete package preparation and office concurrence in 2 weeks, June 30. Assuming about 10 months for rulemaking, this would result in the ultimate approval of the Maine Yankee amendment by late April 2001.

B/75

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

Mr. Thomas C. Thompson, Director
Licensing & Competitive Assessment
NAC International, Inc.
655 Engineering Drive
Norcross, GA 30092

SUBJECT: CONFERENCE CALL CONCERNING THE REVIEW OF THE NAC-UMS MAINE YANKEE AMENDMENT (TAC NO. L22979)

Dear Mr. Thompson:

This letter documents a conference call held on August 10, 2000, between the Nuclear Regulatory Commission (NRC) and NAC International, Inc., (NAC) concerning the review of your Universal Multi-purpose Canister System (UMS) amendment application for Maine Yankee contents. NRC initiated the call as a result of our identification of a technical issue regarding your July 27, 2000, response to our June 29, 2000, request for additional information (RAI). Specifically, the NRC sought clarification of your response to RAI 4-6 as follows:

- the Table associated with the RAI response appeared to imply an averaged heat load distribution for the 20 non-central basket locations,

- the description of the modeled application of a linear heat load distribution in the radial direction was not sufficiently clear for the staff to ascertain what heat loads have been analyzed for all of the possible spent fuel configurations, and

- adequate information was not presented to determine that the heat load and configurations actually loaded will not exceed what has been analyzed.

NAC agreed that the above clarifications discussed were not represented well in the RAI response and the Safety Analysis Report. The staff is in the process of completing its technical review, and inquired if there were other areas in the RAI response that would also need additional clarification. NAC stated that they were not aware of any other areas.

The staff, in a revised schedule letter dated August 8, 2000, and in a meeting summary dated August 10, 2000, re-apportioned resources, accelerated the completion of the scheduled review, and committed to forwarding the preliminary Safety Evaluation Report (SER) and Certificate of Compliance (CoC) for rulemaking by September 15, 2000. However, the staff predicated the accelerated review schedule on: (1) a complete and accurate response to the staff's June 29, 2000, RAI, and (2) no additional technical issues raised by the NAC response to the staff's RAI.

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Depending on the timeliness and quality of your response to the identified issues, there may be an impact on the schedule. We will discuss with you, as soon as possible, any need to adjust the schedule. Alternatively, for the staff to complete the technical review in accordance with the schedule established in our August 8, 2000, letter, our SER may contain unresolved issues and may not result in the issuance of a preliminary CoC, or we may condition the SER/CoC to reflect what you have analyzed.

If you have any questions, I can be reached at (301) 415-8580.

Sincerely,

Timothy J. McGinty, Project Manager
Licensing Section
Spent Fuel Project Office
Office of Nuclear Material Safety
and Safeguards

Docket No. 72-1015

cc: Attached List

Depending on the timeliness and quality of your response to the identified issues, there may be an impact on the schedule. We will discuss with you, as soon as possible, any need to adjust the schedule. Alternatively, for the staff to complete the technical review in accordance with the schedule established in our August 8, 2000, letter, our SER may contain unresolved issues and may not result in the issuance of a preliminary CoC, or we may condition the SER/CoC to reflect what you have analyzed.

If you have any questions, I can be reached at (301) 415-8580.

Sincerely,

Timothy J. McGinty, Project Manager
Licensing Section
Spent Fuel Project Office
Office of Nuclear Material Safety
and Safeguards

Docket No. 72-1015

cc: Attached List

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Engineering Evaluation – Knowledge of design basis or access to it.

What controls prevent loading heat loads of .958 KW on the interior @ 1.05 KW on the perimeter? see Table 12.2.2-8

12 X .958 + 12 X 1.05
= 24.096

How is pkd used in relation to pref

What about 1 pref (1.05) on the perimeter?

For the rubblized fuel was 1.05 KW assembly used? if not, why?

Transportation impact of rubblized fuel. B/77

~ Put Explanation in SAR

Q 4.5.1.1.3 Modified Std Fuel Assy 30,000 6 assemblies missing

For 1.95% enriched what is decay heat, burn up?

~~What is~~ How is it addressed in preparation loading table ~~[illegible]~~ considering fuel may be different in the assembly

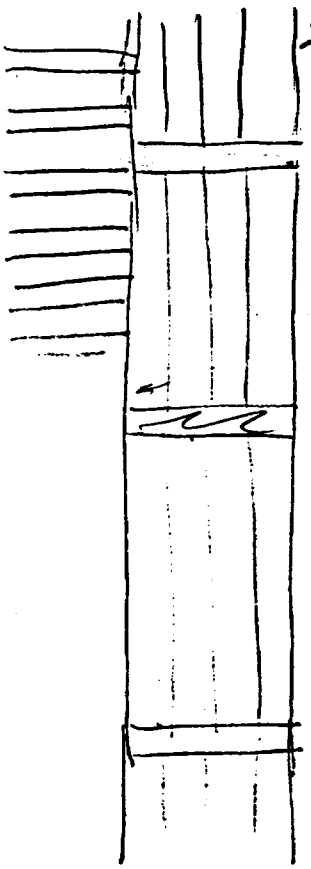
& for Section 4.5.1.1.6 – how do you know the enriching

B/77

For use in Prel Load up

4.5.1.1.9. Standard Fuel Assem with Damaged Lattices

– they are considering this as intact fuel and ~~don't~~ are ~~using~~ loading it under UMS



4/5/2000

Refers to 12132-1, 2 & 4

Tables 12132-6, 7 &
Table 12132-8 for "Standard"

Shouldn't these tables include preferential loading of 5-7 year fuel in accordance with NAC-UMS?

Tech Specs need to be changed to reflect this option

Would like the ANSYS model (data base) for Figure 4.5.1.1-2 "MP3-13 Periodic Canister Internal Model"

We have version 5-6.

What is maximum peak loading in the on-loading cask one 1.05 Kw

Check 50%

Hydrogen with rods failing

– normal

4/6/2000

FOR 40 GWD/MTU 6 year cooled .397 MTU from shielding
3.1% enrich

12 Perimeter assemblies

12(.946 KW) + 12 (.813) From 4.4.7-8

11.32 + 9.76 = 21.1 ≤ 22.1 KW OK

If 1.05 on perimeter

12(1.05) + Interior limit = 22.1

12.6 + Interior limit = 22.1

Interior limit = 9.5 KW OK

FOR 35 GWD/MTU 5 year cooled .397 MTU from shielding
2.9% enrich

If 1.05 on perimeter

=> 2.019 KW/MTU (.397 MTU) = .8015 KW

12(1.05) + 12(.8015) = 22.2 ≤ 23 From 4.4.7-8 for 35 GWD 5 year

OK

FOR 45 GWD/MTU 13 year cooled .397 MTU 3.3% ENRICH

12(.958) + 12(1.596 KW/MTU) .397 MTU = OK

11.496 + 7.603 = 19.1 KW ≈ 19.1 KW limit per Table 4.4-7.

For 1.05 @ 50 GWD/MTU

49.241 GWD/MTU @ 3.52% ENRICH 6 year cooling

From Radlib 2.662 KW/MTU × .373 MTU p.10 of 29

= .992 KW

~~45000~~ Same but 5 years cooling

2.761 KW/MTU × .373 MTU

= ~~1.03~~ 1.03 KW OK

Corrected ~~[illegible]~~

3.607 KW/MTU × .373 MTU

= 1.34 KW

45 GWD/MTU 7 year cooled 4.9% Enriched

Decay Heat Thermal .002 KW/ASS light elements
.258 KW/ASS actinides
.587 KW/ASS fission products
based on .392 MTU
.847 KW/ASS $\leq$ .958 KW
OK

45 GWD/MTU 20 year cooled 1.9% Enriched
Decay Heat Thermal .0003 KW/AS light element
.204 KW/ASS actinides
.313 KW/ASS
.517 KW/ASS

OK

12(.847) + 12(.517) = 16.4 KW < 18.9 KW
for 15 year 45 GWD

perimeter inside
11(.847) + 11(.958) + 12(.517)
11.385 + 6.20 = 17.59 < 18.9 KW
OK

≤40 GWD 2.9% Enrichment 5 year cooled

decay heat (Thermal) / Assem
.002 Kw light elements
.138 Kw actinides
.739 Kw fission products
.879 Kw/Assem

for .958
perimeter interior
12(.958) + 12(.879) Kw = 22 Kw < 23 Kw OK
Table 4.4.7-8

≤40 GWD 2.9% Enrich 6 year cooled

decay heat (Thermal) / Assem
.002 Kw light elements
.138 Kw actinides
.612 Kw fission products
.752 Kw/Assembly

for 1.05 peak
perimeter interior
12(1.05) + 12(.752) Kw = 21.6 Kw < 22.1 Kw
Table 4.4.7-8

40 GWD 2.3% 5 year

thermal decay heat/Ass = .002 Light elem
.168 actinides
.742 fission products

.912 Kw < .958 max pref

40 GWD 2.3% 14 year

thermal decay Ht/Ass = .001 light element
.153 actinides
.347 fission products

.501 Kw

perimeter interior
12(1.05) + 12(.501) = 18.6 Kw < 19 Kw OK 40 GWD 15 year

45GWD 2.1% 7 year

thermal decay Heat/GWD = .002 Kw light elements
.241 Kw actinides
.591 Kw fission products
.834 Kw < .958 Kw max
OK

45GWD 2.1% 15 year

thermal Decay Heat/GWD = .001 Kw light elements
.210 actinides
.367 fission products
.578 Kw

12(.958) + 12(.578) = 18.4 Kw ≤ 18.9 Kw 45 GWD & 15 yr.
Table 44.7

45GWD 2.7% 6 year

thermal decay heat = .002 Kw light elements
.202 actinides
.695 fission prod 1.05 Kw or
.899 Kw < .958 Kw

45GWD 2.7 14 years

.001 light elements
.183 actinides
.395 fission products
.579 Kw

12(.958) + (.579)12 = 18.4 Kw ≤ 18.9 Kw (45GWD + 15 years)

/1000Kg U SAS2H

ce 14x14 45 gwd/mtu pwr 1.9 wt%: 7 year cooled light elements
page 22
decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 8.08E+13n/cm**2-sec
0 element thermal power, watts
basis =single reactor assembly

,397MTU
,392

	initial	425.8 d	851.7 d	1277.5 d	1703.3 d	2129.2 d	2555.0 d
mn	8.80E+02	1.89E-01	7.34E-02	2.85E-02	1.11E-02	4.30E-03	1.67E-03
fe	4.23E-01	1.87E-02	1.35E-02	1.00E-02	7.47E-03	5.56E-03	4.13E-03
co	5.49E+00	3.88E+00	3.31E+00	2.84E+00	2.44E+00	2.09E+00	1.79E+00
ni	2.00E-01	1.61E-03	1.60E-03	1.58E-03	1.57E-03	1.56E-03	1.55E-03
cd	4.02E-04	4.68E-08	1.42E-08	1.34E-08	1.27E-08	1.19E-08	1.13E-08
in	2.93E+00	1.53E-01	1.17E-02	8.97E-04	6.90E-05	5.31E-06	4.09E-07
sn	2.40E+01	1.10E+00	3.84E-01	1.38E-01	5.06E-02	1.86E-02	6.99E-03
sb	4.33E+00	1.29E+00	9.58E-01	7.13E-01	5.30E-01	3.94E-01	2.93E-01
te	1.07E-01	8.42E-02	6.23E-02	4.63E-02	3.45E-02	2.56E-02	1.91E-02
totals	9.19E+02	6.72E+00	4.82E+00	3.78E+00	3.07E+00	2.54E+00	2.12E+00

1

ce 14x14 45 gwd/mtu pwr 1.9 wt%: 7 year cooled light elements
page 23
decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 8.08E+13n/cm**2-sec
0 element gamma power, watts
basis =single reactor assembly

	initial	425.8 d	851.7 d	1277.5 d	1703.3 d	2129.2 d	2555.0 d
mn	5.90E+02	1.88E-01	7.30E-02	2.84E-02	1.10E-02	4.28E-03	1.66E-03
fe	3.70E-01	5.76E-03	3.93E-03	2.92E-03	2.17E-03	1.62E-03	1.20E-03
co	5.09E+00	3.73E+00	3.19E+00	2.74E+00	2.35E+00	2.01E+00	1.73E+00
ni	9.19E-02	1.82E-06	1.82E-06	1.82E-06	1.82E-06	1.82E-06	1.82E-06
in	1.37E+00	1.01E-01	7.74E-03	5.95E-04	4.58E-05	3.53E-06	2.71E-07
sn	8.48E+00	1.45E-01	5.00E-02	1.81E-02	6.59E-03	2.41E-03	8.88E-04
sb	2.80E+00	1.05E+00	7.80E-01	5.80E-01	4.31E-01	3.21E-01	2.39E-01
te	2.88E-02	2.13E-02	1.56E-02	1.16E-02	8.64E-03	6.43E-03	4.78E-03
totals	6.09E+02	5.24E+00	4.12E+00	3.38E+00	2.81E+00	2.35E+00	1.98E+00

1

ce 14x14 45 gwd/mtu pwr 1.9 wt%: 7 year cooled actinides
page 24
decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 8.08E+13n/cm**2-sec
0 nuclide concentrations, gram atoms
basis = single reactor assembly

	initial	425.8 d	851.7 d	1277.5 d	1703.3 d	2129.2 d	2555.0 d
he 4	7.67E-02	1.26E-01	1.49E-01	1.68E-01	1.86E-01	2.04E-01	2.21E-01
th232	2.99E-07	4.50E-07	6.00E-07	7.50E-07	9.00E-07	1.05E-06	1.20E-06
u232	3.23E-07	7.40E-07	1.05E-06	1.28E-06	1.45E-06	1.57E-06	1.65E-06
u233	2.85E-07	5.82E-07	8.80E-07	1.18E-06	1.48E-06	1.78E-06	2.07E-06
u234	2.92E-03	6.49E-03	1.02E-02	1.38E-02	1.74E-02	2.10E-02	2.46E-02
u235	1.48E+00	1.48E+00	1.48E+00	1.48E+00	1.48E+00	1.48E+00	1.48E+00
u236	4.35E+00	4.35E+00	4.35E+00	4.35E+00	4.35E+00	4.35E+00	4.35E+00

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   u238  1.60E+03 1.60E+03 1.60E+03 1.60E+03 1.60E+03 1.60E+03 1.60E+03
  np236  1.79E-06 1.79E-06 1.79E-06 1.79E-06 1.79E-06 1.79E-06 1.79E-06
  np237  7.06E-01 7.23E-01 7.23E-01 7.24E-01 7.24E-01 7.26E-01 7.27E-01
  pu238  3.67E-01 3.97E-01 3.98E-01 3.95E-01 3.92E-01 3.88E-01 3.85E-01
  pu239  6.79E+00 7.01E+00 7.01E+00 7.01E+00 7.01E+00 7.01E+00 7.01E+00
  pu240  4.67E+00 4.69E+00 4.70E+00 4.71E+00 4.72E+00 4.74E+00 4.75E+00
  pu241  2.22E+00 2.10E+00 1.98E+00 1.87E+00 1.77E+00 1.67E+00 1.58E+00
  pu242  2.30E+00 2.30E+00 2.30E+00 2.30E+00 2.30E+00 2.30E+00 2.30E+00
  am241  4.97E-02 1.71E-01 2.85E-01 3.93E-01 4.95E-01 5.91E-01 6.82E-01
  am242m 8.89E-04 8.84E-04 8.79E-04 8.74E-04 8.69E-04 8.64E-04 8.59E-04
  am243  6.41E-01 6.42E-01 6.42E-01 6.41E-01 6.41E-01 6.41E-01 6.41E-01
  cm242  3.57E-02 5.86E-03 9.60E-04 1.59E-04 2.78E-05 6.44E-06 2.93E-06
  cm243  1.23E-03 1.19E-03 1.16E-03 1.13E-03 1.10E-03 1.07E-03 1.04E-03
  cm244  3.26E-01 3.12E-01 2.98E-01 2.85E-01 2.73E-01 2.61E-01 2.50E-01
  cm245  9.99E-03 9.98E-03 9.98E-03 9.98E-03 9.98E-03 9.98E-03 9.98E-03
  cm246  3.69E-03 3.69E-03 3.69E-03 3.69E-03 3.69E-03 3.69E-03 3.69E-03
  cm247  8.39E-05 8.39E-05 8.39E-05 8.39E-05 8.39E-05 8.39E-05 8.39E-05
  cm248  1.25E-05 1.25E-05 1.25E-05 1.25E-05 1.25E-05 1.25E-05 1.25E-05
 total   1.62E+03 1.62E+03 1.62E+03 1.62E+03 1.62E+03 1.62E+03 1.62E+03
1
  ce 14x14  45 gwd/mtu pwr 1.9 wt%: 7 year cooled                    actinides
 page  25
 decay, following reactor irradiation identified by: power=  16.11mw, burnup=  17640.mwd, flux=
8.08E+13n/cm**2-sec
0                          element concentrations, gram atoms
                          basis = single reactor assembly
        initial  425.8 d  851.7 d  1277.5 d  1703.3 d  2129.2 d  2555.0 d
   he   7.67E-02 1.26E-01 1.49E-01 1.68E-01 1.86E-01 2.04E-01 2.21E-01
   th   3.33E-07 5.03E-07 6.87E-07 8.83E-07 1.09E-06 1.31E-06 1.54E-06
    u   1.60E+03 1.60E+03 1.60E+03 1.60E+03 1.60E+03 1.60E+03 1.60E+03
   np   9.26E-01 7.23E-01 7.23E-01 7.24E-01 7.24E-01 7.26E-01 7.27E-01
   pu   1.64E+01 1.65E+01 1.64E+01 1.63E+01 1.62E+01 1.61E+01 1.60E+01
   am   6.93E-01 8.14E-01 9.28E-01 1.04E+00 1.14E+00 1.23E+00 1.32E+00
   cm   3.76E-01 3.33E-01 3.14E-01 3.00E-01 2.88E-01 2.76E-01 2.64E-01
 totals 1.62E+03 1.62E+03 1.62E+03 1.62E+03 1.62E+03 1.62E+03 1.62E+03
1
  ce 14x14  45 gwd/mtu pwr 1.9 wt%: 7 year cooled                    actinides
 page  26
 decay, following reactor irradiation identified by: power=  16.11mw, burnup=  17640.mwd, flux=
8.08E+13n/cm**2-sec
0                          nuclide concentrations, grams
                          basis =single reactor assembly
        initial  425.8 d  851.7 d  1277.5 d  1703.3 d  2129.2 d  2555.0 d
  he 4  3.07E-01 5.03E-01 5.97E-01 6.73E-01 7.45E-01 8.15E-01 8.83E-01
  pb208 1.07E-07 4.60E-07 1.31E-06 2.74E-06 4.74E-06 7.26E-06 1.02E-05
  th228 4.54E-07 1.50E-06 2.95E-06 4.47E-06 5.89E-06 7.12E-06 8.15E-06
  th230 1.76E-06 5.30E-06 1.16E-05 2.07E-05 3.25E-05 4.71E-05 6.43E-05
  th232 6.95E-05 1.04E-04 1.39E-04 1.74E-04 2.09E-04 2.44E-04 2.78E-04
  th234 5.52E-06 5.51E-06 5.51E-06 5.51E-06 5.51E-06 5.51E-06 5.51E-06
```

pa231	1.71E-06	2.10E-06	2.50E-06	2.89E-06	3.29E-06	3.68E-06	4.07E-06
pa233	5.70E-06	5.82E-06	5.82E-06	5.83E-06	5.83E-06	5.84E-06	5.85E-06
u232	7.49E-05	1.72E-04	2.44E-04	2.97E-04	3.36E-04	3.64E-04	3.84E-04
u233	6.63E-05	1.36E-04	2.05E-04	2.74E-04	3.44E-04	4.14E-04	4.83E-04
u234	6.83E-01	1.52E+00	2.38E+00	3.23E+00	4.08E+00	4.92E+00	5.75E+00
u235	3.48E+02	3.48E+02	3.48E+02	3.48E+02	3.48E+02	3.48E+02	3.48E+02
u236	1.03E+03	1.03E+03	1.03E+03	1.03E+03	1.03E+03	1.03E+03	1.03E+03
u237	3.84E+00	1.53E-05	1.45E-05	1.37E-05	1.29E-05	1.22E-05	1.16E-05
u238	3.80E+05	3.80E+05	3.80E+05	3.80E+05	3.80E+05	3.80E+05	3.80E+05
np236	4.23E-04	4.23E-04	4.23E-04	4.23E-04	4.23E-04	4.23E-04	4.23E-04
np237	1.67E+02	1.71E+02	1.71E+02	1.72E+02	1.72E+02	1.72E+02	1.72E+02
np239	5.16E+01	1.34E-04	1.34E-04	1.34E-04	1.34E-04	1.34E-04	1.34E-04
pu236	4.09E-04	3.11E-04	2.35E-04	1.78E-04	1.35E-04	1.02E-04	7.72E-05
pu238	8.73E+01	9.44E+01	9.47E+01	9.40E+01	9.32E+01	9.24E+01	9.15E+01
pu239	1.62E+03	1.68E+03	1.68E+03	1.68E+03	1.68E+03	1.68E+03	1.68E+03
pu240	1.12E+03	1.13E+03	1.13E+03	1.13E+03	1.13E+03	1.14E+03	1.14E+03
pu241	5.35E+02	5.05E+02	4.78E+02	4.52E+02	4.27E+02	4.03E+02	3.81E+02
pu242	5.57E+02	5.57E+02	5.57E+02	5.57E+02	5.57E+02	5.57E+02	5.57E+02
am241	1.20E+01	4.12E+01	6.88E+01	9.48E+01	1.19E+02	1.42E+02	1.64E+02
am242m	2.15E-01	2.14E-01	2.13E-01	2.12E-01	2.10E-01	2.09E-01	2.08E-01
am242	5.36E-02	2.76E-06	2.75E-06	2.73E-06	2.71E-06	2.70E-06	2.68E-06
am243	1.56E+02	1.56E+02	1.56E+02	1.56E+02	1.56E+02	1.56E+02	1.56E+02
cm242	8.63E+00	1.42E+00	2.32E-01	3.84E-02	6.74E-03	1.56E-03	7.08E-04
cm243	2.99E-01	2.90E-01	2.82E-01	2.74E-01	2.67E-01	2.59E-01	2.52E-01
cm244	7.94E+01	7.61E+01	7.28E+01	6.96E+01	6.66E+01	6.37E+01	6.09E+01
cm245	2.45E+00	2.45E+00	2.45E+00	2.45E+00	2.45E+00	2.45E+00	2.45E+00
cm246	9.09E-01	9.09E-01	9.09E-01	9.08E-01	9.08E-01	9.08E-01	9.08E-01
cm247	2.07E-02	2.07E-02	2.07E-02	2.07E-02	2.07E-02	2.07E-02	2.07E-02
cm248	3.10E-03	3.10E-03	3.11E-03	3.11E-03	3.11E-03	3.11E-03	3.11E-03
cf249	4.94E-06	3.58E-05	4.80E-05	5.28E-05	5.46E-05	5.53E-05	5.54E-05
cf250	1.23E-05	1.16E-05	1.09E-05	1.03E-05	9.67E-06	9.09E-06	8.55E-06
cf251	7.02E-06	7.01E-06	7.00E-06	7.00E-06	6.99E-06	6.98E-06	6.98E-06
cf252	9.97E-06	7.34E-06	5.41E-06	3.99E-06	2.94E-06	2.16E-06	1.59E-06
total	3.86E+05	3.86E+05	3.86E+05	3.86E+05	3.86E+05	3.86E+05	3.86E+05

1

ce 14x14 45 gwd/mtu pwr 1.9 wt%: 7 year cooled actinides

page 27

decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 8.08E+13n/cm**2-sec

0 element concentrations, grams

basis =single reactor assembly

	initial	425.8 d	851.7 d	1277.5 d	1703.3 d	2129.2 d	2555.0 d
he	3.07E-01	5.03E-01	5.97E-01	6.73E-01	7.45E-01	8.15E-01	8.83E-01
pb	1.07E-07	4.61E-07	1.31E-06	2.74E-06	4.74E-06	7.26E-06	1.02E-05
th	7.73E-05	1.17E-04	1.59E-04	2.05E-04	2.53E-04	3.03E-04	3.57E-04
pa	7.42E-06	7.92E-06	8.32E-06	8.72E-06	9.12E-06	9.52E-06	9.92E-06
u	3.81E+05	3.81E+05	3.81E+05	3.81E+05	3.81E+05	3.81E+05	3.81E+05
np	2.20E+02	1.71E+02	1.71E+02	1.72E+02	1.72E+02	1.72E+02	1.72E+02
pu	3.92E+03	3.96E+03	3.93E+03	3.91E+03	3.89E+03	3.86E+03	3.84E+03

am	1.68E+02	1.97E+02	2.25E+02	2.51E+02	2.75E+02	2.99E+02	3.20E+02
cm	9.17E+01	8.12E+01	7.67E+01	7.33E+01	7.03E+01	6.73E+01	6.45E+01
cf	3.43E-05	6.18E-05	7.14E-05	7.41E-05	7.42E-05	7.35E-05	7.26E-05
totals	3.86E+05	3.86E+05	3.86E+05	3.86E+05	3.86E+05	3.86E+05	3.86E+05

1

ce 14x14 45 gwd/mtu pwr 1.9 wt%: 7 year cooled actinides

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 8.08E+13n/cm**2-sec

0 element radioactivity, curies

basis =single reactor assembly

	initial	425.8 d	851.7 d	1277.5 d	1703.3 d	2129.2 d	2555.0 d
tl	1.35E-04	4.41E-04	8.70E-04	1.32E-03	1.74E-03	2.10E-03	2.41E-03
pb	3.75E-04	1.23E-03	2.42E-03	3.67E-03	4.84E-03	5.85E-03	6.70E-03
bi	3.75E-04	1.23E-03	2.42E-03	3.67E-03	4.84E-03	5.85E-03	6.70E-03
po	6.14E-04	2.01E-03	3.97E-03	6.03E-03	7.94E-03	9.60E-03	1.10E-02
rn	3.74E-04	1.23E-03	2.42E-03	3.67E-03	4.84E-03	5.85E-03	6.70E-03
ra	3.75E-04	1.23E-03	2.42E-03	3.67E-03	4.84E-03	5.85E-03	6.70E-03
th	1.38E-01	1.30E-01	1.31E-01	1.32E-01	1.33E-01	1.34E-01	1.35E-01
pa	2.55E-01	2.49E-01	2.49E-01	2.49E-01	2.49E-01	2.49E-01	2.49E-01
u	1.23E+07	1.46E+00	1.40E+00	1.34E+00	1.28E+00	1.23E+00	1.18E+00
np	1.22E+07	3.13E+01	3.13E+01	3.13E+01	3.13E+01	3.13E+01	3.12E+01
pu	5.50E+05	5.43E+04	5.14E+04	4.87E+04	4.61E+04	4.37E+04	4.14E+04
am	2.82E+05	1.77E+02	2.72E+02	3.61E+02	4.45E+02	5.24E+02	5.99E+02
cm	3.50E+04	1.09E+04	6.68E+03	5.78E+03	5.43E+03	5.18E+03	4.95E+03
bk	4.10E-01	3.35E-02	1.33E-02	5.29E-03	2.10E-03	8.36E-04	3.33E-04
cf	7.58E-03	5.37E-03	4.31E-03	3.49E-03	2.87E-03	2.39E-03	2.03E-03
totals	2.54E+07	6.53E+04	5.84E+04	5.49E+04	5.20E+04	4.94E+04	4.70E+04

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ce 14x14 45 gwd/mtu pwr 1.9 wt%: 7 year cooled actinides

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 8.08E+13n/cm**2-sec

0 element thermal power, watts

basis =single reactor assembly

	initial	425.8 d	851.7 d	1277.5 d	1703.3 d	2129.2 d	2555.0 d
tl	3.15E-06	1.03E-05	2.04E-05	3.09E-05	4.07E-05	4.92E-05	5.63E-05
pb	7.08E-07	2.32E-06	4.58E-06	6.94E-06	9.15E-06	1.11E-05	1.27E-05
bi	6.27E-06	2.06E-05	4.05E-05	6.15E-05	8.10E-05	9.80E-05	1.12E-04
po	2.81E-05	9.20E-05	1.81E-04	2.75E-04	3.63E-04	4.39E-04	5.02E-04
rn	1.42E-05	4.66E-05	9.19E-05	1.39E-04	1.84E-04	2.22E-04	2.54E-04
ra	1.29E-05	4.21E-05	8.31E-05	1.26E-04	1.66E-04	2.01E-04	2.30E-04
th	8.68E-05	9.38E-05	1.33E-04	1.74E-04	2.12E-04	2.45E-04	2.73E-04
pa	9.99E-04	9.35E-04	9.36E-04	9.36E-04	9.36E-04	9.37E-04	9.37E-04
u	3.32E+04	7.87E-03	7.94E-03	8.01E-03	8.07E-03	8.13E-03	8.18E-03
np	3.17E+04	8.22E-02	8.22E-02	8.22E-02	8.22E-02	8.22E-02	8.22E-02
pu	6.30E+02	6.65E+01	6.66E+01	6.62E+01	6.56E+01	6.51E+01	6.46E+01
am	1.65E+03	5.72E+00	8.88E+00	1.19E+01	1.47E+01	1.73E+01	1.98E+01
cm	1.27E+03	3.88E+02	2.35E+02	2.02E+02	1.90E+02	1.81E+02	1.73E+02

bk	2.32E-03	6.56E-06	2.61E-06	1.04E-06	4.12E-07	1.64E-07	6.51E-08
cf	4.40E-04	3.39E-04	2.63E-04	2.05E-04	1.62E-04	1.30E-04	1.06E-04
totals	6.85E+04	4.60E+02	3.10E+02	2.81E+02	2.70E+02	2.64E+02	2.58E+02

1

ce 14x14 45 gwd/mtu pwr 1.9 wt%: 7 year cooled actinides

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 8.08E+13n/cm**2-sec

0 element gamma power, watts

basis =single reactor assembly

	initial	425.8 d	851.7 d	1277.5 d	1703.3 d	2129.2 d	2555.0 d
tl	2.68E-06	8.79E-06	1.73E-05	2.63E-05	3.46E-05	4.19E-05	4.80E-05
pb	3.22E-07	1.06E-06	2.08E-06	3.16E-06	4.16E-06	5.03E-06	5.76E-06
bi	2.34E-07	7.66E-07	1.51E-06	2.29E-06	3.02E-06	3.65E-06	4.18E-06
rn	1.36E-09	4.44E-09	8.76E-09	1.33E-08	1.75E-08	2.12E-08	2.42E-08
ra	2.24E-08	7.33E-08	1.45E-07	2.19E-07	2.89E-07	3.49E-07	4.00E-07
th	9.30E-06	7.51E-06	7.53E-06	7.56E-06	7.59E-06	7.61E-06	7.62E-06
pa	2.14E-04	1.70E-04	1.70E-04	1.71E-04	1.71E-04	1.71E-04	1.71E-04
u	3.91E+03	1.06E-03	1.00E-03	9.47E-04	8.96E-04	8.47E-04	8.01E-04
np	1.42E+04	3.39E-02	3.39E-02	3.39E-02	3.39E-02	3.39E-02	3.39E-02
pu	7.31E+01	2.18E-02	2.18E-02	2.17E-02	2.15E-02	2.13E-02	2.11E-02
am	1.15E+03	3.51E-02	5.12E-02	6.63E-02	8.06E-02	9.40E-02	1.07E-01
cm	4.41E-01	1.39E-01	8.63E-02	7.51E-02	7.08E-02	6.77E-02	6.49E-02
cf	1.25E-05	9.48E-06	7.18E-06	5.44E-06	4.15E-06	3.19E-06	2.49E-06
totals	1.93E+04	2.31E-01	1.94E-01	1.98E-01	2.08E-01	2.18E-01	2.28E-01

1

ce 14x14 45 gwd/mtu pwr 1.9 wt%: 7 year cooled fission products

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 8.08E+13n/cm**2-sec

0 nuclide concentrations, grams

basis =single reactor assembly

	initial	425.8 d	851.7 d	1277.5 d	1703.3 d	2129.2 d	2555.0 d
h 3	2.76E-02	2.59E-02	2.43E-02	2.27E-02	2.13E-02	1.99E-02	1.87E-02
li 6	4.64E-05	4.64E-05	4.64E-05	4.64E-05	4.64E-05	4.64E-05	4.64E-05
li 7	5.35E-06	5.35E-06	5.35E-06	5.35E-06	5.35E-06	5.35E-06	5.35E-06
be 9	1.03E-05	1.03E-05	1.03E-05	1.03E-05	1.03E-05	1.03E-05	1.03E-05
be 10	6.87E-05	6.87E-05	6.87E-05	6.87E-05	6.87E-05	6.87E-05	6.87E-05
c 14	1.39E-05	1.39E-05	1.39E-05	1.39E-05	1.39E-05	1.39E-05	1.39E-05
zn 70	6.09E-06	6.09E-06	6.09E-06	6.09E-06	6.09E-06	6.09E-06	6.09E-06
ga 71	5.66E-05	5.66E-05	5.66E-05	5.66E-05	5.66E-05	5.66E-05	5.66E-05
ge 72	3.20E-03	3.21E-03	3.21E-03	3.21E-03	3.21E-03	3.21E-03	3.21E-03
ge 73	8.17E-03	8.17E-03	8.17E-03	8.17E-03	8.17E-03	8.17E-03	8.17E-03
ge 74	7.25E-03	7.25E-03	7.25E-03	7.25E-03	7.25E-03	7.25E-03	7.25E-03
as 75	5.61E-02	5.61E-02	5.61E-02	5.61E-02	5.61E-02	5.61E-02	5.61E-02
ge 76	1.60E-01	1.60E-01	1.60E-01	1.60E-01	1.60E-01	1.60E-01	1.60E-01
se 76	2.44E-03	2.44E-03	2.44E-03	2.44E-03	2.44E-03	2.44E-03	2.44E-03
se 77	3.53E-01	3.54E-01	3.54E-01	3.54E-01	3.54E-01	3.54E-01	3.54E-01
se 78	1.39E+00	1.39E+00	1.39E+00	1.39E+00	1.39E+00	1.39E+00	1.39E+00

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se 79  2.45E+00 2.45E+00 2.45E+00 2.45E+00 2.45E+00 2.45E+00 2.45E+00
br 79  9.08E-06 1.51E-05 2.11E-05 2.71E-05 3.31E-05 3.91E-05 4.51E-05
se 80  6.50E+00 6.50E+00 6.50E+00 6.50E+00 6.50E+00 6.50E+00 6.50E+00
kr 80  4.14E-05 4.14E-05 4.14E-05 4.14E-05 4.14E-05 4.14E-05 4.14E-05
br 81  9.63E+00 9.63E+00 9.63E+00 9.63E+00 9.63E+00 9.63E+00 9.63E+00
kr 81  4.18E-06 4.18E-06 4.18E-06 4.18E-06 4.18E-06 4.18E-06 4.18E-06
se 82  1.50E+01 1.50E+01 1.50E+01 1.50E+01 1.50E+01 1.50E+01 1.50E+01
kr 82  4.32E-01 4.34E-01 4.34E-01 4.34E-01 4.34E-01 4.34E-01 4.34E-01
kr 83  1.39E+01 1.39E+01 1.39E+01 1.39E+01 1.39E+01 1.39E+01 1.39E+01
kr 84  5.56E+01 5.56E+01 5.56E+01 5.56E+01 5.56E+01 5.56E+01 5.56E+01
kr 85  9.67E+00 8.97E+00 8.32E+00 7.71E+00 7.15E+00 6.63E+00 6.15E+00
rb 85  4.01E+01 4.08E+01 4.14E+01 4.20E+01 4.26E+01 4.31E+01 4.36E+01
kr 86  7.85E+01 7.85E+01 7.85E+01 7.85E+01 7.85E+01 7.85E+01 7.85E+01
sr 86  2.33E-01 2.44E-01 2.44E-01 2.44E-01 2.44E-01 2.44E-01 2.44E-01
rb 87  1.02E+02 1.02E+02 1.02E+02 1.02E+02 1.02E+02 1.02E+02 1.02E+02
sr 87  1.86E-03 1.86E-03 1.86E-03 1.86E-03 1.86E-03 1.86E-03 1.86E-03
sr 88  1.45E+02 1.45E+02 1.45E+02 1.45E+02 1.45E+02 1.45E+02 1.45E+02
 y 89  1.82E+02 1.91E+02 1.91E+02 1.91E+02 1.91E+02 1.91E+02 1.91E+02
sr 90  2.23E+02 2.17E+02 2.11E+02 2.05E+02 1.99E+02 1.94E+02 1.88E+02
 y 90  6.30E-02 5.64E-02 5.48E-02 5.33E-02 5.18E-02 5.03E-02 4.89E-02
zr 90  1.10E+01 1.73E+01 2.34E+01 2.94E+01 3.52E+01 4.09E+01 4.63E+01
zr 91  2.43E+02 2.57E+02 2.57E+02 2.57E+02 2.57E+02 2.57E+02 2.57E+02
zr 92  2.86E+02 2.86E+02 2.86E+02 2.86E+02 2.86E+02 2.86E+02 2.86E+02
zr 93  2.18E+02 2.18E+02 2.18E+02 2.18E+02 2.18E+02 2.18E+02 2.18E+02
nb 93  1.50E-05 2.59E-05 4.19E-05 6.27E-05 8.81E-05 1.18E-04 1.52E-04
nb 93m 1.65E-04 2.69E-04 3.68E-04 4.62E-04 5.52E-04 6.37E-04 7.18E-04
zr 94  3.67E+02 3.67E+02 3.67E+02 3.67E+02 3.67E+02 3.67E+02 3.67E+02
nb 94  3.07E-04 3.07E-04 3.07E-04 3.07E-04 3.07E-04 3.07E-04 3.07E-04
mo 95  3.15E+02 3.59E+02 3.59E+02 3.59E+02 3.59E+02 3.59E+02 3.59E+02
zr 96  4.01E+02 4.01E+02 4.01E+02 4.01E+02 4.01E+02 4.01E+02 4.01E+02
mo 96  2.96E+01 2.96E+01 2.96E+01 2.96E+01 2.96E+01 2.96E+01 2.96E+01
mo 97  3.89E+02 3.89E+02 3.89E+02 3.89E+02 3.89E+02 3.89E+02 3.89E+02
mo 98  4.34E+02 4.34E+02 4.34E+02 4.34E+02 4.34E+02 4.34E+02 4.34E+02
tc 98  4.26E-03 4.26E-03 4.26E-03 4.26E-03 4.26E-03 4.26E-03 4.26E-03
tc 99  3.90E+02 3.92E+02 3.92E+02 3.92E+02 3.92E+02 3.92E+02 3.92E+02
ru 99  1.61E-02 1.77E-02 1.92E-02 2.07E-02 2.22E-02 2.37E-02 2.52E-02
1
ce 14x14  45 gwd/mtu pwr 1.9 wt%: 7 year cooled                    fission products
 page  32
decay, following reactor irradiation identified by: power=  16.11mw, burnup=  17640.mwd, flux=
8.08E+13n/cm**2-sec
0                          nuclide concentrations, grams
                          basis =single reactor assembly
      initial  425.8 d  851.7 d  1277.5 d  1703.3 d  2129.2 d  2555.0 d
mo100  4.98E+02 4.98E+02 4.98E+02 4.98E+02 4.98E+02 4.98E+02 4.98E+02
ru100  7.99E+01 7.99E+01 7.99E+01 7.99E+01 7.99E+01 7.99E+01 7.99E+01
ru101  4.12E+02 4.12E+02 4.12E+02 4.12E+02 4.12E+02 4.12E+02 4.12E+02
ru102  4.49E+02 4.49E+02 4.49E+02 4.49E+02 4.49E+02 4.49E+02 4.49E+02
rh102  7.46E-04 5.65E-04 4.28E-04 3.24E-04 2.45E-04 1.85E-04 1.40E-04
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rh103	2.10E+02	2.35E+02	2.35E+02	2.35E+02	2.35E+02	2.35E+02	2.35E+02
ru104	3.65E+02	3.65E+02	3.65E+02	3.65E+02	3.65E+02	3.65E+02	3.65E+02
pd104	1.96E+02	1.96E+02	1.96E+02	1.96E+02	1.96E+02	1.96E+02	1.96E+02
pd105	2.53E+02	2.54E+02	2.54E+02	2.54E+02	2.54E+02	2.54E+02	2.54E+02
ru106	1.19E+02	5.39E+01	2.43E+01	1.10E+01	4.97E+00	2.25E+00	1.02E+00
rh106	1.30E-04	5.00E-05	2.26E-05	1.02E-05	4.61E-06	2.09E-06	9.42E-07
pd106	1.91E+02	2.56E+02	2.85E+02	2.99E+02	3.05E+02	3.07E+02	3.09E+02
pd107	1.81E+02	1.81E+02	1.81E+02	1.81E+02	1.81E+02	1.81E+02	1.81E+02
ag107	2.30E-05	4.56E-05	6.81E-05	9.07E-05	1.13E-04	1.36E-04	1.58E-04
pd108	1.22E+02	1.22E+02	1.22E+02	1.22E+02	1.22E+02	1.22E+02	1.22E+02
ag108m	1.99E-04	1.98E-04	1.97E-04	1.96E-04	1.94E-04	1.93E-04	1.92E-04
cd108	2.03E-04	2.03E-04	2.03E-04	2.03E-04	2.03E-04	2.04E-04	2.04E-04
ag109	6.46E+01	6.47E+01	6.47E+01	6.47E+01	6.47E+01	6.47E+01	6.47E+01
pd110	3.68E+01	3.68E+01	3.68E+01	3.68E+01	3.68E+01	3.68E+01	3.68E+01
ag110m	8.27E-01	2.54E-01	7.78E-02	2.39E-02	7.32E-03	2.25E-03	6.89E-04
cd110	4.64E+01	4.70E+01	4.72E+01	4.72E+01	4.72E+01	4.72E+01	4.73E+01
cd111	1.95E+01	1.98E+01	1.98E+01	1.98E+01	1.98E+01	1.98E+01	1.98E+01
cd112	9.83E+00	9.85E+00	9.85E+00	9.85E+00	9.85E+00	9.85E+00	9.85E+00
cd113	2.62E-02	2.80E-02	2.80E-02	2.80E-02	2.81E-02	2.81E-02	2.81E-02
cd113m	1.10E-01	1.04E-01	9.82E-02	9.27E-02	8.76E-02	8.27E-02	7.81E-02
in113	5.94E-03	1.21E-02	1.78E-02	2.33E-02	2.85E-02	3.33E-02	3.79E-02
cd114	8.82E+00	8.82E+00	8.82E+00	8.82E+00	8.82E+00	8.82E+00	8.82E+00
sn114	4.31E-04	5.03E-04	5.03E-04	5.03E-04	5.03E-04	5.03E-04	5.03E-04
in115	7.14E-01	7.32E-01	7.32E-01	7.32E-01	7.32E-01	7.32E-01	7.32E-01
sn115	1.11E-01	1.12E-01	1.12E-01	1.12E-01	1.12E-01	1.12E-01	1.12E-01
cd116	3.14E+00	3.14E+00	3.14E+00	3.14E+00	3.14E+00	3.14E+00	3.14E+00
sn116	1.82E+00	1.82E+00	1.82E+00	1.82E+00	1.82E+00	1.82E+00	1.82E+00
sn117	3.16E+00	3.16E+00	3.16E+00	3.16E+00	3.16E+00	3.16E+00	3.16E+00
sn118	2.44E+00	2.44E+00	2.44E+00	2.44E+00	2.44E+00	2.44E+00	2.44E+00
sn119	2.52E+00	2.53E+00	2.54E+00	2.54E+00	2.54E+00	2.54E+00	2.54E+00
sn119m	1.52E-02	5.54E-03	2.02E-03	7.39E-04	2.70E-04	9.86E-05	3.60E-05
sn120	2.47E+00	2.47E+00	2.47E+00	2.47E+00	2.47E+00	2.47E+00	2.47E+00
sn121	4.41E-03	1.29E-06	1.27E-06	1.25E-06	1.24E-06	1.22E-06	1.20E-06
sn121m	3.01E-02	2.97E-02	2.92E-02	2.88E-02	2.84E-02	2.80E-02	2.76E-02
sb121	2.37E+00	2.37E+00	2.37E+00	2.37E+00	2.37E+00	2.38E+00	2.38E+00
sn122	3.20E+00	3.20E+00	3.20E+00	3.20E+00	3.20E+00	3.20E+00	3.20E+00
te122	2.24E-01	2.26E-01	2.26E-01	2.26E-01	2.26E-01	2.26E-01	2.26E-01
sb123	2.76E+00	2.79E+00	2.80E+00	2.80E+00	2.80E+00	2.80E+00	2.80E+00
te123	2.01E-03	2.82E-03	2.89E-03	2.89E-03	2.89E-03	2.89E-03	2.89E-03
sn124	5.32E+00	5.32E+00	5.32E+00	5.32E+00	5.32E+00	5.32E+00	5.32E+00
te124	1.73E-01	2.06E-01	2.06E-01	2.06E-01	2.06E-01	2.06E-01	2.06E-01
sb125	4.76E+00	3.56E+00	2.64E+00	1.97E+00	1.46E+00	1.09E+00	8.09E-01
te125	1.85E+00	3.08E+00	4.00E+00	4.69E+00	5.20E+00	5.58E+00	5.87E+00
te125m	6.06E-02	5.05E-02	3.76E-02	2.79E-02	2.08E-02	1.55E-02	1.15E-02
sn126	1.32E+01	1.32E+01	1.32E+01	1.32E+01	1.32E+01	1.32E+01	1.32E+01
te126	2.80E-01	2.83E-01	2.83E-01	2.83E-01	2.83E-01	2.84E-01	2.84E-01
te127m	8.44E-01	5.84E-02	3.89E-03	2.60E-04	1.73E-05	1.15E-06	7.70E-08

decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 8.08E+13n/cm**2-sec

0 nuclide concentrations, grams
basis =single reactor assembly

	initial	425.8 d	851.7 d	1277.5 d	1703.3 d	2129.2 d	2555.0 d
i127	2.66E+01	2.76E+01	2.77E+01	2.77E+01	2.77E+01	2.77E+01	2.77E+01
te128	5.35E+01	5.35E+01	5.35E+01	5.35E+01	5.35E+01	5.35E+01	5.35E+01
xe128	2.35E+00	2.35E+00	2.35E+00	2.35E+00	2.35E+00	2.35E+00	2.35E+00
i129	1.01E+02	1.02E+02	1.02E+02	1.02E+02	1.02E+02	1.02E+02	1.02E+02
xe129	2.55E-02	2.61E-02	2.61E-02	2.61E-02	2.61E-02	2.61E-02	2.61E-02
te130	1.99E+02	1.99E+02	1.99E+02	1.99E+02	1.99E+02	1.99E+02	1.99E+02
xe130	8.32E+00	8.33E+00	8.33E+00	8.33E+00	8.33E+00	8.33E+00	8.33E+00
xe131	1.89E+02	1.92E+02	1.92E+02	1.92E+02	1.92E+02	1.92E+02	1.92E+02
xe132	6.46E+02	6.49E+02	6.49E+02	6.49E+02	6.49E+02	6.49E+02	6.49E+02
ba132	1.59E-04	1.62E-04	1.62E-04	1.62E-04	1.62E-04	1.62E-04	1.62E-04
cs133	5.56E+02	5.61E+02	5.61E+02	5.61E+02	5.61E+02	5.61E+02	5.61E+02
xe134	7.94E+02	7.94E+02	7.94E+02	7.94E+02	7.94E+02	7.94E+02	7.94E+02
cs134	8.30E+01	5.61E+01	3.79E+01	2.56E+01	1.73E+01	1.17E+01	7.90E+00
ba134	3.27E+01	5.96E+01	7.78E+01	9.01E+01	9.84E+01	1.04E+02	1.08E+02
cs135	1.21E+02	1.22E+02	1.22E+02	1.22E+02	1.22E+02	1.22E+02	1.22E+02
ba135	3.64E-01	3.64E-01	3.64E-01	3.64E-01	3.64E-01	3.64E-01	3.64E-01
xe136	1.32E+03	1.32E+03	1.32E+03	1.32E+03	1.32E+03	1.32E+03	1.32E+03
ba136	1.01E+01	1.04E+01	1.04E+01	1.04E+01	1.04E+01	1.04E+01	1.04E+01
cs137	6.62E+02	6.44E+02	6.27E+02	6.10E+02	5.94E+02	5.78E+02	5.63E+02
ba137	2.47E+01	4.23E+01	5.94E+01	7.61E+01	9.23E+01	1.08E+02	1.23E+02
ba137m	1.02E-04	9.84E-05	9.58E-05	9.32E-05	9.07E-05	8.83E-05	8.60E-05
ba138	6.64E+02	6.64E+02	6.64E+02	6.64E+02	6.64E+02	6.64E+02	6.64E+02
la138	4.82E-03	4.82E-03	4.82E-03	4.82E-03	4.82E-03	4.82E-03	4.82E-03
la139	6.13E+02	6.13E+02	6.13E+02	6.13E+02	6.13E+02	6.13E+02	6.13E+02
ce140	6.53E+02	6.65E+02	6.65E+02	6.65E+02	6.65E+02	6.65E+02	6.65E+02
pr141	5.38E+02	5.62E+02	5.62E+02	5.62E+02	5.62E+02	5.62E+02	5.62E+02
ce142	5.74E+02	5.74E+02	5.74E+02	5.74E+02	5.74E+02	5.74E+02	5.74E+02
nd142	1.94E+01	1.95E+01	1.95E+01	1.95E+01	1.95E+01	1.95E+01	1.95E+01
nd143	2.63E+02	2.73E+02	2.73E+02	2.73E+02	2.73E+02	2.73E+02	2.73E+02
ce144	1.55E+02	5.49E+01	1.95E+01	6.92E+00	2.46E+00	8.72E-01	3.09E-01
pr144	6.61E-03	2.31E-03	8.21E-04	2.92E-04	1.03E-04	3.67E-05	1.30E-05
nd144	6.08E+02	7.08E+02	7.43E+02	7.56E+02	7.60E+02	7.62E+02	7.62E+02
nd145	3.11E+02	3.11E+02	3.11E+02	3.11E+02	3.11E+02	3.11E+02	3.11E+02
pm145	1.23E-05	1.23E-05	1.19E-05	1.15E-05	1.10E-05	1.05E-05	1.00E-05
nd146	3.79E+02	3.79E+02	3.79E+02	3.79E+02	3.79E+02	3.79E+02	3.79E+02
pm146	4.26E-03	3.68E-03	3.18E-03	2.75E-03	2.37E-03	2.05E-03	1.77E-03
sm146	3.37E-03	3.57E-03	3.74E-03	3.89E-03	4.01E-03	4.12E-03	4.22E-03
pm147	6.65E+01	5.14E+01	3.78E+01	2.78E+01	2.04E+01	1.50E+01	1.10E+01
sm147	2.88E+01	4.73E+01	6.10E+01	7.10E+01	7.83E+01	8.38E+01	8.77E+01
nd148	1.94E+02	1.94E+02	1.94E+02	1.94E+02	1.94E+02	1.94E+02	1.94E+02
sm148	7.17E+01	7.26E+01	7.26E+01	7.26E+01	7.26E+01	7.26E+01	7.26E+01
sm149	5.73E-01	1.34E+00	1.34E+00	1.34E+00	1.34E+00	1.34E+00	1.34E+00

nd150	1.04E+02	1.04E+02	1.04E+02	1.04E+02	1.04E+02	1.04E+02	1.04E+02
sm150	1.63E+02	1.63E+02	1.63E+02	1.63E+02	1.63E+02	1.63E+02	1.63E+02
sm151	5.24E+00	5.33E+00	5.29E+00	5.24E+00	5.19E+00	5.15E+00	5.10E+00
eu151	2.82E-03	5.09E-02	9.86E-02	1.46E-01	1.93E-01	2.39E-01	2.85E-01
sm152	7.08E+01	7.08E+01	7.08E+01	7.08E+01	7.08E+01	7.08E+01	7.08E+01
eu152	7.65E-03	7.20E-03	6.78E-03	6.38E-03	6.00E-03	5.65E-03	5.32E-03
gd152	1.89E-02	1.90E-02	1.91E-02	1.93E-02	1.94E-02	1.95E-02	1.96E-02
eu153	7.49E+01	7.57E+01	7.57E+01	7.57E+01	7.57E+01	7.57E+01	7.57E+01
gd153	2.01E-03	5.91E-04	1.74E-04	5.13E-05	1.51E-05	4.46E-06	1.31E-06
sm154	2.61E+01	2.61E+01	2.61E+01	2.61E+01	2.61E+01	2.61E+01	2.61E+01

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ce 14x14 45 gwd/mtu pwr 1.9 wt%: 7 year cooled fission products

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 8.08E+13n/cm**2-sec

0 nuclide concentrations, grams

basis =single reactor assembly

	initial	425.8 d	851.7 d	1277.5 d	1703.3 d	2129.2 d	2555.0 d
eu154	1.24E+01	1.13E+01	1.03E+01	9.36E+00	8.52E+00	7.76E+00	7.06E+00
gd154	1.06E+00	2.18E+00	3.19E+00	4.11E+00	4.95E+00	5.72E+00	6.42E+00
eu155	3.68E+00	3.10E+00	2.61E+00	2.19E+00	1.85E+00	1.55E+00	1.31E+00
gd155	1.47E-02	5.99E-01	1.09E+00	1.50E+00	1.85E+00	2.15E+00	2.39E+00
gd156	8.32E+01	8.73E+01	8.73E+01	8.73E+01	8.73E+01	8.73E+01	8.73E+01
gd157	5.32E-02	7.42E-02	7.42E-02	7.42E-02	7.42E-02	7.42E-02	7.42E-02
gd158	1.96E+01	1.96E+01	1.96E+01	1.96E+01	1.96E+01	1.96E+01	1.96E+01
tb159	2.02E+00	2.03E+00	2.03E+00	2.03E+00	2.03E+00	2.03E+00	2.03E+00
gd160	8.68E-01	8.68E-01	8.68E-01	8.68E-01	8.68E-01	8.68E-01	8.68E-01
dy160	1.94E-01	2.78E-01	2.79E-01	2.79E-01	2.79E-01	2.79E-01	2.79E-01
dy161	2.49E-01	2.57E-01	2.57E-01	2.57E-01	2.57E-01	2.57E-01	2.57E-01
dy162	2.57E-01	2.57E-01	2.57E-01	2.57E-01	2.57E-01	2.57E-01	2.57E-01
dy163	2.45E-01	2.45E-01	2.45E-01	2.45E-01	2.45E-01	2.45E-01	2.45E-01
dy164	3.93E-02	3.93E-02	3.93E-02	3.93E-02	3.93E-02	3.93E-02	3.93E-02
ho165	1.18E-01	1.18E-01	1.18E-01	1.18E-01	1.18E-01	1.18E-01	1.18E-01
ho166m	5.45E-04	5.45E-04	5.45E-04	5.44E-04	5.44E-04	5.43E-04	5.43E-04
er166	3.39E-02	3.41E-02	3.41E-02	3.41E-02	3.41E-02	3.41E-02	3.41E-02
er167	7.53E-04	7.53E-04	7.53E-04	7.53E-04	7.53E-04	7.53E-04	7.53E-04
er168	1.64E-03	1.64E-03	1.64E-03	1.64E-03	1.64E-03	1.64E-03	1.64E-03
tm169	2.52E-06	2.56E-06	2.56E-06	2.56E-06	2.56E-06	2.56E-06	2.56E-06
er170	2.84E-06	2.84E-06	2.84E-06	2.84E-06	2.84E-06	2.84E-06	2.84E-06
yb171	1.28E-06	2.10E-06	2.64E-06	3.00E-06	3.23E-06	3.39E-06	3.49E-06
yb172	2.47E-06	2.49E-06	2.49E-06	2.49E-06	2.49E-06	2.49E-06	2.49E-06
total	1.80E+04	1.80E+04	1.80E+04	1.80E+04	1.80E+04	1.80E+04	1.80E+04

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ce 14x14 45 gwd/mtu pwr 1.9 wt%: 7 year cooled fission products

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 8.08E+13n/cm**2-sec

0 element radioactivity, curies

basis =single reactor assembly

	initial	425.8 d	851.7 d	1277.5 d	1703.3 d	2129.2 d	2555.0 d
h	2.67E+02	2.50E+02	2.34E+02	2.20E+02	2.06E+02	1.93E+02	1.80E+02
be	1.54E-06	1.54E-06	1.54E-06	1.54E-06	1.54E-06	1.54E-06	1.54E-06
c	6.20E-05	6.20E-05	6.19E-05	6.19E-05	6.19E-05	6.19E-05	6.19E-05
se	3.07E+05	3.36E-02	3.36E-02	3.36E-02	3.36E-02	3.36E-02	3.36E-02
kr	1.16E+06	3.52E+03	3.26E+03	3.03E+03	2.81E+03	2.60E+03	2.41E+03
rb	1.83E+06	1.32E-04	8.74E-06	8.74E-06	8.74E-06	8.74E-06	8.74E-06
sr	3.09E+06	3.14E+04	2.98E+04	2.89E+04	2.81E+04	2.73E+04	2.65E+04
y	4.30E+06	3.30E+04	2.98E+04	2.89E+04	2.81E+04	2.73E+04	2.66E+04
zr	4.19E+06	6.16E+03	6.18E+01	1.16E+00	5.54E-01	5.48E-01	5.48E-01
nb	6.44E+06	1.37E+04	1.38E+02	1.48E+00	1.45E-01	1.52E-01	1.71E-01
tc	5.72E+06	6.70E+00	6.70E+00	6.70E+00	6.70E+00	6.70E+00	6.70E+00
ru	2.86E+06	1.79E+05	8.07E+04	3.65E+04	1.65E+04	7.45E+03	3.37E+03
rh	3.93E+06	1.79E+05	8.07E+04	3.65E+04	1.65E+04	7.45E+03	3.37E+03
pd	3.76E+05	9.33E-02	9.33E-02	9.33E-02	9.33E-02	9.33E-02	9.33E-02
ag	6.02E+05	1.22E+03	3.75E+02	1.15E+02	3.53E+01	1.08E+01	3.33E+00
cd	4.77E+04	2.36E+01	2.20E+01	2.08E+01	1.97E+01	1.86E+01	1.75E+01
sn	6.36E+05	5.37E+01	1.38E+01	6.20E+00	4.13E+00	3.42E+00	3.14E+00
sb	1.60E+06	3.73E+03	2.77E+03	2.06E+03	1.53E+03	1.14E+03	8.49E+02
te	3.49E+06	2.01E+03	7.50E+02	5.08E+02	3.75E+02	2.78E+02	2.07E+02
i	5.17E+06	1.81E-02	1.81E-02	1.81E-02	1.81E-02	1.81E-02	1.81E-02
cs	3.31E+06	1.29E+05	1.04E+05	8.63E+04	7.41E+04	6.55E+04	5.92E+04
ba	3.89E+06	5.29E+04	5.15E+04	5.02E+04	4.88E+04	4.75E+04	4.63E+04
ce	3.09E+06	1.75E+05	6.21E+04	2.20E+04	7.82E+03	2.78E+03	9.85E+02
pr	2.73E+06	1.77E+05	6.30E+04	2.23E+04	7.93E+03	2.81E+03	9.99E+02
pm	7.58E+05	4.77E+04	3.50E+04	2.58E+04	1.89E+04	1.39E+04	1.02E+04
sm	3.84E+05	1.40E+02	1.39E+02	1.38E+02	1.37E+02	1.35E+02	1.34E+02
eu	2.71E+05	4.58E+03	4.07E+03	3.61E+03	3.22E+03	2.86E+03	2.55E+03
gd	5.94E+03	2.09E+00	6.16E-01	1.81E-01	5.34E-02	1.57E-02	4.64E-03
tb	2.38E+03	1.62E+01	2.73E-01	4.60E-03	7.77E-05	1.31E-06	2.21E-08
ho	1.46E+02	9.78E-04	9.78E-04	9.77E-04	9.76E-04	9.76E-04	9.75E-04
tm	5.98E-03	1.72E-03	1.13E-03	7.41E-04	4.86E-04	3.19E-04	2.10E-04
totals	7.42E+07	1.04E+06	5.48E+05	3.47E+05	2.55E+05	2.09E+05	1.84E+05

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ce 14x14 45 gwd/mtu pwr 1.9 wt%: 7 year cooled fission products

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 8.08E+13n/cm**2-sec

0 element thermal power, watts

basis =single reactor assembly

	initial	425.8 d	851.7 d	1277.5 d	1703.3 d	2129.2 d	2555.0 d
h	9.02E-03	8.44E-03	7.91E-03	7.41E-03	6.94E-03	6.50E-03	6.08E-03
c	1.82E-08	1.82E-08	1.82E-08	1.82E-08	1.82E-08	1.82E-08	1.82E-08
se	5.32E+03	1.06E-05	1.06E-05	1.06E-05	1.06E-05	1.06E-05	1.06E-05
kr	1.87E+04	5.28E+00	4.89E+00	4.54E+00	4.21E+00	3.90E+00	3.62E+00
sr	4.67E+04	3.81E+01	3.46E+01	3.36E+01	3.26E+01	3.17E+01	3.08E+01
y	7.46E+04	1.78E+02	1.65E+02	1.60E+02	1.56E+02	1.51E+02	1.47E+02
zr	4.34E+04	3.11E+01	3.09E-01	3.13E-03	9.22E-05	6.20E-05	6.17E-05
nb	9.56E+04	6.54E+01	6.59E-01	6.57E-03	8.83E-05	2.73E-05	3.00E-05

tc	7.26E+04	3.36E-03	3.36E-03	3.36E-03	3.36E-03	3.36E-03	3.36E-03
ru	1.58E+04	1.21E+01	4.80E+00	2.17E+00	9.80E-01	4.43E-01	2.00E-01
rh	2.08E+04	1.71E+03	7.74E+02	3.50E+02	1.58E+02	7.14E+01	3.23E+01
pd	1.14E+03	5.14E-06	5.14E-06	5.14E-06	5.14E-06	5.14E-06	5.14E-06
ag	2.41E+03	2.02E+01	6.21E+00	1.90E+00	5.84E-01	1.79E-01	5.50E-02
cd	5.45E+02	2.65E-02	2.40E-02	2.26E-02	2.14E-02	2.02E-02	1.91E-02
sn	8.42E+03	1.06E-01	1.52E-02	4.16E-03	2.37E-03	1.93E-03	1.78E-03
sb	2.93E+04	1.18E+01	8.77E+00	6.52E+00	4.85E+00	3.61E+00	2.69E+00
te	3.31E+04	1.81E+00	6.38E-01	4.28E-01	3.15E-01	2.34E-01	1.74E-01
i	7.64E+04	8.45E-06	8.45E-06	8.45E-06	8.45E-06	8.45E-06	8.45E-06
cs	5.97E+04	8.03E+02	5.61E+02	3.97E+02	2.86E+02	2.10E+02	1.59E+02
ba	3.33E+04	2.08E+02	2.02E+02	1.97E+02	1.92E+02	1.87E+02	1.82E+02
ce	1.45E+04	1.15E+02	4.06E+01	1.44E+01	5.12E+00	1.82E+00	6.45E-01
pr	2.24E+04	1.28E+03	4.56E+02	1.62E+02	5.74E+01	2.04E+01	7.24E+00
pm	3.90E+03	1.76E+01	1.29E+01	9.46E+00	6.95E+00	5.11E+00	3.76E+00
sm	9.12E+02	1.65E-02	1.64E-02	1.62E-02	1.61E-02	1.59E-02	1.58E-02
eu	2.55E+03	2.89E+01	2.63E+01	2.38E+01	2.16E+01	1.96E+01	1.78E+01
gd	1.68E+01	1.84E-03	5.41E-04	1.59E-04	4.70E-05	1.38E-05	4.08E-06
tb	1.38E+01	1.42E-01	2.39E-03	4.04E-05	6.81E-07	1.15E-08	1.94E-10
ho	6.27E-01	1.03E-05	1.03E-05	1.03E-05	1.03E-05	1.03E-05	1.03E-05
tm	2.03E-05	2.69E-07	1.74E-07	1.14E-07	7.50E-08	4.92E-08	3.23E-08
totals	8.93E+05	4.53E+03	2.30E+03	1.36E+03	9.26E+02	7.07E+02	5.87E+02

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ce 14x14 45 gwd/mtu pwr 1.9 wt%: 7 year cooled fission products

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 8.08E+13n/cm**2-sec

0 nuclide gamma power, watts

basis =single reactor assembly

	initial	425.8 d	851.7 d	1277.5 d	1703.3 d	2129.2 d	2555.0 d
kr 85	5.01E-02	4.65E-02	4.31E-02	4.00E-02	3.71E-02	3.44E-02	3.19E-02
y 90	3.45E-04	3.09E-04	3.00E-04	2.92E-04	2.83E-04	2.75E-04	2.68E-04
nb 93m	4.37E-07	7.14E-07	9.77E-07	1.23E-06	1.47E-06	1.69E-06	1.91E-06
nb 94	5.36E-07	5.36E-07	5.36E-07	5.35E-07	5.35E-07	5.35E-07	5.35E-07
zr 95	2.69E+03	2.67E+01	2.66E-01	2.64E-03	2.63E-05	2.61E-07	2.60E-09
nb 95	2.81E+03	6.17E+01	6.21E-01	6.18E-03	6.14E-05	6.11E-07	6.08E-09
tc 98	3.06E-08	3.06E-08	3.06E-08	3.06E-08	3.06E-08	3.06E-08	3.06E-08
tc 99	2.45E-08	2.46E-08	2.46E-08	2.46E-08	2.46E-08	2.46E-08	2.46E-08
rh102	1.16E-02	8.74E-03	6.62E-03	5.01E-03	3.79E-03	2.87E-03	2.17E-03
rh106	5.68E+02	2.18E+02	9.86E+01	4.45E+01	2.01E+01	9.10E+00	4.11E+00
ag108	8.48E-05	4.90E-08	4.87E-08	4.84E-08	4.81E-08	4.78E-08	4.75E-08
ag108m	5.00E-05	4.96E-05	4.93E-05	4.90E-05	4.87E-05	4.84E-05	4.81E-05
ag110	3.15E+01	2.99E-03	9.16E-04	2.81E-04	8.62E-05	2.64E-05	8.11E-06
ag110m	6.39E+01	1.96E+01	6.01E+00	1.84E+00	5.65E-01	1.73E-01	5.32E-02
cd113m	1.04E-05	9.78E-06	9.24E-06	8.72E-06	8.24E-06	7.78E-06	7.35E-06
sn119m	3.85E-03	1.41E-03	5.14E-04	1.88E-04	6.86E-05	2.50E-05	9.14E-06
sn121m	4.80E-05	4.73E-05	4.66E-05	4.59E-05	4.52E-05	4.46E-05	4.39E-05
sn123	1.20E-02	1.22E-03	1.24E-04	1.26E-05	1.28E-06	1.31E-07	1.33E-08
te123m	6.88E-03	5.84E-04	4.96E-05	4.21E-06	3.57E-07	3.03E-08	2.58E-09

ce 14x14 45 gwd/mtu pwr 1.9 wt%: 20 year cooled light elements
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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 8.08E+13n/cm**2-sec
0 element thermal power, watts
basis =single reactor assembly

	initial	1216.7 d	2433.3 d	3650.0 d	4866.7 d	6083.3 d	7300.0 d
mn	8.80E+02	3.26E-02	2.19E-03	1.47E-04	9.86E-06	6.61E-07	4.44E-08
fe	4.23E-01	1.05E-02	4.50E-03	1.93E-03	8.29E-04	3.56E-04	1.53E-04
co	5.49E+00	2.91E+00	1.88E+00	1.21E+00	7.81E-01	5.04E-01	3.25E-01
ni	2.00E-01	1.59E-03	1.55E-03	1.51E-03	1.48E-03	1.45E-03	1.41E-03
sn	2.40E+01	1.60E-01	9.22E-03	7.87E-04	3.02E-04	2.64E-04	2.51E-04
sb	4.33E+00	7.43E-01	3.19E-01	1.37E-01	5.88E-02	2.52E-02	1.08E-02
te	1.07E-01	4.83E-02	2.07E-02	8.90E-03	3.82E-03	1.64E-03	7.04E-04
totals	9.19E+02	3.90E+00	2.23E+00	1.36E+00	8.46E-01	5.33E-01	3.38E-01

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ce 14x14 45 gwd/mtu pwr 1.9 wt%: 20 year cooled .010 light elements
page 23
decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 8.08E+13n/cm**2-sec
0 element gamma power, watts
basis =single reactor assembly

	initial	1216.7 d	2433.3 d	3650.0 d	4866.7 d	6083.3 d	7300.0 d
mn	5.90E+02	3.25E-02	2.18E-03	1.46E-04	9.81E-06	6.58E-07	4.42E-08
fe	3.70E-01	3.05E-03	1.31E-03	5.61E-04	2.41E-04	1.03E-04	4.44E-05
co	5.09E+00	2.80E+00	1.81E+00	1.16E+00	7.52E-01	4.85E-01	3.13E-01
ni	9.19E-02	1.82E-06	1.82E-06	1.82E-06	1.82E-06	1.82E-06	1.82E-06
sn	8.48E+00	2.09E-02	1.18E-03	7.68E-05	1.43E-05	1.04E-05	9.80E-06
sb	2.80E+00	6.05E-01	2.60E-01	1.11E-01	4.78E-02	2.05E-02	8.81E-03
te	2.88E-02	1.21E-02	5.20E-03	2.23E-03	9.58E-04	4.11E-04	1.77E-04
totals	6.09E+02	3.47E+00	2.07E+00	1.28E+00	8.01E-01	5.06E-01	3.22E-01

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ce 14x14 45 gwd/mtu pwr 1.9 wt%: 20 year cooled actinides
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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 8.08E+13n/cm**2-sec
0 nuclide concentrations, gram atoms
basis = single reactor assembly

	initial	1216.7 d	2433.3 d	3650.0 d	4866.7 d	6083.3 d	7300.0 d
he 4	7.67E-02	1.66E-01	2.16E-01	2.63E-01	3.07E-01	3.49E-01	3.89E-01
th230	7.65E-09	8.35E-08	2.57E-07	5.26E-07	8.88E-07	1.34E-06	1.88E-06
th232	2.99E-07	7.28E-07	1.16E-06	1.59E-06	2.02E-06	2.45E-06	2.88E-06
u232	3.23E-07	1.25E-06	1.63E-06	1.77E-06	1.80E-06	1.78E-06	1.74E-06
u233	2.85E-07	1.06E-06	1.85E-06	2.63E-06	3.42E-06	4.22E-06	5.02E-06
u234	2.92E-03	1.33E-02	2.36E-02	3.36E-02	4.34E-02	5.29E-02	6.21E-02
u235	1.48E+00	1.48E+00	1.48E+00	1.48E+00	1.48E+00	1.48E+00	1.48E+00
u236	4.35E+00	4.35E+00	4.35E+00	4.36E+00	4.36E+00	4.36E+00	4.36E+00
u238	1.60E+03	1.60E+03	1.60E+03	1.60E+03	1.60E+03	1.60E+03	1.60E+03
np236	1.79E-06	1.79E-06	1.79E-06	1.79E-06	1.79E-06	1.79E-06	1.79E-06

np237	7.06E-01	7.24E-01	7.26E-01	7.30E-01	7.36E-01	7.42E-01	7.49E-01
pu238	3.67E-01	3.96E-01	3.86E-01	3.76E-01	3.66E-01	3.56E-01	3.47E-01
pu239	6.79E+00	7.01E+00	7.01E+00	7.01E+00	7.01E+00	7.01E+00	7.01E+00
pu240	4.67E+00	4.71E+00	4.74E+00	4.77E+00	4.80E+00	4.82E+00	4.84E+00
pu241	2.22E+00	1.89E+00	1.61E+00	1.37E+00	1.17E+00	9.92E-01	8.45E-01
pu242	2.30E+00	2.30E+00	2.30E+00	2.30E+00	2.30E+00	2.30E+00	2.30E+00
am241	4.97E-02	3.78E-01	6.56E-01	8.91E-01	1.09E+00	1.26E+00	1.40E+00
am242m	8.89E-04	8.75E-04	8.61E-04	8.47E-04	8.33E-04	8.19E-04	8.06E-04
am243	6.41E-01	6.41E-01	6.41E-01	6.41E-01	6.41E-01	6.41E-01	6.40E-01
cm242	3.57E-02	2.05E-04	3.39E-06	2.22E-06	2.18E-06	2.14E-06	2.11E-06
cm243	1.23E-03	1.13E-03	1.05E-03	9.64E-04	8.89E-04	8.20E-04	7.56E-04
cm244	3.26E-01	2.87E-01	2.53E-01	2.23E-01	1.96E-01	1.72E-01	1.52E-01
cm245	9.99E-03	9.98E-03	9.98E-03	9.98E-03	9.97E-03	9.97E-03	9.97E-03
cm246	3.69E-03	3.69E-03	3.69E-03	3.69E-03	3.69E-03	3.69E-03	3.68E-03
cm247	8.39E-05	8.39E-05	8.39E-05	8.39E-05	8.39E-05	8.39E-05	8.39E-05
cm248	1.25E-05	1.25E-05	1.25E-05	1.25E-05	1.25E-05	1.25E-05	1.25E-05
total	1.62E+03	1.62E+03	1.62E+03	1.62E+03	1.62E+03	1.62E+03	1.62E+03

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ce 14x14 45 gwd/mtu pwr 1.9 wt%: 20 year cooled actinides

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 8.08E+13n/cm**2-sec

0 element concentrations, gram atoms

basis = single reactor assembly

	initial	1216.7 d	2433.3 d	3650.0 d	4866.7 d	6083.3 d	7300.0 d
he	7.67E-02	1.66E-01	2.16E-01	2.63E-01	3.07E-01	3.49E-01	3.89E-01
th	3.33E-07	8.54E-07	1.47E-06	2.18E-06	2.98E-06	3.86E-06	4.83E-06
u	1.60E+03	1.60E+03	1.60E+03	1.60E+03	1.60E+03	1.60E+03	1.60E+03
np	9.26E-01	7.24E-01	7.26E-01	7.30E-01	7.36E-01	7.42E-01	7.49E-01
pu	1.64E+01	1.63E+01	1.60E+01	1.58E+01	1.56E+01	1.55E+01	1.53E+01
am	6.93E-01	1.02E+00	1.30E+00	1.53E+00	1.73E+00	1.90E+00	2.04E+00
cm	3.76E-01	3.02E-01	2.68E-01	2.37E-01	2.11E-01	1.87E-01	1.66E-01
totals	1.62E+03	1.62E+03	1.62E+03	1.62E+03	1.62E+03	1.62E+03	1.62E+03

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ce 14x14 45 gwd/mtu pwr 1.9 wt%: 20 year cooled actinides

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 8.08E+13n/cm**2-sec

0 nuclide concentrations, grams

basis =single reactor assembly

	initial	1216.7 d	2433.3 d	3650.0 d	4866.7 d	6083.3 d	7300.0 d
he 4	3.07E-01	6.63E-01	8.64E-01	1.05E+00	1.23E+00	1.40E+00	1.56E+00
pb208	1.07E-07	2.50E-06	9.32E-06	1.93E-05	3.08E-05	4.29E-05	5.51E-05
th228	4.54E-07	4.26E-06	7.87E-06	9.92E-06	1.08E-05	1.11E-05	1.10E-05
th230	1.76E-06	1.92E-05	5.91E-05	1.21E-04	2.04E-04	3.08E-04	4.32E-04
th232	6.95E-05	1.69E-04	2.69E-04	3.68E-04	4.68E-04	5.67E-04	6.67E-04
th234	5.52E-06	5.51E-06	5.51E-06	5.51E-06	5.51E-06	5.51E-06	5.51E-06
pa231	1.71E-06	2.83E-06	3.96E-06	5.08E-06	6.21E-06	7.33E-06	8.46E-06
pa233	5.70E-06	5.82E-06	5.85E-06	5.88E-06	5.92E-06	5.97E-06	6.03E-06

u232	7.49E-05	2.90E-04	3.79E-04	4.11E-04	4.17E-04	4.13E-04	4.03E-04
u233	6.63E-05	2.48E-04	4.30E-04	6.13E-04	7.97E-04	9.83E-04	1.17E-03
u234	6.83E-01	3.11E+00	5.52E+00	7.86E+00	1.01E+01	1.24E+01	1.45E+01
u235	3.48E+02	3.48E+02	3.48E+02	3.48E+02	3.49E+02	3.49E+02	3.49E+02
u236	1.03E+03	1.03E+03	1.03E+03	1.03E+03	1.03E+03	1.03E+03	1.03E+03
u237	3.84E+00	1.38E-05	1.17E-05	1.00E-05	8.51E-06	7.25E-06	6.17E-06
u238	3.80E+05	3.80E+05	3.80E+05	3.80E+05	3.80E+05	3.80E+05	3.80E+05
np236	4.23E-04	4.23E-04	4.23E-04	4.23E-04	4.23E-04	4.23E-04	4.23E-04
np237	1.67E+02	1.71E+02	1.72E+02	1.73E+02	1.74E+02	1.76E+02	1.78E+02
np239	5.16E+01	1.34E-04	1.34E-04	1.34E-04	1.34E-04	1.34E-04	1.34E-04
pu236	4.09E-04	1.85E-04	8.36E-05	3.77E-05	1.70E-05	7.67E-06	3.46E-06
pu238	8.73E+01	9.42E+01	9.18E+01	8.94E+01	8.71E+01	8.48E+01	8.26E+01
pu239	1.62E+03	1.68E+03	1.68E+03	1.68E+03	1.68E+03	1.68E+03	1.68E+03
pu240	1.12E+03	1.13E+03	1.14E+03	1.15E+03	1.15E+03	1.16E+03	1.16E+03
pu241	5.35E+02	4.55E+02	3.88E+02	3.30E+02	2.81E+02	2.39E+02	2.04E+02
pu242	5.57E+02	5.57E+02	5.57E+02	5.57E+02	5.57E+02	5.57E+02	5.57E+02
am241	1.20E+01	9.12E+01	1.58E+02	2.15E+02	2.63E+02	3.03E+02	3.37E+02
am242m	2.15E-01	2.12E-01	2.08E-01	2.05E-01	2.02E-01	1.98E-01	1.95E-01
am242	5.36E-02	2.73E-06	2.69E-06	2.64E-06	2.60E-06	2.56E-06	2.52E-06
am243	1.56E+02	1.56E+02	1.56E+02	1.56E+02	1.56E+02	1.56E+02	1.56E+02
cm242	8.63E+00	4.96E-02	8.21E-04	5.37E-04	5.26E-04	5.18E-04	5.09E-04
cm243	2.99E-01	2.75E-01	2.54E-01	2.34E-01	2.16E-01	1.99E-01	1.84E-01
cm244	7.94E+01	7.01E+01	6.17E+01	5.43E+01	4.78E+01	4.21E+01	3.70E+01
cm245	2.45E+00	2.45E+00	2.45E+00	2.44E+00	2.44E+00	2.44E+00	2.44E+00
cm246	9.09E-01	9.09E-01	9.08E-01	9.08E-01	9.07E-01	9.07E-01	9.06E-01
cm247	2.07E-02	2.07E-02	2.07E-02	2.07E-02	2.07E-02	2.07E-02	2.07E-02
cm248	3.10E-03	3.11E-03	3.11E-03	3.11E-03	3.11E-03	3.11E-03	3.11E-03
cf249	4.94E-06	5.24E-05	5.54E-05	5.53E-05	5.50E-05	5.46E-05	5.42E-05
cf250	1.23E-05	1.04E-05	8.70E-06	7.29E-06	6.11E-06	5.12E-06	4.29E-06
cf251	7.02E-06	7.00E-06	6.98E-06	6.96E-06	6.94E-06	6.93E-06	6.91E-06
total	3.86E+05	3.86E+05	3.86E+05	3.86E+05	3.86E+05	3.86E+05	3.86E+05

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ce 14x14 45 gwd/mtu pwr 1.9 wt%: 20 year cooled actinides

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 8.08E+13n/cm**2-sec

0 element concentrations, grams

basis =single reactor assembly

	initial	1216.7 d	2433.3 d	3650.0 d	4866.7 d	6083.3 d	7300.0 d
he	3.07E-01	6.63E-01	8.64E-01	1.05E+00	1.23E+00	1.40E+00	1.56E+00
pb	1.07E-07	2.50E-06	9.33E-06	1.93E-05	3.08E-05	4.29E-05	5.51E-05
th	7.73E-05	1.98E-04	3.41E-04	5.05E-04	6.88E-04	8.92E-04	1.12E-03
pa	7.42E-06	8.66E-06	9.80E-06	1.10E-05	1.21E-05	1.33E-05	1.45E-05
u	3.81E+05	3.81E+05	3.81E+05	3.81E+05	3.81E+05	3.81E+05	3.81E+05
np	2.20E+02	1.71E+02	1.72E+02	1.73E+02	1.74E+02	1.76E+02	1.78E+02
pu	3.92E+03	3.91E+03	3.85E+03	3.80E+03	3.75E+03	3.71E+03	3.68E+03
am	1.68E+02	2.47E+02	3.14E+02	3.71E+02	4.18E+02	4.59E+02	4.92E+02
cm	9.17E+01	7.38E+01	6.53E+01	5.79E+01	5.14E+01	4.57E+01	4.06E+01
cf	3.43E-05	7.39E-05	7.28E-05	7.03E-05	6.83E-05	6.68E-05	6.55E-05

totals 3.86E+05 3.86E+05 3.86E+05 3.86E+05 3.86E+05 3.86E+05 3.86E+05
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ce 14x14 45 gwd/mtu pwr 1.9 wt%: 20 year cooled actinides
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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 8.08E+13n/cm**2-sec
0 element radioactivity, curies
basis =single reactor assembly

	initial	1216.7 d	2433.3 d	3650.0 d	4866.7 d	6083.3 d	7300.0 d
tl	1.35E-04	1.25E-03	2.32E-03	2.93E-03	3.19E-03	3.27E-03	3.25E-03
pb	3.75E-04	3.49E-03	6.46E-03	8.15E-03	8.89E-03	9.10E-03	9.04E-03
bi	3.75E-04	3.49E-03	6.46E-03	8.15E-03	8.89E-03	9.10E-03	9.04E-03
po	6.14E-04	5.73E-03	1.06E-02	1.34E-02	1.46E-02	1.49E-02	1.48E-02
rn	3.74E-04	3.49E-03	6.46E-03	8.15E-03	8.89E-03	9.10E-03	9.04E-03
ra	3.75E-04	3.49E-03	6.46E-03	8.15E-03	8.89E-03	9.10E-03	9.04E-03
th	1.38E-01	1.32E-01	1.35E-01	1.37E-01	1.37E-01	1.38E-01	1.38E-01
pa	2.55E-01	2.49E-01	2.49E-01	2.50E-01	2.51E-01	2.52E-01	2.53E-01
u	1.23E+07	1.35E+00	1.20E+00	1.07E+00	9.63E-01	8.73E-01	7.98E-01
np	1.22E+07	3.13E+01	3.12E+01	3.12E+01	3.12E+01	3.12E+01	3.12E+01
pu	5.50E+05	4.91E+04	4.20E+04	3.60E+04	3.09E+04	2.66E+04	2.28E+04
am	2.82E+05	3.48E+02	5.78E+02	7.72E+02	9.36E+02	1.07E+03	1.19E+03
cm	3.50E+04	5.86E+03	5.01E+03	4.41E+03	3.88E+03	3.42E+03	3.01E+03
cf	7.58E-03	3.59E-03	2.12E-03	1.43E-03	1.07E-03	8.63E-04	7.31E-04
totals	2.54E+07	5.53E+04	4.76E+04	4.12E+04	3.58E+04	3.11E+04	2.71E+04

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ce 14x14 45 gwd/mtu pwr 1.9 wt%: 20 year cooled actinides
page 29
decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 8.08E+13n/cm**2-sec
0 element thermal power, watts
basis =single reactor assembly

	initial	1216.7 d	2433.3 d	3650.0 d	4866.7 d	6083.3 d	7300.0 d
tl	3.15E-06	2.93E-05	5.43E-05	6.85E-05	7.47E-05	7.65E-05	7.60E-05
pb	7.08E-07	6.60E-06	1.22E-05	1.54E-05	1.68E-05	1.72E-05	1.71E-05
bi	6.27E-06	5.84E-05	1.08E-04	1.36E-04	1.49E-04	1.52E-04	1.51E-04
po	2.81E-05	2.61E-04	4.84E-04	6.10E-04	6.66E-04	6.82E-04	6.77E-04
rn	1.42E-05	1.32E-04	2.45E-04	3.09E-04	3.37E-04	3.45E-04	3.43E-04
ra	1.29E-05	1.20E-04	2.22E-04	2.80E-04	3.05E-04	3.12E-04	3.10E-04
th	8.68E-05	1.68E-04	2.65E-04	3.20E-04	3.44E-04	3.51E-04	3.49E-04
pa	9.99E-04	9.36E-04	9.37E-04	9.39E-04	9.41E-04	9.44E-04	9.47E-04
u	3.32E+04	8.00E-03	8.17E-03	8.33E-03	8.51E-03	8.71E-03	8.92E-03
np	3.17E+04	8.22E-02	8.22E-02	8.22E-02	8.22E-02	8.22E-02	8.22E-02
pu	6.30E+02	6.63E+01	6.47E+01	6.32E+01	6.18E+01	6.04E+01	5.91E+01
am	1.65E+03	1.14E+01	1.91E+01	2.56E+01	3.11E+01	3.57E+01	3.95E+01
cm	1.27E+03	2.05E+02	1.75E+02	1.54E+02	1.36E+02	1.20E+02	1.05E+02
cf	4.40E-04	2.12E-04	1.12E-04	6.68E-05	4.55E-05	3.45E-05	2.82E-05
totals	6.85E+04	2.83E+02	2.59E+02	2.43E+02	2.29E+02	2.16E+02	2.04E+02

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ce 14x14 45 gwd/mtu pwr 1.9 wt%: 20 year cooled actinides
page 30
decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 8.08E+13n/cm**2-sec
0 element gamma power, watts
basis =single reactor assembly

	initial	1216.7 d	2433.3 d	3650.0 d	4866.7 d	6083.3 d	7300.0 d
tl	2.68E-06	2.50E-05	4.63E-05	5.83E-05	6.36E-05	6.51E-05	6.47E-05
pb	3.22E-07	3.00E-06	5.56E-06	7.00E-06	7.64E-06	7.82E-06	7.77E-06
bi	2.34E-07	2.18E-06	4.03E-06	5.08E-06	5.54E-06	5.67E-06	5.64E-06
rn	1.36E-09	1.26E-08	2.34E-08	2.95E-08	3.22E-08	3.29E-08	3.27E-08
ra	2.24E-08	2.08E-07	3.86E-07	4.86E-07	5.30E-07	5.43E-07	5.40E-07
th	9.30E-06	7.56E-06	7.62E-06	7.65E-06	7.67E-06	7.67E-06	7.67E-06
pa	2.14E-04	1.71E-04	1.71E-04	1.72E-04	1.73E-04	1.75E-04	1.76E-04
u	3.91E+03	9.55E-04	8.14E-04	6.93E-04	5.91E-04	5.04E-04	4.29E-04
np	1.42E+04	3.39E-02	3.39E-02	3.39E-02	3.39E-02	3.39E-02	3.39E-02
pu	7.31E+01	2.17E-02	2.12E-02	2.07E-02	2.02E-02	1.97E-02	1.93E-02
am	1.15E+03	6.42E-02	1.03E-01	1.36E-01	1.64E-01	1.87E-01	2.07E-01
cm	4.41E-01	7.60E-02	6.56E-02	5.82E-02	5.17E-02	4.59E-02	4.08E-02
cf	1.25E-05	5.66E-06	2.67E-06	1.40E-06	8.65E-07	6.36E-07	5.35E-07
totals	1.93E+04	1.97E-01	2.25E-01	2.50E-01	2.70E-01	2.88E-01	3.02E-01

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ce 14x14 45 gwd/mtu pwr 1.9 wt%: 20 year cooled fission products
page 31
decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 8.08E+13n/cm**2-sec
0 nuclide concentrations, grams
basis =single reactor assembly

	initial	1216.7 d	2433.3 d	3650.0 d	4866.7 d	6083.3 d	7300.0 d
h 3	2.76E-02	2.29E-02	1.90E-02	1.58E-02	1.31E-02	1.08E-02	8.99E-03
li 6	4.64E-05	4.64E-05	4.64E-05	4.64E-05	4.64E-05	4.64E-05	4.64E-05
li 7	5.35E-06	5.35E-06	5.35E-06	5.35E-06	5.35E-06	5.35E-06	5.35E-06
be 9	1.03E-05	1.03E-05	1.03E-05	1.03E-05	1.03E-05	1.03E-05	1.03E-05
be 10	6.87E-05	6.87E-05	6.87E-05	6.87E-05	6.87E-05	6.87E-05	6.87E-05
c 14	1.39E-05	1.39E-05	1.39E-05	1.39E-05	1.39E-05	1.39E-05	1.39E-05
zn 70	6.09E-06	6.09E-06	6.09E-06	6.09E-06	6.09E-06	6.09E-06	6.09E-06
ga 71	5.66E-05	5.66E-05	5.66E-05	5.66E-05	5.66E-05	5.66E-05	5.66E-05
ge 72	3.20E-03	3.21E-03	3.21E-03	3.21E-03	3.21E-03	3.21E-03	3.21E-03
ge 73	8.17E-03	8.17E-03	8.17E-03	8.17E-03	8.17E-03	8.17E-03	8.17E-03
ge 74	7.25E-03	7.25E-03	7.25E-03	7.25E-03	7.25E-03	7.25E-03	7.25E-03
as 75	5.61E-02	5.61E-02	5.61E-02	5.61E-02	5.61E-02	5.61E-02	5.61E-02
ge 76	1.60E-01	1.60E-01	1.60E-01	1.60E-01	1.60E-01	1.60E-01	1.60E-01
se 76	2.44E-03	2.44E-03	2.44E-03	2.44E-03	2.44E-03	2.44E-03	2.44E-03
se 77	3.53E-01	3.54E-01	3.54E-01	3.54E-01	3.54E-01	3.54E-01	3.54E-01
se 78	1.39E+00	1.39E+00	1.39E+00	1.39E+00	1.39E+00	1.39E+00	1.39E+00
se 79	2.45E+00	2.45E+00	2.45E+00	2.45E+00	2.45E+00	2.45E+00	2.45E+00
br 79	9.08E-06	2.62E-05	4.34E-05	6.06E-05	7.77E-05	9.49E-05	1.12E-04
se 80	6.50E+00	6.50E+00	6.50E+00	6.50E+00	6.50E+00	6.50E+00	6.50E+00
kr 80	4.14E-05	4.14E-05	4.14E-05	4.14E-05	4.14E-05	4.14E-05	4.14E-05

br 81	9.63E+00	9.63E+00	9.63E+00	9.63E+00	9.63E+00	9.63E+00	9.63E+00
kr 81	4.18E-06	4.18E-06	4.18E-06	4.18E-06	4.18E-06	4.18E-06	4.18E-06
se 82	1.50E+01	1.50E+01	1.50E+01	1.50E+01	1.50E+01	1.50E+01	1.50E+01
kr 82	4.32E-01	4.34E-01	4.34E-01	4.34E-01	4.34E-01	4.34E-01	4.34E-01
kr 83	1.39E+01	1.39E+01	1.39E+01	1.39E+01	1.39E+01	1.39E+01	1.39E+01
kr 84	5.56E+01	5.56E+01	5.56E+01	5.56E+01	5.56E+01	5.56E+01	5.56E+01
kr 85	9.67E+00	7.80E+00	6.28E+00	5.07E+00	4.09E+00	3.29E+00	2.66E+00
rb 85	4.01E+01	4.20E+01	4.35E+01	4.47E+01	4.57E+01	4.65E+01	4.71E+01
kr 86	7.85E+01	7.85E+01	7.85E+01	7.85E+01	7.85E+01	7.85E+01	7.85E+01
sr 86	2.33E-01	2.44E-01	2.44E-01	2.44E-01	2.44E-01	2.44E-01	2.44E-01
rb 87	1.02E+02	1.02E+02	1.02E+02	1.02E+02	1.02E+02	1.02E+02	1.02E+02
sr 87	1.86E-03	1.86E-03	1.86E-03	1.86E-03	1.86E-03	1.86E-03	1.86E-03
sr 88	1.45E+02	1.45E+02	1.45E+02	1.45E+02	1.45E+02	1.45E+02	1.45E+02
y 89	1.82E+02	1.91E+02	1.91E+02	1.91E+02	1.91E+02	1.91E+02	1.91E+02
sr 90	2.23E+02	2.06E+02	1.90E+02	1.75E+02	1.61E+02	1.48E+02	1.37E+02
y 90	6.30E-02	5.35E-02	4.93E-02	4.54E-02	4.18E-02	3.85E-02	3.55E-02
zr 90	1.10E+01	2.86E+01	4.48E+01	5.97E+01	7.35E+01	8.61E+01	9.78E+01
zr 91	2.43E+02	2.57E+02	2.57E+02	2.57E+02	2.57E+02	2.57E+02	2.57E+02
zr 92	2.86E+02	2.86E+02	2.86E+02	2.86E+02	2.86E+02	2.86E+02	2.86E+02
zr 93	2.18E+02	2.18E+02	2.18E+02	2.18E+02	2.18E+02	2.18E+02	2.18E+02
nb 93	1.50E-05	5.94E-05	1.42E-04	2.57E-04	4.01E-04	5.69E-04	7.59E-04
nb 93m	1.65E-04	4.49E-04	6.95E-04	9.09E-04	1.09E-03	1.25E-03	1.39E-03
zr 94	3.67E+02	3.67E+02	3.67E+02	3.67E+02	3.67E+02	3.67E+02	3.67E+02
nb 94	3.07E-04	3.07E-04	3.07E-04	3.07E-04	3.07E-04	3.06E-04	3.06E-04
mo 95	3.15E+02	3.59E+02	3.59E+02	3.59E+02	3.59E+02	3.59E+02	3.59E+02
zr 96	4.01E+02	4.01E+02	4.01E+02	4.01E+02	4.01E+02	4.01E+02	4.01E+02
mo 96	2.96E+01	2.96E+01	2.96E+01	2.96E+01	2.96E+01	2.96E+01	2.96E+01
mo 97	3.89E+02	3.89E+02	3.89E+02	3.89E+02	3.89E+02	3.89E+02	3.89E+02
mo 98	4.34E+02	4.34E+02	4.34E+02	4.34E+02	4.34E+02	4.34E+02	4.34E+02
tc 98	4.26E-03	4.26E-03	4.26E-03	4.26E-03	4.26E-03	4.26E-03	4.26E-03
tc 99	3.90E+02	3.92E+02	3.92E+02	3.92E+02	3.92E+02	3.92E+02	3.92E+02
ru 99	1.61E-02	2.05E-02	2.47E-02	2.90E-02	3.33E-02	3.76E-02	4.19E-02

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ce 14x14 45 gwd/mtu pwr 1.9 wt%: 20 year cooled fission products

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 8.08E+13n/cm**2-sec

0 nuclide concentrations, grams

basis =single reactor assembly

	initial	1216.7 d	2433.3 d	3650.0 d	4866.7 d	6083.3 d	7300.0 d
mo100	4.98E+02	4.98E+02	4.98E+02	4.98E+02	4.98E+02	4.98E+02	4.98E+02
ru100	7.99E+01	7.99E+01	7.99E+01	7.99E+01	7.99E+01	7.99E+01	7.99E+01
ru101	4.12E+02	4.12E+02	4.12E+02	4.12E+02	4.12E+02	4.12E+02	4.12E+02
ru102	4.49E+02	4.49E+02	4.49E+02	4.49E+02	4.49E+02	4.49E+02	4.49E+02
rh102	7.46E-04	3.37E-04	1.52E-04	6.85E-05	3.09E-05	1.39E-05	6.29E-06
rh103	2.10E+02	2.35E+02	2.35E+02	2.35E+02	2.35E+02	2.35E+02	2.35E+02
ru104	3.65E+02	3.65E+02	3.65E+02	3.65E+02	3.65E+02	3.65E+02	3.65E+02
pd104	1.96E+02	1.96E+02	1.96E+02	1.96E+02	1.96E+02	1.96E+02	1.96E+02
pd105	2.53E+02	2.54E+02	2.54E+02	2.54E+02	2.54E+02	2.54E+02	2.54E+02

ru106	1.19E+02	1.23E+01	1.27E+00	1.32E-01	1.36E-02	1.41E-03	1.46E-04
pd106	1.91E+02	2.97E+02	3.08E+02	3.10E+02	3.10E+02	3.10E+02	3.10E+02
pd107	1.81E+02	1.81E+02	1.81E+02	1.81E+02	1.81E+02	1.81E+02	1.81E+02
ag107	2.30E-05	8.75E-05	1.52E-04	2.16E-04	2.81E-04	3.45E-04	4.10E-04
pd108	1.22E+02	1.22E+02	1.22E+02	1.22E+02	1.22E+02	1.22E+02	1.22E+02
ag108m	1.99E-04	1.96E-04	1.92E-04	1.89E-04	1.85E-04	1.82E-04	1.79E-04
cd108	2.03E-04	2.03E-04	2.04E-04	2.04E-04	2.04E-04	2.04E-04	2.05E-04
ag109	6.46E+01	6.47E+01	6.47E+01	6.47E+01	6.47E+01	6.47E+01	6.47E+01
pd110	3.68E+01	3.68E+01	3.68E+01	3.68E+01	3.68E+01	3.68E+01	3.68E+01
cd110	4.64E+01	4.72E+01	4.73E+01	4.73E+01	4.73E+01	4.73E+01	4.73E+01
cd111	1.95E+01	1.98E+01	1.98E+01	1.98E+01	1.98E+01	1.98E+01	1.98E+01
cd112	9.83E+00	9.85E+00	9.85E+00	9.85E+00	9.85E+00	9.85E+00	9.85E+00
cd113	2.62E-02	2.80E-02	2.81E-02	2.81E-02	2.81E-02	2.81E-02	2.81E-02
cd113m	1.10E-01	9.35E-02	7.94E-02	6.74E-02	5.72E-02	4.86E-02	4.12E-02
in113	5.94E-03	2.25E-02	3.66E-02	4.86E-02	5.88E-02	6.74E-02	7.47E-02
cd114	8.82E+00	8.82E+00	8.82E+00	8.82E+00	8.82E+00	8.82E+00	8.82E+00
sn114	4.31E-04	5.03E-04	5.03E-04	5.03E-04	5.03E-04	5.03E-04	5.03E-04
in115	7.14E-01	7.32E-01	7.32E-01	7.32E-01	7.32E-01	7.32E-01	7.32E-01
sn115	1.11E-01	1.12E-01	1.12E-01	1.12E-01	1.12E-01	1.12E-01	1.12E-01
cd116	3.14E+00	3.14E+00	3.14E+00	3.14E+00	3.14E+00	3.14E+00	3.14E+00
sn116	1.82E+00	1.82E+00	1.82E+00	1.82E+00	1.82E+00	1.82E+00	1.82E+00
sn117	3.16E+00	3.16E+00	3.16E+00	3.16E+00	3.16E+00	3.16E+00	3.16E+00
sn118	2.44E+00	2.44E+00	2.44E+00	2.44E+00	2.44E+00	2.44E+00	2.44E+00
sn119	2.52E+00	2.54E+00	2.54E+00	2.54E+00	2.54E+00	2.54E+00	2.54E+00
sn120	2.47E+00	2.47E+00	2.47E+00	2.47E+00	2.47E+00	2.47E+00	2.47E+00
sn121	4.41E-03	1.26E-06	1.21E-06	1.16E-06	1.11E-06	1.06E-06	1.02E-06
sn121m	3.01E-02	2.89E-02	2.77E-02	2.66E-02	2.55E-02	2.44E-02	2.34E-02
sb121	2.37E+00	2.37E+00	2.38E+00	2.38E+00	2.38E+00	2.38E+00	2.38E+00
sn122	3.20E+00	3.20E+00	3.20E+00	3.20E+00	3.20E+00	3.20E+00	3.20E+00
te122	2.24E-01	2.26E-01	2.26E-01	2.26E-01	2.26E-01	2.26E-01	2.26E-01
sb123	2.76E+00	2.80E+00	2.80E+00	2.80E+00	2.80E+00	2.80E+00	2.80E+00
te123	2.01E-03	2.89E-03	2.89E-03	2.89E-03	2.89E-03	2.89E-03	2.89E-03
sn124	5.32E+00	5.32E+00	5.32E+00	5.32E+00	5.32E+00	5.32E+00	5.32E+00
te124	1.73E-01	2.06E-01	2.06E-01	2.06E-01	2.06E-01	2.06E-01	2.06E-01
sb125	4.76E+00	2.05E+00	8.81E-01	3.78E-01	1.62E-01	6.96E-02	2.99E-02
te125	1.85E+00	4.61E+00	5.79E+00	6.30E+00	6.52E+00	6.62E+00	6.66E+00
te125m	6.06E-02	2.91E-02	1.25E-02	5.37E-03	2.30E-03	9.89E-04	4.25E-04
sn126	1.32E+01	1.32E+01	1.32E+01	1.32E+01	1.32E+01	1.32E+01	1.32E+01
te126	2.80E-01	2.83E-01	2.84E-01	2.84E-01	2.84E-01	2.85E-01	2.85E-01
i127	2.66E+01	2.77E+01	2.77E+01	2.77E+01	2.77E+01	2.77E+01	2.77E+01
te128	5.35E+01	5.35E+01	5.35E+01	5.35E+01	5.35E+01	5.35E+01	5.35E+01
xe128	2.35E+00	2.35E+00	2.35E+00	2.35E+00	2.35E+00	2.35E+00	2.35E+00
i129	1.01E+02	1.02E+02	1.02E+02	1.02E+02	1.02E+02	1.02E+02	1.02E+02

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ce 14x14 45 gwd/mtu pwr 1.9 wt%: 20 year cooled fission products

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 8.08E+13n/cm**2-sec

0 nuclide concentrations, grams

basis =single reactor assembly

	initial	1216.7 d	2433.3 d	3650.0 d	4866.7 d	6083.3 d	7300.0 d
xe129	2.55E-02	2.61E-02	2.61E-02	2.61E-02	2.61E-02	2.62E-02	2.62E-02
te130	1.99E+02	1.99E+02	1.99E+02	1.99E+02	1.99E+02	1.99E+02	1.99E+02
xe130	8.32E+00	8.33E+00	8.33E+00	8.33E+00	8.33E+00	8.33E+00	8.33E+00
xe131	1.89E+02	1.92E+02	1.92E+02	1.92E+02	1.92E+02	1.92E+02	1.92E+02
xe132	6.46E+02	6.49E+02	6.49E+02	6.49E+02	6.49E+02	6.49E+02	6.49E+02
ba132	1.59E-04	1.62E-04	1.62E-04	1.62E-04	1.62E-04	1.62E-04	1.62E-04
cs133	5.56E+02	5.61E+02	5.61E+02	5.61E+02	5.61E+02	5.61E+02	5.61E+02
xe134	7.94E+02	7.94E+02	7.94E+02	7.94E+02	7.94E+02	7.94E+02	7.94E+02
cs134	8.30E+01	2.71E+01	8.84E+00	2.89E+00	9.42E-01	3.07E-01	1.00E-01
ba134	3.27E+01	8.86E+01	1.07E+02	1.13E+02	1.15E+02	1.15E+02	1.16E+02
cs135	1.21E+02	1.22E+02	1.22E+02	1.22E+02	1.22E+02	1.22E+02	1.22E+02
ba135	3.64E-01	3.64E-01	3.64E-01	3.64E-01	3.65E-01	3.65E-01	3.65E-01
xe136	1.32E+03	1.32E+03	1.32E+03	1.32E+03	1.32E+03	1.32E+03	1.32E+03
ba136	1.01E+01	1.04E+01	1.04E+01	1.04E+01	1.04E+01	1.04E+01	1.04E+01
cs137	6.62E+02	6.13E+02	5.67E+02	5.25E+02	4.86E+02	4.50E+02	4.17E+02
ba137	2.47E+01	7.37E+01	1.19E+02	1.61E+02	2.00E+02	2.36E+02	2.69E+02
ba137m	1.02E-04	9.36E-05	8.67E-05	8.02E-05	7.43E-05	6.88E-05	6.37E-05
ba138	6.64E+02	6.64E+02	6.64E+02	6.64E+02	6.64E+02	6.64E+02	6.64E+02
la138	4.82E-03	4.82E-03	4.82E-03	4.82E-03	4.82E-03	4.82E-03	4.82E-03
la139	6.13E+02	6.13E+02	6.13E+02	6.13E+02	6.13E+02	6.13E+02	6.13E+02
ce140	6.53E+02	6.65E+02	6.65E+02	6.65E+02	6.65E+02	6.65E+02	6.65E+02
pr141	5.38E+02	5.62E+02	5.62E+02	5.62E+02	5.62E+02	5.62E+02	5.62E+02
ce142	5.74E+02	5.74E+02	5.74E+02	5.74E+02	5.74E+02	5.74E+02	5.74E+02
nd142	1.94E+01	1.95E+01	1.95E+01	1.95E+01	1.95E+01	1.95E+01	1.95E+01
nd143	2.63E+02	2.73E+02	2.73E+02	2.73E+02	2.73E+02	2.73E+02	2.73E+02
ce144	1.55E+02	8.03E+00	4.16E-01	2.16E-02	1.12E-03	5.80E-05	3.01E-06
nd144	6.08E+02	7.55E+02	7.62E+02	7.63E+02	7.63E+02	7.63E+02	7.63E+02
nd145	3.11E+02	3.11E+02	3.11E+02	3.11E+02	3.11E+02	3.11E+02	3.11E+02
pm145	1.23E-05	1.15E-05	1.02E-05	8.94E-06	7.84E-06	6.89E-06	6.04E-06
nd146	3.79E+02	3.79E+02	3.79E+02	3.79E+02	3.79E+02	3.79E+02	3.79E+02
pm146	4.26E-03	2.80E-03	1.85E-03	1.22E-03	8.01E-04	5.28E-04	3.48E-04
sm146	3.37E-03	3.87E-03	4.19E-03	4.40E-03	4.54E-03	4.64E-03	4.70E-03
pm147	6.65E+01	2.90E+01	1.20E+01	4.99E+00	2.07E+00	8.59E-01	3.56E-01
sm147	2.88E+01	6.97E+01	8.67E+01	9.38E+01	9.67E+01	9.79E+01	9.84E+01
nd148	1.94E+02	1.94E+02	1.94E+02	1.94E+02	1.94E+02	1.94E+02	1.94E+02
sm148	7.17E+01	7.26E+01	7.26E+01	7.26E+01	7.26E+01	7.26E+01	7.26E+01
sm149	5.73E-01	1.34E+00	1.34E+00	1.34E+00	1.34E+00	1.34E+00	1.34E+00
nd150	1.04E+02	1.04E+02	1.04E+02	1.04E+02	1.04E+02	1.04E+02	1.04E+02
sm150	1.63E+02	1.63E+02	1.63E+02	1.63E+02	1.63E+02	1.63E+02	1.63E+02
sm151	5.24E+00	5.25E+00	5.11E+00	4.98E+00	4.86E+00	4.73E+00	4.61E+00
eu151	2.82E-03	1.39E-01	2.72E-01	4.02E-01	5.28E-01	6.51E-01	7.71E-01
sm152	7.08E+01	7.08E+01	7.08E+01	7.08E+01	7.08E+01	7.08E+01	7.08E+01
eu152	7.65E-03	6.44E-03	5.41E-03	4.55E-03	3.83E-03	3.22E-03	2.71E-03
gd152	1.89E-02	1.92E-02	1.95E-02	1.98E-02	2.00E-02	2.01E-02	2.03E-02
eu153	7.49E+01	7.57E+01	7.57E+01	7.57E+01	7.57E+01	7.57E+01	7.57E+01
sm154	2.61E+01	2.61E+01	2.61E+01	2.61E+01	2.61E+01	2.61E+01	2.61E+01
eu154	1.24E+01	9.49E+00	7.25E+00	5.54E+00	4.24E+00	3.24E+00	2.47E+00

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   gd154  1.06E+00 3.99E+00 6.22E+00 7.93E+00 9.24E+00 1.02E+01 1.10E+01
   eu155  3.68E+00 2.25E+00 1.37E+00 8.39E-01 5.12E-01 3.13E-01 1.91E-01
   gd155  1.47E-02 1.45E+00 2.33E+00 2.86E+00 3.19E+00 3.39E+00 3.51E+00
   gd156  8.32E+01 8.73E+01 8.73E+01 8.73E+01 8.73E+01 8.73E+01 8.73E+01
   gd157  5.32E-02 7.42E-02 7.42E-02 7.42E-02 7.42E-02 7.42E-02 7.42E-02
1
   ce 14x14  45 gwd/mtu pwr 1.9 wt%: 20 year cooled                    fission products
    page  34
 decay, following reactor irradiation identified by: power=  16.11mw, burnup=  17640.mwd, flux=
8.08E+13n/cm**2-sec
0                              nuclide concentrations, grams
                              basis =single reactor assembly
        initial 1216.7 d  2433.3 d  3650.0 d  4866.7 d  6083.3 d  7300.0 d
   gd158  1.96E+01 1.96E+01 1.96E+01 1.96E+01 1.96E+01 1.96E+01 1.96E+01
   tb159  2.02E+00 2.03E+00 2.03E+00 2.03E+00 2.03E+00 2.03E+00 2.03E+00
   gd160  8.68E-01 8.68E-01 8.68E-01 8.68E-01 8.68E-01 8.68E-01 8.68E-01
   dy160  1.94E-01 2.79E-01 2.79E-01 2.79E-01 2.79E-01 2.79E-01 2.79E-01
   dy161  2.49E-01 2.57E-01 2.57E-01 2.57E-01 2.57E-01 2.57E-01 2.57E-01
   dy162  2.57E-01 2.57E-01 2.57E-01 2.57E-01 2.57E-01 2.57E-01 2.57E-01
   dy163  2.45E-01 2.45E-01 2.45E-01 2.45E-01 2.45E-01 2.45E-01 2.45E-01
   dy164  3.93E-02 3.93E-02 3.93E-02 3.93E-02 3.93E-02 3.93E-02 3.93E-02
   ho165  1.18E-01 1.18E-01 1.18E-01 1.18E-01 1.18E-01 1.18E-01 1.18E-01
   ho166m 5.45E-04 5.44E-04 5.43E-04 5.42E-04 5.41E-04 5.40E-04 5.39E-04
   er166  3.39E-02 3.41E-02 3.41E-02 3.41E-02 3.41E-02 3.41E-02 3.41E-02
   er167  7.53E-04 7.53E-04 7.53E-04 7.53E-04 7.53E-04 7.53E-04 7.53E-04
   er168  1.64E-03 1.64E-03 1.64E-03 1.64E-03 1.64E-03 1.64E-03 1.64E-03
   tm169  2.52E-06 2.56E-06 2.56E-06 2.56E-06 2.56E-06 2.56E-06 2.56E-06
   er170  2.84E-06 2.84E-06 2.84E-06 2.84E-06 2.84E-06 2.84E-06 2.84E-06
   yb171  1.28E-06 2.96E-06 3.46E-06 3.61E-06 3.66E-06 3.67E-06 3.68E-06
   yb172  2.47E-06 2.49E-06 2.49E-06 2.49E-06 2.49E-06 2.49E-06 2.49E-06
  total   1.80E+04 1.80E+04 1.80E+04 1.80E+04 1.80E+04 1.80E+04 1.80E+04
1
   ce 14x14  45 gwd/mtu pwr 1.9 wt%: 20 year cooled                    fission products
    page  35
 decay, following reactor irradiation identified by: power=  16.11mw, burnup=  17640.mwd, flux=
8.08E+13n/cm**2-sec
0                              element radioactivity, curies
                              basis =single reactor assembly
        initial 1216.7 d  2433.3 d  3650.0 d  4866.7 d  6083.3 d  7300.0 d
    h   2.67E+02 2.22E+02 1.84E+02 1.52E+02 1.26E+02 1.05E+02 8.69E+01
   be   1.54E-06 1.54E-06 1.54E-06 1.54E-06 1.54E-06 1.54E-06 1.54E-06
    c   6.20E-05 6.19E-05 6.19E-05 6.19E-05 6.19E-05 6.18E-05 6.18E-05
   se   3.07E+05 3.36E-02 3.36E-02 3.36E-02 3.36E-02 3.36E-02 3.36E-02
   kr   1.16E+06 3.06E+03 2.47E+03 1.99E+03 1.60E+03 1.29E+03 1.04E+03
   rb   1.83E+06 8.74E-06 8.74E-06 8.74E-06 8.74E-06 8.74E-06 8.74E-06
   sr   3.09E+06 2.91E+04 2.68E+04 2.47E+04 2.27E+04 2.09E+04 1.93E+04
    y   4.30E+06 2.91E+04 2.68E+04 2.47E+04 2.27E+04 2.09E+04 1.93E+04
   zr   4.19E+06 1.72E+00 5.48E-01 5.48E-01 5.48E-01 5.48E-01 5.48E-01
   nb   6.44E+06 2.71E+00 1.66E-01 2.17E-01 2.61E-01 2.99E-01 3.32E-01
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tc	5.72E+06	6.70E+00	6.70E+00	6.70E+00	6.70E+00	6.70E+00	6.70E+00
ru	2.86E+06	4.09E+04	4.22E+03	4.37E+02	4.52E+01	4.67E+00	4.83E-01
rh	3.93E+06	4.09E+04	4.22E+03	4.37E+02	4.52E+01	4.69E+00	4.90E-01
pd	3.76E+05	9.33E-02	9.33E-02	9.33E-02	9.33E-02	9.33E-02	9.33E-02
ag	6.02E+05	1.36E+02	4.66E+00	1.64E-01	1.07E-02	5.35E-03	5.07E-03
cd	4.77E+04	2.10E+01	1.78E+01	1.51E+01	1.28E+01	1.09E+01	9.25E+00
sn	6.36E+05	6.76E+00	3.20E+00	2.92E+00	2.80E+00	2.70E+00	2.61E+00
sb	1.60E+06	2.15E+03	9.23E+02	3.97E+02	1.70E+02	7.34E+01	3.18E+01
te	3.49E+06	5.32E+02	2.25E+02	9.67E+01	4.15E+01	1.78E+01	7.65E+00
i	5.17E+06	1.81E-02	1.81E-02	1.81E-02	1.81E-02	1.81E-02	1.81E-02
cs	3.31E+06	8.84E+04	6.08E+04	4.95E+04	4.36E+04	3.96E+04	3.64E+04
ba	3.89E+06	5.04E+04	4.66E+04	4.32E+04	4.00E+04	3.70E+04	3.43E+04
ce	3.09E+06	2.56E+04	1.32E+03	6.87E+01	3.56E+00	1.85E-01	9.58E-03
pr	2.73E+06	2.59E+04	1.34E+03	6.96E+01	3.61E+00	1.87E-01	9.70E-03
pm	7.58E+05	2.69E+04	1.12E+04	4.63E+03	1.92E+03	7.96E+02	3.30E+02
sm	3.84E+05	1.38E+02	1.35E+02	1.31E+02	1.28E+02	1.25E+02	1.21E+02
eu	2.71E+05	3.68E+03	2.64E+03	1.91E+03	1.40E+03	1.03E+03	7.64E+02
ho	1.46E+02	9.77E-04	9.75E-04	9.73E-04	9.72E-04	9.70E-04	9.68E-04
tm	5.98E-03	7.87E-04	2.36E-04	7.10E-05	2.13E-05	6.41E-06	1.93E-06
totals	7.42E+07	3.67E+05	1.90E+05	1.52E+05	1.34E+05	1.22E+05	1.12E+05

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ce 14x14 45 gwd/mtu pwr 1.9 wt%: 20 year cooled fission products

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 8.08E+13n/cm**2-sec

0 element thermal power, watts

basis =single reactor assembly

	initial	1216.7 d	2433.3 d	3650.0 d	4866.7 d	6083.3 d	7300.0 d
h	9.02E-03	7.48E-03	6.20E-03	5.14E-03	4.26E-03	3.54E-03	2.93E-03
c	1.82E-08	1.82E-08	1.82E-08	1.81E-08	1.81E-08	1.81E-08	1.81E-08
se	5.32E+03	1.06E-05	1.06E-05	1.06E-05	1.06E-05	1.06E-05	1.06E-05
kr	1.87E+04	4.59E+00	3.70E+00	2.98E+00	2.40E+00	1.94E+00	1.56E+00
sr	4.67E+04	3.37E+01	3.11E+01	2.86E+01	2.64E+01	2.43E+01	2.24E+01
y	7.46E+04	1.61E+02	1.48E+02	1.37E+02	1.26E+02	1.16E+02	1.07E+02
zr	4.34E+04	6.00E-03	6.17E-05	6.17E-05	6.17E-05	6.17E-05	6.17E-05
nb	9.56E+04	1.25E-02	2.91E-05	3.78E-05	4.54E-05	5.20E-05	5.77E-05
tc	7.26E+04	3.36E-03	3.36E-03	3.36E-03	3.36E-03	3.36E-03	3.36E-03
ru	1.58E+04	2.43E+00	2.51E-01	2.60E-02	2.69E-03	2.78E-04	2.87E-05
rh	2.08E+04	3.92E+02	4.05E+01	4.19E+00	4.33E-01	4.50E-02	4.73E-03
pd	1.14E+03	5.14E-06	5.14E-06	5.14E-06	5.14E-06	5.14E-06	5.14E-06
ag	2.41E+03	2.25E+00	7.71E-02	2.68E-03	1.38E-04	5.06E-05	4.68E-05
cd	5.45E+02	2.28E-02	1.94E-02	1.64E-02	1.40E-02	1.19E-02	1.01E-02
sn	8.42E+03	4.76E-03	1.81E-03	1.67E-03	1.63E-03	1.58E-03	1.54E-03
sb	2.93E+04	6.80E+00	2.92E+00	1.26E+00	5.43E-01	2.37E-01	1.05E-01
te	3.31E+04	4.49E-01	1.90E-01	8.14E-02	3.50E-02	1.50E-02	6.44E-03
i	7.64E+04	8.45E-06	8.45E-06	8.45E-06	8.45E-06	8.45E-06	8.45E-06
cs	5.97E+04	4.17E+02	1.72E+02	8.89E+01	5.95E+01	4.76E+01	4.17E+01
ba	3.33E+04	1.98E+02	1.83E+02	1.70E+02	1.57E+02	1.45E+02	1.35E+02
ce	1.45E+04	1.67E+01	8.67E-01	4.49E-02	2.33E-03	1.21E-04	6.26E-06

pr	2.24E+04	1.88E+02	9.73E+00	5.04E-01	2.61E-02	1.36E-03	7.03E-05
pm	3.90E+03	9.88E+00	4.10E+00	1.70E+00	7.07E-01	2.93E-01	1.22E-01
sm	9.12E+02	1.62E-02	1.58E-02	1.54E-02	1.50E-02	1.47E-02	1.43E-02
eu	2.55E+03	2.42E+01	1.83E+01	1.39E+01	1.06E+01	8.07E+00	6.15E+00
ho	6.27E-01	1.03E-05	1.03E-05	1.02E-05	1.02E-05	1.02E-05	1.02E-05
totals	8.93E+05	1.46E+03	6.15E+02	4.48E+02	3.83E+02	3.44E+02	3.13E+02

1

ce 14x14 45 gwd/mtu pwr 1.9 wt%: 20 year cooled fission products

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 8.08E+13n/cm**2-sec

0 nuclide gamma power, watts

basis =single reactor assembly

	initial	1216.7 d	2433.3 d	3650.0 d	4866.7 d	6083.3 d	7300.0 d
kr 85	5.01E-02	4.04E-02	3.26E-02	2.63E-02	2.12E-02	1.71E-02	1.38E-02
y 90	3.45E-04	2.93E-04	2.70E-04	2.49E-04	2.29E-04	2.11E-04	1.94E-04
nb 93m	4.37E-07	1.19E-06	1.85E-06	2.41E-06	2.91E-06	3.33E-06	3.70E-06
nb 94	5.36E-07	5.35E-07	5.35E-07	5.35E-07	5.35E-07	5.35E-07	5.35E-07
tc 98	3.06E-08	3.06E-08	3.06E-08	3.06E-08	3.06E-08	3.06E-08	3.06E-08
tc 99	2.45E-08	2.46E-08	2.46E-08	2.46E-08	2.46E-08	2.46E-08	2.46E-08
rh102	1.16E-02	5.21E-03	2.35E-03	1.06E-03	4.78E-04	2.16E-04	9.73E-05
rh106	5.68E+02	4.99E+01	5.16E+00	5.33E-01	5.52E-02	5.70E-03	5.90E-04
ag108	8.48E-05	4.84E-08	4.76E-08	4.67E-08	4.59E-08	4.50E-08	4.42E-08
ag108m	5.00E-05	4.91E-05	4.82E-05	4.73E-05	4.65E-05	4.56E-05	4.48E-05
ag110m	6.39E+01	2.18E+00	7.46E-02	2.55E-03	8.70E-05	2.97E-06	1.02E-07
cd113m	1.04E-05	8.80E-06	7.47E-06	6.34E-06	5.38E-06	4.57E-06	3.88E-06
sn121m	4.80E-05	4.60E-05	4.41E-05	4.23E-05	4.05E-05	3.89E-05	3.73E-05
sb125	1.28E+01	5.53E+00	2.37E+00	1.02E+00	4.37E-01	1.88E-01	8.06E-02
te125m	2.30E-01	1.11E-01	4.76E-02	2.04E-02	8.76E-03	3.76E-03	1.61E-03
sn126	2.90E-04	2.90E-04	2.90E-04	2.90E-04	2.90E-04	2.90E-04	2.90E-04
sb126	4.28E+00	8.55E-04	8.55E-04	8.55E-04	8.55E-04	8.55E-04	8.55E-04
sb126m	2.81E+00	3.45E-03	3.45E-03	3.45E-03	3.45E-03	3.45E-03	3.45E-03
i129	2.61E-06	2.64E-06	2.64E-06	2.64E-06	2.64E-06	2.64E-06	2.64E-06
ba133	4.93E-08	3.96E-08	3.18E-08	2.55E-08	2.05E-08	1.65E-08	1.32E-08
cs134	9.90E+02	3.23E+02	1.05E+02	3.44E+01	1.12E+01	3.67E+00	1.20E+00
ba137m	1.95E+02	1.79E+02	1.66E+02	1.53E+02	1.42E+02	1.31E+02	1.22E+02
ce144	5.55E+01	2.88E+00	1.49E-01	7.73E-03	4.01E-04	2.08E-05	1.08E-06
pr144	8.56E+01	4.38E+00	2.27E-01	1.18E-02	6.10E-04	3.16E-05	1.64E-06
pr144m	5.13E-01	2.65E-02	1.37E-03	7.12E-05	3.69E-06	1.91E-07	9.93E-09
pm145	3.29E-07	3.08E-07	2.72E-07	2.38E-07	2.09E-07	1.84E-07	1.61E-07
pm146	8.40E-03	5.53E-03	3.64E-03	2.40E-03	1.58E-03	1.04E-03	6.85E-04
pm147	1.60E-03	6.99E-04	2.90E-04	1.20E-04	4.98E-05	2.07E-05	8.57E-06
eu150	4.93E-08	4.62E-08	4.34E-08	4.07E-08	3.81E-08	3.57E-08	3.35E-08
sm151	1.16E-05	1.16E-05	1.13E-05	1.10E-05	1.08E-05	1.05E-05	1.02E-05
eu152	9.31E-03	7.83E-03	6.58E-03	5.53E-03	4.65E-03	3.91E-03	3.29E-03
eu154	2.49E+01	1.91E+01	1.46E+01	1.11E+01	8.51E+00	6.51E+00	4.97E+00
eu155	6.96E-01	4.25E-01	2.60E-01	1.59E-01	9.68E-02	5.91E-02	3.61E-02
ho166m	9.45E-06	9.43E-06	9.41E-06	9.39E-06	9.37E-06	9.36E-06	9.34E-06
total	4.40E+05	5.87E+02	2.94E+02	2.01E+02	1.62E+02	1.42E+02	1.28E+02

ce 14x14 40 gwd/mtu pwr 2.9 wt%: 5 year cooled light elements
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decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 5.11E+13n/cm**2-sec
0 element thermal power, watts
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
mn	6.21E+02	1.99E-01	1.01E-01	5.15E-02	2.62E-02	1.33E-02	6.79E-03
fe	2.83E-01	1.50E-02	1.03E-02	8.33E-03	6.74E-03	5.46E-03	4.42E-03
co	4.02E+00	2.83E+00	2.50E+00	2.24E+00	2.01E+00	1.80E+00	1.61E+00
ni	1.37E-01	1.06E-03	1.05E-03	1.04E-03	1.04E-03	1.03E-03	1.03E-03
in	2.16E+00	2.55E-01	4.00E-02	6.40E-03	1.02E-03	1.64E-04	2.62E-05
sn	1.94E+01	1.20E+00	5.51E-01	2.62E-01	1.27E-01	6.16E-02	3.01E-02
sb	2.94E+00	1.10E+00	8.87E-01	7.18E-01	5.81E-01	4.70E-01	3.81E-01
te	8.10E-02	7.15E-02	5.78E-02	4.67E-02	3.78E-02	3.06E-02	2.48E-02
totals	6.51E+02	5.67E+00	4.15E+00	3.34E+00	2.79E+00	2.38E+00	2.06E+00

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ce 14x14 40 gwd/mtu pwr 2.9 wt%: 5 year cooled light elements
page 23
decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 5.11E+13n/cm**2-sec
0 element gamma power, watts
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
mn	4.17E+02	1.98E-01	1.01E-01	5.12E-02	2.61E-02	1.33E-02	6.76E-03
fe	2.47E-01	5.82E-03	3.01E-03	2.42E-03	1.96E-03	1.59E-03	1.28E-03
co	3.73E+00	2.72E+00	2.41E+00	2.16E+00	1.93E+00	1.73E+00	1.55E+00
ni	6.31E-02	1.28E-06	1.28E-06	1.28E-06	1.28E-06	1.28E-06	1.28E-06
in	1.08E+00	1.66E-01	2.65E-02	4.25E-03	6.80E-04	1.09E-04	1.74E-05
sn	6.90E+00	1.58E-01	7.19E-02	3.42E-02	1.65E-02	8.03E-03	3.91E-03
sb	1.95E+00	8.96E-01	7.22E-01	5.84E-01	4.73E-01	3.83E-01	3.10E-01
te	2.12E-02	1.81E-02	1.45E-02	1.17E-02	9.48E-03	7.67E-03	6.21E-03
totals	4.31E+02	4.17E+00	3.35E+00	2.85E+00	2.46E+00	2.15E+00	1.88E+00

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ce 14x14 40 gwd/mtu pwr 2.9 wt%: 5 year cooled actinides
page 24
decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 5.11E+13n/cm**2-sec
0 nuclide concentrations, gram atoms
basis = single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
he 4	4.79E-02	7.55E-02	8.78E-02	9.59E-02	1.03E-01	1.10E-01	1.16E-01
th232	3.94E-07	5.58E-07	7.21E-07	8.85E-07	1.05E-06	1.21E-06	1.38E-06
u232	2.85E-07	5.42E-07	7.49E-07	9.17E-07	1.05E-06	1.16E-06	1.25E-06
u233	5.87E-07	8.31E-07	1.08E-06	1.32E-06	1.57E-06	1.81E-06	2.06E-06
u234	3.07E-03	5.28E-03	7.55E-03	9.82E-03	1.21E-02	1.43E-02	1.66E-02
u235	7.09E+00	7.09E+00	7.09E+00	7.09E+00	7.09E+00	7.09E+00	7.09E+00
u236	6.64E+00	6.64E+00	6.64E+00	6.64E+00	6.64E+00	6.64E+00	6.65E+00
u238	1.60E+03	1.60E+03	1.60E+03	1.60E+03	1.60E+03	1.60E+03	1.60E+03

np236	1.37E-06	1.37E-06	1.37E-06	1.37E-06	1.37E-06	1.37E-06	1.37E-06
np237	7.87E-01	8.05E-01	8.05E-01	8.05E-01	8.06E-01	8.06E-01	8.07E-01
pu238	3.21E-01	3.43E-01	3.46E-01	3.45E-01	3.44E-01	3.41E-01	3.39E-01
pu239	7.60E+00	7.76E+00	7.76E+00	7.76E+00	7.76E+00	7.76E+00	7.76E+00
pu240	4.18E+00	4.18E+00	4.19E+00	4.19E+00	4.19E+00	4.19E+00	4.20E+00
pu241	2.22E+00	2.13E+00	2.05E+00	1.97E+00	1.89E+00	1.82E+00	1.74E+00
pu242	1.38E+00	1.38E+00	1.38E+00	1.38E+00	1.38E+00	1.38E+00	1.38E+00
am241	6.24E-02	1.50E-01	2.34E-01	3.14E-01	3.91E-01	4.65E-01	5.36E-01
am242m	1.18E-03	1.17E-03	1.17E-03	1.17E-03	1.16E-03	1.16E-03	1.15E-03
am243	3.20E-01	3.20E-01	3.20E-01	3.20E-01	3.20E-01	3.20E-01	3.20E-01
cm242	2.88E-02	7.95E-03	2.18E-03	6.01E-04	1.67E-04	4.80E-05	1.53E-05
cm243	8.33E-04	8.16E-04	8.00E-04	7.84E-04	7.68E-04	7.53E-04	7.38E-04
cm244	1.12E-01	1.09E-01	1.06E-01	1.02E-01	9.93E-02	9.61E-02	9.31E-02
cm245	3.47E-03	3.47E-03	3.47E-03	3.47E-03	3.47E-03	3.47E-03	3.47E-03
cm246	7.33E-04	7.33E-04	7.33E-04	7.33E-04	7.33E-04	7.33E-04	7.32E-04
cm247	1.31E-05	1.31E-05	1.31E-05	1.31E-05	1.31E-05	1.31E-05	1.31E-05
cm248	1.34E-06	1.34E-06	1.34E-06	1.34E-06	1.34E-06	1.34E-06	1.34E-06
total	1.63E+03	1.63E+03	1.63E+03	1.63E+03	1.63E+03	1.63E+03	1.63E+03

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ce 14x14 40 gwd/mtu pwr 2.9 wt%: 5 year cooled actinides

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decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 5.11E+13n/cm**2-sec

0 element concentrations, gram atoms

basis = single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
he	4.79E-02	7.55E-02	8.78E-02	9.59E-02	1.03E-01	1.10E-01	1.16E-01
th	4.29E-07	6.05E-07	7.87E-07	9.75E-07	1.17E-06	1.37E-06	1.57E-06
u	1.61E+03	1.61E+03	1.61E+03	1.61E+03	1.61E+03	1.61E+03	1.61E+03
np	9.56E-01	8.05E-01	8.05E-01	8.05E-01	8.06E-01	8.06E-01	8.07E-01
pu	1.57E+01	1.58E+01	1.57E+01	1.56E+01	1.56E+01	1.55E+01	1.54E+01
am	3.84E-01	4.71E-01	5.55E-01	6.35E-01	7.12E-01	7.86E-01	8.57E-01
cm	1.46E-01	1.22E-01	1.13E-01	1.08E-01	1.04E-01	1.01E-01	9.81E-02
totals	1.63E+03	1.63E+03	1.63E+03	1.63E+03	1.63E+03	1.63E+03	1.63E+03

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ce 14x14 40 gwd/mtu pwr 2.9 wt%: 5 year cooled actinides

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decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 5.11E+13n/cm**2-sec

0 nuclide concentrations, grams

basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
he 4	1.92E-01	3.02E-01	3.51E-01	3.84E-01	4.12E-01	4.38E-01	4.65E-01
pb208	9.44E-08	2.78E-07	6.58E-07	1.27E-06	2.14E-06	3.26E-06	4.60E-06
th228	4.05E-07	9.90E-07	1.80E-06	2.70E-06	3.61E-06	4.47E-06	5.27E-06
th230	2.11E-06	4.36E-06	7.82E-06	1.25E-05	1.84E-05	2.56E-05	3.39E-05
th232	9.14E-05	1.29E-04	1.67E-04	2.05E-04	2.43E-04	2.81E-04	3.19E-04
th234	5.52E-06	5.52E-06	5.52E-06	5.52E-06	5.52E-06	5.52E-06	5.52E-06
pa231	6.09E-06	7.44E-06	8.79E-06	1.01E-05	1.15E-05	1.28E-05	1.42E-05

pa233	6.28E-06	6.48E-06	6.48E-06	6.48E-06	6.49E-06	6.49E-06	6.50E-06
u232	6.61E-05	1.26E-04	1.74E-04	2.13E-04	2.44E-04	2.69E-04	2.89E-04
u233	1.37E-04	1.94E-04	2.51E-04	3.08E-04	3.65E-04	4.22E-04	4.79E-04
u234	7.18E-01	1.23E+00	1.77E+00	2.30E+00	2.83E+00	3.36E+00	3.88E+00
u235	1.67E+03	1.67E+03	1.67E+03	1.67E+03	1.67E+03	1.67E+03	1.67E+03
u236	1.57E+03	1.57E+03	1.57E+03	1.57E+03	1.57E+03	1.57E+03	1.57E+03
u237	4.16E+00	1.56E-05	1.50E-05	1.44E-05	1.38E-05	1.33E-05	1.27E-05
u238	3.80E+05	3.80E+05	3.80E+05	3.80E+05	3.80E+05	3.80E+05	3.80E+05
np236	3.24E-04	3.24E-04	3.24E-04	3.24E-04	3.24E-04	3.24E-04	3.24E-04
np237	1.86E+02	1.91E+02	1.91E+02	1.91E+02	1.91E+02	1.91E+02	1.91E+02
np239	3.96E+01	6.69E-05	6.69E-05	6.69E-05	6.69E-05	6.69E-05	6.69E-05
pu236	3.38E-04	2.79E-04	2.28E-04	1.87E-04	1.53E-04	1.26E-04	1.03E-04
pu238	7.63E+01	8.15E+01	8.24E+01	8.22E+01	8.18E+01	8.13E+01	8.07E+01
pu239	1.82E+03	1.86E+03	1.86E+03	1.86E+03	1.86E+03	1.86E+03	1.86E+03
pu240	1.00E+03	1.00E+03	1.00E+03	1.01E+03	1.01E+03	1.01E+03	1.01E+03
pu241	5.35E+02	5.14E+02	4.94E+02	4.74E+02	4.55E+02	4.38E+02	4.20E+02
pu242	3.33E+02	3.33E+02	3.33E+02	3.33E+02	3.33E+02	3.33E+02	3.33E+02
am241	1.50E+01	3.61E+01	5.63E+01	7.57E+01	9.43E+01	1.12E+02	1.29E+02
am242m	2.85E-01	2.84E-01	2.83E-01	2.82E-01	2.81E-01	2.80E-01	2.79E-01
am242	4.82E-02	3.67E-06	3.65E-06	3.64E-06	3.62E-06	3.61E-06	3.59E-06
am243	7.77E+01	7.78E+01	7.78E+01	7.78E+01	7.77E+01	7.77E+01	7.77E+01
cm242	6.98E+00	1.92E+00	5.28E-01	1.45E-01	4.04E-02	1.16E-02	3.71E-03
cm243	2.02E-01	1.98E-01	1.94E-01	1.90E-01	1.87E-01	1.83E-01	1.79E-01
cm244	2.74E+01	2.67E+01	2.58E+01	2.50E+01	2.42E+01	2.35E+01	2.27E+01
cm245	8.51E-01	8.51E-01	8.51E-01	8.51E-01	8.51E-01	8.51E-01	8.51E-01
cm246	1.80E-01	1.80E-01	1.80E-01	1.80E-01	1.80E-01	1.80E-01	1.80E-01
cm247	3.25E-03	3.25E-03	3.25E-03	3.25E-03	3.25E-03	3.25E-03	3.25E-03
cm248	3.33E-04	3.33E-04	3.33E-04	3.33E-04	3.33E-04	3.33E-04	3.34E-04
cf249	5.31E-07	2.86E-06	4.06E-06	4.68E-06	4.99E-06	5.15E-06	5.23E-06
total	3.87E+05	3.87E+05	3.87E+05	3.87E+05	3.87E+05	3.87E+05	3.87E+05

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ce 14x14 40 gwd/mtu pwr 2.9 wt%: 5 year cooled actinides

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decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 5.11E+13n/cm**2-sec

0 element concentrations, grams

basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
he	1.92E-01	3.02E-01	3.51E-01	3.84E-01	4.12E-01	4.38E-01	4.65E-01
pb	9.47E-08	2.79E-07	6.59E-07	1.28E-06	2.14E-06	3.26E-06	4.60E-06
th	9.95E-05	1.40E-04	1.83E-04	2.26E-04	2.71E-04	3.17E-04	3.64E-04
pa	1.24E-05	1.39E-05	1.53E-05	1.66E-05	1.80E-05	1.93E-05	2.07E-05
u	3.83E+05	3.83E+05	3.83E+05	3.83E+05	3.83E+05	3.83E+05	3.83E+05
np	2.27E+02	1.91E+02	1.91E+02	1.91E+02	1.91E+02	1.91E+02	1.91E+02
pu	3.76E+03	3.79E+03	3.77E+03	3.75E+03	3.73E+03	3.71E+03	3.70E+03
am	9.31E+01	1.14E+02	1.34E+02	1.54E+02	1.72E+02	1.90E+02	2.07E+02
cm	3.57E+01	2.98E+01	2.76E+01	2.64E+01	2.55E+01	2.47E+01	2.39E+01
cf	2.44E-06	4.65E-06	5.74E-06	6.26E-06	6.49E-06	6.58E-06	6.59E-06
totals	3.87E+05	3.87E+05	3.87E+05	3.87E+05	3.87E+05	3.87E+05	3.87E+05

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ce 14x14 40 gwd/mtu pwr 2.9 wt%: 5 year cooled actinides

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decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 5.11E+13n/cm**2-sec

0 element radioactivity, curies

basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
tl	1.20E-04	2.92E-04	5.31E-04	7.97E-04	1.07E-03	1.32E-03	1.56E-03
pb	3.34E-04	8.13E-04	1.48E-03	2.22E-03	2.96E-03	3.68E-03	4.34E-03
bi	3.34E-04	8.13E-04	1.48E-03	2.22E-03	2.96E-03	3.68E-03	4.34E-03
po	5.47E-04	1.33E-03	2.42E-03	3.64E-03	4.86E-03	6.04E-03	7.12E-03
rn	3.34E-04	8.13E-04	1.48E-03	2.22E-03	2.96E-03	3.68E-03	4.34E-03
ra	3.34E-04	8.13E-04	1.48E-03	2.22E-03	2.96E-03	3.68E-03	4.34E-03
th	1.41E-01	1.32E-01	1.33E-01	1.34E-01	1.34E-01	1.35E-01	1.36E-01
pa	2.72E-01	2.63E-01	2.63E-01	2.63E-01	2.63E-01	2.63E-01	2.63E-01
u	9.56E+06	1.52E+00	1.47E+00	1.43E+00	1.38E+00	1.34E+00	1.30E+00
np	9.40E+06	1.57E+01	1.57E+01	1.57E+01	1.57E+01	1.57E+01	1.57E+01
pu	3.18E+05	5.49E+04	5.28E+04	5.08E+04	4.89E+04	4.70E+04	4.52E+04
am	1.35E+05	1.45E+02	2.15E+02	2.81E+02	3.45E+02	4.06E+02	4.65E+02
cm	2.53E+04	8.54E+03	3.85E+03	2.52E+03	2.11E+03	1.95E+03	1.86E+03
bk	2.93E-02	4.10E-03	2.12E-03	1.10E-03	5.68E-04	2.94E-04	1.52E-04
cf	3.75E-04	3.05E-04	2.68E-04	2.36E-04	2.08E-04	1.86E-04	1.66E-04
totals	1.94E+07	6.36E+04	5.69E+04	5.36E+04	5.13E+04	4.94E+04	4.75E+04

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ce 14x14 40 gwd/mtu pwr 2.9 wt%: 5 year cooled actinides

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decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 5.11E+13n/cm**2-sec

0 element thermal power, watts

basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
tl	2.80E-06	6.83E-06	1.24E-05	1.86E-05	2.49E-05	3.09E-05	3.65E-05
pb	6.31E-07	1.54E-06	2.79E-06	4.19E-06	5.61E-06	6.96E-06	8.20E-06
bi	5.59E-06	1.36E-05	2.47E-05	3.71E-05	4.96E-05	6.16E-05	7.26E-05
po	2.50E-05	6.09E-05	1.11E-04	1.66E-04	2.22E-04	2.76E-04	3.25E-04
rn	1.27E-05	3.09E-05	5.61E-05	8.42E-05	1.13E-04	1.40E-04	1.65E-04
ra	1.15E-05	2.79E-05	5.07E-05	7.61E-05	1.02E-04	1.26E-04	1.49E-04
th	8.91E-05	8.34E-05	1.05E-04	1.29E-04	1.54E-04	1.77E-04	1.98E-04
pa	1.06E-03	9.71E-04	9.71E-04	9.71E-04	9.71E-04	9.72E-04	9.72E-04
u	2.57E+04	8.85E-03	8.89E-03	8.92E-03	8.94E-03	8.97E-03	9.00E-03
np	2.44E+04	4.32E-02	4.32E-02	4.32E-02	4.32E-02	4.32E-02	4.32E-02
pu	3.56E+02	5.87E+01	5.91E+01	5.90E+01	5.87E+01	5.83E+01	5.80E+01
am	6.86E+02	4.64E+00	6.95E+00	9.17E+00	1.13E+01	1.33E+01	1.53E+01
cm	9.21E+02	3.08E+02	1.37E+02	8.88E+01	7.38E+01	6.82E+01	6.51E+01
bk	1.52E-04	8.01E-07	4.15E-07	2.15E-07	1.11E-07	5.74E-08	2.97E-08
cf	2.15E-05	1.82E-05	1.55E-05	1.32E-05	1.13E-05	9.77E-06	8.49E-06
totals	5.20E+04	3.72E+02	2.03E+02	1.57E+02	1.44E+02	1.40E+02	1.38E+02

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ce 14x14 40 gwd/mtu pwr 2.9 wt%: 5 year cooled actinides
page 30
decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 5.11E+13n/cm**2-sec
0 element gamma power, watts
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
tl	2.39E-06	5.82E-06	1.06E-05	1.59E-05	2.12E-05	2.63E-05	3.10E-05
pb	2.87E-07	6.99E-07	1.27E-06	1.91E-06	2.55E-06	3.16E-06	3.73E-06
bi	2.08E-07	5.07E-07	9.21E-07	1.38E-06	1.85E-06	2.29E-06	2.70E-06
rn	1.22E-09	2.95E-09	5.35E-09	8.03E-09	1.07E-08	1.33E-08	1.57E-08
ra	1.99E-08	4.85E-08	8.82E-08	1.32E-07	1.77E-07	2.20E-07	2.59E-07
th	9.85E-06	8.03E-06	8.04E-06	8.06E-06	8.08E-06	8.09E-06	8.10E-06
pa	2.59E-04	1.89E-04	1.89E-04	1.89E-04	1.89E-04	1.89E-04	1.89E-04
u	3.08E+03	1.08E-03	1.04E-03	9.98E-04	9.59E-04	9.21E-04	8.85E-04
np	1.09E+04	1.70E-02	1.70E-02	1.70E-02	1.70E-02	1.70E-02	1.70E-02
pu	3.86E+01	1.91E-02	1.92E-02	1.92E-02	1.91E-02	1.90E-02	1.88E-02
am	4.63E+02	2.68E-02	3.86E-02	4.99E-02	6.07E-02	7.10E-02	8.10E-02
cm	3.22E-01	1.12E-01	5.29E-02	3.62E-02	3.10E-02	2.89E-02	2.78E-02
cf	5.71E-07	4.79E-07	4.00E-07	3.34E-07	2.79E-07	2.34E-07	1.98E-07
totals	1.45E+04	1.76E-01	1.29E-01	1.23E-01	1.29E-01	1.37E-01	1.46E-01

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ce 14x14 40 gwd/mtu pwr 2.9 wt%: 5 year cooled fission products
page 31
decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 5.11E+13n/cm**2-sec
0 nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
h 3	2.38E-02	2.27E-02	2.17E-02	2.07E-02	1.97E-02	1.88E-02	1.80E-02
li 6	6.39E-05	6.39E-05	6.39E-05	6.39E-05	6.39E-05	6.39E-05	6.39E-05
li 7	4.82E-06	4.82E-06	4.82E-06	4.82E-06	4.82E-06	4.82E-06	4.82E-06
be 9	9.28E-06	9.28E-06	9.28E-06	9.28E-06	9.28E-06	9.28E-06	9.28E-06
be 10	6.19E-05	6.19E-05	6.19E-05	6.19E-05	6.19E-05	6.19E-05	6.19E-05
c 14	1.25E-05	1.25E-05	1.25E-05	1.25E-05	1.25E-05	1.25E-05	1.25E-05
zn 70	4.32E-06	4.32E-06	4.32E-06	4.32E-06	4.32E-06	4.32E-06	4.32E-06
ga 71	4.12E-05	4.12E-05	4.12E-05	4.12E-05	4.12E-05	4.12E-05	4.12E-05
ge 72	2.49E-03	2.49E-03	2.49E-03	2.49E-03	2.49E-03	2.49E-03	2.49E-03
ge 73	7.05E-03	7.06E-03	7.06E-03	7.06E-03	7.06E-03	7.06E-03	7.06E-03
ge 74	6.18E-03	6.18E-03	6.18E-03	6.18E-03	6.18E-03	6.18E-03	6.18E-03
as 75	5.33E-02	5.33E-02	5.33E-02	5.33E-02	5.33E-02	5.33E-02	5.33E-02
ge 76	1.60E-01	1.60E-01	1.60E-01	1.60E-01	1.60E-01	1.60E-01	1.60E-01
se 76	1.81E-03	1.82E-03	1.82E-03	1.82E-03	1.82E-03	1.82E-03	1.82E-03
se 77	3.55E-01	3.55E-01	3.55E-01	3.55E-01	3.55E-01	3.55E-01	3.55E-01
se 78	1.23E+00	1.23E+00	1.23E+00	1.23E+00	1.23E+00	1.23E+00	1.23E+00
se 79	2.28E+00	2.28E+00	2.28E+00	2.28E+00	2.28E+00	2.28E+00	2.28E+00
br 79	8.27E-06	1.23E-05	1.63E-05	2.02E-05	2.42E-05	2.82E-05	3.22E-05
se 80	6.26E+00	6.26E+00	6.26E+00	6.26E+00	6.26E+00	6.26E+00	6.26E+00
kr 80	2.95E-05	2.95E-05	2.95E-05	2.95E-05	2.95E-05	2.95E-05	2.95E-05

br 81	9.25E+00	9.25E+00	9.25E+00	9.25E+00	9.25E+00	9.25E+00	9.25E+00
kr 81	2.34E-06	2.34E-06	2.34E-06	2.34E-06	2.34E-06	2.34E-06	2.34E-06
se 82	1.49E+01	1.49E+01	1.49E+01	1.49E+01	1.49E+01	1.49E+01	1.49E+01
kr 82	3.20E-01	3.21E-01	3.21E-01	3.21E-01	3.21E-01	3.21E-01	3.21E-01
kr 83	1.69E+01	1.69E+01	1.69E+01	1.69E+01	1.69E+01	1.69E+01	1.69E+01
kr 84	5.40E+01	5.40E+01	5.40E+01	5.40E+01	5.40E+01	5.40E+01	5.40E+01
kr 85	1.01E+01	9.60E+00	9.10E+00	8.62E+00	8.17E+00	7.74E+00	7.34E+00
rb 85	4.20E+01	4.26E+01	4.31E+01	4.36E+01	4.40E+01	4.44E+01	4.48E+01
kr 86	8.31E+01	8.31E+01	8.31E+01	8.31E+01	8.31E+01	8.31E+01	8.31E+01
sr 86	1.80E-01	1.89E-01	1.89E-01	1.89E-01	1.89E-01	1.89E-01	1.89E-01
rb 87	1.08E+02	1.08E+02	1.08E+02	1.08E+02	1.08E+02	1.08E+02	1.08E+02
sr 87	1.10E-03	1.10E-03	1.10E-03	1.10E-03	1.10E-03	1.10E-03	1.10E-03
sr 88	1.55E+02	1.55E+02	1.55E+02	1.55E+02	1.55E+02	1.55E+02	1.55E+02
y 89	1.96E+02	2.06E+02	2.06E+02	2.06E+02	2.06E+02	2.06E+02	2.06E+02
sr 90	2.41E+02	2.36E+02	2.32E+02	2.27E+02	2.22E+02	2.18E+02	2.13E+02
y 90	6.64E-02	6.14E-02	6.02E-02	5.90E-02	5.78E-02	5.66E-02	5.55E-02
zr 90	1.11E+01	1.60E+01	2.08E+01	2.55E+01	3.01E+01	3.47E+01	3.91E+01
zr 91	2.54E+02	2.69E+02	2.70E+02	2.70E+02	2.70E+02	2.70E+02	2.70E+02
zr 92	2.91E+02	2.91E+02	2.91E+02	2.91E+02	2.91E+02	2.91E+02	2.91E+02
zr 93	2.16E+02	2.16E+02	2.16E+02	2.16E+02	2.16E+02	2.16E+02	2.16E+02
nb 93	1.30E-05	2.00E-05	2.97E-05	4.19E-05	5.66E-05	7.36E-05	9.28E-05
nb 93m	1.60E-04	2.34E-04	3.06E-04	3.76E-04	4.43E-04	5.07E-04	5.69E-04
zr 94	3.55E+02	3.55E+02	3.55E+02	3.55E+02	3.55E+02	3.55E+02	3.55E+02
nb 94	2.38E-04	2.38E-04	2.38E-04	2.38E-04	2.38E-04	2.38E-04	2.38E-04
zr 95	2.78E+01	1.03E+00	3.83E-02	1.42E-03	5.28E-05	1.96E-06	7.27E-08
nb 95	1.52E+01	1.20E+00	4.59E-02	1.71E-03	6.35E-05	2.36E-06	8.75E-08
mo 95	3.07E+02	3.48E+02	3.50E+02	3.50E+02	3.50E+02	3.50E+02	3.50E+02
zr 96	3.76E+02	3.76E+02	3.76E+02	3.76E+02	3.76E+02	3.76E+02	3.76E+02
mo 96	2.08E+01	2.08E+01	2.08E+01	2.08E+01	2.08E+01	2.08E+01	2.08E+01
mo 97	3.57E+02	3.58E+02	3.58E+02	3.58E+02	3.58E+02	3.58E+02	3.58E+02
mo 98	3.91E+02	3.91E+02	3.91E+02	3.91E+02	3.91E+02	3.91E+02	3.91E+02
tc 98	3.12E-03	3.12E-03	3.12E-03	3.12E-03	3.12E-03	3.12E-03	3.12E-03

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ce 14x14 40 gwd/mtu pwr 2.9 wt%: 5 year cooled fission products

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decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 5.11E+13n/cm**2-sec

0 nuclide concentrations, grams

basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
tc 99	3.65E+02	3.66E+02	3.66E+02	3.66E+02	3.66E+02	3.66E+02	3.66E+02
ru 99	1.47E-02	1.58E-02	1.68E-02	1.78E-02	1.88E-02	1.98E-02	2.08E-02
mo100	4.44E+02	4.44E+02	4.44E+02	4.44E+02	4.44E+02	4.44E+02	4.44E+02
ru100	5.56E+01	5.56E+01	5.56E+01	5.56E+01	5.56E+01	5.56E+01	5.56E+01
ru101	3.66E+02	3.66E+02	3.66E+02	3.66E+02	3.66E+02	3.66E+02	3.66E+02
ru102	3.77E+02	3.77E+02	3.77E+02	3.77E+02	3.77E+02	3.77E+02	3.77E+02
rh102	5.36E-04	4.39E-04	3.60E-04	2.95E-04	2.42E-04	1.98E-04	1.62E-04
rh103	1.97E+02	2.18E+02	2.18E+02	2.18E+02	2.18E+02	2.18E+02	2.18E+02
ru104	2.75E+02	2.75E+02	2.75E+02	2.75E+02	2.75E+02	2.75E+02	2.75E+02

pd104	1.26E+02	1.26E+02	1.26E+02	1.26E+02	1.26E+02	1.26E+02	1.26E+02
pd105	1.94E+02	1.94E+02	1.94E+02	1.94E+02	1.94E+02	1.94E+02	1.94E+02
ru106	8.36E+01	4.74E+01	2.69E+01	1.53E+01	8.65E+00	4.90E+00	2.78E+00
rh106	8.85E-05	4.40E-05	2.50E-05	1.42E-05	8.03E-06	4.55E-06	2.58E-06
pd106	1.17E+02	1.53E+02	1.74E+02	1.85E+02	1.92E+02	1.96E+02	1.98E+02
pd107	1.22E+02	1.22E+02	1.22E+02	1.22E+02	1.22E+02	1.22E+02	1.22E+02
ag107	1.50E-05	2.58E-05	3.66E-05	4.74E-05	5.82E-05	6.90E-05	7.98E-05
pd108	8.05E+01	8.05E+01	8.05E+01	8.05E+01	8.05E+01	8.05E+01	8.05E+01
ag108m	1.06E-04	1.06E-04	1.05E-04	1.05E-04	1.04E-04	1.04E-04	1.03E-04
cd108	1.09E-04	1.09E-04	1.09E-04	1.09E-04	1.09E-04	1.09E-04	1.09E-04
ag109	4.69E+01	4.70E+01	4.70E+01	4.70E+01	4.70E+01	4.70E+01	4.70E+01
pd110	2.41E+01	2.41E+01	2.41E+01	2.41E+01	2.41E+01	2.41E+01	2.41E+01
ag110m	4.48E-01	1.93E-01	8.29E-02	3.56E-02	1.53E-02	6.58E-03	2.83E-03
cd110	2.36E+01	2.38E+01	2.39E+01	2.40E+01	2.40E+01	2.40E+01	2.40E+01
cd111	1.26E+01	1.27E+01	1.27E+01	1.27E+01	1.27E+01	1.27E+01	1.27E+01
cd112	6.38E+00	6.40E+00	6.40E+00	6.40E+00	6.40E+00	6.40E+00	6.40E+00
cd113	3.02E-02	3.16E-02	3.16E-02	3.16E-02	3.16E-02	3.16E-02	3.16E-02
cd113m	7.02E-02	6.74E-02	6.47E-02	6.21E-02	5.96E-02	5.72E-02	5.49E-02
in113	3.94E-03	6.75E-03	9.44E-03	1.20E-02	1.45E-02	1.69E-02	1.92E-02
cd114	6.33E+00	6.33E+00	6.33E+00	6.33E+00	6.33E+00	6.33E+00	6.33E+00
sn114	2.22E-04	2.59E-04	2.60E-04	2.60E-04	2.60E-04	2.60E-04	2.60E-04
in115	6.75E-01	6.89E-01	6.89E-01	6.89E-01	6.89E-01	6.89E-01	6.89E-01
sn115	8.64E-02	8.68E-02	8.68E-02	8.68E-02	8.68E-02	8.68E-02	8.68E-02
cd116	2.46E+00	2.46E+00	2.46E+00	2.46E+00	2.46E+00	2.46E+00	2.46E+00
sn116	1.21E+00	1.21E+00	1.21E+00	1.21E+00	1.21E+00	1.21E+00	1.21E+00
sn117	2.36E+00	2.36E+00	2.36E+00	2.36E+00	2.36E+00	2.36E+00	2.36E+00
sn118	1.87E+00	1.87E+00	1.87E+00	1.87E+00	1.87E+00	1.87E+00	1.87E+00
sn119	1.96E+00	1.96E+00	1.97E+00	1.97E+00	1.97E+00	1.97E+00	1.97E+00
sn119m	9.89E-03	4.82E-03	2.35E-03	1.14E-03	5.56E-04	2.71E-04	1.32E-04
sn120	1.92E+00	1.92E+00	1.92E+00	1.92E+00	1.92E+00	1.92E+00	1.92E+00
sn121m	2.21E-02	2.18E-02	2.16E-02	2.14E-02	2.12E-02	2.09E-02	2.07E-02
sb121	1.89E+00	1.90E+00	1.90E+00	1.90E+00	1.90E+00	1.90E+00	1.90E+00
sn122	2.49E+00	2.49E+00	2.49E+00	2.49E+00	2.49E+00	2.49E+00	2.49E+00
te122	1.37E-01	1.38E-01	1.38E-01	1.38E-01	1.38E-01	1.38E-01	1.38E-01
sn123	3.09E-02	6.04E-03	1.18E-03	2.31E-04	4.51E-05	8.82E-06	1.72E-06
sb123	2.22E+00	2.24E+00	2.25E+00	2.25E+00	2.25E+00	2.25E+00	2.25E+00
te123	1.14E-03	1.49E-03	1.55E-03	1.56E-03	1.56E-03	1.56E-03	1.56E-03
sn124	4.16E+00	4.16E+00	4.16E+00	4.16E+00	4.16E+00	4.16E+00	4.16E+00
te124	1.05E-01	1.26E-01	1.26E-01	1.26E-01	1.26E-01	1.26E-01	1.26E-01
sb125	3.69E+00	3.00E+00	2.43E+00	1.97E+00	1.59E+00	1.29E+00	1.04E+00
te125	1.41E+00	2.12E+00	2.70E+00	3.16E+00	3.54E+00	3.85E+00	4.10E+00
te125m	4.64E-02	4.24E-02	3.45E-02	2.79E-02	2.26E-02	1.83E-02	1.48E-02
sn126	9.83E+00	9.83E+00	9.83E+00	9.83E+00	9.83E+00	9.83E+00	9.83E+00

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ce 14x14 40 gwd/mtu pwr 2.9 wt%: 5 year cooled fission products

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decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 5.11E+13n/cm**2-sec

0 nuclide concentrations, grams

basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
te126	1.86E-01	1.89E-01	1.89E-01	1.89E-01	1.89E-01	1.89E-01	1.89E-01
te127m	6.64E-01	9.98E-02	1.44E-02	2.08E-03	3.01E-04	4.36E-05	6.30E-06
i127	2.06E+01	2.13E+01	2.14E+01	2.14E+01	2.14E+01	2.14E+01	2.14E+01
te128	4.40E+01	4.40E+01	4.40E+01	4.40E+01	4.40E+01	4.40E+01	4.40E+01
xe128	1.38E+00	1.38E+00	1.38E+00	1.38E+00	1.38E+00	1.38E+00	1.38E+00
i129	8.61E+01	8.70E+01	8.70E+01	8.70E+01	8.70E+01	8.70E+01	8.70E+01
xe129	1.04E-02	1.06E-02	1.06E-02	1.06E-02	1.06E-02	1.06E-02	1.06E-02
te130	1.74E+02	1.74E+02	1.74E+02	1.74E+02	1.74E+02	1.74E+02	1.74E+02
xe130	4.70E+00	4.70E+00	4.70E+00	4.70E+00	4.70E+00	4.70E+00	4.70E+00
xe131	1.87E+02	1.90E+02	1.90E+02	1.90E+02	1.90E+02	1.90E+02	1.90E+02
xe132	5.37E+02	5.39E+02	5.39E+02	5.39E+02	5.39E+02	5.39E+02	5.39E+02
ba132	1.13E-04	1.15E-04	1.15E-04	1.15E-04	1.15E-04	1.15E-04	1.15E-04
cs133	5.24E+02	5.29E+02	5.29E+02	5.29E+02	5.29E+02	5.29E+02	5.29E+02
xe134	7.17E+02	7.17E+02	7.17E+02	7.17E+02	7.17E+02	7.17E+02	7.17E+02
cs134	6.12E+01	4.63E+01	3.50E+01	2.64E+01	2.00E+01	1.51E+01	1.14E+01
ba134	2.31E+01	3.80E+01	4.93E+01	5.79E+01	6.43E+01	6.92E+01	7.29E+01
cs135	1.42E+02	1.42E+02	1.42E+02	1.42E+02	1.42E+02	1.42E+02	1.42E+02
ba135	1.92E-01	1.93E-01	1.93E-01	1.93E-01	1.93E-01	1.93E-01	1.93E-01
xe136	1.12E+03	1.12E+03	1.12E+03	1.12E+03	1.12E+03	1.12E+03	1.12E+03
ba136	8.33E+00	8.61E+00	8.61E+00	8.61E+00	8.61E+00	8.61E+00	8.61E+00
cs137	5.89E+02	5.77E+02	5.66E+02	5.56E+02	5.45E+02	5.35E+02	5.24E+02
ba137	2.19E+01	3.32E+01	4.42E+01	5.50E+01	6.55E+01	7.59E+01	8.61E+01
ba137m	9.06E-05	8.82E-05	8.65E-05	8.49E-05	8.32E-05	8.16E-05	8.01E-05
ba138	6.06E+02	6.06E+02	6.06E+02	6.06E+02	6.06E+02	6.06E+02	6.06E+02
la138	4.12E-03	4.12E-03	4.12E-03	4.12E-03	4.12E-03	4.12E-03	4.12E-03
la139	5.67E+02	5.67E+02	5.67E+02	5.67E+02	5.67E+02	5.67E+02	5.67E+02
ce140	5.93E+02	6.04E+02	6.04E+02	6.04E+02	6.04E+02	6.04E+02	6.04E+02
pr141	5.01E+02	5.22E+02	5.22E+02	5.22E+02	5.22E+02	5.22E+02	5.22E+02
ce142	5.31E+02	5.31E+02	5.31E+02	5.31E+02	5.31E+02	5.31E+02	5.31E+02
nd142	1.22E+01	1.22E+01	1.22E+01	1.22E+01	1.22E+01	1.22E+01	1.22E+01
nd143	3.16E+02	3.25E+02	3.25E+02	3.25E+02	3.25E+02	3.25E+02	3.25E+02
ce144	1.49E+02	7.11E+01	3.39E+01	1.62E+01	7.73E+00	3.69E+00	1.76E+00
pr144	6.34E-03	3.00E-03	1.43E-03	6.82E-04	3.25E-04	1.55E-04	7.41E-05
nd144	5.09E+02	5.87E+02	6.24E+02	6.42E+02	6.50E+02	6.54E+02	6.56E+02
nd145	3.06E+02	3.07E+02	3.07E+02	3.07E+02	3.07E+02	3.07E+02	3.07E+02
pm145	1.02E-05	1.02E-05	1.01E-05	9.84E-06	9.58E-06	9.30E-06	9.01E-06
nd146	3.33E+02	3.33E+02	3.33E+02	3.33E+02	3.33E+02	3.33E+02	3.33E+02
pm146	3.53E-03	3.18E-03	2.87E-03	2.58E-03	2.33E-03	2.10E-03	1.89E-03
sm146	2.88E-03	3.00E-03	3.11E-03	3.21E-03	3.29E-03	3.37E-03	3.44E-03
pm147	7.31E+01	6.11E+01	4.91E+01	3.94E+01	3.16E+01	2.54E+01	2.03E+01
sm147	3.32E+01	4.83E+01	6.03E+01	7.00E+01	7.78E+01	8.40E+01	8.90E+01
nd148	1.73E+02	1.73E+02	1.73E+02	1.73E+02	1.73E+02	1.73E+02	1.73E+02
sm148	6.04E+01	6.14E+01	6.14E+01	6.14E+01	6.14E+01	6.14E+01	6.14E+01
sm149	7.30E-01	1.37E+00	1.37E+00	1.37E+00	1.37E+00	1.37E+00	1.37E+00
nd150	8.64E+01	8.64E+01	8.64E+01	8.64E+01	8.64E+01	8.64E+01	8.64E+01
sm150	1.44E+02	1.44E+02	1.44E+02	1.44E+02	1.44E+02	1.44E+02	1.44E+02
sm151	5.57E+00	5.65E+00	5.62E+00	5.58E+00	5.55E+00	5.51E+00	5.47E+00

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   eu151  4.37E-03 4.07E-02 7.69E-02 1.13E-01 1.48E-01 1.84E-01 2.19E-01
   sm152  6.27E+01 6.27E+01 6.27E+01 6.27E+01 6.27E+01 6.27E+01 6.27E+01
   eu152  1.16E-02 1.11E-02 1.06E-02 1.01E-02 9.72E-03 9.30E-03 8.91E-03
   gd152  2.16E-02 2.18E-02 2.19E-02 2.20E-02 2.21E-02 2.22E-02 2.24E-02
   eu153  6.02E+01 6.08E+01 6.08E+01 6.08E+01 6.08E+01 6.08E+01 6.08E+01
1
   ce 14x14  40 gwd/mtu pwr 2.9 wt%: 5 year cooled                    fission products
    page  34
 decay, following reactor irradiation identified by: power=  14.32mw, burnup=  15680.mwd, flux=
5.11E+13n/cm**2-sec
0                              nuclide concentrations, grams
                              basis =single reactor assembly
        initial  304.2 d  608.3 d  912.5 d  1216.7 d  1520.8 d  1825.0 d
   gd153  1.79E-03 7.47E-04 3.12E-04 1.30E-04 5.45E-05 2.28E-05 9.51E-06
   sm154  1.90E+01 1.90E+01 1.90E+01 1.90E+01 1.90E+01 1.90E+01 1.90E+01
   eu154  1.05E+01 9.77E+00 9.14E+00 8.54E+00 7.99E+00 7.47E+00 6.98E+00
   gd154  8.66E-01 1.54E+00 2.18E+00 2.77E+00 3.33E+00 3.85E+00 4.33E+00
   eu155  2.85E+00 2.52E+00 2.23E+00 1.97E+00 1.74E+00 1.54E+00 1.36E+00
   gd155  1.62E-02 3.47E-01 6.39E-01 8.97E-01 1.13E+00 1.33E+00 1.51E+00
   gd156  4.60E+01 4.84E+01 4.84E+01 4.84E+01 4.84E+01 4.84E+01 4.84E+01
   gd157  4.18E-02 5.33E-02 5.33E-02 5.33E-02 5.33E-02 5.33E-02 5.33E-02
   gd158  1.06E+01 1.06E+01 1.06E+01 1.06E+01 1.06E+01 1.06E+01 1.06E+01
   tb159  1.28E+00 1.28E+00 1.28E+00 1.28E+00 1.28E+00 1.28E+00 1.28E+00
   gd160  5.64E-01 5.64E-01 5.64E-01 5.64E-01 5.64E-01 5.64E-01 5.64E-01
   dy160  1.07E-01 1.49E-01 1.52E-01 1.52E-01 1.52E-01 1.52E-01 1.52E-01
   dy161  1.73E-01 1.78E-01 1.78E-01 1.78E-01 1.78E-01 1.78E-01 1.78E-01
   dy162  1.60E-01 1.60E-01 1.60E-01 1.60E-01 1.60E-01 1.60E-01 1.60E-01
   dy163  1.32E-01 1.32E-01 1.32E-01 1.32E-01 1.32E-01 1.32E-01 1.32E-01
   dy164  2.35E-02 2.35E-02 2.35E-02 2.35E-02 2.35E-02 2.35E-02 2.35E-02
   ho165  4.90E-02 4.90E-02 4.90E-02 4.90E-02 4.90E-02 4.90E-02 4.90E-02
   ho166m 1.76E-04 1.76E-04 1.76E-04 1.76E-04 1.76E-04 1.76E-04 1.75E-04
   er166  1.11E-02 1.12E-02 1.12E-02 1.12E-02 1.12E-02 1.12E-02 1.12E-02
   er167  2.24E-04 2.24E-04 2.24E-04 2.24E-04 2.24E-04 2.24E-04 2.24E-04
   er168  3.48E-04 3.48E-04 3.48E-04 3.48E-04 3.48E-04 3.48E-04 3.48E-04
   tm169  1.68E-06 1.71E-06 1.71E-06 1.71E-06 1.71E-06 1.71E-06 1.71E-06
   er170  1.88E-06 1.88E-06 1.88E-06 1.88E-06 1.88E-06 1.88E-06 1.88E-06
   yb171  8.11E-07 1.24E-06 1.55E-06 1.79E-06 1.96E-06 2.09E-06 2.19E-06
   yb172  1.62E-06 1.63E-06 1.63E-06 1.63E-06 1.63E-06 1.63E-06 1.63E-06
  total   1.61E+04 1.61E+04 1.61E+04 1.61E+04 1.61E+04 1.61E+04 1.61E+04
1
   ce 14x14  40 gwd/mtu pwr 2.9 wt%: 5 year cooled                    fission products
    page  35
 decay, following reactor irradiation identified by: power=  14.32mw, burnup=  15680.mwd, flux=
5.11E+13n/cm**2-sec
0                              element radioactivity, curies
                              basis =single reactor assembly
        initial  304.2 d  608.3 d  912.5 d  1216.7 d  1520.8 d  1825.0 d
    h   2.30E+02 2.19E+02 2.09E+02 2.00E+02 1.91E+02 1.82E+02 1.74E+02
   be   1.38E-06 1.38E-06 1.38E-06 1.38E-06 1.38E-06 1.38E-06 1.38E-06
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c	5.58E-05	5.58E-05	5.58E-05	5.58E-05	5.58E-05	5.58E-05	5.58E-05
se	3.32E+05	3.13E-02	3.13E-02	3.13E-02	3.13E-02	3.13E-02	3.13E-02
kr	1.32E+06	3.77E+03	3.57E+03	3.38E+03	3.21E+03	3.04E+03	2.88E+03
rb	1.97E+06	9.39E-03	9.39E-06	9.27E-06	9.27E-06	9.27E-06	9.27E-06
sr	3.12E+06	3.78E+04	3.28E+04	3.20E+04	3.14E+04	3.07E+04	3.01E+04
y	4.20E+06	4.41E+04	3.30E+04	3.20E+04	3.14E+04	3.08E+04	3.01E+04
zr	3.81E+06	2.21E+04	8.23E+02	3.11E+01	1.68E+00	5.85E-01	5.45E-01
nb	5.72E+06	4.73E+04	1.82E+03	6.77E+01	2.61E+00	2.14E-01	1.39E-01
tc	4.65E+06	6.27E+00	6.27E+00	6.27E+00	6.27E+00	6.27E+00	6.27E+00
ru	2.18E+06	1.60E+05	8.92E+04	5.06E+04	2.87E+04	1.63E+04	9.22E+03
rh	2.96E+06	1.60E+05	8.92E+04	5.06E+04	2.87E+04	1.63E+04	9.22E+03
pd	2.65E+05	6.25E-02	6.25E-02	6.25E-02	6.25E-02	6.25E-02	6.25E-02
ag	4.02E+05	9.29E+02	3.99E+02	1.72E+02	7.38E+01	3.17E+01	1.36E+01
cd	3.87E+04	1.67E+01	1.45E+01	1.39E+01	1.34E+01	1.28E+01	1.23E+01
sn	5.53E+05	7.01E+01	2.08E+01	8.50E+00	4.75E+00	3.36E+00	2.76E+00
sb	1.42E+06	3.16E+03	2.55E+03	2.06E+03	1.67E+03	1.35E+03	1.09E+03
te	3.13E+06	2.71E+03	8.91E+02	5.42E+02	4.13E+02	3.30E+02	2.67E+02
i	4.60E+06	1.54E-02	1.54E-02	1.54E-02	1.54E-02	1.54E-02	1.54E-02
cs	2.99E+06	1.10E+05	9.46E+04	8.26E+04	7.33E+04	6.61E+04	6.04E+04
ba	3.61E+06	4.75E+04	4.65E+04	4.57E+04	4.48E+04	4.39E+04	4.31E+04
ce	2.86E+06	2.27E+05	1.08E+05	5.15E+04	2.46E+04	1.17E+04	5.60E+03
pr	2.49E+06	2.30E+05	1.10E+05	5.23E+04	2.49E+04	1.19E+04	5.68E+03
pm	6.46E+05	5.68E+04	4.55E+04	3.65E+04	2.93E+04	2.35E+04	1.89E+04
sm	2.73E+05	1.49E+02	1.48E+02	1.47E+02	1.46E+02	1.45E+02	1.44E+02
eu	1.62E+05	3.89E+03	3.57E+03	3.28E+03	3.02E+03	2.78E+03	2.56E+03
gd	3.82E+03	2.64E+00	1.10E+00	4.61E-01	1.93E-01	8.04E-02	3.36E-02
tb	1.42E+03	2.75E+01	1.49E+00	8.06E-02	4.36E-03	2.36E-04	1.28E-05
ho	4.77E+01	3.16E-04	3.16E-04	3.15E-04	3.15E-04	3.15E-04	3.15E-04
tm	4.30E-03	1.33E-03	9.84E-04	7.28E-04	5.39E-04	3.99E-04	2.95E-04
totals	6.62E+07	1.16E+06	6.62E+05	4.44E+05	3.26E+05	2.59E+05	2.20E+05

1

ce 14x14 40 gwd/mtu pwr 2.9 wt%: 5 year cooled fission products

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decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 5.11E+13n/cm**2-sec

0 element thermal power, watts

basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
h	7.75E-03	7.40E-03	7.06E-03	6.74E-03	6.43E-03	6.14E-03	5.86E-03
c	1.64E-08	1.64E-08	1.64E-08	1.64E-08	1.64E-08	1.64E-08	1.64E-08
se	5.87E+03	9.82E-06	9.82E-06	9.82E-06	9.82E-06	9.82E-06	9.82E-06
kr	2.13E+04	5.65E+00	5.36E+00	5.08E+00	4.81E+00	4.56E+00	4.32E+00
sr	4.61E+04	5.42E+01	3.82E+01	3.72E+01	3.64E+01	3.57E+01	3.50E+01
y	7.10E+04	2.23E+02	1.82E+02	1.77E+02	1.74E+02	1.70E+02	1.67E+02
zr	3.90E+04	1.12E+02	4.14E+00	1.54E-01	5.77E-03	2.73E-04	6.91E-05
nb	8.32E+04	2.26E+02	8.67E+00	3.23E-01	1.20E-02	4.66E-04	4.03E-05
tc	5.72E+04	3.14E-03	3.14E-03	3.14E-03	3.14E-03	3.14E-03	3.14E-03
ru	1.21E+04	1.98E+01	5.35E+00	3.01E+00	1.71E+00	9.67E-01	5.48E-01
rh	1.49E+04	1.51E+03	8.55E+02	4.85E+02	2.75E+02	1.56E+02	8.84E+01

pd	8.23E+02	3.45E-06	3.45E-06	3.45E-06	3.45E-06	3.45E-06	3.45E-06
ag	1.59E+03	1.54E+01	6.61E+00	2.84E+00	1.22E+00	5.25E-01	2.26E-01
cd	4.47E+02	2.22E-02	1.58E-02	1.52E-02	1.45E-02	1.40E-02	1.34E-02
sn	7.33E+03	1.66E-01	3.62E-02	9.45E-03	3.54E-03	2.04E-03	1.58E-03
sb	2.60E+04	1.01E+01	8.05E+00	6.52E+00	5.27E+00	4.27E+00	3.46E+00
te	2.98E+04	2.60E+00	7.78E-01	4.60E-01	3.48E-01	2.78E-01	2.25E-01
i	6.85E+04	7.19E-06	7.18E-06	7.18E-06	7.18E-06	7.18E-06	7.18E-06
cs	5.44E+04	6.67E+02	5.16E+02	4.03E+02	3.16E+02	2.51E+02	2.01E+02
ba	3.11E+04	1.86E+02	1.83E+02	1.79E+02	1.76E+02	1.73E+02	1.69E+02
ce	1.33E+04	1.50E+02	7.07E+01	3.37E+01	1.61E+01	7.68E+00	3.66E+00
pr	2.02E+04	1.66E+03	7.93E+02	3.79E+02	1.81E+02	8.62E+01	4.11E+01
pm	3.21E+03	2.16E+01	1.67E+01	1.34E+01	1.08E+01	8.64E+00	6.93E+00
sm	6.51E+02	1.75E-02	1.74E-02	1.73E-02	1.72E-02	1.71E-02	1.69E-02
eu	1.53E+03	2.50E+01	2.33E+01	2.17E+01	2.03E+01	1.89E+01	1.77E+01
gd	1.12E+01	2.32E-03	9.70E-04	4.05E-04	1.69E-04	7.07E-05	2.95E-05
tb	8.29E+00	2.41E-01	1.31E-02	7.07E-04	3.83E-05	2.07E-06	1.12E-07
ho	2.05E-01	3.32E-06	3.32E-06	3.32E-06	3.32E-06	3.31E-06	3.31E-06
tm	1.51E-05	2.10E-07	1.53E-07	1.12E-07	8.31E-08	6.15E-08	4.55E-08
totals	8.08E+05	4.89E+03	2.72E+03	1.75E+03	1.22E+03	9.18E+02	7.39E+02

1

ce 14x14 40 gwd/mtu pwr 2.9 wt%: 5 year cooled fission products

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decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 5.11E+13n/cm**2-sec

0 nuclide gamma power, watts

basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
kr 85	5.26E-02	4.98E-02	4.72E-02	4.47E-02	4.24E-02	4.02E-02	3.81E-02
y 90	3.63E-04	3.36E-04	3.30E-04	3.23E-04	3.16E-04	3.10E-04	3.04E-04
y 91	8.35E+00	2.29E-01	6.23E-03	1.70E-04	4.62E-06	1.26E-07	3.43E-09
nb 93m	4.25E-07	6.23E-07	8.14E-07	9.98E-07	1.18E-06	1.35E-06	1.51E-06
nb 94	4.16E-07	4.16E-07	4.16E-07	4.16E-07	4.16E-07	4.16E-07	4.16E-07
zr 95	2.59E+03	9.61E+01	3.57E+00	1.32E-01	4.92E-03	1.83E-04	6.78E-06
nb 95	2.72E+03	2.13E+02	8.18E+00	3.04E-01	1.13E-02	4.20E-04	1.56E-05
nb 95m	2.76E+00	1.06E-01	3.93E-03	1.46E-04	5.42E-06	2.01E-07	7.47E-09
tc 98	2.24E-08	2.24E-08	2.24E-08	2.24E-08	2.24E-08	2.24E-08	2.24E-08
tc 99	2.29E-08	2.30E-08	2.30E-08	2.30E-08	2.30E-08	2.30E-08	2.30E-08
rh102	8.30E-03	6.80E-03	5.57E-03	4.57E-03	3.74E-03	3.07E-03	2.51E-03
rh106	3.86E+02	1.92E+02	1.09E+02	6.18E+01	3.50E+01	1.99E+01	1.13E+01
ag108	5.07E-05	2.62E-08	2.60E-08	2.59E-08	2.58E-08	2.57E-08	2.56E-08
ag108m	2.66E-05	2.65E-05	2.64E-05	2.62E-05	2.61E-05	2.60E-05	2.59E-05
ag110	1.78E+01	2.27E-03	9.75E-04	4.19E-04	1.80E-04	7.75E-05	3.33E-05
ag110m	3.46E+01	1.49E+01	6.40E+00	2.75E+00	1.18E+00	5.08E-01	2.19E-01
cd113m	6.60E-06	6.34E-06	6.08E-06	5.84E-06	5.61E-06	5.38E-06	5.17E-06
sn119m	2.51E-03	1.22E-03	5.95E-04	2.90E-04	1.41E-04	6.88E-05	3.35E-05
sn121m	3.51E-05	3.48E-05	3.44E-05	3.41E-05	3.37E-05	3.33E-05	3.30E-05
sn123	1.04E-02	2.03E-03	3.97E-04	7.76E-05	1.52E-05	2.97E-06	5.80E-07
te123m	3.28E-03	5.63E-04	9.66E-05	1.66E-05	2.85E-06	4.89E-07	8.41E-08
sb124	4.03E+00	1.21E-01	3.66E-03	1.10E-04	3.32E-06	1.00E-07	3.01E-09

ce 14x14 40 gwd/mtu pwr 2.9 wt%: 6 year cooled light elements
page 22
decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 5.11E+13n/cm**2-sec
0 element thermal power, watts
basis =single reactor assembly

	initial	365.0 d	730.0 d	1095.0 d	1460.0 d	1825.0 d	2190.0 d
mn	6.21E+02	1.74E-01	7.72E-02	3.43E-02	1.53E-02	6.79E-03	3.02E-03
fe	2.83E-01	1.31E-02	9.46E-03	7.34E-03	5.69E-03	4.42E-03	3.43E-03
co	4.02E+00	2.75E+00	2.39E+00	2.10E+00	1.84E+00	1.61E+00	1.41E+00
ni	1.37E-01	1.05E-03	1.05E-03	1.04E-03	1.03E-03	1.03E-03	1.02E-03
in	2.16E+00	1.75E-01	1.92E-02	2.13E-03	2.36E-04	2.62E-05	2.91E-06
sn	1.94E+01	1.02E+00	4.08E-01	1.69E-01	7.11E-02	3.01E-02	1.28E-02
sb	2.94E+00	1.05E+00	8.15E-01	6.33E-01	4.91E-01	3.81E-01	2.95E-01
te	8.10E-02	6.85E-02	5.30E-02	4.11E-02	3.19E-02	2.48E-02	1.92E-02
totals	6.51E+02	5.26E+00	3.78E+00	2.99E+00	2.46E+00	2.06E+00	1.75E+00

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ce 14x14 40 gwd/mtu pwr 2.9 wt%: 6 year cooled light elements
page 23
decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 5.11E+13n/cm**2-sec
0 element gamma power, watts
basis =single reactor assembly

	initial	365.0 d	730.0 d	1095.0 d	1460.0 d	1825.0 d	2190.0 d
mn	4.17E+02	1.73E-01	7.68E-02	3.42E-02	1.52E-02	6.76E-03	3.00E-03
fe	2.47E-01	4.37E-03	2.75E-03	2.13E-03	1.65E-03	1.28E-03	9.96E-04
co	3.73E+00	2.65E+00	2.31E+00	2.02E+00	1.77E+00	1.55E+00	1.36E+00
ni	6.31E-02	1.28E-06	1.28E-06	1.28E-06	1.28E-06	1.28E-06	1.28E-06
in	1.08E+00	1.15E-01	1.27E-02	1.41E-03	1.57E-04	1.74E-05	1.93E-06
sn	6.90E+00	1.34E-01	5.33E-02	2.21E-02	9.28E-03	3.91E-03	1.65E-03
sb	1.95E+00	8.57E-01	6.63E-01	5.15E-01	3.99E-01	3.10E-01	2.40E-01
te	2.12E-02	1.73E-02	1.33E-02	1.03E-02	8.00E-03	6.21E-03	4.82E-03
totals	4.31E+02	3.95E+00	3.13E+00	2.61E+00	2.21E+00	1.88E+00	1.61E+00

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ce 14x14 40 gwd/mtu pwr 2.9 wt%: 6 year cooled actinides
page 24
decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 5.11E+13n/cm**2-sec
0 nuclide concentrations, gram atoms
basis = single reactor assembly

	initial	365.0 d	730.0 d	1095.0 d	1460.0 d	1825.0 d	2190.0 d
he 4	4.79E-02	7.86E-02	9.13E-02	1.00E-01	1.08E-01	1.16E-01	1.24E-01
th232	3.94E-07	5.90E-07	7.87E-07	9.83E-07	1.18E-06	1.38E-06	1.57E-06
u232	2.85E-07	5.87E-07	8.21E-07	1.00E-06	1.14E-06	1.25E-06	1.33E-06
u233	5.87E-07	8.75E-07	1.16E-06	1.45E-06	1.74E-06	2.03E-06	2.32E-06
u234	3.07E-03	5.73E-03	8.46E-03	1.12E-02	1.39E-02	1.66E-02	1.93E-02
u235	7.09E+00	7.09E+00	7.09E+00	7.09E+00	7.09E+00	7.09E+00	7.09E+00
u236	6.64E+00	6.64E+00	6.64E+00	6.64E+00	6.64E+00	6.65E+00	6.65E+00
u238	1.60E+03	1.60E+03	1.60E+03	1.60E+03	1.60E+03	1.60E+03	1.60E+03

np236	1.37E-06	1.37E-06	1.37E-06	1.37E-06	1.37E-06	1.37E-06	1.37E-06
np237	7.87E-01	8.05E-01	8.05E-01	8.05E-01	8.06E-01	8.07E-01	8.08E-01
pu238	3.21E-01	3.44E-01	3.46E-01	3.44E-01	3.42E-01	3.39E-01	3.37E-01
pu239	7.60E+00	7.76E+00	7.76E+00	7.76E+00	7.76E+00	7.76E+00	7.76E+00
pu240	4.18E+00	4.18E+00	4.19E+00	4.19E+00	4.19E+00	4.20E+00	4.20E+00
pu241	2.22E+00	2.12E+00	2.02E+00	1.92E+00	1.83E+00	1.74E+00	1.66E+00
pu242	1.38E+00	1.38E+00	1.38E+00	1.38E+00	1.38E+00	1.38E+00	1.38E+00
am241	6.24E-02	1.67E-01	2.66E-01	3.61E-01	4.51E-01	5.36E-01	6.17E-01
am242m	1.18E-03	1.17E-03	1.17E-03	1.16E-03	1.16E-03	1.15E-03	1.15E-03
am243	3.20E-01	3.20E-01	3.20E-01	3.20E-01	3.20E-01	3.20E-01	3.20E-01
cm242	2.88E-02	6.14E-03	1.30E-03	2.78E-04	6.13E-05	1.53E-05	5.60E-06
cm243	8.33E-04	8.13E-04	7.93E-04	7.74E-04	7.56E-04	7.38E-04	7.20E-04
cm244	1.12E-01	1.09E-01	1.04E-01	1.01E-01	9.68E-02	9.31E-02	8.96E-02
cm245	3.47E-03	3.47E-03	3.47E-03	3.47E-03	3.47E-03	3.47E-03	3.47E-03
cm246	7.33E-04	7.33E-04	7.33E-04	7.33E-04	7.33E-04	7.32E-04	7.32E-04
cm247	1.31E-05	1.31E-05	1.31E-05	1.31E-05	1.31E-05	1.31E-05	1.31E-05
cm248	1.34E-06	1.34E-06	1.34E-06	1.34E-06	1.34E-06	1.34E-06	1.34E-06
total	1.63E+03	1.63E+03	1.63E+03	1.63E+03	1.63E+03	1.63E+03	1.63E+03

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ce 14x14 40 gwd/mtu pwr 2.9 wt%: 6 year cooled actinides

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decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 5.11E+13n/cm**2-sec

0 element concentrations, gram atoms

basis = single reactor assembly

	initial	365.0 d	730.0 d	1095.0 d	1460.0 d	1825.0 d	2190.0 d
he	4.79E-02	7.86E-02	9.13E-02	1.00E-01	1.08E-01	1.16E-01	1.24E-01
th	4.29E-07	6.41E-07	8.62E-07	1.09E-06	1.33E-06	1.57E-06	1.82E-06
u	1.61E+03	1.61E+03	1.61E+03	1.61E+03	1.61E+03	1.61E+03	1.61E+03
np	9.56E-01	8.05E-01	8.05E-01	8.05E-01	8.06E-01	8.07E-01	8.08E-01
pu	1.57E+01	1.58E+01	1.57E+01	1.56E+01	1.55E+01	1.54E+01	1.53E+01
am	3.84E-01	4.88E-01	5.87E-01	6.82E-01	7.72E-01	8.57E-01	9.38E-01
cm	1.46E-01	1.20E-01	1.11E-01	1.06E-01	1.02E-01	9.81E-02	9.46E-02
totals	1.63E+03	1.63E+03	1.63E+03	1.63E+03	1.63E+03	1.63E+03	1.63E+03

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ce 14x14 40 gwd/mtu pwr 2.9 wt%: 6 year cooled actinides

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decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 5.11E+13n/cm**2-sec

0 nuclide concentrations, grams

basis =single reactor assembly

	initial	365.0 d	730.0 d	1095.0 d	1460.0 d	1825.0 d	2190.0 d
he 4	1.92E-01	3.14E-01	3.65E-01	4.01E-01	4.33E-01	4.65E-01	4.96E-01
pb208	9.44E-08	3.37E-07	8.74E-07	1.76E-06	3.01E-06	4.60E-06	6.49E-06
th228	4.05E-07	1.14E-06	2.15E-06	3.24E-06	4.30E-06	5.27E-06	6.12E-06
th230	2.11E-06	4.96E-06	9.55E-06	1.59E-05	2.41E-05	3.39E-05	4.56E-05
th232	9.14E-05	1.37E-04	1.83E-04	2.28E-04	2.74E-04	3.19E-04	3.65E-04
th234	5.52E-06	5.52E-06	5.52E-06	5.52E-06	5.52E-06	5.52E-06	5.52E-06
pa231	6.09E-06	7.71E-06	9.33E-06	1.09E-05	1.26E-05	1.42E-05	1.58E-05

pa233	6.28E-06	6.48E-06	6.48E-06	6.48E-06	6.49E-06	6.50E-06	6.50E-06
u232	6.61E-05	1.36E-04	1.90E-04	2.32E-04	2.64E-04	2.89E-04	3.08E-04
u233	1.37E-04	2.04E-04	2.71E-04	3.38E-04	4.05E-04	4.73E-04	5.40E-04
u234	7.18E-01	1.34E+00	1.98E+00	2.62E+00	3.25E+00	3.88E+00	4.51E+00
u235	1.67E+03	1.67E+03	1.67E+03	1.67E+03	1.67E+03	1.67E+03	1.67E+03
u236	1.57E+03	1.57E+03	1.57E+03	1.57E+03	1.57E+03	1.57E+03	1.57E+03
u237	4.16E+00	1.55E-05	1.47E-05	1.40E-05	1.34E-05	1.27E-05	1.21E-05
u238	3.80E+05	3.80E+05	3.80E+05	3.80E+05	3.80E+05	3.80E+05	3.80E+05
np236	3.24E-04	3.24E-04	3.24E-04	3.24E-04	3.24E-04	3.24E-04	3.24E-04
np237	1.86E+02	1.91E+02	1.91E+02	1.91E+02	1.91E+02	1.91E+02	1.91E+02
np239	3.96E+01	6.69E-05	6.69E-05	6.69E-05	6.69E-05	6.69E-05	6.69E-05
pu236	3.38E-04	2.68E-04	2.11E-04	1.66E-04	1.31E-04	1.03E-04	8.11E-05
pu238	7.63E+01	8.19E+01	8.24E+01	8.20E+01	8.14E+01	8.07E+01	8.01E+01
pu239	1.82E+03	1.86E+03	1.86E+03	1.86E+03	1.86E+03	1.86E+03	1.86E+03
pu240	1.00E+03	1.00E+03	1.01E+03	1.01E+03	1.01E+03	1.01E+03	1.01E+03
pu241	5.35E+02	5.10E+02	4.86E+02	4.63E+02	4.41E+02	4.20E+02	4.00E+02
pu242	3.33E+02	3.33E+02	3.33E+02	3.33E+02	3.33E+02	3.33E+02	3.33E+02
am241	1.50E+01	4.02E+01	6.41E+01	8.69E+01	1.09E+02	1.29E+02	1.49E+02
am242m	2.85E-01	2.84E-01	2.83E-01	2.81E-01	2.80E-01	2.79E-01	2.77E-01
am242	4.82E-02	3.66E-06	3.65E-06	3.63E-06	3.61E-06	3.59E-06	3.58E-06
am243	7.77E+01	7.78E+01	7.78E+01	7.77E+01	7.77E+01	7.77E+01	7.77E+01
cm242	6.98E+00	1.49E+00	3.15E-01	6.73E-02	1.48E-02	3.71E-03	1.36E-03
cm243	2.02E-01	1.98E-01	1.93E-01	1.88E-01	1.84E-01	1.79E-01	1.75E-01
cm244	2.74E+01	2.65E+01	2.55E+01	2.45E+01	2.36E+01	2.27E+01	2.19E+01
cm245	8.51E-01	8.51E-01	8.51E-01	8.51E-01	8.51E-01	8.51E-01	8.51E-01
cm246	1.80E-01	1.80E-01	1.80E-01	1.80E-01	1.80E-01	1.80E-01	1.80E-01
cm247	3.25E-03	3.25E-03	3.25E-03	3.25E-03	3.25E-03	3.25E-03	3.25E-03
cm248	3.33E-04	3.33E-04	3.33E-04	3.33E-04	3.33E-04	3.34E-04	3.34E-04
cf249	5.31E-07	3.17E-06	4.36E-06	4.89E-06	5.13E-06	5.23E-06	5.27E-06
total	3.87E+05	3.87E+05	3.87E+05	3.87E+05	3.87E+05	3.87E+05	3.87E+05

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ce 14x14 40 gwd/mtu pwr 2.9 wt%: 6 year cooled actinides

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decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 5.11E+13n/cm**2-sec

0 element concentrations, grams

basis =single reactor assembly

	initial	365.0 d	730.0 d	1095.0 d	1460.0 d	1825.0 d	2190.0 d
he	1.92E-01	3.14E-01	3.65E-01	4.01E-01	4.33E-01	4.65E-01	4.96E-01
pb	9.47E-08	3.38E-07	8.76E-07	1.77E-06	3.02E-06	4.60E-06	6.49E-06
th	9.95E-05	1.49E-04	2.00E-04	2.53E-04	3.08E-04	3.64E-04	4.22E-04
pa	1.24E-05	1.42E-05	1.58E-05	1.74E-05	1.91E-05	2.07E-05	2.23E-05
u	3.83E+05	3.83E+05	3.83E+05	3.83E+05	3.83E+05	3.83E+05	3.83E+05
np	2.27E+02	1.91E+02	1.91E+02	1.91E+02	1.91E+02	1.91E+02	1.91E+02
pu	3.76E+03	3.78E+03	3.76E+03	3.74E+03	3.72E+03	3.70E+03	3.68E+03
am	9.31E+01	1.18E+02	1.42E+02	1.65E+02	1.87E+02	2.07E+02	2.27E+02
cm	3.57E+01	2.92E+01	2.70E+01	2.58E+01	2.48E+01	2.39E+01	2.31E+01
cf	2.44E-06	4.93E-06	5.99E-06	6.42E-06	6.57E-06	6.59E-06	6.57E-06
totals	3.87E+05	3.87E+05	3.87E+05	3.87E+05	3.87E+05	3.87E+05	3.87E+05

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ce 14x14 40 gwd/mtu pwr 2.9 wt%: 6 year cooled actinides

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decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 5.11E+13n/cm**2-sec

0 element radioactivity, curies

basis =single reactor assembly

	initial	365.0 d	730.0 d	1095.0 d	1460.0 d	1825.0 d	2190.0 d
tl	1.20E-04	3.36E-04	6.35E-04	9.58E-04	1.27E-03	1.56E-03	1.81E-03
pb	3.34E-04	9.35E-04	1.77E-03	2.67E-03	3.54E-03	4.34E-03	5.03E-03
bi	3.34E-04	9.35E-04	1.77E-03	2.67E-03	3.54E-03	4.34E-03	5.03E-03
po	5.47E-04	1.53E-03	2.90E-03	4.37E-03	5.81E-03	7.11E-03	8.26E-03
rn	3.34E-04	9.35E-04	1.77E-03	2.67E-03	3.54E-03	4.34E-03	5.03E-03
ra	3.34E-04	9.35E-04	1.77E-03	2.67E-03	3.54E-03	4.34E-03	5.03E-03
th	1.41E-01	1.32E-01	1.33E-01	1.34E-01	1.35E-01	1.36E-01	1.36E-01
pa	2.72E-01	2.62E-01	2.63E-01	2.63E-01	2.63E-01	2.63E-01	2.63E-01
u	9.56E+06	1.51E+00	1.45E+00	1.40E+00	1.35E+00	1.30E+00	1.26E+00
np	9.40E+06	1.57E+01	1.57E+01	1.57E+01	1.57E+01	1.57E+01	1.57E+01
pu	3.18E+05	5.45E+04	5.20E+04	4.96E+04	4.74E+04	4.52E+04	4.31E+04
am	1.35E+05	1.59E+02	2.42E+02	3.20E+02	3.94E+02	4.65E+02	5.32E+02
cm	2.53E+04	7.08E+03	3.12E+03	2.22E+03	1.97E+03	1.86E+03	1.78E+03
bk	2.93E-02	3.59E-03	1.63E-03	7.39E-04	3.35E-04	1.52E-04	6.90E-05
cf	3.75E-04	2.97E-04	2.54E-04	2.19E-04	1.90E-04	1.66E-04	1.48E-04
totals	1.94E+07	6.17E+04	5.54E+04	5.22E+04	4.97E+04	4.75E+04	4.55E+04

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ce 14x14 40 gwd/mtu pwr 2.9 wt%: 6 year cooled actinides

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decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 5.11E+13n/cm**2-sec

0 element thermal power, watts

basis =single reactor assembly

	initial	365.0 d	730.0 d	1095.0 d	1460.0 d	1825.0 d	2190.0 d
tl	2.80E-06	7.86E-06	1.49E-05	2.24E-05	2.98E-05	3.64E-05	4.23E-05
pb	6.31E-07	1.77E-06	3.34E-06	5.04E-06	6.69E-06	8.20E-06	9.52E-06
bi	5.59E-06	1.57E-05	2.96E-05	4.47E-05	5.93E-05	7.26E-05	8.43E-05
po	2.50E-05	7.00E-05	1.32E-04	2.00E-04	2.65E-04	3.25E-04	3.77E-04
rn	1.27E-05	3.55E-05	6.71E-05	1.01E-04	1.34E-04	1.65E-04	1.91E-04
ra	1.15E-05	3.21E-05	6.06E-05	9.15E-05	1.21E-04	1.49E-04	1.73E-04
th	8.91E-05	8.74E-05	1.15E-04	1.44E-04	1.72E-04	1.98E-04	2.21E-04
pa	1.06E-03	9.71E-04	9.71E-04	9.71E-04	9.71E-04	9.72E-04	9.72E-04
u	2.57E+04	8.86E-03	8.90E-03	8.93E-03	8.97E-03	9.00E-03	9.03E-03
np	2.44E+04	4.32E-02	4.32E-02	4.32E-02	4.32E-02	4.32E-02	4.32E-02
pu	3.56E+02	5.89E+01	5.91E+01	5.88E+01	5.84E+01	5.80E+01	5.75E+01
am	6.86E+02	5.11E+00	7.85E+00	1.05E+01	1.29E+01	1.53E+01	1.75E+01
cm	9.21E+02	2.55E+02	1.11E+02	7.80E+01	6.90E+01	6.51E+01	6.24E+01
bk	1.52E-04	7.02E-07	3.19E-07	1.44E-07	6.55E-08	2.97E-08	1.35E-08
cf	2.15E-05	1.76E-05	1.45E-05	1.20E-05	1.01E-05	8.49E-06	7.26E-06
totals	5.20E+04	3.19E+02	1.78E+02	1.47E+02	1.40E+02	1.38E+02	1.38E+02

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ce 14x14 40 gwd/mtu pwr 2.9 wt%: 6 year cooled actinides
page 30
decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 5.11E+13n/cm**2-sec
0 element gamma power, watts
basis =single reactor assembly

	initial	365.0 d	730.0 d	1095.0 d	1460.0 d	1825.0 d	2190.0 d
tl	2.39E-06	6.69E-06	1.27E-05	1.91E-05	2.53E-05	3.10E-05	3.60E-05
pb	2.87E-07	8.03E-07	1.52E-06	2.29E-06	3.04E-06	3.73E-06	4.33E-06
bi	2.08E-07	5.83E-07	1.10E-06	1.66E-06	2.21E-06	2.70E-06	3.14E-06
rn	1.22E-09	3.39E-09	6.41E-09	9.66E-09	1.28E-08	1.57E-08	1.82E-08
ra	1.99E-08	5.58E-08	1.06E-07	1.59E-07	2.11E-07	2.59E-07	3.01E-07
th	9.85E-06	8.03E-06	8.05E-06	8.07E-06	8.09E-06	8.10E-06	8.12E-06
pa	2.59E-04	1.89E-04	1.89E-04	1.89E-04	1.89E-04	1.89E-04	1.89E-04
u	3.08E+03	1.07E-03	1.02E-03	9.74E-04	9.29E-04	8.85E-04	8.44E-04
np	1.09E+04	1.70E-02	1.70E-02	1.70E-02	1.70E-02	1.70E-02	1.70E-02
pu	3.86E+01	1.91E-02	1.92E-02	1.91E-02	1.90E-02	1.88E-02	1.87E-02
am	4.63E+02	2.92E-02	4.32E-02	5.64E-02	6.90E-02	8.10E-02	9.24E-02
cm	3.22E-01	9.33E-02	4.37E-02	3.24E-02	2.92E-02	2.78E-02	2.68E-02
cf	5.71E-07	4.62E-07	3.72E-07	3.00E-07	2.43E-07	1.98E-07	1.63E-07
totals	1.45E+04	1.60E-01	1.24E-01	1.26E-01	1.35E-01	1.46E-01	1.56E-01

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ce 14x14 40 gwd/mtu pwr 2.9 wt%: 6 year cooled fission products
page 31
decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 5.11E+13n/cm**2-sec
0 nuclide concentrations, grams
basis =single reactor assembly

	initial	365.0 d	730.0 d	1095.0 d	1460.0 d	1825.0 d	2190.0 d
h 3	2.38E-02	2.25E-02	2.13E-02	2.01E-02	1.90E-02	1.80E-02	1.70E-02
li 6	6.39E-05	6.39E-05	6.39E-05	6.39E-05	6.39E-05	6.39E-05	6.39E-05
li 7	4.82E-06	4.82E-06	4.82E-06	4.82E-06	4.82E-06	4.82E-06	4.82E-06
be 9	9.28E-06	9.28E-06	9.28E-06	9.28E-06	9.28E-06	9.28E-06	9.28E-06
be 10	6.19E-05	6.19E-05	6.19E-05	6.19E-05	6.19E-05	6.19E-05	6.19E-05
c 14	1.25E-05	1.25E-05	1.25E-05	1.25E-05	1.25E-05	1.25E-05	1.25E-05
zn 70	4.32E-06	4.32E-06	4.32E-06	4.32E-06	4.32E-06	4.32E-06	4.32E-06
ga 71	4.12E-05	4.12E-05	4.12E-05	4.12E-05	4.12E-05	4.12E-05	4.12E-05
ge 72	2.49E-03	2.49E-03	2.49E-03	2.49E-03	2.49E-03	2.49E-03	2.49E-03
ge 73	7.05E-03	7.06E-03	7.06E-03	7.06E-03	7.06E-03	7.06E-03	7.06E-03
ge 74	6.18E-03	6.18E-03	6.18E-03	6.18E-03	6.18E-03	6.18E-03	6.18E-03
as 75	5.33E-02	5.33E-02	5.33E-02	5.33E-02	5.33E-02	5.33E-02	5.33E-02
ge 76	1.60E-01	1.60E-01	1.60E-01	1.60E-01	1.60E-01	1.60E-01	1.60E-01
se 76	1.81E-03	1.82E-03	1.82E-03	1.82E-03	1.82E-03	1.82E-03	1.82E-03
se 77	3.55E-01	3.55E-01	3.55E-01	3.55E-01	3.55E-01	3.55E-01	3.55E-01
se 78	1.23E+00	1.23E+00	1.23E+00	1.23E+00	1.23E+00	1.23E+00	1.23E+00
se 79	2.28E+00	2.28E+00	2.28E+00	2.28E+00	2.28E+00	2.28E+00	2.28E+00
br 79	8.27E-06	1.31E-05	1.79E-05	2.26E-05	2.74E-05	3.22E-05	3.70E-05
se 80	6.26E+00	6.26E+00	6.26E+00	6.26E+00	6.26E+00	6.26E+00	6.26E+00
kr 80	2.95E-05	2.95E-05	2.95E-05	2.95E-05	2.95E-05	2.95E-05	2.95E-05

br 81	9.25E+00	9.25E+00	9.25E+00	9.25E+00	9.25E+00	9.25E+00	9.25E+00
kr 81	2.34E-06	2.34E-06	2.34E-06	2.34E-06	2.34E-06	2.34E-06	2.34E-06
se 82	1.49E+01	1.49E+01	1.49E+01	1.49E+01	1.49E+01	1.49E+01	1.49E+01
kr 82	3.20E-01	3.21E-01	3.21E-01	3.21E-01	3.21E-01	3.21E-01	3.21E-01
kr 83	1.69E+01	1.69E+01	1.69E+01	1.69E+01	1.69E+01	1.69E+01	1.69E+01
kr 84	5.40E+01	5.40E+01	5.40E+01	5.40E+01	5.40E+01	5.40E+01	5.40E+01
kr 85	1.01E+01	9.50E+00	8.91E+00	8.35E+00	7.83E+00	7.34E+00	6.88E+00
rb 85	4.20E+01	4.27E+01	4.33E+01	4.38E+01	4.43E+01	4.48E+01	4.53E+01
kr 86	8.31E+01	8.31E+01	8.31E+01	8.31E+01	8.31E+01	8.31E+01	8.31E+01
sr 86	1.80E-01	1.89E-01	1.89E-01	1.89E-01	1.89E-01	1.89E-01	1.89E-01
rb 87	1.08E+02	1.08E+02	1.08E+02	1.08E+02	1.08E+02	1.08E+02	1.08E+02
sr 87	1.10E-03	1.10E-03	1.10E-03	1.10E-03	1.10E-03	1.10E-03	1.10E-03
sr 88	1.55E+02	1.55E+02	1.55E+02	1.55E+02	1.55E+02	1.55E+02	1.55E+02
y 89	1.96E+02	2.06E+02	2.06E+02	2.06E+02	2.06E+02	2.06E+02	2.06E+02
sr 90	2.41E+02	2.35E+02	2.30E+02	2.24E+02	2.19E+02	2.13E+02	2.08E+02
y 90	6.64E-02	6.12E-02	5.97E-02	5.82E-02	5.68E-02	5.55E-02	5.41E-02
zr 90	1.11E+01	1.70E+01	2.27E+01	2.83E+01	3.38E+01	3.91E+01	4.43E+01
zr 91	2.54E+02	2.70E+02	2.70E+02	2.70E+02	2.70E+02	2.70E+02	2.70E+02
zr 92	2.91E+02	2.91E+02	2.91E+02	2.91E+02	2.91E+02	2.91E+02	2.91E+02
zr 93	2.16E+02	2.16E+02	2.16E+02	2.16E+02	2.16E+02	2.16E+02	2.16E+02
nb 93	1.30E-05	2.18E-05	3.43E-05	5.04E-05	7.00E-05	9.28E-05	1.19E-04
nb 93m	1.60E-04	2.49E-04	3.34E-04	4.16E-04	4.94E-04	5.69E-04	6.41E-04
zr 94	3.55E+02	3.55E+02	3.55E+02	3.55E+02	3.55E+02	3.55E+02	3.55E+02
nb 94	2.38E-04	2.38E-04	2.38E-04	2.38E-04	2.38E-04	2.38E-04	2.38E-04
mo 95	3.07E+02	3.49E+02	3.50E+02	3.50E+02	3.50E+02	3.50E+02	3.50E+02
zr 96	3.76E+02	3.76E+02	3.76E+02	3.76E+02	3.76E+02	3.76E+02	3.76E+02
mo 96	2.08E+01	2.08E+01	2.08E+01	2.08E+01	2.08E+01	2.08E+01	2.08E+01
mo 97	3.57E+02	3.58E+02	3.58E+02	3.58E+02	3.58E+02	3.58E+02	3.58E+02
mo 98	3.91E+02	3.91E+02	3.91E+02	3.91E+02	3.91E+02	3.91E+02	3.91E+02
tc 98	3.12E-03	3.12E-03	3.12E-03	3.12E-03	3.12E-03	3.12E-03	3.12E-03
tc 99	3.65E+02	3.66E+02	3.66E+02	3.66E+02	3.66E+02	3.66E+02	3.66E+02
ru 99	1.47E-02	1.60E-02	1.72E-02	1.84E-02	1.96E-02	2.08E-02	2.20E-02

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ce 14x14 40 gwd/mtu pwr 2.9 wt%: 6 year cooled fission products

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decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 5.11E+13n/cm**2-sec

0 nuclide concentrations, grams

basis =single reactor assembly

	initial	365.0 d	730.0 d	1095.0 d	1460.0 d	1825.0 d	2190.0 d
mo100	4.44E+02	4.44E+02	4.44E+02	4.44E+02	4.44E+02	4.44E+02	4.44E+02
ru100	5.56E+01	5.56E+01	5.56E+01	5.56E+01	5.56E+01	5.56E+01	5.56E+01
ru101	3.66E+02	3.66E+02	3.66E+02	3.66E+02	3.66E+02	3.66E+02	3.66E+02
ru102	3.77E+02	3.77E+02	3.77E+02	3.77E+02	3.77E+02	3.77E+02	3.77E+02
rh102	5.36E-04	4.22E-04	3.32E-04	2.62E-04	2.06E-04	1.62E-04	1.28E-04
rh103	1.97E+02	2.18E+02	2.18E+02	2.18E+02	2.18E+02	2.18E+02	2.18E+02
ru104	2.75E+02	2.75E+02	2.75E+02	2.75E+02	2.75E+02	2.75E+02	2.75E+02
pd104	1.26E+02	1.26E+02	1.26E+02	1.26E+02	1.26E+02	1.26E+02	1.26E+02
pd105	1.94E+02	1.94E+02	1.94E+02	1.94E+02	1.94E+02	1.94E+02	1.94E+02

ru106	8.36E+01	4.23E+01	2.14E+01	1.09E+01	5.49E+00	2.78E+00	1.41E+00
rh106	8.85E-05	3.93E-05	1.99E-05	1.01E-05	5.10E-06	2.58E-06	1.31E-06
pd106	1.17E+02	1.58E+02	1.79E+02	1.90E+02	1.95E+02	1.98E+02	1.99E+02
pd107	1.22E+02	1.22E+02	1.22E+02	1.22E+02	1.22E+02	1.22E+02	1.22E+02
ag107	1.50E-05	2.80E-05	4.09E-05	5.39E-05	6.68E-05	7.98E-05	9.27E-05
pd108	8.05E+01	8.05E+01	8.05E+01	8.05E+01	8.05E+01	8.05E+01	8.05E+01
ag108m	1.06E-04	1.06E-04	1.05E-04	1.04E-04	1.04E-04	1.03E-04	1.03E-04
cd108	1.09E-04	1.09E-04	1.09E-04	1.09E-04	1.09E-04	1.09E-04	1.09E-04
ag109	4.69E+01	4.70E+01	4.70E+01	4.70E+01	4.70E+01	4.70E+01	4.70E+01
pd110	2.41E+01	2.41E+01	2.41E+01	2.41E+01	2.41E+01	2.41E+01	2.41E+01
ag110m	4.48E-01	1.63E-01	5.91E-02	2.15E-02	7.80E-03	2.83E-03	1.03E-03
cd110	2.36E+01	2.38E+01	2.39E+01	2.40E+01	2.40E+01	2.40E+01	2.40E+01
cd111	1.26E+01	1.27E+01	1.27E+01	1.27E+01	1.27E+01	1.27E+01	1.27E+01
cd112	6.38E+00	6.40E+00	6.40E+00	6.40E+00	6.40E+00	6.40E+00	6.40E+00
cd113	3.02E-02	3.16E-02	3.16E-02	3.16E-02	3.16E-02	3.16E-02	3.16E-02
cd113m	7.02E-02	6.68E-02	6.36E-02	6.06E-02	5.77E-02	5.49E-02	5.23E-02
in113	3.94E-03	7.30E-03	1.05E-02	1.35E-02	1.64E-02	1.92E-02	2.18E-02
cd114	6.33E+00	6.33E+00	6.33E+00	6.33E+00	6.33E+00	6.33E+00	6.33E+00
sn114	2.22E-04	2.60E-04	2.60E-04	2.60E-04	2.60E-04	2.60E-04	2.60E-04
in115	6.75E-01	6.89E-01	6.89E-01	6.89E-01	6.89E-01	6.89E-01	6.89E-01
sn115	8.64E-02	8.68E-02	8.68E-02	8.68E-02	8.68E-02	8.68E-02	8.68E-02
cd116	2.46E+00	2.46E+00	2.46E+00	2.46E+00	2.46E+00	2.46E+00	2.46E+00
sn116	1.21E+00	1.21E+00	1.21E+00	1.21E+00	1.21E+00	1.21E+00	1.21E+00
sn117	2.36E+00	2.36E+00	2.36E+00	2.36E+00	2.36E+00	2.36E+00	2.36E+00
sn118	1.87E+00	1.87E+00	1.87E+00	1.87E+00	1.87E+00	1.87E+00	1.87E+00
sn119	1.96E+00	1.97E+00	1.97E+00	1.97E+00	1.97E+00	1.97E+00	1.97E+00
sn119m	9.89E-03	4.17E-03	1.76E-03	7.42E-04	3.13E-04	1.32E-04	5.57E-05
sn120	1.92E+00	1.92E+00	1.92E+00	1.92E+00	1.92E+00	1.92E+00	1.92E+00
sn121m	2.21E-02	2.18E-02	2.15E-02	2.12E-02	2.10E-02	2.07E-02	2.05E-02
sb121	1.89E+00	1.90E+00	1.90E+00	1.90E+00	1.90E+00	1.90E+00	1.90E+00
sn122	2.49E+00	2.49E+00	2.49E+00	2.49E+00	2.49E+00	2.49E+00	2.49E+00
te122	1.37E-01	1.38E-01	1.38E-01	1.38E-01	1.38E-01	1.38E-01	1.38E-01
sn123	3.09E-02	4.36E-03	6.14E-04	8.67E-05	1.22E-05	1.72E-06	2.43E-07
sb123	2.22E+00	2.24E+00	2.25E+00	2.25E+00	2.25E+00	2.25E+00	2.25E+00
te123	1.14E-03	1.51E-03	1.56E-03	1.56E-03	1.56E-03	1.56E-03	1.56E-03
sn124	4.16E+00	4.16E+00	4.16E+00	4.16E+00	4.16E+00	4.16E+00	4.16E+00
te124	1.05E-01	1.26E-01	1.26E-01	1.26E-01	1.26E-01	1.26E-01	1.26E-01
sb125	3.69E+00	2.88E+00	2.23E+00	1.73E+00	1.34E+00	1.04E+00	8.09E-01
te125	1.41E+00	2.24E+00	2.90E+00	3.40E+00	3.80E+00	4.10E+00	4.34E+00
te125m	4.64E-02	4.08E-02	3.17E-02	2.46E-02	1.91E-02	1.48E-02	1.15E-02
sn126	9.83E+00	9.83E+00	9.83E+00	9.83E+00	9.83E+00	9.83E+00	9.83E+00
te126	1.86E-01	1.89E-01	1.89E-01	1.89E-01	1.89E-01	1.89E-01	1.89E-01
te127m	6.64E-01	6.78E-02	6.65E-03	6.53E-04	6.41E-05	6.30E-06	6.18E-07

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ce 14x14 40 gwd/mtu pwr 2.9 wt%: 6 year cooled fission products

page 33

decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 5.11E+13n/cm**2-sec

0 nuclide concentrations, grams

basis =single reactor assembly

	initial	365.0 d	730.0 d	1095.0 d	1460.0 d	1825.0 d	2190.0 d
i127	2.06E+01	2.13E+01	2.14E+01	2.14E+01	2.14E+01	2.14E+01	2.14E+01
te128	4.40E+01	4.40E+01	4.40E+01	4.40E+01	4.40E+01	4.40E+01	4.40E+01
xe128	1.38E+00	1.38E+00	1.38E+00	1.38E+00	1.38E+00	1.38E+00	1.38E+00
i129	8.61E+01	8.70E+01	8.70E+01	8.70E+01	8.70E+01	8.70E+01	8.70E+01
xe129	1.04E-02	1.06E-02	1.06E-02	1.06E-02	1.06E-02	1.06E-02	1.06E-02
te130	1.74E+02	1.74E+02	1.74E+02	1.74E+02	1.74E+02	1.74E+02	1.74E+02
xe130	4.70E+00	4.70E+00	4.70E+00	4.70E+00	4.70E+00	4.70E+00	4.70E+00
xe131	1.87E+02	1.90E+02	1.90E+02	1.90E+02	1.90E+02	1.90E+02	1.90E+02
xe132	5.37E+02	5.39E+02	5.39E+02	5.39E+02	5.39E+02	5.39E+02	5.39E+02
ba132	1.13E-04	1.15E-04	1.15E-04	1.15E-04	1.15E-04	1.15E-04	1.15E-04
cs133	5.24E+02	5.29E+02	5.29E+02	5.29E+02	5.29E+02	5.29E+02	5.29E+02
xe134	7.17E+02	7.17E+02	7.17E+02	7.17E+02	7.17E+02	7.17E+02	7.17E+02
cs134	6.12E+01	4.38E+01	3.13E+01	2.23E+01	1.60E+01	1.14E+01	8.16E+00
ba134	2.31E+01	4.05E+01	5.30E+01	6.19E+01	6.83E+01	7.29E+01	7.61E+01
cs135	1.42E+02	1.42E+02	1.42E+02	1.42E+02	1.42E+02	1.42E+02	1.42E+02
ba135	1.92E-01	1.93E-01	1.93E-01	1.93E-01	1.93E-01	1.93E-01	1.93E-01
xe136	1.12E+03	1.12E+03	1.12E+03	1.12E+03	1.12E+03	1.12E+03	1.12E+03
ba136	8.33E+00	8.61E+00	8.61E+00	8.61E+00	8.61E+00	8.61E+00	8.61E+00
cs137	5.89E+02	5.75E+02	5.62E+02	5.49E+02	5.37E+02	5.24E+02	5.13E+02
ba137	2.19E+01	3.54E+01	4.85E+01	6.13E+01	7.39E+01	8.61E+01	9.81E+01
ba137m	9.06E-05	8.78E-05	8.58E-05	8.39E-05	8.20E-05	8.01E-05	7.83E-05
ba138	6.06E+02	6.06E+02	6.06E+02	6.06E+02	6.06E+02	6.06E+02	6.06E+02
la138	4.12E-03	4.12E-03	4.12E-03	4.12E-03	4.12E-03	4.12E-03	4.12E-03
la139	5.67E+02	5.67E+02	5.67E+02	5.67E+02	5.67E+02	5.67E+02	5.67E+02
ce140	5.93E+02	6.04E+02	6.04E+02	6.04E+02	6.04E+02	6.04E+02	6.04E+02
pr141	5.01E+02	5.22E+02	5.22E+02	5.22E+02	5.22E+02	5.22E+02	5.22E+02
ce142	5.31E+02	5.31E+02	5.31E+02	5.31E+02	5.31E+02	5.31E+02	5.31E+02
nd142	1.22E+01	1.22E+01	1.22E+01	1.22E+01	1.22E+01	1.22E+01	1.22E+01
nd143	3.16E+02	3.25E+02	3.25E+02	3.25E+02	3.25E+02	3.25E+02	3.25E+02
ce144	1.49E+02	6.13E+01	2.52E+01	1.04E+01	4.27E+00	1.76E+00	7.24E-01
pr144	6.34E-03	2.58E-03	1.06E-03	4.38E-04	1.80E-04	7.41E-05	3.05E-05
nd144	5.09E+02	5.97E+02	6.33E+02	6.48E+02	6.54E+02	6.56E+02	6.57E+02
nd145	3.06E+02	3.07E+02	3.07E+02	3.07E+02	3.07E+02	3.07E+02	3.07E+02
pm145	1.02E-05	1.02E-05	9.98E-06	9.69E-06	9.35E-06	9.01E-06	8.68E-06
nd146	3.33E+02	3.33E+02	3.33E+02	3.33E+02	3.33E+02	3.33E+02	3.33E+02
pm146	3.53E-03	3.12E-03	2.75E-03	2.43E-03	2.14E-03	1.89E-03	1.67E-03
sm146	2.88E-03	3.02E-03	3.15E-03	3.26E-03	3.36E-03	3.44E-03	3.52E-03
pm147	7.31E+01	5.85E+01	4.49E+01	3.45E+01	2.65E+01	2.03E+01	1.56E+01
sm147	3.32E+01	5.09E+01	6.45E+01	7.49E+01	8.29E+01	8.90E+01	9.38E+01
nd148	1.73E+02	1.73E+02	1.73E+02	1.73E+02	1.73E+02	1.73E+02	1.73E+02
sm148	6.04E+01	6.14E+01	6.14E+01	6.14E+01	6.14E+01	6.14E+01	6.14E+01
sm149	7.30E-01	1.37E+00	1.37E+00	1.37E+00	1.37E+00	1.37E+00	1.37E+00
nd150	8.64E+01	8.64E+01	8.64E+01	8.64E+01	8.64E+01	8.64E+01	8.64E+01
sm150	1.44E+02	1.44E+02	1.44E+02	1.44E+02	1.44E+02	1.44E+02	1.44E+02
sm151	5.57E+00	5.65E+00	5.60E+00	5.56E+00	5.52E+00	5.47E+00	5.43E+00
eu151	4.37E-03	4.80E-02	9.13E-02	1.34E-01	1.77E-01	2.19E-01	2.61E-01
sm152	6.27E+01	6.27E+01	6.27E+01	6.27E+01	6.27E+01	6.27E+01	6.27E+01

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   eu152  1.16E-02 1.10E-02 1.04E-02 9.89E-03 9.38E-03 8.91E-03 8.46E-03
   gd152  2.16E-02 2.18E-02 2.19E-02 2.21E-02 2.22E-02 2.24E-02 2.25E-02
   eu153  6.02E+01 6.08E+01 6.08E+01 6.08E+01 6.08E+01 6.08E+01 6.08E+01
   gd153  1.79E-03 6.27E-04 2.20E-04 7.72E-05 2.71E-05 9.51E-06 3.33E-06
   sm154  1.90E+01 1.90E+01 1.90E+01 1.90E+01 1.90E+01 1.90E+01 1.90E+01
1
   ce 14x14  40 gwd/mtu pwr 2.9 wt%: 6 year cooled                    fission products
    page  34
 decay, following reactor irradiation identified by: power=  14.32mw, burnup=  15680.mwd, flux=
5.11E+13n/cm**2-sec
0                                nuclide concentrations, grams
                                 basis =single reactor assembly
         initial  365.0 d  730.0 d  1095.0 d  1460.0 d  1825.0 d  2190.0 d
   eu154  1.05E+01 9.64E+00 8.89E+00 8.21E+00 7.57E+00 6.98E+00 6.44E+00
   gd154  8.66E-01 1.68E+00 2.42E+00 3.11E+00 3.75E+00 4.33E+00 4.87E+00
   eu155  2.85E+00 2.46E+00 2.12E+00 1.83E+00 1.58E+00 1.36E+00 1.17E+00
   gd155  1.62E-02 4.08E-01 7.46E-01 1.04E+00 1.29E+00 1.51E+00 1.69E+00
   gd156  4.60E+01 4.84E+01 4.84E+01 4.84E+01 4.84E+01 4.84E+01 4.84E+01
   gd157  4.18E-02 5.33E-02 5.33E-02 5.33E-02 5.33E-02 5.33E-02 5.33E-02
   gd158  1.06E+01 1.06E+01 1.06E+01 1.06E+01 1.06E+01 1.06E+01 1.06E+01
   tb159  1.28E+00 1.28E+00 1.28E+00 1.28E+00 1.28E+00 1.28E+00 1.28E+00
   gd160  5.64E-01 5.64E-01 5.64E-01 5.64E-01 5.64E-01 5.64E-01 5.64E-01
   dy160  1.07E-01 1.50E-01 1.52E-01 1.52E-01 1.52E-01 1.52E-01 1.52E-01
   dy161  1.73E-01 1.78E-01 1.78E-01 1.78E-01 1.78E-01 1.78E-01 1.78E-01
   dy162  1.60E-01 1.60E-01 1.60E-01 1.60E-01 1.60E-01 1.60E-01 1.60E-01
   dy163  1.32E-01 1.32E-01 1.32E-01 1.32E-01 1.32E-01 1.32E-01 1.32E-01
   dy164  2.35E-02 2.35E-02 2.35E-02 2.35E-02 2.35E-02 2.35E-02 2.35E-02
   ho165  4.90E-02 4.90E-02 4.90E-02 4.90E-02 4.90E-02 4.90E-02 4.90E-02
   ho166m 1.76E-04 1.76E-04 1.76E-04 1.76E-04 1.76E-04 1.75E-04 1.75E-04
   er166  1.11E-02 1.12E-02 1.12E-02 1.12E-02 1.12E-02 1.12E-02 1.12E-02
   er167  2.24E-04 2.24E-04 2.24E-04 2.24E-04 2.24E-04 2.24E-04 2.24E-04
   er168  3.48E-04 3.48E-04 3.48E-04 3.48E-04 3.48E-04 3.48E-04 3.48E-04
   tm169  1.68E-06 1.71E-06 1.71E-06 1.71E-06 1.71E-06 1.71E-06 1.71E-06
   er170  1.88E-06 1.88E-06 1.88E-06 1.88E-06 1.88E-06 1.88E-06 1.88E-06
   yb171  8.11E-07 1.31E-06 1.66E-06 1.90E-06 2.07E-06 2.19E-06 2.27E-06
   yb172  1.62E-06 1.63E-06 1.63E-06 1.63E-06 1.63E-06 1.63E-06 1.63E-06
  total   1.61E+04 1.61E+04 1.61E+04 1.61E+04 1.61E+04 1.61E+04 1.61E+04
1
   ce 14x14  40 gwd/mtu pwr 2.9 wt%: 6 year cooled                    fission products
    page  35
 decay, following reactor irradiation identified by: power=  14.32mw, burnup=  15680.mwd, flux=
5.11E+13n/cm**2-sec
0                                element radioactivity, curies
                                 basis =single reactor assembly
         initial  365.0 d  730.0 d  1095.0 d  1460.0 d  1825.0 d  2190.0 d
    h   2.30E+02 2.17E+02 2.05E+02 1.94E+02 1.84E+02 1.74E+02 1.64E+02
   be   1.38E-06 1.38E-06 1.38E-06 1.38E-06 1.38E-06 1.38E-06 1.38E-06
    c   5.58E-05 5.58E-05 5.58E-05 5.58E-05 5.58E-05 5.58E-05 5.58E-05
   se   3.32E+05 3.13E-02 3.13E-02 3.13E-02 3.13E-02 3.13E-02 3.13E-02
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kr	1.32E+06	3.73E+03	3.50E+03	3.28E+03	3.07E+03	2.88E+03	2.70E+03
rb	1.97E+06	9.85E-04	9.27E-06	9.27E-06	9.27E-06	9.27E-06	9.27E-06
sr	3.12E+06	3.52E+04	3.24E+04	3.16E+04	3.09E+04	3.01E+04	2.94E+04
y	4.20E+06	3.85E+04	3.25E+04	3.17E+04	3.09E+04	3.01E+04	2.94E+04
zr	3.81E+06	1.15E+04	2.21E+02	4.77E+00	6.25E-01	5.45E-01	5.43E-01
nb	5.72E+06	2.57E+04	5.03E+02	9.78E+00	3.04E-01	1.39E-01	1.53E-01
tc	4.65E+06	6.27E+00	6.27E+00	6.27E+00	6.27E+00	6.27E+00	6.27E+00
ru	2.18E+06	1.41E+05	7.11E+04	3.60E+04	1.82E+04	9.22E+03	4.67E+03
rh	2.96E+06	1.41E+05	7.11E+04	3.60E+04	1.82E+04	9.22E+03	4.67E+03
pd	2.65E+05	6.25E-02	6.25E-02	6.25E-02	6.25E-02	6.25E-02	6.25E-02
ag	4.02E+05	7.84E+02	2.85E+02	1.03E+02	3.76E+01	1.36E+01	4.96E+00
cd	3.87E+04	1.56E+01	1.43E+01	1.36E+01	1.29E+01	1.23E+01	1.17E+01
sn	5.53E+05	5.38E+01	1.40E+01	5.80E+00	3.55E+00	2.76E+00	2.44E+00
sb	1.42E+06	3.02E+03	2.34E+03	1.81E+03	1.41E+03	1.09E+03	8.48E+02
te	3.13E+06	2.02E+03	6.95E+02	4.55E+02	3.45E+02	2.67E+02	2.07E+02
i	4.60E+06	1.54E-02	1.54E-02	1.54E-02	1.54E-02	1.54E-02	1.54E-02
cs	2.99E+06	1.07E+05	8.94E+04	7.67E+04	6.74E+04	6.04E+04	5.52E+04
ba	3.61E+06	4.73E+04	4.62E+04	4.51E+04	4.41E+04	4.31E+04	4.21E+04
ce	2.86E+06	1.96E+05	8.04E+04	3.31E+04	1.36E+04	5.60E+03	2.30E+03
pr	2.49E+06	1.98E+05	8.15E+04	3.35E+04	1.38E+04	5.68E+03	2.34E+03
pm	6.46E+05	5.43E+04	4.17E+04	3.20E+04	2.46E+04	1.89E+04	1.45E+04
sm	2.73E+05	1.49E+02	1.47E+02	1.46E+02	1.45E+02	1.44E+02	1.43E+02
eu	1.62E+05	3.82E+03	3.45E+03	3.12E+03	2.83E+03	2.56E+03	2.32E+03
gd	3.82E+03	2.22E+00	7.78E-01	2.73E-01	9.58E-02	3.36E-02	1.18E-02
tb	1.42E+03	1.53E+01	4.63E-01	1.40E-02	4.23E-04	1.28E-05	3.87E-07
ho	4.77E+01	3.16E-04	3.16E-04	3.15E-04	3.15E-04	3.15E-04	3.15E-04
tm	4.30E-03	1.25E-03	8.72E-04	6.08E-04	4.24E-04	2.95E-04	2.06E-04
totals	6.62E+07	1.01E+06	5.58E+05	3.65E+05	2.70E+05	2.20E+05	1.91E+05

1

ce 14x14 40 gwd/mtu pwr 2.9 wt%: 6 year cooled fission products

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decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 5.11E+13n/cm**2-sec

0 element thermal power, watts

basis =single reactor assembly

	initial	365.0 d	730.0 d	1095.0 d	1460.0 d	1825.0 d	2190.0 d
h	7.75E-03	7.33E-03	6.93E-03	6.55E-03	6.19E-03	5.86E-03	5.54E-03
c	1.64E-08	1.64E-08	1.64E-08	1.64E-08	1.64E-08	1.64E-08	1.64E-08
se	5.87E+03	9.82E-06	9.82E-06	9.82E-06	9.82E-06	9.82E-06	9.82E-06
kr	2.13E+04	5.59E+00	5.24E+00	4.91E+00	4.61E+00	4.32E+00	4.05E+00
sr	4.61E+04	4.53E+01	3.77E+01	3.67E+01	3.58E+01	3.50E+01	3.41E+01
y	7.10E+04	2.03E+02	1.80E+02	1.75E+02	1.71E+02	1.67E+02	1.63E+02
zr	3.90E+04	5.78E+01	1.11E+00	2.14E-02	4.71E-04	6.91E-05	6.13E-05
nb	8.32E+04	1.23E+02	2.40E+00	4.62E-02	9.09E-04	4.08E-05	2.70E-05
tc	5.72E+04	3.14E-03	3.14E-03	3.14E-03	3.14E-03	3.14E-03	3.14E-03
ru	1.21E+04	1.19E+01	4.23E+00	2.14E+00	1.08E+00	5.48E-01	2.78E-01
rh	1.49E+04	1.35E+03	6.81E+02	3.45E+02	1.75E+02	8.84E+01	4.47E+01
pd	8.23E+02	3.45E-06	3.45E-06	3.45E-06	3.45E-06	3.45E-06	3.45E-06
ag	1.59E+03	1.30E+01	4.71E+00	1.71E+00	6.22E-01	2.26E-01	8.20E-02

cd	4.47E+02	1.86E-02	1.55E-02	1.48E-02	1.41E-02	1.34E-02	1.28E-02
sn	7.33E+03	1.21E-01	2.05E-02	4.97E-03	2.21E-03	1.58E-03	1.39E-03
sb	2.60E+04	9.60E+00	7.40E+00	5.74E+00	4.45E+00	3.46E+00	2.68E+00
te	2.98E+04	1.87E+00	5.98E-01	3.84E-01	2.91E-01	2.25E-01	1.74E-01
i	6.85E+04	7.18E-06	7.18E-06	7.18E-06	7.18E-06	7.18E-06	7.18E-06
cs	5.44E+04	6.33E+02	4.67E+02	3.48E+02	2.63E+02	2.01E+02	1.57E+02
ba	3.11E+04	1.86E+02	1.81E+02	1.77E+02	1.73E+02	1.69E+02	1.65E+02
ce	1.33E+04	1.28E+02	5.26E+01	2.16E+01	8.91E+00	3.66E+00	1.51E+00
pr	2.02E+04	1.43E+03	5.90E+02	2.43E+02	9.99E+01	4.11E+01	1.69E+01
pm	3.21E+03	2.02E+01	1.53E+01	1.18E+01	9.03E+00	6.93E+00	5.32E+00
sm	6.51E+02	1.75E-02	1.73E-02	1.72E-02	1.71E-02	1.69E-02	1.68E-02
eu	1.53E+03	2.46E+01	2.27E+01	2.09E+01	1.92E+01	1.77E+01	1.63E+01
gd	1.12E+01	1.95E-03	6.84E-04	2.40E-04	8.42E-05	2.95E-05	1.04E-05
tb	8.29E+00	1.35E-01	4.07E-03	1.23E-04	3.71E-06	1.12E-07	3.39E-09
ho	2.05E-01	3.32E-06	3.32E-06	3.32E-06	3.31E-06	3.31E-06	3.31E-06
tm	1.51E-05	1.97E-07	1.35E-07	9.38E-08	6.53E-08	4.55E-08	3.18E-08
totals	8.08E+05	4.24E+03	2.25E+03	1.39E+03	9.66E+02	7.39E+02	6.12E+02

1

ce 14x14 40 gwd/mtu pwr 2.9 wt%: 6 year cooled fission products

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decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 5.11E+13n/cm**2-sec

0 nuclide gamma power, watts

basis =single reactor assembly

	initial	365.0 d	730.0 d	1095.0 d	1460.0 d	1825.0 d	2190.0 d
kr 85	5.26E-02	4.93E-02	4.62E-02	4.33E-02	4.06E-02	3.81E-02	3.57E-02
y 90	3.63E-04	3.35E-04	3.27E-04	3.19E-04	3.11E-04	3.04E-04	2.96E-04
nb 93m	4.25E-07	6.62E-07	8.88E-07	1.11E-06	1.31E-06	1.51E-06	1.70E-06
nb 94	4.16E-07	4.16E-07	4.16E-07	4.16E-07	4.16E-07	4.16E-07	4.16E-07
zr 95	2.59E+03	4.97E+01	9.55E-01	1.84E-02	3.53E-04	6.78E-06	1.30E-07
nb 95	2.72E+03	1.16E+02	2.27E+00	4.36E-02	8.38E-04	1.61E-05	3.09E-07
tc 98	2.24E-08	2.24E-08	2.24E-08	2.24E-08	2.24E-08	2.24E-08	2.24E-08
tc 99	2.29E-08	2.30E-08	2.30E-08	2.30E-08	2.30E-08	2.30E-08	2.30E-08
rh102	8.30E-03	6.53E-03	5.15E-03	4.05E-03	3.19E-03	2.51E-03	1.98E-03
rh106	3.86E+02	1.71E+02	8.68E+01	4.39E+01	2.22E+01	1.13E+01	5.70E+00
ag108	5.07E-05	2.61E-08	2.60E-08	2.58E-08	2.57E-08	2.56E-08	2.54E-08
ag108m	2.66E-05	2.65E-05	2.63E-05	2.62E-05	2.60E-05	2.59E-05	2.57E-05
ag110	1.78E+01	1.92E-03	6.96E-04	2.53E-04	9.17E-05	3.33E-05	1.21E-05
ag110m	3.46E+01	1.26E+01	4.56E+00	1.66E+00	6.02E-01	2.19E-01	7.94E-02
cd113m	6.60E-06	6.29E-06	5.99E-06	5.70E-06	5.43E-06	5.17E-06	4.92E-06
sn119m	2.51E-03	1.06E-03	4.47E-04	1.88E-04	7.94E-05	3.35E-05	1.41E-05
sn121m	3.51E-05	3.47E-05	3.43E-05	3.38E-05	3.34E-05	3.30E-05	3.26E-05
sn123	1.04E-02	1.47E-03	2.07E-04	2.92E-05	4.11E-06	5.80E-07	8.18E-08
te123m	3.28E-03	3.95E-04	4.78E-05	5.77E-06	6.96E-07	8.41E-08	1.02E-08
sb125	9.94E+00	7.75E+00	6.02E+00	4.67E+00	3.62E+00	2.81E+00	2.18E+00
te125m	1.76E-01	1.55E-01	1.21E-01	9.35E-02	7.25E-02	5.63E-02	4.37E-02
sn126	2.16E-04	2.16E-04	2.16E-04	2.16E-04	2.16E-04	2.16E-04	2.16E-04
sb126	3.03E+00	6.37E-04	6.37E-04	6.37E-04	6.37E-04	6.37E-04	6.37E-04
sb126m	2.03E+00	2.57E-03	2.57E-03	2.57E-03	2.57E-03	2.57E-03	2.57E-03

te127	1.08E+00	1.82E-02	1.79E-03	1.75E-04	1.72E-05	1.69E-06	1.66E-07
te127m	4.12E-01	4.21E-02	4.13E-03	4.06E-04	3.98E-05	3.91E-06	3.84E-07
i129	2.22E-06	2.24E-06	2.24E-06	2.24E-06	2.24E-06	2.24E-06	2.24E-06
ba133	3.41E-08	3.20E-08	2.99E-08	2.80E-08	2.62E-08	2.46E-08	2.30E-08
cs134	7.30E+02	5.22E+02	3.73E+02	2.67E+02	1.91E+02	1.36E+02	9.73E+01
ba137m	1.73E+02	1.68E+02	1.64E+02	1.60E+02	1.57E+02	1.53E+02	1.50E+02
ce144	5.34E+01	2.20E+01	9.05E+00	3.72E+00	1.53E+00	6.31E-01	2.60E-01
pr144	8.21E+01	3.35E+01	1.38E+01	5.67E+00	2.33E+00	9.60E-01	3.95E-01
pr144m	4.94E-01	2.03E-01	8.34E-02	3.43E-02	1.41E-02	5.81E-03	2.39E-03
pm145	2.72E-07	2.72E-07	2.66E-07	2.58E-07	2.50E-07	2.41E-07	2.32E-07
sm145	7.50E-07	3.56E-07	1.69E-07	8.05E-08	3.82E-08	1.82E-08	8.63E-09
pm146	6.97E-03	6.15E-03	5.43E-03	4.79E-03	4.22E-03	3.73E-03	3.29E-03
pm147	1.76E-03	1.41E-03	1.08E-03	8.31E-04	6.38E-04	4.90E-04	3.76E-04
eu150	6.71E-08	6.58E-08	6.46E-08	6.33E-08	6.21E-08	6.09E-08	5.98E-08
sm151	1.23E-05	1.25E-05	1.24E-05	1.23E-05	1.22E-05	1.21E-05	1.20E-05
eu152	1.40E-02	1.33E-02	1.27E-02	1.20E-02	1.14E-02	1.08E-02	1.03E-02
gd153	4.03E-03	1.41E-03	4.96E-04	1.74E-04	6.11E-05	2.14E-05	7.52E-06
eu154	2.10E+01	1.94E+01	1.79E+01	1.65E+01	1.52E+01	1.40E+01	1.29E+01
eu155	5.39E-01	4.65E-01	4.01E-01	3.46E-01	2.98E-01	2.57E-01	2.22E-01
tb160	3.68E+00	1.11E-01	3.36E-03	1.02E-04	3.07E-06	9.27E-08	2.80E-09
ho166m	3.05E-06	3.05E-06	3.04E-06	3.04E-06	3.04E-06	3.04E-06	3.04E-06
total	3.99E+05	1.13E+03	6.79E+02	5.04E+02	3.93E+02	3.20E+02	2.69E+02

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photon spectrum as a function of time for light elements, cladding and structural materials

0 ce 14x14 40 gwd/mtu pwr 2.9 wt%: 6 year cooled
power= 14.32 mw, burnup= 15680.mwd, flux= 5.11E+13 n**2-sec

0 spectrum of photon release rates, photons/sec
basis = single reactor assembly

0

emean	time after discharge						
(mev)	initial	365.0 d	730.0 d	1095.0 d	1460.0 d	1825.0 d	2190.0 d
1.00E-02	7.73E+14	4.58E+12	2.33E+12	1.37E+12	9.03E+11	6.45E+11	4.87E+11
3.00E-02	4.30E+14	3.60E+13	1.81E+13	1.02E+13	6.37E+12	4.30E+12	3.06E+12
5.50E-02	1.69E+14	2.17E+11	1.22E+11	8.70E+10	6.71E+10	5.36E+10	4.35E+10
8.50E-02	9.73E+13	7.61E+10	4.23E+10	3.18E+10	2.56E+10	2.09E+10	1.71E+10
1.20E-01	6.85E+13	9.05E+10	5.86E+10	4.44E+10	3.48E+10	2.74E+10	2.17E+10
1.70E-01	2.19E+14	9.48E+11	7.18E+11	5.55E+11	4.31E+11	3.34E+11	2.60E+11
3.00E-01	1.25E+14	4.17E+11	2.79E+11	2.11E+11	1.63E+11	1.27E+11	9.83E+10
6.50E-01	2.04E+15	9.33E+12	6.53E+12	4.82E+12	3.63E+12	2.77E+12	2.13E+12
1.12E+00	2.55E+13	1.46E+13	1.28E+13	1.12E+13	9.83E+12	8.62E+12	7.56E+12
1.58E+00	2.43E+14	4.55E+09	7.77E+07	1.48E+06	3.85E+04	4.02E+03	2.25E+03
2.00E+00	4.22E+14	4.90E+08	7.43E+07	5.99E+07	5.24E+07	4.60E+07	4.03E+07
2.40E+00	1.62E+13	2.87E+06	2.55E+05	1.90E+05	1.66E+05	1.45E+05	1.28E+05
2.80E+00	1.46E+13	2.63E+05	3.93E+03	5.88E+01	8.79E-01	1.31E-02	1.97E-04
3.25E+00	2.68E+12	2.22E-15	2.18E-15	2.13E-15	2.09E-15	2.04E-15	2.00E-15
3.75E+00	5.33E+05	2.69E-18	2.63E-18	2.58E-18	2.53E-18	2.47E-18	2.42E-18
4.25E+00	1.52E+06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

ce 14x14 40 gwd/mtu pwr 2.3 wt%: 5 year cooled light elements
page 22
decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 6.17E+13n/cm**2-sec
0 element thermal power, watts
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
mn	7.14E+02	2.10E-01	1.07E-01	5.43E-02	2.76E-02	1.41E-02	7.15E-03
fe	3.30E-01	1.79E-02	1.23E-02	9.96E-03	8.06E-03	6.52E-03	5.28E-03
co	4.52E+00	3.26E+00	2.89E+00	2.59E+00	2.32E+00	2.08E+00	1.86E+00
ni	1.59E-01	1.26E-03	1.25E-03	1.24E-03	1.23E-03	1.23E-03	1.22E-03
in	2.35E+00	2.73E-01	4.27E-02	6.82E-03	1.09E-03	1.75E-04	2.80E-05
sn	2.04E+01	1.27E+00	5.85E-01	2.78E-01	1.34E-01	6.53E-02	3.19E-02
sb	3.28E+00	1.18E+00	9.48E-01	7.68E-01	6.21E-01	5.03E-01	4.07E-01
te	8.73E-02	7.65E-02	6.18E-02	4.99E-02	4.04E-02	3.27E-02	2.65E-02
totals	7.46E+02	6.29E+00	4.65E+00	3.76E+00	3.15E+00	2.70E+00	2.34E+00

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ce 14x14 40 gwd/mtu pwr 2.3 wt%: 5 year cooled light elements
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decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 6.17E+13n/cm**2-sec
0 element gamma power, watts
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
mn	4.79E+02	2.08E-01	1.06E-01	5.40E-02	2.75E-02	1.40E-02	7.12E-03
fe	2.88E-01	6.89E-03	3.60E-03	2.89E-03	2.34E-03	1.90E-03	1.53E-03
co	4.19E+00	3.14E+00	2.78E+00	2.49E+00	2.23E+00	2.00E+00	1.79E+00
ni	7.31E-02	1.49E-06	1.49E-06	1.49E-06	1.49E-06	1.49E-06	1.49E-06
in	1.15E+00	1.77E-01	2.83E-02	4.53E-03	7.25E-04	1.16E-04	1.86E-05
sn	7.25E+00	1.68E-01	7.63E-02	3.63E-02	1.75E-02	8.52E-03	4.15E-03
sb	2.15E+00	9.58E-01	7.72E-01	6.25E-01	5.06E-01	4.09E-01	3.31E-01
te	2.30E-02	1.94E-02	1.55E-02	1.25E-02	1.01E-02	8.20E-03	6.64E-03
totals	4.95E+02	4.68E+00	3.78E+00	3.23E+00	2.80E+00	2.44E+00	2.15E+00

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ce 14x14 40 gwd/mtu pwr 2.3 wt%: 5 year cooled actinides
page 24
decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 6.17E+13n/cm**2-sec
0 nuclide concentrations, gram atoms
basis = single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
he 4	5.66E-02	8.75E-02	1.02E-01	1.12E-01	1.20E-01	1.28E-01	1.36E-01
u232	2.74E-07	5.28E-07	7.33E-07	8.99E-07	1.03E-06	1.14E-06	1.22E-06
u233	4.03E-07	6.25E-07	8.47E-07	1.07E-06	1.29E-06	1.52E-06	1.74E-06
u234	2.77E-03	4.98E-03	7.26E-03	9.55E-03	1.18E-02	1.41E-02	1.63E-02
u235	3.74E+00	3.74E+00	3.74E+00	3.74E+00	3.74E+00	3.74E+00	3.74E+00
u236	5.33E+00	5.33E+00	5.33E+00	5.33E+00	5.33E+00	5.33E+00	5.33E+00
u238	1.60E+03	1.60E+03	1.60E+03	1.60E+03	1.60E+03	1.60E+03	1.60E+03
np236	1.39E-06	1.39E-06	1.39E-06	1.39E-06	1.39E-06	1.39E-06	1.39E-06

np237	7.15E-01	7.31E-01	7.31E-01	7.32E-01	7.32E-01	7.33E-01	7.33E-01
pu238	3.20E-01	3.43E-01	3.47E-01	3.47E-01	3.45E-01	3.43E-01	3.41E-01
pu239	7.13E+00	7.31E+00	7.31E+00	7.31E+00	7.31E+00	7.31E+00	7.31E+00
pu240	4.38E+00	4.39E+00	4.39E+00	4.39E+00	4.40E+00	4.40E+00	4.41E+00
pu241	2.18E+00	2.10E+00	2.02E+00	1.94E+00	1.86E+00	1.79E+00	1.72E+00
pu242	1.68E+00	1.68E+00	1.68E+00	1.68E+00	1.68E+00	1.68E+00	1.68E+00
am241	5.70E-02	1.43E-01	2.25E-01	3.05E-01	3.80E-01	4.53E-01	5.23E-01
am242m	1.04E-03	1.04E-03	1.03E-03	1.03E-03	1.03E-03	1.02E-03	1.02E-03
am243	4.14E-01	4.15E-01	4.15E-01	4.15E-01	4.15E-01	4.15E-01	4.15E-01
cm242	3.12E-02	8.60E-03	2.36E-03	6.49E-04	1.80E-04	5.13E-05	1.60E-05
cm243	9.59E-04	9.39E-04	9.21E-04	9.02E-04	8.84E-04	8.66E-04	8.49E-04
cm244	1.65E-01	1.60E-01	1.55E-01	1.50E-01	1.45E-01	1.41E-01	1.36E-01
cm245	4.96E-03	4.96E-03	4.96E-03	4.96E-03	4.96E-03	4.96E-03	4.96E-03
cm246	1.31E-03	1.31E-03	1.31E-03	1.31E-03	1.31E-03	1.31E-03	1.31E-03
cm247	2.52E-05	2.52E-05	2.52E-05	2.52E-05	2.52E-05	2.52E-05	2.52E-05
cm248	2.91E-06	2.91E-06	2.91E-06	2.91E-06	2.91E-06	2.91E-06	2.91E-06
total	1.63E+03	1.63E+03	1.63E+03	1.63E+03	1.63E+03	1.63E+03	1.63E+03

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ce 14x14 40 gwd/mtu pwr 2.3 wt%: 5 year cooled actinides

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decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 6.17E+13n/cm**2-sec

0 element concentrations, gram atoms

basis = single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
he	5.66E-02	8.75E-02	1.02E-01	1.12E-01	1.20E-01	1.28E-01	1.36E-01
th	3.69E-07	5.12E-07	6.61E-07	8.16E-07	9.76E-07	1.14E-06	1.31E-06
u	1.61E+03	1.61E+03	1.61E+03	1.61E+03	1.61E+03	1.61E+03	1.61E+03
np	8.99E-01	7.31E-01	7.31E-01	7.32E-01	7.32E-01	7.33E-01	7.33E-01
pu	1.57E+01	1.58E+01	1.57E+01	1.57E+01	1.56E+01	1.55E+01	1.55E+01
am	4.73E-01	5.59E-01	6.41E-01	7.20E-01	7.96E-01	8.69E-01	9.39E-01
cm	2.03E-01	1.76E-01	1.64E-01	1.58E-01	1.53E-01	1.48E-01	1.43E-01
totals	1.63E+03	1.63E+03	1.63E+03	1.63E+03	1.63E+03	1.63E+03	1.63E+03

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ce 14x14 40 gwd/mtu pwr 2.3 wt%: 5 year cooled actinides

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decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 6.17E+13n/cm**2-sec

0 nuclide concentrations, grams

basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
he 4	2.26E-01	3.50E-01	4.08E-01	4.47E-01	4.81E-01	5.14E-01	5.45E-01
pb208	9.06E-08	2.68E-07	6.36E-07	1.24E-06	2.09E-06	3.18E-06	4.49E-06
th228	3.88E-07	9.57E-07	1.75E-06	2.63E-06	3.53E-06	4.38E-06	5.17E-06
th230	1.80E-06	3.89E-06	7.20E-06	1.17E-05	1.75E-05	2.45E-05	3.27E-05
th232	7.78E-05	1.08E-04	1.39E-04	1.69E-04	2.00E-04	2.30E-04	2.61E-04
th234	5.54E-06	5.53E-06	5.53E-06	5.53E-06	5.53E-06	5.53E-06	5.53E-06
pa231	3.53E-06	4.24E-06	4.96E-06	5.67E-06	6.38E-06	7.09E-06	7.81E-06
pa233	5.73E-06	5.89E-06	5.89E-06	5.89E-06	5.90E-06	5.90E-06	5.91E-06

u232	6.36E-05	1.22E-04	1.70E-04	2.09E-04	2.40E-04	2.64E-04	2.84E-04
u233	9.39E-05	1.46E-04	1.97E-04	2.49E-04	3.01E-04	3.53E-04	4.05E-04
u234	6.49E-01	1.17E+00	1.70E+00	2.23E+00	2.77E+00	3.30E+00	3.82E+00
u235	8.79E+02	8.79E+02	8.79E+02	8.80E+02	8.80E+02	8.80E+02	8.80E+02
u236	1.26E+03	1.26E+03	1.26E+03	1.26E+03	1.26E+03	1.26E+03	1.26E+03
u237	3.77E+00	1.53E-05	1.47E-05	1.41E-05	1.36E-05	1.30E-05	1.25E-05
u238	3.81E+05	3.81E+05	3.81E+05	3.81E+05	3.81E+05	3.81E+05	3.81E+05
np236	3.29E-04	3.29E-04	3.29E-04	3.29E-04	3.29E-04	3.29E-04	3.29E-04
np237	1.69E+02	1.73E+02	1.73E+02	1.73E+02	1.74E+02	1.74E+02	1.74E+02
np239	4.31E+01	8.67E-05	8.67E-05	8.67E-05	8.67E-05	8.67E-05	8.67E-05
pu236	3.35E-04	2.75E-04	2.26E-04	1.85E-04	1.52E-04	1.24E-04	1.02E-04
pu238	7.61E+01	8.17E+01	8.27E+01	8.26E+01	8.21E+01	8.16E+01	8.11E+01
pu239	1.70E+03	1.75E+03	1.75E+03	1.75E+03	1.75E+03	1.75E+03	1.75E+03
pu240	1.05E+03	1.05E+03	1.05E+03	1.05E+03	1.06E+03	1.06E+03	1.06E+03
pu241	5.26E+02	5.06E+02	4.86E+02	4.66E+02	4.48E+02	4.30E+02	4.13E+02
pu242	4.07E+02	4.07E+02	4.07E+02	4.07E+02	4.07E+02	4.07E+02	4.07E+02
am241	1.37E+01	3.45E+01	5.43E+01	7.34E+01	9.17E+01	1.09E+02	1.26E+02
am242m	2.52E-01	2.51E-01	2.50E-01	2.49E-01	2.48E-01	2.47E-01	2.46E-01
am242	4.99E-02	3.24E-06	3.23E-06	3.21E-06	3.20E-06	3.19E-06	3.17E-06
am243	1.01E+02	1.01E+02	1.01E+02	1.01E+02	1.01E+02	1.01E+02	1.01E+02
cm242	7.55E+00	2.08E+00	5.71E-01	1.57E-01	4.36E-02	1.24E-02	3.87E-03
cm243	2.33E-01	2.28E-01	2.24E-01	2.19E-01	2.15E-01	2.11E-01	2.06E-01
cm244	4.02E+01	3.90E+01	3.78E+01	3.66E+01	3.54E+01	3.43E+01	3.33E+01
cm245	1.22E+00	1.22E+00	1.22E+00	1.21E+00	1.21E+00	1.21E+00	1.21E+00
cm246	3.22E-01	3.22E-01	3.22E-01	3.22E-01	3.22E-01	3.22E-01	3.22E-01
cm247	6.22E-03	6.22E-03	6.22E-03	6.22E-03	6.22E-03	6.22E-03	6.22E-03
cm248	7.21E-04	7.22E-04	7.22E-04	7.22E-04	7.22E-04	7.22E-04	7.22E-04
cf249	1.13E-06	6.30E-06	8.97E-06	1.03E-05	1.10E-05	1.14E-05	1.16E-05
cf250	2.30E-06	2.22E-06	2.12E-06	2.03E-06	1.94E-06	1.86E-06	1.78E-06
cf251	1.28E-06	1.28E-06	1.28E-06	1.28E-06	1.28E-06	1.28E-06	1.28E-06
total	3.87E+05	3.87E+05	3.87E+05	3.87E+05	3.87E+05	3.87E+05	3.87E+05

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ce 14x14 40 gwd/mtu pwr 2.3 wt%: 5 year cooled actinides

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decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 6.17E+13n/cm**2-sec

0 element concentrations, grams

basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
he	2.26E-01	3.50E-01	4.08E-01	4.47E-01	4.81E-01	5.14E-01	5.45E-01
pb	9.09E-08	2.68E-07	6.37E-07	1.24E-06	2.09E-06	3.18E-06	4.50E-06
th	8.56E-05	1.19E-04	1.53E-04	1.89E-04	2.26E-04	2.65E-04	3.04E-04
pa	9.28E-06	1.01E-05	1.08E-05	1.16E-05	1.23E-05	1.30E-05	1.37E-05
u	3.83E+05	3.83E+05	3.83E+05	3.83E+05	3.83E+05	3.83E+05	3.83E+05
np	2.13E+02	1.73E+02	1.73E+02	1.73E+02	1.74E+02	1.74E+02	1.74E+02
pu	3.76E+03	3.79E+03	3.78E+03	3.76E+03	3.74E+03	3.72E+03	3.71E+03
am	1.15E+02	1.36E+02	1.55E+02	1.74E+02	1.93E+02	2.10E+02	2.27E+02
cm	4.95E+01	4.29E+01	4.01E+01	3.85E+01	3.72E+01	3.61E+01	3.50E+01
cf	6.06E-06	1.09E-05	1.32E-05	1.43E-05	1.48E-05	1.50E-05	1.50E-05

totals 3.87E+05 3.87E+05 3.87E+05 3.87E+05 3.87E+05 3.87E+05 3.87E+05

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ce 14x14 40 gwd/mtu pwr 2.3 wt%: 5 year cooled actinides

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decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 6.17E+13n/cm**2-sec

0 element radioactivity, curies

basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
tl	1.15E-04	2.83E-04	5.16E-04	7.78E-04	1.04E-03	1.30E-03	1.53E-03
pb	3.19E-04	7.86E-04	1.44E-03	2.16E-03	2.90E-03	3.61E-03	4.25E-03
bi	3.19E-04	7.86E-04	1.44E-03	2.16E-03	2.90E-03	3.61E-03	4.25E-03
po	5.24E-04	1.29E-03	2.36E-03	3.55E-03	4.76E-03	5.92E-03	6.98E-03
rn	3.19E-04	7.86E-04	1.44E-03	2.16E-03	2.90E-03	3.61E-03	4.25E-03
ra	3.19E-04	7.86E-04	1.44E-03	2.16E-03	2.90E-03	3.61E-03	4.25E-03
th	1.38E-01	1.31E-01	1.32E-01	1.32E-01	1.33E-01	1.34E-01	1.34E-01
pa	2.58E-01	2.51E-01	2.51E-01	2.51E-01	2.51E-01	2.51E-01	2.51E-01
u	1.03E+07	1.47E+00	1.43E+00	1.38E+00	1.34E+00	1.30E+00	1.26E+00
np	1.02E+07	2.03E+01	2.03E+01	2.03E+01	2.03E+01	2.03E+01	2.03E+01
pu	3.83E+05	5.40E+04	5.20E+04	5.00E+04	4.81E+04	4.63E+04	4.45E+04
am	1.72E+05	1.44E+02	2.12E+02	2.77E+02	3.40E+02	4.00E+02	4.58E+02
cm	2.83E+04	1.01E+04	4.96E+03	3.50E+03	3.03E+03	2.83E+03	2.72E+03
bk	7.22E-02	9.11E-03	4.71E-03	2.44E-03	1.26E-03	6.53E-04	3.38E-04
cf	1.07E-03	8.48E-04	7.35E-04	6.40E-04	5.60E-04	4.93E-04	4.38E-04
totals	2.11E+07	6.43E+04	5.72E+04	5.38E+04	5.15E+04	4.95E+04	4.77E+04

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ce 14x14 40 gwd/mtu pwr 2.3 wt%: 5 year cooled actinides

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decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 6.17E+13n/cm**2-sec

0 element thermal power, watts

basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
tl	2.68E-06	6.61E-06	1.21E-05	1.82E-05	2.44E-05	3.03E-05	3.58E-05
pb	6.04E-07	1.49E-06	2.72E-06	4.09E-06	5.49E-06	6.82E-06	8.05E-06
bi	5.35E-06	1.32E-05	2.41E-05	3.62E-05	4.86E-05	6.04E-05	7.12E-05
po	2.39E-05	5.89E-05	1.08E-04	1.62E-04	2.17E-04	2.70E-04	3.19E-04
rn	1.21E-05	2.98E-05	5.45E-05	8.22E-05	1.10E-04	1.37E-04	1.62E-04
ra	1.10E-05	2.70E-05	4.93E-05	7.43E-05	9.96E-05	1.24E-04	1.46E-04
th	8.51E-05	8.08E-05	1.02E-04	1.26E-04	1.50E-04	1.73E-04	1.94E-04
pa	1.01E-03	9.42E-04	9.42E-04	9.42E-04	9.42E-04	9.42E-04	9.43E-04
u	2.78E+04	8.22E-03	8.25E-03	8.29E-03	8.32E-03	8.34E-03	8.37E-03
np	2.65E+04	5.44E-02	5.44E-02	5.44E-02	5.44E-02	5.44E-02	5.44E-02
pu	4.31E+02	5.89E+01	5.94E+01	5.93E+01	5.90E+01	5.86E+01	5.83E+01
am	9.31E+02	4.60E+00	6.87E+00	9.05E+00	1.11E+01	1.32E+01	1.51E+01
cm	1.03E+03	3.62E+02	1.76E+02	1.23E+02	1.06E+02	9.91E+01	9.50E+01
bk	3.88E-04	1.78E-06	9.22E-07	4.77E-07	2.47E-07	1.28E-07	6.61E-08
cf	6.18E-05	5.19E-05	4.37E-05	3.70E-05	3.14E-05	2.69E-05	2.31E-05
totals	5.67E+04	4.26E+02	2.43E+02	1.91E+02	1.76E+02	1.71E+02	1.68E+02

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ce 14x14 40 gwd/mtu pwr 2.3 wt%: 5 year cooled actinides

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decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 6.17E+13n/cm**2-sec

0 element gamma power, watts

basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
tl	2.29E-06	5.63E-06	1.03E-05	1.55E-05	2.08E-05	2.58E-05	3.05E-05
pb	2.74E-07	6.76E-07	1.23E-06	1.86E-06	2.49E-06	3.10E-06	3.66E-06
bi	1.99E-07	4.90E-07	8.96E-07	1.35E-06	1.81E-06	2.25E-06	2.65E-06
rn	1.16E-09	2.85E-09	5.20E-09	7.84E-09	1.05E-08	1.31E-08	1.54E-08
ra	1.91E-08	4.69E-08	8.58E-08	1.29E-07	1.73E-07	2.15E-07	2.54E-07
th	9.41E-06	7.74E-06	7.75E-06	7.77E-06	7.78E-06	7.80E-06	7.81E-06
pa	2.25E-04	1.72E-04	1.72E-04	1.72E-04	1.73E-04	1.73E-04	1.73E-04
u	3.30E+03	1.06E-03	1.02E-03	9.80E-04	9.41E-04	9.04E-04	8.69E-04
np	1.18E+04	2.20E-02	2.20E-02	2.20E-02	2.20E-02	2.20E-02	2.20E-02
pu	4.84E+01	1.92E-02	1.94E-02	1.93E-02	1.92E-02	1.91E-02	1.90E-02
am	6.38E+02	2.74E-02	3.90E-02	5.01E-02	6.07E-02	7.09E-02	8.07E-02
cm	3.58E-01	1.30E-01	6.66E-02	4.82E-02	4.23E-02	3.98E-02	3.83E-02
cf	1.69E-06	1.40E-06	1.16E-06	9.62E-07	7.97E-07	6.63E-07	5.55E-07
totals	1.58E+04	2.00E-01	1.48E-01	1.41E-01	1.45E-01	1.53E-01	1.61E-01

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ce 14x14 40 gwd/mtu pwr 2.3 wt%: 5 year cooled fission products

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decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 6.17E+13n/cm**2-sec

0 nuclide concentrations, grams

basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
h 3	2.42E-02	2.31E-02	2.20E-02	2.10E-02	2.00E-02	1.91E-02	1.82E-02
li 6	5.37E-05	5.37E-05	5.37E-05	5.37E-05	5.37E-05	5.37E-05	5.37E-05
li 7	4.79E-06	4.79E-06	4.79E-06	4.79E-06	4.79E-06	4.79E-06	4.79E-06
be 9	9.23E-06	9.23E-06	9.23E-06	9.23E-06	9.23E-06	9.23E-06	9.23E-06
be 10	6.16E-05	6.16E-05	6.16E-05	6.16E-05	6.16E-05	6.16E-05	6.16E-05
c 14	1.24E-05	1.24E-05	1.24E-05	1.24E-05	1.24E-05	1.24E-05	1.24E-05
zn 70	4.85E-06	4.85E-06	4.85E-06	4.85E-06	4.85E-06	4.85E-06	4.85E-06
ga 71	4.56E-05	4.56E-05	4.56E-05	4.56E-05	4.56E-05	4.56E-05	4.56E-05
ge 72	2.66E-03	2.67E-03	2.67E-03	2.67E-03	2.67E-03	2.67E-03	2.67E-03
ge 73	7.19E-03	7.19E-03	7.19E-03	7.19E-03	7.19E-03	7.19E-03	7.19E-03
ge 74	6.29E-03	6.29E-03	6.29E-03	6.29E-03	6.29E-03	6.29E-03	6.29E-03
as 75	5.19E-02	5.19E-02	5.19E-02	5.19E-02	5.19E-02	5.19E-02	5.19E-02
ge 76	1.52E-01	1.52E-01	1.52E-01	1.52E-01	1.52E-01	1.52E-01	1.52E-01
se 76	1.90E-03	1.91E-03	1.91E-03	1.91E-03	1.91E-03	1.91E-03	1.91E-03
se 77	3.38E-01	3.39E-01	3.39E-01	3.39E-01	3.39E-01	3.39E-01	3.39E-01
se 78	1.24E+00	1.24E+00	1.24E+00	1.24E+00	1.24E+00	1.24E+00	1.24E+00
se 79	2.24E+00	2.24E+00	2.24E+00	2.24E+00	2.24E+00	2.24E+00	2.24E+00
br 79	8.23E-06	1.21E-05	1.61E-05	2.00E-05	2.39E-05	2.78E-05	3.17E-05
se 80	6.05E+00	6.05E+00	6.05E+00	6.05E+00	6.05E+00	6.05E+00	6.05E+00

kr 80	3.31E-05	3.31E-05	3.31E-05	3.31E-05	3.31E-05	3.31E-05	3.31E-05
br 81	8.96E+00	8.96E+00	8.96E+00	8.96E+00	8.96E+00	8.96E+00	8.96E+00
kr 81	2.81E-06	2.81E-06	2.81E-06	2.81E-06	2.81E-06	2.81E-06	2.81E-06
se 82	1.42E+01	1.42E+01	1.42E+01	1.42E+01	1.42E+01	1.42E+01	1.42E+01
kr 82	3.39E-01	3.41E-01	3.41E-01	3.41E-01	3.41E-01	3.41E-01	3.41E-01
kr 83	1.49E+01	1.49E+01	1.49E+01	1.49E+01	1.49E+01	1.49E+01	1.49E+01
kr 84	5.18E+01	5.18E+01	5.18E+01	5.18E+01	5.18E+01	5.18E+01	5.18E+01
kr 85	9.43E+00	8.94E+00	8.47E+00	8.02E+00	7.60E+00	7.21E+00	6.83E+00
rb 85	3.91E+01	3.96E+01	4.01E+01	4.05E+01	4.10E+01	4.14E+01	4.17E+01
kr 86	7.71E+01	7.71E+01	7.71E+01	7.71E+01	7.71E+01	7.71E+01	7.71E+01
sr 86	1.84E-01	1.94E-01	1.94E-01	1.94E-01	1.94E-01	1.94E-01	1.94E-01
rb 87	1.00E+02	1.00E+02	1.00E+02	1.00E+02	1.00E+02	1.00E+02	1.00E+02
sr 87	1.26E-03	1.26E-03	1.26E-03	1.26E-03	1.26E-03	1.26E-03	1.26E-03
sr 88	1.43E+02	1.43E+02	1.43E+02	1.43E+02	1.43E+02	1.43E+02	1.43E+02
y 89	1.81E+02	1.89E+02	1.89E+02	1.89E+02	1.89E+02	1.89E+02	1.89E+02
sr 90	2.22E+02	2.17E+02	2.13E+02	2.09E+02	2.04E+02	2.00E+02	1.96E+02
y 90	6.15E-02	5.65E-02	5.53E-02	5.42E-02	5.31E-02	5.20E-02	5.10E-02
zr 90	1.05E+01	1.50E+01	1.94E+01	2.38E+01	2.80E+01	3.21E+01	3.62E+01
zr 91	2.37E+02	2.51E+02	2.51E+02	2.51E+02	2.51E+02	2.51E+02	2.51E+02
zr 92	2.74E+02	2.74E+02	2.74E+02	2.74E+02	2.74E+02	2.74E+02	2.74E+02
zr 93	2.06E+02	2.06E+02	2.06E+02	2.06E+02	2.06E+02	2.06E+02	2.06E+02
nb 93	1.32E-05	2.00E-05	2.93E-05	4.10E-05	5.50E-05	7.12E-05	8.97E-05
nb 93m	1.54E-04	2.25E-04	2.94E-04	3.60E-04	4.23E-04	4.85E-04	5.44E-04
zr 94	3.42E+02	3.42E+02	3.42E+02	3.42E+02	3.42E+02	3.42E+02	3.42E+02
nb 94	2.56E-04	2.56E-04	2.56E-04	2.56E-04	2.56E-04	2.56E-04	2.56E-04
zr 95	2.67E+01	9.92E-01	3.68E-02	1.37E-03	5.08E-05	1.88E-06	7.00E-08
nb 95	1.46E+01	1.15E+00	4.42E-02	1.64E-03	6.11E-05	2.27E-06	8.42E-08
mo 95	2.96E+02	3.35E+02	3.37E+02	3.37E+02	3.37E+02	3.37E+02	3.37E+02
zr 96	3.67E+02	3.67E+02	3.67E+02	3.67E+02	3.67E+02	3.67E+02	3.67E+02
mo 96	2.24E+01	2.24E+01	2.24E+01	2.24E+01	2.24E+01	2.24E+01	2.24E+01
mo 97	3.52E+02	3.53E+02	3.53E+02	3.53E+02	3.53E+02	3.53E+02	3.53E+02
mo 98	3.89E+02	3.89E+02	3.89E+02	3.89E+02	3.89E+02	3.89E+02	3.89E+02
tc 98	3.26E-03	3.26E-03	3.26E-03	3.26E-03	3.26E-03	3.26E-03	3.26E-03

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ce 14x14 40 gwd/mtu pwr 2.3 wt%: 5 year cooled fission products

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decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 6.17E+13n/cm**2-sec

0 nuclide concentrations, grams

basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
tc 99	3.59E+02	3.61E+02	3.61E+02	3.61E+02	3.61E+02	3.61E+02	3.61E+02
ru 99	1.46E-02	1.56E-02	1.66E-02	1.76E-02	1.86E-02	1.96E-02	2.06E-02
mo100	4.44E+02	4.44E+02	4.44E+02	4.44E+02	4.44E+02	4.44E+02	4.44E+02
ru100	5.99E+01	5.99E+01	5.99E+01	5.99E+01	5.99E+01	5.99E+01	5.99E+01
ru101	3.67E+02	3.67E+02	3.67E+02	3.67E+02	3.67E+02	3.67E+02	3.67E+02
ru102	3.86E+02	3.86E+02	3.86E+02	3.86E+02	3.86E+02	3.86E+02	3.86E+02
rh102	5.73E-04	4.70E-04	3.85E-04	3.15E-04	2.58E-04	2.12E-04	1.74E-04
rh103	1.97E+02	2.19E+02	2.19E+02	2.19E+02	2.19E+02	2.19E+02	2.19E+02

ru104	2.98E+02	2.98E+02	2.98E+02	2.98E+02	2.98E+02	2.98E+02	2.98E+02
pd104	1.43E+02	1.43E+02	1.43E+02	1.43E+02	1.43E+02	1.43E+02	1.43E+02
pd105	2.10E+02	2.11E+02	2.11E+02	2.11E+02	2.11E+02	2.11E+02	2.11E+02
ru106	9.42E+01	5.34E+01	3.03E+01	1.72E+01	9.74E+00	5.52E+00	3.13E+00
rh106	1.01E-04	4.96E-05	2.81E-05	1.59E-05	9.04E-06	5.12E-06	2.91E-06
pd106	1.38E+02	1.79E+02	2.02E+02	2.15E+02	2.22E+02	2.27E+02	2.29E+02
pd107	1.40E+02	1.40E+02	1.40E+02	1.40E+02	1.40E+02	1.40E+02	1.40E+02
ag107	1.75E-05	2.99E-05	4.24E-05	5.48E-05	6.72E-05	7.96E-05	9.21E-05
pd108	9.35E+01	9.35E+01	9.35E+01	9.35E+01	9.35E+01	9.35E+01	9.35E+01
ag108m	1.30E-04	1.30E-04	1.29E-04	1.29E-04	1.28E-04	1.27E-04	1.27E-04
cd108	1.34E-04	1.34E-04	1.34E-04	1.34E-04	1.34E-04	1.34E-04	1.34E-04
ag109	5.29E+01	5.30E+01	5.30E+01	5.30E+01	5.30E+01	5.30E+01	5.30E+01
pd110	2.79E+01	2.79E+01	2.79E+01	2.79E+01	2.79E+01	2.79E+01	2.79E+01
ag110m	5.54E-01	2.38E-01	1.02E-01	4.40E-02	1.89E-02	8.14E-03	3.50E-03
cd110	2.98E+01	3.01E+01	3.03E+01	3.03E+01	3.04E+01	3.04E+01	3.04E+01
cd111	1.46E+01	1.48E+01	1.48E+01	1.48E+01	1.48E+01	1.48E+01	1.48E+01
cd112	7.37E+00	7.39E+00	7.39E+00	7.39E+00	7.39E+00	7.39E+00	7.39E+00
cd113	2.75E-02	2.91E-02	2.91E-02	2.91E-02	2.91E-02	2.91E-02	2.91E-02
cd113m	8.07E-02	7.75E-02	7.44E-02	7.14E-02	6.85E-02	6.58E-02	6.31E-02
in113	4.46E-03	7.70E-03	1.08E-02	1.38E-02	1.66E-02	1.94E-02	2.20E-02
cd114	7.01E+00	7.01E+00	7.01E+00	7.01E+00	7.01E+00	7.01E+00	7.01E+00
sn114	2.70E-04	3.16E-04	3.16E-04	3.16E-04	3.16E-04	3.16E-04	3.16E-04
in115	6.84E-01	6.99E-01	6.99E-01	6.99E-01	6.99E-01	6.99E-01	6.99E-01
sn115	9.26E-02	9.30E-02	9.30E-02	9.30E-02	9.30E-02	9.30E-02	9.30E-02
cd116	2.62E+00	2.62E+00	2.62E+00	2.62E+00	2.62E+00	2.62E+00	2.62E+00
sn116	1.36E+00	1.36E+00	1.36E+00	1.36E+00	1.36E+00	1.36E+00	1.36E+00
sn117	2.57E+00	2.58E+00	2.58E+00	2.58E+00	2.58E+00	2.58E+00	2.58E+00
sn118	2.01E+00	2.01E+00	2.01E+00	2.01E+00	2.01E+00	2.01E+00	2.01E+00
sn119	2.09E+00	2.10E+00	2.10E+00	2.10E+00	2.10E+00	2.10E+00	2.10E+00
sn119m	1.11E-02	5.39E-03	2.62E-03	1.28E-03	6.22E-04	3.03E-04	1.48E-04
sn120	2.05E+00	2.05E+00	2.05E+00	2.05E+00	2.05E+00	2.05E+00	2.05E+00
sn121	3.77E-03	1.05E-06	1.04E-06	1.03E-06	1.02E-06	1.01E-06	9.95E-07
sn121m	2.43E-02	2.41E-02	2.38E-02	2.36E-02	2.33E-02	2.31E-02	2.28E-02
sb121	2.00E+00	2.01E+00	2.01E+00	2.01E+00	2.01E+00	2.01E+00	2.01E+00
sn122	2.66E+00	2.66E+00	2.66E+00	2.66E+00	2.66E+00	2.66E+00	2.66E+00
te122	1.56E-01	1.57E-01	1.57E-01	1.57E-01	1.57E-01	1.57E-01	1.57E-01
sn123	3.14E-02	6.13E-03	1.20E-03	2.34E-04	4.58E-05	8.96E-06	1.75E-06
sb123	2.34E+00	2.36E+00	2.37E+00	2.37E+00	2.37E+00	2.37E+00	2.37E+00
te123	1.33E-03	1.75E-03	1.83E-03	1.84E-03	1.84E-03	1.84E-03	1.84E-03
sn124	4.44E+00	4.44E+00	4.44E+00	4.44E+00	4.44E+00	4.44E+00	4.44E+00
te124	1.20E-01	1.43E-01	1.44E-01	1.44E-01	1.44E-01	1.44E-01	1.44E-01
sb125	3.95E+00	3.22E+00	2.60E+00	2.11E+00	1.70E+00	1.38E+00	1.12E+00
te125	1.51E+00	2.28E+00	2.90E+00	3.40E+00	3.81E+00	4.14E+00	4.40E+00
te125m	4.99E-02	4.55E-02	3.70E-02	2.99E-02	2.42E-02	1.96E-02	1.59E-02

decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 6.17E+13n/cm**2-sec

0

nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
sn126	1.07E+01	1.07E+01	1.07E+01	1.07E+01	1.07E+01	1.07E+01	1.07E+01
te126	2.12E-01	2.14E-01	2.14E-01	2.14E-01	2.14E-01	2.15E-01	2.15E-01
te127m	7.09E-01	1.07E-01	1.54E-02	2.23E-03	3.22E-04	4.65E-05	6.72E-06
i127	2.21E+01	2.29E+01	2.30E+01	2.30E+01	2.30E+01	2.30E+01	2.30E+01
te128	4.57E+01	4.57E+01	4.57E+01	4.57E+01	4.57E+01	4.57E+01	4.57E+01
xe128	1.60E+00	1.60E+00	1.60E+00	1.60E+00	1.60E+00	1.60E+00	1.60E+00
i129	8.84E+01	8.93E+01	8.93E+01	8.93E+01	8.93E+01	8.93E+01	8.93E+01
xe129	1.38E-02	1.41E-02	1.41E-02	1.41E-02	1.41E-02	1.42E-02	1.42E-02
te130	1.75E+02	1.75E+02	1.75E+02	1.75E+02	1.75E+02	1.75E+02	1.75E+02
xe130	5.65E+00	5.66E+00	5.66E+00	5.66E+00	5.66E+00	5.66E+00	5.66E+00
xe131	1.82E+02	1.85E+02	1.85E+02	1.85E+02	1.85E+02	1.85E+02	1.85E+02
xe132	5.51E+02	5.53E+02	5.53E+02	5.53E+02	5.53E+02	5.53E+02	5.53E+02
ba132	1.20E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04
cs133	5.15E+02	5.20E+02	5.20E+02	5.20E+02	5.20E+02	5.20E+02	5.20E+02
xe134	7.12E+02	7.12E+02	7.12E+02	7.12E+02	7.12E+02	7.12E+02	7.12E+02
cs134	6.52E+01	4.93E+01	3.73E+01	2.82E+01	2.13E+01	1.61E+01	1.22E+01
ba134	2.49E+01	4.09E+01	5.29E+01	6.20E+01	6.89E+01	7.41E+01	7.80E+01
cs135	1.24E+02	1.24E+02	1.24E+02	1.24E+02	1.24E+02	1.24E+02	1.24E+02
ba135	2.27E-01	2.27E-01	2.27E-01	2.28E-01	2.28E-01	2.28E-01	2.28E-01
xe136	1.15E+03	1.15E+03	1.15E+03	1.15E+03	1.15E+03	1.15E+03	1.15E+03
ba136	8.43E+00	8.71E+00	8.71E+00	8.71E+00	8.71E+00	8.71E+00	8.71E+00
cs137	5.89E+02	5.77E+02	5.66E+02	5.56E+02	5.45E+02	5.35E+02	5.24E+02
ba137	2.19E+01	3.32E+01	4.42E+01	5.50E+01	6.55E+01	7.59E+01	8.61E+01
ba137m	9.07E-05	8.82E-05	8.65E-05	8.48E-05	8.32E-05	8.16E-05	8.01E-05
ba138	5.99E+02	5.99E+02	5.99E+02	5.99E+02	5.99E+02	5.99E+02	5.99E+02
la138	4.19E-03	4.19E-03	4.19E-03	4.19E-03	4.19E-03	4.19E-03	4.19E-03
la139	5.57E+02	5.57E+02	5.57E+02	5.57E+02	5.57E+02	5.57E+02	5.57E+02
ce140	5.87E+02	5.97E+02	5.97E+02	5.97E+02	5.97E+02	5.97E+02	5.97E+02
pr141	4.92E+02	5.13E+02	5.13E+02	5.13E+02	5.13E+02	5.13E+02	5.13E+02
ce142	5.21E+02	5.21E+02	5.21E+02	5.21E+02	5.21E+02	5.21E+02	5.21E+02
nd142	1.39E+01	1.39E+01	1.39E+01	1.39E+01	1.39E+01	1.39E+01	1.39E+01
nd143	2.81E+02	2.90E+02	2.90E+02	2.90E+02	2.90E+02	2.90E+02	2.90E+02
ce144	1.44E+02	6.85E+01	3.27E+01	1.56E+01	7.44E+00	3.55E+00	1.70E+00
pr144	6.11E-03	2.89E-03	1.38E-03	6.57E-04	3.14E-04	1.50E-04	7.14E-05
nd144	5.21E+02	5.96E+02	6.32E+02	6.49E+02	6.57E+02	6.61E+02	6.63E+02
nd145	2.95E+02	2.95E+02	2.95E+02	2.95E+02	2.95E+02	2.95E+02	2.95E+02
pm145	1.03E-05	1.03E-05	1.01E-05	9.89E-06	9.62E-06	9.34E-06	9.05E-06
nd146	3.32E+02	3.32E+02	3.32E+02	3.32E+02	3.32E+02	3.32E+02	3.32E+02
pm146	3.55E-03	3.20E-03	2.88E-03	2.60E-03	2.34E-03	2.11E-03	1.90E-03
sm146	2.88E-03	3.00E-03	3.10E-03	3.20E-03	3.29E-03	3.37E-03	3.44E-03
pm147	6.83E+01	5.73E+01	4.60E+01	3.69E+01	2.96E+01	2.38E+01	1.91E+01
sm147	3.07E+01	4.48E+01	5.61E+01	6.52E+01	7.25E+01	7.83E+01	8.30E+01
nd148	1.73E+02	1.73E+02	1.73E+02	1.73E+02	1.73E+02	1.73E+02	1.73E+02
sm148	6.14E+01	6.23E+01	6.23E+01	6.23E+01	6.23E+01	6.23E+01	6.23E+01
sm149	6.25E-01	1.28E+00	1.28E+00	1.28E+00	1.28E+00	1.28E+00	1.28E+00
nd150	8.91E+01	8.91E+01	8.91E+01	8.91E+01	8.91E+01	8.91E+01	8.91E+01

sm150	1.44E+02	1.44E+02	1.44E+02	1.44E+02	1.44E+02	1.44E+02	1.44E+02
sm151	5.15E+00	5.23E+00	5.20E+00	5.17E+00	5.13E+00	5.10E+00	5.07E+00
eu151	3.48E-03	3.72E-02	7.06E-02	1.04E-01	1.37E-01	1.70E-01	2.02E-01
sm152	6.40E+01	6.40E+01	6.40E+01	6.40E+01	6.40E+01	6.40E+01	6.40E+01
eu152	9.31E-03	8.92E-03	8.54E-03	8.18E-03	7.83E-03	7.50E-03	7.18E-03
gd152	1.94E-02	1.95E-02	1.96E-02	1.97E-02	1.98E-02	1.99E-02	2.00E-02

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ce 14x14 40 gwd/mtu pwr 2.3 wt%: 5 year cooled fission products

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decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 6.17E+13n/cm**2-sec

0 nuclide concentrations, grams

basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
eu153	6.34E+01	6.40E+01	6.40E+01	6.40E+01	6.40E+01	6.40E+01	6.40E+01
gd153	1.72E-03	7.20E-04	3.01E-04	1.26E-04	5.25E-05	2.19E-05	9.16E-06
sm154	2.08E+01	2.08E+01	2.08E+01	2.08E+01	2.08E+01	2.08E+01	2.08E+01
eu154	1.06E+01	9.91E+00	9.27E+00	8.66E+00	8.10E+00	7.58E+00	7.08E+00
gd154	8.89E-01	1.58E+00	2.22E+00	2.82E+00	3.39E+00	3.91E+00	4.41E+00
eu155	3.05E+00	2.70E+00	2.39E+00	2.11E+00	1.87E+00	1.65E+00	1.46E+00
gd155	1.48E-02	3.69E-01	6.83E-01	9.60E-01	1.20E+00	1.42E+00	1.61E+00
gd156	5.56E+01	5.85E+01	5.85E+01	5.85E+01	5.85E+01	5.85E+01	5.85E+01
gd157	4.29E-02	5.69E-02	5.69E-02	5.69E-02	5.69E-02	5.69E-02	5.69E-02
gd158	1.30E+01	1.30E+01	1.30E+01	1.30E+01	1.30E+01	1.30E+01	1.30E+01
tb159	1.50E+00	1.50E+00	1.50E+00	1.50E+00	1.50E+00	1.50E+00	1.50E+00
gd160	6.57E-01	6.57E-01	6.57E-01	6.57E-01	6.57E-01	6.57E-01	6.57E-01
dy160	1.31E-01	1.83E-01	1.86E-01	1.86E-01	1.86E-01	1.86E-01	1.86E-01
dy161	1.94E-01	2.00E-01	2.00E-01	2.00E-01	2.00E-01	2.00E-01	2.00E-01
dy162	1.90E-01	1.90E-01	1.90E-01	1.90E-01	1.90E-01	1.90E-01	1.90E-01
dy163	1.65E-01	1.65E-01	1.65E-01	1.65E-01	1.65E-01	1.65E-01	1.65E-01
dy164	2.74E-02	2.74E-02	2.74E-02	2.74E-02	2.74E-02	2.74E-02	2.74E-02
ho165	6.71E-02	6.72E-02	6.72E-02	6.72E-02	6.72E-02	6.72E-02	6.72E-02
ho166m	2.61E-04	2.61E-04	2.60E-04	2.60E-04	2.60E-04	2.60E-04	2.60E-04
er166	1.64E-02	1.65E-02	1.65E-02	1.65E-02	1.65E-02	1.65E-02	1.65E-02
er167	3.43E-04	3.43E-04	3.43E-04	3.43E-04	3.43E-04	3.43E-04	3.43E-04
er168	6.02E-04	6.02E-04	6.02E-04	6.02E-04	6.02E-04	6.02E-04	6.02E-04
tm169	1.94E-06	1.98E-06	1.98E-06	1.98E-06	1.98E-06	1.98E-06	1.98E-06
er170	2.18E-06	2.18E-06	2.18E-06	2.18E-06	2.18E-06	2.18E-06	2.18E-06
yb171	9.57E-07	1.45E-06	1.81E-06	2.08E-06	2.27E-06	2.42E-06	2.53E-06
yb172	1.88E-06	1.90E-06	1.90E-06	1.90E-06	1.90E-06	1.90E-06	1.90E-06
total	1.61E+04	1.61E+04	1.61E+04	1.61E+04	1.61E+04	1.61E+04	1.61E+04

1

ce 14x14 40 gwd/mtu pwr 2.3 wt%: 5 year cooled fission products

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decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 6.17E+13n/cm**2-sec

0 element radioactivity, curies

basis =single reactor assembly

initial 304.2 d 608.3 d 912.5 d 1216.7 d 1520.8 d 1825.0 d

h	2.34E+02	2.23E+02	2.13E+02	2.03E+02	1.94E+02	1.85E+02	1.76E+02
be	1.38E-06	1.38E-06	1.38E-06	1.38E-06	1.38E-06	1.38E-06	1.38E-06
c	5.55E-05	5.55E-05	5.55E-05	5.55E-05	5.55E-05	5.55E-05	5.55E-05
se	3.02E+05	3.07E-02	3.07E-02	3.07E-02	3.07E-02	3.07E-02	3.07E-02
kr	1.17E+06	3.51E+03	3.32E+03	3.15E+03	2.98E+03	2.83E+03	2.68E+03
rb	1.79E+06	9.36E-03	8.70E-06	8.59E-06	8.59E-06	8.59E-06	8.59E-06
sr	2.93E+06	3.46E+04	3.01E+04	2.94E+04	2.88E+04	2.83E+04	2.77E+04
y	4.01E+06	4.04E+04	3.03E+04	2.95E+04	2.89E+04	2.83E+04	2.77E+04
zr	3.77E+06	2.13E+04	7.92E+02	2.99E+01	1.61E+00	5.59E-01	5.20E-01
nb	5.73E+06	4.55E+04	1.75E+03	6.51E+01	2.52E+00	2.05E-01	1.33E-01
tc	4.87E+06	6.17E+00	6.17E+00	6.17E+00	6.17E+00	6.17E+00	6.17E+00
ru	2.37E+06	1.80E+05	1.00E+05	5.69E+04	3.23E+04	1.83E+04	1.04E+04
rh	3.22E+06	1.80E+05	1.00E+05	5.69E+04	3.23E+04	1.83E+04	1.04E+04
pd	2.97E+05	7.20E-02	7.20E-02	7.20E-02	7.20E-02	7.20E-02	7.20E-02
ag	4.59E+05	1.15E+03	4.94E+02	2.12E+02	9.12E+01	3.92E+01	1.69E+01
cd	4.06E+04	1.91E+01	1.67E+01	1.60E+01	1.54E+01	1.48E+01	1.42E+01
sn	5.60E+05	7.32E+01	2.23E+01	9.27E+00	5.24E+00	3.72E+00	3.05E+00
sb	1.43E+06	3.38E+03	2.73E+03	2.21E+03	1.79E+03	1.45E+03	1.17E+03
te	3.12E+06	2.89E+03	9.54E+02	5.81E+02	4.42E+02	3.54E+02	2.86E+02
i	4.60E+06	1.58E-02	1.58E-02	1.58E-02	1.58E-02	1.58E-02	1.58E-02
cs	2.96E+06	1.14E+05	9.75E+04	8.48E+04	7.50E+04	6.73E+04	6.14E+04
ba	3.53E+06	4.74E+04	4.65E+04	4.57E+04	4.48E+04	4.39E+04	4.31E+04
ce	2.80E+06	2.19E+05	1.04E+05	4.97E+04	2.37E+04	1.13E+04	5.40E+03
pr	2.46E+06	2.21E+05	1.06E+05	5.04E+04	2.40E+04	1.15E+04	5.47E+03
pm	6.60E+05	5.32E+04	4.26E+04	3.42E+04	2.75E+04	2.20E+04	1.77E+04
sm	2.99E+05	1.38E+02	1.37E+02	1.36E+02	1.35E+02	1.34E+02	1.33E+02
eu	1.90E+05	4.01E+03	3.68E+03	3.38E+03	3.11E+03	2.86E+03	2.63E+03
gd	4.38E+03	2.54E+00	1.06E+00	4.44E-01	1.86E-01	7.75E-02	3.24E-02
tb	1.68E+03	3.37E+01	1.83E+00	9.89E-02	5.35E-03	2.90E-04	1.57E-05
ho	7.01E+01	4.68E-04	4.68E-04	4.67E-04	4.67E-04	4.67E-04	4.67E-04
tm	4.81E-03	1.52E-03	1.12E-03	8.32E-04	6.16E-04	4.56E-04	3.38E-04
totals	6.61E+07	1.17E+06	6.72E+05	4.47E+05	3.26E+05	2.57E+05	2.16E+05

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ce 14x14 40 gwd/mtu pwr 2.3 wt%: 5 year cooled fission products

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decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 6.17E+13n/cm**2-sec

0 element thermal power, watts

basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
h	7.88E-03	7.52E-03	7.17E-03	6.85E-03	6.53E-03	6.23E-03	5.95E-03
c	1.63E-08	1.63E-08	1.63E-08	1.63E-08	1.63E-08	1.63E-08	1.63E-08
se	5.28E+03	9.64E-06	9.64E-06	9.64E-06	9.64E-06	9.64E-06	9.64E-06
kr	1.89E+04	5.26E+00	4.98E+00	4.72E+00	4.48E+00	4.24E+00	4.02E+00
sr	4.38E+04	4.92E+01	3.51E+01	3.42E+01	3.35E+01	3.28E+01	3.22E+01
y	6.86E+04	2.05E+02	1.67E+02	1.63E+02	1.60E+02	1.57E+02	1.53E+02
zr	3.88E+04	1.07E+02	3.99E+00	1.48E-01	5.56E-03	2.62E-04	6.59E-05
nb	8.42E+04	2.17E+02	8.35E+00	3.11E-01	1.16E-02	4.49E-04	3.87E-05
tc	6.10E+04	3.09E-03	3.09E-03	3.09E-03	3.09E-03	3.09E-03	3.09E-03

ru	1.31E+04	2.14E+01	6.02E+00	3.39E+00	1.92E+00	1.09E+00	6.17E-01
rh	1.66E+04	1.70E+03	9.62E+02	5.46E+02	3.09E+02	1.76E+02	9.95E+01
pd	9.11E+02	3.97E-06	3.97E-06	3.97E-06	3.97E-06	3.97E-06	3.97E-06
ag	1.81E+03	1.90E+01	8.17E+00	3.51E+00	1.51E+00	6.49E-01	2.79E-01
cd	4.67E+02	2.52E-02	1.82E-02	1.74E-02	1.67E-02	1.61E-02	1.54E-02
sn	7.42E+03	1.70E-01	3.73E-02	9.94E-03	3.81E-03	2.24E-03	1.74E-03
sb	2.61E+04	1.08E+01	8.63E+00	6.98E+00	5.65E+00	4.58E+00	3.71E+00
te	2.96E+04	2.77E+00	8.32E-01	4.93E-01	3.73E-01	2.98E-01	2.41E-01
i	6.83E+04	7.38E-06	7.37E-06	7.37E-06	7.37E-06	7.37E-06	7.37E-06
cs	5.37E+04	7.06E+02	5.46E+02	4.25E+02	3.34E+02	2.64E+02	2.11E+02
ba	3.03E+04	1.86E+02	1.83E+02	1.79E+02	1.76E+02	1.73E+02	1.69E+02
ce	1.31E+04	1.44E+02	6.81E+01	3.25E+01	1.55E+01	7.40E+00	3.53E+00
pr	2.01E+04	1.60E+03	7.64E+02	3.65E+02	1.74E+02	8.31E+01	3.96E+01
pm	3.34E+03	2.02E+01	1.57E+01	1.26E+01	1.01E+01	8.09E+00	6.50E+00
sm	7.15E+02	1.62E-02	1.61E-02	1.60E-02	1.59E-02	1.58E-02	1.57E-02
eu	1.79E+03	2.54E+01	2.37E+01	2.21E+01	2.06E+01	1.92E+01	1.80E+01
gd	1.27E+01	2.24E-03	9.34E-04	3.90E-04	1.63E-04	6.81E-05	2.85E-05
tb	9.76E+00	2.96E-01	1.60E-02	8.67E-04	4.70E-05	2.54E-06	1.38E-07
ho	3.02E-01	4.92E-06	4.92E-06	4.92E-06	4.91E-06	4.91E-06	4.91E-06
tm	1.67E-05	2.40E-07	1.75E-07	1.29E-07	9.51E-08	7.04E-08	5.21E-08
totals	8.01E+05	5.02E+03	2.81E+03	1.80E+03	1.25E+03	9.30E+02	7.42E+02

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ce 14x14 40 gwd/mtu pwr 2.3 wt%: 5 year cooled fission products

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decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 6.17E+13n/cm**2-sec

0 nuclide gamma power, watts

basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
kr 85	4.89E-02	4.64E-02	4.39E-02	4.16E-02	3.94E-02	3.74E-02	3.54E-02
y 90	3.37E-04	3.09E-04	3.03E-04	2.97E-04	2.91E-04	2.85E-04	2.79E-04
y 91	7.55E+00	2.07E-01	5.64E-03	1.54E-04	4.18E-06	1.14E-07	3.10E-09
nb 93m	4.09E-07	5.98E-07	7.80E-07	9.55E-07	1.12E-06	1.29E-06	1.45E-06
nb 94	4.48E-07	4.48E-07	4.48E-07	4.48E-07	4.48E-07	4.48E-07	4.48E-07
zr 95	2.49E+03	9.25E+01	3.43E+00	1.27E-01	4.73E-03	1.76E-04	6.52E-06
nb 95	2.61E+03	2.05E+02	7.88E+00	2.93E-01	1.09E-02	4.04E-04	1.50E-05
nb 95m	2.65E+00	1.02E-01	3.78E-03	1.41E-04	5.22E-06	1.94E-07	7.19E-09
tc 98	2.34E-08	2.34E-08	2.34E-08	2.34E-08	2.34E-08	2.34E-08	2.34E-08
tc 99	2.26E-08	2.27E-08	2.27E-08	2.27E-08	2.27E-08	2.27E-08	2.27E-08
rh102	8.87E-03	7.27E-03	5.96E-03	4.88E-03	4.00E-03	3.28E-03	2.69E-03
rh106	4.40E+02	2.16E+02	1.23E+02	6.95E+01	3.94E+01	2.24E+01	1.27E+01
ag108	5.96E-05	3.21E-08	3.20E-08	3.18E-08	3.17E-08	3.15E-08	3.14E-08
ag108m	3.27E-05	3.25E-05	3.24E-05	3.22E-05	3.21E-05	3.19E-05	3.18E-05
ag110	2.16E+01	2.80E-03	1.21E-03	5.18E-04	2.23E-04	9.58E-05	4.12E-05
ag110m	4.28E+01	1.84E+01	7.91E+00	3.40E+00	1.46E+00	6.28E-01	2.70E-01
cd113m	7.59E-06	7.29E-06	7.00E-06	6.72E-06	6.45E-06	6.19E-06	5.94E-06
sn119m	2.81E-03	1.37E-03	6.66E-04	3.24E-04	1.58E-04	7.69E-05	3.75E-05
sn121m	3.87E-05	3.83E-05	3.79E-05	3.75E-05	3.71E-05	3.68E-05	3.64E-05
sn123	1.06E-02	2.06E-03	4.03E-04	7.88E-05	1.54E-05	3.01E-06	5.89E-07

ce 14x14 40 gwd/mtu pwr 2.3 wt%: 14 year cooled light elements
page 22
decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 6.17E+13n/cm**2-sec
0 element thermal power, watts
basis =single reactor assembly

	initial	851.7 d	1703.3 d	2555.0 d	3406.7 d	4258.3 d	5110.0 d
mn	7.14E+02	6.21E-02	9.37E-03	1.41E-03	2.13E-04	3.22E-05	4.86E-06
fe	3.30E-01	1.04E-02	5.75E-03	3.18E-03	1.76E-03	9.73E-04	5.38E-04
co	4.52E+00	2.65E+00	1.95E+00	1.43E+00	1.05E+00	7.76E-01	5.71E-01
ni	1.59E-01	1.24E-03	1.22E-03	1.20E-03	1.18E-03	1.17E-03	1.15E-03
sn	2.04E+01	3.22E-01	4.25E-02	5.87E-03	9.86E-04	3.29E-04	2.35E-04
sb	3.28E+00	8.01E-01	4.43E-01	2.45E-01	1.36E-01	7.50E-02	4.15E-02
te	8.73E-02	5.21E-02	2.88E-02	1.59E-02	8.82E-03	4.88E-03	2.70E-03
totals	7.46E+02	3.90E+00	2.48E+00	1.71E+00	1.20E+00	8.58E-01	6.17E-01

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ce 14x14 40 gwd/mtu pwr 2.3 wt%: 14 year cooled light elements
page 23
decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 6.17E+13n/cm**2-sec
0 element gamma power, watts
basis =single reactor assembly

	initial	851.7 d	1703.3 d	2555.0 d	3406.7 d	4258.3 d	5110.0 d
mn	4.79E+02	6.18E-02	9.33E-03	1.41E-03	2.12E-04	3.20E-05	4.84E-06
fe	2.88E-01	3.02E-03	1.67E-03	9.24E-04	5.11E-04	2.83E-04	1.56E-04
co	4.19E+00	2.55E+00	1.87E+00	1.38E+00	1.02E+00	7.47E-01	5.50E-01
ni	7.31E-02	1.49E-06	1.49E-06	1.49E-06	1.49E-06	1.49E-06	1.49E-06
sn	7.25E+00	4.20E-02	5.53E-03	7.46E-04	1.07E-04	2.20E-05	1.04E-05
sb	2.15E+00	6.52E-01	3.60E-01	1.99E-01	1.10E-01	6.10E-02	3.38E-02
te	2.30E-02	1.31E-02	7.22E-03	3.99E-03	2.21E-03	1.22E-03	6.76E-04
totals	4.95E+02	3.33E+00	2.26E+00	1.59E+00	1.13E+00	8.10E-01	5.84E-01

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ce 14x14 40 gwd/mtu pwr 2.3 wt%: 14 year cooled actinides
page 24
decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 6.17E+13n/cm**2-sec
0 nuclide concentrations, gram atoms
basis = single reactor assembly

	initial	851.7 d	1703.3 d	2555.0 d	3406.7 d	4258.3 d	5110.0 d
he 4	5.66E-02	1.10E-01	1.33E-01	1.55E-01	1.77E-01	1.98E-01	2.18E-01
th232	3.35E-07	7.03E-07	1.07E-06	1.44E-06	1.81E-06	2.18E-06	2.54E-06
u232	2.74E-07	8.69E-07	1.19E-06	1.36E-06	1.44E-06	1.48E-06	1.48E-06
u233	4.03E-07	9.80E-07	1.56E-06	2.14E-06	2.72E-06	3.30E-06	3.89E-06
u234	2.77E-03	9.09E-03	1.54E-02	2.17E-02	2.78E-02	3.38E-02	3.97E-02
u235	3.74E+00	3.74E+00	3.74E+00	3.74E+00	3.74E+00	3.74E+00	3.75E+00
u236	5.33E+00	5.33E+00	5.33E+00	5.34E+00	5.34E+00	5.34E+00	5.34E+00
u238	1.60E+03	1.60E+03	1.60E+03	1.60E+03	1.60E+03	1.60E+03	1.60E+03
np236	1.39E-06	1.39E-06	1.39E-06	1.39E-06	1.39E-06	1.39E-06	1.39E-06
np237	7.15E-01	7.32E-01	7.33E-01	7.35E-01	7.38E-01	7.42E-01	7.46E-01

pu238	3.20E-01	3.47E-01	3.42E-01	3.35E-01	3.29E-01	3.23E-01	3.17E-01
pu239	7.13E+00	7.31E+00	7.31E+00	7.31E+00	7.31E+00	7.31E+00	7.30E+00
pu240	4.38E+00	4.39E+00	4.41E+00	4.42E+00	4.43E+00	4.43E+00	4.44E+00
pu241	2.18E+00	1.95E+00	1.74E+00	1.56E+00	1.39E+00	1.24E+00	1.11E+00
pu242	1.68E+00	1.68E+00	1.68E+00	1.68E+00	1.68E+00	1.68E+00	1.68E+00
am241	5.70E-02	2.89E-01	4.95E-01	6.79E-01	8.42E-01	9.87E-01	1.12E+00
am242m	1.04E-03	1.03E-03	1.02E-03	1.01E-03	9.95E-04	9.84E-04	9.73E-04
am243	4.14E-01	4.15E-01	4.15E-01	4.15E-01	4.14E-01	4.14E-01	4.14E-01
cm242	3.12E-02	8.40E-04	2.50E-05	3.23E-06	2.61E-06	2.57E-06	2.54E-06
cm243	9.59E-04	9.06E-04	8.56E-04	8.09E-04	7.64E-04	7.22E-04	6.82E-04
cm244	1.65E-01	1.51E-01	1.38E-01	1.26E-01	1.15E-01	1.06E-01	9.66E-02
cm245	4.96E-03	4.96E-03	4.96E-03	4.96E-03	4.96E-03	4.96E-03	4.95E-03
cm246	1.31E-03	1.31E-03	1.31E-03	1.31E-03	1.31E-03	1.31E-03	1.31E-03
cm247	2.52E-05	2.52E-05	2.52E-05	2.52E-05	2.52E-05	2.52E-05	2.52E-05
cm248	2.91E-06	2.91E-06	2.91E-06	2.91E-06	2.91E-06	2.91E-06	2.91E-06
total	1.63E+03	1.63E+03	1.63E+03	1.63E+03	1.63E+03	1.63E+03	1.63E+03

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ce 14x14 40 gwd/mtu pwr 2.3 wt%: 14 year cooled actinides

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decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 6.17E+13n/cm**2-sec

0 element concentrations, gram atoms

basis = single reactor assembly

	initial	851.7 d	1703.3 d	2555.0 d	3406.7 d	4258.3 d	5110.0 d
he	5.66E-02	1.10E-01	1.33E-01	1.55E-01	1.77E-01	1.98E-01	2.18E-01
th	3.69E-07	7.85E-07	1.24E-06	1.74E-06	2.28E-06	2.85E-06	3.46E-06
u	1.61E+03	1.61E+03	1.61E+03	1.61E+03	1.61E+03	1.61E+03	1.61E+03
np	8.99E-01	7.32E-01	7.33E-01	7.35E-01	7.38E-01	7.42E-01	7.46E-01
pu	1.57E+01	1.57E+01	1.55E+01	1.53E+01	1.51E+01	1.50E+01	1.49E+01
am	4.73E-01	7.05E-01	9.11E-01	1.09E+00	1.26E+00	1.40E+00	1.53E+00
cm	2.03E-01	1.59E-01	1.45E-01	1.33E-01	1.23E-01	1.13E-01	1.04E-01
totals	1.63E+03	1.63E+03	1.63E+03	1.63E+03	1.63E+03	1.63E+03	1.63E+03

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ce 14x14 40 gwd/mtu pwr 2.3 wt%: 14 year cooled actinides

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decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 6.17E+13n/cm**2-sec

0 nuclide concentrations, grams

basis =single reactor assembly

	initial	851.7 d	1703.3 d	2555.0 d	3406.7 d	4258.3 d	5110.0 d
he 4	2.26E-01	4.40E-01	5.33E-01	6.21E-01	7.07E-01	7.91E-01	8.73E-01
pb208	9.06E-08	1.10E-06	3.94E-06	8.45E-06	1.41E-05	2.06E-05	2.74E-05
th228	3.88E-07	2.45E-06	4.87E-06	6.72E-06	7.93E-06	8.63E-06	8.98E-06
th230	1.80E-06	1.07E-05	2.93E-05	5.74E-05	9.48E-05	1.41E-04	1.97E-04
th232	7.78E-05	1.63E-04	2.49E-04	3.34E-04	4.19E-04	5.05E-04	5.90E-04
th234	5.54E-06	5.53E-06	5.53E-06	5.53E-06	5.53E-06	5.53E-06	5.53E-06
pa231	3.53E-06	5.52E-06	7.51E-06	9.50E-06	1.15E-05	1.35E-05	1.55E-05
pa233	5.73E-06	5.89E-06	5.90E-06	5.92E-06	5.94E-06	5.97E-06	6.00E-06
u232	6.36E-05	2.02E-04	2.77E-04	3.16E-04	3.35E-04	3.42E-04	3.43E-04

u233	9.39E-05	2.28E-04	3.63E-04	4.98E-04	6.34E-04	7.70E-04	9.07E-04
u234	6.49E-01	2.13E+00	3.61E+00	5.07E+00	6.51E+00	7.91E+00	9.29E+00
u235	8.79E+02	8.80E+02	8.80E+02	8.80E+02	8.80E+02	8.80E+02	8.80E+02
u236	1.26E+03	1.26E+03	1.26E+03	1.26E+03	1.26E+03	1.26E+03	1.26E+03
u237	3.77E+00	1.43E-05	1.27E-05	1.14E-05	1.02E-05	9.08E-06	8.12E-06
u238	3.81E+05	3.81E+05	3.81E+05	3.81E+05	3.81E+05	3.81E+05	3.81E+05
np236	3.29E-04	3.29E-04	3.29E-04	3.29E-04	3.29E-04	3.29E-04	3.29E-04
np237	1.69E+02	1.73E+02	1.74E+02	1.74E+02	1.75E+02	1.76E+02	1.77E+02
np239	4.31E+01	8.67E-05	8.67E-05	8.67E-05	8.67E-05	8.66E-05	8.66E-05
pu236	3.35E-04	1.92E-04	1.10E-04	6.31E-05	3.62E-05	2.07E-05	1.19E-05
pu238	7.61E+01	8.26E+01	8.13E+01	7.98E+01	7.84E+01	7.69E+01	7.55E+01
pu239	1.70E+03	1.75E+03	1.75E+03	1.75E+03	1.75E+03	1.75E+03	1.75E+03
pu240	1.05E+03	1.05E+03	1.06E+03	1.06E+03	1.06E+03	1.06E+03	1.07E+03
pu241	5.26E+02	4.70E+02	4.20E+02	3.75E+02	3.35E+02	3.00E+02	2.68E+02
pu242	4.07E+02	4.07E+02	4.07E+02	4.07E+02	4.07E+02	4.07E+02	4.07E+02
am241	1.37E+01	6.96E+01	1.19E+02	1.64E+02	2.03E+02	2.38E+02	2.69E+02
am242m	2.52E-01	2.49E-01	2.46E-01	2.44E-01	2.41E-01	2.38E-01	2.35E-01
am242	4.99E-02	3.22E-06	3.18E-06	3.14E-06	3.11E-06	3.07E-06	3.04E-06
am243	1.01E+02	1.01E+02	1.01E+02	1.01E+02	1.01E+02	1.01E+02	1.01E+02
cm242	7.55E+00	2.03E-01	6.06E-03	7.81E-04	6.33E-04	6.22E-04	6.15E-04
cm243	2.33E-01	2.20E-01	2.08E-01	1.97E-01	1.86E-01	1.75E-01	1.66E-01
cm244	4.02E+01	3.68E+01	3.37E+01	3.08E+01	2.82E+01	2.58E+01	2.36E+01
cm245	1.22E+00	1.21E+00	1.21E+00	1.21E+00	1.21E+00	1.21E+00	1.21E+00
cm246	3.22E-01	3.22E-01	3.22E-01	3.22E-01	3.22E-01	3.22E-01	3.22E-01
cm247	6.22E-03	6.22E-03	6.22E-03	6.22E-03	6.22E-03	6.22E-03	6.22E-03
cm248	7.21E-04	7.22E-04	7.22E-04	7.22E-04	7.22E-04	7.22E-04	7.22E-04
cf249	1.13E-06	1.01E-05	1.15E-05	1.17E-05	1.17E-05	1.16E-05	1.16E-05
cf250	2.30E-06	2.05E-06	1.81E-06	1.60E-06	1.41E-06	1.25E-06	1.10E-06
cf251	1.28E-06	1.28E-06	1.28E-06	1.28E-06	1.27E-06	1.27E-06	1.27E-06
total	3.87E+05	3.87E+05	3.87E+05	3.87E+05	3.87E+05	3.87E+05	3.87E+05

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ce 14x14 40 gwd/mtu pwr 2.3 wt%: 14 year cooled actinides

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decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 6.17E+13n/cm**2-sec

0 element concentrations, grams

basis =single reactor assembly

	initial	851.7 d	1703.3 d	2555.0 d	3406.7 d	4258.3 d	5110.0 d
he	2.26E-01	4.40E-01	5.33E-01	6.21E-01	7.07E-01	7.91E-01	8.73E-01
pb	9.09E-08	1.10E-06	3.94E-06	8.46E-06	1.42E-05	2.06E-05	2.74E-05
th	8.56E-05	1.82E-04	2.88E-04	4.04E-04	5.28E-04	6.61E-04	8.02E-04
pa	9.28E-06	1.14E-05	1.34E-05	1.54E-05	1.74E-05	1.94E-05	2.15E-05
u	3.83E+05	3.83E+05	3.83E+05	3.83E+05	3.83E+05	3.83E+05	3.83E+05
np	2.13E+02	1.73E+02	1.74E+02	1.74E+02	1.75E+02	1.76E+02	1.77E+02
pu	3.76E+03	3.76E+03	3.71E+03	3.67E+03	3.63E+03	3.59E+03	3.56E+03
am	1.15E+02	1.71E+02	2.20E+02	2.65E+02	3.04E+02	3.39E+02	3.70E+02
cm	4.95E+01	3.88E+01	3.54E+01	3.25E+01	2.99E+01	2.75E+01	2.53E+01
cf	6.06E-06	1.42E-05	1.50E-05	1.48E-05	1.45E-05	1.42E-05	1.40E-05
totals	3.87E+05	3.87E+05	3.87E+05	3.87E+05	3.87E+05	3.87E+05	3.87E+05

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ce 14x14 40 gwd/mtu pwr 2.3 wt%: 14 year cooled actinides
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decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 6.17E+13n/cm**2-sec
0 element radioactivity, curies
basis =single reactor assembly

	initial	851.7 d	1703.3 d	2555.0 d	3406.7 d	4258.3 d	5110.0 d
tl	1.15E-04	7.23E-04	1.44E-03	1.98E-03	2.34E-03	2.55E-03	2.65E-03
pb	3.19E-04	2.01E-03	3.99E-03	5.52E-03	6.51E-03	7.09E-03	7.38E-03
bi	3.19E-04	2.01E-03	3.99E-03	5.52E-03	6.51E-03	7.09E-03	7.38E-03
po	5.24E-04	3.30E-03	6.55E-03	9.05E-03	1.07E-02	1.16E-02	1.21E-02
rn	3.19E-04	2.01E-03	3.99E-03	5.52E-03	6.51E-03	7.09E-03	7.38E-03
ra	3.19E-04	2.01E-03	3.99E-03	5.52E-03	6.51E-03	7.09E-03	7.38E-03
th	1.38E-01	1.32E-01	1.34E-01	1.36E-01	1.37E-01	1.37E-01	1.37E-01
pa	2.58E-01	2.51E-01	2.51E-01	2.51E-01	2.52E-01	2.52E-01	2.53E-01
u	1.03E+07	1.39E+00	1.28E+00	1.18E+00	1.09E+00	1.01E+00	9.40E-01
np	1.02E+07	2.03E+01	2.03E+01	2.03E+01	2.02E+01	2.02E+01	2.02E+01
pu	3.83E+05	5.04E+04	4.52E+04	4.05E+04	3.64E+04	3.27E+04	2.93E+04
am	1.72E+05	2.64E+02	4.35E+02	5.87E+02	7.21E+02	8.41E+02	9.47E+02
cm	2.83E+04	3.67E+03	2.76E+03	2.51E+03	2.29E+03	2.10E+03	1.92E+03
bk	7.22E-02	2.78E-03	4.40E-04	6.95E-05	1.10E-05	1.74E-06	2.75E-07
cf	1.07E-03	6.58E-04	4.59E-04	3.40E-04	2.67E-04	2.20E-04	1.88E-04
totals	2.11E+07	5.44E+04	4.84E+04	4.37E+04	3.94E+04	3.56E+04	3.22E+04

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ce 14x14 40 gwd/mtu pwr 2.3 wt%: 14 year cooled actinides
page 29
decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 6.17E+13n/cm**2-sec
0 element thermal power, watts
basis =single reactor assembly

	initial	851.7 d	1703.3 d	2555.0 d	3406.7 d	4258.3 d	5110.0 d
tl	2.68E-06	1.69E-05	3.36E-05	4.64E-05	5.47E-05	5.96E-05	6.20E-05
pb	6.04E-07	3.80E-06	7.55E-06	1.04E-05	1.23E-05	1.34E-05	1.40E-05
bi	5.35E-06	3.37E-05	6.69E-05	9.24E-05	1.09E-04	1.19E-04	1.24E-04
po	2.39E-05	1.51E-04	2.99E-04	4.14E-04	4.88E-04	5.31E-04	5.53E-04
rn	1.21E-05	7.64E-05	1.52E-04	2.10E-04	2.47E-04	2.69E-04	2.80E-04
ra	1.10E-05	6.91E-05	1.37E-04	1.89E-04	2.24E-04	2.43E-04	2.53E-04
th	8.51E-05	1.21E-04	1.86E-04	2.36E-04	2.68E-04	2.87E-04	2.96E-04
pa	1.01E-03	9.42E-04	9.42E-04	9.43E-04	9.44E-04	9.46E-04	9.48E-04
u	2.78E+04	8.28E-03	8.36E-03	8.43E-03	8.51E-03	8.60E-03	8.70E-03
np	2.65E+04	5.44E-02	5.44E-02	5.44E-02	5.44E-02	5.44E-02	5.44E-02
pu	4.31E+02	5.93E+01	5.84E+01	5.75E+01	5.65E+01	5.56E+01	5.47E+01
am	9.31E+02	8.63E+00	1.43E+01	1.94E+01	2.39E+01	2.79E+01	3.14E+01
cm	1.03E+03	1.29E+02	9.65E+01	8.77E+01	8.02E+01	7.34E+01	6.71E+01
cf	6.18E-05	3.82E-05	2.45E-05	1.67E-05	1.21E-05	9.38E-06	7.66E-06
totals	5.67E+04	1.97E+02	1.69E+02	1.65E+02	1.61E+02	1.57E+02	1.53E+02

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ce 14x14 40 gwd/mtu pwr 2.3 wt%: 14 year cooled actinides
page 30
decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 6.17E+13n/cm**2-sec
0 element gamma power, watts
basis =single reactor assembly

	initial	851.7 d	1703.3 d	2555.0 d	3406.7 d	4258.3 d	5110.0 d
tl	2.29E-06	1.44E-05	2.86E-05	3.95E-05	4.66E-05	5.07E-05	5.28E-05
pb	2.74E-07	1.73E-06	3.43E-06	4.74E-06	5.60E-06	6.09E-06	6.34E-06
bi	1.99E-07	1.25E-06	2.49E-06	3.44E-06	4.06E-06	4.42E-06	4.60E-06
rn	1.16E-09	7.29E-09	1.45E-08	2.00E-08	2.36E-08	2.57E-08	2.67E-08
ra	1.91E-08	1.20E-07	2.38E-07	3.29E-07	3.89E-07	4.23E-07	4.40E-07
th	9.41E-06	7.76E-06	7.81E-06	7.84E-06	7.86E-06	7.87E-06	7.88E-06
pa	2.25E-04	1.72E-04	1.73E-04	1.73E-04	1.74E-04	1.75E-04	1.75E-04
u	3.30E+03	9.88E-04	8.83E-04	7.89E-04	7.06E-04	6.31E-04	5.65E-04
np	1.18E+04	2.20E-02	2.20E-02	2.20E-02	2.20E-02	2.20E-02	2.19E-02
pu	4.84E+01	1.93E-02	1.90E-02	1.87E-02	1.84E-02	1.81E-02	1.78E-02
am	6.38E+02	4.79E-02	7.68E-02	1.03E-01	1.25E-01	1.46E-01	1.64E-01
cm	3.58E-01	5.03E-02	3.89E-02	3.56E-02	3.28E-02	3.03E-02	2.79E-02
cf	1.69E-06	9.99E-07	5.95E-07	3.71E-07	2.49E-07	1.81E-07	1.44E-07
totals	1.58E+04	1.41E-01	1.58E-01	1.80E-01	2.00E-01	2.17E-01	2.32E-01

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ce 14x14 40 gwd/mtu pwr 2.3 wt%: 14 year cooled fission products
page 31
decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 6.17E+13n/cm**2-sec
0 nuclide concentrations, grams
basis =single reactor assembly

	initial	851.7 d	1703.3 d	2555.0 d	3406.7 d	4258.3 d	5110.0 d
h 3	2.42E-02	2.12E-02	1.86E-02	1.63E-02	1.43E-02	1.25E-02	1.10E-02
li 6	5.37E-05	5.37E-05	5.37E-05	5.37E-05	5.37E-05	5.37E-05	5.37E-05
li 7	4.79E-06	4.79E-06	4.79E-06	4.79E-06	4.79E-06	4.79E-06	4.79E-06
be 9	9.23E-06	9.23E-06	9.23E-06	9.23E-06	9.23E-06	9.23E-06	9.23E-06
be 10	6.16E-05	6.16E-05	6.16E-05	6.16E-05	6.16E-05	6.16E-05	6.16E-05
c 14	1.24E-05	1.24E-05	1.24E-05	1.24E-05	1.24E-05	1.24E-05	1.24E-05
zn 70	4.85E-06	4.85E-06	4.85E-06	4.85E-06	4.85E-06	4.85E-06	4.85E-06
ga 71	4.56E-05	4.56E-05	4.56E-05	4.56E-05	4.56E-05	4.56E-05	4.56E-05
ge 72	2.66E-03	2.67E-03	2.67E-03	2.67E-03	2.67E-03	2.67E-03	2.67E-03
ge 73	7.19E-03	7.19E-03	7.19E-03	7.19E-03	7.19E-03	7.19E-03	7.19E-03
ge 74	6.29E-03	6.29E-03	6.29E-03	6.29E-03	6.29E-03	6.29E-03	6.29E-03
as 75	5.19E-02	5.19E-02	5.19E-02	5.19E-02	5.19E-02	5.19E-02	5.19E-02
ge 76	1.52E-01	1.52E-01	1.52E-01	1.52E-01	1.52E-01	1.52E-01	1.52E-01
se 76	1.90E-03	1.91E-03	1.91E-03	1.91E-03	1.91E-03	1.91E-03	1.91E-03
se 77	3.38E-01	3.39E-01	3.39E-01	3.39E-01	3.39E-01	3.39E-01	3.39E-01
se 78	1.24E+00	1.24E+00	1.24E+00	1.24E+00	1.24E+00	1.24E+00	1.24E+00
se 79	2.24E+00	2.24E+00	2.24E+00	2.24E+00	2.24E+00	2.24E+00	2.24E+00
br 79	8.23E-06	1.92E-05	3.02E-05	4.11E-05	5.21E-05	6.31E-05	7.41E-05
se 80	6.05E+00	6.05E+00	6.05E+00	6.05E+00	6.05E+00	6.05E+00	6.05E+00
kr 80	3.31E-05	3.31E-05	3.31E-05	3.31E-05	3.31E-05	3.31E-05	3.31E-05

br 81	8.96E+00	8.96E+00	8.96E+00	8.96E+00	8.96E+00	8.96E+00	8.96E+00
kr 81	2.81E-06	2.81E-06	2.81E-06	2.81E-06	2.81E-06	2.81E-06	2.81E-06
se 82	1.42E+01	1.42E+01	1.42E+01	1.42E+01	1.42E+01	1.42E+01	1.42E+01
kr 82	3.39E-01	3.41E-01	3.41E-01	3.41E-01	3.41E-01	3.41E-01	3.41E-01
kr 83	1.49E+01	1.49E+01	1.49E+01	1.49E+01	1.49E+01	1.49E+01	1.49E+01
kr 84	5.18E+01	5.18E+01	5.18E+01	5.18E+01	5.18E+01	5.18E+01	5.18E+01
kr 85	9.43E+00	8.11E+00	6.98E+00	6.00E+00	5.16E+00	4.44E+00	3.82E+00
rb 85	3.91E+01	4.05E+01	4.16E+01	4.26E+01	4.34E+01	4.41E+01	4.48E+01
kr 86	7.71E+01	7.71E+01	7.71E+01	7.71E+01	7.71E+01	7.71E+01	7.71E+01
sr 86	1.84E-01	1.94E-01	1.94E-01	1.94E-01	1.94E-01	1.94E-01	1.94E-01
rb 87	1.00E+02	1.00E+02	1.00E+02	1.00E+02	1.00E+02	1.00E+02	1.00E+02
sr 87	1.26E-03	1.26E-03	1.26E-03	1.26E-03	1.26E-03	1.26E-03	1.26E-03
sr 88	1.43E+02	1.43E+02	1.43E+02	1.43E+02	1.43E+02	1.43E+02	1.43E+02
y 89	1.81E+02	1.89E+02	1.89E+02	1.89E+02	1.89E+02	1.89E+02	1.89E+02
sr 90	2.22E+02	2.09E+02	1.98E+02	1.87E+02	1.76E+02	1.66E+02	1.57E+02
y 90	6.15E-02	5.44E-02	5.14E-02	4.85E-02	4.58E-02	4.33E-02	4.08E-02
zr 90	1.05E+01	2.29E+01	3.46E+01	4.56E+01	5.60E+01	6.59E+01	7.52E+01
zr 91	2.37E+02	2.51E+02	2.51E+02	2.51E+02	2.51E+02	2.51E+02	2.51E+02
zr 92	2.74E+02	2.74E+02	2.74E+02	2.74E+02	2.74E+02	2.74E+02	2.74E+02
zr 93	2.06E+02	2.06E+02	2.06E+02	2.06E+02	2.06E+02	2.06E+02	2.06E+02
nb 93	1.32E-05	3.84E-05	8.20E-05	1.42E-04	2.17E-04	3.06E-04	4.07E-04
nb 93m	1.54E-04	3.47E-04	5.21E-04	6.78E-04	8.21E-04	9.50E-04	1.07E-03
zr 94	3.42E+02	3.42E+02	3.42E+02	3.42E+02	3.42E+02	3.42E+02	3.42E+02
nb 94	2.56E-04	2.56E-04	2.56E-04	2.56E-04	2.56E-04	2.56E-04	2.56E-04
mo 95	2.96E+02	3.37E+02	3.37E+02	3.37E+02	3.37E+02	3.37E+02	3.37E+02
zr 96	3.67E+02	3.67E+02	3.67E+02	3.67E+02	3.67E+02	3.67E+02	3.67E+02
mo 96	2.24E+01	2.24E+01	2.24E+01	2.24E+01	2.24E+01	2.24E+01	2.24E+01
mo 97	3.52E+02	3.53E+02	3.53E+02	3.53E+02	3.53E+02	3.53E+02	3.53E+02
mo 98	3.89E+02	3.89E+02	3.89E+02	3.89E+02	3.89E+02	3.89E+02	3.89E+02
tc 98	3.26E-03	3.26E-03	3.26E-03	3.26E-03	3.26E-03	3.26E-03	3.26E-03
tc 99	3.59E+02	3.61E+02	3.61E+02	3.61E+02	3.61E+02	3.61E+02	3.61E+02
ru 99	1.46E-02	1.74E-02	2.02E-02	2.29E-02	2.57E-02	2.85E-02	3.12E-02

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ce 14x14 40 gwd/mtu pwr 2.3 wt%: 14 year cooled fission products

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decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 6.17E+13n/cm**2-sec

0 nuclide concentrations, grams

basis =single reactor assembly

	initial	851.7 d	1703.3 d	2555.0 d	3406.7 d	4258.3 d	5110.0 d
mo100	4.44E+02	4.44E+02	4.44E+02	4.44E+02	4.44E+02	4.44E+02	4.44E+02
ru100	5.99E+01	5.99E+01	5.99E+01	5.99E+01	5.99E+01	5.99E+01	5.99E+01
ru101	3.67E+02	3.67E+02	3.67E+02	3.67E+02	3.67E+02	3.67E+02	3.67E+02
ru102	3.86E+02	3.86E+02	3.86E+02	3.86E+02	3.86E+02	3.86E+02	3.86E+02
rh102	5.73E-04	3.28E-04	1.88E-04	1.08E-04	6.17E-05	3.53E-05	2.02E-05
rh103	1.97E+02	2.19E+02	2.19E+02	2.19E+02	2.19E+02	2.19E+02	2.19E+02
ru104	2.98E+02	2.98E+02	2.98E+02	2.98E+02	2.98E+02	2.98E+02	2.98E+02
pd104	1.43E+02	1.43E+02	1.43E+02	1.43E+02	1.43E+02	1.43E+02	1.43E+02
pd105	2.10E+02	2.11E+02	2.11E+02	2.11E+02	2.11E+02	2.11E+02	2.11E+02

ru106	9.42E+01	1.92E+01	3.93E+00	8.02E-01	1.64E-01	3.35E-02	6.84E-03
pd106	1.38E+02	2.13E+02	2.28E+02	2.31E+02	2.32E+02	2.32E+02	2.32E+02
pd107	1.40E+02	1.40E+02	1.40E+02	1.40E+02	1.40E+02	1.40E+02	1.40E+02
ag107	1.75E-05	5.23E-05	8.71E-05	1.22E-04	1.57E-04	1.91E-04	2.26E-04
pd108	9.35E+01	9.35E+01	9.35E+01	9.35E+01	9.35E+01	9.35E+01	9.35E+01
ag108m	1.30E-04	1.29E-04	1.27E-04	1.26E-04	1.24E-04	1.22E-04	1.21E-04
cd108	1.34E-04	1.34E-04	1.34E-04	1.34E-04	1.34E-04	1.34E-04	1.34E-04
ag109	5.29E+01	5.30E+01	5.30E+01	5.30E+01	5.30E+01	5.30E+01	5.30E+01
pd110	2.79E+01	2.79E+01	2.79E+01	2.79E+01	2.79E+01	2.79E+01	2.79E+01
ag110m	5.54E-01	5.21E-02	4.91E-03	4.62E-04	4.34E-05	4.09E-06	3.84E-07
cd110	2.98E+01	3.03E+01	3.04E+01	3.04E+01	3.04E+01	3.04E+01	3.04E+01
cd111	1.46E+01	1.48E+01	1.48E+01	1.48E+01	1.48E+01	1.48E+01	1.48E+01
cd112	7.37E+00	7.39E+00	7.39E+00	7.39E+00	7.39E+00	7.39E+00	7.39E+00
cd113	2.75E-02	2.91E-02	2.91E-02	2.91E-02	2.91E-02	2.91E-02	2.91E-02
cd113m	8.07E-02	7.20E-02	6.42E-02	5.72E-02	5.10E-02	4.55E-02	4.06E-02
in113	4.46E-03	1.32E-02	2.10E-02	2.79E-02	3.41E-02	3.96E-02	4.45E-02
cd114	7.01E+00	7.01E+00	7.01E+00	7.01E+00	7.01E+00	7.01E+00	7.01E+00
sn114	2.70E-04	3.16E-04	3.16E-04	3.16E-04	3.16E-04	3.16E-04	3.16E-04
in115	6.84E-01	6.99E-01	6.99E-01	6.99E-01	6.99E-01	6.99E-01	6.99E-01
sn115	9.26E-02	9.30E-02	9.30E-02	9.30E-02	9.30E-02	9.30E-02	9.30E-02
cd116	2.62E+00	2.62E+00	2.62E+00	2.62E+00	2.62E+00	2.62E+00	2.62E+00
sn116	1.36E+00	1.36E+00	1.36E+00	1.36E+00	1.36E+00	1.36E+00	1.36E+00
sn117	2.57E+00	2.58E+00	2.58E+00	2.58E+00	2.58E+00	2.58E+00	2.58E+00
sn118	2.01E+00	2.01E+00	2.01E+00	2.01E+00	2.01E+00	2.01E+00	2.01E+00
sn119	2.09E+00	2.10E+00	2.10E+00	2.10E+00	2.10E+00	2.10E+00	2.10E+00
sn120	2.05E+00	2.05E+00	2.05E+00	2.05E+00	2.05E+00	2.05E+00	2.05E+00
sn121m	2.43E-02	2.36E-02	2.29E-02	2.23E-02	2.16E-02	2.10E-02	2.04E-02
sb121	2.00E+00	2.01E+00	2.01E+00	2.01E+00	2.01E+00	2.01E+00	2.01E+00
sn122	2.66E+00	2.66E+00	2.66E+00	2.66E+00	2.66E+00	2.66E+00	2.66E+00
te122	1.56E-01	1.57E-01	1.57E-01	1.57E-01	1.57E-01	1.57E-01	1.57E-01
sb123	2.34E+00	2.37E+00	2.37E+00	2.37E+00	2.37E+00	2.37E+00	2.37E+00
te123	1.33E-03	1.84E-03	1.84E-03	1.84E-03	1.84E-03	1.84E-03	1.84E-03
sn124	4.44E+00	4.44E+00	4.44E+00	4.44E+00	4.44E+00	4.44E+00	4.44E+00
te124	1.20E-01	1.44E-01	1.44E-01	1.44E-01	1.44E-01	1.44E-01	1.44E-01
sb125	3.95E+00	2.20E+00	1.22E+00	6.72E-01	3.72E-01	2.06E-01	1.14E-01
te125	1.51E+00	3.31E+00	4.30E+00	4.85E+00	5.16E+00	5.33E+00	5.42E+00
te125m	4.99E-02	3.12E-02	1.73E-02	9.55E-03	5.28E-03	2.92E-03	1.62E-03
sn126	1.07E+01	1.07E+01	1.07E+01	1.07E+01	1.07E+01	1.07E+01	1.07E+01
te126	2.12E-01	2.14E-01	2.15E-01	2.15E-01	2.15E-01	2.15E-01	2.15E-01
i127	2.21E+01	2.30E+01	2.30E+01	2.30E+01	2.30E+01	2.30E+01	2.30E+01
te128	4.57E+01	4.57E+01	4.57E+01	4.57E+01	4.57E+01	4.57E+01	4.57E+01
xe128	1.60E+00	1.60E+00	1.60E+00	1.60E+00	1.60E+00	1.60E+00	1.60E+00
i129	8.84E+01	8.93E+01	8.93E+01	8.93E+01	8.93E+01	8.93E+01	8.93E+01

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ce 14x14 40 gwd/mtu pwr 2.3 wt%: 14 year cooled fission products

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decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 6.17E+13n/cm**2-sec

0 nuclide concentrations, grams

basis =single reactor assembly

	initial	851.7 d	1703.3 d	2555.0 d	3406.7 d	4258.3 d	5110.0 d
xe129	1.38E-02	1.41E-02	1.42E-02	1.42E-02	1.42E-02	1.42E-02	1.42E-02
te130	1.75E+02	1.75E+02	1.75E+02	1.75E+02	1.75E+02	1.75E+02	1.75E+02
xe130	5.65E+00	5.66E+00	5.66E+00	5.66E+00	5.66E+00	5.66E+00	5.66E+00
xe131	1.82E+02	1.85E+02	1.85E+02	1.85E+02	1.85E+02	1.85E+02	1.85E+02
xe132	5.51E+02	5.53E+02	5.53E+02	5.53E+02	5.53E+02	5.53E+02	5.53E+02
ba132	1.20E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04
cs133	5.15E+02	5.20E+02	5.20E+02	5.20E+02	5.20E+02	5.20E+02	5.20E+02
xe134	7.12E+02	7.12E+02	7.12E+02	7.12E+02	7.12E+02	7.12E+02	7.12E+02
cs134	6.52E+01	2.98E+01	1.36E+01	6.21E+00	2.84E+00	1.30E+00	5.91E-01
ba134	2.49E+01	6.04E+01	7.66E+01	8.39E+01	8.73E+01	8.89E+01	8.96E+01
cs135	1.24E+02	1.24E+02	1.24E+02	1.24E+02	1.24E+02	1.24E+02	1.24E+02
ba135	2.27E-01	2.28E-01	2.28E-01	2.28E-01	2.28E-01	2.28E-01	2.28E-01
xe136	1.15E+03	1.15E+03	1.15E+03	1.15E+03	1.15E+03	1.15E+03	1.15E+03
ba136	8.43E+00	8.71E+00	8.71E+00	8.71E+00	8.71E+00	8.71E+00	8.71E+00
cs137	5.89E+02	5.58E+02	5.28E+02	5.01E+02	4.74E+02	4.50E+02	4.26E+02
ba137	2.19E+01	5.28E+01	8.21E+01	1.10E+02	1.36E+02	1.61E+02	1.85E+02
ba137m	9.07E-05	8.52E-05	8.07E-05	7.65E-05	7.25E-05	6.87E-05	6.51E-05
ba138	5.99E+02	5.99E+02	5.99E+02	5.99E+02	5.99E+02	5.99E+02	5.99E+02
la138	4.19E-03	4.19E-03	4.19E-03	4.19E-03	4.19E-03	4.19E-03	4.19E-03
la139	5.57E+02	5.57E+02	5.57E+02	5.57E+02	5.57E+02	5.57E+02	5.57E+02
ce140	5.87E+02	5.97E+02	5.97E+02	5.97E+02	5.97E+02	5.97E+02	5.97E+02
pr141	4.92E+02	5.13E+02	5.13E+02	5.13E+02	5.13E+02	5.13E+02	5.13E+02
ce142	5.21E+02	5.21E+02	5.21E+02	5.21E+02	5.21E+02	5.21E+02	5.21E+02
nd142	1.39E+01	1.39E+01	1.39E+01	1.39E+01	1.39E+01	1.39E+01	1.39E+01
nd143	2.81E+02	2.90E+02	2.90E+02	2.90E+02	2.90E+02	2.90E+02	2.90E+02
ce144	1.44E+02	1.81E+01	2.28E+00	2.87E-01	3.62E-02	4.56E-03	5.74E-04
nd144	5.21E+02	6.46E+02	6.62E+02	6.64E+02	6.64E+02	6.64E+02	6.64E+02
nd145	2.95E+02	2.95E+02	2.95E+02	2.95E+02	2.95E+02	2.95E+02	2.95E+02
pm145	1.03E-05	9.94E-06	9.17E-06	8.39E-06	7.66E-06	6.99E-06	6.38E-06
nd146	3.32E+02	3.32E+02	3.32E+02	3.32E+02	3.32E+02	3.32E+02	3.32E+02
pm146	3.55E-03	2.65E-03	1.98E-03	1.48E-03	1.10E-03	8.23E-04	6.15E-04
sm146	2.88E-03	3.18E-03	3.41E-03	3.58E-03	3.71E-03	3.80E-03	3.87E-03
pm147	6.83E+01	3.86E+01	2.08E+01	1.12E+01	6.07E+00	3.28E+00	1.77E+00
sm147	3.07E+01	6.35E+01	8.12E+01	9.08E+01	9.60E+01	9.88E+01	1.00E+02
nd148	1.73E+02	1.73E+02	1.73E+02	1.73E+02	1.73E+02	1.73E+02	1.73E+02
sm148	6.14E+01	6.23E+01	6.23E+01	6.23E+01	6.23E+01	6.23E+01	6.23E+01
sm149	6.25E-01	1.28E+00	1.28E+00	1.28E+00	1.28E+00	1.28E+00	1.28E+00
nd150	8.91E+01	8.91E+01	8.91E+01	8.91E+01	8.91E+01	8.91E+01	8.91E+01
sm150	1.44E+02	1.44E+02	1.44E+02	1.44E+02	1.44E+02	1.44E+02	1.44E+02
sm151	5.15E+00	5.17E+00	5.08E+00	4.99E+00	4.90E+00	4.82E+00	4.73E+00
eu151	3.48E-03	9.72E-02	1.89E-01	2.80E-01	3.69E-01	4.56E-01	5.42E-01
sm152	6.40E+01	6.40E+01	6.40E+01	6.40E+01	6.40E+01	6.40E+01	6.40E+01
eu152	9.31E-03	8.25E-03	7.31E-03	6.47E-03	5.73E-03	5.08E-03	4.50E-03
gd152	1.94E-02	1.97E-02	2.00E-02	2.02E-02	2.04E-02	2.06E-02	2.08E-02
eu153	6.34E+01	6.40E+01	6.40E+01	6.40E+01	6.40E+01	6.40E+01	6.40E+01
sm154	2.08E+01	2.08E+01	2.08E+01	2.08E+01	2.08E+01	2.08E+01	2.08E+01
eu154	1.06E+01	8.78E+00	7.28E+00	6.03E+00	4.99E+00	4.14E+00	3.43E+00

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   gd154  8.89E-01 2.71E+00 4.21E+00 5.46E+00 6.49E+00 7.35E+00 8.06E+00
   eu155  3.05E+00 2.16E+00 1.53E+00 1.08E+00 7.68E-01 5.43E-01 3.85E-01
   gd155  1.48E-02 9.07E-01 1.54E+00 1.99E+00 2.30E+00 2.53E+00 2.69E+00
   gd156  5.56E+01 5.85E+01 5.85E+01 5.85E+01 5.85E+01 5.85E+01 5.85E+01
   gd157  4.29E-02 5.69E-02 5.69E-02 5.69E-02 5.69E-02 5.69E-02 5.69E-02
1
   ce 14x14  40 gwd/mtu pwr 2.3 wt%: 14 year cooled                    fission products
    page  34
 decay, following reactor irradiation identified by: power=  14.32mw, burnup=  15680.mwd, flux=
6.17E+13n/cm**2-sec
0                              nuclide concentrations, grams
                              basis =single reactor assembly
         initial  851.7 d  1703.3 d  2555.0 d  3406.7 d  4258.3 d  5110.0 d
   gd158  1.30E+01 1.30E+01 1.30E+01 1.30E+01 1.30E+01 1.30E+01 1.30E+01
   tb159  1.50E+00 1.50E+00 1.50E+00 1.50E+00 1.50E+00 1.50E+00 1.50E+00
   gd160  6.57E-01 6.57E-01 6.57E-01 6.57E-01 6.57E-01 6.57E-01 6.57E-01
   dy160  1.31E-01 1.86E-01 1.86E-01 1.86E-01 1.86E-01 1.86E-01 1.86E-01
   dy161  1.94E-01 2.00E-01 2.00E-01 2.00E-01 2.00E-01 2.00E-01 2.00E-01
   dy162  1.90E-01 1.90E-01 1.90E-01 1.90E-01 1.90E-01 1.90E-01 1.90E-01
   dy163  1.65E-01 1.65E-01 1.65E-01 1.65E-01 1.65E-01 1.65E-01 1.65E-01
   dy164  2.74E-02 2.74E-02 2.74E-02 2.74E-02 2.74E-02 2.74E-02 2.74E-02
   ho165  6.71E-02 6.72E-02 6.72E-02 6.72E-02 6.72E-02 6.72E-02 6.72E-02
   ho166m 2.61E-04 2.60E-04 2.60E-04 2.60E-04 2.59E-04 2.59E-04 2.59E-04
   er166  1.64E-02 1.65E-02 1.65E-02 1.65E-02 1.65E-02 1.65E-02 1.65E-02
   er167  3.43E-04 3.43E-04 3.43E-04 3.43E-04 3.43E-04 3.43E-04 3.43E-04
   er168  6.02E-04 6.02E-04 6.02E-04 6.02E-04 6.02E-04 6.02E-04 6.02E-04
   tm169  1.94E-06 1.98E-06 1.98E-06 1.98E-06 1.98E-06 1.98E-06 1.98E-06
   er170  2.18E-06 2.18E-06 2.18E-06 2.18E-06 2.18E-06 2.18E-06 2.18E-06
   yb171  9.57E-07 2.03E-06 2.49E-06 2.69E-06 2.78E-06 2.81E-06 2.83E-06
   yb172  1.88E-06 1.90E-06 1.90E-06 1.90E-06 1.90E-06 1.90E-06 1.90E-06
  total   1.61E+04 1.61E+04 1.61E+04 1.61E+04 1.61E+04 1.61E+04 1.61E+04
1
   ce 14x14  40 gwd/mtu pwr 2.3 wt%: 14 year cooled                    fission products
    page  35
 decay, following reactor irradiation identified by: power=  14.32mw, burnup=  15680.mwd, flux=
6.17E+13n/cm**2-sec
0                              element radioactivity, curies
                              basis =single reactor assembly
         initial  851.7 d  1703.3 d  2555.0 d  3406.7 d  4258.3 d  5110.0 d
    h   2.34E+02 2.05E+02 1.80E+02 1.58E+02 1.38E+02 1.21E+02 1.06E+02
   be   1.38E-06 1.38E-06 1.38E-06 1.38E-06 1.38E-06 1.38E-06 1.38E-06
    c   5.55E-05 5.55E-05 5.55E-05 5.54E-05 5.54E-05 5.54E-05 5.54E-05
   se   3.02E+05 3.07E-02 3.07E-02 3.07E-02 3.07E-02 3.07E-02 3.07E-02
   kr   1.17E+06 3.18E+03 2.74E+03 2.35E+03 2.03E+03 1.74E+03 1.50E+03
   rb   1.79E+06 8.59E-06 8.59E-06 8.59E-06 8.59E-06 8.59E-06 8.59E-06
   sr   2.93E+06 2.96E+04 2.79E+04 2.64E+04 2.49E+04 2.35E+04 2.22E+04
    y   4.01E+06 2.96E+04 2.79E+04 2.64E+04 2.49E+04 2.35E+04 2.22E+04
   zr   3.77E+06 5.73E+01 5.24E-01 5.18E-01 5.18E-01 5.18E-01 5.18E-01
   nb   5.73E+06 1.26E+02 1.37E-01 1.62E-01 1.96E-01 2.26E-01 2.54E-01
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tc	4.87E+06	6.17E+00	6.17E+00	6.17E+00	6.17E+00	6.17E+00	6.17E+00
ru	2.37E+06	6.38E+04	1.30E+04	2.66E+03	5.43E+02	1.11E+02	2.27E+01
rh	3.22E+06	6.38E+04	1.30E+04	2.66E+03	5.44E+02	1.11E+02	2.27E+01
pd	2.97E+05	7.20E-02	7.20E-02	7.20E-02	7.20E-02	7.20E-02	7.20E-02
ag	4.59E+05	2.51E+02	2.36E+01	2.23E+00	2.13E-01	2.32E-02	5.28E-03
cd	4.06E+04	1.62E+01	1.44E+01	1.28E+01	1.15E+01	1.02E+01	9.11E+00
sn	5.60E+05	1.08E+01	3.26E+00	2.53E+00	2.38E+00	2.31E+00	2.25E+00
sb	1.43E+06	2.30E+03	1.27E+03	7.05E+02	3.90E+02	2.16E+02	1.20E+02
te	3.12E+06	6.24E+02	3.11E+02	1.72E+02	9.52E+01	5.27E+01	2.91E+01
i	4.60E+06	1.58E-02	1.58E-02	1.58E-02	1.58E-02	1.58E-02	1.58E-02
cs	2.96E+06	8.71E+04	6.36E+04	5.16E+04	4.50E+04	4.08E+04	3.78E+04
ba	3.53E+06	4.58E+04	4.34E+04	4.11E+04	3.90E+04	3.69E+04	3.50E+04
ce	2.80E+06	5.76E+04	7.26E+03	9.14E+02	1.15E+02	1.45E+01	1.83E+00
pr	2.46E+06	5.84E+04	7.36E+03	9.27E+02	1.17E+02	1.47E+01	1.85E+00
pm	6.60E+05	3.58E+04	1.93E+04	1.04E+04	5.63E+03	3.04E+03	1.64E+03
sm	2.99E+05	1.36E+02	1.34E+02	1.31E+02	1.29E+02	1.27E+02	1.24E+02
eu	1.90E+05	3.44E+03	2.72E+03	2.17E+03	1.73E+03	1.39E+03	1.12E+03
gd	4.38E+03	5.29E-01	4.59E-02	3.99E-03	3.46E-04	3.00E-05	2.61E-06
ho	7.01E+01	4.67E-04	4.67E-04	4.66E-04	4.66E-04	4.65E-04	4.64E-04
tm	4.81E-03	8.84E-04	3.81E-04	1.64E-04	7.08E-05	3.05E-05	1.31E-05
totals	6.61E+07	4.82E+05	2.30E+05	1.69E+05	1.45E+05	1.32E+05	1.22E+05

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ce 14x14 40 gwd/mtu pwr 2.3 wt%: 14 year cooled fission products

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decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 6.17E+13n/cm**2-sec

0 element thermal power, watts

basis =single reactor assembly

	initial	851.7 d	1703.3 d	2555.0 d	3406.7 d	4258.3 d	5110.0 d
h	7.88E-03	6.91E-03	6.06E-03	5.32E-03	4.66E-03	4.09E-03	3.59E-03
c	1.63E-08	1.63E-08	1.63E-08	1.63E-08	1.63E-08	1.62E-08	1.62E-08
se	5.28E+03	9.64E-06	9.64E-06	9.64E-06	9.64E-06	9.64E-06	9.64E-06
kr	1.89E+04	4.77E+00	4.11E+00	3.53E+00	3.04E+00	2.61E+00	2.25E+00
sr	4.38E+04	3.43E+01	3.24E+01	3.06E+01	2.89E+01	2.73E+01	2.58E+01
y	6.86E+04	1.64E+02	1.55E+02	1.46E+02	1.38E+02	1.30E+02	1.23E+02
zr	3.88E+04	2.86E-01	8.66E-05	5.84E-05	5.84E-05	5.84E-05	5.84E-05
nb	8.42E+04	6.01E-01	8.12E-05	2.83E-05	3.41E-05	3.94E-05	4.42E-05
tc	6.10E+04	3.09E-03	3.09E-03	3.09E-03	3.09E-03	3.09E-03	3.09E-03
ru	1.31E+04	3.79E+00	7.75E-01	1.58E-01	3.23E-02	6.60E-03	1.35E-03
rh	1.66E+04	6.11E+02	1.25E+02	2.55E+01	5.21E+00	1.06E+00	2.18E-01
pd	9.11E+02	3.97E-06	3.97E-06	3.97E-06	3.97E-06	3.97E-06	3.97E-06
ag	1.81E+03	4.16E+00	3.91E-01	3.68E-02	3.50E-03	3.58E-04	6.22E-05
cd	4.67E+02	1.76E-02	1.57E-02	1.40E-02	1.25E-02	1.11E-02	9.91E-03
sn	7.42E+03	1.26E-02	1.88E-03	1.44E-03	1.37E-03	1.33E-03	1.31E-03
sb	2.61E+04	7.29E+00	4.03E+00	2.23E+00	1.24E+00	6.87E-01	3.82E-01
te	2.96E+04	5.31E-01	2.62E-01	1.45E-01	8.01E-02	4.43E-02	2.45E-02
i	6.83E+04	7.37E-06	7.37E-06	7.37E-06	7.37E-06	7.37E-06	7.37E-06
cs	5.37E+04	4.47E+02	2.31E+02	1.30E+02	8.33E+01	6.06E+01	4.90E+01
ba	3.03E+04	1.80E+02	1.71E+02	1.62E+02	1.53E+02	1.45E+02	1.38E+02

ce	1.31E+04	3.77E+01	4.75E+00	5.98E-01	7.53E-02	9.49E-03	1.20E-03
pr	2.01E+04	4.23E+02	5.33E+01	6.71E+00	8.45E-01	1.07E-01	1.34E-02
pm	3.34E+03	1.31E+01	7.09E+00	3.83E+00	2.07E+00	1.12E+00	6.04E-01
sm	7.15E+02	1.60E-02	1.57E-02	1.54E-02	1.52E-02	1.49E-02	1.46E-02
eu	1.79E+03	2.24E+01	1.85E+01	1.52E+01	1.26E+01	1.04E+01	8.57E+00
gd	1.27E+01	4.65E-04	4.04E-05	3.50E-06	3.04E-07	2.64E-08	2.29E-09
ho	3.02E-01	4.92E-06	4.91E-06	4.90E-06	4.90E-06	4.89E-06	4.88E-06
totals	8.01E+05	1.95E+03	8.06E+02	5.27E+02	4.28E+02	3.79E+02	3.47E+02

1

ce 14x14 40 gwd/mtu pwr 2.3 wt%: 14 year cooled fission products

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decay, following reactor irradiation identified by: power= 14.32mw, burnup= 15680.mwd, flux= 6.17E+13n/cm**2-sec

0 nuclide gamma power, watts

basis =single reactor assembly

	initial	851.7 d	1703.3 d	2555.0 d	3406.7 d	4258.3 d	5110.0 d
kr 85	4.89E-02	4.21E-02	3.62E-02	3.11E-02	2.68E-02	2.30E-02	1.98E-02
y 90	3.37E-04	2.98E-04	2.81E-04	2.66E-04	2.51E-04	2.37E-04	2.24E-04
nb 93m	4.09E-07	9.21E-07	1.38E-06	1.80E-06	2.18E-06	2.52E-06	2.83E-06
nb 94	4.48E-07	4.48E-07	4.48E-07	4.48E-07	4.48E-07	4.48E-07	4.48E-07
tc 98	2.34E-08	2.34E-08	2.34E-08	2.34E-08	2.34E-08	2.34E-08	2.34E-08
tc 99	2.26E-08	2.27E-08	2.27E-08	2.27E-08	2.27E-08	2.27E-08	2.27E-08
rh102	8.87E-03	5.08E-03	2.91E-03	1.67E-03	9.54E-04	5.47E-04	3.13E-04
rh106	4.40E+02	7.79E+01	1.59E+01	3.25E+00	6.64E-01	1.36E-01	2.77E-02
ag108	5.96E-05	3.19E-08	3.15E-08	3.11E-08	3.07E-08	3.03E-08	2.99E-08
ag108m	3.27E-05	3.23E-05	3.18E-05	3.14E-05	3.10E-05	3.07E-05	3.03E-05
ag110	2.16E+01	6.13E-04	5.77E-05	5.43E-06	5.11E-07	4.81E-08	4.52E-09
ag110m	4.28E+01	4.02E+00	3.79E-01	3.56E-02	3.35E-03	3.15E-04	2.97E-05
cd113m	7.59E-06	6.77E-06	6.04E-06	5.39E-06	4.80E-06	4.28E-06	3.82E-06
sn119m	2.81E-03	3.74E-04	5.00E-05	6.66E-06	8.89E-07	1.19E-07	1.58E-08
sn121m	3.87E-05	3.76E-05	3.65E-05	3.55E-05	3.44E-05	3.34E-05	3.25E-05
sb125	1.07E+01	5.92E+00	3.28E+00	1.81E+00	1.00E+00	5.55E-01	3.07E-01
te125m	1.90E-01	1.19E-01	6.57E-02	3.63E-02	2.01E-02	1.11E-02	6.15E-03
sn126	2.36E-04	2.36E-04	2.36E-04	2.36E-04	2.36E-04	2.36E-04	2.36E-04
sb126	3.34E+00	6.96E-04	6.96E-04	6.96E-04	6.96E-04	6.96E-04	6.96E-04
sb126m	2.23E+00	2.81E-03	2.81E-03	2.81E-03	2.81E-03	2.81E-03	2.81E-03
i129	2.28E-06	2.30E-06	2.30E-06	2.30E-06	2.30E-06	2.30E-06	2.30E-06
ba133	3.88E-08	3.33E-08	2.86E-08	2.45E-08	2.10E-08	1.80E-08	1.54E-08
cs134	7.78E+02	3.55E+02	1.62E+02	7.41E+01	3.38E+01	1.55E+01	7.06E+00
ba137m	1.73E+02	1.63E+02	1.54E+02	1.46E+02	1.38E+02	1.31E+02	1.24E+02
ce144	5.15E+01	6.49E+00	8.17E-01	1.03E-01	1.30E-02	1.63E-03	2.06E-04
pr144	7.92E+01	9.87E+00	1.24E+00	1.57E-01	1.97E-02	2.49E-03	3.13E-04
pr144m	4.76E-01	5.97E-02	7.53E-03	9.48E-04	1.19E-04	1.50E-05	1.90E-06
pm145	2.74E-07	2.65E-07	2.45E-07	2.24E-07	2.04E-07	1.86E-07	1.70E-07
pm146	7.00E-03	5.23E-03	3.90E-03	2.91E-03	2.17E-03	1.62E-03	1.21E-03
pm147	1.64E-03	9.28E-04	5.01E-04	2.71E-04	1.46E-04	7.90E-05	4.26E-05
eu150	5.40E-08	5.16E-08	4.94E-08	4.72E-08	4.51E-08	4.31E-08	4.12E-08
sm151	1.14E-05	1.15E-05	1.13E-05	1.11E-05	1.09E-05	1.07E-05	1.05E-05
eu152	1.13E-02	1.00E-02	8.89E-03	7.87E-03	6.97E-03	6.18E-03	5.47E-03

ce 14x14 45 gwd/mtu pwr 2.1 wt%: 7 year cooled light elements
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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 7.59E+13n/cm**2-sec
0 element thermal power, watts
basis =single reactor assembly

	initial	425.8 d	851.7 d	1277.5 d	1703.3 d	2129.2 d	2555.0 d
mn	8.55E+02	1.86E-01	7.24E-02	2.81E-02	1.09E-02	4.24E-03	1.65E-03
fe	4.07E-01	1.77E-02	1.28E-02	9.49E-03	7.06E-03	5.25E-03	3.91E-03
co	5.29E+00	3.70E+00	3.17E+00	2.72E+00	2.33E+00	2.00E+00	1.71E+00
ni	1.93E-01	1.52E-03	1.51E-03	1.50E-03	1.48E-03	1.47E-03	1.46E-03
cd	3.89E-04	4.42E-08	1.36E-08	1.28E-08	1.21E-08	1.14E-08	1.08E-08
in	2.87E+00	1.51E-01	1.15E-02	8.84E-04	6.81E-05	5.24E-06	4.03E-07
sn	2.38E+01	1.09E+00	3.78E-01	1.36E-01	4.98E-02	1.83E-02	6.88E-03
sb	4.20E+00	1.26E+00	9.38E-01	6.98E-01	5.19E-01	3.86E-01	2.87E-01
te	1.04E-01	8.24E-02	6.11E-02	4.54E-02	3.38E-02	2.51E-02	1.87E-02
totals	8.93E+02	6.49E+00	4.64E+00	3.64E+00	2.95E+00	2.44E+00	2.03E+00

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ce 14x14 45 gwd/mtu pwr 2.1 wt%: 7 year cooled light elements
page 23
decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 7.59E+13n/cm**2-sec
0 element gamma power, watts
basis =single reactor assembly

	initial	425.8 d	851.7 d	1277.5 d	1703.3 d	2129.2 d	2555.0 d
mn	5.73E+02	1.86E-01	7.21E-02	2.80E-02	1.09E-02	4.22E-03	1.64E-03
fe	3.56E-01	5.45E-03	3.71E-03	2.76E-03	2.05E-03	1.53E-03	1.14E-03
co	4.90E+00	3.57E+00	3.05E+00	2.62E+00	2.24E+00	1.92E+00	1.65E+00
ni	8.88E-02	1.74E-06	1.74E-06	1.74E-06	1.74E-06	1.74E-06	1.74E-06
in	1.35E+00	9.94E-02	7.63E-03	5.87E-04	4.52E-05	3.48E-06	2.68E-07
sn	8.42E+00	1.42E-01	4.92E-02	1.78E-02	6.48E-03	2.37E-03	8.74E-04
sb	2.71E+00	1.03E+00	7.64E-01	5.68E-01	4.22E-01	3.14E-01	2.34E-01
te	2.80E-02	2.08E-02	1.53E-02	1.14E-02	8.46E-03	6.29E-03	4.68E-03
totals	5.92E+02	5.05E+00	3.96E+00	3.24E+00	2.69E+00	2.25E+00	1.89E+00

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ce 14x14 45 gwd/mtu pwr 2.1 wt%: 7 year cooled actinides
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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 7.59E+13n/cm**2-sec
0 nuclide concentrations, gram atoms
basis = single reactor assembly

	initial	425.8 d	851.7 d	1277.5 d	1703.3 d	2129.2 d	2555.0 d
he 4	7.32E-02	1.21E-01	1.43E-01	1.61E-01	1.77E-01	1.94E-01	2.10E-01
th232	3.25E-07	4.92E-07	6.60E-07	8.27E-07	9.94E-07	1.16E-06	1.33E-06
u232	3.32E-07	7.63E-07	1.08E-06	1.32E-06	1.49E-06	1.62E-06	1.71E-06
u233	3.26E-07	6.41E-07	9.57E-07	1.27E-06	1.59E-06	1.91E-06	2.22E-06
u234	3.05E-03	6.73E-03	1.05E-02	1.43E-02	1.80E-02	2.17E-02	2.53E-02
u235	1.97E+00	1.97E+00	1.97E+00	1.97E+00	1.97E+00	1.97E+00	1.98E+00
u236	4.85E+00	4.85E+00	4.85E+00	4.85E+00	4.85E+00	4.85E+00	4.85E+00

u238	1.59E+03	1.59E+03	1.59E+03	1.59E+03	1.59E+03	1.59E+03	1.59E+03
np236	1.82E-06	1.82E-06	1.82E-06	1.82E-06	1.82E-06	1.82E-06	1.82E-06
np237	7.48E-01	7.66E-01	7.66E-01	7.67E-01	7.68E-01	7.69E-01	7.70E-01
pu238	3.78E-01	4.08E-01	4.09E-01	4.06E-01	4.03E-01	3.99E-01	3.95E-01
pu239	6.92E+00	7.13E+00	7.13E+00	7.13E+00	7.13E+00	7.13E+00	7.13E+00
pu240	4.63E+00	4.64E+00	4.65E+00	4.67E+00	4.68E+00	4.69E+00	4.70E+00
pu241	2.24E+00	2.12E+00	2.00E+00	1.89E+00	1.79E+00	1.69E+00	1.60E+00
pu242	2.18E+00	2.18E+00	2.18E+00	2.18E+00	2.18E+00	2.18E+00	2.18E+00
am241	5.15E-02	1.74E-01	2.90E-01	3.99E-01	5.02E-01	5.99E-01	6.90E-01
am242m	9.30E-04	9.24E-04	9.19E-04	9.14E-04	9.08E-04	9.03E-04	8.98E-04
am243	5.97E-01	5.98E-01	5.98E-01	5.98E-01	5.98E-01	5.98E-01	5.98E-01
cm242	3.55E-02	5.83E-03	9.54E-04	1.58E-04	2.78E-05	6.51E-06	3.02E-06
cm243	1.21E-03	1.17E-03	1.14E-03	1.11E-03	1.08E-03	1.05E-03	1.02E-03
cm244	2.91E-01	2.79E-01	2.67E-01	2.55E-01	2.44E-01	2.34E-01	2.23E-01
cm245	9.03E-03	9.03E-03	9.03E-03	9.03E-03	9.03E-03	9.02E-03	9.02E-03
cm246	3.12E-03	3.11E-03	3.11E-03	3.11E-03	3.11E-03	3.11E-03	3.11E-03
cm247	6.91E-05	6.91E-05	6.91E-05	6.91E-05	6.91E-05	6.91E-05	6.91E-05
cm248	9.88E-06	9.88E-06	9.89E-06	9.89E-06	9.90E-06	9.90E-06	9.90E-06
total	1.62E+03	1.62E+03	1.62E+03	1.62E+03	1.62E+03	1.62E+03	1.62E+03

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ce 14x14 45 gwd/mtu pwr 2.1 wt%: 7 year cooled actinides

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 7.59E+13n/cm**2-sec

0 element concentrations, gram atoms

basis = single reactor assembly

	initial	425.8 d	851.7 d	1277.5 d	1703.3 d	2129.2 d	2555.0 d
he	7.32E-02	1.21E-01	1.43E-01	1.61E-01	1.77E-01	1.94E-01	2.10E-01
th	3.59E-07	5.47E-07	7.49E-07	9.64E-07	1.19E-06	1.43E-06	1.68E-06
u	1.60E+03	1.60E+03	1.60E+03	1.60E+03	1.60E+03	1.60E+03	1.60E+03
np	9.64E-01	7.66E-01	7.66E-01	7.67E-01	7.68E-01	7.69E-01	7.70E-01
pu	1.63E+01	1.65E+01	1.64E+01	1.63E+01	1.62E+01	1.61E+01	1.60E+01
am	6.51E-01	7.73E-01	8.89E-01	9.98E-01	1.10E+00	1.20E+00	1.29E+00
cm	3.40E-01	2.98E-01	2.81E-01	2.69E-01	2.58E-01	2.47E-01	2.37E-01
totals	1.62E+03	1.62E+03	1.62E+03	1.62E+03	1.62E+03	1.62E+03	1.62E+03

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ce 14x14 45 gwd/mtu pwr 2.1 wt%: 7 year cooled actinides

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 7.59E+13n/cm**2-sec

0 nuclide concentrations, grams

basis =single reactor assembly

	initial	425.8 d	851.7 d	1277.5 d	1703.3 d	2129.2 d	2555.0 d
he 4	2.93E-01	4.82E-01	5.71E-01	6.42E-01	7.09E-01	7.75E-01	8.39E-01
pb208	1.09E-07	4.73E-07	1.35E-06	2.82E-06	4.88E-06	7.48E-06	1.05E-05
th228	4.66E-07	1.54E-06	3.04E-06	4.61E-06	6.07E-06	7.34E-06	8.40E-06
th230	1.87E-06	5.55E-06	1.21E-05	2.14E-05	3.36E-05	4.86E-05	6.64E-05
th232	7.54E-05	1.14E-04	1.53E-04	1.92E-04	2.31E-04	2.70E-04	3.08E-04
th234	5.52E-06	5.51E-06	5.51E-06	5.51E-06	5.51E-06	5.51E-06	5.51E-06

pa231	2.14E-06	2.67E-06	3.20E-06	3.72E-06	4.25E-06	4.77E-06	5.30E-06
pa233	6.04E-06	6.17E-06	6.17E-06	6.17E-06	6.18E-06	6.19E-06	6.20E-06
u232	7.71E-05	1.77E-04	2.51E-04	3.06E-04	3.46E-04	3.75E-04	3.96E-04
u233	7.60E-05	1.49E-04	2.23E-04	2.97E-04	3.70E-04	4.44E-04	5.18E-04
u234	7.13E-01	1.57E+00	2.46E+00	3.34E+00	4.21E+00	5.07E+00	5.93E+00
u235	4.64E+02	4.64E+02	4.64E+02	4.64E+02	4.64E+02	4.64E+02	4.64E+02
u236	1.14E+03	1.14E+03	1.14E+03	1.14E+03	1.14E+03	1.14E+03	1.14E+03
u237	4.10E+00	1.55E-05	1.46E-05	1.38E-05	1.31E-05	1.24E-05	1.17E-05
u238	3.80E+05	3.80E+05	3.80E+05	3.80E+05	3.80E+05	3.80E+05	3.80E+05
np236	4.30E-04	4.30E-04	4.30E-04	4.30E-04	4.30E-04	4.30E-04	4.30E-04
np237	1.77E+02	1.82E+02	1.82E+02	1.82E+02	1.82E+02	1.82E+02	1.83E+02
np239	5.07E+01	1.25E-04	1.25E-04	1.25E-04	1.25E-04	1.25E-04	1.25E-04
pu236	4.22E-04	3.21E-04	2.43E-04	1.84E-04	1.39E-04	1.05E-04	7.97E-05
pu238	9.00E+01	9.71E+01	9.74E+01	9.67E+01	9.58E+01	9.50E+01	9.41E+01
pu239	1.65E+03	1.70E+03	1.70E+03	1.70E+03	1.70E+03	1.70E+03	1.70E+03
pu240	1.11E+03	1.11E+03	1.12E+03	1.12E+03	1.12E+03	1.12E+03	1.13E+03
pu241	5.41E+02	5.11E+02	4.83E+02	4.57E+02	4.32E+02	4.08E+02	3.86E+02
pu242	5.28E+02	5.28E+02	5.28E+02	5.28E+02	5.28E+02	5.28E+02	5.28E+02
am241	1.24E+01	4.20E+01	6.98E+01	9.61E+01	1.21E+02	1.44E+02	1.66E+02
am242m	2.25E-01	2.24E-01	2.22E-01	2.21E-01	2.20E-01	2.19E-01	2.17E-01
am242	5.40E-02	2.89E-06	2.87E-06	2.85E-06	2.84E-06	2.82E-06	2.80E-06
am243	1.45E+02	1.45E+02	1.45E+02	1.45E+02	1.45E+02	1.45E+02	1.45E+02
cm242	8.58E+00	1.41E+00	2.31E-01	3.82E-02	6.73E-03	1.58E-03	7.32E-04
cm243	2.93E-01	2.85E-01	2.77E-01	2.69E-01	2.62E-01	2.54E-01	2.47E-01
cm244	7.11E+01	6.81E+01	6.51E+01	6.23E+01	5.96E+01	5.70E+01	5.45E+01
cm245	2.21E+00	2.21E+00	2.21E+00	2.21E+00	2.21E+00	2.21E+00	2.21E+00
cm246	7.66E-01	7.66E-01	7.66E-01	7.66E-01	7.66E-01	7.66E-01	7.66E-01
cm247	1.71E-02	1.71E-02	1.71E-02	1.71E-02	1.71E-02	1.71E-02	1.71E-02
cm248	2.45E-03	2.45E-03	2.45E-03	2.45E-03	2.45E-03	2.45E-03	2.46E-03
cf249	3.90E-06	2.81E-05	3.77E-05	4.15E-05	4.29E-05	4.34E-05	4.35E-05
cf250	9.39E-06	8.89E-06	8.36E-06	7.86E-06	7.39E-06	6.94E-06	6.53E-06
cf251	5.38E-06	5.37E-06	5.37E-06	5.36E-06	5.36E-06	5.35E-06	5.35E-06
cf252	7.18E-06	5.29E-06	3.90E-06	2.87E-06	2.12E-06	1.56E-06	1.15E-06
total	3.86E+05	3.86E+05	3.86E+05	3.86E+05	3.86E+05	3.86E+05	3.86E+05

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ce 14x14 45 gwd/mtu pwr 2.1 wt%: 7 year cooled actinides

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 7.59E+13n/cm**2-sec

0 element concentrations, grams

basis =single reactor assembly

	initial	425.8 d	851.7 d	1277.5 d	1703.3 d	2129.2 d	2555.0 d
he	2.93E-01	4.82E-01	5.71E-01	6.42E-01	7.09E-01	7.75E-01	8.39E-01
pb	1.10E-07	4.73E-07	1.35E-06	2.82E-06	4.89E-06	7.48E-06	1.05E-05
th	8.33E-05	1.27E-04	1.74E-04	2.23E-04	2.76E-04	3.31E-04	3.89E-04
pa	8.19E-06	8.84E-06	9.37E-06	9.90E-06	1.04E-05	1.10E-05	1.15E-05
u	3.81E+05	3.81E+05	3.81E+05	3.81E+05	3.81E+05	3.81E+05	3.81E+05
np	2.29E+02	1.82E+02	1.82E+02	1.82E+02	1.82E+02	1.82E+02	1.83E+02
pu	3.92E+03	3.95E+03	3.93E+03	3.90E+03	3.88E+03	3.86E+03	3.84E+03

am	1.58E+02	1.88E+02	2.15E+02	2.42E+02	2.66E+02	2.90E+02	3.12E+02
cm	8.29E+01	7.28E+01	6.87E+01	6.56E+01	6.28E+01	6.02E+01	5.77E+01
cf	2.59E-05	4.77E-05	5.53E-05	5.76E-05	5.78E-05	5.73E-05	5.66E-05
totals	3.86E+05	3.86E+05	3.86E+05	3.86E+05	3.86E+05	3.86E+05	3.86E+05

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ce 14x14 45 gwd/mtu pwr 2.1 wt%: 7 year cooled actinides

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 7.59E+13n/cm**2-sec

0 element radioactivity, curies

basis =single reactor assembly

	initial	425.8 d	851.7 d	1277.5 d	1703.3 d	2129.2 d	2555.0 d
tl	1.38E-04	4.54E-04	8.96E-04	1.36E-03	1.79E-03	2.17E-03	2.48E-03
pb	3.84E-04	1.26E-03	2.49E-03	3.79E-03	4.99E-03	6.04E-03	6.91E-03
bi	3.84E-04	1.26E-03	2.49E-03	3.79E-03	4.99E-03	6.04E-03	6.91E-03
po	6.30E-04	2.07E-03	4.09E-03	6.21E-03	8.18E-03	9.90E-03	1.13E-02
rn	3.84E-04	1.26E-03	2.49E-03	3.79E-03	4.99E-03	6.04E-03	6.91E-03
ra	3.84E-04	1.26E-03	2.49E-03	3.79E-03	4.99E-03	6.04E-03	6.91E-03
th	1.38E-01	1.30E-01	1.31E-01	1.32E-01	1.34E-01	1.35E-01	1.36E-01
pa	2.63E-01	2.56E-01	2.56E-01	2.56E-01	2.56E-01	2.56E-01	2.57E-01
u	1.21E+07	1.48E+00	1.42E+00	1.36E+00	1.30E+00	1.25E+00	1.20E+00
np	1.20E+07	2.92E+01	2.92E+01	2.92E+01	2.92E+01	2.91E+01	2.91E+01
pu	5.27E+05	5.49E+04	5.20E+04	4.92E+04	4.66E+04	4.42E+04	4.19E+04
am	2.64E+05	1.78E+02	2.73E+02	3.63E+02	4.49E+02	5.29E+02	6.04E+02
cm	3.42E+04	1.02E+04	6.06E+03	5.19E+03	4.86E+03	4.63E+03	4.43E+03
bk	3.14E-01	2.63E-02	1.04E-02	4.15E-03	1.65E-03	6.56E-04	2.61E-04
cf	5.51E-03	3.94E-03	3.17E-03	2.58E-03	2.13E-03	1.78E-03	1.52E-03
totals	2.50E+07	6.53E+04	5.83E+04	5.48E+04	5.20E+04	4.94E+04	4.69E+04

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ce 14x14 45 gwd/mtu pwr 2.1 wt%: 7 year cooled actinides

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 7.59E+13n/cm**2-sec

0 element thermal power, watts

basis =single reactor assembly

	initial	425.8 d	851.7 d	1277.5 d	1703.3 d	2129.2 d	2555.0 d
tl	3.23E-06	1.06E-05	2.10E-05	3.18E-05	4.19E-05	5.07E-05	5.81E-05
pb	7.27E-07	2.39E-06	4.72E-06	7.16E-06	9.43E-06	1.14E-05	1.31E-05
bi	6.43E-06	2.12E-05	4.18E-05	6.34E-05	8.35E-05	1.01E-04	1.16E-04
po	2.88E-05	9.47E-05	1.87E-04	2.84E-04	3.74E-04	4.52E-04	5.18E-04
rn	1.46E-05	4.80E-05	9.47E-05	1.44E-04	1.89E-04	2.29E-04	2.62E-04
ra	1.32E-05	4.34E-05	8.56E-05	1.30E-04	1.71E-04	2.07E-04	2.37E-04
th	8.88E-05	9.52E-05	1.35E-04	1.78E-04	2.17E-04	2.51E-04	2.80E-04
pa	1.02E-03	9.53E-04	9.54E-04	9.54E-04	9.54E-04	9.55E-04	9.55E-04
u	3.27E+04	8.12E-03	8.20E-03	8.27E-03	8.33E-03	8.39E-03	8.45E-03
np	3.13E+04	7.71E-02	7.71E-02	7.71E-02	7.71E-02	7.71E-02	7.71E-02
pu	6.04E+02	6.81E+01	6.81E+01	6.77E+01	6.71E+01	6.66E+01	6.60E+01
am	1.53E+03	5.74E+00	8.93E+00	1.19E+01	1.48E+01	1.75E+01	2.00E+01
cm	1.24E+03	3.64E+02	2.13E+02	1.82E+02	1.70E+02	1.62E+02	1.55E+02

bk	1.76E-03	5.14E-06	2.04E-06	8.13E-07	3.23E-07	1.28E-07	5.11E-08
cf	3.19E-04	2.46E-04	1.92E-04	1.50E-04	1.19E-04	9.58E-05	7.82E-05
totals	6.73E+04	4.38E+02	2.90E+02	2.61E+02	2.52E+02	2.46E+02	2.41E+02

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ce 14x14 45 gwd/mtu pwr 2.1 wt%: 7 year cooled actinides

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 7.59E+13n/cm**2-sec

0 element gamma power, watts

basis =single reactor assembly

	initial	425.8 d	851.7 d	1277.5 d	1703.3 d	2129.2 d	2555.0 d
tl	2.75E-06	9.05E-06	1.79E-05	2.71E-05	3.57E-05	4.32E-05	4.95E-05
pb	3.30E-07	1.09E-06	2.14E-06	3.25E-06	4.29E-06	5.19E-06	5.94E-06
bi	2.40E-07	7.88E-07	1.56E-06	2.36E-06	3.11E-06	3.76E-06	4.31E-06
rn	1.39E-09	4.57E-09	9.03E-09	1.37E-08	1.80E-08	2.18E-08	2.50E-08
ra	2.30E-08	7.54E-08	1.49E-07	2.26E-07	2.98E-07	3.60E-07	4.12E-07
th	9.46E-06	7.55E-06	7.58E-06	7.60E-06	7.63E-06	7.65E-06	7.67E-06
pa	2.29E-04	1.80E-04	1.80E-04	1.80E-04	1.80E-04	1.81E-04	1.81E-04
u	3.86E+03	1.07E-03	1.01E-03	9.58E-04	9.06E-04	8.57E-04	8.10E-04
np	1.40E+04	3.17E-02	3.17E-02	3.16E-02	3.16E-02	3.16E-02	3.16E-02
pu	6.95E+01	2.23E-02	2.23E-02	2.22E-02	2.20E-02	2.18E-02	2.16E-02
am	1.06E+03	3.49E-02	5.11E-02	6.64E-02	8.08E-02	9.44E-02	1.07E-01
cm	4.31E-01	1.31E-01	7.92E-02	6.83E-02	6.43E-02	6.15E-02	5.89E-02
cf	9.04E-06	6.85E-06	5.20E-06	3.95E-06	3.02E-06	2.33E-06	1.82E-06
totals	1.90E+04	2.21E-01	1.85E-01	1.90E-01	2.00E-01	2.10E-01	2.20E-01

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ce 14x14 45 gwd/mtu pwr 2.1 wt%: 7 year cooled fission products

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 7.59E+13n/cm**2-sec

0 nuclide concentrations, grams

basis =single reactor assembly

	initial	425.8 d	851.7 d	1277.5 d	1703.3 d	2129.2 d	2555.0 d
h 3	2.75E-02	2.57E-02	2.41E-02	2.26E-02	2.12E-02	1.98E-02	1.86E-02
li 6	4.88E-05	4.88E-05	4.88E-05	4.88E-05	4.88E-05	4.88E-05	4.88E-05
li 7	5.37E-06	5.37E-06	5.37E-06	5.37E-06	5.37E-06	5.37E-06	5.37E-06
be 9	1.03E-05	1.03E-05	1.03E-05	1.03E-05	1.03E-05	1.03E-05	1.03E-05
be 10	6.89E-05	6.89E-05	6.89E-05	6.89E-05	6.89E-05	6.89E-05	6.89E-05
c 14	1.39E-05	1.39E-05	1.39E-05	1.39E-05	1.39E-05	1.39E-05	1.39E-05
zn 70	5.87E-06	5.87E-06	5.87E-06	5.87E-06	5.87E-06	5.87E-06	5.87E-06
ga 71	5.48E-05	5.48E-05	5.48E-05	5.48E-05	5.48E-05	5.48E-05	5.48E-05
ge 72	3.13E-03	3.14E-03	3.14E-03	3.14E-03	3.14E-03	3.14E-03	3.14E-03
ge 73	8.12E-03	8.12E-03	8.12E-03	8.12E-03	8.12E-03	8.12E-03	8.12E-03
ge 74	7.20E-03	7.20E-03	7.20E-03	7.20E-03	7.20E-03	7.20E-03	7.20E-03
as 75	5.67E-02	5.67E-02	5.67E-02	5.67E-02	5.67E-02	5.67E-02	5.67E-02
ge 76	1.63E-01	1.63E-01	1.63E-01	1.63E-01	1.63E-01	1.63E-01	1.63E-01
se 76	2.41E-03	2.42E-03	2.42E-03	2.42E-03	2.42E-03	2.42E-03	2.42E-03
se 77	3.61E-01	3.61E-01	3.61E-01	3.61E-01	3.61E-01	3.61E-01	3.61E-01
se 78	1.39E+00	1.39E+00	1.39E+00	1.39E+00	1.39E+00	1.39E+00	1.39E+00

se 79	2.47E+00	2.47E+00	2.47E+00	2.47E+00	2.47E+00	2.47E+00	2.47E+00
br 79	9.11E-06	1.52E-05	2.12E-05	2.73E-05	3.33E-05	3.94E-05	4.54E-05
se 80	6.59E+00	6.59E+00	6.59E+00	6.59E+00	6.59E+00	6.59E+00	6.59E+00
kr 80	3.99E-05	3.99E-05	3.99E-05	3.99E-05	3.99E-05	3.99E-05	3.99E-05
br 81	9.75E+00	9.75E+00	9.75E+00	9.75E+00	9.75E+00	9.75E+00	9.75E+00
kr 81	3.94E-06	3.94E-06	3.94E-06	3.94E-06	3.94E-06	3.94E-06	3.94E-06
se 82	1.53E+01	1.53E+01	1.53E+01	1.53E+01	1.53E+01	1.53E+01	1.53E+01
kr 82	4.27E-01	4.28E-01	4.28E-01	4.28E-01	4.28E-01	4.28E-01	4.28E-01
kr 83	1.46E+01	1.46E+01	1.46E+01	1.46E+01	1.46E+01	1.46E+01	1.46E+01
kr 84	5.67E+01	5.67E+01	5.67E+01	5.67E+01	5.67E+01	5.67E+01	5.67E+01
kr 85	9.96E+00	9.24E+00	8.57E+00	7.95E+00	7.37E+00	6.84E+00	6.34E+00
rb 85	4.13E+01	4.21E+01	4.27E+01	4.34E+01	4.39E+01	4.45E+01	4.50E+01
kr 86	8.12E+01	8.12E+01	8.12E+01	8.12E+01	8.12E+01	8.12E+01	8.12E+01
sr 86	2.33E-01	2.45E-01	2.45E-01	2.45E-01	2.45E-01	2.45E-01	2.45E-01
rb 87	1.05E+02	1.05E+02	1.05E+02	1.05E+02	1.05E+02	1.05E+02	1.05E+02
sr 87	1.79E-03	1.79E-03	1.79E-03	1.79E-03	1.79E-03	1.79E-03	1.79E-03
sr 88	1.50E+02	1.50E+02	1.50E+02	1.50E+02	1.50E+02	1.50E+02	1.50E+02
y 89	1.89E+02	1.98E+02	1.98E+02	1.98E+02	1.98E+02	1.98E+02	1.98E+02
sr 90	2.32E+02	2.25E+02	2.19E+02	2.13E+02	2.07E+02	2.01E+02	1.95E+02
y 90	6.52E-02	5.85E-02	5.69E-02	5.52E-02	5.37E-02	5.22E-02	5.07E-02
zr 90	1.13E+01	1.79E+01	2.42E+01	3.04E+01	3.64E+01	4.23E+01	4.80E+01
zr 91	2.50E+02	2.65E+02	2.65E+02	2.65E+02	2.65E+02	2.65E+02	2.65E+02
zr 92	2.93E+02	2.93E+02	2.93E+02	2.93E+02	2.93E+02	2.93E+02	2.93E+02
zr 93	2.22E+02	2.22E+02	2.22E+02	2.22E+02	2.22E+02	2.22E+02	2.22E+02
nb 93	1.50E-05	2.60E-05	4.23E-05	6.35E-05	8.94E-05	1.20E-04	1.54E-04
nb 93m	1.68E-04	2.74E-04	3.75E-04	4.71E-04	5.62E-04	6.49E-04	7.32E-04
zr 94	3.73E+02	3.73E+02	3.73E+02	3.73E+02	3.73E+02	3.73E+02	3.73E+02
nb 94	2.99E-04	2.99E-04	2.99E-04	2.99E-04	2.99E-04	2.99E-04	2.99E-04
mo 95	3.19E+02	3.64E+02	3.65E+02	3.65E+02	3.65E+02	3.65E+02	3.65E+02
zr 96	4.04E+02	4.04E+02	4.04E+02	4.04E+02	4.04E+02	4.04E+02	4.04E+02
mo 96	2.91E+01	2.91E+01	2.91E+01	2.91E+01	2.91E+01	2.91E+01	2.91E+01
mo 97	3.91E+02	3.91E+02	3.91E+02	3.91E+02	3.91E+02	3.91E+02	3.91E+02
mo 98	4.35E+02	4.35E+02	4.35E+02	4.35E+02	4.35E+02	4.35E+02	4.35E+02
tc 98	4.21E-03	4.21E-03	4.21E-03	4.21E-03	4.21E-03	4.21E-03	4.21E-03
tc 99	3.92E+02	3.94E+02	3.94E+02	3.94E+02	3.94E+02	3.94E+02	3.94E+02
ru 99	1.62E-02	1.77E-02	1.92E-02	2.07E-02	2.23E-02	2.38E-02	2.53E-02

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ce 14x14 45 gwd/mtu pwr 2.1 wt%: 7 year cooled fission products

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 7.59E+13n/cm**2-sec

0 nuclide concentrations, grams

basis =single reactor assembly

	initial	425.8 d	851.7 d	1277.5 d	1703.3 d	2129.2 d	2555.0 d
mo100	4.99E+02	4.99E+02	4.99E+02	4.99E+02	4.99E+02	4.99E+02	4.99E+02
ru100	7.82E+01	7.82E+01	7.82E+01	7.82E+01	7.82E+01	7.82E+01	7.82E+01
ru101	4.12E+02	4.12E+02	4.12E+02	4.12E+02	4.12E+02	4.12E+02	4.12E+02
ru102	4.45E+02	4.45E+02	4.45E+02	4.45E+02	4.45E+02	4.45E+02	4.45E+02
rh102	7.32E-04	5.54E-04	4.19E-04	3.17E-04	2.40E-04	1.82E-04	1.38E-04

rh103	2.10E+02	2.35E+02	2.35E+02	2.35E+02	2.35E+02	2.35E+02	2.35E+02
ru104	3.55E+02	3.55E+02	3.55E+02	3.55E+02	3.55E+02	3.55E+02	3.55E+02
pd104	1.88E+02	1.88E+02	1.88E+02	1.88E+02	1.88E+02	1.88E+02	1.88E+02
pd105	2.47E+02	2.47E+02	2.47E+02	2.47E+02	2.47E+02	2.47E+02	2.47E+02
ru106	1.15E+02	5.21E+01	2.36E+01	1.06E+01	4.81E+00	2.17E+00	9.83E-01
rh106	1.26E-04	4.84E-05	2.19E-05	9.88E-06	4.46E-06	2.02E-06	9.12E-07
pd106	1.80E+02	2.43E+02	2.72E+02	2.85E+02	2.90E+02	2.93E+02	2.94E+02
pd107	1.74E+02	1.74E+02	1.74E+02	1.74E+02	1.74E+02	1.74E+02	1.74E+02
ag107	2.18E-05	4.34E-05	6.50E-05	8.66E-05	1.08E-04	1.30E-04	1.51E-04
pd108	1.17E+02	1.17E+02	1.17E+02	1.17E+02	1.17E+02	1.17E+02	1.17E+02
ag108m	1.87E-04	1.86E-04	1.84E-04	1.83E-04	1.82E-04	1.81E-04	1.80E-04
cd108	1.90E-04	1.90E-04	1.91E-04	1.91E-04	1.91E-04	1.91E-04	1.91E-04
ag109	6.25E+01	6.26E+01	6.26E+01	6.26E+01	6.26E+01	6.26E+01	6.26E+01
pd110	3.51E+01	3.51E+01	3.51E+01	3.51E+01	3.51E+01	3.51E+01	3.51E+01
ag110m	7.79E-01	2.39E-01	7.33E-02	2.25E-02	6.90E-03	2.12E-03	6.49E-04
cd110	4.31E+01	4.36E+01	4.38E+01	4.38E+01	4.39E+01	4.39E+01	4.39E+01
cd111	1.86E+01	1.89E+01	1.89E+01	1.89E+01	1.89E+01	1.89E+01	1.89E+01
cd112	9.37E+00	9.38E+00	9.38E+00	9.38E+00	9.38E+00	9.38E+00	9.38E+00
cd113	2.68E-02	2.86E-02	2.86E-02	2.86E-02	2.86E-02	2.86E-02	2.87E-02
cd113m	1.05E-01	9.90E-02	9.34E-02	8.82E-02	8.33E-02	7.87E-02	7.43E-02
in113	5.65E-03	1.15E-02	1.70E-02	2.22E-02	2.71E-02	3.17E-02	3.61E-02
cd114	8.52E+00	8.52E+00	8.52E+00	8.52E+00	8.52E+00	8.52E+00	8.52E+00
sn114	4.01E-04	4.68E-04	4.68E-04	4.68E-04	4.68E-04	4.68E-04	4.68E-04
in115	7.11E-01	7.30E-01	7.30E-01	7.30E-01	7.30E-01	7.30E-01	7.30E-01
sn115	1.09E-01	1.10E-01	1.10E-01	1.10E-01	1.10E-01	1.10E-01	1.10E-01
cd116	3.07E+00	3.07E+00	3.07E+00	3.07E+00	3.07E+00	3.07E+00	3.07E+00
sn116	1.75E+00	1.75E+00	1.75E+00	1.75E+00	1.75E+00	1.75E+00	1.75E+00
sn117	3.07E+00	3.07E+00	3.07E+00	3.07E+00	3.07E+00	3.07E+00	3.07E+00
sn118	2.38E+00	2.38E+00	2.38E+00	2.38E+00	2.38E+00	2.38E+00	2.38E+00
sn119	2.47E+00	2.48E+00	2.48E+00	2.48E+00	2.48E+00	2.48E+00	2.48E+00
sn119m	1.47E-02	5.35E-03	1.96E-03	7.14E-04	2.61E-04	9.53E-05	3.48E-05
sn120	2.42E+00	2.42E+00	2.42E+00	2.42E+00	2.42E+00	2.42E+00	2.42E+00
sn121	4.37E-03	1.25E-06	1.23E-06	1.22E-06	1.20E-06	1.18E-06	1.16E-06
sn121m	2.92E-02	2.87E-02	2.83E-02	2.79E-02	2.75E-02	2.71E-02	2.67E-02
sb121	2.32E+00	2.33E+00	2.33E+00	2.33E+00	2.33E+00	2.33E+00	2.33E+00
sn122	3.13E+00	3.13E+00	3.13E+00	3.13E+00	3.13E+00	3.13E+00	3.13E+00
te122	2.14E-01	2.16E-01	2.16E-01	2.16E-01	2.16E-01	2.16E-01	2.16E-01
sb123	2.71E+00	2.74E+00	2.75E+00	2.75E+00	2.75E+00	2.75E+00	2.75E+00
te123	1.91E-03	2.67E-03	2.74E-03	2.74E-03	2.74E-03	2.74E-03	2.74E-03
sn124	5.21E+00	5.21E+00	5.21E+00	5.21E+00	5.21E+00	5.21E+00	5.21E+00
te124	1.65E-01	1.97E-01	1.97E-01	1.97E-01	1.97E-01	1.97E-01	1.97E-01
sb125	4.65E+00	3.48E+00	2.59E+00	1.92E+00	1.43E+00	1.06E+00	7.92E-01
te125	1.79E+00	3.00E+00	3.90E+00	4.58E+00	5.08E+00	5.45E+00	5.73E+00
te125m	5.91E-02	4.94E-02	3.67E-02	2.73E-02	2.03E-02	1.51E-02	1.12E-02
sn126	1.28E+01	1.28E+01	1.28E+01	1.28E+01	1.28E+01	1.28E+01	1.28E+01
te126	2.68E-01	2.72E-01	2.72E-01	2.72E-01	2.72E-01	2.72E-01	2.72E-01
te127m	8.31E-01	5.75E-02	3.84E-03	2.56E-04	1.71E-05	1.14E-06	7.58E-08

ce 14x14 45 gwd/mtu pwr 2.1 wt%: 7 year cooled fission products

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 7.59E+13n/cm**2-sec

0 nuclide concentrations, grams

basis =single reactor assembly

	initial	425.8 d	851.7 d	1277.5 d	1703.3 d	2129.2 d	2555.0 d
i127	2.60E+01	2.69E+01	2.70E+01	2.70E+01	2.70E+01	2.70E+01	2.70E+01
te128	5.28E+01	5.28E+01	5.28E+01	5.28E+01	5.28E+01	5.28E+01	5.28E+01
xe128	2.23E+00	2.23E+00	2.23E+00	2.23E+00	2.23E+00	2.23E+00	2.23E+00
i129	1.00E+02	1.01E+02	1.01E+02	1.01E+02	1.01E+02	1.01E+02	1.01E+02
xe129	2.32E-02	2.38E-02	2.38E-02	2.38E-02	2.38E-02	2.38E-02	2.38E-02
te130	1.98E+02	1.98E+02	1.98E+02	1.98E+02	1.98E+02	1.98E+02	1.98E+02
xe130	7.85E+00	7.86E+00	7.86E+00	7.86E+00	7.86E+00	7.86E+00	7.86E+00
xe131	1.90E+02	1.94E+02	1.94E+02	1.94E+02	1.94E+02	1.94E+02	1.94E+02
xe132	6.41E+02	6.43E+02	6.43E+02	6.43E+02	6.43E+02	6.43E+02	6.43E+02
ba132	1.56E-04	1.59E-04	1.59E-04	1.59E-04	1.59E-04	1.59E-04	1.59E-04
cs133	5.59E+02	5.65E+02	5.65E+02	5.65E+02	5.65E+02	5.65E+02	5.65E+02
xe134	7.96E+02	7.96E+02	7.96E+02	7.96E+02	7.96E+02	7.96E+02	7.96E+02
cs134	8.19E+01	5.53E+01	3.74E+01	2.53E+01	1.71E+01	1.15E+01	7.79E+00
ba134	3.19E+01	5.84E+01	7.64E+01	8.85E+01	9.67E+01	1.02E+02	1.06E+02
cs135	1.26E+02	1.26E+02	1.26E+02	1.26E+02	1.26E+02	1.26E+02	1.26E+02
ba135	3.46E-01	3.46E-01	3.46E-01	3.46E-01	3.46E-01	3.46E-01	3.46E-01
xe136	1.31E+03	1.31E+03	1.31E+03	1.31E+03	1.31E+03	1.31E+03	1.31E+03
ba136	1.00E+01	1.04E+01	1.04E+01	1.04E+01	1.04E+01	1.04E+01	1.04E+01
cs137	6.62E+02	6.44E+02	6.27E+02	6.11E+02	5.94E+02	5.79E+02	5.63E+02
ba137	2.47E+01	4.23E+01	5.94E+01	7.61E+01	9.23E+01	1.08E+02	1.23E+02
ba137m	1.02E-04	9.84E-05	9.58E-05	9.32E-05	9.08E-05	8.83E-05	8.60E-05
ba138	6.67E+02	6.67E+02	6.67E+02	6.67E+02	6.67E+02	6.67E+02	6.67E+02
la138	4.80E-03	4.80E-03	4.80E-03	4.80E-03	4.80E-03	4.80E-03	4.80E-03
la139	6.17E+02	6.17E+02	6.17E+02	6.17E+02	6.17E+02	6.17E+02	6.17E+02
ce140	6.56E+02	6.68E+02	6.68E+02	6.68E+02	6.68E+02	6.68E+02	6.68E+02
pr141	5.43E+02	5.66E+02	5.66E+02	5.66E+02	5.66E+02	5.66E+02	5.66E+02
ce142	5.78E+02	5.78E+02	5.78E+02	5.78E+02	5.78E+02	5.78E+02	5.78E+02
nd142	1.87E+01	1.88E+01	1.88E+01	1.88E+01	1.88E+01	1.88E+01	1.88E+01
nd143	2.75E+02	2.84E+02	2.84E+02	2.84E+02	2.84E+02	2.84E+02	2.84E+02
ce144	1.57E+02	5.56E+01	1.97E+01	7.01E+00	2.49E+00	8.83E-01	3.13E-01
pr144	6.69E-03	2.34E-03	8.32E-04	2.95E-04	1.05E-04	3.72E-05	1.32E-05
nd144	6.07E+02	7.08E+02	7.44E+02	7.56E+02	7.61E+02	7.62E+02	7.63E+02
nd145	3.15E+02	3.16E+02	3.16E+02	3.16E+02	3.16E+02	3.16E+02	3.16E+02
pm145	1.24E-05	1.23E-05	1.20E-05	1.15E-05	1.10E-05	1.06E-05	1.01E-05
nd146	3.79E+02	3.79E+02	3.79E+02	3.79E+02	3.79E+02	3.79E+02	3.79E+02
pm146	4.27E-03	3.69E-03	3.19E-03	2.76E-03	2.38E-03	2.06E-03	1.78E-03
sm146	3.41E-03	3.60E-03	3.77E-03	3.92E-03	4.05E-03	4.16E-03	4.25E-03
pm147	6.79E+01	5.25E+01	3.86E+01	2.83E+01	2.08E+01	1.53E+01	1.12E+01
sm147	2.97E+01	4.86E+01	6.25E+01	7.27E+01	8.02E+01	8.58E+01	8.98E+01
nd148	1.94E+02	1.94E+02	1.94E+02	1.94E+02	1.94E+02	1.94E+02	1.94E+02
sm148	7.17E+01	7.26E+01	7.26E+01	7.26E+01	7.26E+01	7.26E+01	7.26E+01
sm149	5.96E-01	1.36E+00	1.36E+00	1.36E+00	1.36E+00	1.36E+00	1.36E+00

nd150	1.03E+02	1.03E+02	1.03E+02	1.03E+02	1.03E+02	1.03E+02	1.03E+02
sm150	1.63E+02	1.63E+02	1.63E+02	1.63E+02	1.63E+02	1.63E+02	1.63E+02
sm151	5.35E+00	5.44E+00	5.39E+00	5.34E+00	5.29E+00	5.25E+00	5.20E+00
eu151	2.98E-03	5.20E-02	1.01E-01	1.49E-01	1.97E-01	2.44E-01	2.91E-01
sm152	7.05E+01	7.05E+01	7.05E+01	7.05E+01	7.05E+01	7.05E+01	7.05E+01
eu152	8.06E-03	7.58E-03	7.14E-03	6.72E-03	6.32E-03	5.95E-03	5.60E-03
gd152	1.95E-02	1.97E-02	1.98E-02	1.99E-02	2.00E-02	2.01E-02	2.02E-02
eu153	7.40E+01	7.47E+01	7.47E+01	7.47E+01	7.47E+01	7.47E+01	7.47E+01
gd153	2.04E-03	6.02E-04	1.77E-04	5.23E-05	1.54E-05	4.54E-06	1.34E-06
sm154	2.53E+01	2.53E+01	2.53E+01	2.53E+01	2.53E+01	2.53E+01	2.53E+01

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ce 14x14 45 gwd/mtu pwr 2.1 wt%: 7 year cooled fission products

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 7.59E+13n/cm**2-sec

0 nuclide concentrations, grams

basis =single reactor assembly

	initial	425.8 d	851.7 d	1277.5 d	1703.3 d	2129.2 d	2555.0 d
eu154	1.24E+01	1.13E+01	1.03E+01	9.35E+00	8.51E+00	7.74E+00	7.05E+00
gd154	1.05E+00	2.17E+00	3.18E+00	4.10E+00	4.94E+00	5.70E+00	6.40E+00
eu155	3.63E+00	3.05E+00	2.57E+00	2.16E+00	1.82E+00	1.53E+00	1.29E+00
gd155	1.50E-02	5.90E-01	1.07E+00	1.48E+00	1.82E+00	2.11E+00	2.35E+00
gd156	7.85E+01	8.25E+01	8.25E+01	8.25E+01	8.25E+01	8.25E+01	8.25E+01
gd157	5.26E-02	7.27E-02	7.27E-02	7.27E-02	7.27E-02	7.27E-02	7.27E-02
gd158	1.84E+01	1.84E+01	1.84E+01	1.84E+01	1.84E+01	1.84E+01	1.84E+01
tb159	1.92E+00	1.93E+00	1.93E+00	1.93E+00	1.93E+00	1.93E+00	1.93E+00
gd160	8.28E-01	8.28E-01	8.28E-01	8.28E-01	8.28E-01	8.28E-01	8.28E-01
dy160	1.82E-01	2.60E-01	2.62E-01	2.62E-01	2.62E-01	2.62E-01	2.62E-01
dy161	2.40E-01	2.48E-01	2.48E-01	2.48E-01	2.48E-01	2.48E-01	2.48E-01
dy162	2.44E-01	2.44E-01	2.44E-01	2.44E-01	2.44E-01	2.44E-01	2.44E-01
dy163	2.29E-01	2.29E-01	2.29E-01	2.29E-01	2.29E-01	2.29E-01	2.29E-01
dy164	3.72E-02	3.72E-02	3.72E-02	3.72E-02	3.72E-02	3.72E-02	3.72E-02
ho165	1.06E-01	1.06E-01	1.06E-01	1.06E-01	1.06E-01	1.06E-01	1.06E-01
ho166m	4.77E-04	4.76E-04	4.76E-04	4.76E-04	4.75E-04	4.75E-04	4.75E-04
er166	2.97E-02	2.99E-02	2.99E-02	2.99E-02	2.99E-02	2.99E-02	2.99E-02
er167	6.53E-04	6.53E-04	6.53E-04	6.53E-04	6.53E-04	6.53E-04	6.53E-04
er168	1.36E-03	1.36E-03	1.36E-03	1.36E-03	1.36E-03	1.36E-03	1.36E-03
tm169	2.40E-06	2.45E-06	2.45E-06	2.45E-06	2.45E-06	2.45E-06	2.45E-06
er170	2.71E-06	2.71E-06	2.71E-06	2.71E-06	2.71E-06	2.71E-06	2.71E-06
yb171	1.21E-06	2.00E-06	2.52E-06	2.86E-06	3.09E-06	3.24E-06	3.33E-06
yb172	2.35E-06	2.37E-06	2.37E-06	2.37E-06	2.37E-06	2.37E-06	2.37E-06
total	1.80E+04	1.80E+04	1.80E+04	1.80E+04	1.80E+04	1.80E+04	1.80E+04

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ce 14x14 45 gwd/mtu pwr 2.1 wt%: 7 year cooled fission products

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 7.59E+13n/cm**2-sec

0 element radioactivity, curies

basis =single reactor assembly

	initial	425.8 d	851.7 d	1277.5 d	1703.3 d	2129.2 d	2555.0 d
h	2.66E+02	2.49E+02	2.33E+02	2.18E+02	2.05E+02	1.92E+02	1.79E+02
be	1.54E-06	1.54E-06	1.54E-06	1.54E-06	1.54E-06	1.54E-06	1.54E-06
c	6.21E-05	6.21E-05	6.21E-05	6.21E-05	6.21E-05	6.21E-05	6.21E-05
se	3.15E+05	3.39E-02	3.39E-02	3.39E-02	3.39E-02	3.39E-02	3.39E-02
kr	1.20E+06	3.63E+03	3.36E+03	3.12E+03	2.89E+03	2.68E+03	2.49E+03
rb	1.87E+06	1.34E-04	9.03E-06	9.03E-06	9.03E-06	9.03E-06	9.03E-06
sr	3.14E+06	3.25E+04	3.09E+04	3.00E+04	2.92E+04	2.83E+04	2.75E+04
y	4.34E+06	3.42E+04	3.09E+04	3.00E+04	2.92E+04	2.83E+04	2.75E+04
zr	4.20E+06	6.22E+03	6.24E+01	1.17E+00	5.64E-01	5.58E-01	5.58E-01
nb	6.44E+06	1.38E+04	1.39E+02	1.50E+00	1.48E-01	1.55E-01	1.75E-01
tc	5.67E+06	6.74E+00	6.74E+00	6.74E+00	6.74E+00	6.74E+00	6.74E+00
ru	2.81E+06	1.73E+05	7.81E+04	3.53E+04	1.60E+04	7.21E+03	3.26E+03
rh	3.86E+06	1.73E+05	7.81E+04	3.53E+04	1.60E+04	7.21E+03	3.26E+03
pd	3.67E+05	8.93E-02	8.93E-02	8.93E-02	8.93E-02	8.93E-02	8.93E-02
ag	5.84E+05	1.15E+03	3.53E+02	1.08E+02	3.32E+01	1.02E+01	3.13E+00
cd	4.72E+04	2.25E+01	2.10E+01	1.98E+01	1.87E+01	1.77E+01	1.67E+01
sn	6.35E+05	5.28E+01	1.34E+01	6.01E+00	4.00E+00	3.31E+00	3.04E+00
sb	1.60E+06	3.65E+03	2.71E+03	2.02E+03	1.50E+03	1.12E+03	8.30E+02
te	3.49E+06	1.97E+03	7.34E+02	4.97E+02	3.67E+02	2.72E+02	2.03E+02
i	5.17E+06	1.79E-02	1.79E-02	1.79E-02	1.79E-02	1.79E-02	1.79E-02
cs	3.32E+06	1.28E+05	1.03E+05	8.58E+04	7.38E+04	6.53E+04	5.91E+04
ba	3.91E+06	5.29E+04	5.15E+04	5.02E+04	4.88E+04	4.75E+04	4.63E+04
ce	3.11E+06	1.77E+05	6.29E+04	2.23E+04	7.92E+03	2.81E+03	9.98E+02
pr	2.74E+06	1.80E+05	6.38E+04	2.26E+04	8.03E+03	2.85E+03	1.01E+03
pm	7.56E+05	4.87E+04	3.58E+04	2.63E+04	1.93E+04	1.42E+04	1.04E+04
sm	3.77E+05	1.43E+02	1.42E+02	1.41E+02	1.39E+02	1.38E+02	1.37E+02
eu	2.62E+05	4.56E+03	4.04E+03	3.59E+03	3.20E+03	2.85E+03	2.54E+03
gd	5.73E+03	2.13E+00	6.27E-01	1.85E-01	5.44E-02	1.60E-02	4.73E-03
tb	2.27E+03	1.52E+01	2.57E-01	4.34E-03	7.32E-05	1.23E-06	2.08E-08
ho	1.30E+02	8.55E-04	8.55E-04	8.54E-04	8.54E-04	8.53E-04	8.52E-04
tm	5.81E-03	1.66E-03	1.09E-03	7.13E-04	4.68E-04	3.07E-04	2.02E-04
totals	7.42E+07	1.03E+06	5.47E+05	3.48E+05	2.57E+05	2.11E+05	1.86E+05

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ce 14x14 45 gwd/mtu pwr 2.1 wt%: 7 year cooled fission products

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 7.59E+13n/cm**2-sec

0 element thermal power, watts

basis =single reactor assembly

	initial	425.8 d	851.7 d	1277.5 d	1703.3 d	2129.2 d	2555.0 d
h	8.97E-03	8.40E-03	7.86E-03	7.37E-03	6.90E-03	6.46E-03	6.05E-03
c	1.82E-08	1.82E-08	1.82E-08	1.82E-08	1.82E-08	1.82E-08	1.82E-08
se	5.46E+03	1.06E-05	1.06E-05	1.06E-05	1.06E-05	1.06E-05	1.06E-05
kr	1.93E+04	5.44E+00	5.05E+00	4.68E+00	4.34E+00	4.02E+00	3.73E+00
sr	4.72E+04	3.95E+01	3.59E+01	3.49E+01	3.39E+01	3.29E+01	3.20E+01
y	7.51E+04	1.85E+02	1.71E+02	1.66E+02	1.62E+02	1.57E+02	1.52E+02
zr	4.34E+04	3.14E+01	3.12E-01	3.16E-03	9.37E-05	6.32E-05	6.29E-05
nb	9.53E+04	6.61E+01	6.65E-01	6.64E-03	8.94E-05	2.78E-05	3.06E-05

tc	7.17E+04	3.38E-03	3.38E-03	3.38E-03	3.38E-03	3.38E-03	3.38E-03
ru	1.56E+04	1.17E+01	4.64E+00	2.10E+00	9.49E-01	4.29E-01	1.94E-01
rh	2.03E+04	1.66E+03	7.49E+02	3.38E+02	1.53E+02	6.91E+01	3.12E+01
pd	1.11E+03	4.92E-06	4.92E-06	4.92E-06	4.92E-06	4.92E-06	4.92E-06
ag	2.33E+03	1.91E+01	5.85E+00	1.79E+00	5.50E-01	1.69E-01	5.18E-02
cd	5.40E+02	2.53E-02	2.28E-02	2.15E-02	2.03E-02	1.92E-02	1.81E-02
sn	8.40E+03	1.05E-01	1.49E-02	4.05E-03	2.30E-03	1.87E-03	1.73E-03
sb	2.93E+04	1.16E+01	8.58E+00	6.38E+00	4.75E+00	3.53E+00	2.63E+00
te	3.31E+04	1.78E+00	6.25E-01	4.19E-01	3.09E-01	2.29E-01	1.71E-01
i	7.65E+04	8.38E-06	8.38E-06	8.38E-06	8.38E-06	8.38E-06	8.38E-06
cs	5.98E+04	7.92E+02	5.54E+02	3.92E+02	2.83E+02	2.08E+02	1.57E+02
ba	3.35E+04	2.08E+02	2.02E+02	1.97E+02	1.92E+02	1.87E+02	1.82E+02
ce	1.45E+04	1.16E+02	4.11E+01	1.46E+01	5.18E+00	1.84E+00	6.53E-01
pr	2.25E+04	1.30E+03	4.62E+02	1.64E+02	5.82E+01	2.06E+01	7.33E+00
pm	3.88E+03	1.80E+01	1.31E+01	9.65E+00	7.09E+00	5.21E+00	3.83E+00
sm	8.95E+02	1.68E-02	1.67E-02	1.65E-02	1.64E-02	1.62E-02	1.61E-02
eu	2.46E+03	2.89E+01	2.62E+01	2.38E+01	2.16E+01	1.96E+01	1.78E+01
gd	1.62E+01	1.87E-03	5.51E-04	1.62E-04	4.78E-05	1.41E-05	4.15E-06
tb	1.32E+01	1.34E-01	2.26E-03	3.81E-05	6.42E-07	1.08E-08	1.83E-10
ho	5.58E-01	8.99E-06	8.99E-06	8.98E-06	8.98E-06	8.97E-06	8.96E-06
tm	2.00E-05	2.59E-07	1.68E-07	1.10E-07	7.21E-08	4.74E-08	3.11E-08
totals	8.94E+05	4.49E+03	2.28E+03	1.36E+03	9.26E+02	7.10E+02	5.91E+02

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ce 14x14 45 gwd/mtu pwr 2.1 wt%: 7 year cooled fission products

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 7.59E+13n/cm**2-sec

0 nuclide gamma power, watts

basis =single reactor assembly

	initial	425.8 d	851.7 d	1277.5 d	1703.3 d	2129.2 d	2555.0 d
kr 85	5.17E-02	4.79E-02	4.45E-02	4.12E-02	3.82E-02	3.55E-02	3.29E-02
y 90	3.57E-04	3.20E-04	3.11E-04	3.02E-04	2.94E-04	2.86E-04	2.78E-04
nb 93m	4.45E-07	7.27E-07	9.96E-07	1.25E-06	1.49E-06	1.73E-06	1.94E-06
nb 94	5.23E-07	5.23E-07	5.23E-07	5.23E-07	5.23E-07	5.23E-07	5.23E-07
zr 95	2.72E+03	2.70E+01	2.69E-01	2.67E-03	2.65E-05	2.64E-07	2.63E-09
nb 95	2.84E+03	6.24E+01	6.28E-01	6.24E-03	6.21E-05	6.17E-07	6.14E-09
tc 98	3.03E-08	3.03E-08	3.03E-08	3.03E-08	3.03E-08	3.03E-08	3.03E-08
tc 99	2.47E-08	2.48E-08	2.48E-08	2.48E-08	2.48E-08	2.48E-08	2.48E-08
rh102	1.13E-02	8.58E-03	6.49E-03	4.91E-03	3.72E-03	2.81E-03	2.13E-03
rh106	5.49E+02	2.11E+02	9.54E+01	4.31E+01	1.95E+01	8.80E+00	3.98E+00
ag108	8.15E-05	4.59E-08	4.56E-08	4.54E-08	4.51E-08	4.48E-08	4.45E-08
ag108m	4.68E-05	4.65E-05	4.62E-05	4.59E-05	4.56E-05	4.53E-05	4.51E-05
ag110	3.00E+01	2.81E-03	8.63E-04	2.65E-04	8.12E-05	2.49E-05	7.64E-06
ag110m	6.01E+01	1.84E+01	5.66E+00	1.74E+00	5.32E-01	1.63E-01	5.01E-02
cd113m	9.86E-06	9.31E-06	8.79E-06	8.30E-06	7.84E-06	7.40E-06	6.99E-06
sn119m	3.72E-03	1.36E-03	4.96E-04	1.81E-04	6.62E-05	2.42E-05	8.83E-06
sn121m	4.65E-05	4.58E-05	4.51E-05	4.44E-05	4.38E-05	4.32E-05	4.25E-05
sn123	1.19E-02	1.21E-03	1.23E-04	1.26E-05	1.28E-06	1.30E-07	1.32E-08
te123m	6.47E-03	5.49E-04	4.66E-05	3.96E-06	3.36E-07	2.85E-08	2.42E-09

ce 14x14 45 gwd/mtu pwr 2.1 wt%: 15 year cooled light elements
page 22
decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 7.59E+13n/cm**2-sec
0 element thermal power, watts
basis =single reactor assembly

	initial	912.5 d	1825.0 d	2737.5 d	3650.0 d	4562.5 d	5475.0 d
mn	8.55E+02	6.33E-02	8.34E-03	1.10E-03	1.45E-04	1.91E-05	2.52E-06
fe	4.07E-01	1.22E-02	6.49E-03	3.44E-03	1.82E-03	9.67E-04	5.13E-04
co	5.29E+00	3.10E+00	2.23E+00	1.61E+00	1.16E+00	8.32E-01	5.99E-01
ni	1.93E-01	1.51E-03	1.48E-03	1.46E-03	1.43E-03	1.41E-03	1.38E-03
sn	2.38E+01	3.26E-01	3.74E-02	4.57E-03	7.71E-04	3.25E-04	2.66E-04
sb	4.20E+00	8.99E-01	4.77E-01	2.53E-01	1.34E-01	7.11E-02	3.77E-02
te	1.04E-01	5.85E-02	3.10E-02	1.64E-02	8.72E-03	4.63E-03	2.45E-03
totals	8.93E+02	4.47E+00	2.79E+00	1.89E+00	1.30E+00	9.11E-01	6.41E-01

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ce 14x14 45 gwd/mtu pwr 2.1 wt%: 15 year cooled light elements
page 23
decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 7.59E+13n/cm**2-sec
0 element gamma power, watts
basis =single reactor assembly

	initial	912.5 d	1825.0 d	2737.5 d	3650.0 d	4562.5 d	5475.0 d
mn	5.73E+02	6.30E-02	8.30E-03	1.09E-03	1.44E-04	1.90E-05	2.51E-06
fe	3.56E-01	3.56E-03	1.89E-03	1.00E-03	5.30E-04	2.81E-04	1.49E-04
co	4.90E+00	2.98E+00	2.15E+00	1.55E+00	1.11E+00	8.01E-01	5.77E-01
ni	8.88E-02	1.74E-06	1.74E-06	1.74E-06	1.74E-06	1.74E-06	1.74E-06
sn	8.42E+00	4.25E-02	4.86E-03	5.71E-04	7.55E-05	1.79E-05	1.10E-05
sb	2.71E+00	7.32E-01	3.88E-01	2.06E-01	1.09E-01	5.79E-02	3.07E-02
te	2.80E-02	1.47E-02	7.78E-03	4.12E-03	2.19E-03	1.16E-03	6.15E-04
totals	5.92E+02	3.84E+00	2.56E+00	1.76E+00	1.23E+00	8.61E-01	6.08E-01

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ce 14x14 45 gwd/mtu pwr 2.1 wt%: 15 year cooled actinides
page 24
decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 7.59E+13n/cm**2-sec
0 nuclide concentrations, gram atoms
basis = single reactor assembly

	initial	912.5 d	1825.0 d	2737.5 d	3650.0 d	4562.5 d	5475.0 d
he 4	7.32E-02	1.45E-01	1.82E-01	2.16E-01	2.49E-01	2.81E-01	3.11E-01
th232	3.25E-07	6.83E-07	1.04E-06	1.40E-06	1.76E-06	2.12E-06	2.48E-06
u232	3.32E-07	1.12E-06	1.53E-06	1.74E-06	1.83E-06	1.85E-06	1.85E-06
u233	3.26E-07	9.72E-07	1.62E-06	2.27E-06	2.92E-06	3.57E-06	4.23E-06
u234	3.05E-03	1.10E-02	1.90E-02	2.69E-02	3.46E-02	4.21E-02	4.95E-02
u235	1.97E+00	1.97E+00	1.97E+00	1.98E+00	1.98E+00	1.98E+00	1.98E+00
u236	4.85E+00	4.85E+00	4.85E+00	4.85E+00	4.85E+00	4.85E+00	4.86E+00
u238	1.59E+03	1.59E+03	1.59E+03	1.59E+03	1.59E+03	1.59E+03	1.59E+03
np236	1.82E-06	1.82E-06	1.82E-06	1.82E-06	1.82E-06	1.82E-06	1.82E-06
np237	7.48E-01	7.67E-01	7.68E-01	7.71E-01	7.74E-01	7.78E-01	7.82E-01

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   pu238  3.78E-01 4.09E-01 4.02E-01 3.94E-01 3.86E-01 3.79E-01 3.71E-01
   pu239  6.92E+00 7.13E+00 7.13E+00 7.13E+00 7.13E+00 7.13E+00 7.13E+00
   pu240  4.63E+00 4.66E+00 4.68E+00 4.70E+00 4.72E+00 4.74E+00 4.75E+00
   pu241  2.24E+00 1.99E+00 1.76E+00 1.56E+00 1.38E+00 1.23E+00 1.09E+00
   pu242  2.18E+00 2.18E+00 2.18E+00 2.18E+00 2.18E+00 2.18E+00 2.18E+00
   am241  5.15E-02 3.06E-01 5.30E-01 7.28E-01 9.02E-01 1.06E+00 1.19E+00
   am242m 9.30E-04 9.18E-04 9.07E-04 8.96E-04 8.85E-04 8.74E-04 8.64E-04
   am243  5.97E-01 5.98E-01 5.98E-01 5.98E-01 5.98E-01 5.97E-01 5.97E-01
   cm242  3.55E-02 7.37E-04 1.75E-05 2.65E-06 2.32E-06 2.28E-06 2.25E-06
   cm243  1.21E-03 1.14E-03 1.07E-03 1.01E-03 9.46E-04 8.90E-04 8.38E-04
   cm244  2.91E-01 2.65E-01 2.41E-01 2.19E-01 1.99E-01 1.81E-01 1.64E-01
   cm245  9.03E-03 9.03E-03 9.03E-03 9.02E-03 9.02E-03 9.02E-03 9.02E-03
   cm246  3.12E-03 3.11E-03 3.11E-03 3.11E-03 3.11E-03 3.11E-03 3.11E-03
   cm247  6.91E-05 6.91E-05 6.91E-05 6.91E-05 6.91E-05 6.91E-05 6.91E-05
   cm248  9.88E-06 9.89E-06 9.90E-06 9.90E-06 9.90E-06 9.90E-06 9.90E-06
  total   1.62E+03 1.62E+03 1.62E+03 1.62E+03 1.62E+03 1.62E+03 1.62E+03
1
   ce 14x14  45 gwd/mtu pwr 2.1 wt%: 15 year cooled                    actinides
  page  25
 decay, following reactor irradiation identified by: power=  16.11mw, burnup=  17640.mwd, flux=
7.59E+13n/cm**2-sec
0                          element concentrations, gram atoms
                          basis = single reactor assembly
        initial  912.5 d  1825.0 d  2737.5 d  3650.0 d  4562.5 d  5475.0 d
    he   7.32E-02 1.45E-01 1.82E-01 2.16E-01 2.49E-01 2.81E-01 3.11E-01
    th   3.59E-07 7.79E-07 1.26E-06 1.79E-06 2.37E-06 3.00E-06 3.69E-06
     u   1.60E+03 1.60E+03 1.60E+03 1.60E+03 1.60E+03 1.60E+03 1.60E+03
    np   9.64E-01 7.67E-01 7.68E-01 7.71E-01 7.74E-01 7.78E-01 7.82E-01
    pu   1.63E+01 1.64E+01 1.62E+01 1.60E+01 1.58E+01 1.56E+01 1.55E+01
    am   6.51E-01 9.05E-01 1.13E+00 1.33E+00 1.50E+00 1.65E+00 1.79E+00
    cm   3.40E-01 2.79E-01 2.54E-01 2.32E-01 2.12E-01 1.94E-01 1.77E-01
  totals 1.62E+03 1.62E+03 1.62E+03 1.62E+03 1.62E+03 1.62E+03 1.62E+03
1
   ce 14x14  45 gwd/mtu pwr 2.1 wt%: 15 year cooled                    actinides
  page  26
 decay, following reactor irradiation identified by: power=  16.11mw, burnup=  17640.mwd, flux=
7.59E+13n/cm**2-sec
0                          nuclide concentrations, grams
                          basis =single reactor assembly
        initial  912.5 d  1825.0 d  2737.5 d  3650.0 d  4562.5 d  5475.0 d
   he 4  2.93E-01 5.82E-01 7.28E-01 8.66E-01 9.97E-01 1.12E+00 1.25E+00
   pb208  1.09E-07 1.52E-06 5.57E-06 1.19E-05 1.99E-05 2.87E-05 3.80E-05
   th228  4.66E-07 3.26E-06 6.45E-06 8.79E-06 1.02E-05 1.10E-05 1.13E-05
   th230  1.87E-06 1.32E-05 3.76E-05 7.49E-05 1.25E-04 1.87E-04 2.61E-04
   th232  7.54E-05 1.59E-04 2.42E-04 3.25E-04 4.08E-04 4.91E-04 5.75E-04
   th234  5.52E-06 5.51E-06 5.51E-06 5.51E-06 5.51E-06 5.51E-06 5.51E-06
   pa231  2.14E-06 3.27E-06 4.39E-06 5.52E-06 6.64E-06 7.77E-06 8.89E-06
   pa233  6.04E-06 6.17E-06 6.18E-06 6.20E-06 6.23E-06 6.26E-06 6.30E-06
    u232  7.71E-05 2.60E-04 3.55E-04 4.03E-04 4.24E-04 4.30E-04 4.29E-04
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u233	7.60E-05	2.27E-04	3.77E-04	5.29E-04	6.80E-04	8.33E-04	9.86E-04
u234	7.13E-01	2.58E+00	4.46E+00	6.29E+00	8.09E+00	9.86E+00	1.16E+01
u235	4.64E+02	4.64E+02	4.64E+02	4.64E+02	4.64E+02	4.64E+02	4.65E+02
u236	1.14E+03	1.14E+03	1.14E+03	1.15E+03	1.15E+03	1.15E+03	1.15E+03
u237	4.10E+00	1.45E-05	1.29E-05	1.14E-05	1.01E-05	8.96E-06	7.94E-06
u238	3.80E+05	3.80E+05	3.80E+05	3.80E+05	3.80E+05	3.80E+05	3.80E+05
np236	4.30E-04	4.30E-04	4.30E-04	4.30E-04	4.30E-04	4.30E-04	4.30E-04
np237	1.77E+02	1.82E+02	1.82E+02	1.83E+02	1.83E+02	1.84E+02	1.85E+02
np239	5.07E+01	1.25E-04	1.25E-04	1.25E-04	1.25E-04	1.25E-04	1.25E-04
pu236	4.22E-04	2.33E-04	1.28E-04	7.07E-05	3.89E-05	2.14E-05	1.18E-05
pu238	9.00E+01	9.73E+01	9.56E+01	9.37E+01	9.19E+01	9.01E+01	8.83E+01
pu239	1.65E+03	1.70E+03	1.70E+03	1.70E+03	1.70E+03	1.70E+03	1.70E+03
pu240	1.11E+03	1.12E+03	1.12E+03	1.13E+03	1.13E+03	1.14E+03	1.14E+03
pu241	5.41E+02	4.79E+02	4.25E+02	3.76E+02	3.34E+02	2.96E+02	2.62E+02
pu242	5.28E+02	5.28E+02	5.28E+02	5.28E+02	5.28E+02	5.28E+02	5.28E+02
am241	1.24E+01	7.37E+01	1.28E+02	1.75E+02	2.17E+02	2.54E+02	2.87E+02
am242m	2.25E-01	2.22E-01	2.19E-01	2.17E-01	2.14E-01	2.12E-01	2.09E-01
am242	5.40E-02	2.87E-06	2.83E-06	2.80E-06	2.76E-06	2.73E-06	2.70E-06
am243	1.45E+02	1.45E+02	1.45E+02	1.45E+02	1.45E+02	1.45E+02	1.45E+02
cm242	8.58E+00	1.78E-01	4.24E-03	6.42E-04	5.61E-04	5.52E-04	5.46E-04
cm243	2.93E-01	2.76E-01	2.60E-01	2.44E-01	2.30E-01	2.16E-01	2.04E-01
cm244	7.11E+01	6.47E+01	5.88E+01	5.35E+01	4.86E+01	4.41E+01	4.01E+01
cm245	2.21E+00	2.21E+00	2.21E+00	2.21E+00	2.21E+00	2.21E+00	2.21E+00
cm246	7.66E-01	7.66E-01	7.66E-01	7.66E-01	7.65E-01	7.65E-01	7.65E-01
cm247	1.71E-02	1.71E-02	1.71E-02	1.71E-02	1.71E-02	1.71E-02	1.71E-02
cm248	2.45E-03	2.45E-03	2.45E-03	2.46E-03	2.46E-03	2.46E-03	2.46E-03
cf249	3.90E-06	3.85E-05	4.31E-05	4.35E-05	4.34E-05	4.32E-05	4.30E-05
cf250	9.39E-06	8.28E-06	7.26E-06	6.36E-06	5.57E-06	4.88E-06	4.27E-06
cf251	5.38E-06	5.37E-06	5.36E-06	5.35E-06	5.34E-06	5.33E-06	5.32E-06
total	3.86E+05	3.86E+05	3.86E+05	3.86E+05	3.86E+05	3.86E+05	3.86E+05

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ce 14x14 45 gwd/mtu pwr 2.1 wt%: 15 year cooled actinides

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 7.59E+13n/cm**2-sec

0 element concentrations, grams

basis =single reactor assembly

	initial	912.5 d	1825.0 d	2737.5 d	3650.0 d	4562.5 d	5475.0 d
he	2.93E-01	5.82E-01	7.28E-01	8.66E-01	9.97E-01	1.12E+00	1.25E+00
pb	1.10E-07	1.52E-06	5.58E-06	1.19E-05	1.99E-05	2.87E-05	3.80E-05
th	8.33E-05	1.81E-04	2.91E-04	4.14E-04	5.49E-04	6.95E-04	8.53E-04
pa	8.19E-06	9.44E-06	1.06E-05	1.17E-05	1.29E-05	1.40E-05	1.52E-05
u	3.81E+05	3.81E+05	3.81E+05	3.81E+05	3.81E+05	3.81E+05	3.81E+05
np	2.29E+02	1.82E+02	1.82E+02	1.83E+02	1.83E+02	1.84E+02	1.85E+02
pu	3.92E+03	3.93E+03	3.87E+03	3.83E+03	3.79E+03	3.75E+03	3.72E+03
am	1.58E+02	2.19E+02	2.73E+02	3.21E+02	3.63E+02	4.00E+02	4.32E+02
cm	8.29E+01	6.82E+01	6.21E+01	5.67E+01	5.18E+01	4.74E+01	4.33E+01
cf	2.59E-05	5.59E-05	5.76E-05	5.63E-05	5.49E-05	5.37E-05	5.27E-05
totals	3.86E+05	3.86E+05	3.86E+05	3.86E+05	3.86E+05	3.86E+05	3.86E+05

1

ce 14x14 45 gwd/mtu pwr 2.1 wt%: 15 year cooled actinides

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 7.59E+13n/cm**2-sec

0 element radioactivity, curies

basis =single reactor assembly

	initial	912.5 d	1825.0 d	2737.5 d	3650.0 d	4562.5 d	5475.0 d
tl	1.38E-04	9.62E-04	1.90E-03	2.59E-03	3.02E-03	3.25E-03	3.35E-03
pb	3.84E-04	2.68E-03	5.30E-03	7.22E-03	8.41E-03	9.04E-03	9.32E-03
bi	3.84E-04	2.68E-03	5.30E-03	7.22E-03	8.41E-03	9.04E-03	9.32E-03
po	6.30E-04	4.39E-03	8.69E-03	1.18E-02	1.38E-02	1.48E-02	1.53E-02
rn	3.84E-04	2.68E-03	5.30E-03	7.22E-03	8.41E-03	9.04E-03	9.32E-03
ra	3.84E-04	2.68E-03	5.30E-03	7.22E-03	8.41E-03	9.04E-03	9.32E-03
th	1.38E-01	1.31E-01	1.34E-01	1.36E-01	1.37E-01	1.38E-01	1.38E-01
pa	2.63E-01	2.56E-01	2.56E-01	2.57E-01	2.57E-01	2.58E-01	2.59E-01
u	1.21E+07	1.41E+00	1.29E+00	1.18E+00	1.09E+00	1.01E+00	9.33E-01
np	1.20E+07	2.92E+01	2.92E+01	2.91E+01	2.91E+01	2.91E+01	2.91E+01
pu	5.27E+05	5.16E+04	4.59E+04	4.09E+04	3.64E+04	3.25E+04	2.90E+04
am	2.64E+05	2.86E+02	4.72E+02	6.35E+02	7.79E+02	9.06E+02	1.02E+03
cm	3.42E+04	5.85E+03	4.79E+03	4.34E+03	3.95E+03	3.59E+03	3.26E+03
bk	3.14E-01	9.16E-03	1.27E-03	1.76E-04	2.44E-05	3.38E-06	4.68E-07
cf	5.51E-03	3.07E-03	2.02E-03	1.42E-03	1.08E-03	8.65E-04	7.28E-04
totals	2.50E+07	5.77E+04	5.12E+04	4.59E+04	4.12E+04	3.70E+04	3.33E+04

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ce 14x14 45 gwd/mtu pwr 2.1 wt%: 15 year cooled actinides

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 7.59E+13n/cm**2-sec

0 element thermal power, watts

basis =single reactor assembly

	initial	912.5 d	1825.0 d	2737.5 d	3650.0 d	4562.5 d	5475.0 d
tl	3.23E-06	2.25E-05	4.45E-05	6.07E-05	7.07E-05	7.60E-05	7.84E-05
pb	7.27E-07	5.06E-06	1.00E-05	1.37E-05	1.59E-05	1.71E-05	1.76E-05
bi	6.43E-06	4.48E-05	8.87E-05	1.21E-04	1.41E-04	1.51E-04	1.56E-04
po	2.88E-05	2.00E-04	3.97E-04	5.41E-04	6.30E-04	6.78E-04	6.99E-04
rn	1.46E-05	1.02E-04	2.01E-04	2.74E-04	3.19E-04	3.43E-04	3.54E-04
ra	1.32E-05	9.18E-05	1.82E-04	2.48E-04	2.88E-04	3.10E-04	3.20E-04
th	8.88E-05	1.42E-04	2.27E-04	2.90E-04	3.29E-04	3.50E-04	3.59E-04
pa	1.02E-03	9.54E-04	9.54E-04	9.55E-04	9.57E-04	9.58E-04	9.60E-04
u	3.27E+04	8.21E-03	8.35E-03	8.48E-03	8.61E-03	8.75E-03	8.90E-03
np	3.13E+04	7.71E-02	7.71E-02	7.71E-02	7.71E-02	7.71E-02	7.71E-02
pu	6.04E+02	6.81E+01	6.70E+01	6.58E+01	6.46E+01	6.35E+01	6.24E+01
am	1.53E+03	9.37E+00	1.56E+01	2.10E+01	2.58E+01	3.01E+01	3.38E+01
cm	1.24E+03	2.05E+02	1.68E+02	1.52E+02	1.38E+02	1.26E+02	1.14E+02
cf	3.19E-04	1.85E-04	1.12E-04	7.20E-05	5.00E-05	3.73E-05	2.98E-05
totals	6.73E+04	2.83E+02	2.50E+02	2.39E+02	2.29E+02	2.19E+02	2.10E+02

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ce 14x14 45 gwd/mtu pwr 2.1 wt%: 15 year cooled actinides
page 30
decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 7.59E+13n/cm**2-sec
0 element gamma power, watts
basis =single reactor assembly

	initial	912.5 d	1825.0 d	2737.5 d	3650.0 d	4562.5 d	5475.0 d
tl	2.75E-06	1.92E-05	3.79E-05	5.17E-05	6.02E-05	6.47E-05	6.68E-05
pb	3.30E-07	2.30E-06	4.55E-06	6.21E-06	7.23E-06	7.77E-06	8.02E-06
bi	2.40E-07	1.67E-06	3.30E-06	4.50E-06	5.24E-06	5.64E-06	5.82E-06
rn	1.39E-09	9.68E-09	1.92E-08	2.61E-08	3.04E-08	3.27E-08	3.38E-08
ra	2.30E-08	1.60E-07	3.16E-07	4.31E-07	5.02E-07	5.40E-07	5.57E-07
th	9.46E-06	7.58E-06	7.64E-06	7.68E-06	7.70E-06	7.71E-06	7.72E-06
pa	2.29E-04	1.80E-04	1.80E-04	1.81E-04	1.82E-04	1.83E-04	1.84E-04
u	3.86E+03	1.01E-03	8.91E-04	7.91E-04	7.01E-04	6.22E-04	5.52E-04
np	1.40E+04	3.17E-02	3.16E-02	3.16E-02	3.16E-02	3.16E-02	3.16E-02
pu	6.95E+01	2.23E-02	2.19E-02	2.15E-02	2.11E-02	2.08E-02	2.04E-02
am	1.06E+03	5.33E-02	8.48E-02	1.12E-01	1.37E-01	1.58E-01	1.77E-01
cm	4.31E-01	7.66E-02	6.34E-02	5.79E-02	5.29E-02	4.84E-02	4.43E-02
cf	9.04E-06	5.00E-06	2.80E-06	1.65E-06	1.04E-06	7.22E-07	5.54E-07
totals	1.90E+04	1.85E-01	2.03E-01	2.25E-01	2.44E-01	2.60E-01	2.74E-01

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ce 14x14 45 gwd/mtu pwr 2.1 wt%: 15 year cooled fission products
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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 7.59E+13n/cm**2-sec
0 nuclide concentrations, grams
basis =single reactor assembly

	initial	912.5 d	1825.0 d	2737.5 d	3650.0 d	4562.5 d	5475.0 d
h 3	2.75E-02	2.39E-02	2.08E-02	1.80E-02	1.57E-02	1.36E-02	1.18E-02
li 6	4.88E-05	4.88E-05	4.88E-05	4.88E-05	4.88E-05	4.88E-05	4.88E-05
li 7	5.37E-06	5.37E-06	5.37E-06	5.37E-06	5.37E-06	5.37E-06	5.37E-06
be 9	1.03E-05	1.03E-05	1.03E-05	1.03E-05	1.03E-05	1.03E-05	1.03E-05
be 10	6.89E-05	6.89E-05	6.89E-05	6.89E-05	6.89E-05	6.89E-05	6.89E-05
c 14	1.39E-05	1.39E-05	1.39E-05	1.39E-05	1.39E-05	1.39E-05	1.39E-05
zn 70	5.87E-06	5.87E-06	5.87E-06	5.87E-06	5.87E-06	5.87E-06	5.87E-06
ga 71	5.48E-05	5.48E-05	5.48E-05	5.48E-05	5.48E-05	5.48E-05	5.48E-05
ge 72	3.13E-03	3.14E-03	3.14E-03	3.14E-03	3.14E-03	3.14E-03	3.14E-03
ge 73	8.12E-03	8.12E-03	8.12E-03	8.12E-03	8.12E-03	8.12E-03	8.12E-03
ge 74	7.20E-03	7.20E-03	7.20E-03	7.20E-03	7.20E-03	7.20E-03	7.20E-03
as 75	5.67E-02	5.67E-02	5.67E-02	5.67E-02	5.67E-02	5.67E-02	5.67E-02
ge 76	1.63E-01	1.63E-01	1.63E-01	1.63E-01	1.63E-01	1.63E-01	1.63E-01
se 76	2.41E-03	2.42E-03	2.42E-03	2.42E-03	2.42E-03	2.42E-03	2.42E-03
se 77	3.61E-01	3.61E-01	3.61E-01	3.61E-01	3.61E-01	3.61E-01	3.61E-01
se 78	1.39E+00	1.39E+00	1.39E+00	1.39E+00	1.39E+00	1.39E+00	1.39E+00
se 79	2.47E+00	2.47E+00	2.47E+00	2.47E+00	2.47E+00	2.47E+00	2.47E+00
br 79	9.11E-06	2.21E-05	3.50E-05	4.80E-05	6.10E-05	7.40E-05	8.69E-05
se 80	6.59E+00	6.59E+00	6.59E+00	6.59E+00	6.59E+00	6.59E+00	6.59E+00
kr 80	3.99E-05	3.99E-05	3.99E-05	3.99E-05	3.99E-05	3.99E-05	3.99E-05

br 81	9.75E+00	9.75E+00	9.75E+00	9.75E+00	9.75E+00	9.75E+00	9.75E+00
kr 81	3.94E-06	3.94E-06	3.94E-06	3.94E-06	3.94E-06	3.94E-06	3.94E-06
se 82	1.53E+01	1.53E+01	1.53E+01	1.53E+01	1.53E+01	1.53E+01	1.53E+01
kr 82	4.27E-01	4.28E-01	4.28E-01	4.28E-01	4.28E-01	4.28E-01	4.28E-01
kr 83	1.46E+01	1.46E+01	1.46E+01	1.46E+01	1.46E+01	1.46E+01	1.46E+01
kr 84	5.67E+01	5.67E+01	5.67E+01	5.67E+01	5.67E+01	5.67E+01	5.67E+01
kr 85	9.96E+00	8.48E+00	7.22E+00	6.14E+00	5.22E+00	4.44E+00	3.78E+00
rb 85	4.13E+01	4.28E+01	4.41E+01	4.52E+01	4.61E+01	4.69E+01	4.75E+01
kr 86	8.12E+01	8.12E+01	8.12E+01	8.12E+01	8.12E+01	8.12E+01	8.12E+01
sr 86	2.33E-01	2.45E-01	2.45E-01	2.45E-01	2.45E-01	2.45E-01	2.45E-01
rb 87	1.05E+02	1.05E+02	1.05E+02	1.05E+02	1.05E+02	1.05E+02	1.05E+02
sr 87	1.79E-03	1.79E-03	1.79E-03	1.79E-03	1.79E-03	1.79E-03	1.79E-03
sr 88	1.50E+02	1.50E+02	1.50E+02	1.50E+02	1.50E+02	1.50E+02	1.50E+02
y 89	1.89E+02	1.98E+02	1.98E+02	1.98E+02	1.98E+02	1.98E+02	1.98E+02
sr 90	2.32E+02	2.18E+02	2.05E+02	1.93E+02	1.81E+02	1.70E+02	1.60E+02
y 90	6.52E-02	5.66E-02	5.32E-02	5.01E-02	4.71E-02	4.43E-02	4.16E-02
zr 90	1.13E+01	2.51E+01	3.81E+01	5.04E+01	6.19E+01	7.27E+01	8.28E+01
zr 91	2.50E+02	2.65E+02	2.65E+02	2.65E+02	2.65E+02	2.65E+02	2.65E+02
zr 92	2.93E+02	2.93E+02	2.93E+02	2.93E+02	2.93E+02	2.93E+02	2.93E+02
zr 93	2.22E+02	2.22E+02	2.22E+02	2.22E+02	2.22E+02	2.22E+02	2.22E+02
nb 93	1.50E-05	4.50E-05	9.76E-05	1.70E-04	2.62E-04	3.69E-04	4.91E-04
nb 93m	1.68E-04	3.89E-04	5.88E-04	7.66E-04	9.27E-04	1.07E-03	1.20E-03
zr 94	3.73E+02	3.73E+02	3.73E+02	3.73E+02	3.73E+02	3.73E+02	3.73E+02
nb 94	2.99E-04	2.99E-04	2.99E-04	2.99E-04	2.99E-04	2.99E-04	2.99E-04
mo 95	3.19E+02	3.65E+02	3.65E+02	3.65E+02	3.65E+02	3.65E+02	3.65E+02
zr 96	4.04E+02	4.04E+02	4.04E+02	4.04E+02	4.04E+02	4.04E+02	4.04E+02
mo 96	2.91E+01	2.91E+01	2.91E+01	2.91E+01	2.91E+01	2.91E+01	2.91E+01
mo 97	3.91E+02	3.91E+02	3.91E+02	3.91E+02	3.91E+02	3.91E+02	3.91E+02
mo 98	4.35E+02	4.35E+02	4.35E+02	4.35E+02	4.35E+02	4.35E+02	4.35E+02
tc 98	4.21E-03	4.21E-03	4.21E-03	4.21E-03	4.21E-03	4.21E-03	4.21E-03
tc 99	3.92E+02	3.94E+02	3.94E+02	3.94E+02	3.94E+02	3.94E+02	3.94E+02
ru 99	1.62E-02	1.95E-02	2.27E-02	2.59E-02	2.91E-02	3.24E-02	3.56E-02

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ce 14x14 45 gwd/mtu pwr 2.1 wt%: 15 year cooled fission products

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 7.59E+13n/cm**2-sec

0 nuclide concentrations, grams

basis =single reactor assembly

	initial	912.5 d	1825.0 d	2737.5 d	3650.0 d	4562.5 d	5475.0 d
mo100	4.99E+02	4.99E+02	4.99E+02	4.99E+02	4.99E+02	4.99E+02	4.99E+02
ru100	7.82E+01	7.82E+01	7.82E+01	7.82E+01	7.82E+01	7.82E+01	7.82E+01
ru101	4.12E+02	4.12E+02	4.12E+02	4.12E+02	4.12E+02	4.12E+02	4.12E+02
ru102	4.45E+02	4.45E+02	4.45E+02	4.45E+02	4.45E+02	4.45E+02	4.45E+02
rh102	7.32E-04	4.03E-04	2.22E-04	1.22E-04	6.72E-05	3.70E-05	2.04E-05
rh103	2.10E+02	2.35E+02	2.35E+02	2.35E+02	2.35E+02	2.35E+02	2.35E+02
ru104	3.55E+02	3.55E+02	3.55E+02	3.55E+02	3.55E+02	3.55E+02	3.55E+02
pd104	1.88E+02	1.88E+02	1.88E+02	1.88E+02	1.88E+02	1.88E+02	1.88E+02
pd105	2.47E+02	2.47E+02	2.47E+02	2.47E+02	2.47E+02	2.47E+02	2.47E+02

ru106	1.15E+02	2.10E+01	3.83E+00	6.99E-01	1.27E-01	2.32E-02	4.24E-03
pd106	1.80E+02	2.74E+02	2.91E+02	2.95E+02	2.95E+02	2.95E+02	2.95E+02
pd107	1.74E+02	1.74E+02	1.74E+02	1.74E+02	1.74E+02	1.74E+02	1.74E+02
ag107	2.18E-05	6.81E-05	1.14E-04	1.61E-04	2.07E-04	2.53E-04	2.99E-04
pd108	1.17E+02	1.17E+02	1.17E+02	1.17E+02	1.17E+02	1.17E+02	1.17E+02
ag108m	1.87E-04	1.84E-04	1.82E-04	1.79E-04	1.77E-04	1.75E-04	1.72E-04
cd108	1.90E-04	1.91E-04	1.91E-04	1.91E-04	1.91E-04	1.91E-04	1.92E-04
ag109	6.25E+01	6.26E+01	6.26E+01	6.26E+01	6.26E+01	6.26E+01	6.26E+01
pd110	3.51E+01	3.51E+01	3.51E+01	3.51E+01	3.51E+01	3.51E+01	3.51E+01
ag110m	7.79E-01	6.19E-02	4.92E-03	3.91E-04	3.11E-05	2.47E-06	1.96E-07
cd110	4.31E+01	4.38E+01	4.39E+01	4.39E+01	4.39E+01	4.39E+01	4.39E+01
cd111	1.86E+01	1.89E+01	1.89E+01	1.89E+01	1.89E+01	1.89E+01	1.89E+01
cd112	9.37E+00	9.38E+00	9.38E+00	9.38E+00	9.38E+00	9.38E+00	9.38E+00
cd113	2.68E-02	2.86E-02	2.86E-02	2.87E-02	2.87E-02	2.87E-02	2.87E-02
cd113m	1.05E-01	9.27E-02	8.20E-02	7.25E-02	6.41E-02	5.67E-02	5.02E-02
in113	5.65E-03	1.77E-02	2.84E-02	3.79E-02	4.63E-02	5.37E-02	6.02E-02
cd114	8.52E+00	8.52E+00	8.52E+00	8.52E+00	8.52E+00	8.52E+00	8.52E+00
sn114	4.01E-04	4.68E-04	4.68E-04	4.68E-04	4.68E-04	4.68E-04	4.68E-04
in115	7.11E-01	7.30E-01	7.30E-01	7.30E-01	7.30E-01	7.30E-01	7.30E-01
sn115	1.09E-01	1.10E-01	1.10E-01	1.10E-01	1.10E-01	1.10E-01	1.10E-01
cd116	3.07E+00	3.07E+00	3.07E+00	3.07E+00	3.07E+00	3.07E+00	3.07E+00
sn116	1.75E+00	1.75E+00	1.75E+00	1.75E+00	1.75E+00	1.75E+00	1.75E+00
sn117	3.07E+00	3.07E+00	3.07E+00	3.07E+00	3.07E+00	3.07E+00	3.07E+00
sn118	2.38E+00	2.38E+00	2.38E+00	2.38E+00	2.38E+00	2.38E+00	2.38E+00
sn119	2.47E+00	2.48E+00	2.48E+00	2.48E+00	2.48E+00	2.48E+00	2.48E+00
sn120	2.42E+00	2.42E+00	2.42E+00	2.42E+00	2.42E+00	2.42E+00	2.42E+00
sn121	4.37E-03	1.23E-06	1.19E-06	1.16E-06	1.12E-06	1.09E-06	1.05E-06
sn121m	2.92E-02	2.83E-02	2.74E-02	2.65E-02	2.57E-02	2.49E-02	2.41E-02
sb121	2.32E+00	2.33E+00	2.33E+00	2.33E+00	2.33E+00	2.33E+00	2.33E+00
sn122	3.13E+00	3.13E+00	3.13E+00	3.13E+00	3.13E+00	3.13E+00	3.13E+00
te122	2.14E-01	2.16E-01	2.16E-01	2.16E-01	2.16E-01	2.16E-01	2.16E-01
sb123	2.71E+00	2.75E+00	2.75E+00	2.75E+00	2.75E+00	2.75E+00	2.75E+00
te123	1.91E-03	2.74E-03	2.74E-03	2.74E-03	2.74E-03	2.74E-03	2.74E-03
sn124	5.21E+00	5.21E+00	5.21E+00	5.21E+00	5.21E+00	5.21E+00	5.21E+00
te124	1.65E-01	1.97E-01	1.97E-01	1.97E-01	1.97E-01	1.97E-01	1.97E-01
sb125	4.65E+00	2.48E+00	1.31E+00	6.97E-01	3.70E-01	1.96E-01	1.04E-01
te125	1.79E+00	4.01E+00	5.19E+00	5.82E+00	6.15E+00	6.33E+00	6.42E+00
te125m	5.91E-02	3.52E-02	1.87E-02	9.90E-03	5.25E-03	2.79E-03	1.48E-03
sn126	1.28E+01	1.28E+01	1.28E+01	1.28E+01	1.28E+01	1.28E+01	1.28E+01
te126	2.68E-01	2.72E-01	2.72E-01	2.72E-01	2.72E-01	2.73E-01	2.73E-01
i127	2.60E+01	2.70E+01	2.70E+01	2.70E+01	2.70E+01	2.70E+01	2.70E+01
te128	5.28E+01	5.28E+01	5.28E+01	5.28E+01	5.28E+01	5.28E+01	5.28E+01
xe128	2.23E+00	2.23E+00	2.23E+00	2.23E+00	2.23E+00	2.23E+00	2.23E+00

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ce 14x14 45 gwd/mtu pwr 2.1 wt%: 15 year cooled fission products

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 7.59E+13n/cm**2-sec

0 nuclide concentrations, grams

basis =single reactor assembly

	initial	912.5 d	1825.0 d	2737.5 d	3650.0 d	4562.5 d	5475.0 d
i129	1.00E+02	1.01E+02	1.01E+02	1.01E+02	1.01E+02	1.01E+02	1.01E+02
xe129	2.32E-02	2.38E-02	2.38E-02	2.38E-02	2.38E-02	2.38E-02	2.38E-02
te130	1.98E+02	1.98E+02	1.98E+02	1.98E+02	1.98E+02	1.98E+02	1.98E+02
xe130	7.85E+00	7.86E+00	7.86E+00	7.86E+00	7.86E+00	7.86E+00	7.86E+00
xe131	1.90E+02	1.94E+02	1.94E+02	1.94E+02	1.94E+02	1.94E+02	1.94E+02
xe132	6.41E+02	6.43E+02	6.43E+02	6.43E+02	6.43E+02	6.43E+02	6.43E+02
ba132	1.56E-04	1.59E-04	1.59E-04	1.59E-04	1.59E-04	1.59E-04	1.59E-04
cs133	5.59E+02	5.65E+02	5.65E+02	5.65E+02	5.65E+02	5.65E+02	5.65E+02
xe134	7.96E+02	7.96E+02	7.96E+02	7.96E+02	7.96E+02	7.96E+02	7.96E+02
cs134	8.19E+01	3.53E+01	1.53E+01	6.59E+00	2.85E+00	1.23E+00	5.30E-01
ba134	3.19E+01	7.84E+01	9.85E+01	1.07E+02	1.11E+02	1.13E+02	1.13E+02
cs135	1.26E+02	1.26E+02	1.26E+02	1.26E+02	1.26E+02	1.26E+02	1.26E+02
ba135	3.46E-01	3.46E-01	3.46E-01	3.46E-01	3.46E-01	3.47E-01	3.47E-01
xe136	1.31E+03	1.31E+03	1.31E+03	1.31E+03	1.31E+03	1.31E+03	1.31E+03
ba136	1.00E+01	1.04E+01	1.04E+01	1.04E+01	1.04E+01	1.04E+01	1.04E+01
cs137	6.62E+02	6.25E+02	5.90E+02	5.57E+02	5.25E+02	4.96E+02	4.68E+02
ba137	2.47E+01	6.18E+01	9.69E+01	1.30E+02	1.61E+02	1.91E+02	2.18E+02
ba137m	1.02E-04	9.54E-05	9.01E-05	8.50E-05	8.02E-05	7.57E-05	7.15E-05
ba138	6.67E+02	6.67E+02	6.67E+02	6.67E+02	6.67E+02	6.67E+02	6.67E+02
la138	4.80E-03	4.80E-03	4.80E-03	4.80E-03	4.80E-03	4.80E-03	4.80E-03
la139	6.17E+02	6.17E+02	6.17E+02	6.17E+02	6.17E+02	6.17E+02	6.17E+02
ce140	6.56E+02	6.68E+02	6.68E+02	6.68E+02	6.68E+02	6.68E+02	6.68E+02
pr141	5.43E+02	5.66E+02	5.66E+02	5.66E+02	5.66E+02	5.66E+02	5.66E+02
ce142	5.78E+02	5.78E+02	5.78E+02	5.78E+02	5.78E+02	5.78E+02	5.78E+02
nd142	1.87E+01	1.88E+01	1.88E+01	1.88E+01	1.88E+01	1.88E+01	1.88E+01
nd143	2.75E+02	2.84E+02	2.84E+02	2.84E+02	2.84E+02	2.84E+02	2.84E+02
ce144	1.57E+02	1.70E+01	1.85E+00	2.01E-01	2.18E-02	2.37E-03	2.58E-04
nd144	6.07E+02	7.46E+02	7.61E+02	7.63E+02	7.63E+02	7.63E+02	7.63E+02
nd145	3.15E+02	3.16E+02	3.16E+02	3.16E+02	3.16E+02	3.16E+02	3.16E+02
pm145	1.24E-05	1.19E-05	1.09E-05	9.90E-06	8.98E-06	8.14E-06	7.38E-06
nd146	3.79E+02	3.79E+02	3.79E+02	3.79E+02	3.79E+02	3.79E+02	3.79E+02
pm146	4.27E-03	3.13E-03	2.29E-03	1.67E-03	1.22E-03	8.93E-04	6.53E-04
sm146	3.41E-03	3.80E-03	4.08E-03	4.29E-03	4.44E-03	4.55E-03	4.64E-03
pm147	6.79E+01	3.69E+01	1.91E+01	9.85E+00	5.09E+00	2.63E+00	1.36E+00
sm147	2.97E+01	6.42E+01	8.20E+01	9.12E+01	9.60E+01	9.84E+01	9.97E+01
nd148	1.94E+02	1.94E+02	1.94E+02	1.94E+02	1.94E+02	1.94E+02	1.94E+02
sm148	7.17E+01	7.26E+01	7.26E+01	7.26E+01	7.26E+01	7.26E+01	7.26E+01
sm149	5.96E-01	1.36E+00	1.36E+00	1.36E+00	1.36E+00	1.36E+00	1.36E+00
nd150	1.03E+02	1.03E+02	1.03E+02	1.03E+02	1.03E+02	1.03E+02	1.03E+02
sm150	1.63E+02	1.63E+02	1.63E+02	1.63E+02	1.63E+02	1.63E+02	1.63E+02
sm151	5.35E+00	5.38E+00	5.28E+00	5.18E+00	5.08E+00	4.98E+00	4.89E+00
eu151	2.98E-03	1.08E-01	2.10E-01	3.11E-01	4.09E-01	5.06E-01	6.01E-01
sm152	7.05E+01	7.05E+01	7.05E+01	7.05E+01	7.05E+01	7.05E+01	7.05E+01
eu152	8.06E-03	7.08E-03	6.21E-03	5.46E-03	4.79E-03	4.21E-03	3.70E-03
gd152	1.95E-02	1.98E-02	2.00E-02	2.02E-02	2.04E-02	2.06E-02	2.07E-02
eu153	7.40E+01	7.47E+01	7.47E+01	7.47E+01	7.47E+01	7.47E+01	7.47E+01
sm154	2.53E+01	2.53E+01	2.53E+01	2.53E+01	2.53E+01	2.53E+01	2.53E+01

eu154	1.24E+01	1.01E+01	8.28E+00	6.77E+00	5.53E+00	4.52E+00	3.70E+00
gd154	1.05E+00	3.32E+00	5.17E+00	6.68E+00	7.91E+00	8.92E+00	9.75E+00
eu155	3.63E+00	2.50E+00	1.73E+00	1.20E+00	8.25E-01	5.70E-01	3.94E-01
gd155	1.50E-02	1.14E+00	1.91E+00	2.45E+00	2.82E+00	3.07E+00	3.25E+00
gd156	7.85E+01	8.25E+01	8.25E+01	8.25E+01	8.25E+01	8.25E+01	8.25E+01

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ce 14x14 45 gwd/mtu pwr 2.1 wt%: 15 year cooled fission products

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 7.59E+13n/cm**2-sec

0 nuclide concentrations, grams

basis =single reactor assembly

	initial	912.5 d	1825.0 d	2737.5 d	3650.0 d	4562.5 d	5475.0 d
gd157	5.26E-02	7.27E-02	7.27E-02	7.27E-02	7.27E-02	7.27E-02	7.27E-02
gd158	1.84E+01	1.84E+01	1.84E+01	1.84E+01	1.84E+01	1.84E+01	1.84E+01
tb159	1.92E+00	1.93E+00	1.93E+00	1.93E+00	1.93E+00	1.93E+00	1.93E+00
gd160	8.28E-01	8.28E-01	8.28E-01	8.28E-01	8.28E-01	8.28E-01	8.28E-01
dy160	1.82E-01	2.62E-01	2.62E-01	2.62E-01	2.62E-01	2.62E-01	2.62E-01
dy161	2.40E-01	2.48E-01	2.48E-01	2.48E-01	2.48E-01	2.48E-01	2.48E-01
dy162	2.44E-01	2.44E-01	2.44E-01	2.44E-01	2.44E-01	2.44E-01	2.44E-01
dy163	2.29E-01	2.29E-01	2.29E-01	2.29E-01	2.29E-01	2.29E-01	2.29E-01
dy164	3.72E-02	3.72E-02	3.72E-02	3.72E-02	3.72E-02	3.72E-02	3.72E-02
ho165	1.06E-01	1.06E-01	1.06E-01	1.06E-01	1.06E-01	1.06E-01	1.06E-01
ho166m	4.77E-04	4.76E-04	4.75E-04	4.75E-04	4.74E-04	4.73E-04	4.73E-04
er166	2.97E-02	2.99E-02	2.99E-02	2.99E-02	2.99E-02	2.99E-02	2.99E-02
er167	6.53E-04	6.53E-04	6.53E-04	6.53E-04	6.53E-04	6.53E-04	6.53E-04
er168	1.36E-03	1.36E-03	1.36E-03	1.36E-03	1.36E-03	1.36E-03	1.36E-03
tm169	2.40E-06	2.45E-06	2.45E-06	2.45E-06	2.45E-06	2.45E-06	2.45E-06
er170	2.71E-06	2.71E-06	2.71E-06	2.71E-06	2.71E-06	2.71E-06	2.71E-06
yb171	1.21E-06	2.58E-06	3.14E-06	3.36E-06	3.46E-06	3.49E-06	3.51E-06
yb172	2.35E-06	2.37E-06	2.37E-06	2.37E-06	2.37E-06	2.37E-06	2.37E-06
total	1.80E+04	1.80E+04	1.80E+04	1.80E+04	1.80E+04	1.80E+04	1.80E+04

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ce 14x14 45 gwd/mtu pwr 2.1 wt%: 15 year cooled fission products

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 7.59E+13n/cm**2-sec

0 element radioactivity, curies

basis =single reactor assembly

	initial	912.5 d	1825.0 d	2737.5 d	3650.0 d	4562.5 d	5475.0 d
h	2.66E+02	2.31E+02	2.01E+02	1.74E+02	1.52E+02	1.32E+02	1.14E+02
be	1.54E-06	1.54E-06	1.54E-06	1.54E-06	1.54E-06	1.54E-06	1.54E-06
c	6.21E-05	6.21E-05	6.21E-05	6.20E-05	6.20E-05	6.20E-05	6.20E-05
se	3.15E+05	3.39E-02	3.39E-02	3.39E-02	3.39E-02	3.39E-02	3.39E-02
kr	1.20E+06	3.33E+03	2.83E+03	2.41E+03	2.05E+03	1.74E+03	1.48E+03
rb	1.87E+06	9.03E-06	9.03E-06	9.03E-06	9.03E-06	9.03E-06	9.03E-06
sr	3.14E+06	3.08E+04	2.89E+04	2.72E+04	2.56E+04	2.41E+04	2.26E+04
y	4.34E+06	3.08E+04	2.89E+04	2.72E+04	2.56E+04	2.41E+04	2.26E+04
zr	4.20E+06	3.26E+01	5.60E-01	5.58E-01	5.58E-01	5.58E-01	5.58E-01

nb	6.44E+06	7.10E+01	1.44E-01	1.83E-01	2.21E-01	2.55E-01	2.86E-01
tc	5.67E+06	6.74E+00	6.74E+00	6.74E+00	6.74E+00	6.74E+00	6.74E+00
ru	2.81E+06	6.97E+04	1.27E+04	2.32E+03	4.23E+02	7.71E+01	1.41E+01
rh	3.86E+06	6.97E+04	1.27E+04	2.32E+03	4.23E+02	7.71E+01	1.41E+01
pd	3.67E+05	8.93E-02	8.93E-02	8.93E-02	8.93E-02	8.93E-02	8.93E-02
ag	5.84E+05	2.98E+02	2.37E+01	1.89E+00	1.55E-01	1.68E-02	5.83E-03
cd	4.72E+04	2.08E+01	1.84E+01	1.63E+01	1.44E+01	1.27E+01	1.13E+01
sn	6.35E+05	1.16E+01	3.73E+00	2.98E+00	2.83E+00	2.74E+00	2.67E+00
sb	1.60E+06	2.60E+03	1.38E+03	7.31E+02	3.88E+02	2.06E+02	1.09E+02
te	3.49E+06	6.83E+02	3.37E+02	1.78E+02	9.46E+01	5.02E+01	2.66E+01
i	5.17E+06	1.79E-02	1.79E-02	1.79E-02	1.79E-02	1.79E-02	1.79E-02
cs	3.32E+06	1.00E+05	7.11E+04	5.70E+04	4.94E+04	4.48E+04	4.14E+04
ba	3.91E+06	5.13E+04	4.85E+04	4.57E+04	4.32E+04	4.08E+04	3.85E+04
ce	3.11E+06	5.42E+04	5.89E+03	6.40E+02	6.95E+01	7.56E+00	8.21E-01
pr	2.74E+06	5.50E+04	5.97E+03	6.49E+02	7.05E+01	7.66E+00	8.32E-01
pm	7.56E+05	3.42E+04	1.77E+04	9.14E+03	4.72E+03	2.44E+03	1.26E+03
sm	3.77E+05	1.42E+02	1.39E+02	1.36E+02	1.34E+02	1.31E+02	1.29E+02
eu	2.62E+05	3.98E+03	3.09E+03	2.42E+03	1.90E+03	1.50E+03	1.19E+03
gd	5.73E+03	5.27E-01	3.84E-02	2.80E-03	2.04E-04	1.49E-05	1.09E-06
ho	1.30E+02	8.55E-04	8.53E-04	8.52E-04	8.51E-04	8.50E-04	8.49E-04
tm	5.81E-03	1.02E-03	4.15E-04	1.68E-04	6.83E-05	2.77E-05	1.13E-05
totals	7.42E+07	5.07E+05	2.40E+05	1.78E+05	1.54E+05	1.40E+05	1.30E+05

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ce 14x14 45 gwd/mtu pwr 2.1 wt%: 15 year cooled fission products

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 7.59E+13n/cm**2-sec

0 element thermal power, watts

basis =single reactor assembly

	initial	912.5 d	1825.0 d	2737.5 d	3650.0 d	4562.5 d	5475.0 d
h	8.97E-03	7.79E-03	6.77E-03	5.88E-03	5.11E-03	4.44E-03	3.86E-03
c	1.82E-08	1.82E-08	1.82E-08	1.82E-08	1.82E-08	1.82E-08	1.82E-08
se	5.46E+03	1.06E-05	1.06E-05	1.06E-05	1.06E-05	1.06E-05	1.06E-05
kr	1.93E+04	4.99E+00	4.25E+00	3.61E+00	3.07E+00	2.62E+00	2.23E+00
sr	4.72E+04	3.57E+01	3.36E+01	3.16E+01	2.97E+01	2.79E+01	2.63E+01
y	7.51E+04	1.70E+02	1.60E+02	1.51E+02	1.42E+02	1.33E+02	1.25E+02
zr	4.34E+04	1.61E-01	7.11E-05	6.29E-05	6.29E-05	6.29E-05	6.29E-05
nb	9.53E+04	3.39E-01	4.20E-05	3.20E-05	3.85E-05	4.44E-05	4.97E-05
tc	7.17E+04	3.38E-03	3.38E-03	3.38E-03	3.38E-03	3.38E-03	3.38E-03
ru	1.56E+04	4.15E+00	7.56E-01	1.38E-01	2.51E-02	4.58E-03	8.36E-04
rh	2.03E+04	6.68E+02	1.22E+02	2.22E+01	4.05E+00	7.39E-01	1.35E-01
pd	1.11E+03	4.92E-06	4.92E-06	4.92E-06	4.92E-06	4.92E-06	4.92E-06
ag	2.33E+03	4.94E+00	3.92E-01	3.12E-02	2.52E-03	2.43E-04	6.06E-05
cd	5.40E+02	2.26E-02	2.00E-02	1.77E-02	1.57E-02	1.38E-02	1.22E-02
sn	8.40E+03	1.18E-02	2.12E-03	1.70E-03	1.62E-03	1.59E-03	1.55E-03
sb	2.93E+04	8.22E+00	4.36E+00	2.32E+00	1.23E+00	6.55E-01	3.50E-01
te	3.31E+04	5.80E-01	2.83E-01	1.50E-01	7.97E-02	4.22E-02	2.24E-02
i	7.65E+04	8.38E-06	8.38E-06	8.38E-06	8.38E-06	8.38E-06	8.38E-06
cs	5.98E+04	5.27E+02	2.58E+02	1.41E+02	8.84E+01	6.42E+01	5.23E+01

ba	3.35E+04	2.02E+02	1.90E+02	1.80E+02	1.70E+02	1.60E+02	1.51E+02
ce	1.45E+04	3.55E+01	3.86E+00	4.19E-01	4.55E-02	4.94E-03	5.37E-04
pr	2.25E+04	3.98E+02	4.33E+01	4.70E+00	5.11E-01	5.55E-02	6.03E-03
pm	3.88E+03	1.26E+01	6.50E+00	3.36E+00	1.74E+00	8.98E-01	4.65E-01
sm	8.95E+02	1.67E-02	1.63E-02	1.60E-02	1.57E-02	1.54E-02	1.51E-02
eu	2.46E+03	2.58E+01	2.10E+01	1.71E+01	1.39E+01	1.13E+01	9.24E+00
gd	1.62E+01	4.63E-04	3.37E-05	2.46E-06	1.79E-07	1.31E-08	9.54E-10
ho	5.58E-01	8.99E-06	8.97E-06	8.96E-06	8.95E-06	8.94E-06	8.92E-06
totals	8.94E+05	2.10E+03	8.49E+02	5.57E+02	4.54E+02	4.02E+02	3.67E+02

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ce 14x14 45 gwd/mtu pwr 2.1 wt%: 15 year cooled fission products

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 7.59E+13n/cm**2-sec

0 nuclide gamma power, watts

basis =single reactor assembly

	initial	912.5 d	1825.0 d	2737.5 d	3650.0 d	4562.5 d	5475.0 d
kr 85	5.17E-02	4.40E-02	3.74E-02	3.18E-02	2.71E-02	2.31E-02	1.96E-02
y 90	3.57E-04	3.10E-04	2.92E-04	2.74E-04	2.58E-04	2.42E-04	2.28E-04
nb 93m	4.45E-07	1.03E-06	1.56E-06	2.04E-06	2.46E-06	2.84E-06	3.19E-06
nb 94	5.23E-07	5.23E-07	5.23E-07	5.23E-07	5.23E-07	5.23E-07	5.23E-07
tc 98	3.03E-08	3.03E-08	3.03E-08	3.03E-08	3.03E-08	3.03E-08	3.03E-08
tc 99	2.47E-08	2.48E-08	2.48E-08	2.48E-08	2.48E-08	2.48E-08	2.48E-08
rh102	1.13E-02	6.24E-03	3.43E-03	1.89E-03	1.04E-03	5.73E-04	3.15E-04
rh106	5.49E+02	8.52E+01	1.55E+01	2.83E+00	5.16E-01	9.41E-02	1.72E-02
ag108	8.15E-05	4.56E-08	4.50E-08	4.44E-08	4.38E-08	4.32E-08	4.26E-08
ag108m	4.68E-05	4.62E-05	4.56E-05	4.49E-05	4.43E-05	4.37E-05	4.31E-05
ag110	3.00E+01	7.29E-04	5.79E-05	4.60E-06	3.66E-07	2.91E-08	2.31E-09
ag110m	6.01E+01	4.78E+00	3.80E-01	3.02E-02	2.40E-03	1.91E-04	1.52E-05
cd113m	9.86E-06	8.72E-06	7.71E-06	6.82E-06	6.03E-06	5.34E-06	4.72E-06
sn119m	3.72E-03	4.30E-04	4.97E-05	5.74E-06	6.63E-07	7.66E-08	8.84E-09
sn121m	4.65E-05	4.50E-05	4.36E-05	4.23E-05	4.10E-05	3.97E-05	3.85E-05
sb125	1.25E+01	6.69E+00	3.55E+00	1.88E+00	9.97E-01	5.29E-01	2.80E-01
te125m	2.25E-01	1.34E-01	7.10E-02	3.77E-02	2.00E-02	1.06E-02	5.62E-03
sn126	2.81E-04	2.81E-04	2.81E-04	2.81E-04	2.81E-04	2.81E-04	2.81E-04
sb126	4.19E+00	8.31E-04	8.31E-04	8.31E-04	8.30E-04	8.30E-04	8.30E-04
sb126m	2.75E+00	3.35E-03	3.35E-03	3.35E-03	3.35E-03	3.35E-03	3.35E-03
i129	2.59E-06	2.61E-06	2.61E-06	2.61E-06	2.61E-06	2.61E-06	2.61E-06
ba133	4.74E-08	4.02E-08	3.41E-08	2.89E-08	2.45E-08	2.08E-08	1.76E-08
cs134	9.77E+02	4.22E+02	1.82E+02	7.86E+01	3.39E+01	1.47E+01	6.33E+00
ba137m	1.95E+02	1.82E+02	1.72E+02	1.62E+02	1.53E+02	1.45E+02	1.37E+02
ce144	5.62E+01	6.11E+00	6.63E-01	7.21E-02	7.83E-03	8.51E-04	9.24E-05
pr144	8.66E+01	9.29E+00	1.01E+00	1.10E-01	1.19E-02	1.29E-03	1.41E-04
pr144m	5.20E-01	5.63E-02	6.11E-03	6.64E-04	7.21E-05	7.84E-06	8.52E-07
pm145	3.30E-07	3.18E-07	2.91E-07	2.64E-07	2.40E-07	2.17E-07	1.97E-07
pm146	8.43E-03	6.16E-03	4.51E-03	3.30E-03	2.41E-03	1.76E-03	1.29E-03
pm147	1.64E-03	8.88E-04	4.59E-04	2.37E-04	1.23E-04	6.34E-05	3.27E-05
eu150	5.28E-08	5.03E-08	4.80E-08	4.57E-08	4.35E-08	4.15E-08	3.95E-08
sm151	1.18E-05	1.19E-05	1.17E-05	1.15E-05	1.13E-05	1.10E-05	1.08E-05

ce 14x14 45 gwd/mtu pwr 2.7 wt%: 6 year cooled light elements
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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 6.31E+13n/cm**2-sec
0 element thermal power, watts
basis =single reactor assembly

	initial	365.0 d	730.0 d	1095.0 d	1460.0 d	1825.0 d	2190.0 d
mn	7.65E+02	2.04E-01	9.06E-02	4.03E-02	1.79E-02	7.97E-03	3.54E-03
fe	3.55E-01	1.62E-02	1.17E-02	9.07E-03	7.04E-03	5.46E-03	4.24E-03
co	4.73E+00	3.31E+00	2.88E+00	2.53E+00	2.22E+00	1.94E+00	1.70E+00
ni	1.71E-01	1.29E-03	1.28E-03	1.27E-03	1.26E-03	1.25E-03	1.24E-03
cd	3.51E-04	7.66E-08	1.22E-08	1.14E-08	1.08E-08	1.03E-08	9.82E-09
in	2.67E+00	2.08E-01	2.27E-02	2.52E-03	2.80E-04	3.11E-05	3.45E-06
sn	2.29E+01	1.20E+00	4.82E-01	2.00E-01	8.39E-02	3.55E-02	1.51E-02
sb	3.80E+00	1.24E+00	9.59E-01	7.44E-01	5.77E-01	4.48E-01	3.47E-01
te	9.67E-02	8.07E-02	6.24E-02	4.84E-02	3.75E-02	2.91E-02	2.26E-02
totals	8.01E+02	6.26E+00	4.51E+00	3.57E+00	2.94E+00	2.47E+00	2.10E+00

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ce 14x14 45 gwd/mtu pwr 2.7 wt%: 6 year cooled light elements
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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 6.31E+13n/cm**2-sec
0 element gamma power, watts
basis =single reactor assembly

	initial	365.0 d	730.0 d	1095.0 d	1460.0 d	1825.0 d	2190.0 d
mn	5.13E+02	2.03E-01	9.02E-02	4.01E-02	1.78E-02	7.93E-03	3.53E-03
fe	3.11E-01	5.42E-03	3.40E-03	2.64E-03	2.05E-03	1.59E-03	1.23E-03
co	4.38E+00	3.19E+00	2.78E+00	2.43E+00	2.13E+00	1.87E+00	1.64E+00
ni	7.86E-02	1.51E-06	1.51E-06	1.51E-06	1.51E-06	1.51E-06	1.51E-06
in	1.28E+00	1.36E-01	1.51E-02	1.67E-03	1.86E-04	2.06E-05	2.29E-06
sn	8.14E+00	1.59E-01	6.28E-02	2.60E-02	1.09E-02	4.61E-03	1.95E-03
sb	2.47E+00	1.01E+00	7.80E-01	6.05E-01	4.70E-01	3.64E-01	2.83E-01
te	2.58E-02	2.04E-02	1.57E-02	1.21E-02	9.41E-03	7.30E-03	5.66E-03
totals	5.30E+02	4.72E+00	3.74E+00	3.12E+00	2.64E+00	2.26E+00	1.94E+00

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ce 14x14 45 gwd/mtu pwr 2.7 wt%: 6 year cooled actinides
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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 6.31E+13n/cm**2-sec
0 nuclide concentrations, gram atoms
basis = single reactor assembly

	initial	365.0 d	730.0 d	1095.0 d	1460.0 d	1825.0 d	2190.0 d
he 4	6.35E-02	1.03E-01	1.20E-01	1.34E-01	1.46E-01	1.57E-01	1.69E-01
th232	3.94E-07	5.81E-07	7.67E-07	9.54E-07	1.14E-06	1.33E-06	1.51E-06
u232	3.52E-07	7.48E-07	1.06E-06	1.29E-06	1.48E-06	1.61E-06	1.72E-06
u233	4.82E-07	7.95E-07	1.11E-06	1.42E-06	1.73E-06	2.05E-06	2.36E-06
u234	3.41E-03	6.70E-03	1.01E-02	1.34E-02	1.68E-02	2.01E-02	2.34E-02
u235	4.15E+00	4.15E+00	4.15E+00	4.15E+00	4.15E+00	4.15E+00	4.15E+00
u236	6.30E+00	6.30E+00	6.31E+00	6.31E+00	6.31E+00	6.31E+00	6.31E+00

u238	1.59E+03	1.59E+03	1.59E+03	1.59E+03	1.59E+03	1.59E+03	1.59E+03
np236	1.85E-06	1.85E-06	1.85E-06	1.85E-06	1.85E-06	1.85E-06	1.85E-06
np237	8.54E-01	8.74E-01	8.75E-01	8.75E-01	8.76E-01	8.77E-01	8.78E-01
pu238	3.98E-01	4.26E-01	4.28E-01	4.26E-01	4.23E-01	4.19E-01	4.16E-01
pu239	7.34E+00	7.54E+00	7.54E+00	7.54E+00	7.54E+00	7.54E+00	7.54E+00
pu240	4.48E+00	4.49E+00	4.50E+00	4.50E+00	4.51E+00	4.52E+00	4.52E+00
pu241	2.32E+00	2.21E+00	2.10E+00	2.00E+00	1.91E+00	1.82E+00	1.73E+00
pu242	1.84E+00	1.84E+00	1.84E+00	1.84E+00	1.84E+00	1.84E+00	1.84E+00
am241	5.75E-02	1.66E-01	2.70E-01	3.69E-01	4.62E-01	5.51E-01	6.36E-01
am242m	1.07E-03	1.07E-03	1.06E-03	1.06E-03	1.05E-03	1.05E-03	1.04E-03
am243	4.79E-01	4.79E-01	4.79E-01	4.79E-01	4.79E-01	4.79E-01	4.79E-01
cm242	3.43E-02	7.30E-03	1.55E-03	3.30E-04	7.20E-05	1.74E-05	5.82E-06
cm243	1.11E-03	1.09E-03	1.06E-03	1.03E-03	1.01E-03	9.86E-04	9.62E-04
cm244	2.07E-01	2.00E-01	1.92E-01	1.85E-01	1.78E-01	1.71E-01	1.65E-01
cm245	6.63E-03	6.63E-03	6.63E-03	6.63E-03	6.63E-03	6.63E-03	6.63E-03
cm246	1.84E-03	1.84E-03	1.84E-03	1.84E-03	1.84E-03	1.84E-03	1.84E-03
cm247	3.83E-05	3.83E-05	3.83E-05	3.83E-05	3.83E-05	3.83E-05	3.83E-05
cm248	4.84E-06	4.84E-06	4.84E-06	4.84E-06	4.84E-06	4.85E-06	4.85E-06
total	1.62E+03	1.62E+03	1.62E+03	1.62E+03	1.62E+03	1.62E+03	1.62E+03

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ce 14x14 45 gwd/mtu pwr 2.7 wt%: 6 year cooled actinides

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 6.31E+13n/cm**2-sec

0 element concentrations, gram atoms

basis = single reactor assembly

	initial	365.0 d	730.0 d	1095.0 d	1460.0 d	1825.0 d	2190.0 d
he	6.35E-02	1.03E-01	1.20E-01	1.34E-01	1.46E-01	1.57E-01	1.69E-01
th	4.30E-07	6.35E-07	8.50E-07	1.08E-06	1.31E-06	1.56E-06	1.81E-06
u	1.60E+03	1.60E+03	1.60E+03	1.60E+03	1.60E+03	1.60E+03	1.60E+03
np	1.06E+00	8.74E-01	8.75E-01	8.75E-01	8.76E-01	8.77E-01	8.78E-01
pu	1.64E+01	1.65E+01	1.64E+01	1.63E+01	1.62E+01	1.61E+01	1.61E+01
am	5.38E-01	6.47E-01	7.51E-01	8.49E-01	9.43E-01	1.03E+00	1.12E+00
cm	2.51E-01	2.17E-01	2.03E-01	1.95E-01	1.88E-01	1.81E-01	1.74E-01
totals	1.62E+03	1.62E+03	1.62E+03	1.62E+03	1.62E+03	1.62E+03	1.62E+03

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ce 14x14 45 gwd/mtu pwr 2.7 wt%: 6 year cooled actinides

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 6.31E+13n/cm**2-sec

0 nuclide concentrations, grams

basis =single reactor assembly

	initial	365.0 d	730.0 d	1095.0 d	1460.0 d	1825.0 d	2190.0 d
he 4	2.54E-01	4.11E-01	4.82E-01	5.34E-01	5.82E-01	6.29E-01	6.75E-01
pb208	1.15E-07	4.15E-07	1.10E-06	2.23E-06	3.84E-06	5.88E-06	8.32E-06
th228	4.94E-07	1.43E-06	2.74E-06	4.16E-06	5.54E-06	6.80E-06	7.91E-06
th230	2.19E-06	5.46E-06	1.09E-05	1.85E-05	2.83E-05	4.03E-05	5.44E-05
th232	9.15E-05	1.35E-04	1.78E-04	2.21E-04	2.65E-04	3.08E-04	3.51E-04
th234	5.50E-06	5.50E-06	5.50E-06	5.50E-06	5.50E-06	5.50E-06	5.50E-06

pa231	3.93E-06	4.88E-06	5.82E-06	6.77E-06	7.72E-06	8.67E-06	9.61E-06
pa233	6.86E-06	7.04E-06	7.04E-06	7.04E-06	7.05E-06	7.06E-06	7.06E-06
u232	8.17E-05	1.74E-04	2.45E-04	3.00E-04	3.42E-04	3.75E-04	3.99E-04
u233	1.12E-04	1.85E-04	2.58E-04	3.31E-04	4.04E-04	4.77E-04	5.51E-04
u234	7.97E-01	1.57E+00	2.36E+00	3.15E+00	3.93E+00	4.71E+00	5.48E+00
u235	9.75E+02	9.75E+02	9.75E+02	9.75E+02	9.75E+02	9.75E+02	9.75E+02
u236	1.49E+03	1.49E+03	1.49E+03	1.49E+03	1.49E+03	1.49E+03	1.49E+03
u237	4.74E+00	1.61E-05	1.54E-05	1.46E-05	1.39E-05	1.33E-05	1.27E-05
u238	3.79E+05	3.79E+05	3.79E+05	3.79E+05	3.79E+05	3.79E+05	3.79E+05
np236	4.37E-04	4.37E-04	4.37E-04	4.37E-04	4.37E-04	4.37E-04	4.37E-04
np237	2.02E+02	2.07E+02	2.07E+02	2.07E+02	2.08E+02	2.08E+02	2.08E+02
np239	4.75E+01	1.00E-04	1.00E-04	1.00E-04	1.00E-04	1.00E-04	1.00E-04
pu236	4.44E-04	3.51E-04	2.77E-04	2.18E-04	1.72E-04	1.35E-04	1.06E-04
pu238	9.47E+01	1.01E+02	1.02E+02	1.01E+02	1.01E+02	9.98E+01	9.90E+01
pu239	1.75E+03	1.80E+03	1.80E+03	1.80E+03	1.80E+03	1.80E+03	1.80E+03
pu240	1.08E+03	1.08E+03	1.08E+03	1.08E+03	1.08E+03	1.08E+03	1.09E+03
pu241	5.58E+02	5.32E+02	5.07E+02	4.83E+02	4.60E+02	4.38E+02	4.18E+02
pu242	4.45E+02	4.45E+02	4.45E+02	4.45E+02	4.45E+02	4.45E+02	4.45E+02
am241	1.38E+01	4.01E+01	6.51E+01	8.88E+01	1.11E+02	1.33E+02	1.53E+02
am242m	2.59E-01	2.58E-01	2.57E-01	2.56E-01	2.54E-01	2.53E-01	2.52E-01
am242	5.44E-02	3.33E-06	3.31E-06	3.30E-06	3.28E-06	3.27E-06	3.25E-06
am243	1.16E+02	1.17E+02	1.17E+02	1.16E+02	1.16E+02	1.16E+02	1.16E+02
cm242	8.29E+00	1.77E+00	3.74E-01	7.98E-02	1.74E-02	4.21E-03	1.41E-03
cm243	2.70E-01	2.64E-01	2.58E-01	2.51E-01	2.45E-01	2.40E-01	2.34E-01
cm244	5.05E+01	4.87E+01	4.69E+01	4.51E+01	4.34E+01	4.18E+01	4.02E+01
cm245	1.62E+00	1.62E+00	1.62E+00	1.62E+00	1.62E+00	1.62E+00	1.62E+00
cm246	4.54E-01	4.54E-01	4.54E-01	4.53E-01	4.53E-01	4.53E-01	4.53E-01
cm247	9.46E-03	9.46E-03	9.46E-03	9.46E-03	9.46E-03	9.46E-03	9.46E-03
cm248	1.20E-03	1.20E-03	1.20E-03	1.20E-03	1.20E-03	1.20E-03	1.20E-03
cf249	1.94E-06	1.25E-05	1.73E-05	1.94E-05	2.04E-05	2.08E-05	2.09E-05
cf250	4.13E-06	3.94E-06	3.74E-06	3.54E-06	3.36E-06	3.19E-06	3.02E-06
cf251	2.39E-06	2.39E-06	2.39E-06	2.39E-06	2.39E-06	2.38E-06	2.38E-06
total	3.85E+05	3.85E+05	3.85E+05	3.85E+05	3.85E+05	3.85E+05	3.85E+05

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ce 14x14 45 gwd/mtu pwr 2.7 wt%: 6 year cooled actinides

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 6.31E+13n/cm**2-sec

0 element concentrations, grams

basis =single reactor assembly

	initial	365.0 d	730.0 d	1095.0 d	1460.0 d	1825.0 d	2190.0 d
he	2.54E-01	4.11E-01	4.82E-01	5.34E-01	5.82E-01	6.29E-01	6.75E-01
pb	1.15E-07	4.16E-07	1.10E-06	2.24E-06	3.84E-06	5.89E-06	8.33E-06
th	9.97E-05	1.47E-04	1.97E-04	2.50E-04	3.04E-04	3.60E-04	4.19E-04
pa	1.08E-05	1.19E-05	1.29E-05	1.38E-05	1.48E-05	1.57E-05	1.67E-05
u	3.81E+05	3.81E+05	3.81E+05	3.81E+05	3.81E+05	3.81E+05	3.81E+05
np	2.51E+02	2.07E+02	2.07E+02	2.07E+02	2.08E+02	2.08E+02	2.08E+02
pu	3.93E+03	3.96E+03	3.94E+03	3.91E+03	3.89E+03	3.87E+03	3.85E+03
am	1.31E+02	1.57E+02	1.82E+02	2.06E+02	2.28E+02	2.50E+02	2.70E+02

cm	6.11E+01	5.28E+01	4.96E+01	4.75E+01	4.58E+01	4.41E+01	4.26E+01
cf	1.11E-05	2.09E-05	2.50E-05	2.65E-05	2.70E-05	2.71E-05	2.69E-05
totals	3.85E+05	3.85E+05	3.85E+05	3.85E+05	3.85E+05	3.85E+05	3.85E+05

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ce 14x14 45 gwd/mtu pwr 2.7 wt%: 6 year cooled actinides

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 6.31E+13n/cm**2-sec

0 element radioactivity, curies

basis =single reactor assembly

	initial	365.0 d	730.0 d	1095.0 d	1460.0 d	1825.0 d	2190.0 d
tl	1.46E-04	4.21E-04	8.08E-04	1.23E-03	1.64E-03	2.01E-03	2.34E-03
pb	4.07E-04	1.17E-03	2.25E-03	3.42E-03	4.56E-03	5.60E-03	6.51E-03
bi	4.07E-04	1.17E-03	2.25E-03	3.42E-03	4.56E-03	5.60E-03	6.51E-03
po	6.68E-04	1.92E-03	3.69E-03	5.61E-03	7.47E-03	9.18E-03	1.07E-02
rn	4.07E-04	1.17E-03	2.25E-03	3.42E-03	4.56E-03	5.60E-03	6.51E-03
ra	4.07E-04	1.17E-03	2.25E-03	3.42E-03	4.56E-03	5.60E-03	6.51E-03
th	1.40E-01	1.31E-01	1.32E-01	1.33E-01	1.34E-01	1.35E-01	1.36E-01
pa	2.83E-01	2.74E-01	2.74E-01	2.74E-01	2.74E-01	2.74E-01	2.74E-01
u	1.14E+07	1.56E+00	1.50E+00	1.45E+00	1.40E+00	1.35E+00	1.30E+00
np	1.13E+07	2.34E+01	2.34E+01	2.34E+01	2.34E+01	2.34E+01	2.34E+01
pu	4.53E+05	5.71E+04	5.45E+04	5.20E+04	4.97E+04	4.74E+04	4.53E+04
am	2.13E+05	1.66E+02	2.52E+02	3.33E+02	4.11E+02	4.85E+02	5.55E+02
cm	3.16E+04	9.81E+03	5.05E+03	3.93E+03	3.59E+03	3.41E+03	3.28E+03
bk	1.38E-01	1.44E-02	6.53E-03	2.96E-03	1.34E-03	6.10E-04	2.76E-04
cf	2.08E-03	1.58E-03	1.32E-03	1.12E-03	9.52E-04	8.20E-04	7.15E-04
totals	2.34E+07	6.71E+04	5.98E+04	5.63E+04	5.37E+04	5.13E+04	4.91E+04

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ce 14x14 45 gwd/mtu pwr 2.7 wt%: 6 year cooled actinides

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 6.31E+13n/cm**2-sec

0 element thermal power, watts

basis =single reactor assembly

	initial	365.0 d	730.0 d	1095.0 d	1460.0 d	1825.0 d	2190.0 d
tl	3.42E-06	9.85E-06	1.89E-05	2.87E-05	3.83E-05	4.70E-05	5.47E-05
pb	7.70E-07	2.22E-06	4.25E-06	6.46E-06	8.61E-06	1.06E-05	1.23E-05
bi	6.82E-06	1.96E-05	3.76E-05	5.72E-05	7.63E-05	9.37E-05	1.09E-04
po	3.05E-05	8.78E-05	1.68E-04	2.56E-04	3.41E-04	4.19E-04	4.88E-04
rn	1.55E-05	4.45E-05	8.53E-05	1.30E-04	1.73E-04	2.12E-04	2.47E-04
ra	1.40E-05	4.02E-05	7.71E-05	1.17E-04	1.56E-04	1.92E-04	2.23E-04
th	9.39E-05	9.33E-05	1.28E-04	1.67E-04	2.04E-04	2.38E-04	2.68E-04
pa	1.09E-03	9.98E-04	9.98E-04	9.98E-04	9.99E-04	9.99E-04	9.99E-04
u	3.07E+04	8.84E-03	8.91E-03	8.98E-03	9.04E-03	9.10E-03	9.15E-03
np	2.94E+04	6.31E-02	6.31E-02	6.31E-02	6.31E-02	6.31E-02	6.30E-02
pu	5.20E+02	7.04E+01	7.07E+01	7.03E+01	6.98E+01	6.93E+01	6.88E+01
am	1.18E+03	5.34E+00	8.20E+00	1.09E+01	1.35E+01	1.60E+01	1.83E+01
cm	1.15E+03	3.52E+02	1.79E+02	1.38E+02	1.26E+02	1.19E+02	1.15E+02
bk	7.54E-04	2.82E-06	1.28E-06	5.80E-07	2.63E-07	1.19E-07	5.41E-08

cf	1.20E-04	9.71E-05	7.88E-05	6.43E-05	5.29E-05	4.40E-05	3.70E-05
totals	6.30E+04	4.28E+02	2.57E+02	2.19E+02	2.09E+02	2.05E+02	2.02E+02

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ce 14x14 45 gwd/mtu pwr 2.7 wt%: 6 year cooled actinides

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 6.31E+13n/cm**2-sec

0 element gamma power, watts

basis =single reactor assembly

	initial	365.0 d	730.0 d	1095.0 d	1460.0 d	1825.0 d	2190.0 d
tl	2.91E-06	8.39E-06	1.61E-05	2.45E-05	3.26E-05	4.01E-05	4.66E-05
pb	3.50E-07	1.01E-06	1.93E-06	2.94E-06	3.92E-06	4.81E-06	5.60E-06
bi	2.54E-07	7.31E-07	1.40E-06	2.13E-06	2.84E-06	3.49E-06	4.06E-06
rn	1.48E-09	4.25E-09	8.14E-09	1.24E-08	1.65E-08	2.03E-08	2.36E-08
ra	2.43E-08	6.99E-08	1.34E-07	2.04E-07	2.72E-07	3.34E-07	3.89E-07
th	9.92E-06	7.74E-06	7.76E-06	7.78E-06	7.81E-06	7.83E-06	7.85E-06
pa	2.71E-04	2.04E-04	2.04E-04	2.04E-04	2.04E-04	2.04E-04	2.05E-04
u	3.68E+03	1.12E-03	1.06E-03	1.01E-03	9.67E-04	9.21E-04	8.78E-04
np	1.32E+04	2.54E-02	2.54E-02	2.54E-02	2.54E-02	2.54E-02	2.54E-02
pu	5.83E+01	2.31E-02	2.32E-02	2.30E-02	2.29E-02	2.27E-02	2.25E-02
am	8.16E+02	3.18E-02	4.64E-02	6.02E-02	7.33E-02	8.58E-02	9.77E-02
cm	4.00E-01	1.28E-01	6.80E-02	5.40E-02	4.96E-02	4.74E-02	4.56E-02
cf	3.33E-06	2.65E-06	2.11E-06	1.67E-06	1.34E-06	1.07E-06	8.71E-07
totals	1.77E+04	2.09E-01	1.64E-01	1.64E-01	1.72E-01	1.82E-01	1.92E-01

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ce 14x14 45 gwd/mtu pwr 2.7 wt%: 6 year cooled fission products

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 6.31E+13n/cm**2-sec

0 nuclide concentrations, grams

basis =single reactor assembly

	initial	365.0 d	730.0 d	1095.0 d	1460.0 d	1825.0 d	2190.0 d
h 3	2.71E-02	2.56E-02	2.42E-02	2.29E-02	2.16E-02	2.04E-02	1.93E-02
li 6	5.77E-05	5.77E-05	5.77E-05	5.77E-05	5.77E-05	5.77E-05	5.77E-05
li 7	5.40E-06	5.40E-06	5.40E-06	5.40E-06	5.40E-06	5.40E-06	5.40E-06
be 9	1.04E-05	1.04E-05	1.04E-05	1.04E-05	1.04E-05	1.04E-05	1.04E-05
be 10	6.93E-05	6.93E-05	6.93E-05	6.93E-05	6.93E-05	6.93E-05	6.93E-05
c 14	1.40E-05	1.40E-05	1.40E-05	1.40E-05	1.40E-05	1.40E-05	1.40E-05
zn 70	5.26E-06	5.26E-06	5.26E-06	5.26E-06	5.26E-06	5.26E-06	5.26E-06
ga 71	4.97E-05	4.97E-05	4.97E-05	4.97E-05	4.97E-05	4.97E-05	4.97E-05
ge 72	2.93E-03	2.94E-03	2.94E-03	2.94E-03	2.94E-03	2.94E-03	2.94E-03
ge 73	7.97E-03	7.97E-03	7.97E-03	7.97E-03	7.97E-03	7.97E-03	7.97E-03
ge 74	7.07E-03	7.07E-03	7.07E-03	7.07E-03	7.07E-03	7.07E-03	7.07E-03
as 75	5.83E-02	5.83E-02	5.83E-02	5.83E-02	5.83E-02	5.83E-02	5.83E-02
ge 76	1.73E-01	1.73E-01	1.73E-01	1.73E-01	1.73E-01	1.73E-01	1.73E-01
se 76	2.33E-03	2.34E-03	2.34E-03	2.34E-03	2.34E-03	2.34E-03	2.34E-03
se 77	3.81E-01	3.81E-01	3.81E-01	3.81E-01	3.81E-01	3.81E-01	3.81E-01
se 78	1.39E+00	1.39E+00	1.39E+00	1.39E+00	1.39E+00	1.39E+00	1.39E+00
se 79	2.52E+00	2.52E+00	2.52E+00	2.52E+00	2.52E+00	2.52E+00	2.52E+00

br 79	9.18E-06	1.45E-05	1.98E-05	2.51E-05	3.04E-05	3.57E-05	4.10E-05
se 80	6.84E+00	6.84E+00	6.84E+00	6.84E+00	6.84E+00	6.84E+00	6.84E+00
kr 80	3.58E-05	3.58E-05	3.58E-05	3.58E-05	3.58E-05	3.58E-05	3.58E-05
br 81	1.01E+01	1.01E+01	1.01E+01	1.01E+01	1.01E+01	1.01E+01	1.01E+01
kr 81	3.29E-06	3.29E-06	3.29E-06	3.29E-06	3.29E-06	3.29E-06	3.29E-06
se 82	1.61E+01	1.61E+01	1.61E+01	1.61E+01	1.61E+01	1.61E+01	1.61E+01
kr 82	4.07E-01	4.08E-01	4.08E-01	4.08E-01	4.08E-01	4.08E-01	4.08E-01
kr 83	1.67E+01	1.67E+01	1.67E+01	1.67E+01	1.67E+01	1.67E+01	1.67E+01
kr 84	5.95E+01	5.95E+01	5.95E+01	5.95E+01	5.95E+01	5.95E+01	5.95E+01
kr 85	1.08E+01	1.01E+01	9.48E+00	8.89E+00	8.33E+00	7.81E+00	7.32E+00
rb 85	4.48E+01	4.54E+01	4.61E+01	4.67E+01	4.72E+01	4.77E+01	4.82E+01
kr 86	8.83E+01	8.83E+01	8.83E+01	8.83E+01	8.83E+01	8.83E+01	8.83E+01
sr 86	2.30E-01	2.42E-01	2.42E-01	2.42E-01	2.42E-01	2.42E-01	2.42E-01
rb 87	1.15E+02	1.15E+02	1.15E+02	1.15E+02	1.15E+02	1.15E+02	1.15E+02
sr 87	1.58E-03	1.58E-03	1.58E-03	1.58E-03	1.58E-03	1.58E-03	1.58E-03
sr 88	1.64E+02	1.64E+02	1.64E+02	1.64E+02	1.64E+02	1.64E+02	1.64E+02
y 89	2.07E+02	2.17E+02	2.17E+02	2.17E+02	2.17E+02	2.17E+02	2.17E+02
sr 90	2.55E+02	2.48E+02	2.42E+02	2.37E+02	2.31E+02	2.25E+02	2.20E+02
y 90	7.10E-02	6.46E-02	6.30E-02	6.15E-02	6.00E-02	5.85E-02	5.71E-02
zr 90	1.21E+01	1.83E+01	2.43E+01	3.02E+01	3.60E+01	4.16E+01	4.70E+01
zr 91	2.71E+02	2.87E+02	2.87E+02	2.87E+02	2.87E+02	2.87E+02	2.87E+02
zr 92	3.13E+02	3.13E+02	3.13E+02	3.13E+02	3.13E+02	3.13E+02	3.13E+02
zr 93	2.34E+02	2.34E+02	2.34E+02	2.34E+02	2.34E+02	2.34E+02	2.34E+02
nb 93	1.47E-05	2.43E-05	3.80E-05	5.55E-05	7.67E-05	1.02E-04	1.30E-04
nb 93m	1.75E-04	2.71E-04	3.64E-04	4.52E-04	5.37E-04	6.18E-04	6.95E-04
zr 94	3.88E+02	3.88E+02	3.88E+02	3.88E+02	3.88E+02	3.88E+02	3.88E+02
nb 94	2.79E-04	2.79E-04	2.79E-04	2.79E-04	2.79E-04	2.79E-04	2.79E-04
mo 95	3.33E+02	3.78E+02	3.80E+02	3.80E+02	3.80E+02	3.80E+02	3.80E+02
zr 96	4.15E+02	4.15E+02	4.15E+02	4.15E+02	4.15E+02	4.15E+02	4.15E+02
mo 96	2.74E+01	2.74E+01	2.74E+01	2.74E+01	2.74E+01	2.74E+01	2.74E+01
mo 97	3.97E+02	3.98E+02	3.98E+02	3.98E+02	3.98E+02	3.98E+02	3.98E+02
mo 98	4.38E+02	4.38E+02	4.38E+02	4.38E+02	4.38E+02	4.38E+02	4.38E+02
tc 98	4.05E-03	4.05E-03	4.05E-03	4.05E-03	4.05E-03	4.05E-03	4.05E-03
tc 99	3.99E+02	4.01E+02	4.01E+02	4.01E+02	4.01E+02	4.01E+02	4.01E+02
ru 99	1.63E-02	1.77E-02	1.90E-02	2.03E-02	2.16E-02	2.29E-02	2.43E-02

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ce 14x14 45 gwd/mtu pwr 2.7 wt%: 6 year cooled fission products

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 6.31E+13n/cm**2-sec

0 nuclide concentrations, grams

basis =single reactor assembly

	initial	365.0 d	730.0 d	1095.0 d	1460.0 d	1825.0 d	2190.0 d
mo100	4.99E+02	4.99E+02	4.99E+02	4.99E+02	4.99E+02	4.99E+02	4.99E+02
ru100	7.31E+01	7.31E+01	7.31E+01	7.31E+01	7.31E+01	7.31E+01	7.31E+01
ru101	4.10E+02	4.10E+02	4.10E+02	4.10E+02	4.10E+02	4.10E+02	4.10E+02
ru102	4.34E+02	4.34E+02	4.34E+02	4.34E+02	4.34E+02	4.34E+02	4.34E+02
rh102	6.91E-04	5.44E-04	4.28E-04	3.37E-04	2.66E-04	2.09E-04	1.65E-04
rh103	2.11E+02	2.35E+02	2.35E+02	2.35E+02	2.35E+02	2.35E+02	2.35E+02

ru104	3.29E+02	3.29E+02	3.29E+02	3.29E+02	3.29E+02	3.29E+02	3.29E+02
pd104	1.67E+02	1.67E+02	1.67E+02	1.67E+02	1.67E+02	1.67E+02	1.67E+02
pd105	2.29E+02	2.30E+02	2.30E+02	2.30E+02	2.30E+02	2.30E+02	2.30E+02
ru106	1.04E+02	5.25E+01	2.66E+01	1.35E+01	6.82E+00	3.45E+00	1.75E+00
rh106	1.12E-04	4.88E-05	2.47E-05	1.25E-05	6.33E-06	3.20E-06	1.62E-06
pd106	1.52E+02	2.04E+02	2.30E+02	2.43E+02	2.49E+02	2.53E+02	2.55E+02
pd107	1.52E+02	1.52E+02	1.52E+02	1.52E+02	1.52E+02	1.52E+02	1.52E+02
ag107	1.88E-05	3.50E-05	5.13E-05	6.75E-05	8.37E-05	1.00E-04	1.16E-04
pd108	1.02E+02	1.02E+02	1.02E+02	1.02E+02	1.02E+02	1.02E+02	1.02E+02
ag108m	1.54E-04	1.53E-04	1.52E-04	1.51E-04	1.51E-04	1.50E-04	1.49E-04
cd108	1.57E-04	1.57E-04	1.57E-04	1.57E-04	1.57E-04	1.57E-04	1.58E-04
ag109	5.63E+01	5.64E+01	5.64E+01	5.64E+01	5.64E+01	5.64E+01	5.64E+01
pd110	3.05E+01	3.05E+01	3.05E+01	3.05E+01	3.05E+01	3.05E+01	3.05E+01
ag110m	6.45E-01	2.34E-01	8.50E-02	3.09E-02	1.12E-02	4.07E-03	1.48E-03
cd110	3.45E+01	3.49E+01	3.51E+01	3.51E+01	3.51E+01	3.51E+01	3.51E+01
cd111	1.61E+01	1.63E+01	1.63E+01	1.63E+01	1.63E+01	1.63E+01	1.63E+01
cd112	8.13E+00	8.15E+00	8.15E+00	8.15E+00	8.15E+00	8.15E+00	8.15E+00
cd113	2.91E-02	3.08E-02	3.08E-02	3.08E-02	3.08E-02	3.08E-02	3.08E-02
cd113m	9.09E-02	8.65E-02	8.24E-02	7.84E-02	7.47E-02	7.11E-02	6.77E-02
in113	4.93E-03	9.28E-03	1.34E-02	1.74E-02	2.11E-02	2.47E-02	2.81E-02
cd114	7.73E+00	7.73E+00	7.73E+00	7.73E+00	7.73E+00	7.73E+00	7.73E+00
sn114	3.27E-04	3.83E-04	3.83E-04	3.83E-04	3.83E-04	3.83E-04	3.83E-04
in115	7.06E-01	7.23E-01	7.23E-01	7.23E-01	7.23E-01	7.23E-01	7.23E-01
sn115	1.02E-01	1.03E-01	1.03E-01	1.03E-01	1.03E-01	1.03E-01	1.03E-01
cd116	2.89E+00	2.89E+00	2.89E+00	2.89E+00	2.89E+00	2.89E+00	2.89E+00
sn116	1.56E+00	1.56E+00	1.56E+00	1.56E+00	1.56E+00	1.56E+00	1.56E+00
sn117	2.82E+00	2.83E+00	2.83E+00	2.83E+00	2.83E+00	2.83E+00	2.83E+00
sn118	2.22E+00	2.22E+00	2.22E+00	2.22E+00	2.22E+00	2.22E+00	2.22E+00
sn119	2.31E+00	2.32E+00	2.32E+00	2.32E+00	2.32E+00	2.32E+00	2.32E+00
sn119m	1.32E-02	5.56E-03	2.35E-03	9.89E-04	4.17E-04	1.76E-04	7.42E-05
sn120	2.27E+00	2.27E+00	2.27E+00	2.27E+00	2.27E+00	2.27E+00	2.27E+00
sn121	4.20E-03	1.14E-06	1.13E-06	1.11E-06	1.10E-06	1.09E-06	1.07E-06
sn121m	2.66E-02	2.62E-02	2.59E-02	2.56E-02	2.53E-02	2.49E-02	2.46E-02
sb121	2.20E+00	2.20E+00	2.20E+00	2.20E+00	2.20E+00	2.20E+00	2.20E+00
sn122	2.93E+00	2.93E+00	2.93E+00	2.93E+00	2.93E+00	2.93E+00	2.93E+00
te122	1.88E-01	1.90E-01	1.90E-01	1.90E-01	1.90E-01	1.90E-01	1.90E-01
sn123	3.50E-02	4.94E-03	6.96E-04	9.82E-05	1.38E-05	1.95E-06	2.75E-07
sb123	2.57E+00	2.60E+00	2.61E+00	2.61E+00	2.61E+00	2.61E+00	2.61E+00
te123	1.65E-03	2.26E-03	2.33E-03	2.34E-03	2.34E-03	2.34E-03	2.34E-03
sn124	4.89E+00	4.89E+00	4.89E+00	4.89E+00	4.89E+00	4.89E+00	4.89E+00
te124	1.45E-01	1.73E-01	1.74E-01	1.74E-01	1.74E-01	1.74E-01	1.74E-01
sb125	4.35E+00	3.40E+00	2.63E+00	2.04E+00	1.59E+00	1.23E+00	9.55E-01
te125	1.66E+00	2.65E+00	3.42E+00	4.02E+00	4.48E+00	4.84E+00	5.12E+00
te125m	5.51E-02	4.81E-02	3.74E-02	2.90E-02	2.25E-02	1.75E-02	1.36E-02
sn126	1.18E+01	1.18E+01	1.18E+01	1.18E+01	1.18E+01	1.18E+01	1.18E+01
te126	2.37E-01	2.40E-01	2.40E-01	2.40E-01	2.40E-01	2.40E-01	2.40E-01

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 6.31E+13n/cm**2-sec

0 nuclide concentrations, grams

basis =single reactor assembly

	initial	365.0 d	730.0 d	1095.0 d	1460.0 d	1825.0 d	2190.0 d
te127m	7.87E-01	8.02E-02	7.88E-03	7.73E-04	7.59E-05	7.45E-06	7.32E-07
i127	2.42E+01	2.51E+01	2.51E+01	2.52E+01	2.52E+01	2.52E+01	2.52E+01
te128	5.08E+01	5.08E+01	5.08E+01	5.08E+01	5.08E+01	5.08E+01	5.08E+01
xe128	1.92E+00	1.92E+00	1.92E+00	1.92E+00	1.92E+00	1.92E+00	1.92E+00
i129	9.80E+01	9.90E+01	9.90E+01	9.90E+01	9.90E+01	9.90E+01	9.90E+01
xe129	1.76E-02	1.80E-02	1.80E-02	1.80E-02	1.80E-02	1.80E-02	1.80E-02
te130	1.96E+02	1.96E+02	1.96E+02	1.96E+02	1.96E+02	1.96E+02	1.96E+02
xe130	6.58E+00	6.59E+00	6.59E+00	6.59E+00	6.59E+00	6.59E+00	6.59E+00
xe131	1.96E+02	2.00E+02	2.00E+02	2.00E+02	2.00E+02	2.00E+02	2.00E+02
xe132	6.25E+02	6.28E+02	6.28E+02	6.28E+02	6.28E+02	6.28E+02	6.28E+02
ba132	1.48E-04	1.51E-04	1.51E-04	1.51E-04	1.51E-04	1.51E-04	1.51E-04
cs133	5.71E+02	5.76E+02	5.76E+02	5.76E+02	5.76E+02	5.76E+02	5.76E+02
xe134	8.02E+02	8.02E+02	8.02E+02	8.02E+02	8.02E+02	8.02E+02	8.02E+02
cs134	7.79E+01	5.56E+01	3.98E+01	2.84E+01	2.03E+01	1.45E+01	1.04E+01
ba134	2.96E+01	5.19E+01	6.77E+01	7.91E+01	8.72E+01	9.30E+01	9.71E+01
cs135	1.41E+02	1.41E+02	1.41E+02	1.41E+02	1.41E+02	1.41E+02	1.41E+02
ba135	2.96E-01	2.96E-01	2.96E-01	2.96E-01	2.96E-01	2.96E-01	2.96E-01
xe136	1.29E+03	1.29E+03	1.29E+03	1.29E+03	1.29E+03	1.29E+03	1.29E+03
ba136	9.93E+00	1.03E+01	1.03E+01	1.03E+01	1.03E+01	1.03E+01	1.03E+01
cs137	6.62E+02	6.47E+02	6.32E+02	6.18E+02	6.04E+02	5.90E+02	5.76E+02
ba137	2.47E+01	3.98E+01	5.46E+01	6.90E+01	8.31E+01	9.69E+01	1.10E+02
ba137m	1.02E-04	9.88E-05	9.65E-05	9.43E-05	9.22E-05	9.01E-05	8.80E-05
ba138	6.76E+02	6.76E+02	6.76E+02	6.76E+02	6.76E+02	6.76E+02	6.76E+02
la138	4.72E-03	4.72E-03	4.72E-03	4.72E-03	4.72E-03	4.72E-03	4.72E-03
la139	6.29E+02	6.29E+02	6.29E+02	6.29E+02	6.29E+02	6.29E+02	6.29E+02
ce140	6.63E+02	6.75E+02	6.75E+02	6.75E+02	6.75E+02	6.75E+02	6.75E+02
pr141	5.54E+02	5.78E+02	5.78E+02	5.78E+02	5.78E+02	5.78E+02	5.78E+02
ce142	5.89E+02	5.89E+02	5.89E+02	5.89E+02	5.89E+02	5.89E+02	5.89E+02
nd142	1.66E+01	1.66E+01	1.66E+01	1.66E+01	1.66E+01	1.66E+01	1.66E+01
nd143	3.12E+02	3.22E+02	3.22E+02	3.22E+02	3.22E+02	3.22E+02	3.22E+02
ce144	1.63E+02	6.70E+01	2.76E+01	1.13E+01	4.67E+00	1.92E+00	7.90E-01
pr144	6.93E-03	2.82E-03	1.16E-03	4.78E-04	1.97E-04	8.09E-05	3.33E-05
nd144	5.97E+02	6.93E+02	7.32E+02	7.48E+02	7.55E+02	7.58E+02	7.59E+02
nd145	3.29E+02	3.29E+02	3.29E+02	3.29E+02	3.29E+02	3.29E+02	3.29E+02
pm145	1.24E-05	1.24E-05	1.21E-05	1.18E-05	1.14E-05	1.10E-05	1.06E-05
nd146	3.80E+02	3.80E+02	3.80E+02	3.80E+02	3.80E+02	3.80E+02	3.80E+02
pm146	4.30E-03	3.79E-03	3.35E-03	2.95E-03	2.60E-03	2.30E-03	2.03E-03
sm146	3.47E-03	3.64E-03	3.79E-03	3.92E-03	4.04E-03	4.15E-03	4.24E-03
pm147	7.26E+01	5.85E+01	4.49E+01	3.45E+01	2.65E+01	2.03E+01	1.56E+01
sm147	3.24E+01	5.01E+01	6.37E+01	7.41E+01	8.21E+01	8.82E+01	9.29E+01
nd148	1.95E+02	1.95E+02	1.95E+02	1.95E+02	1.95E+02	1.95E+02	1.95E+02
sm148	7.12E+01	7.22E+01	7.22E+01	7.22E+01	7.22E+01	7.22E+01	7.22E+01
sm149	6.84E-01	1.44E+00	1.44E+00	1.44E+00	1.44E+00	1.44E+00	1.44E+00
nd150	9.95E+01	9.95E+01	9.95E+01	9.95E+01	9.95E+01	9.95E+01	9.95E+01

sm150	1.64E+02	1.64E+02	1.64E+02	1.64E+02	1.64E+02	1.64E+02	1.64E+02
sm151	5.73E+00	5.82E+00	5.77E+00	5.73E+00	5.69E+00	5.64E+00	5.60E+00
eu151	3.61E-03	4.86E-02	9.32E-02	1.37E-01	1.81E-01	2.25E-01	2.68E-01
sm152	6.93E+01	6.93E+01	6.93E+01	6.93E+01	6.93E+01	6.93E+01	6.93E+01
eu152	9.68E-03	9.19E-03	8.72E-03	8.28E-03	7.86E-03	7.46E-03	7.09E-03
gd152	2.16E-02	2.17E-02	2.19E-02	2.20E-02	2.21E-02	2.22E-02	2.23E-02
eu153	7.10E+01	7.17E+01	7.17E+01	7.17E+01	7.17E+01	7.17E+01	7.17E+01
gd153	2.14E-03	7.51E-04	2.63E-04	9.24E-05	3.24E-05	1.14E-05	3.99E-06

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ce 14x14 45 gwd/mtu pwr 2.7 wt%: 6 year cooled fission products

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 6.31E+13n/cm**2-sec

0 nuclide concentrations, grams

basis =single reactor assembly

	initial	365.0 d	730.0 d	1095.0 d	1460.0 d	1825.0 d	2190.0 d
sm154	2.31E+01	2.31E+01	2.31E+01	2.31E+01	2.31E+01	2.31E+01	2.31E+01
eu154	1.24E+01	1.14E+01	1.05E+01	9.70E+00	8.95E+00	8.25E+00	7.61E+00
gd154	1.04E+00	1.99E+00	2.87E+00	3.69E+00	4.44E+00	5.13E+00	5.77E+00
eu155	3.44E+00	2.96E+00	2.56E+00	2.20E+00	1.90E+00	1.64E+00	1.41E+00
gd155	1.62E-02	4.89E-01	8.97E-01	1.25E+00	1.55E+00	1.81E+00	2.04E+00
gd156	6.58E+01	6.93E+01	6.93E+01	6.93E+01	6.93E+01	6.93E+01	6.93E+01
gd157	5.10E-02	6.81E-02	6.81E-02	6.81E-02	6.81E-02	6.81E-02	6.81E-02
gd158	1.51E+01	1.51E+01	1.51E+01	1.51E+01	1.51E+01	1.51E+01	1.51E+01
tb159	1.65E+00	1.66E+00	1.66E+00	1.66E+00	1.66E+00	1.66E+00	1.66E+00
gd160	7.18E-01	7.18E-01	7.18E-01	7.18E-01	7.18E-01	7.18E-01	7.18E-01
dy160	1.49E-01	2.14E-01	2.16E-01	2.16E-01	2.16E-01	2.16E-01	2.16E-01
dy161	2.15E-01	2.22E-01	2.22E-01	2.22E-01	2.22E-01	2.22E-01	2.22E-01
dy162	2.07E-01	2.07E-01	2.07E-01	2.07E-01	2.07E-01	2.07E-01	2.07E-01
dy163	1.85E-01	1.85E-01	1.85E-01	1.85E-01	1.85E-01	1.85E-01	1.85E-01
dy164	3.20E-02	3.20E-02	3.20E-02	3.20E-02	3.20E-02	3.20E-02	3.20E-02
ho165	7.83E-02	7.84E-02	7.84E-02	7.84E-02	7.84E-02	7.84E-02	7.84E-02
ho166m	3.22E-04	3.22E-04	3.21E-04	3.21E-04	3.21E-04	3.21E-04	3.21E-04
er166	2.02E-02	2.03E-02	2.03E-02	2.03E-02	2.03E-02	2.03E-02	2.03E-02
er167	4.29E-04	4.29E-04	4.29E-04	4.29E-04	4.29E-04	4.29E-04	4.29E-04
er168	7.88E-04	7.88E-04	7.88E-04	7.88E-04	7.88E-04	7.88E-04	7.88E-04
tm169	2.10E-06	2.14E-06	2.14E-06	2.14E-06	2.14E-06	2.14E-06	2.14E-06
er170	2.36E-06	2.36E-06	2.36E-06	2.36E-06	2.36E-06	2.36E-06	2.36E-06
yb171	1.03E-06	1.65E-06	2.08E-06	2.38E-06	2.59E-06	2.74E-06	2.84E-06
yb172	2.04E-06	2.06E-06	2.06E-06	2.06E-06	2.06E-06	2.06E-06	2.06E-06
total	1.81E+04	1.81E+04	1.81E+04	1.81E+04	1.81E+04	1.81E+04	1.81E+04

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ce 14x14 45 gwd/mtu pwr 2.7 wt%: 6 year cooled fission products

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 6.31E+13n/cm**2-sec

0 element radioactivity, curies

basis =single reactor assembly

initial 365.0 d 730.0 d 1095.0 d 1460.0 d 1825.0 d 2190.0 d

h	2.62E+02	2.47E+02	2.34E+02	2.21E+02	2.09E+02	1.98E+02	1.87E+02
be	1.55E-06	1.55E-06	1.55E-06	1.55E-06	1.55E-06	1.55E-06	1.55E-06
c	6.25E-05	6.25E-05	6.25E-05	6.25E-05	6.25E-05	6.25E-05	6.25E-05
se	3.42E+05	3.46E-02	3.46E-02	3.46E-02	3.46E-02	3.46E-02	3.46E-02
kr	1.33E+06	3.97E+03	3.72E+03	3.49E+03	3.27E+03	3.07E+03	2.87E+03
rb	2.03E+06	1.25E-03	9.84E-06	9.84E-06	9.84E-06	9.84E-06	9.84E-06
sr	3.31E+06	3.70E+04	3.42E+04	3.34E+04	3.26E+04	3.18E+04	3.10E+04
y	4.51E+06	4.05E+04	3.43E+04	3.34E+04	3.26E+04	3.18E+04	3.10E+04
zr	4.23E+06	1.24E+04	2.40E+02	5.18E+00	6.76E-01	5.90E-01	5.88E-01
nb	6.43E+06	2.79E+04	5.46E+02	1.06E+01	3.30E-01	1.51E-01	1.66E-01
tc	5.47E+06	6.86E+00	6.86E+00	6.86E+00	6.86E+00	6.86E+00	6.86E+00
ru	2.64E+06	1.75E+05	8.82E+04	4.46E+04	2.26E+04	1.14E+04	5.79E+03
rh	3.62E+06	1.75E+05	8.82E+04	4.46E+04	2.26E+04	1.14E+04	5.79E+03
pd	3.35E+05	7.83E-02	7.83E-02	7.83E-02	7.83E-02	7.83E-02	7.83E-02
ag	5.24E+05	1.13E+03	4.10E+02	1.49E+02	5.40E+01	1.96E+01	7.13E+00
cd	4.54E+04	2.02E+01	1.85E+01	1.76E+01	1.68E+01	1.60E+01	1.52E+01
sn	6.28E+05	6.43E+01	1.73E+01	7.29E+00	4.42E+00	3.39E+00	2.96E+00
sb	1.60E+06	3.57E+03	2.76E+03	2.14E+03	1.66E+03	1.29E+03	1.00E+03
te	3.50E+06	2.39E+03	8.22E+02	5.38E+02	4.07E+02	3.15E+02	2.44E+02
i	5.16E+06	1.75E-02	1.75E-02	1.75E-02	1.75E-02	1.75E-02	1.75E-02
cs	3.34E+06	1.28E+05	1.06E+05	9.05E+04	7.88E+04	7.01E+04	6.36E+04
ba	3.97E+06	5.32E+04	5.20E+04	5.08E+04	4.96E+04	4.85E+04	4.74E+04
ce	3.16E+06	2.13E+05	8.77E+04	3.61E+04	1.49E+04	6.11E+03	2.52E+03
pr	2.77E+06	2.16E+05	8.89E+04	3.66E+04	1.51E+04	6.20E+03	2.55E+03
pm	7.47E+05	5.42E+04	4.16E+04	3.20E+04	2.46E+04	1.89E+04	1.45E+04
sm	3.51E+05	1.53E+02	1.52E+02	1.51E+02	1.50E+02	1.49E+02	1.47E+02
eu	2.30E+05	4.54E+03	4.10E+03	3.71E+03	3.36E+03	3.04E+03	2.76E+03
gd	5.08E+03	2.65E+00	9.31E-01	3.27E-01	1.15E-01	4.02E-02	1.41E-02
tb	1.96E+03	2.27E+01	6.86E-01	2.07E-02	6.27E-04	1.89E-05	5.73E-07
ho	9.05E+01	5.77E-04	5.77E-04	5.77E-04	5.76E-04	5.76E-04	5.76E-04
tm	5.29E-03	1.56E-03	1.08E-03	7.56E-04	5.27E-04	3.67E-04	2.56E-04
totals	7.43E+07	1.15E+06	6.35E+05	4.13E+05	3.02E+05	2.44E+05	2.11E+05

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ce 14x14 45 gwd/mtu pwr 2.7 wt%: 6 year cooled fission products

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 6.31E+13n/cm**2-sec

0 element thermal power, watts

basis =single reactor assembly

	initial	365.0 d	730.0 d	1095.0 d	1460.0 d	1825.0 d	2190.0 d
h	8.82E-03	8.34E-03	7.89E-03	7.46E-03	7.05E-03	6.66E-03	6.30E-03
c	1.83E-08	1.83E-08	1.83E-08	1.83E-08	1.83E-08	1.83E-08	1.83E-08
se	5.99E+03	1.09E-05	1.09E-05	1.09E-05	1.09E-05	1.09E-05	1.09E-05
kr	2.14E+04	5.95E+00	5.58E+00	5.23E+00	4.91E+00	4.60E+00	4.31E+00
sr	4.93E+04	4.75E+01	3.98E+01	3.88E+01	3.78E+01	3.69E+01	3.60E+01
y	7.72E+04	2.14E+02	1.90E+02	1.85E+02	1.80E+02	1.76E+02	1.72E+02
zr	4.36E+04	6.27E+01	1.21E+00	2.32E-02	5.11E-04	7.48E-05	6.64E-05
nb	9.44E+04	1.33E+02	2.61E+00	5.02E-02	9.87E-04	4.44E-05	2.94E-05
tc	6.83E+04	3.44E-03	3.44E-03	3.44E-03	3.44E-03	3.44E-03	3.44E-03

ru	1.46E+04	1.45E+01	5.25E+00	2.65E+00	1.34E+00	6.80E-01	3.44E-01
rh	1.87E+04	1.67E+03	8.45E+02	4.28E+02	2.17E+02	1.10E+02	5.55E+01
pd	1.02E+03	4.32E-06	4.32E-06	4.32E-06	4.32E-06	4.32E-06	4.32E-06
ag	2.08E+03	1.87E+01	6.78E+00	2.46E+00	8.94E-01	3.25E-01	1.18E-01
cd	5.22E+02	2.39E-02	2.01E-02	1.92E-02	1.82E-02	1.74E-02	1.65E-02
sn	8.32E+03	1.39E-01	2.40E-02	6.01E-03	2.72E-03	1.93E-03	1.68E-03
sb	2.92E+04	1.14E+01	8.74E+00	6.78E+00	5.26E+00	4.08E+00	3.17E+00
te	3.33E+04	2.21E+00	7.07E-01	4.54E-01	3.43E-01	2.65E-01	2.06E-01
i	7.66E+04	8.18E-06	8.18E-06	8.18E-06	8.18E-06	8.18E-06	8.18E-06
cs	6.05E+04	7.97E+02	5.86E+02	4.35E+02	3.26E+02	2.49E+02	1.93E+02
ba	3.41E+04	2.09E+02	2.04E+02	1.99E+02	1.95E+02	1.90E+02	1.86E+02
ce	1.47E+04	1.40E+02	5.74E+01	2.36E+01	9.72E+00	4.00E+00	1.65E+00
pr	2.26E+04	1.57E+03	6.44E+02	2.65E+02	1.09E+02	4.49E+01	1.85E+01
pm	3.78E+03	2.02E+01	1.53E+01	1.17E+01	9.02E+00	6.93E+00	5.32E+00
sm	8.33E+02	1.80E-02	1.79E-02	1.77E-02	1.76E-02	1.75E-02	1.73E-02
eu	2.17E+03	2.91E+01	2.68E+01	2.47E+01	2.27E+01	2.09E+01	1.92E+01
gd	1.45E+01	2.33E-03	8.19E-04	2.87E-04	1.01E-04	3.54E-05	1.24E-05
tb	1.14E+01	1.99E-01	6.02E-03	1.82E-04	5.50E-06	1.66E-07	5.02E-09
ho	3.89E-01	6.07E-06	6.07E-06	6.07E-06	6.06E-06	6.06E-06	6.06E-06
tm	1.85E-05	2.45E-07	1.68E-07	1.17E-07	8.13E-08	5.66E-08	3.95E-08
totals	9.00E+05	4.94E+03	2.64E+03	1.63E+03	1.12E+03	8.48E+02	6.95E+02

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ce 14x14 45 gwd/mtu pwr 2.7 wt%: 6 year cooled fission products

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 6.31E+13n/cm**2-sec

0 nuclide gamma power, watts

basis =single reactor assembly

	initial	365.0 d	730.0 d	1095.0 d	1460.0 d	1825.0 d	2190.0 d
kr 85	5.60E-02	5.25E-02	4.92E-02	4.61E-02	4.32E-02	4.05E-02	3.80E-02
y 90	3.89E-04	3.53E-04	3.45E-04	3.37E-04	3.28E-04	3.20E-04	3.13E-04
nb 93m	4.65E-07	7.21E-07	9.66E-07	1.20E-06	1.43E-06	1.64E-06	1.85E-06
nb 94	4.88E-07	4.88E-07	4.88E-07	4.88E-07	4.88E-07	4.88E-07	4.88E-07
zr 95	2.81E+03	5.40E+01	1.04E+00	1.99E-02	3.83E-04	7.36E-06	1.41E-07
nb 95	2.95E+03	1.26E+02	2.46E+00	4.74E-02	9.10E-04	1.75E-05	3.36E-07
tc 98	2.91E-08	2.91E-08	2.91E-08	2.91E-08	2.91E-08	2.91E-08	2.91E-08
tc 99	2.51E-08	2.52E-08	2.52E-08	2.52E-08	2.52E-08	2.52E-08	2.52E-08
rh102	1.07E-02	8.42E-03	6.63E-03	5.22E-03	4.11E-03	3.24E-03	2.55E-03
rh106	4.90E+02	2.13E+02	1.08E+02	5.45E+01	2.76E+01	1.40E+01	7.07E+00
ag108	7.14E-05	3.79E-08	3.77E-08	3.75E-08	3.73E-08	3.71E-08	3.69E-08
ag108m	3.86E-05	3.84E-05	3.82E-05	3.80E-05	3.78E-05	3.75E-05	3.73E-05
ag110	2.56E+01	2.76E-03	1.00E-03	3.63E-04	1.32E-04	4.79E-05	1.74E-05
ag110m	4.98E+01	1.81E+01	6.56E+00	2.38E+00	8.66E-01	3.14E-01	1.14E-01
cd113m	8.55E-06	8.14E-06	7.75E-06	7.38E-06	7.03E-06	6.69E-06	6.37E-06
sn119m	3.35E-03	1.41E-03	5.95E-04	2.51E-04	1.06E-04	4.47E-05	1.88E-05
sn121m	4.23E-05	4.18E-05	4.13E-05	4.07E-05	4.02E-05	3.97E-05	3.92E-05
sn123	1.18E-02	1.66E-03	2.34E-04	3.30E-05	4.66E-06	6.57E-07	9.27E-08
te123m	5.36E-03	6.47E-04	7.81E-05	9.43E-06	1.14E-06	1.38E-07	1.66E-08
sb125	1.17E+01	9.16E+00	7.10E+00	5.51E+00	4.28E+00	3.32E+00	2.57E+00

tc	5.47E+06	6.86E+00	6.86E+00	6.86E+00	6.86E+00	6.86E+00	6.86E+00
ru	2.64E+06	7.03E+04	1.44E+04	2.93E+03	5.99E+02	1.22E+02	2.50E+01
rh	3.62E+06	7.03E+04	1.44E+04	2.93E+03	5.99E+02	1.22E+02	2.50E+01
pd	3.35E+05	7.83E-02	7.83E-02	7.83E-02	7.83E-02	7.83E-02	7.83E-02
ag	5.24E+05	2.92E+02	2.75E+01	2.59E+00	2.48E-01	2.70E-02	6.20E-03
cd	4.54E+04	1.82E+01	1.62E+01	1.45E+01	1.29E+01	1.15E+01	1.03E+01
sn	6.28E+05	1.24E+01	3.63E+00	2.77E+00	2.60E+00	2.52E+00	2.46E+00
sb	1.60E+06	2.54E+03	1.40E+03	7.77E+02	4.30E+02	2.38E+02	1.32E+02
te	3.50E+06	6.88E+02	3.43E+02	1.90E+02	1.05E+02	5.80E+01	3.21E+01
i	5.16E+06	1.75E-02	1.75E-02	1.75E-02	1.75E-02	1.75E-02	1.75E-02
cs	3.34E+06	1.01E+05	7.27E+04	5.86E+04	5.08E+04	4.60E+04	4.26E+04
ba	3.97E+06	5.16E+04	4.89E+04	4.63E+04	4.39E+04	4.16E+04	3.94E+04
ce	3.16E+06	6.52E+04	8.22E+03	1.04E+03	1.30E+02	1.64E+01	2.07E+00
pr	2.77E+06	6.62E+04	8.33E+03	1.05E+03	1.32E+02	1.67E+01	2.10E+00
pm	7.47E+05	3.81E+04	2.06E+04	1.11E+04	6.01E+03	3.24E+03	1.75E+03
sm	3.51E+05	1.52E+02	1.49E+02	1.46E+02	1.44E+02	1.41E+02	1.39E+02
eu	2.30E+05	3.97E+03	3.14E+03	2.50E+03	2.00E+03	1.61E+03	1.29E+03
gd	5.08E+03	6.57E-01	5.70E-02	4.95E-03	4.30E-04	3.73E-05	3.24E-06
ho	9.05E+01	5.77E-04	5.76E-04	5.75E-04	5.75E-04	5.74E-04	5.73E-04
tm	5.29E-03	9.61E-04	4.14E-04	1.79E-04	7.70E-05	3.32E-05	1.43E-05
totals	7.43E+07	5.42E+05	2.60E+05	1.91E+05	1.64E+05	1.49E+05	1.38E+05

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ce 14x14 45 gwd/mtu pwr 2.7 wt%: 14 year cooled fission products

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 6.31E+13n/cm**2-sec

0 element thermal power, watts

basis =single reactor assembly

	initial	851.7 d	1703.3 d	2555.0 d	3406.7 d	4258.3 d	5110.0 d
h	8.82E-03	7.74E-03	6.79E-03	5.96E-03	5.22E-03	4.58E-03	4.02E-03
c	1.83E-08	1.83E-08	1.83E-08	1.83E-08	1.83E-08	1.83E-08	1.83E-08
se	5.99E+03	1.09E-05	1.09E-05	1.09E-05	1.09E-05	1.09E-05	1.09E-05
kr	2.14E+04	5.46E+00	4.70E+00	4.04E+00	3.48E+00	2.99E+00	2.57E+00
sr	4.93E+04	3.94E+01	3.72E+01	3.51E+01	3.32E+01	3.13E+01	2.96E+01
y	7.72E+04	1.88E+02	1.77E+02	1.68E+02	1.58E+02	1.49E+02	1.41E+02
zr	4.36E+04	3.23E-01	9.81E-05	6.62E-05	6.62E-05	6.62E-05	6.62E-05
nb	9.44E+04	6.77E-01	9.17E-05	3.21E-05	3.87E-05	4.47E-05	5.01E-05
tc	6.83E+04	3.44E-03	3.44E-03	3.44E-03	3.44E-03	3.44E-03	3.44E-03
ru	1.46E+04	4.18E+00	8.54E-01	1.74E-01	3.56E-02	7.27E-03	1.49E-03
rh	1.87E+04	6.74E+02	1.38E+02	2.81E+01	5.74E+00	1.17E+00	2.40E-01
pd	1.02E+03	4.32E-06	4.32E-06	4.32E-06	4.32E-06	4.32E-06	4.32E-06
ag	2.08E+03	4.84E+00	4.55E-01	4.29E-02	4.07E-03	4.17E-04	7.30E-05
cd	5.22E+02	1.98E-02	1.76E-02	1.57E-02	1.40E-02	1.25E-02	1.12E-02
sn	8.32E+03	1.43E-02	2.10E-03	1.58E-03	1.49E-03	1.46E-03	1.43E-03
sb	2.92E+04	8.03E+00	4.44E+00	2.46E+00	1.36E+00	7.56E-01	4.21E-01
te	3.33E+04	5.86E-01	2.89E-01	1.60E-01	8.83E-02	4.89E-02	2.70E-02
i	7.66E+04	8.18E-06	8.18E-06	8.18E-06	8.18E-06	8.18E-06	8.18E-06
cs	6.05E+04	5.30E+02	2.72E+02	1.52E+02	9.63E+01	6.93E+01	5.57E+01
ba	3.41E+04	2.03E+02	1.92E+02	1.82E+02	1.72E+02	1.63E+02	1.55E+02

ce	1.47E+04	4.27E+01	5.38E+00	6.78E-01	8.54E-02	1.08E-02	1.35E-03
pr	2.26E+04	4.79E+02	6.04E+01	7.60E+00	9.58E-01	1.21E-01	1.52E-02
pm	3.78E+03	1.40E+01	7.57E+00	4.09E+00	2.21E+00	1.19E+00	6.45E-01
sm	8.33E+02	1.78E-02	1.75E-02	1.72E-02	1.69E-02	1.66E-02	1.63E-02
eu	2.17E+03	2.61E+01	2.15E+01	1.77E+01	1.46E+01	1.21E+01	9.98E+00
gd	1.45E+01	5.77E-04	5.01E-05	4.35E-06	3.78E-07	3.28E-08	2.85E-09
ho	3.89E-01	6.07E-06	6.06E-06	6.05E-06	6.04E-06	6.04E-06	6.03E-06
totals	9.00E+05	2.22E+03	9.22E+02	6.02E+02	4.89E+02	4.32E+02	3.95E+02

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ce 14x14 45 gwd/mtu pwr 2.7 wt%: 14 year cooled fission products

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 6.31E+13n/cm**2-sec

0 nuclide gamma power, watts

basis =single reactor assembly

	initial	851.7 d	1703.3 d	2555.0 d	3406.7 d	4258.3 d	5110.0 d
kr 85	5.60E-02	4.81E-02	4.14E-02	3.56E-02	3.06E-02	2.63E-02	2.27E-02
y 90	3.89E-04	3.42E-04	3.23E-04	3.05E-04	2.88E-04	2.72E-04	2.57E-04
nb 93m	4.65E-07	1.05E-06	1.57E-06	2.05E-06	2.48E-06	2.86E-06	3.22E-06
nb 94	4.88E-07	4.88E-07	4.88E-07	4.88E-07	4.88E-07	4.88E-07	4.88E-07
tc 98	2.91E-08	2.91E-08	2.91E-08	2.91E-08	2.91E-08	2.91E-08	2.91E-08
tc 99	2.51E-08	2.52E-08	2.52E-08	2.52E-08	2.52E-08	2.52E-08	2.52E-08
rh102	1.07E-02	6.12E-03	3.51E-03	2.01E-03	1.15E-03	6.59E-04	3.77E-04
rh106	4.90E+02	8.58E+01	1.75E+01	3.58E+00	7.31E-01	1.49E-01	3.05E-02
ag108	7.14E-05	3.76E-08	3.71E-08	3.67E-08	3.62E-08	3.58E-08	3.53E-08
ag108m	3.86E-05	3.81E-05	3.76E-05	3.71E-05	3.67E-05	3.62E-05	3.57E-05
ag110	2.56E+01	7.14E-04	6.72E-05	6.32E-06	5.95E-07	5.59E-08	5.26E-09
ag110m	4.98E+01	4.68E+00	4.41E-01	4.15E-02	3.90E-03	3.67E-04	3.45E-05
cd113m	8.55E-06	7.63E-06	6.80E-06	6.06E-06	5.41E-06	4.82E-06	4.30E-06
sn119m	3.35E-03	4.47E-04	5.96E-05	7.95E-06	1.06E-06	1.41E-07	1.89E-08
sn121m	4.23E-05	4.11E-05	3.99E-05	3.87E-05	3.76E-05	3.65E-05	3.55E-05
sb125	1.17E+01	6.53E+00	3.61E+00	2.00E+00	1.11E+00	6.11E-01	3.38E-01
te125m	2.09E-01	1.31E-01	7.23E-02	4.00E-02	2.21E-02	1.22E-02	6.78E-03
sn126	2.58E-04	2.58E-04	2.58E-04	2.58E-04	2.58E-04	2.58E-04	2.58E-04
sb126	3.86E+00	7.62E-04	7.62E-04	7.62E-04	7.62E-04	7.62E-04	7.62E-04
sb126m	2.55E+00	3.07E-03	3.07E-03	3.07E-03	3.07E-03	3.07E-03	3.07E-03
i129	2.52E-06	2.55E-06	2.55E-06	2.55E-06	2.55E-06	2.55E-06	2.55E-06
ba133	4.20E-08	3.60E-08	3.09E-08	2.65E-08	2.27E-08	1.95E-08	1.67E-08
cs134	9.29E+02	4.24E+02	1.94E+02	8.85E+01	4.04E+01	1.84E+01	8.42E+00
ba137m	1.95E+02	1.83E+02	1.73E+02	1.64E+02	1.56E+02	1.48E+02	1.40E+02
ce144	5.83E+01	7.35E+00	9.26E-01	1.17E-01	1.47E-02	1.85E-03	2.33E-04
pr144	8.98E+01	1.12E+01	1.41E+00	1.77E-01	2.24E-02	2.82E-03	3.55E-04
pr144m	5.39E-01	6.77E-02	8.53E-03	1.07E-03	1.35E-04	1.70E-05	2.15E-06
pm145	3.32E-07	3.21E-07	2.96E-07	2.71E-07	2.47E-07	2.26E-07	2.06E-07
pm146	8.48E-03	6.33E-03	4.72E-03	3.53E-03	2.63E-03	1.97E-03	1.47E-03
pm147	1.75E-03	9.90E-04	5.35E-04	2.89E-04	1.56E-04	8.42E-05	4.55E-05
eu150	6.52E-08	6.24E-08	5.96E-08	5.70E-08	5.45E-08	5.21E-08	4.98E-08
sm151	1.27E-05	1.28E-05	1.25E-05	1.23E-05	1.21E-05	1.19E-05	1.17E-05
eu152	1.18E-02	1.04E-02	9.23E-03	8.18E-03	7.25E-03	6.42E-03	5.69E-03

ce 14x14 45 gwd/mtu pwr 2.7 wt%: 14 year cooled light elements
page 22
decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 6.31E+13n/cm**2-sec
0 element thermal power, watts
basis =single reactor assembly

	initial	851.7 d	1703.3 d	2555.0 d	3406.7 d	4258.3 d	5110.0 d
mn	7.65E+02	6.92E-02	1.04E-02	1.58E-03	2.38E-04	3.59E-05	5.41E-06
fe	3.55E-01	1.07E-02	5.94E-03	3.29E-03	1.82E-03	1.01E-03	5.57E-04
co	4.73E+00	2.76E+00	2.03E+00	1.49E+00	1.10E+00	8.09E-01	5.95E-01
ni	1.71E-01	1.28E-03	1.25E-03	1.23E-03	1.22E-03	1.20E-03	1.18E-03
sn	2.29E+01	3.58E-01	4.72E-02	6.52E-03	1.09E-03	3.59E-04	2.56E-04
sb	3.80E+00	8.81E-01	4.87E-01	2.70E-01	1.49E-01	8.25E-02	4.56E-02
te	9.67E-02	5.73E-02	3.17E-02	1.75E-02	9.70E-03	5.36E-03	2.97E-03
totals	8.01E+02	4.15E+00	2.61E+00	1.79E+00	1.26E+00	8.99E-01	6.46E-01

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ce 14x14 45 gwd/mtu pwr 2.7 wt%: 14 year cooled light elements
page 23
decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 6.31E+13n/cm**2-sec
0 element gamma power, watts
basis =single reactor assembly

	initial	851.7 d	1703.3 d	2555.0 d	3406.7 d	4258.3 d	5110.0 d
mn	5.13E+02	6.88E-02	1.04E-02	1.57E-03	2.37E-04	3.57E-05	5.39E-06
fe	3.11E-01	3.12E-03	1.73E-03	9.56E-04	5.29E-04	2.93E-04	1.62E-04
co	4.38E+00	2.66E+00	1.95E+00	1.44E+00	1.06E+00	7.79E-01	5.73E-01
ni	7.86E-02	1.51E-06	1.51E-06	1.51E-06	1.51E-06	1.51E-06	1.51E-06
sn	8.14E+00	4.67E-02	6.15E-03	8.29E-04	1.19E-04	2.42E-05	1.13E-05
sb	2.47E+00	7.17E-01	3.97E-01	2.19E-01	1.21E-01	6.71E-02	3.71E-02
te	2.58E-02	1.44E-02	7.94E-03	4.39E-03	2.43E-03	1.34E-03	7.44E-04
totals	5.30E+02	3.51E+00	2.38E+00	1.67E+00	1.18E+00	8.48E-01	6.11E-01

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ce 14x14 45 gwd/mtu pwr 2.7 wt%: 14 year cooled actinides
page 24
decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 6.31E+13n/cm**2-sec
0 nuclide concentrations, gram atoms
basis = single reactor assembly

	initial	851.7 d	1703.3 d	2555.0 d	3406.7 d	4258.3 d	5110.0 d
he 4	6.35E-02	1.25E-01	1.53E-01	1.80E-01	2.06E-01	2.31E-01	2.56E-01
th232	3.94E-07	8.29E-07	1.26E-06	1.70E-06	2.14E-06	2.57E-06	3.01E-06
u232	3.52E-07	1.14E-06	1.57E-06	1.80E-06	1.91E-06	1.95E-06	1.95E-06
u233	4.82E-07	1.17E-06	1.86E-06	2.56E-06	3.25E-06	3.95E-06	4.65E-06
u234	3.41E-03	1.12E-02	1.90E-02	2.67E-02	3.42E-02	4.16E-02	4.89E-02
u235	4.15E+00	4.15E+00	4.15E+00	4.15E+00	4.15E+00	4.15E+00	4.15E+00
u236	6.30E+00	6.31E+00	6.31E+00	6.31E+00	6.31E+00	6.31E+00	6.31E+00
u238	1.59E+03	1.59E+03	1.59E+03	1.59E+03	1.59E+03	1.59E+03	1.59E+03
np236	1.85E-06	1.85E-06	1.85E-06	1.85E-06	1.85E-06	1.85E-06	1.85E-06
np237	8.54E-01	8.75E-01	8.76E-01	8.79E-01	8.82E-01	8.85E-01	8.89E-01

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pu238	3.98E-01	4.27E-01	4.21E-01	4.13E-01	4.05E-01	3.98E-01	3.91E-01
pu239	7.34E+00	7.54E+00	7.54E+00	7.54E+00	7.54E+00	7.54E+00	7.54E+00
pu240	4.48E+00	4.50E+00	4.52E+00	4.53E+00	4.54E+00	4.55E+00	4.56E+00
pu241	2.32E+00	2.07E+00	1.85E+00	1.65E+00	1.48E+00	1.32E+00	1.18E+00
pu242	1.84E+00	1.84E+00	1.84E+00	1.84E+00	1.84E+00	1.84E+00	1.84E+00
am241	5.75E-02	3.03E-01	5.22E-01	7.17E-01	8.90E-01	1.04E+00	1.18E+00
am242m	1.07E-03	1.06E-03	1.05E-03	1.04E-03	1.02E-03	1.01E-03	1.00E-03
am243	4.79E-01	4.79E-01	4.79E-01	4.79E-01	4.79E-01	4.79E-01	4.79E-01
cm242	3.43E-02	9.23E-04	2.73E-05	3.36E-06	2.69E-06	2.64E-06	2.61E-06
cm243	1.11E-03	1.05E-03	9.94E-04	9.39E-04	8.87E-04	8.38E-04	7.92E-04
cm244	2.07E-01	1.90E-01	1.74E-01	1.59E-01	1.45E-01	1.33E-01	1.21E-01
cm245	6.63E-03	6.63E-03	6.63E-03	6.63E-03	6.63E-03	6.63E-03	6.62E-03
cm246	1.84E-03	1.84E-03	1.84E-03	1.84E-03	1.84E-03	1.84E-03	1.84E-03
cm247	3.83E-05	3.83E-05	3.83E-05	3.83E-05	3.83E-05	3.83E-05	3.83E-05
cm248	4.84E-06	4.84E-06	4.85E-06	4.85E-06	4.85E-06	4.85E-06	4.85E-06
total	1.62E+03	1.62E+03	1.62E+03	1.62E+03	1.62E+03	1.62E+03	1.62E+03

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ce 14x14 45 gwd/mtu pwr 2.7 wt%: 14 year cooled actinides

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 6.31E+13n/cm**2-sec

0 element concentrations, gram atoms

basis = single reactor assembly

	initial	851.7 d	1703.3 d	2555.0 d	3406.7 d	4258.3 d	5110.0 d
he	6.35E-02	1.25E-01	1.53E-01	1.80E-01	2.06E-01	2.31E-01	2.56E-01
th	4.30E-07	9.25E-07	1.47E-06	2.07E-06	2.71E-06	3.40E-06	4.14E-06
u	1.60E+03	1.60E+03	1.60E+03	1.60E+03	1.60E+03	1.60E+03	1.60E+03
np	1.06E+00	8.75E-01	8.76E-01	8.79E-01	8.82E-01	8.85E-01	8.89E-01
pu	1.64E+01	1.64E+01	1.62E+01	1.60E+01	1.58E+01	1.56E+01	1.55E+01
am	5.38E-01	7.84E-01	1.00E+00	1.20E+00	1.37E+00	1.52E+00	1.66E+00
cm	2.51E-01	2.00E-01	1.83E-01	1.68E-01	1.55E-01	1.42E-01	1.31E-01
totals	1.62E+03	1.62E+03	1.62E+03	1.62E+03	1.62E+03	1.62E+03	1.62E+03

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ce 14x14 45 gwd/mtu pwr 2.7 wt%: 14 year cooled actinides

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 6.31E+13n/cm**2-sec

0 nuclide concentrations, grams

basis =single reactor assembly

	initial	851.7 d	1703.3 d	2555.0 d	3406.7 d	4258.3 d	5110.0 d
he 4	2.54E-01	5.00E-01	6.13E-01	7.20E-01	8.24E-01	9.25E-01	1.02E+00
pb208	1.15E-07	1.42E-06	5.15E-06	1.11E-05	1.86E-05	2.71E-05	3.61E-05
th228	4.94E-07	3.21E-06	6.40E-06	8.86E-06	1.05E-05	1.14E-05	1.19E-05
th230	2.19E-06	1.32E-05	3.61E-05	7.07E-05	1.17E-04	1.74E-04	2.43E-04
th232	9.15E-05	1.92E-04	2.93E-04	3.94E-04	4.95E-04	5.96E-04	6.97E-04
th234	5.50E-06	5.50E-06	5.50E-06	5.50E-06	5.50E-06	5.50E-06	5.50E-06
pa231	3.93E-06	6.14E-06	8.34E-06	1.05E-05	1.28E-05	1.50E-05	1.72E-05
pa233	6.86E-06	7.04E-06	7.05E-06	7.07E-06	7.10E-06	7.13E-06	7.16E-06
u232	8.17E-05	2.65E-04	3.65E-04	4.17E-04	4.42E-04	4.52E-04	4.53E-04

u233	1.12E-04	2.73E-04	4.34E-04	5.96E-04	7.58E-04	9.20E-04	1.08E-03
u234	7.97E-01	2.62E+00	4.45E+00	6.25E+00	8.01E+00	9.74E+00	1.14E+01
u235	9.75E+02	9.75E+02	9.75E+02	9.75E+02	9.76E+02	9.76E+02	9.76E+02
u236	1.49E+03	1.49E+03	1.49E+03	1.49E+03	1.49E+03	1.49E+03	1.49E+03
u237	4.74E+00	1.51E-05	1.35E-05	1.21E-05	1.08E-05	9.63E-06	8.60E-06
u238	3.79E+05	3.79E+05	3.79E+05	3.79E+05	3.79E+05	3.79E+05	3.79E+05
np236	4.37E-04	4.37E-04	4.37E-04	4.37E-04	4.37E-04	4.37E-04	4.37E-04
np237	2.02E+02	2.07E+02	2.08E+02	2.08E+02	2.09E+02	2.10E+02	2.11E+02
np239	4.75E+01	1.00E-04	1.00E-04	1.00E-04	1.00E-04	1.00E-04	1.00E-04
pu236	4.44E-04	2.56E-04	1.46E-04	8.38E-05	4.80E-05	2.75E-05	1.58E-05
pu238	9.47E+01	1.02E+02	1.00E+02	9.83E+01	9.65E+01	9.47E+01	9.30E+01
pu239	1.75E+03	1.80E+03	1.80E+03	1.80E+03	1.80E+03	1.80E+03	1.80E+03
pu240	1.08E+03	1.08E+03	1.08E+03	1.09E+03	1.09E+03	1.09E+03	1.10E+03
pu241	5.58E+02	4.99E+02	4.45E+02	3.98E+02	3.56E+02	3.18E+02	2.84E+02
pu242	4.45E+02	4.45E+02	4.45E+02	4.45E+02	4.45E+02	4.45E+02	4.45E+02
am241	1.38E+01	7.31E+01	1.26E+02	1.73E+02	2.14E+02	2.51E+02	2.84E+02
am242m	2.59E-01	2.56E-01	2.54E-01	2.51E-01	2.48E-01	2.45E-01	2.42E-01
am242	5.44E-02	3.31E-06	3.27E-06	3.23E-06	3.20E-06	3.16E-06	3.12E-06
am243	1.16E+02	1.16E+02	1.16E+02	1.16E+02	1.16E+02	1.16E+02	1.16E+02
cm242	8.29E+00	2.23E-01	6.61E-03	8.13E-04	6.51E-04	6.40E-04	6.32E-04
cm243	2.70E-01	2.56E-01	2.41E-01	2.28E-01	2.16E-01	2.04E-01	1.92E-01
cm244	5.05E+01	4.63E+01	4.23E+01	3.87E+01	3.54E+01	3.24E+01	2.96E+01
cm245	1.62E+00	1.62E+00	1.62E+00	1.62E+00	1.62E+00	1.62E+00	1.62E+00
cm246	4.54E-01	4.54E-01	4.53E-01	4.53E-01	4.53E-01	4.53E-01	4.53E-01
cm247	9.46E-03	9.46E-03	9.46E-03	9.46E-03	9.46E-03	9.46E-03	9.46E-03
cm248	1.20E-03	1.20E-03	1.20E-03	1.20E-03	1.20E-03	1.20E-03	1.20E-03
cf249	1.94E-06	1.82E-05	2.07E-05	2.10E-05	2.09E-05	2.09E-05	2.08E-05
cf250	4.13E-06	3.67E-06	3.25E-06	2.87E-06	2.53E-06	2.24E-06	1.98E-06
cf251	2.39E-06	2.39E-06	2.38E-06	2.38E-06	2.38E-06	2.37E-06	2.37E-06
total	3.85E+05	3.85E+05	3.85E+05	3.85E+05	3.85E+05	3.85E+05	3.85E+05

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ce 14x14 45 gwd/mtu pwr 2.7 wt%: 14 year cooled actinides

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 6.31E+13n/cm**2-sec

0 element concentrations, grams

basis =single reactor assembly

	initial	851.7 d	1703.3 d	2555.0 d	3406.7 d	4258.3 d	5110.0 d
he	2.54E-01	5.00E-01	6.13E-01	7.20E-01	8.24E-01	9.25E-01	1.02E+00
pb	1.15E-07	1.42E-06	5.16E-06	1.11E-05	1.86E-05	2.71E-05	3.61E-05
th	9.97E-05	2.14E-04	3.41E-04	4.79E-04	6.28E-04	7.88E-04	9.58E-04
pa	1.08E-05	1.32E-05	1.54E-05	1.76E-05	1.98E-05	2.21E-05	2.43E-05
u	3.81E+05	3.81E+05	3.81E+05	3.81E+05	3.81E+05	3.81E+05	3.81E+05
np	2.51E+02	2.07E+02	2.08E+02	2.08E+02	2.09E+02	2.10E+02	2.11E+02
pu	3.93E+03	3.93E+03	3.88E+03	3.83E+03	3.79E+03	3.75E+03	3.72E+03
am	1.31E+02	1.90E+02	2.43E+02	2.89E+02	3.31E+02	3.68E+02	4.01E+02
cm	6.11E+01	4.89E+01	4.47E+01	4.10E+01	3.77E+01	3.47E+01	3.19E+01
cf	1.11E-05	2.57E-05	2.71E-05	2.67E-05	2.61E-05	2.56E-05	2.52E-05
totals	3.85E+05	3.85E+05	3.85E+05	3.85E+05	3.85E+05	3.85E+05	3.85E+05

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ce 14x14 45 gwd/mtu pwr 2.7 wt%: 14 year cooled actinides

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 6.31E+13n/cm**2-sec

0 element radioactivity, curies

basis =single reactor assembly

	initial	851.7 d	1703.3 d	2555.0 d	3406.7 d	4258.3 d	5110.0 d
tl	1.46E-04	9.45E-04	1.89E-03	2.61E-03	3.09E-03	3.36E-03	3.50E-03
pb	4.07E-04	2.63E-03	5.25E-03	7.27E-03	8.59E-03	9.36E-03	9.74E-03
bi	4.07E-04	2.63E-03	5.25E-03	7.27E-03	8.59E-03	9.36E-03	9.74E-03
po	6.68E-04	4.32E-03	8.62E-03	1.19E-02	1.41E-02	1.54E-02	1.60E-02
rn	4.07E-04	2.63E-03	5.25E-03	7.27E-03	8.59E-03	9.36E-03	9.74E-03
ra	4.07E-04	2.63E-03	5.25E-03	7.27E-03	8.59E-03	9.36E-03	9.74E-03
th	1.40E-01	1.32E-01	1.35E-01	1.37E-01	1.38E-01	1.39E-01	1.39E-01
pa	2.83E-01	2.74E-01	2.74E-01	2.74E-01	2.75E-01	2.75E-01	2.76E-01
u	1.14E+07	1.48E+00	1.36E+00	1.26E+00	1.17E+00	1.08E+00	1.01E+00
np	1.13E+07	2.34E+01	2.34E+01	2.34E+01	2.34E+01	2.34E+01	2.34E+01
pu	4.53E+05	5.37E+04	4.81E+04	4.32E+04	3.88E+04	3.48E+04	3.13E+04
am	2.13E+05	2.80E+02	4.60E+02	6.21E+02	7.64E+02	8.91E+02	1.00E+03
cm	3.16E+04	4.50E+03	3.46E+03	3.15E+03	2.88E+03	2.64E+03	2.41E+03
bk	1.38E-01	5.02E-03	7.93E-04	1.25E-04	1.98E-05	3.13E-06	4.95E-07
cf	2.08E-03	1.25E-03	8.61E-04	6.30E-04	4.90E-04	4.01E-04	3.42E-04
totals	2.34E+07	5.85E+04	5.21E+04	4.70E+04	4.25E+04	3.84E+04	3.48E+04

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ce 14x14 45 gwd/mtu pwr 2.7 wt%: 14 year cooled actinides

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 6.31E+13n/cm**2-sec

0 element thermal power, watts

basis =single reactor assembly

	initial	851.7 d	1703.3 d	2555.0 d	3406.7 d	4258.3 d	5110.0 d
tl	3.42E-06	2.21E-05	4.42E-05	6.12E-05	7.22E-05	7.87E-05	8.19E-05
pb	7.70E-07	4.97E-06	9.93E-06	1.38E-05	1.63E-05	1.77E-05	1.84E-05
bi	6.82E-06	4.40E-05	8.80E-05	1.22E-04	1.44E-04	1.57E-04	1.63E-04
po	3.05E-05	1.97E-04	3.94E-04	5.45E-04	6.44E-04	7.01E-04	7.30E-04
rn	1.55E-05	9.99E-05	1.99E-04	2.76E-04	3.26E-04	3.55E-04	3.70E-04
ra	1.40E-05	9.03E-05	1.80E-04	2.50E-04	2.95E-04	3.21E-04	3.34E-04
th	9.39E-05	1.41E-04	2.27E-04	2.93E-04	3.36E-04	3.61E-04	3.74E-04
pa	1.09E-03	9.98E-04	9.99E-04	1.00E-03	1.00E-03	1.00E-03	1.00E-03
u	3.07E+04	8.93E-03	9.08E-03	9.21E-03	9.34E-03	9.48E-03	9.62E-03
np	2.94E+04	6.31E-02	6.31E-02	6.30E-02	6.30E-02	6.31E-02	6.31E-02
pu	5.20E+02	7.06E+01	6.95E+01	6.83E+01	6.72E+01	6.61E+01	6.50E+01
am	1.18E+03	9.12E+00	1.52E+01	2.05E+01	2.53E+01	2.95E+01	3.33E+01
cm	1.15E+03	1.59E+02	1.21E+02	1.10E+02	1.01E+02	9.22E+01	8.44E+01
cf	1.20E-04	7.36E-05	4.67E-05	3.14E-05	2.26E-05	1.73E-05	1.40E-05
totals	6.30E+04	2.38E+02	2.06E+02	1.99E+02	1.93E+02	1.88E+02	1.83E+02

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ce 14x14 45 gwd/mtu pwr 2.7 wt%: 14 year cooled actinides
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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 6.31E+13n/cm**2-sec
0 element gamma power, watts
basis =single reactor assembly

	initial	851.7 d	1703.3 d	2555.0 d	3406.7 d	4258.3 d	5110.0 d
tl	2.91E-06	1.88E-05	3.76E-05	5.21E-05	6.15E-05	6.70E-05	6.98E-05
pb	3.50E-07	2.26E-06	4.52E-06	6.25E-06	7.39E-06	8.05E-06	8.38E-06
bi	2.54E-07	1.64E-06	3.28E-06	4.54E-06	5.36E-06	5.84E-06	6.08E-06
rn	1.48E-09	9.52E-09	1.90E-08	2.63E-08	3.11E-08	3.39E-08	3.53E-08
ra	2.43E-08	1.57E-07	3.14E-07	4.34E-07	5.13E-07	5.59E-07	5.82E-07
th	9.92E-06	7.77E-06	7.82E-06	7.86E-06	7.89E-06	7.91E-06	7.91E-06
pa	2.71E-04	2.04E-04	2.04E-04	2.05E-04	2.06E-04	2.06E-04	2.07E-04
u	3.68E+03	1.05E-03	9.36E-04	8.37E-04	7.49E-04	6.69E-04	5.99E-04
np	1.32E+04	2.54E-02	2.54E-02	2.54E-02	2.54E-02	2.54E-02	2.54E-02
pu	5.83E+01	2.31E-02	2.28E-02	2.24E-02	2.20E-02	2.16E-02	2.12E-02
am	8.16E+02	5.10E-02	8.17E-02	1.09E-01	1.33E-01	1.55E-01	1.74E-01
cm	4.00E-01	6.11E-02	4.80E-02	4.40E-02	4.05E-02	3.74E-02	3.44E-02
cf	3.33E-06	1.95E-06	1.15E-06	7.14E-07	4.72E-07	3.39E-07	2.66E-07
totals	1.77E+04	1.62E-01	1.79E-01	2.02E-01	2.22E-01	2.40E-01	2.56E-01

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ce 14x14 45 gwd/mtu pwr 2.7 wt%: 14 year cooled fission products
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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 6.31E+13n/cm**2-sec
0 nuclide concentrations, grams
basis =single reactor assembly

	initial	851.7 d	1703.3 d	2555.0 d	3406.7 d	4258.3 d	5110.0 d
h 3	2.71E-02	2.37E-02	2.08E-02	1.83E-02	1.60E-02	1.41E-02	1.23E-02
li 6	5.77E-05	5.77E-05	5.77E-05	5.77E-05	5.77E-05	5.77E-05	5.77E-05
li 7	5.40E-06	5.40E-06	5.40E-06	5.40E-06	5.40E-06	5.40E-06	5.40E-06
be 9	1.04E-05	1.04E-05	1.04E-05	1.04E-05	1.04E-05	1.04E-05	1.04E-05
be 10	6.93E-05	6.93E-05	6.93E-05	6.93E-05	6.93E-05	6.93E-05	6.93E-05
c 14	1.40E-05	1.40E-05	1.40E-05	1.40E-05	1.40E-05	1.40E-05	1.40E-05
zn 70	5.26E-06	5.26E-06	5.26E-06	5.26E-06	5.26E-06	5.26E-06	5.26E-06
ga 71	4.97E-05	4.97E-05	4.97E-05	4.97E-05	4.97E-05	4.97E-05	4.97E-05
ge 72	2.93E-03	2.94E-03	2.94E-03	2.94E-03	2.94E-03	2.94E-03	2.94E-03
ge 73	7.97E-03	7.97E-03	7.97E-03	7.97E-03	7.97E-03	7.97E-03	7.97E-03
ge 74	7.07E-03	7.07E-03	7.07E-03	7.07E-03	7.07E-03	7.07E-03	7.07E-03
as 75	5.83E-02	5.83E-02	5.83E-02	5.83E-02	5.83E-02	5.83E-02	5.83E-02
ge 76	1.73E-01	1.73E-01	1.73E-01	1.73E-01	1.73E-01	1.73E-01	1.73E-01
se 76	2.33E-03	2.34E-03	2.34E-03	2.34E-03	2.34E-03	2.34E-03	2.34E-03
se 77	3.81E-01	3.81E-01	3.81E-01	3.81E-01	3.81E-01	3.81E-01	3.81E-01
se 78	1.39E+00	1.39E+00	1.39E+00	1.39E+00	1.39E+00	1.39E+00	1.39E+00
se 79	2.52E+00	2.52E+00	2.52E+00	2.52E+00	2.52E+00	2.52E+00	2.52E+00
br 79	9.18E-06	2.15E-05	3.39E-05	4.63E-05	5.86E-05	7.10E-05	8.33E-05
se 80	6.84E+00	6.84E+00	6.84E+00	6.84E+00	6.84E+00	6.84E+00	6.84E+00
kr 80	3.58E-05	3.58E-05	3.58E-05	3.58E-05	3.58E-05	3.58E-05	3.58E-05

br 81	1.01E+01	1.01E+01	1.01E+01	1.01E+01	1.01E+01	1.01E+01	1.01E+01
kr 81	3.29E-06	3.29E-06	3.29E-06	3.29E-06	3.29E-06	3.29E-06	3.29E-06
se 82	1.61E+01	1.61E+01	1.61E+01	1.61E+01	1.61E+01	1.61E+01	1.61E+01
kr 82	4.07E-01	4.08E-01	4.08E-01	4.08E-01	4.08E-01	4.08E-01	4.08E-01
kr 83	1.67E+01	1.67E+01	1.67E+01	1.67E+01	1.67E+01	1.67E+01	1.67E+01
kr 84	5.95E+01	5.95E+01	5.95E+01	5.95E+01	5.95E+01	5.95E+01	5.95E+01
kr 85	1.08E+01	9.28E+00	7.98E+00	6.86E+00	5.90E+00	5.08E+00	4.37E+00
rb 85	4.48E+01	4.63E+01	4.76E+01	4.87E+01	4.97E+01	5.05E+01	5.12E+01
kr 86	8.83E+01	8.83E+01	8.83E+01	8.83E+01	8.83E+01	8.83E+01	8.83E+01
sr 86	2.30E-01	2.42E-01	2.42E-01	2.42E-01	2.42E-01	2.42E-01	2.42E-01
rb 87	1.15E+02	1.15E+02	1.15E+02	1.15E+02	1.15E+02	1.15E+02	1.15E+02
sr 87	1.58E-03	1.58E-03	1.58E-03	1.58E-03	1.58E-03	1.58E-03	1.58E-03
sr 88	1.64E+02	1.64E+02	1.64E+02	1.64E+02	1.64E+02	1.64E+02	1.64E+02
y 89	2.07E+02	2.17E+02	2.17E+02	2.17E+02	2.17E+02	2.17E+02	2.17E+02
sr 90	2.55E+02	2.40E+02	2.27E+02	2.14E+02	2.02E+02	1.91E+02	1.80E+02
y 90	7.10E-02	6.25E-02	5.90E-02	5.57E-02	5.26E-02	4.97E-02	4.69E-02
zr 90	1.21E+01	2.63E+01	3.97E+01	5.24E+01	6.44E+01	7.56E+01	8.63E+01
zr 91	2.71E+02	2.87E+02	2.87E+02	2.87E+02	2.87E+02	2.87E+02	2.87E+02
zr 92	3.13E+02	3.13E+02	3.13E+02	3.13E+02	3.13E+02	3.13E+02	3.13E+02
zr 93	2.34E+02	2.34E+02	2.34E+02	2.34E+02	2.34E+02	2.34E+02	2.34E+02
nb 93	1.47E-05	4.34E-05	9.29E-05	1.61E-04	2.47E-04	3.47E-04	4.62E-04
nb 93m	1.75E-04	3.93E-04	5.91E-04	7.70E-04	9.32E-04	1.08E-03	1.21E-03
zr 94	3.88E+02	3.88E+02	3.88E+02	3.88E+02	3.88E+02	3.88E+02	3.88E+02
nb 94	2.79E-04	2.79E-04	2.79E-04	2.79E-04	2.79E-04	2.79E-04	2.79E-04
mo 95	3.33E+02	3.80E+02	3.80E+02	3.80E+02	3.80E+02	3.80E+02	3.80E+02
zr 96	4.15E+02	4.15E+02	4.15E+02	4.15E+02	4.15E+02	4.15E+02	4.15E+02
mo 96	2.74E+01	2.74E+01	2.74E+01	2.74E+01	2.74E+01	2.74E+01	2.74E+01
mo 97	3.97E+02	3.98E+02	3.98E+02	3.98E+02	3.98E+02	3.98E+02	3.98E+02
mo 98	4.38E+02	4.38E+02	4.38E+02	4.38E+02	4.38E+02	4.38E+02	4.38E+02
tc 98	4.05E-03	4.05E-03	4.05E-03	4.05E-03	4.05E-03	4.05E-03	4.05E-03
tc 99	3.99E+02	4.01E+02	4.01E+02	4.01E+02	4.01E+02	4.01E+02	4.01E+02
ru 99	1.63E-02	1.94E-02	2.25E-02	2.56E-02	2.86E-02	3.17E-02	3.48E-02

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ce 14x14 45 gwd/mtu pwr 2.7 wt%: 14 year cooled fission products

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 6.31E+13n/cm**2-sec

0 nuclide concentrations, grams

basis =single reactor assembly

	initial	851.7 d	1703.3 d	2555.0 d	3406.7 d	4258.3 d	5110.0 d
mo100	4.99E+02	4.99E+02	4.99E+02	4.99E+02	4.99E+02	4.99E+02	4.99E+02
ru100	7.31E+01	7.31E+01	7.31E+01	7.31E+01	7.31E+01	7.31E+01	7.31E+01
ru101	4.10E+02	4.10E+02	4.10E+02	4.10E+02	4.10E+02	4.10E+02	4.10E+02
ru102	4.34E+02	4.34E+02	4.34E+02	4.34E+02	4.34E+02	4.34E+02	4.34E+02
rh102	6.91E-04	3.96E-04	2.27E-04	1.30E-04	7.43E-05	4.26E-05	2.44E-05
rh103	2.11E+02	2.35E+02	2.35E+02	2.35E+02	2.35E+02	2.35E+02	2.35E+02
ru104	3.29E+02	3.29E+02	3.29E+02	3.29E+02	3.29E+02	3.29E+02	3.29E+02
pd104	1.67E+02	1.67E+02	1.67E+02	1.67E+02	1.67E+02	1.67E+02	1.67E+02
pd105	2.29E+02	2.30E+02	2.30E+02	2.30E+02	2.30E+02	2.30E+02	2.30E+02

ru106	1.04E+02	2.12E+01	4.33E+00	8.84E-01	1.81E-01	3.69E-02	7.53E-03
pd106	1.52E+02	2.35E+02	2.52E+02	2.55E+02	2.56E+02	2.56E+02	2.56E+02
pd107	1.52E+02	1.52E+02	1.52E+02	1.52E+02	1.52E+02	1.52E+02	1.52E+02
ag107	1.88E-05	5.67E-05	9.46E-05	1.32E-04	1.70E-04	2.08E-04	2.46E-04
pd108	1.02E+02	1.02E+02	1.02E+02	1.02E+02	1.02E+02	1.02E+02	1.02E+02
ag108m	1.54E-04	1.52E-04	1.50E-04	1.48E-04	1.46E-04	1.45E-04	1.43E-04
cd108	1.57E-04	1.57E-04	1.57E-04	1.58E-04	1.58E-04	1.58E-04	1.58E-04
ag109	5.63E+01	5.64E+01	5.64E+01	5.64E+01	5.64E+01	5.64E+01	5.64E+01
pd110	3.05E+01	3.05E+01	3.05E+01	3.05E+01	3.05E+01	3.05E+01	3.05E+01
ag110m	6.45E-01	6.07E-02	5.71E-03	5.37E-04	5.05E-05	4.75E-06	4.47E-07
cd110	3.45E+01	3.51E+01	3.51E+01	3.51E+01	3.51E+01	3.51E+01	3.51E+01
cd111	1.61E+01	1.63E+01	1.63E+01	1.63E+01	1.63E+01	1.63E+01	1.63E+01
cd112	8.13E+00	8.15E+00	8.15E+00	8.15E+00	8.15E+00	8.15E+00	8.15E+00
cd113	2.91E-02	3.08E-02	3.08E-02	3.08E-02	3.09E-02	3.09E-02	3.09E-02
cd113m	9.09E-02	8.11E-02	7.23E-02	6.44E-02	5.75E-02	5.12E-02	4.57E-02
in113	4.93E-03	1.48E-02	2.35E-02	3.13E-02	3.83E-02	4.45E-02	5.01E-02
cd114	7.73E+00	7.73E+00	7.73E+00	7.73E+00	7.73E+00	7.73E+00	7.73E+00
sn114	3.27E-04	3.83E-04	3.83E-04	3.83E-04	3.83E-04	3.83E-04	3.83E-04
in115	7.06E-01	7.23E-01	7.23E-01	7.23E-01	7.23E-01	7.23E-01	7.23E-01
sn115	1.02E-01	1.03E-01	1.03E-01	1.03E-01	1.03E-01	1.03E-01	1.03E-01
cd116	2.89E+00	2.89E+00	2.89E+00	2.89E+00	2.89E+00	2.89E+00	2.89E+00
sn116	1.56E+00	1.56E+00	1.56E+00	1.56E+00	1.56E+00	1.56E+00	1.56E+00
sn117	2.82E+00	2.83E+00	2.83E+00	2.83E+00	2.83E+00	2.83E+00	2.83E+00
sn118	2.22E+00	2.22E+00	2.22E+00	2.22E+00	2.22E+00	2.22E+00	2.22E+00
sn119	2.31E+00	2.32E+00	2.32E+00	2.32E+00	2.32E+00	2.32E+00	2.32E+00
sn120	2.27E+00	2.27E+00	2.27E+00	2.27E+00	2.27E+00	2.27E+00	2.27E+00
sn121m	2.66E-02	2.58E-02	2.50E-02	2.43E-02	2.36E-02	2.29E-02	2.23E-02
sb121	2.20E+00	2.20E+00	2.20E+00	2.20E+00	2.20E+00	2.21E+00	2.21E+00
sn122	2.93E+00	2.93E+00	2.93E+00	2.93E+00	2.93E+00	2.93E+00	2.93E+00
te122	1.88E-01	1.90E-01	1.90E-01	1.90E-01	1.90E-01	1.90E-01	1.90E-01
sb123	2.57E+00	2.61E+00	2.61E+00	2.61E+00	2.61E+00	2.61E+00	2.61E+00
te123	1.65E-03	2.34E-03	2.34E-03	2.34E-03	2.34E-03	2.34E-03	2.34E-03
sn124	4.89E+00	4.89E+00	4.89E+00	4.89E+00	4.89E+00	4.89E+00	4.89E+00
te124	1.45E-01	1.74E-01	1.74E-01	1.74E-01	1.74E-01	1.74E-01	1.74E-01
sb125	4.35E+00	2.42E+00	1.34E+00	7.41E-01	4.10E-01	2.27E-01	1.25E-01
te125	1.66E+00	3.64E+00	4.73E+00	5.34E+00	5.68E+00	5.86E+00	5.96E+00
te125m	5.51E-02	3.44E-02	1.90E-02	1.05E-02	5.82E-03	3.22E-03	1.78E-03
sn126	1.18E+01	1.18E+01	1.18E+01	1.18E+01	1.18E+01	1.18E+01	1.18E+01
te126	2.37E-01	2.40E-01	2.40E-01	2.40E-01	2.41E-01	2.41E-01	2.41E-01
i127	2.42E+01	2.51E+01	2.52E+01	2.52E+01	2.52E+01	2.52E+01	2.52E+01
te128	5.08E+01	5.08E+01	5.08E+01	5.08E+01	5.08E+01	5.08E+01	5.08E+01
xe128	1.92E+00	1.92E+00	1.92E+00	1.92E+00	1.92E+00	1.92E+00	1.92E+00
i129	9.80E+01	9.90E+01	9.90E+01	9.90E+01	9.90E+01	9.90E+01	9.90E+01

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ce 14x14 45 gwd/mtu pwr 2.7 wt%: 14 year cooled fission products

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 6.31E+13n/cm**2-sec

0 nuclide concentrations, grams

basis =single reactor assembly

	initial	851.7 d	1703.3 d	2555.0 d	3406.7 d	4258.3 d	5110.0 d
xe129	1.76E-02	1.80E-02	1.80E-02	1.80E-02	1.80E-02	1.80E-02	1.80E-02
te130	1.96E+02	1.96E+02	1.96E+02	1.96E+02	1.96E+02	1.96E+02	1.96E+02
xe130	6.58E+00	6.59E+00	6.59E+00	6.59E+00	6.59E+00	6.59E+00	6.59E+00
xe131	1.96E+02	2.00E+02	2.00E+02	2.00E+02	2.00E+02	2.00E+02	2.00E+02
xe132	6.25E+02	6.28E+02	6.28E+02	6.28E+02	6.28E+02	6.28E+02	6.28E+02
ba132	1.48E-04	1.51E-04	1.51E-04	1.51E-04	1.51E-04	1.51E-04	1.51E-04
cs133	5.71E+02	5.76E+02	5.76E+02	5.76E+02	5.76E+02	5.76E+02	5.76E+02
xe134	8.02E+02	8.02E+02	8.02E+02	8.02E+02	8.02E+02	8.02E+02	8.02E+02
cs134	7.79E+01	3.56E+01	1.62E+01	7.41E+00	3.39E+00	1.55E+00	7.06E-01
ba134	2.96E+01	7.20E+01	9.13E+01	1.00E+02	1.04E+02	1.06E+02	1.07E+02
cs135	1.41E+02	1.41E+02	1.41E+02	1.41E+02	1.41E+02	1.41E+02	1.41E+02
ba135	2.96E-01	2.96E-01	2.96E-01	2.96E-01	2.96E-01	2.97E-01	2.97E-01
xe136	1.29E+03	1.29E+03	1.29E+03	1.29E+03	1.29E+03	1.29E+03	1.29E+03
ba136	9.93E+00	1.03E+01	1.03E+01	1.03E+01	1.03E+01	1.03E+01	1.03E+01
cs137	6.62E+02	6.27E+02	5.94E+02	5.63E+02	5.34E+02	5.06E+02	4.79E+02
ba137	2.47E+01	5.94E+01	9.23E+01	1.23E+02	1.53E+02	1.81E+02	2.08E+02
ba137m	1.02E-04	9.58E-05	9.08E-05	8.60E-05	8.15E-05	7.72E-05	7.32E-05
ba138	6.76E+02	6.76E+02	6.76E+02	6.76E+02	6.76E+02	6.76E+02	6.76E+02
la138	4.72E-03	4.72E-03	4.72E-03	4.72E-03	4.72E-03	4.72E-03	4.72E-03
la139	6.29E+02	6.29E+02	6.29E+02	6.29E+02	6.29E+02	6.29E+02	6.29E+02
ce140	6.63E+02	6.75E+02	6.75E+02	6.75E+02	6.75E+02	6.75E+02	6.75E+02
pr141	5.54E+02	5.78E+02	5.78E+02	5.78E+02	5.78E+02	5.78E+02	5.78E+02
ce142	5.89E+02	5.89E+02	5.89E+02	5.89E+02	5.89E+02	5.89E+02	5.89E+02
nd142	1.66E+01	1.66E+01	1.66E+01	1.66E+01	1.66E+01	1.66E+01	1.66E+01
nd143	3.12E+02	3.22E+02	3.22E+02	3.22E+02	3.22E+02	3.22E+02	3.22E+02
ce144	1.63E+02	2.05E+01	2.58E+00	3.25E-01	4.10E-02	5.16E-03	6.50E-04
nd144	5.97E+02	7.39E+02	7.57E+02	7.59E+02	7.60E+02	7.60E+02	7.60E+02
nd145	3.29E+02	3.29E+02	3.29E+02	3.29E+02	3.29E+02	3.29E+02	3.29E+02
pm145	1.24E-05	1.20E-05	1.11E-05	1.02E-05	9.27E-06	8.46E-06	7.72E-06
nd146	3.80E+02	3.80E+02	3.80E+02	3.80E+02	3.80E+02	3.80E+02	3.80E+02
pm146	4.30E-03	3.21E-03	2.40E-03	1.79E-03	1.34E-03	9.97E-04	7.44E-04
sm146	3.47E-03	3.84E-03	4.11E-03	4.32E-03	4.47E-03	4.59E-03	4.67E-03
pm147	7.26E+01	4.11E+01	2.22E+01	1.20E+01	6.48E+00	3.50E+00	1.89E+00
sm147	3.24E+01	6.74E+01	8.63E+01	9.66E+01	1.02E+02	1.05E+02	1.07E+02
nd148	1.95E+02	1.95E+02	1.95E+02	1.95E+02	1.95E+02	1.95E+02	1.95E+02
sm148	7.12E+01	7.22E+01	7.22E+01	7.22E+01	7.22E+01	7.22E+01	7.22E+01
sm149	6.84E-01	1.44E+00	1.44E+00	1.44E+00	1.44E+00	1.44E+00	1.44E+00
nd150	9.95E+01	9.95E+01	9.95E+01	9.95E+01	9.95E+01	9.95E+01	9.95E+01
sm150	1.64E+02	1.64E+02	1.64E+02	1.64E+02	1.64E+02	1.64E+02	1.64E+02
sm151	5.73E+00	5.76E+00	5.66E+00	5.56E+00	5.46E+00	5.36E+00	5.27E+00
eu151	3.61E-03	1.08E-01	2.10E-01	3.11E-01	4.10E-01	5.07E-01	6.03E-01
sm152	6.93E+01	6.93E+01	6.93E+01	6.93E+01	6.93E+01	6.93E+01	6.93E+01
eu152	9.68E-03	8.57E-03	7.60E-03	6.73E-03	5.96E-03	5.28E-03	4.68E-03
gd152	2.16E-02	2.19E-02	2.22E-02	2.24E-02	2.26E-02	2.28E-02	2.30E-02
eu153	7.10E+01	7.17E+01	7.17E+01	7.17E+01	7.17E+01	7.17E+01	7.17E+01
sm154	2.31E+01	2.31E+01	2.31E+01	2.31E+01	2.31E+01	2.31E+01	2.31E+01
eu154	1.24E+01	1.02E+01	8.48E+00	7.03E+00	5.82E+00	4.82E+00	4.00E+00

gd154	1.04E+00	3.15E+00	4.91E+00	6.36E+00	7.57E+00	8.56E+00	9.39E+00
eu155	3.44E+00	2.43E+00	1.72E+00	1.22E+00	8.64E-01	6.11E-01	4.33E-01
gd155	1.62E-02	1.02E+00	1.73E+00	2.23E+00	2.59E+00	2.84E+00	3.02E+00
gd156	6.58E+01	6.93E+01	6.93E+01	6.93E+01	6.93E+01	6.93E+01	6.93E+01
gd157	5.10E-02	6.81E-02	6.81E-02	6.81E-02	6.81E-02	6.81E-02	6.81E-02

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ce 14x14 45 gwd/mtu pwr 2.7 wt%: 14 year cooled fission products

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 6.31E+13n/cm**2-sec

0 nuclide concentrations, grams

basis =single reactor assembly

	initial	851.7 d	1703.3 d	2555.0 d	3406.7 d	4258.3 d	5110.0 d
gd158	1.51E+01	1.51E+01	1.51E+01	1.51E+01	1.51E+01	1.51E+01	1.51E+01
tb159	1.65E+00	1.66E+00	1.66E+00	1.66E+00	1.66E+00	1.66E+00	1.66E+00
gd160	7.18E-01	7.18E-01	7.18E-01	7.18E-01	7.18E-01	7.18E-01	7.18E-01
dy160	1.49E-01	2.16E-01	2.16E-01	2.16E-01	2.16E-01	2.16E-01	2.16E-01
dy161	2.15E-01	2.22E-01	2.22E-01	2.22E-01	2.22E-01	2.22E-01	2.22E-01
dy162	2.07E-01	2.07E-01	2.07E-01	2.07E-01	2.07E-01	2.07E-01	2.07E-01
dy163	1.85E-01	1.85E-01	1.85E-01	1.85E-01	1.85E-01	1.85E-01	1.85E-01
dy164	3.20E-02	3.20E-02	3.20E-02	3.20E-02	3.20E-02	3.20E-02	3.20E-02
ho165	7.83E-02	7.84E-02	7.84E-02	7.84E-02	7.84E-02	7.84E-02	7.84E-02
ho166m	3.22E-04	3.21E-04	3.21E-04	3.21E-04	3.20E-04	3.20E-04	3.19E-04
er166	2.02E-02	2.03E-02	2.03E-02	2.03E-02	2.03E-02	2.03E-02	2.03E-02
er167	4.29E-04	4.29E-04	4.29E-04	4.29E-04	4.29E-04	4.29E-04	4.29E-04
er168	7.88E-04	7.88E-04	7.88E-04	7.88E-04	7.88E-04	7.88E-04	7.88E-04
tm169	2.10E-06	2.14E-06	2.14E-06	2.14E-06	2.14E-06	2.14E-06	2.14E-06
er170	2.36E-06	2.36E-06	2.36E-06	2.36E-06	2.36E-06	2.36E-06	2.36E-06
yb171	1.03E-06	2.19E-06	2.69E-06	2.91E-06	3.00E-06	3.04E-06	3.06E-06
yb172	2.04E-06	2.06E-06	2.06E-06	2.06E-06	2.06E-06	2.06E-06	2.06E-06
total	1.81E+04	1.81E+04	1.81E+04	1.81E+04	1.81E+04	1.81E+04	1.81E+04

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ce 14x14 45 gwd/mtu pwr 2.7 wt%: 14 year cooled fission products

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decay, following reactor irradiation identified by: power= 16.11mw, burnup= 17640.mwd, flux= 6.31E+13n/cm**2-sec

0 element radioactivity, curies

basis =single reactor assembly

	initial	851.7 d	1703.3 d	2555.0 d	3406.7 d	4258.3 d	5110.0 d
h	2.62E+02	2.30E+02	2.01E+02	1.77E+02	1.55E+02	1.36E+02	1.19E+02
be	1.55E-06	1.55E-06	1.55E-06	1.55E-06	1.55E-06	1.55E-06	1.55E-06
c	6.25E-05	6.25E-05	6.25E-05	6.24E-05	6.24E-05	6.24E-05	6.24E-05
se	3.42E+05	3.46E-02	3.46E-02	3.46E-02	3.46E-02	3.46E-02	3.46E-02
kr	1.33E+06	3.64E+03	3.13E+03	2.69E+03	2.32E+03	1.99E+03	1.71E+03
rb	2.03E+06	9.84E-06	9.84E-06	9.84E-06	9.84E-06	9.84E-06	9.84E-06
sr	3.31E+06	3.39E+04	3.20E+04	3.03E+04	2.86E+04	2.70E+04	2.55E+04
y	4.51E+06	3.40E+04	3.21E+04	3.03E+04	2.86E+04	2.70E+04	2.55E+04
zr	4.23E+06	6.46E+01	5.94E-01	5.88E-01	5.88E-01	5.88E-01	5.88E-01
nb	6.43E+06	1.42E+02	1.55E-01	1.84E-01	2.22E-01	2.57E-01	2.89E-01