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Electronic Archival of the Results of Pressurized Thermal Shock Analyses for Beaver Valley, Oconee, and Palisades Reactor Pressure Vessels Generated with the 03.1 version of FAVOR

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Abstract

The current federal regulations to insure that nuclear reactor pressure vessels (RPVs) maintain their structural integrity when subjected to transient loading conditions such as pressurized thermal shock (PTS) events were derived from computational models developed in the early-mid 1980s. Since that time, there have been advancements in relevant technologies associated with the modeling of PTS events that impact RPV integrity assessment. These updated computational models have been implemented into the FAVOR (**F**racture **A**nalysis of **V**essels: **O**ak **R**idge) computer code.

An objective of the United States Nuclear Regulatory Commission (USNRC) PTS rule re-evaluation project is to determine if the application of improved technology can provide a technical basis to reduce the conservatism in the current regulations while continuing to provide reasonable assurance of adequate protection to public health and safety. A relaxation of PTS regulations could have profound implications for plant license renewal considerations. As part of the PTS re-evaluation project, to date, the 03.1 version of the FAVOR code has been applied to three domestic commercial pressurized water reactors (PWRs): Beaver Valley Unit 1, Oconee Unit 1, and Palisades Unit 1.

The objective of this report is to document the electronic archival of the PTS analysis results, including the input data files and the output data files generated by the 03.1 version of FAVOR, for these three PWRs. This archival should provide sufficient detail such that the analysis results, and subsequent conclusions, can be reproduced. This report also contains summary reports of the analysis results.

1.0 Introduction

Table 1 is a summary of the integrated risk-informed PTS analysis results of Beaver Valley, Oconee, and Palisades which were generated with the 03.1 version of FAVOR [1-2] as part of the NRC-sponsored PTS Re-evaluation Program. Table 1 contains the mean values of the probability distributions for the frequency of crack initiation (FCI) and the through-wall crack frequency (TWCF). For each of the three PWRs, analyses were performed at four levels of embrittlement, each one in principal, corresponding to a particular point in the operating life of the RPV.

For Oconee and Palisades, detailed neutron fluence maps were provided by Brookhaven National Laboratory (BNL) corresponding to 32 and 40 effective-full-power years (EFPY). For Beaver Valley, the same maps were provided by Westinghouse. The modeling and procedures used in generating these neutron flunece maps were based on the guidance provided in the NRC Draft Regulatory Guide DG-1053 [3]. The calculations were performed using the DORT discrete ordinates transport code [4] and the BUGLE-93 [5] forty-seven neutron group ENDF/B-VI nuclear cross sections and fission spectra. The Eason and Wright irradiation shift model, as specified in equation 74 of reference 1, was used to calculate the irradiation-induced Charpy-transition-temperature shift ΔRT_{NDT}.

Neutron fluence maps for times in the operating life of the RPV later than 40 EFPY were obtained by linear extrapolation from the maps for 32 and 40 EFPY. The assumption associated with this extrapolation is that the current core refueling scheme is maintained. This assumption is also implicit in the fluence maps for 32 and 40 EFPY. The first two analysis results were performed with neutron fluence maps that correspond to 32 and 60 EFPY. Clearly, some of the extrapolations used in these analyses are far beyond the range of EFPY for which plants would ever actually operate. They were performed since an objective of the analyses was to determine the level of embrittlement that corresponds to a frequency of RPV failure in the 10^{-6} to 10^{-7} range.

The objective of this report is to document the electronic archival of the PTS analysis results, including the input data files and the output data files generated by the 03.1 version of FAVOR, for these three PWRs. This archival should provide sufficient detail such that the analysis results, and subsequent conclusions, can be reproduced. This report also contains summary reports of the analysis results.

Table 1 Summary of PTS re-evaluation results evaluated with 03.1 version of FAVOR

EFPY	Beaver Valley RT_{NDT}*(1) (°F)	Beaver Valley FCI(2)	Beaver Valley TWCF(3)	Palisades RT_{NDT}* (°F)	Palisades FCI	Palisades TWCF	Oconee RT_{NDT}* (°F)	Oconee FCI	Oconee TWCF
32	166.0	1.56e-07	1.40e-09	210.0	9.67e-08	9.98e-09	138.0	1.18e-07	1.38e-11
60		5.76e-07	8.46e-09		1.96e-07	3.54e-08		3.51e-07	4.60E-10
100	197.0	1.80e-06	3.05e-08						
200	220.0	9.00e-06	3.81e-07	270.0	1.31e-06	4.08e-07			
500				322.0	5.80e-06	2.10e-06	205.0	3.59e-06	1.42e-07
1000							232.0	6.77e-06	5.65e-07

(1) see Appendix F for a discussion regarding the definition of RT_{NDT}*
(2) mean value of the frequency of crack initiation expressed in cracked RPVs per reactor operating year
(2) mean value of the through-wall crack frequency expressed in failed RPVs per reactor operating year

2.0 FAVOR Data Streams

Figure 1 illustrates the nature of the data streams that flow through the three computational modules of the FAVOR code. The three modules of FAVOR are: (1) a deterministic load generator (**FAVLoad**), (2) a Monte Carlo PFM module (**FAVPFM**), and (3) a post-processor (**FAVPost**). Figure 1 indicates the nature of the data streams that flow through these modules.

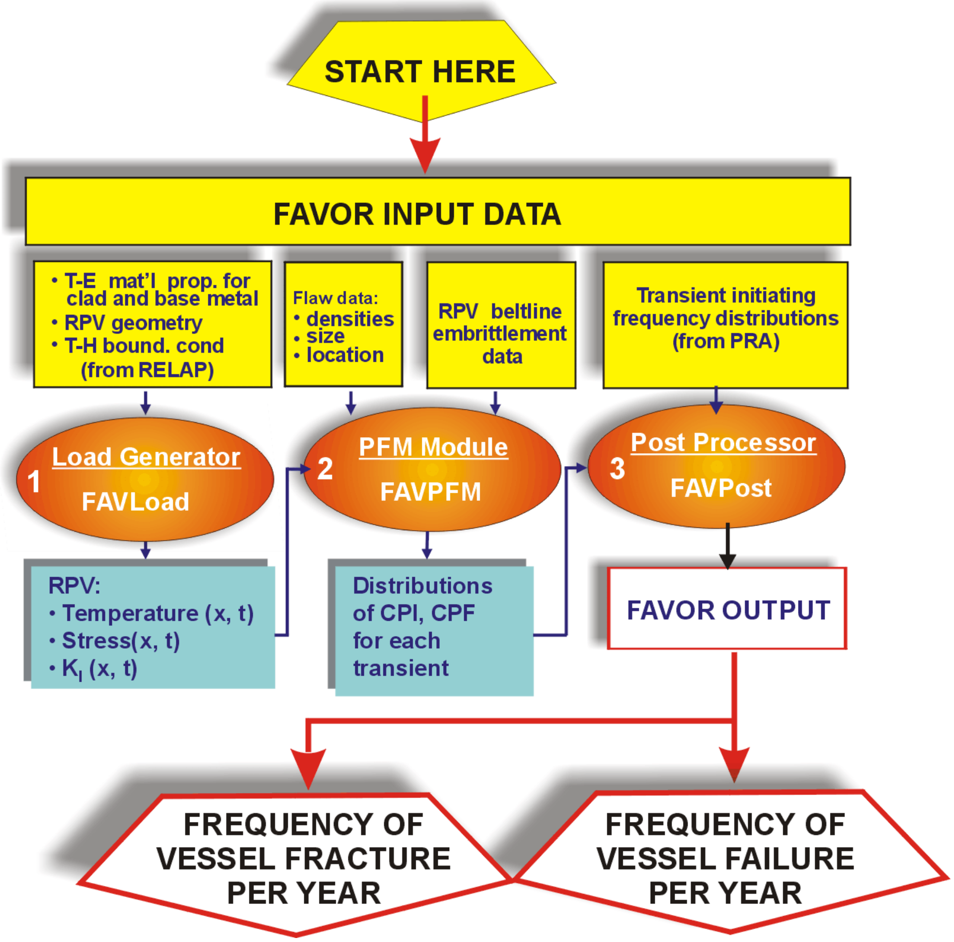


Fig. 1. Data streams flow through three FAVOR modules: (1) FAVLoad, (2) FAVPFM, and (3) FAVPost.

The input data requirements and resulting output data of the **FAVLoad** module are as follows:

FAVLOAD input dataset – contains vessel geometry, thermal-elastic material properties, stress free temperature, and transient definitions, i.e., thermal hydraulic boundary conditions applied to the RPV inner surface for each transient in the form of time histories for convective heat transfer, coolant temperature time history, and pressure. The electronic archive, which this report documents, contains all of the FAVLoad input datasets used in the PTS analyses for the three PWRs. The thermal-hydraulic analyses were performed by Information Systems Laboratories (ISL) using the RELAP 5/MOD3 computer code [6].

FAVLOAD output dataset – contains circumferential and axial stress time histories for various through-wall locations in the RPV wall and applied K_I time histories for various inner-surface breaking flaw geometries for each of the transients. The FAVLoad output dataset becomes one of the input datasets to the FAVPFM module. The FAVLoad output files are not included as part of this archive because (1) the size of the output files are quite large, in one case 538,000 KB, and (2) they can easily be generated in a minimum amount of computational time by applying the FAVLoad (v03.1) module.

The input data requirements of the **FAVPFM** module are five input dataset as follows:

(1) FAVLoad output dataset (discussed above)

(2) embrittlement-related (chemistry and neutron fleunce) data of the RPV beltline

Three flaw characterization files as follows:

(3) inner-surface breaking flaws (applicable to weld and plate material)

(4) embedded flaws for weld material

(5) embedded flaws for plate material

The chemistry data was taken from the RVID database [7]. The flaw-characterization data was provided by Pacific Northwest National Laboratory (PNNL). The USNRC has supported research at PNNL that has resulted in the postulation of fabrication flaws based on the non-destructive and destructive examination of actual RPV material. Such measurements have been used to characterize the number, size, and location of flaws in various types of weld and base metal used to fabricate vessels, thus providing a technical basis for the flaw data which is critical input data into FAVOR analyses [8-10]. These measurements have been supplemented by expert elicitation [11].

The electronic archive, which this report documents, provides all of the FAVPFM input datasets used in the PTS analyses for the three PWRs except the FAVLoad output files.

The resulting output data of the **FAVPFM** module consists of three* output datasets as follows:

(1) initiate.dat – contains the conditional probability of crack initiation (CPI) for each RPV simulated in the PFM Monte Carlo analysis subjected to each transient, i.e., the (i,j) entry in

initiate.dat is the CPI of the *i*th RPV subjected to the *j*th transient. This file will become an input file to the FAVPost module.

(2) failure.dat - contains the conditional probability of RPV failure (CPF) for each RPV simulated in the PFM Monte Carlo analysis subjected to each transient, i.e., the (*i*,*j*) entry in failure.dat is the CPF of the *i*th RPV subjected to the *j*th transient. This file will become an input file to the FAVPost module.

(3) user-named PFM output file - contains informative reports that have the objective of providing useful information and insights into the fracture analysis.

The electronic archive, which this report documents, provides these three FAVPFM ouput datasets generated for each PTS analysis for the three PWRs.

*The FAVPFM module generates additional output reports primarily used by developers for verification and validation purposes. These additional output datasets are not part of the data streams illustrated in Figure 1 and therefore will not be included in this archival.

The input data requirements of the **FAVPost** module are three input dataset as follows:

(1) FAVPost input dataset- contains numerical probability distribution for transient initiating frequency for each transient. Sandia National Laboratory (SNL) provided the probability distributions of the scenario frequency (events per reactor operating year) for all of the transients. The SAPHIRE Version 7 [12] computer code was used to generate the probability distributions

(2) initiate.dat – output file generated by FAVPFM as discussed above

(3) failure.dat – output file generated by FAVPFM as discussed above

The resulting output data of the **FAVPost** module consists of three output datasets as follows:

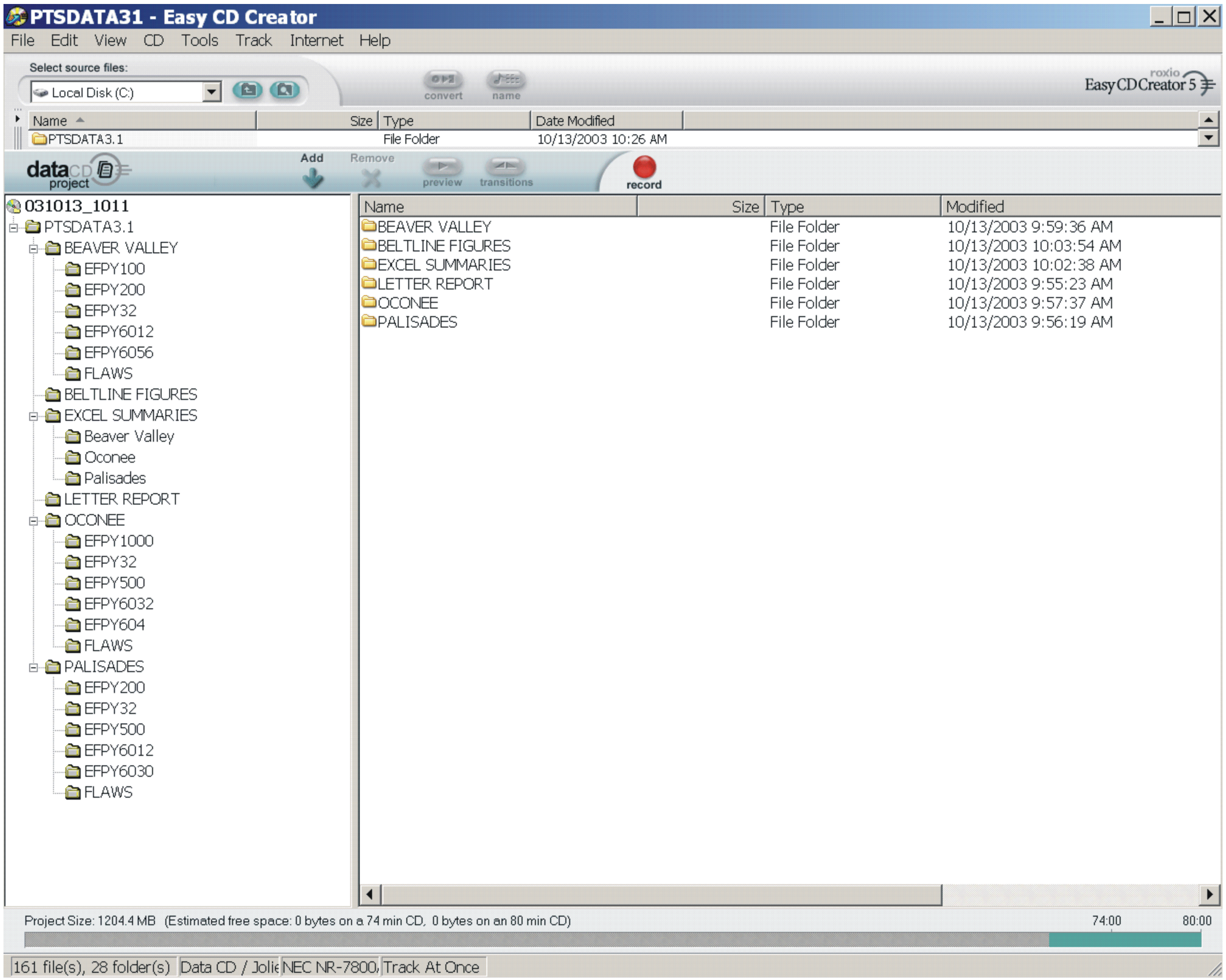
(1) user-named FAVPost output dataset

(2) pdfcpi.out – contains descriptive statistics, including a probability distribution function, (histogram) for the cpi for each transient.

(3) pdfcpf.out - contains descriptive statistics, including a probability distribution function, (histogram) for the cpf for each transient.

3.0 **What's on the Electronic Archival CD – Data File Structure and Naming Convention**

The electronic archival CD contains the following main folder \PTSDATA3.1\ and subfolders:

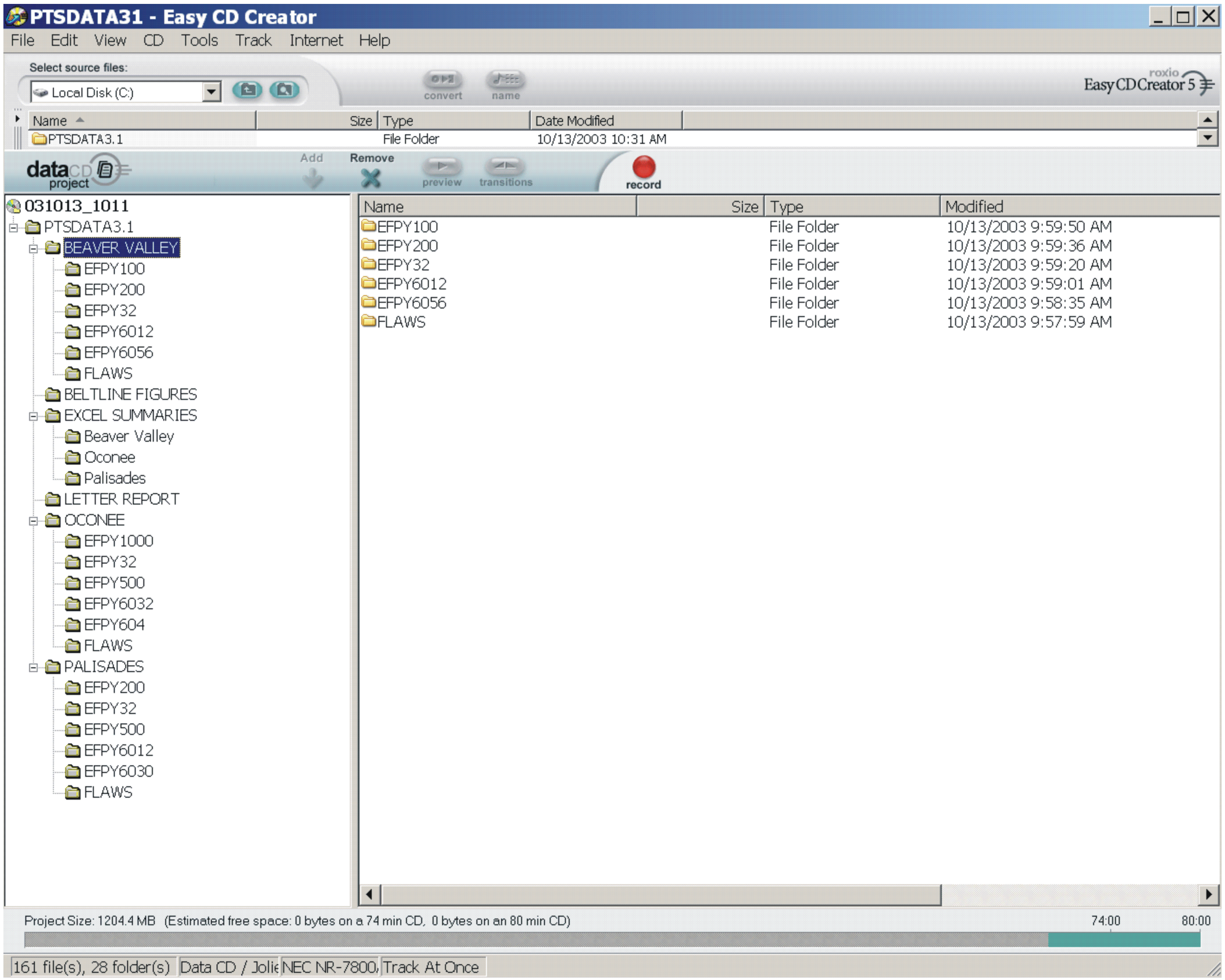


The main folder **\PTSDATA3.1** contains the following six subfolders:

Table 2 - Subfolder Names and Contents of main folder \PTSDATA3.1

Subfolder	**Contents**
Beaver Valley	input and output data files for Beaver Valley PTS analyses
Beltline Figures	illustrations of RPV beltline dimensions and major regions (printed versions are in Appendix A of this report)
Excel Summaries	EXCEL spreadsheet summaries (printed versions are in Appendices B,

	C, D, and E of this report)
Letter Report	this letter report
Oconee	input and output data files for Oconee PTS analyses
Palisades	input and output data files for Palisades PTS analyses



The subfolder **\PTSDATA3.1\Beaver Valley** contains six subfolders; one for each of the PTS analyses performed for Beaver Valley and a subfolder that contains the flaw characterization data files used as input into FAVPFM for all Beaver Valley analyses.

The arbitrary definition of a dominant transient is a transient that contributes approximately 1% or more of the total TWCF when evaluated at the highest level of embrittlement included in the PTS analysis.

For Beaver Valley, the highest level of embrittlement in the analysis was that corresponding to 200 EFPY. The PFM analysis at 200 EFPY was performed for all 61 base case transients. Of these, there were 12 transients that were considered to be dominant.

For Oconee, the highest level of embrittlement in the analysis was that corresponding to 1000 EFPY. The PFM analysis at 1000 EFPY was performed for all 56 base case transients. Of these, there were 4 transients that were considered to be dominant.

For Palisades, the highest level of embrittlement in the analysis was that corresponding to 500 EFPY. The PFM analysis at 500 EFPY was performed for all 30 base case transients. Of these, there were 12 transients that were considered to be dominant.

For each plant, two PFM analyses were performed at 60 EFPY, one with just the dominant transients and another at the request of the NRC staff that included all transients that had CPF > 0 in the analysis performed at the highest level of embrittlement.

For Beaver Valley, there were 56 transients that had CPF > when evaluated at 200 EFPY.

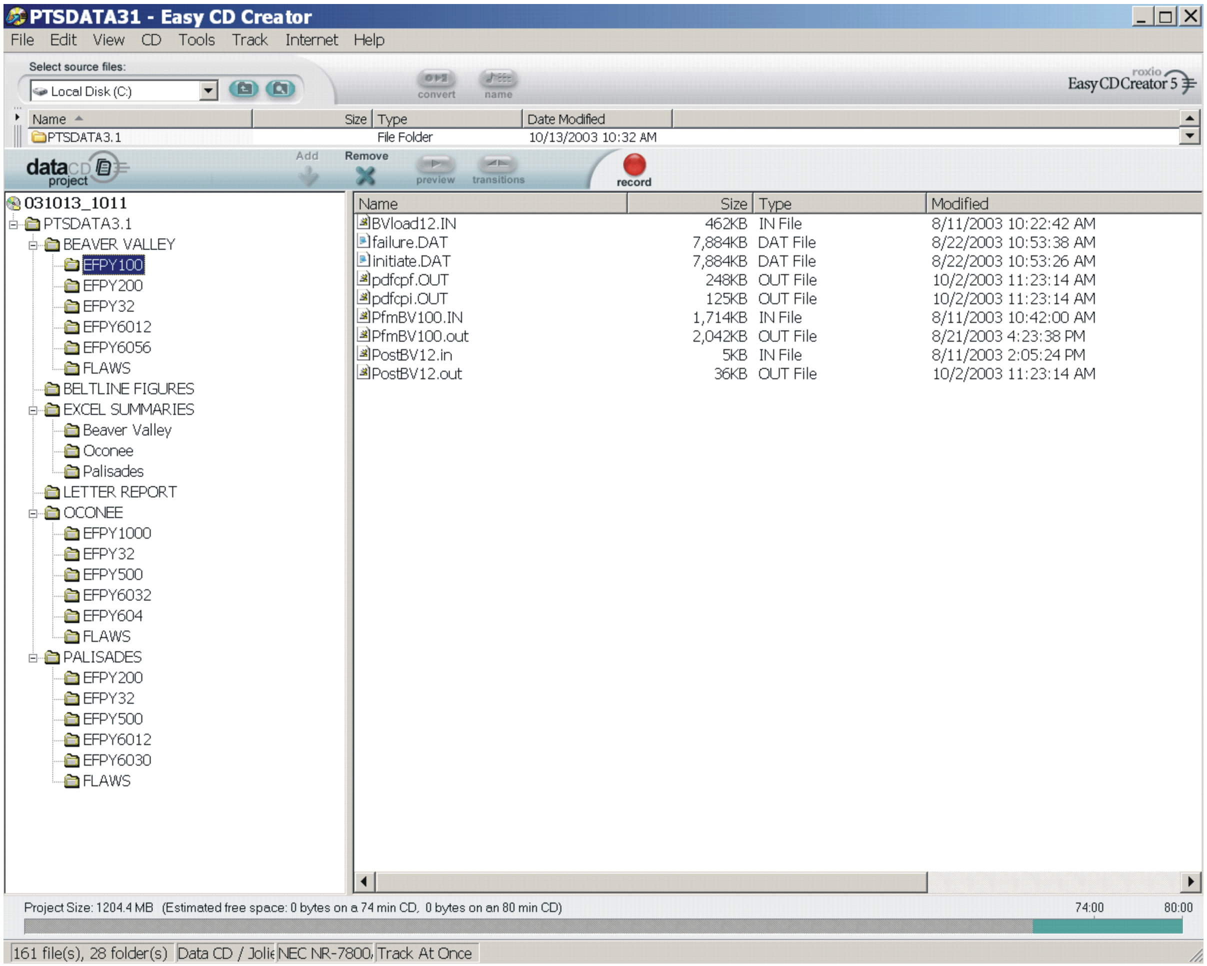
For Oconee, there were 32 transients that had CPF > when evaluated at 1000 EFPY.

For Palisades, there were 30 transients that had CPF > when evaluated at 500 EFPY.

Table 3 - Subfolder Names and Contents of subfolder \PTSDATA3.1\Beaver Valley

Subfolder	Contents
EFPY32	contains input and output data files for a PTS analysis that applies a neutron fluence map that corresponds to 32 EFPY. This analysis was performed for the 12 dominant transients.
EFPY6012	contains input and output data for a PTS analysis for a neutron fluence map that corresponds to 60 EFPY. The analysis is for the 12 dominant transients.
EFPY6056	contains input and output data for a PTS analysis for a neutron fluence map that corresponds to 60 EFPY. The analysis is for the 56 transients.
EFPY100	contains input and output data for a PTS analysis for a neutron fluence map that corresponds to 100 EFPY. The analysis is for the 12 dominant transients.
EFPY200	contains input and output data for a PTS analysis for a neutron fluence map that corresponds to 200 EFPY. The analysis is for all of the 61 transients.
FLAWS	contains Beaver Valley specific flaw characterization files that are input files to FAVPFM

The subfolders **\PTSDATA3.1\Oconee** and **\PTSDATA3.1\Palisades** have an identical structure and similar naming convention as discussed and illustrated above for **\PTSDATA3.1\Beaver Valley.**



The subfolder \PTSDATA3.1\Beaver Valley\EFPY100 contains a total of 9 data files: 3 input data files and 6 output data files for the analysis performed with the neutron fluence map that corresponds to 100 EFPY:

Table 4 - File Names and Contents of subfolder \PTSDATA3.1\Beaver Valley\EFPY100

Data file name	Contents
Bvload12.in	input data file for FAVLOAD (for 12 dominant transients)
PfmBV100.in	input data file to FAVPFM (neutron map for 100 EFPY)
PostBV12.in	input file for FAVPOST (for 12 dominant transients)
initiate.dat	output file generated by FAVPFM that contains a value of conditional probability of crack initiation (CPI) for each simulated RPV subjected to each transient in the analysis. This file becomes an input file to FAVPOST (see figure 1).

failure.dat	output file generated by FAVPFM that contains a value of conditional probability of failure (CPF) for each simulated RPV subjected to each transient in the analysis. This file becomes an input file to FAVPOST.
PostBV100.out	output data file generated by FAVPOST that contains descriptive statistics of the integrated analysis, i.e., the probability distributions for the frequency of crack initiation and through-wall crack frequency, as well as some additional reports.
pdfcpi.out	output data file generated by FAVPOST that contains descriptive statistics for the CPI of each transient included in the PFM analysis.
pdfcpf.out	output data file generated by FAVPOST that contains descriptive statistics for the CPF of each transient included in the PFM analysis.

The subfolders **\PTSDATA3.1\Beaver Valley\EFPY32, EFPY6012, EFPY6056, EFPY100** and **EFPY200** have an identical structure and similar naming convention as illustrated in the following table:

Table 5 - Naming Convention inside of subfolder \PTSDATA3.1\Beaver Valley

subfolder name	**Number of transients in analysis**	**FAVLOAD input dataset**	**FAVPFM input dataset**	**FAVPFM output dataset**	**FAVPOST input dataset**	**FAVPOST output dataset**
EFPY32	12	**BV**load12.in	Pfm**BV**32.in	Pfm**BV**32.out	Post**BV**12.in	Post**BV**12.in
EFPY6012	12	**BV**load12.in	Pfm**BV**60.in	Pfm**BV**60.out	Post**BV**12.in	Post**BV**12.in
EFPY6056	56	**BV**oad56.in	Pfm**BV**60.in	Pfm**BV**60.out	Post**BV**56.in	Post**BV**56.in
EFPY100	12	**BV**load12.in	Pfm**BV**100.in	Pfm**BV**100.out	Post**BV**12.in	Post**BV**12.in
EFPY200	61	**Bv**load61.in	Pfm**BV**200.in	Pfm**BV**200.out	Post**BV**61.in	Post**BV**61.in

The subfolders **\PTSDATA3.1\Oconee\EFPY32, EFPY604, EFPY6032, EFPY500** and **EFPY1000** have an identical structure as **\PTSDATA3.1\Beaver Valley** illustrated above and a similar naming convention as illustrated in the following table:

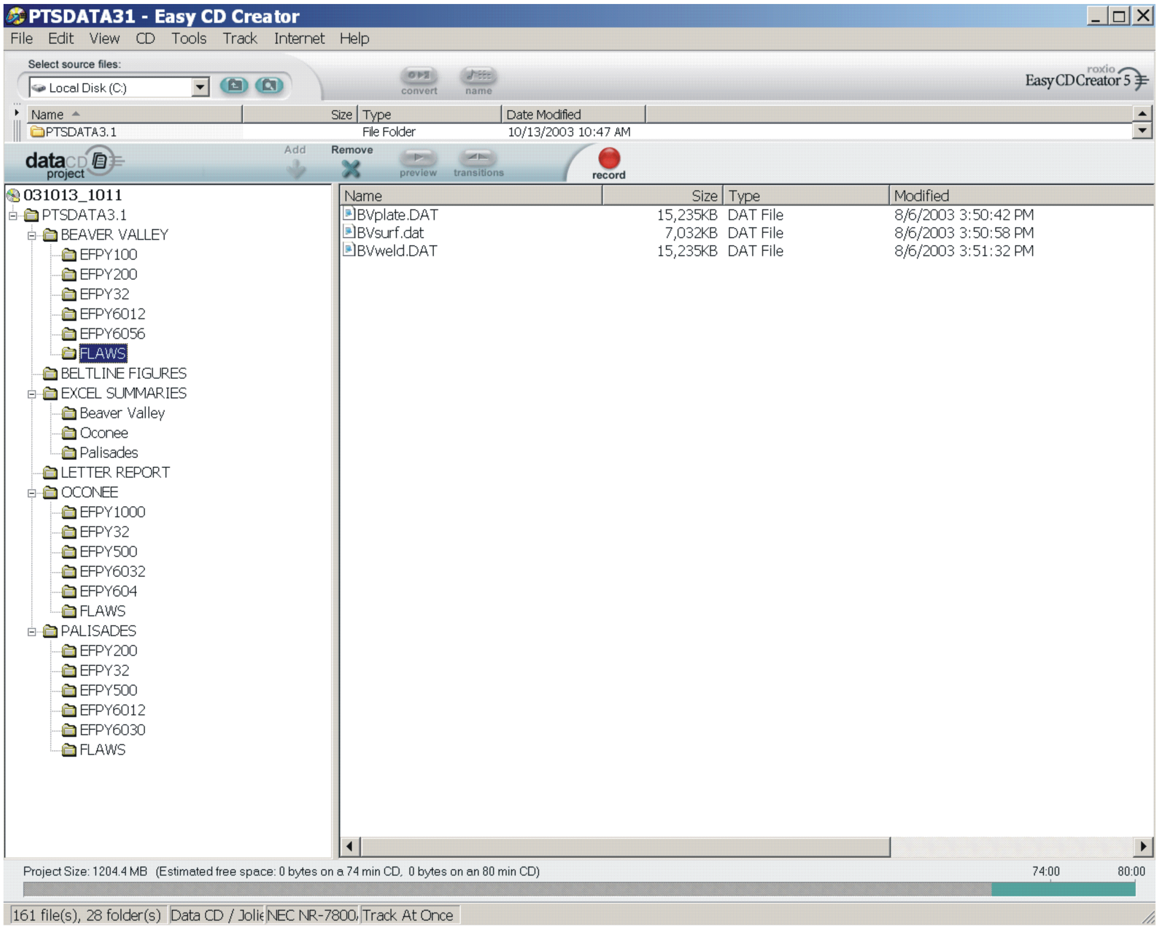
Table 6 - Naming Convention inside of subfolder \PTSDATA3.1\Oconee

Subfolder name	Number of transients in analysis	FAVLOAD input dataset	FAVPFM input dataset	FAVPFM output dataset	FAVPOST input dataset	FAVPOST output dataset
EFPY32	4	**Oc**load4.in	Pfm**OC**32.in	Pfm**OC**32.out	Post**OC**4.in	Post**OC**4.out
EFPY604	4	**Oc**load4.in	Pfm**OC**60.in	Pfm**OC**60.out	Post**OC**4.in	Post**OC**4.out
EFPY6032	32	**Oc**oad32.in	Pfm**OC**60.in	Pfm**OC**60.out	Post**OC**32.in	Post**OC**32.out
EFPY500	4	**Oc**load4.in	Pfm**OC**500.in	Pfm**OC**500.out	Post**OC**4.in	Post**OC**4.out
EFPY1000	54	**Oc**load54.in	Pfm**OC**1000.in	Pfm**OC**1000.out	Post**OC5**4.in	Post**OC5**4.out

The subfolders **\PTSDATA3.1\Palisades\EFPY32, EFPY6012, EFPY6030, EFPY200** and **EFPY500** have an identical structure as **\PTSDATA3.1\Beaver Valley** illustrated above and similar naming convention as illustrated in the following table:

Table 7 - Naming Convention inside of subfolder \PTSDATA3.1\Palisades

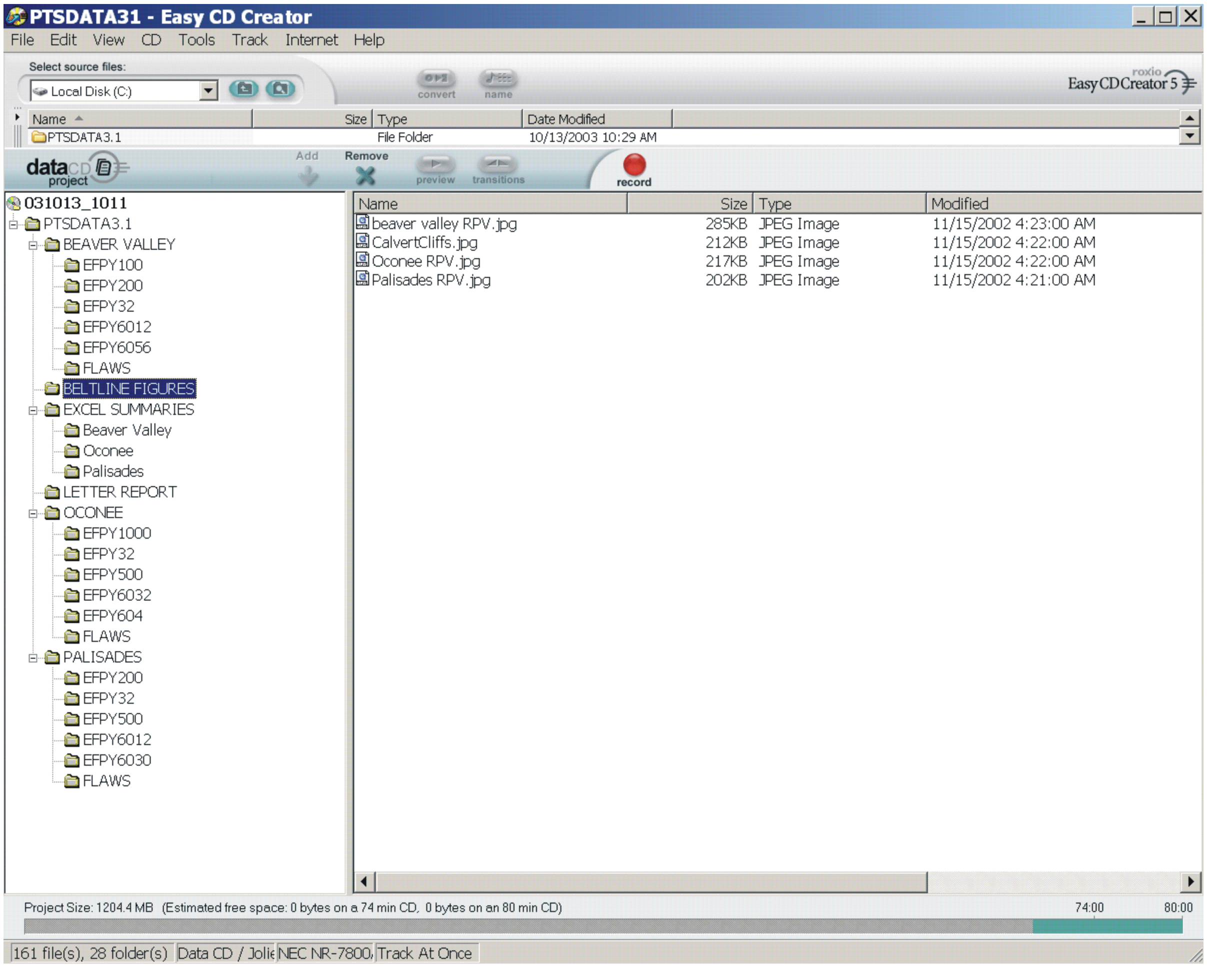
Folder name	**Number of transients in analysis**	**FAVLOAD input dataset**	**FAVPFM input dataset**	**FAVPFM output dataset**	**FAVPOST input dataset**	**FAVPOST output dataset**
EFPY32	12	**PL**load12.in	Pfm**PL**32.in	Pfm**PL**32.out	Post**PL**12.in	Post**PL**12.out
EFPY6012	12	**PL**load12.in	Pfm**PL**60.in	Pfm**PL**60.out	Post**PL**12.in	Post**PL**12.out
EFPY6030	30	**PL**load30.in	Pfm**PL**60.in	Pfm**PL**60.out	Post**PL**30.in	Post**PL**30.out
EFPY200	12	**PL**load12.in	Pfm**PL**200.in	Pfm**PL**200.out	Post**PL**12.in	Post**PL**12.out
EFPY500	30	**PL**load30.in	Pfm**PL**500.in	Pfm**PL**500.out	Post**PL**30.in	Post**PL**30.out



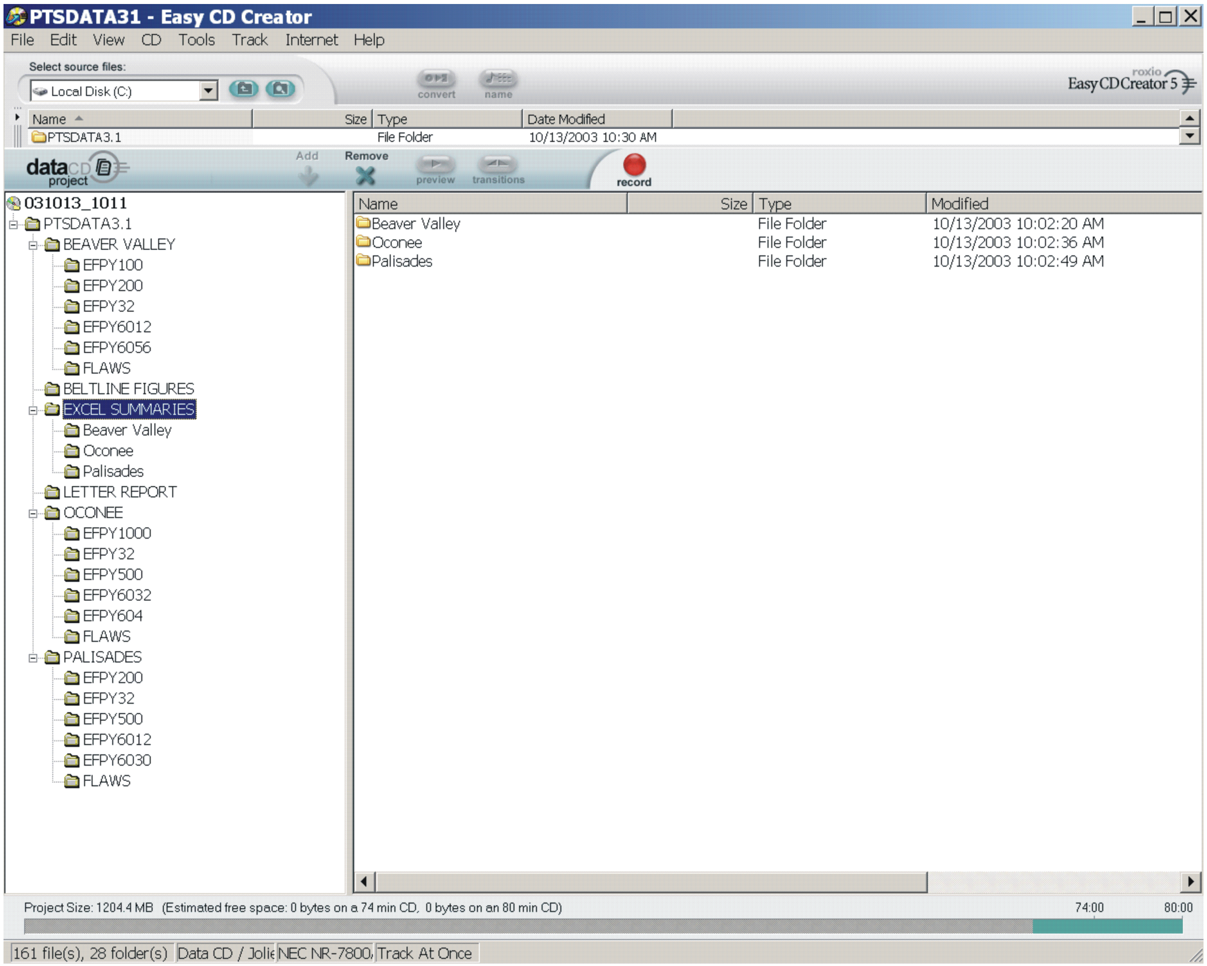
The folder **\PTSDATA3.1\Beaver Valley\FLAWS** contains 3 flaw characterization files used as input for all of the analysis performed for Beaver Valley. The subfolders \PTSDATA3.1\Oconee\FLAWS and \PTSDATA3.1\Palisades\FLAWS have the same structure and naming convention as illustrated in the following table.

Table 8 - Naming Convention for Flaw characterization files in FLAWS subfolders

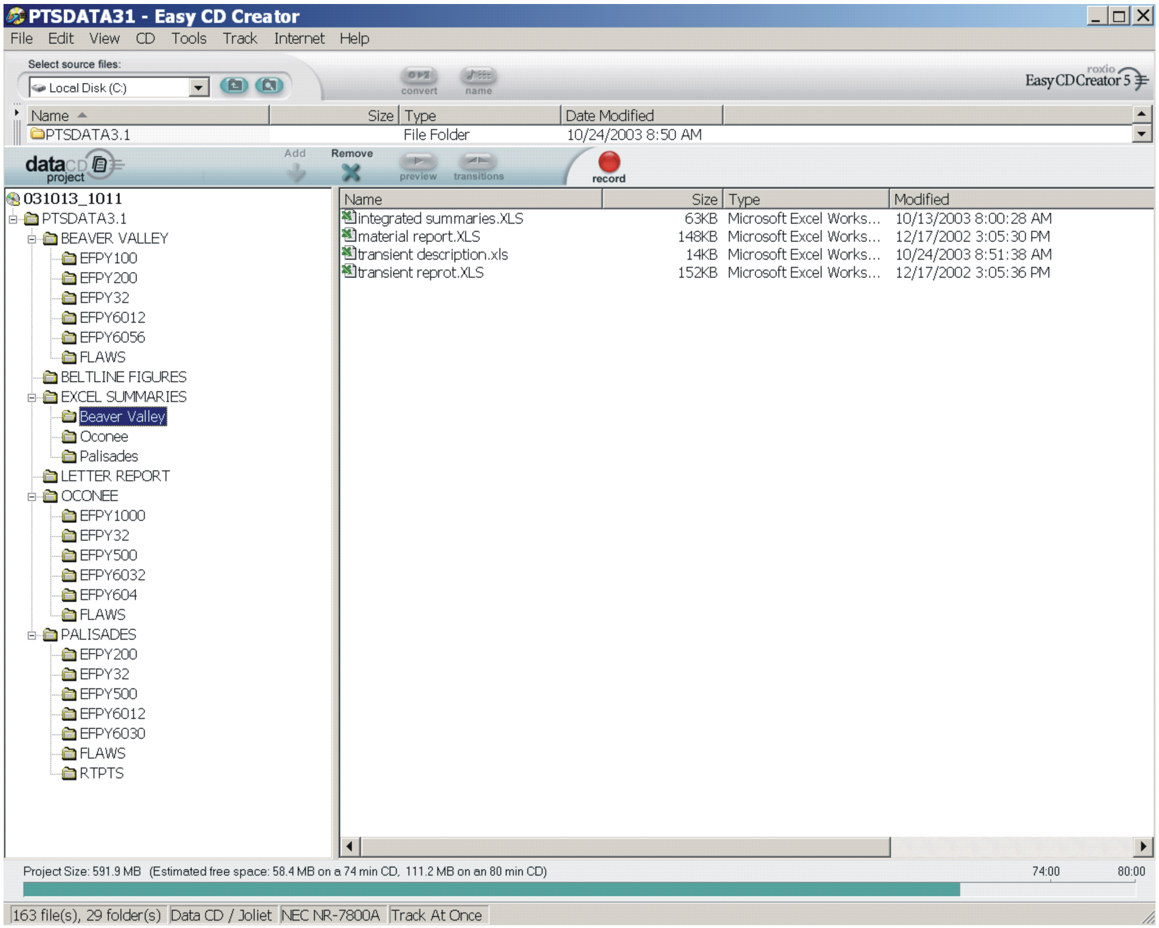
RPV	inner-surface breaking flaws (plate and weld)	weld embedded flaws	plate embedded flaws
Beaver Valley	**BV**surf.dat	**BV**weld.dat	**BV**plate.dat
Oconee	**OC**surf.dat	**OC**weld.dat	**OC**plate.dat
Palisades	**PL**surf.dat	**PL**weld.dat	**PL**plate.dat



The folder \PTSDATA3.1\Beltline Figures\ contains the 360 degree rollout of each of the RPVs as illustrated Appendix A.



The subfolder \PTSDATA3.1\EXCEL SUMMARIES\ contains subfolders for each of the three RPVs.



Each of the subfolders \PTSDATA3.1\EXCEL SUMMARIES\Beaver Valley\, \PTSDATA3.1\EXCEL SUMMARIES\Oconee\, and \PTSDATA3.1\EXCEL SUMMARIES\Palisades contains the four following files:

Table 9 - Naming Convention for files in EXCEL SUMMARIES subfolders

EXECL spreadsheet name	Contents
integrated summaries.XLS	Contains descriptive statistics for the frequency of crack initiation and through wall crack frequency for each PTS analysis. There is a hard copy of each of these reports in Appendix B.
material report.XLS	Contains detailed data regarding the contribution of each of the major RPV beltline regions to the frequency of crack initiation and the through wall crack frequency. There is a hard copy of each of these reports in Appendix C.
transient description.XLS	Contains detailed description of the cause of each transient and operator actions (if any). There is a hard copy of each of these reports in Appendix D.
transient report.XLS	Contains descriptive statistics for the CPI and CPF of each transient and the contribution of each transient to the total frequencies of crack initiation and RPV failure. There is a hard copy of each of these reports in Appendix E.

The material reports (Appendix C) allocate the total FCI and total TWCF to specific RPV major regions. The allocations are further distinguished between parent and child major regions. There is a discussion of the relationship between parent and child regions on page 37 of reference 2. For completeness, an excerpt from that discussion is included here as follows:

The discretization and organization of major regions and subregions in the beltline includes a special treatment of *weld-fusion lines.* These fusion lines can be visualized as approximate boundaries between the weld subregion and its neighboring plate or forging subregions. FAVOR checks for the possibility that the plate subregions adjacent to a weld subregion (termed *parent* subregions) could have a higher degree of radiation-induced embrittlement than the weld. The irradiated value of RT_{NDT} for the weld parent subregion of interest is compared to the corresponding values of the adjacent (i.e., nearest-neighbor) plate subregions. Each weld subregion will have at most two adjacent plate subregions. The embrittlement-related properties of the most-limiting (either the weld or the adjacent plate subregion with the highest value of irradiated RT_{NDT}) material are used when evaluating the fracture toughness of the weld subregion. A given *parent* weld subregion will have either itself or an adjacent plate subregion as its *child* subregion from which it will inherit its chemistry. The flaw orientation, location, size, fast-neutron fluence, and category are not inherited. A *parent* plate subregion always has itself as a *child* subregion.

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Appendix A

360 degree RPV beltline figures

Table number	Table Content
A1	Beaver Valley RPV Beltline Major Region embrittlement-related parameters
A2	Oconee RPV Beltline Major Region embrittlement-related parameters
A3	Palisades RPV Beltline Major Region embrittlement-related parameters

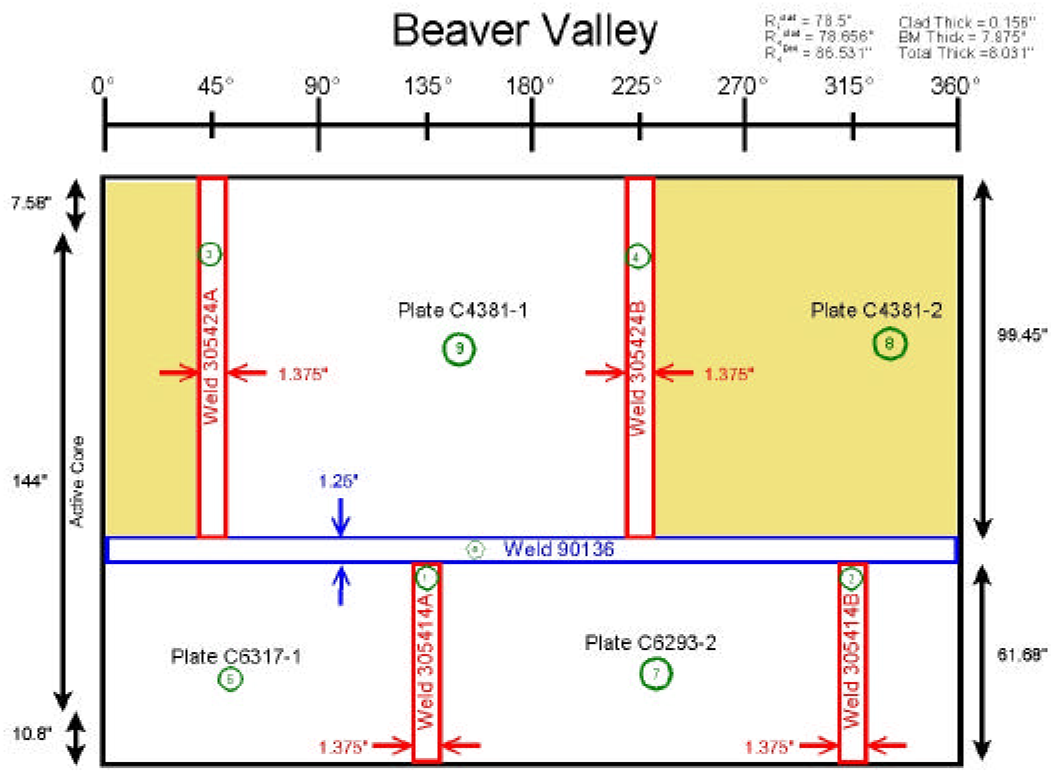

Table A1 - Beaver Valley RPV Beltline Major Region embrittlement-related parameters

Major Region	Description	Heat ID	copper	nickel	phos	$RT_{NDT(u)}$	max neutron fluence @32 EFPY	max DRT_{NDT} @ 32 EFPY	max neutron fluence @60 EFPY	max DRT_{NDT} @ 60 EFPY	max neutron fluence @100 EFPY	max DRT_{NDT} @ 10 EFPY	max neutron fluence @200 EFPY	max DRT_{NDT} @ 200 EFPY
			wt %	wt %	wt %	(°F)	10^{19} n / cm^2	(°F)	10^{19} n / cm^2	(°F)	10^{19} n / cm^2	(°F)	10^{19} n / cm^2	(°F)
1	Axial Weld	305414A	0.337	0.609	0.012	-56.0	0.8428	211.2	1.5738	230.5	2.6182	244.3	5.2292	262.7
2	Axial Weld	305414B	0.337	0.609	0.012	-56.0	0.8428	211.2	1.5738	230.5	2.6182	244.3	5.2292	262.7
3	Axial Weld	305424A	0.273	0.629	0.013	-56.0	0.8274	198.9	1.5439	217.8	2.5676	231.7	5.1266	250.5
4	Axial Weld	305424B	0.273	0.629	0.013	-56.0	0.8274	198.9	1.5439	217.8	2.5676	231.7	5.1266	250.5
5	Circ Weld	90136	0.269	0.070	0.013	-56.0	4.2523	139.7	8.1256	157.9	13.6589	177.7	27.4923	211.6
6	Plate	C6317-1	0.200	0.540	0.100	27.0	4.3218	184.0	8.2642	206.9	13.8962	231.7	27.9761	274.0
7	Plate	C6293-2	0.140	0.570	0.150	20.0	4.3218	166.1	8.2642	194.3	13.8962	225.3	27.9761	278.6
8	Plate	C4381-2	0.140	0.620	0.150	73.0	4.2678	170.1	8.1399	198.1	13.6569	228.8	27.4643	281.5
9	Plate	C4381-1	0.140	0.620	0.150	43.0	4.2678	170.1	8.1399	198.1	13.6569	228.8	27.4643	281.5

∗ΔRT_{NDT} calculated by equation 74 of reference 1.

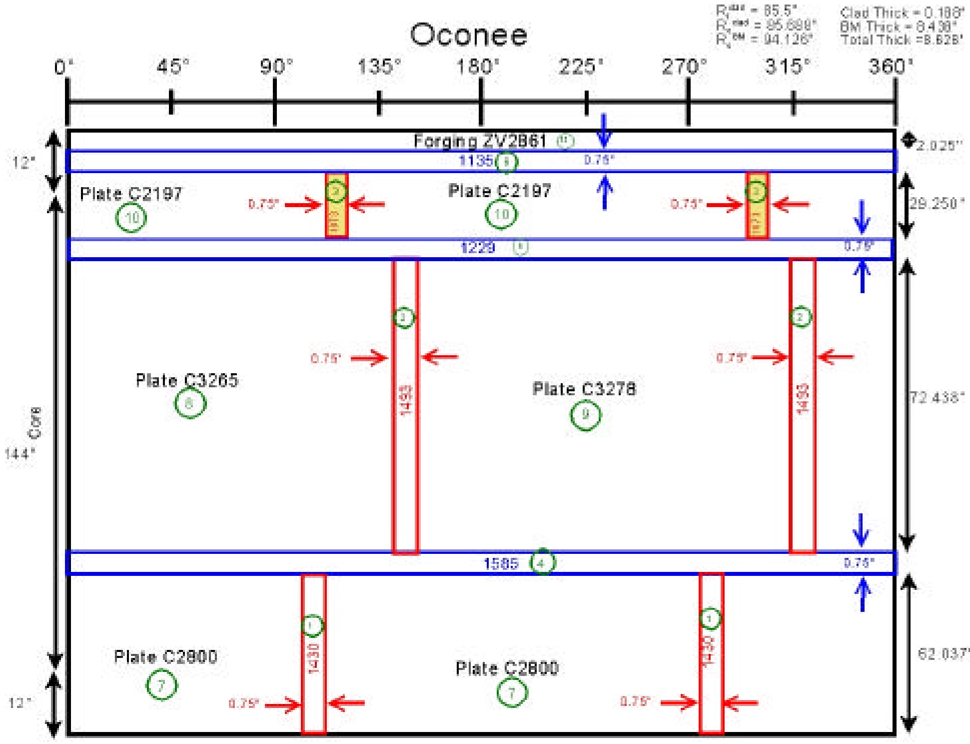

Table A2 - Oconee RPV Beltline Major Region embrittlement-related parameters

Major Region	Description	Heat ID	copper	nickel	phos	$RT_{NDT(u)}$	max neutron fluence @32 EFPY	max DRT_{NDT} @ 32 EFPY	max neutron fluence @60 EFPY	max DRT_{NDT} @ 60 EFPY	max neutron fluence @500 EFPY	max DRT_{NDT} @ 500 EFPY	max neutron fluence @1000 EFPY	max DRT_{NDT} @1000 EFPY
			wt %	wt %	wt %	(°F)	10^{19} n / cm^2	(°F)	10^{19} n / cm^2	(°F)	10^{19} n / cm^2	°F)	10^{19} n / cm^2	(°F)
1	Axial Weld	SA-1430	0.190	0.570	0.017	-5.0	0.7360	135.4	1.3802	149.9	11.5021	199.6	23.0000	225.4
2	Axial Weld	SA-1493	0.190	0.570	0.017	-5.0	0.6820	133.6	1.2791	148.4	10.6591	197.2	21.3000	222.1
3	Axial Weld	SA-1073	0.210	0.640	0.025	-5.0	0.6070	157.2	1.1387	176.3	9.4896	237.5	19.0000	268.5
4	Circ Weld	SA-1585	0.220	0.540	0.016	-5.0	0.8210	150.1	1.5386	164.9	12.8214	215.1	25.6000	241.1
5	Circ Weld	SA-1229	0.230	0.590	0.021	-10.0	0.7690	165.3	1.4422	182.6	12.0180	241.1	24.0000	271.4
6	Circ Weld	SA-1135	0.230	0.520	0.011	-5.0	0.0923	93.0	0.1730	119.3	1.4420	166.0	2.8800	175.7
7	Plate	C-2800	0.110	0.630	0.012	1.0	0.8370	70.4	1.5691	80.8	13.0753	134.9	26.2000	166.4
8	Plate	C3265-1	0.100	0.500	0.015	1.0	0.8330	62.4	1.5610	73.1	13.0080	133.8	26.0000	169.5
9	Plate	C3278-1	0.120	0.600	0.010	1.0	0.8330	72.8	1.5610	82.8	13.0080	132.2	26.0000	160.5
10	Plate	C2197-2	0.150	0.500	0.008	1.0	0.7560	78.4	1.4169	88.3	11.8074	131.8	23.6000	156.1
11	Forging	ZV2861	0.160	0.650	0.006	3.0	0.0855	48.6	0.1602	61.2	1.3354	86.7	2.6700	93.5

*ΔRT_{NDT} calculated by equation 74 of reference 1.

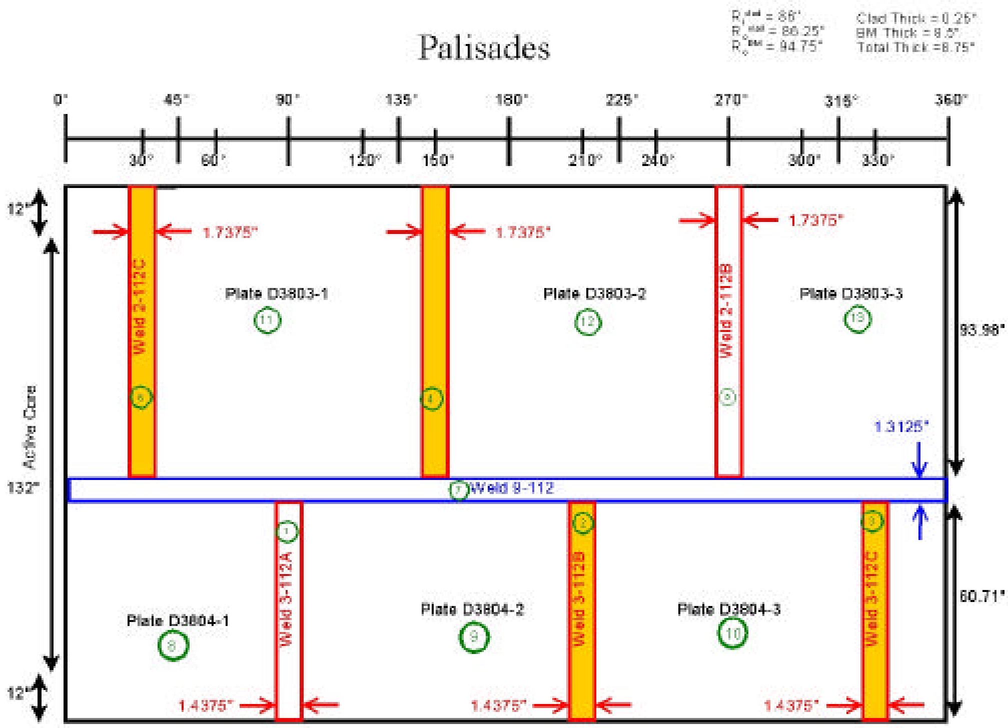

Table A3 – Palisades RPV Beltline Major Region embrittlement-related parameters

Major Region	Description	Heat ID	copper	nickel	phos	$RT_{NDT(u)}$	max neutron fluence @32 EFPY	max DRT_{NDT} @ 32 EFPY	max neutron fluence @60 EFPY	max DRT_{NDT} @ 60 EFPY	max neutron fluence @200 EFPY	max DRT_{NDT} @ 200 EFPY	max neutron fluence @500 EFPY	max DRT_{NDT} @500 EFPY
			wt %	wt %	wt %	(°F)	10^{19} n / cm^2	(°F)	10^{19} n / cm^2	(°F)	10^{19} n / cm^2	(°F)	10^{19} n / cm^2	(°F)
1	Axial Weld	Axial Weld	0.213	1.010	0.019	-56.0	1.6646	262.4	2.4688	276.9	6.4894	315.2	15.1050	360.1
2	Axial Weld	Axial Weld	0.213	1.010	0.019	-56.0	1.9567	268.2	3.1741	286.0	9.2611	332.2	22.3048	386.8
3	Axial Weld	Axial Weld	0.213	1.010	0.019	-56.0	1.9567	268.2	3.1741	286.0	9.2611	332.2	22.3048	386.8
4	Axial Weld	Axial Weld	0.213	1.010	0.019	-56.0	1.9699	268.4	3.2129	286.5	9.4604	333.3	22.8479	388.6
5	Axial Weld	Axial Weld	0.213	1.010	0.019	-56.0	1.6738	262.6	2.4910	277.3	6.6171	316.0	15.4604	361.6
6	Axial Weld	Axial Weld	0.213	1.010	0.019	-56.0	1.9699	268.4	3.2129	286.5	9.4604	333.3	22.8470	388.6
7	Circ Weld	Circ Weld	0.203	1.018	0.013	-56.0	2.5537	256.6	4.0419	270.8	11.5107	309.7	27.5154	356.6
8	Plate	Plate	0.190	0.480	0.016	0.0	2.5516	180.5	4.0380	199.9	11.4979	259.5	27.4834	334.9
9	Plate	Plate	0.190	0.500	0.015	-30.0	2.5516	179.9	4.0380	198.6	11.4979	256.0	27.4834	328.3
10	Plate	Plate	0.120	0.550	0.010	-25.0	2.5516	124.6	4.0380	139.1	11.4979	184.2	27.4834	241.5
11	Plate	Plate	0.240	0.510	0.009	-5.00	2.5680	189.0	4.0846	204.1	11.7410	248.7	28.1477	304.0
12	Plate	Plate	0.240	0.520	0.010	-30.0	2.5680	193.6	4.0846	209.5	11.7410	256.4	28.1477	314.7
13	Plate	Plate	0.240	0.500	0.011	-5.00	2.5680	193.5	4.0846	210.1	11.7410	259.3	28.1477	320.6

*ΔRT_{NDT} calculated by equation 74 of reference 1.

Appendix B - Integrated Summaries

Table number	Table Content
B1	Integrated Summary for Beaver Valley
B2	Integrated Summary for Oconee
B3	Integrated Summary for Palisades

Table B1 - Integrated summary report for Beaver Valley

Number of Simulated RPVs	EFPY	Frequency of Crack Initiation (FCI)						Through-Wall Cracking Frequency (TWCF)					
		Cracked RPVs Per Reactor Operating Year						Cracked RPVs Per Reactor Operating Year					
		Percentiles						Percentiles					
		5%	95%	99%	99.9%	Median	Mean	5%	95%	99%	99.9%	Median	Mean
86,500	32 (12 trans)	0.00E+00	2.52E-07	2.21E-06	1.41E-05	3.32E-09	1.56E-07	0.00E+00	2.77E-10	1.11E-08	2.24E-07	0.00E+00	1.40E-09
46,300	100 (12 Trans)	2.68E-08	6.63E-06	2.00E-05	8.43E-05	5.15E-07	1.80E-06	1.03E-12	4.35E-08	3.95E-07	2.73E-06	1.11E-09	3.05E-08
8,400	200 (61 Trans)	5.61E-07	3.17E-05	8.78E-05	2.10E-04	3.99E-06	9.00E-06	3.12E-09	1.30E-06	5.01E-06	3.19E-05	7.16E-08	3.81E-07
125,880	60 (12 trans)	6.02E-10	1.06E-06	6.80E-06	3.42E-05	7.93E-08	5.66E-07	0.00E+00	5.66E-09	7.97E-08	7.54E-07	1.72E-11	6.15E-09
31,500	60 (56 trans)	6.23E-10	1.08E-06	7.20E-06	3.35E-05	7.99E-08	5.76E-07	7.92E-16	6.19E-09	8.81E-08	1.15E-06	2.21E-11	8.46E-09

Table B2 - Integrated summary report for Oconee

Number of Simulated RPVs	EFPY	Frequency of Crack Initiation (FCI)						Through-Wall Cracking Frequency (TWCF)					
		Cracked RPVs Per Reactor Operating Year						Cracked RPVs Per Reactor Operating Year					
		Percentiles						Percentiles					
		5%	95%	99%	99.9%	Median	Mean	5%	95%	99%	99.9%	Median	Mean
96,550	32 (4 trans)	2.71E-10	2.07E-07	1.54E-06	8.46E-06	1.29E-08	1.18E-07	0.00E+00	0.00E+00	5.10E-11	2.24E-09	0.00E+00	1.38E-11
35,000	500 (4 Trans)	1.21E-07	1.30E-05	3.72E-05	1.72E-04	1.14E-06	3.59E-06	5.83E-12	2.33E-07	2.03E-06	1.22E-05	9.05E-09	1.42E-07
10,930	1000 (54 Trans)	3.64E-07	2.31E-05	6.24E-05	2.42E-04	2.61E-06	6.77E-06	3.28E-09	1.96E-06	7.34E-06	5.36E-05	8.62E-08	5.65E-07
52,000	60 (4 trans)	3.12E-09	1.30E-06	4.77E-06	2.10E-05	6.14E-08	3.47E-07	0.00E+00	1.84E-10	5.20E-09	6.46E-08	0.00E+00	4.06E-10
103,000	60 (32 trans)	3.11E-09	1.27E-06	4.71E-06	2.15E-05	6.10E-08	3.51E-07	0.00E+00	6.86E-11	3.32E-09	5.80E-08	0.00E+00	4.60E-10

Table B3 - Integrated summary report for Palisades

Number of Simulated RPVs	EFPY	Frequency of Crack Initiation (FCI) Cracked RPVs Per Reactor Operating Year Percentiles						Through-Wall Cracking Frequency (TWCF) Cracked RPVs Per Reactor Operating Year Percentiles					
		5%	95%	99%	99.9%	Median	Mean	5%	95%	99%	99.9%	Median	Mean
19,240	**32 (12 trans)**	0.00E+00	1.15E-07	1.33E-06	8.77E-06	4.70E-10	9.67E-08	0.00E+00	5.48E-09	1.35E-07	1.42E-06	8.02E-13	9.98E-09
17,630	**200 (12 Trans)**	7.51E-09	3.94E-06	1.60E-05	8.70E-05	1.93E-07	1.31E-06	2.42E-10	7.59E-07	3.64E-06	3.32E-05	1.99E-08	4.08E-07
7,000	**500 (30 Trans)**	3.06E-07	2.09E-05	6.00E-05	2.22E-04	2.20E-06	5.80E-06	3.45E-08	7.04E-06	2.61E-05	1.19E-04	5.18E-07	2.10E-06
18,030	**60 (12 trans)**	8.05E-13	2.97E-07	3.05E-06	2.23E-05	6.01E-09	2.02E-07	0.00E+00	3.26E-08	4.75E-07	5.17E-06	1.10E-10	3.42E-08
50,000	**60 (30 trans)**	5.57E-13	2.97E-07	2.91E-06	1.90E-05	5.70E-09	1.96E-07	0.00E+00	3.87E-08	4.91E-07	4.55E-06	1.94E-10	3.54E-08

Appendix C - Material Summaries

Table number	Table Content
C1	Material report for Beaver Valley at 32 EFPY (12 dominant transients)
C2	Material report for Beaver Valley at 60 EFPY (56 transients)
C3	Material report for Beaver Valley at 60 EFPY (12 dominant transients)
C4	Material report for Beaver Valley at 100 EFPY (12 dominant transients)
C5	Material report for Beaver Valley at 200 EFPY (61 base case transients)
C6	Material Report for Oconee at 32 EFPY (4 dominant transients)
C7	Material Report for Oconee at 60 EFPY (32 transients)
C8	Material Report for Oconee at 60 EFPY (4 transients)
C9	Material Report for Oconee at 500 EFPY (4 dominant transients)
C10	Material Report for Oconee at 1000 EFPY (54 base case transients)
C11	Material report for Palisades at 32 EFPY (12 dominant transients)
C12	Material report for Palisades at 60 EFPY (12 dominant transients)
C13	Material report for Palisades at 60 EFPY (30 base case transients)
C14	Material report for Palisades at 200 EFPY (12 dominant transients)
C15	Material report for Palisades at 500 EFPY (30 base case transients)

Table C1 - Material report for Beaver Valley at 32 EFPY (12 dominant transients)

Plant Name:	Beaver Valley
EFPY:	32 (12 trans)
WPS:	on
Ductile Tearing	on
Through wall cracking	0.90

Major Region Number	Description		# of Subregions	Cu	Ni	P	Max Neutron Fluence	RT_{NDT0}	?RT_{NDT}	RT_{NDT}	% of Total Flaws	% of total FCI (By Parent)	% of total TWCF (By Parent)	% of total FCI (By Child)	% of total TWCF (By Child)
			(#)	wt%	wt%	wt%	$x10^{19}$ n/cm^2	(°F)	(°F)	(°F)	%	%	%	%t	%
1	Axial Weld	305414A	34	0.337	0.609	0.012	0.8428	-56.0	211.16	155.16	2.30	0.46	3.66	0.00	0.00
2	Axial Weld	305414B	34	0.337	0.609	0.012	0.8428	-56.0	211.16	155.16	2.30	0.25	0.84	0.00	0.00
3	Axial Weld	305424A	53	0.273	0.629	0.013	0.8274	-56.0	198.91	142.91	3.70	2.64	22.53	0.00	0.00
4	Axial Weld	305424B	53	0.273	0.629	0.013	0.8274	-56.0	198.91	142.91	3.70	2.53	35.74	0.00	0.00
5	Circ Weld	90136	664	0.269	0.070	0.013	4.2523	-56.0	139.67	83.67	19.31	93.89	0.53	0.00	0.00
6	Plate	C6317-1	2,822	0.200	0.540	0.010	4.3218	27.0	183.98	210.98	13.15	0.01	0.45	2.58	4.97
7	Plate	C6293-2	2,822	0.140	0.570	0.015	4.3218	20.0	166.10	186.10	13.15	0.00	0.01	0.00	0.01
8	Plate	C4381-2	4,399	0.140	0.620	0.015	4.2678	73.0	170.13	243.13	21.20	0.17	24.96	52.38	83.72
9	Plate	C4381-1	4,399	0.140	0.620	0.015	4.2678	43.0	170.13	213.13	21.20	0.05	11.27	45.05	11.30

Table C2 –Material report for Beaver Valley at 60 EFPY (56 transients)

Plant Name:	Beaver Valley
EFPY:	60 (56 trans)
WPS:	on
Ductile Tearing	on
Through wall cracking	0.90

Major Region Number	Description		# of Subregions	Cu	Ni	P	Max Neutron Fluence	RT_{NDT0}	$?RT_{NDT}$	RT_{NDT}	% of Total Flaws	% of total FCI (By Parent)	% of total TWCF (By Parent)	% of total FCI (By Child)	% of total TWCF (By Child)
			(#)	wt%	wt%	wt%	$x10^{19}$ n/cm^2	(°F)	(°F)	(°F)	%	%	%	%t	%
1	Axial Weld	305414A	34	0.337	0.609	0.012	1.5738	-56	230.49	174.49	2.30	0.24	1.51	0.00	0.00
2	Axial Weld	305414B	34	0.337	0.609	0.012	1.5738	-56	230.49	174.49	2.30	0.19	0.59	0.00	0.00
3	Axial Weld	305424A	53	0.273	0.629	0.013	1.5439	-56	217.84	161.84	3.70	1.75	24.90	0.00	0.00
4	Axial Weld	305424B	53	0.273	0.629	0.013	1.5439	-56	217.84	161.84	3.70	1.69	29.34	0.00	0.00
5	Circ Weld	90136	664	0.269	0.070	0.013	8.1256	-56	157.90	101.90	19.31	95.84	23.16	0.00	0.00
6	Plate	C6317-1	2,822	0.200	0.540	0.010	8.2642	27	206.88	233.88	13.15	0.01	0.43	0.86	2.54
7	Plate	C6293-2	2,822	0.140	0.570	0.015	8.2642	20	194.29	214.29	13.15	0.00	0.11	0.00	0.11
8	Plate	C4381-2	4,399	0.140	0.620	0.015	8.1339	73	198.05	271.05	21.20	0.25	18.29	94.16	95.66
9	Plate	C4381-1	4,399	0.140	0.620	0.015	8.1339	43	198.05	241.05	21.20	0.03	1.66	4.98	1.69

Table C3 - Material report for Beaver Valley at 60 EFPY (12 dominant transients)

Plant Name:	Beaver Valley
EFPY:	60 (12 trans)
WPS:	on
Ductile Tearing	on
Through wall cracking	0.90

Major Region Number	**Description**		**# of Subregions**	**Cu**	**Ni**	**P**	**Max Neutron Fluence**	**RT_{NDT0}**	**?RT_{NDT}**	**RT_{NDT}**	**% of Total Flaws**	**% of total FCI (By Parent)**	**% of total TWCF (By Parent)**	**% of total FCI (By Child)**	**% of total TWCF (By Child)**
			(#)	**wt%**	**wt%**	**wt%**	**$x10^{19}$ n/cm^2**	**(°F)**	**(°F)**	**(°F)**	**%**	**%**	**%**	**%t**	**%**
1	Axial Weld	305414A	34	0.337	0.609	0.012	1.5738	-56	230.49	174.49	2.30	0.84	4.76	0.00	0.00
2	Axial Weld	305414B	34	0.337	0.609	0.012	1.5738	-56	230.49	174.49	2.30	0.27	0.72	0.00	0.00
3	Axial Weld	305424A	53	0.273	0.629	0.013	1.5439	-56	217.84	161.84	3.70	2.92	15.05	0.00	0.00
4	Axial Weld	305424B	53	0.273	0.629	0.013	1.5439	-56	217.84	161.84	3.70	6.09	46.88	0.00	0.00
5	Circ Weld	90136	664	0.269	0.070	0.013	8.1256	-56	157.90	101.90	19.31	89.28	0.69	0.00	0.00
6	Plate	C6317-1	2,822	0.200	0.540	0.010	8.2642	27	206.88	233.88	13.15	0.02	0.47	1.44	5.95
7	Plate	C6293-2	2,822	0.140	0.570	0.015	8.2642	20	194.29	214.29	13.15	0.00	0.04	0.00	0.04
8	Plate	C4381-2	4,399	0.140	0.620	0.015	8.1339	73	198.05	271.05	21.20	0.54	30.19	90.09	92.72
9	Plate	C4381-1	4,399	0.140	0.620	0.015	8.1339	43	198.05	241.05	21.20	0.05	1.20	8.47	1.29

Table C4 - Material report for Beaver Valley at 100 EFPY (12 dominant transients)

Plant Name:	Beaver Valley
EFPY:	100 (12 trans)
WPS:	on
Ductile Tearing	on
Through wall cracking	0.90

Major Region Number	**Description**		**# of Subregions**	**Cu**	**Ni**	**P**	**Max Neutron Fluence**	**RT_{NDT0}**	**?RT_{NDT}**	**RT_{NDT}**	**% of Total Flaws**	**% of total FCI (By Parent)**	**% of total TWCF (By Parent)**	**% of total FCI (By Child)**	**% of total TWCF (By Child)**
			(#)	**wt%**	**wt%**	**wt%**	**$x10^{19}$ n/cm^2**	**(°F)**	**(°F)**	**(°F)**	**%**	**%**	**%**	**%t**	**%**
1	Axial Weld	305414A	34	0.337	0.609	0.012	2.6182	-56	244.27	188.27	2.30	0.48	0.82	0.00	0.00
2	Axial Weld	305414B	34	0.337	0.609	0.012	2.6182	-56	244.27	188.27	2.30	0.62	1.05	0.00	0.00
3	Axial Weld	305424A	53	0.273	0.629	0.013	2.5676	-56	231.66	175.66	3.70	2.65	9.11	0.00	0.00
4	Axial Weld	305424B	53	0.273	0.629	0.013	2.5676	-56	231.66	175.66	3.70	2.69	7.59	0.00	0.00
5	Circ Weld	90136	664	0.269	0.070	0.013	13.6589	-56	177.73	121.73	19.31	88.44	0.53	0.00	0.00
6	Plate	C6317-1	2,822	0.200	0.540	0.010	13.8962	27	231.69	258.69	13.15	0.03	0.26	1.22	2.13
7	Plate	C6293-2	2,822	0.140	0.570	0.015	13.8962	20	225.32	245.32	13.15	0.01	0.05	0.01	0.05
8	Plate	C4381-2	4,399	0.140	0.620	0.015	13.6569	73	228.79	301.79	21.20	4.96	79.31	91.50	96.48
9	Plate	C4381-1	4,399	0.140	0.620	0.015	13.6569	43	228.79	271.79	21.20	0.13	1.29	7.27	1.34

Table C5 - Material report for Beaver Valley at 200 EFPY (61 base case transients)

Plant Name:	Beaver Valley
EFPY:	200 (61 trans)
WPS:	on
Ductile Tearing	on
Through wall cracking	0.90

Major Region Number	**Description**		**# of Subregions**	**Cu**	**Ni**	**P**	**Max Neutron Fluence**	**RT_{NDT0}**	**?RT_{NDT}**	**RT_{NDT}**	**% of Total Flaws**	**% of total FCI (By Parent)**	**% of total TWCF (By Parent)**	**% of total FCI (By Child)**	**% of total TWCF (By Child)**
			(#)	**wt%**	**wt%**	**wt%**	**$x10^{19}$ n/cm^2**	**(°F)**	**(°F)**	**(°F)**	**%**	**%**	**%**	**%t**	**%**
1	Axial Weld	305414A	34	0.337	0.609	0.012	5.2292	-56	262.73	206.73	2.30	0.20	0.36	0.00	0.00
2	Axial Weld	305414B	34	0.337	0.609	0.012	5.2292	-56	262.73	206.73	2.30	0.31	1.01	0.00	0.00
3	Axial Weld	305424A	53	0.273	0.629	0.013	5.1266	-56	250.48	194.48	3.70	1.30	4.97	0.00	0.00
4	Axial Weld	305424B	53	0.273	0.629	0.013	5.1266	-56	250.48	194.48	3.70	1.57	10.29	0.00	0.00
5	Circ Weld	90136	664	0.269	0.070	0.013	27.4923	-56	211.61	155.61	19.31	89.59	8.79	0.00	0.00
6	Plate	C6317-1	2,822	0.200	0.540	0.010	27.9761	27	274.03	301.03	13.15	0.03	0.24	0.55	1.60
7	Plate	C6293-2	2,822	0.140	0.570	0.015	27.9761	20	278.57	298.57	13.15	0.02	0.11	0.02	0.11
8	Plate	C4381-2	4,399	0.140	0.620	0.015	27.4643	73	281.54	354.54	21.20	6.69	72.32	51.16	95.51
9	Plate	C4381-1	4,399	0.140	0.620	0.015	27.4643	43	281.54	324.54	21.20	0.27	1.92	48.27	2.77

Table C6 – Material Report for Oconee at 32 EFPY (4 dominant transients)

Plant Name:	Oconee
EFPY:	32 (4 trans)
WPS:	on
Ductile Tearing	on
Through wall cracking criteria	0.90

Major Region Number	**Description**		**# of Subregions**	**Cu**	**Ni**	**P**	**Max Neutron Fluence**	**RT_{NDT0}**	**?RT_{NDT}**	**RT_{NDT}**	**% of Total Flaws**	**% of total FCI (By Parent)**	**% of total TWCF (By Parent)**	**% of total FCI (By Child)**	**% of total TWCF (By Child)**
			(#)	**wt%**	**wt%**	**wt%**	**$x10^{19}$ n/cm^2**	**(°F)**	**(°F)**	**(°F)**	**%**	**%**	**%**	**%t**	**%**
1	Axial Weld	SA-1430	77	0.190	0.570	0.017	0.7360	-5.00	135.39	130.39	3.03	1.29	0.00	1.29	0.00
2	Axial Weld	SA-1493	85	0.190	0.570	0.017	0.6820	-5.00	133.59	128.59	3.54	3.07	91.86	3.07	91.86
3	Axial Weld	SA-1073	49	0.210	0.640	0.025	0.6070	-5.00	157.19	152.19	1.43	1.54	8.14	1.54	8.14
4	Circ Weld	SA-1585	480	0.220	0.540	0.016	0.8210	-5.00	150.13	145.13	13.82	20.76	0.00	20.76	0.00
5	Circ Weld	SA-1229	480	0.230	0.590	0.021	0.7690	10.00	165.32	175.32	13.82	73.00	0.00	73.00	0.00
6	Circ Weld	SA-1135	480	0.230	0.520	0.011	0.0923	-5.00	93.02	88.02	13.82	0.01	0.00	0.01	0.00
7	Plate	C-2800	4,620	0.110	0.630	0.012	0.8370	1.00	70.37	71.37	18.91	0.26	0.00	0.26	0.00
8	Plate	C3265-1	5,100	0.100	0.500	0.015	0.8330	1.00	62.39	63.39	11.04	0.03	0.00	0.03	0.00
9	Plate	C3278-1	5,100	0.120	0.600	0.010	0.8330	1.00	72.82	73.82	11.04	0.03	0.00	0.03	0.00
10	Plate	C2197-2	2,940	0.150	0.500	0.008	0.7560	1.00	78.41	79.41	8.92	0.02	0.00	0.02	0.00
11	Forging	ZV2861	240	0.160	0.650	0.006	0.0855	3.00	48.57	51.57	0.62	0.00	0.00	0.00	0.00

Table C7 – Material Report for Oconee at 60 EFPY (32 transients)

Plant Name:	Oconee
EFPY:	60 (32 trans)
WPS:	on
Ductile Tearing	on
Through wall cracking criteria	0.90

Major Region Number	Description		# of Subregions	Cu	Ni	P	Max Neutron Fluence	RT_{NDT0}	?RT_{NDT}	RT_{NDT}	% of Total Flaws	% of total FCI (By Parent)	% of total TWCF (By Parent)	% of total FCI (By Child)	% of total TWCF (By Child)
			(#)	wt%	wt%	wt%	$x10^{19}$ n/cm^2	(°F)	(°F)	(°F)	%	%	%	%t	%
1	Axial Weld	SA-1430	77	0.190	0.570	0.017	1.3802	-5.00	149.92	144.92	3.03	1.28	2.06	1.28	2.06
2	Axial Weld	SA-1493	85	0.190	0.570	0.017	1.2791	-5.00	148.42	143.42	3.54	3.03	7.90	3.03	7.90
3	Axial Weld	SA-1073	49	0.210	0.640	0.025	1.1387	-5.00	176.25	171.25	1.43	3.70	83.95	3.70	83.95
4	Circ Weld	SA-1585	480	0.220	0.540	0.016	1.5386	-5.00	164.89	159.89	13.82	12.18	0.01	12.18	0.01
5	Circ Weld	SA-1229	480	0.230	0.590	0.021	1.4422	10.00	182.58	192.58	13.82	78.76	0.00	78.76	0.00
6	Circ Weld	SA-1135	480	0.230	0.520	0.011	0.1730	-5.00	119.26	114.26	13.82	0.06	0.00	0.06	0.00
7	Plate	C-2800	4,620	0.110	0.630	0.012	1.5691	1.00	80.75	81.75	18.91	0.37	0.20	0.37	0.20
8	Plate	C3265-1	5,100	0.100	0.500	0.015	1.5610	1.00	73.13	74.13	11.04	0.05	1.11	0.05	1.11
9	Plate	C3278-1	5,100	0.120	0.600	0.010	1.5610	1.00	82.76	83.76	11.04	0.50	4.67	0.50	4.67
10	Plate	C2197-2	2,940	0.150	0.500	0.008	1.4169	1.00	88.26	89.26	8.92	0.07	0.10	0.07	0.10
11	Forging	ZV2861	240	0.160	0.650	0.006	0.1602	3.00	61.20	64.20	0.62	0.00	0.00	0.00	0.00

Table C8 – Material Report for Oconee at 60 EFPY (4 transients)

Plant Name:	Oconee
EFPY:	60 (4 trans)
WPS:	on
Ductile Tearing	on
Through wall cracking criteria	0.90

Major Region Number	**Description**		**# of Subregions**	**Cu**	**Ni**	**P**	**Max Neutron Fluence**	**RT_{NDT0}**	**?RT_{NDT}**	**RT_{NDT}**	**% of Total Flaws**	**% of total FCI (By Parent)**	**% of total TWCF (By Parent)**	**% of total FCI (By Child)**	**% of total TWCF (By Child)**
			(#)	**wt%**	**wt%**	**wt%**	**$x10^{19}$ n/cm^2**	**(°F)**	**(°F)**	**(°F)**	**%**	**%**	**%**	**%t**	**%**
1	Axial Weld	SA-1430	77	0.190	0.570	0.017	1.3802	-5.00	149.92	144.92	3.03	1.77	15.39	1.77	15.39
2	Axial Weld	SA-1493	85	0.190	0.570	0.017	1.2791	-5.00	148.42	143.42	3.54	3.1	19.51	3.10	19.51
3	Axial Weld	SA-1073	49	0.210	0.640	0.025	1.1387	-5.00	176.25	171.25	1.43	3.23	65.09	3.23	65.09
4	Circ Weld	SA-1585	480	0.220	0.540	0.016	1.5386	-5.00	164.89	159.89	13.82	17.52	0	17.52	0.00
5	Circ Weld	SA-1229	480	0.230	0.590	0.021	1.4422	10.00	182.58	192.58	13.82	74.12	0	74.12	0.00
6	Circ Weld	SA-1135	480	0.230	0.520	0.011	0.1730	-5.00	119.26	114.26	13.82	0.17	0	0.17	0.00
7	Plate	C-2800	4,620	0.110	0.630	0.012	1.5691	1.00	80.75	81.75	18.91	0.04	0	0.04	0.00
8	Plate	C3265-1	5,100	0.100	0.500	0.015	1.5610	1.00	73.13	74.13	11.04	0.01	0	0.01	0.00
9	Plate	C3278-1	5,100	0.120	0.600	0.010	1.5610	1.00	82.76	83.76	11.04	0.04	0	0.04	0.00
10	Plate	C2197-2	2,940	0.150	0.500	0.008	1.4169	1.00	88.26	89.26	8.92	0.01	0	0.01	0.00
11	Forging	ZV2861	240	0.160	0.650	0.006	0.1602	3.00	61.20	64.20	0.62	0	0	0.00	0.00

Table C9 – Material Report for Oconee at 500 EFPY (4 dominant transients)

Plant Name:	Oconee
EFPY:	500 (4 trans)
WPS:	on
Ductile Tearing	on
Through wall cracking criteria	0.90

Major Region Number	**Description**		**# of Subregions**	**Cu**	**Ni**	**P**	**Max Neutron Fluence**	**RT_{NDT0}**	**?RT_{NDT}**	**RT_{NDT}**	**% of Total Flaws**	**% of total FCI (By Parent)**	**% of total TWCF (By Parent)**	**% of total FCI (By Child)**	**% of total TWCF (By Child)**
			(#)	**wt%**	**wt%**	**wt%**	**$x10^{19}$ n/cm^2**	**(°F)**	**(°F)**	**(°F)**	**%**	**%**	**%**	**%t**	**%**
1	Axial Weld	SA-1430	77	0.190	0.570	0.017	11.5021	-5.00	199.58	194.58	3.03	1.71	9.93	1.71	9.93
2	Axial Weld	SA-1493	85	0.190	0.570	0.017	10.6591	-5.00	197.20	192.20	3.54	2.78	12.78	2.78	12.78
3	Axial Weld	SA-1073	49	0.210	0.640	0.025	9.4896	-5.00	237.48	232.48	1.43	3.98	77.22	3.98	77.22
4	Circ Weld	SA-1585	480	0.220	0.540	0.016	12.8214	-5.00	215.07	210.07	13.82	14.97	0.00	14.97	0.00
5	Circ Weld	SA-1229	480	0.230	0.590	0.021	12.0180	10.00	241.12	251.12	13.82	74.23	0.00	74.23	0.00
6	Circ Weld	SA-1135	480	0.230	0.520	0.011	1.4420	-5.00	166.05	161.05	13.82	0.49	0.00	0.49	0.00
7	Plate	C-2800	4,620	0.110	0.630	0.012	13.0753	1.00	134.89	135.89	18.91	0.65	0.01	0.65	0.01
8	Plate	C3265-1	5,100	0.100	0.500	0.015	13.0080	1.00	133.83	134.83	11.04	0.50	0.01	0.50	0.01
9	Plate	C3278-1	5,100	0.120	0.600	0.010	13.0080	1.00	132.17	133.17	11.04	0.55	0.06	0.55	0.06
10	Plate	C2197-2	2,940	0.150	0.500	0.008	11.8074	1.00	131.81	132.81	8.92	0.13	0.00	0.13	0.00
11	Forging	ZV2861	240	0.160	0.650	0.006	1.3354	3.00	86.73	89.73	0.62	0.00	0.00	0.00	0.00

Table C10 – Material Report for Oconee at 1000 EFPY (54 base case transients)

Plant Name:	Oconee
EFPY:	1000 (54 trans)
WPS:	on
Ductile Tearing	on
Through wall cracking criteria	0.90

Major Region Number	**Description**		**# of Subregions**	**Cu**	**Ni**	**P**	**Max Neutron Fluence**	**RT_{NDT0}**	**?RT_{NDT}**	**RT_{NDT}**	**% of Total Flaws**	**% of total FCI (By Parent)**	**% of total TWCF (By Parent)**	**% of total FCI (By Child)**	**% of total TWCF (By Child)**
			(#)	wt%	wt%	wt%	$x10^{19}$ n/cm^2	(°F)	(°F)	(°F)	%	%	%	%t	%
1	Axial Weld	SA-1430	77	0.190	0.570	0.017	23.0000	-5.00	225.39	220.39	3.03	2.00	14.91	2.00	14.91
2	Axial Weld	SA-1493	85	0.190	0.570	0.017	21.3000	-5.00	222.13	217.13	3.54	12.57	42.91	12.57	42.91
3	Axial Weld	SA-1073	49	0.210	0.640	0.025	19.0000	-5.00	268.51	263.51	1.43	5.18	41.14	5.18	41.14
4	Circ Weld	SA-1585	480	0.220	0.540	0.016	25.6000	-5.00	241.09	236.09	13.82	7.54	0.10	7.54	0.10
5	Circ Weld	SA-1229	480	0.230	0.590	0.021	24.0000	10.00	271.43	281.43	13.82	66.73	0.37	66.73	0.37
6	Circ Weld	SA-1135	480	0.230	0.520	0.011	2.8800	-5.00	175.73	170.73	13.82	0.14	0.00	0.14	0.00
7	Plate	C-2800	4,620	0.110	0.630	0.012	26.2000	1.00	166.37	167.37	18.91	1.72	0.12	1.72	0.12
8	Plate	C3265-1	5,100	0.100	0.500	0.015	26.0000	1.00	169.51	170.51	11.04	2.08	0.11	2.08	0.11
9	Plate	C3278-1	5,100	0.120	0.600	0.010	26.0000	1.00	160.51	161.51	11.04	1.56	0.29	1.56	0.29
10	Plate	C2197-2	2,940	0.150	0.500	0.008	23.6000	1.00	156.14	157.14	8.92	0.49	0.03	0.49	0.03
11	Forging	ZV2861	240	0.160	0.650	0.006	2.6700	3.00	93.48	96.48	0.62	0.00	0.00	0.00	0.00

Table C11 - Material report for Palisades at 32 EFPY (12 dominant transients)

Plant Name:	Palisades
EFPY:	32 (12 trans)
WPS:	on
Ductile Tearing	on
Through wall cracking criteria	0.90

Major Region	**Description**		**# of Subregions**	**Cu**	**Ni**	**P**	**Max Neutron Fluence**	**RT_{NDT0}**	**?RT_{NDT}**	**RT_{NDT}**	**% of Total Flaws**	**% of total FCI (By Parent)**	**% of total TWCF (By Parent)**	**% of total FCI (By Child)**	**% of total TWCF (By Child)**
			(#)	**wt%**	**wt%**	**wt%**	**$x10^{19}$ n/cm^2**	**(°F)**	**(°F)**	**(°F)**	**%**	**%**	**%**	**%t**	**%**
1	3-112A*	Axial Weld	80	0.213	1.010	0.019	1.6646	-56.00	262.39	206.39	2.04	0.70	0.22	0.70	0.22
2	3-112B*	Axial Weld	80	0.213	1.010	0.019	1.9567	-56.00	268.19	212.19	2.04	2.56	3.48	2.56	3.48
3	3-112C*	Axial Weld	80	0.213	1.010	0.019	1.9567	-56.00	268.19	212.19	2.04	13.04	12.96	13.04	12.96
4	2-112A	Axial Weld	124	0.213	1.010	0.019	1.9699	-56.00	268.43	212.43	3.16	53.82	62.54	53.82	62.54
5	2-112B	Axial Weld	124	0.213	1.010	0.019	1.6738	-56.00	262.59	206.59	3.16	8.42	6.36	8.42	6.36
6	2-112C	Axial Weld	124	0.213	1.010	0.019	1.9699	-56.00	268.43	212.43	3.16	20.35	14.45	20.35	14.45
7	9-112	Circ Weld	776	0.203	1.018	0.013	2.5537	-56.00	256.59	200.59	19.15	1.10	0.00	0.89	0.00
8	D3804-1	Plate	7,680	0.190	0.480	0.016	2.5516	0.00	180.48	180.48	8.54	0.00	0.00	0.00	0.00
9	D3804-2	Plate	7,680	0.190	0.500	0.015	2.5516	-30.00	179.89	149.89	8.54	0.00	0.00	0.00	0.00
10	D3804-3	Plate	10,400	0.120	0.550	0.010	2.5516	-25.00	124.57	99.57	8.54	0.00	0.00	0.00	0.00
11	D3803-1	Plate	16,120	0.240	0.510	0.009	2.5680	-5.00	189.00	184.00	13.20	0.00	0.00	0.09	0.00
12	D3803-2	Plate	11,904	0.240	0.520	0.010	2.5680	-30.00	193.60	163.60	13.20	0.00	0.00	0.00	0.00
13	D3803-3	Plate	11,904	0.240	0.500	0.011	2.5680	-5.00	193.53	188.53	13.20	0.00	0.00	0.12	0.00

Table C12- Material report for Palisades at 60 EFPY (12 dominant transients)

Plant Name:	Palisades
EFPY:	60 (12 trans)
WPS:	on
Ductile Tearing	on
Through wall cracking criteria	0.90

Major Region	Description		# of Subregions	Cu	Ni	P	Max Neutron Fluence	RT_{NDT0}	?RT_{NDT}	RT_{NDT}	% of Total Flaws	% of total FCI (By Parent)	% of total TWCF (By Parent)	% of total FCI (By Child)	% of total TWCF (By Child)
			(#)	wt%	wt%	wt%	$x10^{19}$ n/cm^2	(°F)	(°F)	(°F)	%	%	%	%t	%
1	3-112A*	Axial Weld	80	0.213	1.010	0.019	2.4688	-56.00	276.95	220.95	2.04	31.83	20.26	31.83	20.26
2	3-112B*	Axial Weld	80	0.213	1.010	0.019	3.1741	-56.00	286.00	230.00	2.04	1.53	1.20	1.53	1.20
3	3-112C*	Axial Weld	80	0.213	1.010	0.019	3.1741	-56.00	286.00	230.00	2.04	0.50	0.42	0.50	0.42
4	2-112A	Axial Weld	124	0.213	1.010	0.019	3.2129	-56.00	286.45	230.45	3.16	37.40	49.41	37.40	49.41
5	2-112B	Axial Weld	124	0.213	1.010	0.019	2.4910	-56.00	277.27	221.27	3.16	10.06	10.84	10.06	10.84
6	2-112C	Axial Weld	124	0.213	1.010	0.019	3.2129	-56.00	286.45	230.45	3.16	17.97	17.86	17.97	17.86
7	9-112	Circ Weld	776	0.203	1.018	0.013	4.0419	-56.00	270.84	214.84	19.15	0.70	0.00	0.43	0.00
8	D3804-1	Plate	7,680	0.190	0.480	0.016	4.0380	0.00	199.91	199.91	8.54	0.00	0.00	0.00	0.00
9	D3804-2	Plate	7,680	0.190	0.500	0.015	4.0380	-30.00	198.64	168.64	8.54	0.00	0.00	0.00	0.00
10	D3804-3	Plate	10,400	0.120	0.550	0.010	4.0380	-25.00	139.10	114.10	8.54	0.00	0.00	0.00	0.00
11	D3803-1	Plate	16,120	0.240	0.510	0.009	4.0846	-5.00	204.12	199.12	13.20	0.00	0.00	0.13	0.00
12	D3803-2	Plate	11,904	0.240	0.520	0.010	4.0846	-30.00	209.47	179.47	13.20	0.00	0.00	0.00	0.00
13	D3803-3	Plate	11,904	0.240	0.500	0.011	4.0846	-5.00	210.07	205.07	13.20	0.00	0.00	0.14	0.00

Table C13 - Material report for Palisades at 60 EFPY (30 base case transients)

Plant Name:	Palisades
EFPY:	60 (30 trans)
WPS:	on
Ductile Tearing	on
Through wall cracking criteria	0.90

Major Region	**Description**		**# of Subregions**	**Cu**	**Ni**	**P**	**Max Neutron Fluence**	**RT_{NDT0}**	**?RT_{NDT}**	**RT_{NDT}**	**% of Total Flaws**	**% of total FCI (By Parent)**	**% of total TWCF (By Parent)**	**% of total FCI (By Child)**	**% of total TWCF (By Child)**
			(#)	**wt%**	**wt%**	**wt%**	**$x10^{19}$ n/cm^2**	**(°F)**	**(°F)**	**(°F)**	**%**	**%**	**%**	**%t**	**%**
1	3-112A*	Axial Weld	80	0.213	1.010	0.019	2.4688	-56.00	276.95	220.95	2.04	8.01	4.29	8.01	4.29
2	3-112B*	Axial Weld	80	0.213	1.010	0.019	3.1741	-56.00	286.00	230.00	2.04	3.76	2.28	3.76	2.28
3	3-112C*	Axial Weld	80	0.213	1.010	0.019	3.1741	-56.00	286.00	230.00	2.04	0.67	0.52	0.67	0.52
4	2-112A	Axial Weld	124	0.213	1.010	0.019	3.2129	-56.00	286.45	230.45	3.16	18.41	19.99	18.41	19.99
5	2-112B	Axial Weld	124	0.213	1.010	0.019	2.4910	-56.00	277.27	221.27	3.16	59.77	65.51	59.77	65.51
6	2-112C	Axial Weld	124	0.213	1.010	0.019	3.2129	-56.00	286.45	230.45	3.16	8.85	7.41	8.85	7.41
7	9-112	Circ Weld	776	0.203	1.018	0.013	4.0419	-56.00	270.84	214.84	19.15	0.55	0.00	0.40	0.00
8	D3804-1	Plate	7,680	0.190	0.480	0.016	4.0380	0.00	199.91	199.91	8.54	0.00	0.00	0.00	0.00
9	D3804-2	Plate	7,680	0.190	0.500	0.015	4.0380	-30.00	198.64	168.64	8.54	0.00	0.00	0.00	0.00
10	D3804-3	Plate	10,400	0.120	0.550	0.010	4.0380	-25.00	139.10	114.10	8.54	0.00	0.00	0.00	0.00
11	D3803-1	Plate	16,120	0.240	0.510	0.009	4.0846	-5.00	204.12	199.12	13.20	0.00	0.00	0.05	0.00
12	D3803-2	Plate	11,904	0.240	0.520	0.010	4.0846	-30.00	209.47	179.47	13.20	0.00	0.00	0.00	0.00
13	D3803-3	Plate	11,904	0.240	0.500	0.011	4.0846	-5.00	210.07	205.07	13.20	0.00	0.00	0.10	0.00

Table C14 - Material report for Palisades at 200 EFPY (12 dominant transients)

Plant Name:	Palisades
EFPY:	200 (12 trans)
WPS:	on
Ductile Tearing	on
Through wall cracking criteria	0.90

Major Region	**Description**		**# of Subregions**	**Cu**	**Ni**	**P**	**Max Neutron Fluence**	**RT_{NDT0}**	**?RT_{NDT}**	**RT_{NDT}**	**% of Total Flaws**	**% of total FCI (By Parent)**	**% of total TWCF (By Parent)**	**% of total FCI (By Child)**	**% of total TWCF (By Child)**
			(#)	wt%	wt%	wt%	$x10^{19}$ n/cm^2	(°F)	(°F)	(°F)	%	%	%	%t	%
1	3-112A*	Axial Weld	80	0.213	1.010	0.019	6.4894	-56.00	315.17	259.17	2.04	1.30	1.17	1.30	1.17
2	3-112B*	Axial Weld	80	0.213	1.010	0.019	9.2611	-56.00	332.18	276.18	2.04	1.43	1.46	1.43	1.46
3	3-112C*	Axial Weld	80	0.213	1.010	0.019	9.2611	-56.00	332.18	276.18	2.04	55.95	59.26	55.95	59.26
4	2-112A	Axial Weld	124	0.213	1.010	0.019	9.4604	-56.00	333.28	277.28	3.16	22.85	24.07	22.85	24.07
5	2-112B	Axial Weld	124	0.213	1.010	0.019	6.6171	-56.00	316.05	260.05	3.16	5.93	6.06	5.93	6.06
6	2-112C	Axial Weld	124	0.213	1.010	0.019	9.4604	-56.00	333.28	277.28	3.16	10.69	7.99	10.69	7.99
7	9-112	Circ Weld	776	0.203	1.018	0.013	11.5107	-56.00	309.71	253.71	19.15	1.85	0.00	0.66	0.00
8	D3804-1	Plate	7,680	0.190	0.480	0.016	11.4979	0.00	259.50	259.50	8.54	0.00	0.00	0.58	0.00
9	D3804-2	Plate	7,680	0.190	0.500	0.015	11.4979	-30.00	255.95	225.95	8.54	0.00	0.00	0.01	0.00
10	D3804-3	Plate	10,400	0.120	0.550	0.010	11.4979	-25.00	184.21	159.21	8.54	0.00	0.00	0.00	0.00
11	D3803-1	Plate	16,120	0.240	0.510	0.009	11.7410	-5.00	248.66	243.66	13.20	0.00	0.00	0.14	0.00
12	D3803-2	Plate	11,904	0.240	0.520	0.010	11.7410	-30.00	256.38	226.38	13.20	0.00	0.00	0.00	0.00
13	D3803-3	Plate	11,904	0.240	0.500	0.011	11.7410	-5.00	259.29	254.29	13.20	0.00	0.00	0.45	0.00

Table C15 - Material report for Palisades at 500 EFPY (30 base case transients)

Plant Name:	Palisades
EFPY:	500 (30 trans)
WPS:	on
Ductile Tearing	on
Through wall cracking criteria	0.90

Major Region	Description		# of Subregions	Cu	Ni	P	Max Neutron Fluence	RT_{NDT0}	?RT_{NDT}	RT_{NDT}	% of Total Flaws	% of total FCI (By Parent)	% of total TWCF (By Parent)	% of total FCI (By Child)	% of total TWCF (By Child)
			(#)	wt%	wt%	wt%	$x10^{19}$ n/cm^2	(°F)	(°F)	(°F)	%	%	%	%t	%
1	3-112A*	Axial Weld	80	0.213	1.010	0.019	15.1050	-56.00	360.09	304.09	2.04	2.54	2.30	0.06	0.07
2	3-112B*	Axial Weld	80	0.213	1.010	0.019	22.3048	-56.00	386.83	330.83	2.04	7.76	7.70	7.76	7.70
3	3-112C*	Axial Weld	80	0.213	1.010	0.019	22.3048	-56.00	386.83	330.83	2.04	2.75	2.92	0.00	0.00
4	2-112A	Axial Weld	124	0.213	1.010	0.019	22.8479	-56.00	388.63	332.63	3.16	14.48	14.63	14.48	14.63
5	2-112B	Axial Weld	124	0.213	1.010	0.019	15.4604	-56.00	361.56	305.56	3.16	4.45	4.21	4.45	4.21
6	2-112C	Axial Weld	124	0.213	1.010	0.019	22.8479	-56.00	388.63	332.63	3.16	65.45	68.24	61.42	63.71
7	9-112	Circ Weld	776	0.203	1.018	0.013	27.5154	-56.00	356.60	300.60	19.15	2.56	0.00	0.00	0.00
8	D3804-1	Plate	7,680	0.190	0.480	0.016	27.4834	0.00	334.85	334.85	8.54	0.00	0.00	6.85	5.14
9	D3804-2	Plate	7,680	0.190	0.500	0.015	27.4834	-30.00	328.33	298.33	8.54	0.00	0.00	0.38	0.00
10	D3804-3	Plate	10,400	0.120	0.550	0.010	27.4834	-25.00	241.48	216.48	8.54	0.00	0.00	0.00	0.00
11	D3803-1	Plate	16,120	0.240	0.510	0.009	28.1477	-5.00	303.95	298.95	13.20	0.00	0.00	0.12	0.00
12	D3803-2	Plate	11,904	0.240	0.520	0.010	28.1477	-30.00	314.71	284.71	13.20	0.00	0.00	0.10	0.00
13	D3803-3	Plate	11,904	0.240	0.500	0.011	28.1477	-5.00	320.64	315.64	13.20	0.00	0.00	4.37	4.53

Appendix D - Transient descriptions

Table number	Table Content
D1	Base case transient descriptions for Beaver Valley
D2	Base case transient descriptions for Oconee
D3	Base case transient descriptions for Palisades

Table D1 - Base Case Transient Descriptions for Beaver Valley

Case	System Failure	Operator Action	HZP	Dominant
002	3.59 cm [1.414 in] surge line break	None.	No	No
003	5.08 cm [2 in] surge line break	None.	No	No
007	2.54 cm [8 in] surge line break	None.	No	Yes
009	2.54 cm [16 in] hot leg break	None.	No	Yes
014	Reactor/turbine trip w/one stuck open pressurizer SRV	None.	No	No
031	Reactor/turbine trip w/feed and bleed (Operator open all pressurizer PORVs and use all charging/HHSI pumps)	None.	No	No
034	Reactor/turbine trip w/two stuck open pressurizer SRV's	None.	No	No
056	10.16 cm [4.0 in] surge line break	None.	Yes	Yes
059	Reactor/turbine trip w/one stuck open pressurizer SRV which recloses at 3,000 s.	None.	No	No
060	Reactor/turbine trip w/one stuck open pressurizer SRV which recloses at 6,000 s.	None.	No	Yes

061	Reactor/turbine trip w/two stuck open pressurizer SRV which recloses at 3,000 s.	None.	No	No
062	Reactor/turbine trip w/two stuck open pressurizer SRV which recloses at 6,000 s.	None.	No	No
064	Reactor/turbine trip w/two stuck open pressurizer SRV's	None.	Yes	No
065	Reactor/turbine trip w/two stuck open pressurizer SRV's and HHSI failure	Operator opens all ASDVs 5 minutes after HHSI would have come on.	No	No
066	Reactor/turbine trip w/two stuck open pressurizer SRV's. One valve recloses at 3000 seconds while the other valve remains open.	None.	No	No
067	Reactor/turbine trip w/two stuck open pressurizer SRV's. One valve recloses at 6000 seconds while the other valve remains open.	None.	No	No
068	Reactor/turbine trip w/two stuck open pressurizer SRV's that reclose at 6000 s with HHSI failure.	Operator opens all ASDVs 5 minutes after HHSI would have come on.	No	No

069	Reactor/turbine trip w/two stuck open pressurizer SRVs which reclose at 3,000 s.	None.	Yes	No
070	Reactor/turbine trip w/two stuck open pressurizer SRVs which reclose at 6,000 s.	None.	Yes	No
071	Reactor/turbine trip w/one stuck open pressurizer SRV which recloses at 6,000 s.	None.	Yes	No
072	Reactor/turbine trip w/one stuck open pressurizer SRV with HHSI failure.	Operator opens all ASDVs 5 minutes after HHSI would have come on.	No	No
073	Reactor/turbine trip w/one stuck open pressurizer SRV with HHSI failure	Operator open all ASDVs 5 minutes after HHSI would have come on.	Yes	No
074	Main steam line break with AFW continuing to feed affected generator	None.	No	No
075	Reactor/turbine trip w/full MFW to all 3 SGs (MFW maintains SG level near top) and RCPs tripped	None.	No	No
076	Reactor/turbine trip w/full MFW to all 3 SGs (MFW maintains SG level near top).	Operator trips reactor coolant pumps.	Yes	No
078	Reactor/turbine trip with failure of MFW and AFW.	Operator opens all ASDVs to let condensate fill SGs.	No	No

080	Main Steam Line Break with AFW continuing to feed affected generator.	Operator trips reactor coolant pumps.	Yes	No
081	Main Steam Line Break with AFW continuing to feed affected generator and with HHSI failure initially.	Operator opens ADVs (on intact generators). HHSI is restored after CFTs discharge 50%.	No	No
082	Reactor/turbine trip w/one stuck open pressurizer SRV (recloses at 6000 s) and with HHSI failure.	Operator opens all ASDVs 5 minutes after HHSI would have started.	No	No
083	2.54 cm [1.0 in] surge line break with HHSI failure and motor driven AFW failure. MFW is tripped. Level control failure causes all steam generators to be overfed with turbine AFW, with the level maintained at top of SGs.	Operator trips RCPs. Operator opens all ASDVs 5 minutes after HHSI would have come on.	No	No
086	Reactor/turbine trip w/two stuck open pressurizer SRV which recloses at 6,000 s	Operator controls HHSI 1 minute after allowed.	No	No
087	Reactor/turbine trip w/two stuck open pressurizer SRV which recloses at 6,000 s	Operator controls HHSI 10 minutes after allowed.	No	No
088	Reactor/turbine trip w/two stuck open pressurizer SRV which recloses at 3,000 s.	None.	Yes	No

089	Reactor/turbine trip w/two stuck open pressurizer SRVs which reclose at 6,000 s.	Operator controls HHSI 1 minute after allowed.	Yes	No
090	Reactor/turbine trip w/two stuck open pressurizer SRVs which reclose at 3,000 s.	Operator controls HHSI 10 minutes after allowed.	Yes	No
091	Reactor/turbine trip w/two stuck open pressurizer SRVs which reclose at 6,000 s.	Operator controls HHSI 10 minutes after allowed.	Yes	No
092	Reactor/turbine trip w/two stuck open pressurizer SRV's, one recloses at 3000 s.	None.	Yes	No
093	Reactor/turbine trip w/two stuck open pressurizer SRV's. One valve recloses at 6000 seconds while the other valve remains open.	None.	Yes	No
094	Reactor/turbine trip w/one stuck open pressurizer SRV.	None.	Yes	No
095	Reactor/turbine trip w/one stuck open pressurizer SRV which recloses at 6,000 s	Operator controls HHSI 1 minute after allowed.	No	No
096	Reactor/turbine trip w/one stuck open pressurizer SRV which recloses at 6,000 s.	Operator controls HHSI 10 minutes after allowed.	No	Yes

097	Reactor/turbine trip w/one stuck open pressurizer SRV which recloses at 3,000 s.	None.	Yes	Yes
098	Reactor/turbine trip w/one stuck open pressurizer SRV which recloses at 6,000 s.	Operator controls HHSI 1 minute after allowed.	Yes	No
099	Reactor/turbine trip w/one stuck open pressurizer SRV which recloses at 3,000 s.	Operator controls HHSI 1 minute after allowed.	Yes	No
100	Reactor/turbine trip w/one stuck open pressurizer SRV which recloses at 6,000 s.	Operator controls HHSI 10 minutes after allowed.	Yes	No
101	Reactor/turbine trip w/one stuck open pressurizer SRV which recloses at 3,000 s.	Operator controls HHSI 10 minutes after allowed.	Yes	Yes
102	Main steam line break with AFW continuing to feed affected generator for 30 minutes.	Operator controls HHSI 30 minutes after allowed. Break is assumed to occur inside containment so that the operator trips the RCPs due to adverse containment conditions.	No	Yes
103	Main steam line break with AFW continuing to feed affected generator for 30 minutes.	Operator controls HHSI 30 minutes after allowed. Break is assumed to occur inside containment so that the operator trips the RCPs due to adverse containment conditions.	Yes	Yes

104	Main steam line break with AFW continuing to feed affected generator for 30 minutes.	Operator controls HHSI 60 minutes after allowed. Break is assumed to occur inside containment so that the operator trips the RCPs due to adverse containment conditions.	No	Yes
105	Main steam line break with AFW continuing to feed affected generator for 30 minutes.	Operator controls HHSI 60 minutes after allowed. Break is assumed to occur inside containment so that the operator trips the RCPs due to adverse containment conditions.	Yes	Yes
106	Main steam line break with AFW continuing to feed affected generator.	Operator controls HHSI 30 minutes after allowed. Break is assumed to occur inside containment so that the operator trips the RCPs due to adverse containment conditions.	No	No
107	Main steam line break with AFW continuing to feed affected generator.	Operator controls HHSI 30 minutes after allowed. Break is assumed to occur inside containment so that the operator trips the RCPs due to adverse containment conditions.	Yes	No
108	Small steam line break (simulated by sticking open all SG-A SRVs) with AFW continuing to feed affected generator for 30 minutes.	Operator controls HHSI 30 minutes after allowed.	Yes	Yes

109	Small steam line break (simulated by sticking open all SG-A SRVs) with AFW continuing to feed affected generator for 30 minutes.	Operator controls HHSI 30 minutes after allowed. Break is assumed to occur inside containment so that the operator trips the RCPs due to adverse containment conditions.	Yes	No
110	Small steam line break (simulated by sticking open all SG-A SRVs) with AFW continuing to feed affected generator for 30 minutes	Operator controls HHSI 60 minutes after allowed.	No	No
111	Small steam line break (simulated by sticking open all SG-A SRVs) with AFW continuing to feed affected generator for 30 minutes.	Operator controls HHSI 60 minutes after allowed. Break is assumed to occur inside containment so that the operator trips the RCPs due to adverse containment conditions.	Yes	No
112	Small steam line break (simulated by sticking open all SG-A SRVs) with AFW continuing to feed affected generator.	Operator controls HHSI 30 minutes after allowed. Break is assumed to occur inside containment so that the operator trips the RCPs due to adverse containment conditions.	No	No
113	Small steam line break (simulated by sticking open all SG-A SRVs) with AFW continuing to feed affected generator.	Operator controls HHSI 30 minutes after allowed. Break is assumed to occur inside containment so that the operator trips the RCPs due to adverse containment conditions.	Yes	No

114	7.18 cm [2.828 in] surge line break, summer conditions (HHSI, LHSI temp = 55°F, Accumulator Temp = 105°F), heat transfer coefficient increased 30% (modeled by increasing heat transfer surface area by 30% in passive heat structures).	None.	No	No
115	7.18 cm [2.828 in] cold leg break	None.	No	No
116	14.366 cm [5.657 in] cold leg break with break area increased 30%	None.	No	No
117	14.366 cm [5.657 in] cold leg break, summer conditions (HHSI, LHSI temp = 55°F, Accumulator Temp = 105°F)	None.	No	No
118	Small steam line break (simulated by sticking open all SG-A SRVs) with AFW continuing to feed affected generator	None.	No	No

Table D2 – Base case transient descriptions for Oconee

Case	System Failure	Operator Action	HZP	Hi K	Dominant
8	2.54 cm [1 in] surge line break with 1 stuck open safety valve in SG-A.	None	No	No	No
12	2.54 cm [1 in] surge line break with 1 stuck open safety valve in SG-A.	HPI throttled to maintain 27.8 K [50° F] subcooling margin	No	No	No
15	2.54 cm [1 in] surge line break with HPI Failure	At 15 minutes after transient initiation, operator opens all TBVs to lower primary system pressure and allow CFT and LPI injection.	No	No	No
27	MSLB without trip of turbine driven emergency feedwater.	Operator throttles HPI to maintain 27.8 K [50° F] subcooling margin.	No	No	No
28	Reactor/turbine trip with 1 stuck open safety valve in SG-A	None	No	No	No
29	Reactor/turbine trip with 1 stuck open safety valve in SG-A and a second stuck open safety valve in SG-B	None	No	No	No
30	Reactor/turtine trip with 1 stuck open safety valve in SG-A	None	Yes	No	No
31	Reactor/turbine trip with 1 stuck open safety valve in SG-A and a second stuck open safety valve in SG-B	None	Yes	No	No

36	Reactor/turbine trip with 1 stuck open safety valve in SG-A and a second stuck open safety valve in SG-B	Operator throttles HPI to maintain 27.8 K [50° F] subcooling and 304.8 cm [120 in] pressurizer level.	No	No	No
37	Reactor/turbine trip with 1 stuck open safety valve in SG-A	Operator throttles HPI to maintain 27.8 K [50° F] subcooling and 304.8 cm [120 in] pressurizer level.	Yes	No	No
38	Reactor/turbine trip with 1 stuck open safety valve in SG-A and a second stuck open safety valve in SG-B	Operator throttles HPI to maintain 27.8 K [50° F] subcooling and 304.8 cm [120 in] pressurizer level.	Yes	No	No
44	2.54 cm [1 in] surge line break with HPI Failure	At 15 minutes after initiation, operators open all TBVs to depressurize the system to the CFT setpoint. When the CFTs are 50 percent discharged, HPI is assumed to be recovered. The TBVs are assumed remain open for the duration of the transient.	No	No	No

89	Reactor/turbine trip with Loss of MFW and EFW.	Operator opens all TBVs to depressurize the secondary side to below the condensate booster pump shutoff head so that these pumps feed the steam generators. Booster pumps are assumed to be initially uncontrolled so that the steam generators are overfilled (609 cm [240 in] startup level). Operator controls booster pump flow to maintain SG level at 76 cm [30 in] due to continued RCP operation. Operator also throttles HPI to maintain 55 K [100EF] subcooling and a pressurizer level of 254 cm [100 in]. The TBVs are kept fully opened due to operator error.	No	No	No
90	Reactor/turbine trip with 2 stuck open safety valves in SG-A	Operator throttles HPI 20 minutes after 2.7 K [5°F] subcooling and 254 cm [100"] pressurizer level is reached [throttling criteria is 27.8 K [50°F] subcooling].	No	No	No
91	SGTR with a stuck open SRV in SG-B. A reactor trip is assumed to occur at the time of the tube rupture. Stuck safety relief valve is assumed to reclose 10 minutes after initiation.	Operator trips RCP's 1 minute after initiation. Operator also throttles HPI 10 minutes after 2.7 K [5°F] subcooling and 254 cm [100"] pressurizer level is reached [assumed throttling criteria is 27.8 K [50°F] subcooling].	No	No	No

98	Reactor/turbine trip with loss of MFW and EFW	Operator opens all TBVs to depressurize the secondary side to below the condensate booster pump shutoff head so that these pumps feed the steam generators. Booster pumps are assumed to be initially uncontrolled so that the steam generators are overfilled (610 cm [240 in] startup level). Operator controls booster pump flow to maintain SG level at 76 cm [30 in] due to continued RCP operation. Operator also throttles HPI to maintain 55 K [100EF] subcooling and a pressurizer level of 254 cm [100 in]. The TBVs are kept fully opened due to operator error.	Yes	No	No
99	MSLB with trip of turbine driven EFW by MSLB Circuitry	HPI is throttled 20 minutes after 2.7 K [5°F] subcooling and 254 cm [100"] pressurizer level is reached (throttling criteria is 27.8 K [50°F] subcooling).	No	No	No
100	MSLB with trip of turbine driven EFW by MSLB Circuitry	Operator throttles HPI 20 minutes after 2.7 K [5°F] subcooling and 254 cm [100"] pressurizer level is reached (throttling criteria is 27.8 K [50°F] subcooling).	Yes	No	No

101	MSLB without trip of turbine driven EFW by MSLB Circuitry	Operator throttles HPI to maintain 27.8 K [50° F] subcooling margin (throttling criteria is 27.8 K [50°F] subcooling).	Yes	No	No
102	Reactor/turbine trip with 2 stuck open safety valves in SG-A	Operator throttles HPI 20 minutes after 2.77 K [5°F] subcooling and 254 cm [100 in] pressurizer level is reached (throttling criteria is 27 K [50°F] subcooling).	Yes	No	No
109	Stuck open pressurizer safety valve. Valve recloses at 6000 secs [RCS low pressure point].	None	No	Yes	No
110	5.08 cm [2 inch] surge line break with HPI failure	At 15 minutes after transient initiation, operator opens both TBV to lower primary system pressure and allow CFT and LPI injection.	No	Yes	No
111	2.54 cm [1 in] surge line break with HPI failure	At 15 minutes after initiation, operator opens all TBVs to lower primary pressure and allow CFT and LPI injection. When the CFTs are 50% discharged, HPI is recovered. At 3000 seconds after initiation, operator starts throttling HPI to 55 K [100°F] subcooling and 254 cm [100"] pressurizer level.	No	Yes	No
112	Stuck open pressurizer safety valve. Valve recloses at 6000 secs.	After valve recloses, operator throttles HPI 1 minute after 2.7 K [5°F] subcooling and 254 cm [100"] pressurizer level is reached (throttling criteria is 27 K [50°F] subcooling)	No	Yes	No

113	Stuck open pressurizer safety valve. Valve recloses at 6000 secs.	After valve recloses, operator throttles HPI 10 minutes after 2.7 K [5°F] subcooling and 254 cm [100"] pressurizer level is reached (throttling criteria is 27.8 K [50°F] subcooling)	No	Yes	No
114	Stuck open pressurizer safety valve. Valve recloses at 3000 secs.	After valve recloses, operator throttles HPI 1 minute after 2.7 K [5°F] subcooling and 254 cm [100"] pressurizer level is reached (throttling criteria is 50°F subcooling)	No	Yes	No
115	Stuck open pressurizer Safety Valve. Valve recloses at 3000 secs.	After valve recloses, operator throttles HPI 10 minutes after 2.7 K [5°F] subcooling and 254 cm [100"] pressurizer level is reached (throttling criteria is 50°F subcooling)	No	Yes	No
116	Stuck open pressurizer safety valve and HPI failure	At 15 minutes after initiation, operator opens all TBVs to lower primary pressure and allow CFT and LPI injection. When the CFTs are 50% discharged, HPI is recovered. The HPI is throttled 20 minutes after 2.7 K [5°F] subcooling and 254 cm [100"] pressurizer level is reached (throttling criteria is 50°F subcooling).	No	Yes	No

117	Stuck open pressurizer safety valve and HPI failure	At 15 minutes after initiation, operator opens all TBV to lower primary pressure and allow CFT and LPI injection. When the CFTs are 50% discharged, HPI is recovered. The SRV is closed 5 minutes after HPI recovered. HPI is throttled at 1 minute after 2.7 K [5°F] subcooling and 254 cm [100"] pressurizer level is reached (throttling criteria is 27.8 K [50°F] subcooling).	No	Yes	No
119	2.54 cm [1 in] surge line break with HPI Failure	At 15 minutes after transient initiation, the operator opens all turbine bypass valves to lower primary system pressure and allow core flood tank and LPI injection.	Yes	Yes	No
120	2.54 cm [1 in] surge line break with HPI Failure	At 15 minutes after sequence initiation, operators open all TBVs to depressurize the system to the CFT setpoint. When the CFTs are 50 percent discharged, HPI is assumed to be recovered. The TBVs are assumed remain opened for the duration of the transient.	Yes	Yes	No
121	Stuck open pressurizer safety valve. Valve recloses at 6000 secs .	Operator throttles HPI at 1 minute after 2.7 K [5°F] subcooling and 254 cm [100"] pressurizer level is reached [throttling criteria is 27.8 K [50°F] subcooling].	Yes	Yes	No

122	Stuck open pressurizer safety valve. Valve recloses at 6000 secs.	Operator throttles HPI at 10 minutes after 2.7 K [5°F] subcooling and 254 cm [100"] pressurizer level is reached (throttling criteria is 27.8 K [50°F] subcooling).	Yes	Yes	No
123	Stuck open pressurizer safety valve. Valve recloses at 3000 secs.	Operator throttles HPI at 1 minute after 2.7 K [5°F] subcooling and 254 cm [100"] pressurizer level is reached (throttling criteria is 27.8 K [50°F] subcooling).	Yes	Yes	No
124	Stuck open pressurizer safety valve. Valve recloses at 3000 secs.	Operator throttles HPI at 10 minutes after 2.7 K [5°F] subcooling and 254 cm [100"] pressurizer level is reached (throttling criteria is 27.8 K [50°F] subcooling).	Yes	Yes	No
125	Stuck open pressurizer safety valve and HPI Failure	At 15 minutes after initiation, operator opens all TBVs to lower primary pressure and allow CFT and LPI injection. When the CFTs are 50% discharged, HPI is recovered. HPI is throttled 20 minutes after 2.7 K [5°F] subcooling and 254 cm [100"] pressurizer level is reached (throttling criteria is 27.8 K [50°F] subcooling).	Yes	Yes	No

126	Stuck open pressurizer safety valve and HPI Failure	At 15 minutes after initiation, operator opens all TBVs to lower primary pressure and allow CFT and LPI injection. When the CFTs are 50% discharged, HPI is recovered. SRV is closed at 5 minutes after HPI is recovered. HPI is throttled at 1 minute after 2.7 K [5°F] subcooling and 254 cm [100"] pressurizer level is reached (throttling criteria is 27.8 K [50°F] subcooling).	Yes	Yes	No
127	SGTR with a stuck open SRV in SG-B. A reactor trip is assumed to occur at the time of the tube rupture. Stuck safety relief valve is assumed to reclose 10 minutes after initiation.	Operator trips RCP's 1 minute after initiation. Operator also throttles HPI 10 minutes after 2.77 K [5° F] subcooling and 254 cm [100 in] pressurizer level is reached (assumed throttling criteria is 27 K [50°F] subcooling).	Yes	Yes	No
141	8.19 cm [3.22 in] surge line break [Break flow area increased by 30% from 7.18 cm [2.828 in] break].	None	No	Yes	No
142	6.01 cm [2.37 in] surge line break [Break flow area decreased by 30% from 7.18 cm [2.828 in] break].	None	No	Yes	No
145	4.34 cm [1.71 in] surge line break [Break flow area increased by 30% from 3.81 cm [1.5 in] break]. Winter conditions assumed [HPI, LPI temp = 277 K [40° F] and CFT temp = 294 K [70° F]].	None	No	Yes	No

146	TT/RT with stuck open pzr SRV [valve flow area reduced by 30 percent]. Summer conditions assumed [HPI, LPI temp = 302 K [85° F] and CFT temp = 310 K [100° F]]. Vent valves do not function.	None	No	Yes	No
147	TT/RT with stuck open pzr SRV. Summer conditions assumed [HPI, LPI temp = 302 K [85° F] and CFT temp = 310 K [100° F]].	None	No	Yes	No
148	TT/RT with partially stuck open pzr SRV [flow area equivalent to 1.5 in diameter opening]. HTC coefficients increased by 1.3.	None	No	Yes	No
149	TT/RT with stuck open pzr SRV. SRV assumed to reclose at 3000 secs. Operator does not throttle HPI.	None	No	Yes	No
154	8.53 cm [3.36 in] surge line break [Break flow area reduced by 30% from 10.16 cm [4 in] break]. Vent valves do not function. ECC suction switch to the containment sump included in the analysis.	None	No	Yes	No
156	40.64 cm [16 in] hot leg break. ECC suction switch to the containment sump included in the analysis.	None	No	Yes	Yes
160	14.37 cm [5.656 in] surge line break. ECC suction switch to the containment sump included in the analysis.	None	No	Yes	Yes

164	20.32 cm [8 inch] surge line break. ECC suction switch to the containment sump included in the analysis.	None	No	Yes	Yes
165	Stuck open pressurizer safety valve. Valve recloses at 6000 secs [RCS low pressure point].	None	Yes	Yes	No
168	TT/RT with stuck open pzr SRV. SRV assumed to reclose at 3000 secs. Operator does not throttle HPI.	None	Yes	Yes	No
169	TT/RT with stuck open pzr SRV [valve flow area reduced by 30 percent]. Summer conditions assumed [HPI, LPI temp = 302 K [85° F] and CFT temp = 310 K [100° F]]. Vent valves do not function.	None	Yes	Yes	No
170	TT/RT with stuck open pzr SRV. Summer conditions assumed [HPI, LPI temp = 302 K [85° F] and CFT temp = 310 K [100° F]].	None	Yes	Yes	No
171	TT/RT with partially stuck open pzr SRV [flow area equivalent to 1.5 in diameter opening]. HTC coefficients increased by 1.3.	None	Yes	Yes	No
172	10.16 cm [4 in] cold leg break. ECC suction switch to the containment sump included in the analysis.	None	No	Yes	Yes

178	8.53 cm [3.36 in] surge line break [Break flow area reduced by 30% from 10.16 cm [4 in] break]. Vent valves do not function. ECC suction switch to the containment sump included in the analysis.	None	No	Yes	No

Table D3 – Base case transient descriptions for Palisades

Case	System Failure	Operator Action	HZP	HiK	Dominant
2	3.59 cm (1.414 in) surge line break. Containment sump recirculation included in the analysis.	None	No	Yes	No
16	Turbine/reactor trip with 2 stuck-open ADVs on SG-A combined with controller failure resulting in the flow from two AFW pumps into affected steam generator.	Operator starts second AFW pump. Operator isolates AFW to affected SG at 30 minutes after initiation. Operator assumed to throttle HPI if auxiliary feedwater is running with SG wide range level > -84% and RCS subcooling > 25 F. HPI is throttled to maintain pressurizer level between 40 and 60 %.	No	No	No
18	Turbine/reactor trip with 1 stuck-open ADV on SG-A. Failure of both MSIVs (SG-A and SG-B) to close.	Operator does not isolate AFW on affected SG. Normal AFW flow assumed (200 gpm). Operator assumed to throttle HPI if auxiliary feedwater is running with SG wide range level > -84% and RCS subcooling > 25 F. HPI is throttled to maintain pressurizer level between 40 and 60 %.	No	No	No
19	Reactor trip with 1 stuck-open ADV on SG-A.	None. Operator does not throttle HPI.	Yes	No	Yes

22	Turbine/reactor trip with loss of MFW and AFW.	Operator depressurizes through ADVs and feeds SG's using condensate booster pumps. Operators maintain a cooldown rate within technical specification limits and throttle condensate flow at 84 % level in the steam generator.	No	No	No
24	Main steam line break with the break assumed to be inside containment causing containment spray actuation.	None	No	No	No
26	Main steam line break with the break assumed to be inside containment causing containment spray actuation.	Operator isolates AFW to affected SG at 30 minutes after initiation.	No	No	No
27	Main steam line break with controller failure resulting in the flow from two AFW pumps into affected steam generator. Break assumed to be inside containment causing containment spray actuation.	Operator starts second AFW pump.	No	No	No
29	Main steam line break with break assumed to be inside containment causing containment spray actuation.	None. Operator does not throttle HPI.	Yes	No	No
31	Turbine/reactor trip with failure of MFW and AFW. Containment spray actuation assumed due to PORV discharge.	Operator maintains core cooling by "feed and bleed" using HPI to feed and two PORVs to bleed.	No	No	No

32	Turbine/reactor trip with failure of MFW and AFW. Containment spray actuation assumed due to PORV discharge.	Operator maintains core cooling by "feed and bleed" using HPI to feed and two PORV to bleed. AFW is recovered 15 minutes after initiation of "feed and bleed" cooling. Operator closes PORVs when SG level reaches 60 percent.	No	No	No
34	Main steam line break concurrent with a single tube failure in SG-A due to MSLB vibration.	Operator isolates AFW to affected SG at 15 minutes after initiation. Operator trips RCPs assuming that they do not trip as a result of the event. Operator assumed to throttle HPI if auxiliary feedwater is running with SG wide range level > -84% and RCS subcooling > 25 F. HPI is throttled to maintain pressurizer level between 40 and 60 %.	No	No	No
40	40.64 cm (16 in) hot leg break. Containment sump recirculation included in the analysis.	None. Operator does not throttle HPI.	No	Yes	Yes
42	Turbine/reactor trip with two stuck open pressurizer SRVs. Containment spray is assumed not to actuate.	Operator assumed to throttle HPI if auxiliary feedwater is running with SG wide range level > -84% and RCS subcooling > 25 F. HPI is throttled to maintain pressurizer level between 40 and 60 %.	No	No	No
48	Two stuck-open pressurizer SRVs that reclose at 6000 sec after initiation. Containment spray is assumed not to actuate.	None. Operator does not throttle HPI.	Yes	No	No
49	Main steam line break with the break assumed to be inside containment causing containment spray actuation.	Operator isolates AFW to affected SG at 30 minutes after initiation. Operator does not throttle HPI.	Yes	No	No

50	Main steam line break with controller failure resulting in the flow from two AFW pumps into affected steam generator. Break assumed to be inside containment causing containment spray actuation.	Operator starts second AFW pump. Operator does not throttle HPI.	Yes	No	No
51	Main steam line break with failure of both MSIVs to close. Break assumed to be inside containment causing containment spray actuation.	Operator does not isolate AFW on affected SG. Operator does not throttle HPI.	Yes	No	No
52	Reactor trip with 1 stuck-open ADV on SG-A. Failure of both MSIVs (SG-A and SG-B) to close.	Operator does not isolate AFW on affected SG. Normal AFW flow assumed (200 gpm). Operator does not throttle HPI.	Yes	No	Yes
53	Turbine/reactor trip with two stuck-open pressurizer SRVs that reclose at 6000 sec after initiation. Containment spray is assumed not to actuate.	None. Operator does not throttle HPI.	No	No	No
54	Main steam line break with failure of both MSIVs to close. Break assumed to be inside containment causing containment spray actuation.	Operator does not isolate AFW on affected SG. Operator does not throttle HPI.	No	No	Yes
55	Turbine/reactor trip with 2 stuck-open ADVs on SG-A combined with controller failure resulting in the flow from two AFW pumps into affected steam generator.	Operator starts second AFW pump.	No	No	Yes
58	10.16 cm (4 in) cold leg break. Winter conditions assumed (HPI and LPI injection temp = 40 F, Accumulator temp = 60 F)	None. Operator does not throttle HPI.	No	Yes	Yes

59	10.16 cm (4 in) cold leg break. Summer conditions assumed (HPI and LPI injection temp = 100 F, Accumulator temp = 90 F)	None. Operator does not throttle HPI.	No	Yes	Yes
60	5.08 cm (2 in) surge line break. Winter conditions assumed (HPI and LPI injection temp = 40 F, Accumulator temp = 60 F)	None. Operator does not throttle HPI.	No	Yes	Yes
61	7.18 cm (2.8 in) cold leg break. Summer conditions assumed (HPI and LPI injection temp = 100 F, Accumulator temp = 90 F)	None. Operator does not throttle HPI.	No	Yes	No
62	20.32 cm (8 in) cold leg break. Winter conditions assumed (HPI and LPI injection temp = 40 F, Accumulator temp = 60 F)	None. Operator does not throttle HPI.	No	Yes	Yes
63	14.37 cm (5.656 in) cold leg break. Winter conditions assumed (HPI and LPI injection temp = 40 F, Accumulator temp = 60 F)	None. Operator does not throttle HPI.	No	Yes	Yes
64	10.16 cm (4 in) surge line break. Summer conditions assumed (HPI and LPI injection temp = 100 F, Accumulator temp = 90 F)	None. Operator does not throttle HPI.	No	Yes	Yes
65	One stuck-open pressurizer SRV that recloses at 6000 sec after initiation. Containment spray is assumed not to actuate.	None. Operator does not throttle HPI.	Yes	No	Yes

Appendix E - Transient Summaries

Table number	Table Content
E1	Transient report for Beaver Valley at 32 EFPY (12 dominant transients)
E2	Transient report for Beaver Valley at 60 EFPY (56 transients)
E3	Transient report for Beaver Valley at 60 EFPY (12 dominant transients)
E4	Transient report for Beaver Valley at 100 EFPY (12 dominant transients)
E5	Transient report for Beaver Valley at 200 EFPY (61 base case transients)
E6	Transient report for Oconee at 32 EFPY (4 dominant transients)
E7	Transient report for Oconee at 60 EFPY(32 transients)
E8	Transient report for Oconee at 60 EFPY(4 dominant transients)
E9	Transient report for Oconee at 500 EFPY(4 dominant transients)
E10	Transient report for Oconee at 1000 EFPY(54 base case transients)
E11	Transient report for Palisades at 32 EFPY(12 dominant transients)
E12	Transient report for Palisades at 60 EFPY (30 transients)
E13	Transient report for Palisades at 60 EFPY(12 dominant transients)
E14	Transient report for Palisades at 200 EFPY (12 dominant transients)
E15	Transient report for Palisades at 500 EFPY (30 base case transients)

Table E1 - Transient report for Beaver Valley at 32 EFPY (12 dominant transients)

Plant Name:	EFPY:	WPS:	Ductile Tearing	Through-Wall Cracking Criteria
Beaver Valley	32 (12 trans)	on	on	0.900

Transient Count	Transient Sequence Number	# of Time	Final Time	Min Temp	Final Temp	Min Press	Final Press	Mean Initiating Frequency	5% CPI	Mean CPI	Median CPI	95% CPI	5% CPF	Mean CPF	Median CPF	95% CPF	% total freq of crack initiation	% total freq of thru-wall cracking	First Crack Initiation Time	Last Crack Initiation Time	Most Crack Init Occur Time	First Failure Time	Last Failure Time	Most Failures Occur Time
			(min)	(°F)	(°F)	(ksi)	(ksi)	(events/yr)	Percentiles								(%)	(%)	(min)	(min)	(min)	(min)	(min)	(min)
1	7	500	249.5	64.50	155.31	0.03	0.05	2.11E-05	0.00E+00	6.91E-04	8.05E-06	1.15E-03	0.00E+00	5.52E-07	0.E+00	2.36E-08	12.97	0.99	5.50	14.00	12.00	8.00	13.50	12.00
2	9	500	249.5	64.55	154.52	0.02	0.02	6.99E-06	0.00E+00	9.40E-04	1.07E-05	1.74E-03	0.00E+00	7.95E-08	0.E+00	0.00E+00	6.19	0.04	1.50	7.50	4.00	2.00	7.50	4.00
3	56	500	249.5	59.33	127.46	0.06	0.15	1.23E-04	0.00E+00	8.93E-04	2.48E-05	1.61E-03	0.00E+00	1.30E-06	0.E+00	1.52E-07	78.84	13.75	10.50	18.50	17.50	12.50	17.50	17.50
4	60	500	249.5	133.92	365.87	0.38	2.37	2.15E-05	0.00E+00	7.52E-06	0.00E+00	0.00E+00	0.00E+00	7.15E-06	0.E+00	0.00E+00	0.13	12.45	62.50	128.00	127.00	63.50	128.00	127.00
5	96	500	249.5	137.16	527.37	0.35	2.36	1.87E-04	0.00E+00	4.46E-06	0.00E+00	0.00E+00	0.00E+00	7.17E-08	0.E+00	0.00E+00	0.76	1.01	59.00	81.00	81.00	76.00	81.00	81.00
6	97	500	249.5	74.68	74.68	0.26	2.35	3.74E-06	0.00E+00	9.37E-05	0.00E+00	4.11E-05	0.00E+00	5.47E-05	0.E+00	1.50E-05	0.27	16.66	14.00	72.50	41.50	41.50	72.50	72.50
7	101	500	249.5	117.13	283.64	0.26	2.32	3.09E-05	0.00E+00	1.83E-05	0.00E+00	3.08E-11	0.00E+00	1.83E-05	0.E+00	3.02E-11	0.49	54.02	13.50	71.00	71.00	70.50	71.00	71.00
8	102	500	249.5	212.22	523.49	0.61	2.37	1.02E-04	0.00E+00	1.57E-06	0.00E+00	0.00E+00	0.00E+00	2.34E-09	0.E+00	0.00E+00	0.08	0.02	8.00	16.00	12.50	11.00	14.00	14.00
9	103	500	249.5	191.46	228.49	0.70	0.70	1.07E-05	0.00E+00	1.25E-05	0.00E+00	0.00E+00	0.00E+00	4.62E-07	0.E+00	0.00E+00	0.11	0.46	5.00	15.50	13.50	8.50	15.50	14.00
10	104	500	249.5	205.59	504.01	0.66	2.36	1.09E-04	0.00E+00	1.57E-06	0.00E+00	0.00E+00	0.00E+00	2.34E-09	0.E+00	0.00E+00	0.05	0.13	8.00	16.00	12.50	11.00	14.00	14.00
11	105	500	249.5	179.39	225.85	0.64	0.64	1.07E-05	0.00E+00	1.25E-05	0.00E+00	0.00E+00	0.00E+00	4.62E-07	0.E+00	0.00E+00	0.10	0.47	5.00	15.50	13.50	8.50	15.50	14.00
12	108	500	249.5	251.79	556.47	0.87	2.32	6.46E-04	0.00E+00	1.60E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.E+00	0.00E+00	0.01	0.00	12.00	17.50	16.50	0.00	0.00	0.00

Table E2 - Transient report for Beaver Valley at 60 EFPY (56 transients)

Plant Name:	EFPY:	WPS:	Ductile Tearing		Through-Wall Cracking Criteria																			
Beaver Valley	60 (56 trans)	on	on		0.900																			
Transient Count	Transient Sequence Number	# of Time	Final Time	Min Temp	Final Temp	Min Press	Final Press	Mean Initiating Frequency	5% CPI	Mean CPI	Median CPI	95% CPI	5% CPF	Mean CPF	Median CPF	95% CPF	% total freq of crack initiation	% total freq of thru-wall cracking	First Crack Initiation Time	Last Crack Initiation Time	Most Crack Init Occur Time	First Failure Time	Last Failure Time	Most Failures Occur Time
			(min)	(°F)	(°F)	(ksi)	(ksi)	(events/yr)	Percentiles								(%)	(%)	(min)	(min)	(min)	(min)	(min)	(min)
1	3	500	249.5	99.98	146.95	0.20	0.22	9.76E-05	0.00E+00	5.75E-07	0.00E+00	0.00E+00	0.00E+00	2.70E-10	0.00E+00	0.00E+00	0.01	0.00	36.5	46.5	46.0	44.0	46.0	46.0
2	7	500	249.5	64.50	155.31	0.03	0.05	2.11E-05	1.20E-06	2.65E-03	3.83E-04	5.02E-03	0.00E+00	9.63E-06	0.00E+00	9.45E-06	11.84	2.64	5.5	14.0	12.0	7.0	13.5	12.0
3	9	500	249.5	64.55	154.52	0.02	0.02	6.99E-06	2.89E-06	3.98E-03	6.28E-04	8.28E-03	0.00E+00	1.97E-06	0.00E+00	1.06E-06	6.41	0.21	1.5	7.5	4.0	1.5	7.5	4.0
4	14	500	249.5	70.89	75.62	0.18	0.21	2.23E-04	0.00E+00	1.07E-06	0.00E+00	0.00E+00	0.00E+00	7.10E-12	0.00E+00	0.00E+00	0.04	0.00	62.0	88.5	87.5	88.0	88.5	88.5
5	31	500	249.5	58.22	58.22	0.16	0.20	3.10E-07	0.00E+00	1.02E-05	0.00E+00	2.91E-09	0.00E+00	1.51E-07	0.00E+00	0.00E+00	0.00	0.00	73.5	91.0	90.5	36.0	42.0	40.5
6	34	500	249.5	57.91	128.28	0.13	0.19	4.95E-07	0.00E+00	6.09E-06	0.00E+00	0.00E+00	0.00E+00	3.78E-09	0.00E+00	0.00E+00	0.00	0.00	28.0	43.0	42.5	36.0	42.0	40.5
7	56	500	249.5	59.33	127.46	0.06	0.15	1.23E-04	4.14E-06	3.22E-03	5.85E-04	6.12E-03	0.00E+00	1.88E-05	1.76E-10	2.17E-05	74.92	32.19	10.0	18.5	17.5	12.0	17.5	17.5
8	59	500	249.5	313.68	416.76	0.57	2.36	3.46E-04	0.00E+00	4.79E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00	73.5	73.5	73.5	0.0	0.0	0.0
9	60	500	249.5	133.92	365.87	0.38	2.37	2.15E-05	0.00E+00	2.53E-05	0.00E+00	4.39E-07	0.00E+00	2.45E-05	0.00E+00	3.72E-07	0.17	11.11	62.5	128.0	127.0	63.0	128.0	127.0
10	61	500	249.5	183.16	398.44	0.43	2.38	1.79E-06	0.00E+00	3.11E-05	0.00E+00	3.00E-06	0.00E+00	1.07E-05	0.00E+00	2.95E-07	0.01	0.21	29.0	84.5	46.0	29.5	84.5	84.5
11	62	500	249.5	65.96	348.56	0.19	2.38	1.08E-07	0.00E+00	1.14E-05	0.00E+00	2.29E-11	0.00E+00	5.32E-06	0.00E+00	0.00E+00	0.00	0.00	28.5	117.0	116.5	36.0	117.0	116.5
12	64	500	249.5	52.23	123.57	0.15	0.19	8.67E-08	0.00E+00	5.92E-04	1.45E-05	1.02E-03	0.00E+00	2.07E-06	0.00E+00	8.47E-10	0.01	0.00	16.5	32.0	32.0	19.5	32.0	28.0
13	65	500	249.5	129.54	177.70	0.14	0.17	1.04E-09	0.00E+00	3.02E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00	21.0	28.0	25.5	0.0	0.0	0.0
14	66	500	249.5	72.14	73.02	0.19	0.21	1.18E-06	0.00E+00	2.40E-05	0.00E+00	1.97E-06	0.00E+00	3.40E-07	0.00E+00	0.00E+00	0.01	0.00	29.0	46.0	46.0	35.5	46.0	46.0
15	67	500	249.5	70.31	118.36	0.14	0.21	1.18E-06	0.00E+00	3.49E-06	0.00E+00	0.00E+00	0.00E+00	2.35E-09	0.00E+00	0.00E+00	0.00	0.00	28.5	42.5	41.5	35.5	41.0	40.5
16	68	500	249.5	162.57	285.87	0.13	2.37	1.33E-08	0.00E+00	1.43E-06	0.00E+00	0.00E+00	0.00E+00	8.48E-07	0.00E+00	0.00E+00	0.00	0.00	24.5	105.0	104.5	103.0	105.0	104.5

17	69	500	249.5	72.09	72.09	0.12	2.37	2.09E-08	0.00E+00	7.49E-04	2.78E-05	1.11E-03	0.00E+00	5.83E-04	1.73E-05	7.87E-04	0.00	0.21	17.0	58.0	58.0	17.0	58.0	58.0
18	70	500	249.5	59.75	68.68	0.15	2.37	2.09E-08	4.28E-08	1.42E-03	1.58E-04	2.46E-03	0.00E+00	1.97E-04	1.58E-06	2.44E-04	0.01	0.06	16.5	106.0	32.5	17.5	106.5	32.5
19	71	500	249.5	71.28	71.28	0.15	2.37	3.74E-06	0.00E+00	1.30E-05	0.00E+00	0.00E+00	0.00E+00	1.30E-05	0.00E+00	0.00E+00	0.01	0.83	12.0	109.0	108.0	108.0	109.0	109.0
20	73	500	249.5	53.32	53.32	0.17	0.19	6.55E-08	0.00E+00	1.22E-05	0.00E+00	2.83E-08	0.00E+00	6.88E-08	0.00E+00	0.00E+00	0.00	0.00	55.5	61.0	60.5	60.5	61.0	60.5
21	74	500	249.5	222.39	224.56	1.99	2.42	1.46E-06	0.00E+00	1.17E-06	0.00E+00	0.00E+00	0.00E+00	1.84E-07	0.00E+00	0.00E+00	0.00	0.00	17.0	33.0	30.5	25.5	33.0	32.5
22	76	500	249.5	143.37	148.71	0.86	2.37	1.06E-04	0.00E+00	1.50E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00	10.0	15.5	15.0	0.0	0.0	0.0
23	81	500	249.5	239.60	243.96	0.39	0.87	2.65E-06	0.00E+00	8.35E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00	11.5	14.5	14.5	0.0	0.0	0.0
24	82	500	249.5	222.59	292.82	0.17	2.37	1.51E-06	0.00E+00	2.37E-09	0.00E+00	0.00E+00	0.00E+00	1.88E-09	0.00E+00	0.00E+00	0.00	0.00	121.5	125.0	124.5	121.5	125.0	124.5
25	86	500	249.5	77.77	500.28	0.16	2.36	6.84E-07	0.00E+00	4.34E-06	0.00E+00	0.00E+00	0.00E+00	3.05E-09	0.00E+00	0.00E+00	0.00	0.00	29.5	43.5	42.0	36.5	43.0	40.0
26	87	500	249.5	80.57	497.49	0.15	2.37	9.98E-07	0.00E+00	4.97E-06	0.00E+00	0.00E+00	0.00E+00	6.26E-07	0.00E+00	0.00E+00	0.00	0.01	29.5	134.0	42.0	36.5	134.0	128.0
27	88	500	249.5	117.95	354.13	0.16	0.56	1.33E-07	0.00E+00	1.13E-04	0.00E+00	9.01E-05	0.00E+00	7.59E-07	0.00E+00	0.00E+00	0.00	0.00	16.5	27.5	27.5	20.0	27.5	26.5
28	89	500	249.5	79.87	231.30	0.15	0.29	1.33E-07	0.00E+00	1.31E-04	0.00E+00	1.16E-04	0.00E+00	8.37E-07	0.00E+00	0.00E+00	0.00	0.00	16.5	28.0	27.5	21.0	28.0	27.5
29	90	500	249.5	101.82	345.85	0.16	0.50	1.65E-07	0.00E+00	1.13E-04	0.00E+00	9.01E-05	0.00E+00	1.77E-06	0.00E+00	1.11E-12	0.00	0.00	16.5	27.5	27.5	20.0	171.5	27.5
30	91	500	249.5	84.53	217.71	0.15	1.40	1.65E-07	0.00E+00	1.32E-04	0.00E+00	1.17E-04	0.00E+00	2.78E-06	0.00E+00	2.95E-09	0.00	0.01	16.5	225.0	27.5	20.0	225.0	27.5
31	92	500	249.5	60.33	66.00	0.16	0.21	2.13E-07	0.00E+00	2.29E-04	4.30E-08	2.69E-04	0.00E+00	1.85E-06	0.00E+00	3.28E-09	0.01	0.01	16.5	29.5	28.5	21.0	29.5	28.5
32	93	500	249.5	65.05	65.05	0.16	0.21	2.13E-07	0.00E+00	2.29E-04	4.30E-08	2.69E-04	0.00E+00	1.85E-06	0.00E+00	3.28E-09	0.01	0.01	16.5	29.5	28.5	21.0	29.5	28.5
33	94	500	249.5	54.20	54.20	0.21	0.21	4.10E-05	0.00E+00	1.61E-04	1.80E-09	1.38E-04	0.00E+00	1.84E-09	0.00E+00	0.00E+00	1.34	0.00	12.0	42.0	41.5	41.5	42.0	41.5
34	95	500	249.5	161.75	532.64	0.37	2.37	1.34E-04	0.00E+00	5.39E-06	0.00E+00	0.00E+00	0.00E+00	1.89E-07	0.00E+00	0.00E+00	0.15	0.31	61.0	83.0	82.5	70.0	83.0	82.5
35	96	500	249.5	137.16	527.37	0.35	2.36	1.87E-04	0.00E+00	1.48E-05	0.00E+00	1.03E-07	0.00E+00	9.54E-07	0.00E+00	0.00E+00	0.46	2.16	58.5	81.0	81.0	64.0	81.0	81.0
36	97	500	249.5	74.68	74.68	0.26	2.35	3.74E-06	0.00E+00	2.80E-04	1.50E-07	2.66E-04	0.00E+00	1.85E-04	5.15E-08	1.31E-04	0.19	8.18	12.0	72.5	41.5	13.0	72.5	72.0

37	98	500	249.5	116.37	296.35	0.19	0.42	2.59E-05	0.00E+00	4.34E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00	11.5	14.5	14.5	0.0	0.0	0.0
38	99	500	249.5	212.41	346.16	0.33	1.70	2.59E-05	0.00E+00	4.34E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00	11.5	14.5	14.5	0.0	0.0	0.0
39	100	500	249.5	99.63	221.94	0.15	0.65	3.09E-05	0.00E+00	4.34E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00	11.5	14.5	14.5	0.0	0.0	0.0
40	101	500	249.5	117.13	283.64	0.26	2.32	3.09E-05	0.00E+00	6.63E-05	0.00E+00	2.17E-06	0.00E+00	6.62E-05	0.00E+00	2.16E-06	0.50	34.25	12.0	71.0	71.0	70.5	71.0	71.0
41	102	500	249.5	212.22	523.49	0.61	2.37	1.02E-04	0.00E+00	6.27E-06	0.00E+00	0.00E+00	0.00E+00	2.99E-07	0.00E+00	0.00E+00	0.11	0.39	7.5	16.0	12.5	10.5	14.0	14.0
42	103	500	249.5	191.46	228.49	0.70	0.70	1.07E-05	0.00E+00	6.43E-05	0.00E+00	2.92E-05	0.00E+00	1.02E-05	0.00E+00	1.11E-07	0.15	1.46	4.5	15.5	13.5	6.5	15.5	14.0
43	104	500	249.5	205.59	504.01	0.66	2.36	1.09E-04	0.00E+00	6.27E-06	0.00E+00	0.00E+00	0.00E+00	2.99E-07	0.00E+00	0.00E+00	0.25	0.47	7.5	16.0	12.5	10.5	14.0	14.0
44	105	500	249.5	179.39	225.85	0.64	0.64	1.07E-05	0.00E+00	6.43E-05	0.00E+00	2.92E-05	0.00E+00	1.02E-05	0.00E+00	1.11E-07	0.14	1.55	4.5	15.5	13.5	6.5	15.5	14.0
45	106	500	249.5	207.13	222.93	0.35	0.36	2.21E-06	0.00E+00	6.75E-06	0.00E+00	0.00E+00	0.00E+00	3.75E-07	0.00E+00	0.00E+00	0.00	0.01	7.5	15.5	12.5	10.5	14.5	13.0
46	107	500	249.5	191.28	220.28	0.73	0.73	4.31E-07	0.00E+00	6.40E-05	0.00E+00	2.88E-05	0.00E+00	1.10E-05	0.00E+00	1.92E-07	0.00	0.08	4.5	15.5	14.0	5.5	15.5	15.0
47	108	500	249.5	251.79	556.47	0.87	2.32	6.46E-04	0.00E+00	1.05E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.07	0.00	10.5	17.0	16.5	0.0	0.0	0.0
48	109	500	249.5	212.98	233.93	0.73	0.73	6.81E-05	0.00E+00	4.92E-07	0.00E+00	0.00E+00	0.00E+00	1.29E-08	0.00E+00	0.00E+00	0.01	0.02	7.5	20.0	15.0	14.5	20.0	20.0
49	110	500	249.5	231.26	541.74	1.41	2.37	6.91E-04	0.00E+00	1.05E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.01	0.00	10.0	17.0	16.5	0.0	0.0	0.0
50	111	500	249.5	189.43	236.77	0.64	0.64	6.82E-05	0.00E+00	4.92E-07	0.00E+00	0.00E+00	0.00E+00	1.29E-08	0.00E+00	0.00E+00	0.00	0.02	7.5	20.0	20.0	14.5	20.0	20.0
51	112	500	249.5	245.43	246.49	0.35	0.35	1.41E-05	0.00E+00	1.06E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00	10.0	16.5	16.0	0.0	0.0	0.0
52	113	500	249.5	210.35	224.22	0.65	0.65	2.74E-06	0.00E+00	4.54E-07	0.00E+00	0.00E+00	0.00E+00	4.30E-08	0.00E+00	0.00E+00	0.00	0.00	8.0	21.0	21.0	20.0	21.0	21.0
53	114	500	249.5	87.46	129.41	0.16	0.19	9.76E-05	0.00E+00	1.37E-04	1.92E-12	1.08E-04	0.00E+00	2.78E-06	0.00E+00	1.04E-08	2.60	3.36	26.0	49.0	48.5	35.0	49.0	48.5
54	116	500	249.5	136.88	187.04	0.06	0.07	1.81E-05	0.00E+00	1.41E-05	0.00E+00	1.90E-07	0.00E+00	1.97E-08	0.00E+00	0.00E+00	0.06	0.01	19.5	43.0	28.5	25.5	28.5	28.5
55	117	500	249.5	145.59	193.82	0.06	0.09	2.11E-05	0.00E+00	9.88E-05	0.00E+00	6.13E-05	0.00E+00	1.04E-06	0.00E+00	7.87E-13	0.48	0.23	29.0	47.5	46.5	31.5	47.5	47.0
56	118	500	249.5	213.47	213.47	1.25	2.37	9.30E-06	0.00E+00	1.51E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00	10.5	20.0	18.0	0.0	0.0	0.0

Table E3 - Transient report for Beaver Valley at 60 EFPY (12 dominant transients)

Plant Name:	EFPY:	WPS:	Ductile Tearing		Through-Wall Cracking Criteria																			
Beaver Valley	60 (12 trans)	on	on		0.900																			
Transient Count	Transient Sequence Number	# of Time	Final Time	Min Temp	Final Temp	Min Press	Final Press	Mean Initiating Frequency	5% CPI	Mean CPI	Median CPI	95% CPI	5% CPF	Mean CPF	Median CPF	95% CPF	% total freq of crack initiation	% total freq of thru-wall cracking	First Crack Initiation Time	Last Crack Initiation Time	Most Crack Init Occur Time	First Failure Time	Last Failure Time	Most Failures Occur Time
			(min)	(°F)	(°F)	(ksi)	(ksi)	(events/yr)	Percentiles								(%)	(%)	(min)	(min)	(min)	(min)	(min)	(min)
1	7	500.00	249.50	64.50	155.31	0.03	0.05	2.11E-05	1.11E-06	2.63E-03	3.84E-04	5.06E-03	0.00E+00	9.04E-06	0.00E+00	9.55E-06	13.77	3.82	5.5	14.5	12.0	6.5	13.5	12.0
2	9	500.00	249.50	64.55	154.52	0.02	0.02	6.99E-06	2.78E-06	3.96E-03	6.23E-04	8.33E-03	0.00E+00	1.82E-06	0.00E+00	1.10E-06	6.58	0.25	1.5	7.5	4.0	1.5	7.5	4.0
3	56	500.00	249.50	59.33	127.46	0.06	0.15	1.23E-04	3.95E-06	3.20E-03	5.83E-04	6.21E-03	0.00E+00	1.78E-05	1.99E-10	2.19E-05	77.85	40.64	10.0	18.5	17.5	11.5	18.0	17.5
4	60	500.00	249.50	133.92	365.87	0.38	2.37	2.15E-05	0.00E+00	2.18E-05	0.00E+00	3.39E-07	0.00E+00	2.06E-05	0.00E+00	3.05E-07	0.08	7.12	62.5	128.0	127.0	63.0	128.0	127.0
5	96	500.00	249.50	137.16	527.37	0.35	2.36	1.87E-04	0.00E+00	1.50E-05	0.00E+00	1.08E-07	0.00E+00	6.85E-07	0.00E+00	0.00E+00	0.67	3.38	59.0	81.0	81.0	65.0	81.0	81.0
6	97	500.00	249.50	74.68	74.68	0.26	2.35	3.74E-06	0.00E+00	2.65E-04	1.57E-07	2.61E-04	0.00E+00	1.71E-04	5.53E-08	1.29E-04	0.21	12.28	12.5	72.5	41.5	41.5	72.5	41.5
7	101	500.00	249.50	117.13	283.64	0.26	2.32	3.09E-05	0.00E+00	5.17E-05	0.00E+00	2.02E-06	0.00E+00	5.16E-05	0.00E+00	2.01E-06	0.30	28.01	12.0	71.0	71.0	70.5	71.0	71.0
8	102	500.00	249.50	212.22	523.49	0.61	2.37	1.02E-04	0.00E+00	7.58E-06	0.00E+00	0.00E+00	0.00E+00	2.28E-07	0.00E+00	0.00E+00	0.13	0.98	7.5	16.0	12.5	9.0	14.0	12.5
9	103	500.00	249.50	191.46	228.49	0.70	0.70	1.07E-05	0.00E+00	6.55E-05	0.00E+00	2.88E-05	0.00E+00	8.51E-06	0.00E+00	9.29E-08	0.12	1.60	4.5	15.5	13.5	5.5	15.5	14.0
10	104	500.00	249.50	205.59	504.01	0.66	2.36	1.09E-04	0.00E+00	7.58E-06	0.00E+00	0.00E+00	0.00E+00	2.28E-07	0.00E+00	0.00E+00	0.13	0.41	7.5	16.0	12.5	9.0	14.0	12.5
11	105	500.00	249.50	179.39	225.85	0.64	0.64	1.07E-05	0.00E+00	6.55E-05	0.00E+00	2.88E-05	0.00E+00	8.51E-06	0.00E+00	9.29E-08	0.14	1.52	4.5	15.5	13.5	5.0	15.5	14.0
12	108	500.00	249.50	251.79	556.47	0.87	2.32	6.46E-04	0.00E+00	5.11E-08	0.00E+00	0.00E+00	0.00E+00	3.17E-10	0.00E+00	0.00E+00	0.00	0.00	10.5	17.5	16.5	13.0	16.5	16.0

Table E4 - Transient report for Beaver Valley at 100 EFPY (12 dominant transients)

Plant Name:	EFPY:	WPS:	Ductile Tearing	Through-Wall Cracking Criteria
Beaver Valley	100 (12 trans)	on	on	0.900

Transient Count	Transient Sequence Number	# of Time	Final Time	Min Temp	Final Temp	Min Press	Final Press	Mean Initiating Frequency	5% CPI	Mean CPI	Median CPI	95% CPI	5% CPF	Mean CPF	Median CPF	95% CPF	% total freq of crack initiation	% total freq of thru-wall cracking	First Crack Initiation Time	Last Crack Initiation Time	Most Crack Init Occur Time	First Failure Time	Last Failure Time	Most Failures Occur Time
			(min)	(°F)	(°F)	(ksi)	(ksi)	(events/yr)	Percentiles								(%)	(%)	(min)	(min)	(min)	(min)	(min)	(min)
1	7	500.00	249.50	64.50	155.31	0.03	0.05	2.11E-05	1.49E-04	8.62E-03	2.95E-03	3.15E-02	0.00E+00	7.38E-05	1.75E-06	1.21E-04	13.49	6.80	5.5	15.5	11.5	5.5	13.5	12.0
2	9	500.00	249.50	64.55	154.52	0.02	0.02	6.99E-06	3.59E-04	1.40E-02	5.13E-03	5.37E-02	0.00E+00	3.20E-05	1.63E-07	3.75E-05	7.60	0.80	1.5	10.5	4.0	1.5	7.5	4.0
3	56	500.00	249.50	59.33	127.46	0.06	0.15	1.23E-04	2.07E-04	9.82E-03	3.61E-03	3.54E-02	0.00E+00	1.21E-04	3.60E-06	2.10E-04	76.54	52.05	9.5	18.5	17.5	10.5	18.0	17.5
4	60	500.00	249.50	133.92	365.87	0.38	2.37	2.15E-05	0.00E+00	5.05E-05	0.00E+00	6.75E-06	0.00E+00	4.77E-05	0.00E+00	6.17E-06	0.07	3.67	58.5	128.0	127.0	58.5	128.0	127.0
5	96	500.00	249.50	137.16	527.37	0.35	2.36	1.87E-04	0.00E+00	4.13E-05	0.00E+00	8.61E-06	0.00E+00	2.67E-06	0.00E+00	1.29E-12	0.45	1.96	57.5	81.0	81.0	64.0	81.0	81.0
6	97	500.00	249.50	74.68	74.68	0.26	2.35	3.74E-06	0.00E+00	6.62E-04	1.27E-05	9.37E-04	0.00E+00	4.72E-04	6.52E-06	5.65E-04	0.16	6.53	11.5	72.5	41.5	13.5	72.5	41.5
7	101	500.00	249.50	117.13	283.64	0.26	2.32	3.09E-05	0.00E+00	1.17E-04	0.00E+00	2.15E-05	0.00E+00	1.17E-04	0.00E+00	2.11E-05	0.24	14.37	11.0	71.0	71.0	14.0	71.0	71.0
8	102	500.00	249.50	212.22	523.49	0.61	2.37	1.02E-04	0.00E+00	5.81E-05	0.00E+00	2.23E-05	0.00E+00	4.77E-06	0.00E+00	1.41E-08	0.38	1.64	7.0	16.0	12.5	7.5	16.0	12.5
9	103	500.00	249.50	191.46	228.49	0.70	0.70	1.07E-05	0.00E+00	3.63E-04	3.63E-04	5.51E-04	0.00E+00	6.03E-05	2.00E-11	5.26E-05	0.24	2.25	4.5	15.5	13.0	4.5	15.5	14.0
10	104	500.00	249.50	205.59	504.01	0.66	2.36	1.09E-04	0.00E+00	5.81E-05	0.00E+00	2.23E-05	0.00E+00	4.77E-06	0.00E+00	1.41E-08	0.56	7.17	7.0	16.0	12.5	7.5	16.0	12.5
11	105	500.00	249.50	179.39	225.85	0.64	0.64	1.07E-05	0.00E+00	3.63E-04	1.43E-06	5.51E-04	0.00E+00	6.03E-05	2.00E-11	5.26E-05	0.24	2.68	4.5	15.5	13.0	4.5	15.5	14.0
12	108	500.00	249.50	251.79	556.47	0.87	2.32	6.46E-04	0.00E+00	1.04E-06	0.00E+00	0.00E+00	0.00E+00	6.63E-08	0.00E+00	0.00E+00	0.02	0.06	9.0	18.0	16.5	11.5	17.0	16.0

Table E5 - Transient report for Beaver Valley at 200 EFPY (61 base case transients)

Plant Name:	EFPY:	WPS:	Ductile Tearing	Through-Wall Cracking Criteria
Beaver Valley	200 (61 trans)	on	on	0.900

Transient Count	Transient Sequence Number	# of Time	Final Time	Min Temp	Final Temp	Min Press	Final Press	Mean Initiating Frequency	5% CPI	Mean CPI	Median CPI	95% CPI	5% CPF	Mean CPF	Median CPF	95% CPF	% total freq of crack initiation	% total freq of thru-wall cracking	First Crack Initiation Time	Last Crack Initiation Time	Most Crack Init Occur Time	First Failure Time	Last Failure Time	Most Failures Occur Time
			(min)	(°F)	(°F)	(ksi)	(ksi)	(events/yr)	Percentiles								(%)	(%)	(min)	(min)	(min)	(min)	(min)	(min)
1	2	500	249.5	263.220	285.010	0.550	0.690	1.23E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00						
2	3	500	249.5	99.980	146.950	0.196	0.216	9.76E-05	0.00E+00	4.62E-05	0.00E+00	7.29E-06	0.00E+00	7.37E-07	0.00E+00	0.00E+00	0.05	0.02	32.0	47.0	46.0	38.0	46.0	46.0
3	7	500	249.5	64.500	155.310	0.027	0.046	2.11E-05	3.99E-03	4.18E-02	2.42E-02	1.29E-01	5.35E-06	1.27E-03	2.59E-04	2.23E-03	15.21	12.10	5.0	15.0	12.0	6.0	14.0	12.0
4	9	500	249.5	64.550	154.520	0.017	0.021	6.99E-06	1.00E-02	7.34E-02	4.65E-02	2.22E-01	1.19E-05	2.01E-03	4.27E-04	3.78E-03	8.15	4.84	1.0	9.0	4.0	2.0	8.0	4.0
5	14	500	249.5	70.890	75.620	0.182	0.212	2.23E-04	0.00E+00	2.57E-05	0.00E+00	1.01E-11	0.00E+00	4.63E-08	0.00E+00	0.00E+00	0.05	0.00	57.0	89.0	86.0	62.0	89.0	87.0
6	31	500	249.5	58.220	58.220	0.160	0.198	3.10E-07	0.00E+00	2.21E-04	2.36E-09	1.76E-04	0.00E+00	9.40E-06	0.00E+00	6.82E-08	0.00	0.00	74.0	91.0	91.0	75.0	91.0	91.0
7	34	500	249.5	57.910	128.280	0.126	0.188	4.95E-07	0.00E+00	2.21E-04	9.10E-09	1.88E-04	0.00E+00	3.10E-06	0.00E+00	2.94E-12	0.00	0.00	25.0	43.0	42.0	29.0	43.0	40.0
8	56	500	249.5	59.330	127.460	0.055	0.145	1.23E-04	4.55E-03	4.44E-02	2.64E-02	1.36E-01	9.95E-06	1.64E-03	3.73E-04	2.92E-03	67.88	54.99	10.0	19.0	18.0	10.0	18.0	18.0
9	59	500	249.5	313.680	416.760	0.565	2.364	3.46E-04	0.00E+00	4.76E-07	0.00E+00	0.00E+00	0.00E+00	3.10E-08	0.00E+00	0.00E+00	0.00	0.00	73.0	74.0	74.0	74.0	74.0	74.0
10	60	500	249.5	133.920	365.870	0.380	2.372	2.15E-05	0.00E+00	1.55E-04	0.00E+00	6.35E-05	0.00E+00	1.44E-04	0.00E+00	5.54E-05	0.03	0.69	57.0	128.0	127.0	57.0	128.0	127.0
11	61	500	249.5	183.160	398.440	0.433	2.379	1.79E-06	0.00E+00	5.61E-04	7.63E-06	7.68E-04	0.00E+00	2.18E-04	1.82E-06	2.73E-04	0.01	0.14	25.0	85.0	46.0	27.0	85.0	46.0
12	62	500	249.5	65.960	348.560	0.186	2.383	1.08E-07	0.00E+00	2.35E-04	1.78E-08	2.05E-04	0.00E+00	2.07E-05	0.00E+00	3.35E-06	0.00	0.00	25.0	117.0	42.0	28.0	117.0	117.0
13	64	500	249.5	52.230	123.570	0.149	0.187	8.67E-08	8.05E-05	7.45E-03	2.34E-03	1.32E-02	0.00E+00	1.24E-04	1.71E-07	1.28E-04	0.01	0.00	16.0	32.0	32.0	17.0	32.0	28.0
14	65	500	249.5	129.540	177.700	0.144	0.168	1.04E-09	0.00E+00	3.23E-05	0.00E+00	5.19E-06	0.00E+00	6.22E-08	0.00E+00	0.00E+00	0.00	0.00	19.0	28.0	26.0	24.0	26.0	26.0
15	66	500	249.5	72.140	73.020	0.190	0.214	1.18E-06	0.00E+00	5.17E-04	6.39E-06	6.79E-04	0.00E+00	1.93E-05	0.00E+00	3.74E-06	0.01	0.00	25.0	46.0	46.0	31.0	46.0	46.0
16	67	500	249.5	70.310	118.360	0.137	0.214	1.18E-06	0.00E+00	1.60E-04	0.00E+00	1.13E-04	0.00E+00	2.76E-06	0.00E+00	0.00E+00	0.00	0.00	25.0	43.0	41.0	30.0	43.0	41.0

17	68	500	249.5	162.570	285.870	0.134	2.369	1.33E-08	0.00E+00	5.01E-05	0.00E+00	1.55E-05	0.00E+00	3.67E-06	0.00E+00	1.55E-14	0.00	0.00	19.0	105.0	27.0	21.0	105.0	105.0
18	69	500	249.5	72.090	72.090	0.120	2.369	2.09E-08	1.45E-04	6.69E-03	1.98E-03	2.36E-02	1.08E-04	5.35E-03	1.48E-03	1.89E-02	0.00	0.04	16.0	58.0	58.0	16.0	58.0	58.0
19	70	500	249.5	59.750	68.680	0.149	2.371	2.09E-08	8.31E-05	7.54E-03	2.37E-03	1.34E-02	5.62E-07	8.89E-04	1.02E-04	1.73E-03	0.00	0.01	16.0	106.0	32.0	17.0	106.0	32.0
20	71	500	249.5	71.280	71.280	0.152	2.373	3.74E-06	0.00E+00	5.38E-05	0.00E+00	3.20E-06	0.00E+00	4.18E-05	0.00E+00	8.15E-08	0.00	0.03	11.0	109.0	108.0	12.0	109.0	108.0
21	72	500	249.5	185.280	185.280	0.169	0.189	5.14E-07	0.00E+00	1.40E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00	24.0	24.0	24.0	0.0	0.0	0.0
22	73	500	249.5	53.320	53.320	0.171	0.188	6.55E-08	0.00E+00	1.33E-04	0.00E+00	7.25E-05	0.00E+00	2.54E-07	0.00E+00	0.00E+00	0.00	0.00	19.0	61.0	61.0	20.0	61.0	61.0
23	74	500	249.5	222.390	224.560	1.992	2.424	1.46E-06	0.00E+00	1.22E-04	0.00E+00	9.09E-05	0.00E+00	3.41E-05	0.00E+00	1.75E-05	0.00	0.01	15.0	33.0	29.0	15.0	33.0	33.0
24	76	500	249.5	143.370	148.710	0.863	2.373	1.06E-04	0.00E+00	1.77E-06	0.00E+00	0.00E+00	0.00E+00	1.89E-07	0.00E+00	0.00E+00	0.00	0.02	4.0	16.0	15.0	8.0	16.0	15.0
25	78	500	249.5	314.010	314.010	1.959	2.426	3.25E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00						
26	81	500	249.5	239.600	243.960	0.394	0.874	2.65E-06	0.00E+00	2.67E-06	0.00E+00	0.00E+00	0.00E+00	3.98E-09	0.00E+00	0.00E+00	0.00	0.00	10.0	16.0	14.0	12.0	15.0	15.0
27	82	500	249.5	222.590	292.820	0.171	2.367	1.51E-06	0.00E+00	2.71E-07	0.00E+00	0.00E+00	0.00E+00	2.59E-07	0.00E+00	0.00E+00	0.00	0.00	24.0	125.0	124.0	124.0	125.0	124.0
28	83	500	249.5	247.300	247.470	0.194	0.210	3.51E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00						
29	86	500	249.5	77.770	500.280	0.155	2.357	6.84E-07	0.00E+00	1.69E-04	8.33E-16	1.28E-04	0.00E+00	2.00E-06	0.00E+00	3.22E-09	0.00	0.00	26.0	44.0	42.0	31.0	44.0	40.0
30	87	500	249.5	80.570	497.490	0.149	2.369	9.98E-07	0.00E+00	1.71E-04	1.87E-13	1.29E-04	0.00E+00	4.37E-06	0.00E+00	6.20E-07	0.00	0.00	26.0	133.0	42.0	29.0	134.0	130.0
31	88	500	249.5	117.950	354.130	0.160	0.558	1.33E-07	4.50E-07	2.20E-03	3.10E-04	3.76E-03	0.00E+00	5.71E-05	0.00E+00	4.39E-05	0.00	0.00	16.0	28.0	27.0	17.0	28.0	27.0
32	89	500	249.5	79.870	231.300	0.151	0.294	1.33E-07	3.16E-06	2.87E-03	5.06E-04	4.82E-03	0.00E+00	8.14E-05	9.74E-09	7.44E-05	0.00	0.00	16.0	31.0	28.0	17.0	28.0	28.0
33	90	500	249.5	101.820	345.850	0.164	0.500	1.65E-07	4.50E-07	2.20E-03	3.10E-04	3.76E-03	0.00E+00	7.78E-05	2.57E-07	8.03E-05	0.00	0.00	16.0	170.0	27.0	17.0	172.0	27.0
34	91	500	249.5	84.530	217.710	0.150	1.403	1.65E-07	3.18E-06	2.87E-03	5.07E-04	4.82E-03	0.00E+00	1.32E-04	2.54E-06	1.68E-04	0.01	0.01	16.0	225.0	28.0	17.0	225.0	28.0
35	92	500	249.5	60.330	66.000	0.155	0.213	2.13E-07	1.72E-05	4.18E-03	9.68E-04	7.18E-03	0.00E+00	1.45E-04	5.55E-07	1.69E-04	0.01	0.01	16.0	30.0	29.0	17.0	30.0	29.0
36	93	500	249.5	65.050	65.050	0.155	0.213	2.13E-07	1.72E-05	4.18E-03	9.68E-04	7.18E-03	0.00E+00	1.45E-04	5.55E-07	1.69E-04	0.01	0.01	16.0	30.0	29.0	17.0	30.0	29.0

37	94	500	249.5	54.200	54.200	0.213	0.213	4.10E-05	6.23E-09	1.63E-03	8.37E-05	2.66E-03	0.00E+00	7.15E-06	0.00E+00	3.89E-06	0.76	0.08	11.0	42.0	42.0	12.0	42.0	42.0
38	95	500	249.5	161.750	532.640	0.371	2.366	1.34E-04	0.00E+00	6.43E-05	0.00E+00	1.33E-05	0.00E+00	3.84E-06	0.00E+00	6.64E-09	0.11	0.13	59.0	83.0	77.0	61.0	83.0	81.0
39	96	500	249.5	137.160	527.370	0.349	2.357	1.87E-04	0.00E+00	1.93E-04	0.00E+00	1.55E-04	0.00E+00	2.18E-05	0.00E+00	7.83E-06	0.45	0.98	57.0	81.0	81.0	58.0	81.0	81.0
40	97	500	249.5	74.680	74.680	0.256	2.354	3.74E-06	1.74E-07	2.10E-03	1.25E-04	3.39E-03	9.18E-08	1.72E-03	9.08E-05	2.66E-03	0.10	1.93	11.0	75.0	42.0	11.0	75.0	42.0
41	98	500	249.5	116.370	296.350	0.190	0.419	2.59E-05	0.00E+00	9.63E-06	0.00E+00	2.02E-08	0.00E+00	9.46E-08	0.00E+00	0.00E+00	0.00	0.00	11.0	15.0	15.0	12.0	15.0	15.0
42	99	500	249.5	212.410	346.160	0.325	1.695	2.59E-05	0.00E+00	9.63E-06	0.00E+00	2.02E-08	0.00E+00	9.46E-08	0.00E+00	0.00E+00	0.00	0.00	11.0	15.0	15.0	12.0	15.0	15.0
43	100	500	249.5	99.630	221.940	0.150	0.653	3.09E-05	0.00E+00	9.63E-06	0.00E+00	2.02E-08	0.00E+00	9.47E-08	0.00E+00	0.00E+00	0.00	0.00	11.0	15.0	15.0	12.0	15.0	15.0
44	101	500	249.5	117.130	283.641	0.255	2.318	3.09E-05	0.00E+00	3.66E-04	0.00E+00	1.70E-04	0.00E+00	3.57E-04	0.00E+00	1.51E-04	0.17	4.02	11.0	71.0	71.0	12.0	71.0	71.0
45	102	500	249.5	212.220	523.490	0.608	2.371	1.02E-04	0.00E+00	1.02E-03	6.39E-05	1.82E-03	0.00E+00	1.78E-04	2.26E-06	2.67E-04	1.50	5.12	7.0	16.0	12.0	7.0	16.0	13.0
46	103	500	249.5	191.460	228.490	0.704	0.704	1.07E-05	1.83E-05	3.75E-03	9.29E-04	6.70E-03	1.08E-06	8.94E-04	1.29E-04	1.63E-03	0.49	2.72	4.0	16.0	13.0	4.0	16.0	13.0
47	104	500	249.5	205.590	504.010	0.659	2.363	1.09E-04	0.00E+00	1.02E-03	6.39E-05	1.82E-03	0.00E+00	1.78E-04	2.26E-06	2.67E-04	1.41	5.72	7.0	16.0	12.0	7.0	16.0	13.0
48	105	500	249.5	179.390	225.850	0.644	0.644	1.07E-05	1.83E-05	3.75E-03	9.29E-04	6.70E-03	1.08E-06	8.94E-04	1.29E-04	1.63E-03	0.48	2.76	4.0	16.0	13.0	4.0	16.0	14.0
49	106	500	249.5	207.130	222.930	0.352	0.363	2.21E-06	0.00E+00	1.00E-03	5.79E-05	1.79E-03	0.00E+00	1.68E-04	1.71E-06	2.47E-04	0.03	0.09	7.0	16.0	12.0	7.0	16.0	13.0
50	107	500	249.5	191.280	220.280	0.727	0.727	4.31E-07	1.90E-05	3.66E-03	9.10E-04	6.60E-03	1.35E-06	9.61E-04	1.46E-04	1.75E-03	0.02	0.15	4.0	16.0	14.0	4.0	16.0	14.0
51	108	500	249.5	251.790	556.470	0.868	2.323	6.46E-04	0.00E+00	3.14E-05	0.00E+00	6.85E-06	0.00E+00	3.29E-06	0.00E+00	4.87E-08	0.38	1.41	8.0	18.0	17.0	9.0	18.0	17.0
52	109	500	249.5	212.980	233.930	0.732	0.732	6.81E-05	0.00E+00	1.09E-04	0.00E+00	8.93E-05	0.00E+00	1.43E-05	0.00E+00	3.38E-06	0.10	0.34	6.0	20.0	15.0	6.0	20.0	15.0
53	110	500	249.5	231.260	541.740	1.410	2.365	6.91E-04	0.00E+00	3.14E-05	0.00E+00	6.85E-06	0.00E+00	3.29E-06	0.00E+00	4.87E-08	0.29	0.53	8.0	18.0	17.0	9.0	18.0	17.0
54	111	500	249.5	189.430	236.770	0.639	0.639	6.82E-05	0.00E+00	1.09E-04	0.00E+00	8.93E-05	0.00E+00	1.43E-05	0.00E+00	3.38E-06	0.08	0.31	6.0	20.0	15.0	6.0	20.0	15.0
55	112	500	249.5	245.430	246.490	0.351	0.351	1.41E-05	0.00E+00	2.92E-05	0.00E+00	4.73E-06	0.00E+00	2.76E-06	0.00E+00	2.09E-08	0.01	0.01	8.0	19.0	16.0	9.0	19.0	16.0
56	113	500	249.5	210.350	224.220	0.646	0.646	2.74E-06	0.00E+00	9.78E-05	0.00E+00	6.11E-05	0.00E+00	1.53E-05	0.00E+00	2.70E-06	0.00	0.01	6.0	21.0	12.0	7.0	21.0	21.0
57	114	500	249.5	87.460	129.410	0.158	0.189	9.76E-05	1.07E-08	1.38E-03	8.27E-05	2.28E-03	0.00E+00	1.42E-05	0.00E+00	5.46E-06	1.74	0.43	22.0	49.0	47.0	27.0	50.0	42.0
58	115	500	249.5	206.190	218.590	0.146	0.225	9.76E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00	0.0	0.0	0.0	0.0	0.0	0.0
59	116	500	249.5	136.880	187.040	0.055	0.072	1.81E-05	0.00E+00	3.40E-04	7.14E-07	3.91E-04	0.00E+00	4.74E-06	0.00E+00	7.64E-07	0.06	0.03	12.0	43.0	28.0	15.0	43.0	28.0
60	117	500	249.5	145.590	193.820	0.056	0.086	2.11E-05	8.83E-14	1.06E-03	4.58E-05	1.74E-03	0.00E+00	3.79E-05	0.00E+00	1.71E-05	0.35	0.28	16.0	48.0	47.0	29.0	48.0	47.0
61	118	500	249.5	213.470	213.470	1.247	2.365	9.30E-06	0.00E+00	4.64E-05	0.00E+00	1.37E-05	0.00E+00	4.76E-06	0.00E+00	2.79E-07	0.00	0.01	9.0	22.0	18.0	10.0	22.0	18.0

Table E6 Transient report for Oconee at 32 EFPY(4 dominant transients)

Plant Name:	EFPY:	WPS:	Ductile Tearing		Through-Wall Cracking Criteria																			
Oconee	32 (4 trans)	on	on		0.900																			
Transient Count	Transient Sequence Number	# of Time	Final Time	Min Temp	Final Temp	Min Press	Final Press	Mean Initiating Frequency	5% CPI	Mean CPI	Median CPI	95% CPI	5% CPF	Mean CPF	Median CPF	95% CPF	% total freq of crack initiation	% total freq of thru-wall cracking	First Crack Initiation Time	Last Crack Initiation Time	Most Crack Init Occur Time	First Failure Time	Last Failure Time	Most Failures Occur Time
			(min)	(°F)	(°F)	(ksi)	(ksi)	(events/yr)	Percentiles								(%)	(%)	(min)	(min)	(min)	(min)	(min)	(min)
1	156	501	250	74.50	111.79	0.02	0.03	7.03E-06	1.76E-04	1.21E-02	4.22E-03	2.34E-02	0.00E+00	1.82E-06	0.00E+00	0.00E+00	99.15	96.46	3	6	5.5	3.5	6	5.5
2	160	501	250	78.12	113.28	0.13	0.14	1.82E-05	0.00E+00	2.14E-05	0.00E+00	1.60E-06	0.00E+00	1.47E-08	0.00E+00	0.00E+00	0.35	2.64	25.5	30.5	30	27.5	30.5	30
3	164	501	250	74.44	112.55	0.08	0.09	2.12E-05	0.00E+00	4.35E-06	0.00E+00	0.00E+00	0.00E+00	2.88E-11	0.00E+00	0.00E+00	0.10	0.01	14	18.5	15	14.5	17.5	15
4	172	501	250	90.32	115.00	0.14	0.19	1.06E-04	0.00E+00	3.89E-06	0.00E+00	0.00E+00	0.00E+00	1.18E-09	0.00E+00	0.00E+00	0.39	0.88	50	57	53.5	52.5	54.5	53.5

Table E7 Transient report for Oconee at 60 EFPY(32 transients)

Plant Name:	EFPY:	WPS:	Ductile Tearing	Through-Wall Cracking Criteria
Oconee	60 (32 trans)	on	on	0.900

Transient Count	Transient Sequence Number	# of Time	Final Time (min)	Min Temp (°F)	Final Temp (°F)	Min Press (ksi)	Final Press (ksi)	Mean Initiating Frequency (events/yr)	5% CPI	Mean CPI	Median CPI	95% CPI	5% CPF	Mean CPF	Median CPF	95% CPF	% total freq of crack initiation (%)	% total freq of thru-wall cracking (%)	First Crack Initiation Time (min)	Last Crack Initiation Time (min)	Most Crack Init Occur Time (min)	First Failure Time (min)	Last Failure Time (min)	Most Failures Occur Time (min)
									Percentiles															
1	15	501	250	205.59	400.56	0.15	0.30	3.39E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00						
2	27	501	250	220.70	222.76	0.22	0.35	2.13E-06	0.00E+00	1.80E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00	58.50	61.00	61.00			
3	44	501	250	203.33	203.33	0.23	1.88	2.69E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00						
4	99	501	250	221.60	222.03	0.41	0.41	2.44E-07	0.00E+00	6.28E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00	54.50	55.50	55.50			
5	100	501	250	217.73	220.51	1.28	1.33	5.11E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00						
6	101	501	250	216.34	220.76	0.26	0.29	3.86E-07	0.00E+00	2.71E-08	0.00E+00	0.00E+00	0.00E+00	1.94E-14	0.00E+00	0.00E+00	0.00	0.00	30.50	37.00	35.50	36.00	36.00	36.00
7	109	501	250	210.29	400.35	0.33	2.45	9.58E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00						
8	110	501	250	172.06	174.03	0.14	0.21	3.42E-06	0.00E+00	5.10E-07	0.00E+00	0.00E+00	0.00E+00	5.41E-12	0.00E+00	0.00E+00	0.00	0.00	32.00	33.50	33.00	33.00	33.50	33.00
9	111	501	250	230.64	231.16	0.24	0.24	4.16E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00						
10	113	501	250	210.29	516.24	0.33	2.48	5.07E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00						
11	116	501	250	187.58	187.58	0.18	0.21	2.60E-07	0.00E+00	6.50E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00	33.50	33.50	33.50			
12	117	501	250	221.70	250.40	0.19	0.25	5.38E-07	0.00E+00	7.34E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00	33.50	33.50	33.50			
13	119	501	250	187.29	205.36	0.13	0.22	4.41E-07	0.00E+00	2.46E-08	0.00E+00	0.00E+00	0.00E+00	5.39E-20	0.00E+00	0.00E+00	0.00	0.00	50.50	55.00	54.00	54.00	54.00	54.00
14	120	501	250	79.74	79.74	0.20	1.85	4.22E-08	0.00E+00	3.96E-16	0.00E+00	0.00E+00	0.00E+00	3.77E-16	0.00E+00	0.00E+00	0.00	0.00	69.00	69.00	69.00	69.00	69.00	69.00
15	121	501	250	94.36	286.61	0.24	0.52	2.28E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00						
16	122	501	250	94.36	282.77	0.24	0.48	7.57E-06	0.00E+00	6.30E-06	0.00E+00	0.00E+00	0.00E+00	6.30E-06	0.00E+00	0.00E+00	0.02	13.50	121.50	124.50	122.00	121.50	124.50	122.00

17	123	501	250	199.97	426.08	0.44	0.75	2.28E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00						
18	124	501	250	192.79	418.40	0.44	0.70	7.57E-06	0.00E+00	2.19E-07	0.00E+00	0.00E+00	0.00E+00	2.17E-07	0.00E+00	0.00E+00	0.00	1.15	67.50	68.00	68.00	67.50	68.00	68.00
19	125	501	250	72.93	72.93	0.15	0.21	4.61E-08	0.00E+00	1.35E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00	45.50	46.00	46.00			
20	126	501	250	225.68	225.68	0.22	0.27	8.41E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00						
21	141	501	250	72.49	72.64	0.19	0.21	1.06E-04	0.00E+00	3.08E-06	0.00E+00	0.00E+00	0.00E+00	3.58E-09	0.00E+00	0.00E+00	0.12	0.07	73.50	87.50	86.50	76.50	87.50	81.50
22	142	501	250	114.92	114.92	0.21	0.22	1.06E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00						
23	146	501	250	96.02	96.02	0.40	0.42	4.23E-05	0.00E+00	3.34E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00	35.50	36.50	36.50			
24	154	501	250	78.99	116.15	0.17	0.21	1.34E-04	0.00E+00	8.52E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00	28.50	29.50	29.50			
25	156	501	250	74.50	111.79	0.02	0.03	7.03E-06	2.72E-03	3.51E-02	1.97E-02	1.14E-01	0.00E+00	2.98E-05	0.00E+00	1.45E-05	98.24	80.08	3.00	7.50	5.50	3.00	6.00	5.50
26	160	501	250	78.12	113.28	0.13	0.14	1.82E-05	0.00E+00	1.08E-04	0.00E+00	1.02E-04	0.00E+00	2.07E-07	0.00E+00	0.00E+00	0.71	0.55	24.50	31.00	30.00	26.00	30.50	30.00
27	164	501	250	74.44	112.55	0.08	0.09	2.12E-05	0.00E+00	2.89E-05	0.00E+00	1.35E-07	0.00E+00	2.51E-08	0.00E+00	0.00E+00	0.20	0.02	13.00	18.50	15.00	14.00	18.50	15.00
28	165	501	250	92.67	139.99	0.26	2.43	1.76E-06	0.00E+00	7.48E-06	0.00E+00	0.00E+00	0.00E+00	7.48E-06	0.00E+00	0.00E+00	0.00	2.65	121.00	121.50	121.00	121.00	121.50	121.00
29	168	501	250	175.79	175.79	0.45	2.43	1.76E-06	0.00E+00	3.13E-07	0.00E+00	0.00E+00	0.00E+00	3.09E-07	0.00E+00	0.00E+00	0.00	0.20	66.00	66.50	66.50	66.00	66.50	66.50
30	169	501	250	92.62	92.62	0.40	0.40	7.33E-06	0.00E+00	1.13E-07	0.00E+00	0.00E+00	0.00E+00	3.57E-10	0.00E+00	0.00E+00	0.00	0.01	30.50	38.00	36.50	34.50	37.50	36.50
31	170	501	250	87.74	87.75	0.31	0.24	6.28E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00						
32	172	501	250	90.32	115.00	0.14	0.19	1.06E-04	0.00E+00	2.17E-05	0.00E+00	2.23E-06	0.00E+00	5.25E-08	0.00E+00	0.00E+00	0.71	1.77	49.50	57.00	53.50	51.00	57.00	53.50

Table E8 Transient report for Oconee at 60 EFPY(4 dominant transients)

Plant Name:	EFPY:	WPS:	Ductile Tearing	Through-Wall Cracking Criteria
Oconee	60 (4 trans)	on	on	0.900

Transient Count	Transient Sequence Number	# of Time	Final Time (min)	Min Temp (°F)	Final Temp (°F)	Min Press (ksi)	Final Press (ksi)	Mean Initiating Frequency (events/yr)	5% CPI	Mean CPI	Median CPI	95% CPI	5% CPF	Mean CPF	Median CPF	95% CPF	% total freq of crack initiation (%)	% total freq of thru-wall cracking (%)	First Crack Initiation Time (min)	Last Crack Initiation Time (min)	Most Crack Init Occur Time (min)	First Failure Time (min)	Last Failure Time (min)	Most Failures Occur Time (min)
									Percentiles															
1	156	501	250	74.50	111.79	0.02	0.03	7.03E-06	2.73E-03	3.52E-02	1.97E-02	1.15E-01	0.00E+00	4.87E-05	0.00E+00	4.41E-05	98.22	96.58	3	7.5	5.5	3.5	6	5.5
2	160	501	250	78.12	113.28	0.13	0.14	1.82E-05	0.00E+00	1.07E-04	0.00E+00	1.04E-04	0.00E+00	3.31E-07	0.00E+00	0.00E+00	0.66	1.58	25.5	31	30	26	30.5	30
3	164	501	250	74.44	112.55	0.08	0.09	2.12E-05	0.00E+00	2.72E-05	0.00E+00	1.41E-07	0.00E+00	2.16E-08	0.00E+00	0.00E+00	0.33	0.13	13.5	18.5	15	14.5	18	15
4	172	501	250	90.32	115.00	0.14	0.19	1.06E-04	0.00E+00	2.10E-05	0.00E+00	2.29E-06	0.00E+00	6.04E-08	0.00E+00	0.00E+00	0.78	1.71	50.5	57	53.5	51	57	53.5

Table E9 Transient report for Oconee at 500 EFPY(4 dominant transients)

Plant Name:	EFPY:	WPS:	Ductile Tearing		Through-Wall Cracking Criteria	
Oconee	500 (4 trans)	on	on		0.900	

Transient Count	Transient Sequence Number	# of Time	Final Time	Min Temp	Final Temp	Min Press	Final Press	Mean Initiating Frequency	5% CPI	Mean CPI	Median CPI	95% CPI	5% CPF	Mean CPF	Median CPF	95% CPF	% total freq of crack initiation	% total freq of thru-wall cracking	First Crack Initiation Time	Last Crack Initiation Time	Most Crack Init Occur Time	First Failure Time	Last Failure Time	Most Failures Occur Time
			(min)	(°F)	(°F)	(ksi)	(ksi)	(events/yr)	Percentiles								(%)	(%)	(min)	(min)	(min)	(min)	(min)	(min)
1	156	501	250	74.5	111.79	0.023	0.027	7.03E-06	1.38E-01	3.47E-01	3.20E-01	6.52E-01	2.94E-06	1.46E-02	3.20E-03	3.27E-02	92.65	96.29	2.5	7.5	5.5	3	7.5	5.5
2	160	501	250	78.12	113.28	0.125	0.142	1.82E-05	3.70E-05	3.94E-03	1.24E-03	6.77E-03	0.00E+00	8.83E-05	0.00E+00	7.83E-05	2.51	1.42	23.5	33	30	23.5	31	30
3	164	501	250	74.44	112.55	0.078	0.092	2.12E-05	5.02E-07	2.06E-03	2.82E-04	3.67E-03	0.00E+00	2.95E-05	0.00E+00	5.29E-06	1.80	0.60	12	18.5	15	12.5	18.5	15
4	172	501	250	90.32	115	0.14	0.193	1.06E-04	1.34E-09	9.00E-04	8.78E-05	1.51E-03	0.00E+00	2.00E-05	0.00E+00	3.33E-06	3.03	1.69	47.5	57.5	53.5	48	57	53.5

Table E10 Transient report for Oconee at 1000 EFPY(54 base case transients)

Plant Name:	EFPY:	WPS:	Ductile Tearing		Through-Wall Cracking Criteria	
Oconee	1000 (54 trans)	on	on		0.900	

FAVOR Transient Number	Transient Sequence Number	# of Time	Final Time	Min Temp	Final Temp	Min Press	Final Press	Mean Initiating Frequency	5% CPI	Mean CPI	Median CPI	95% CPI	5% CPF	Mean CPF	Median CPF	95% CPF	% total freq of crack initiation	% total freq of thru-wall cracking	First Crack Initiation Time	Last Crack Initiation Time	Most Crack Init Occur Time	First Failure Time	Last Failure Time	Most Failures Occur Time
			(min)	(°F)	(°F)	(ksi)	(ksi)	(events/yr)	Percentiles								(%)	(%)	(min)	(min)	(min)	(min)	(min)	(min)
1	8	501	250	325.60	325.60	1.21	1.91	9.68E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00						
2	12	501	250	358.21	359.39	0.35	0.35	9.24E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00						
3	15	501	250	205.59	400.56	0.15	0.30	3.39E-08	0.00E+00	1.42E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00	44.00	44.00	44.00			
4	27	501	250	220.70	222.76	0.22	0.35	2.13E-06	0.00E+00	1.16E-05	0.00E+00	3.59E-08	0.00E+00	4.26E-07	0.00E+00	0.00E+00	0.00	0.00	50.00	62.00	60.00	54.00	60.00	60.00
5	28	501	250	348.99	349.52	1.67	2.53	7.53E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00						
6	29	501	250	305.60	305.60	1.27	2.50	3.09E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00						
7	30	501	250	298.74	298.74	1.68	2.53	1.46E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00						
8	31	501	250	264.13	264.13	1.16	2.53	8.36E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00						
9	36	501	250	330.19	331.06	1.05	1.06	1.40E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00						
10	37	501	250	342.66	342.66	1.43	1.43	1.41E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00						
11	38	501	250	295.00	295.00	1.36	1.36	2.65E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00						
12	44	501	250	203.33	203.33	0.23	1.88	2.69E-07	0.00E+00	1.37E-06	0.00E+00	0.00E+00	0.00E+00	7.93E-07	0.00E+00	0.00E+00	0.00	0.00	42.00	66.00	58.00	42.00	66.00	58.00
13	89	501	250	284.34	284.34	0.87	0.94	5.38E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00						
14	90	501	250	339.32	340.77	0.89	0.92	6.29E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00						
15	98	501	250	258.11	258.11	1.29	1.29	9.96E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00						
16	99	501	250	221.60	222.03	0.41	0.41	2.44E-07	0.00E+00	9.33E-06	0.00E+00	9.41E-10	0.00E+00	1.06E-06	0.00E+00	0.00E+00	0.00	0.00	44.00	58.00	56.00	50.00	58.00	56.00

17	100	501	250	217.73	220.51	1.28	1.33	5.11E-08	0.00E+00	7.24E-06	0.00E+00	1.11E-14	0.00E+00	5.61E-07	0.00E+00	0.00E+00	0.00	0.00	18.00	24.00	24.00	18.00	24.00	22.00
18	101	501	250	216.34	220.76	0.26	0.29	3.86E-07	0.00E+00	4.42E-05	0.00E+00	1.50E-05	0.00E+00	2.80E-06	0.00E+00	0.00E+00	0.00	0.00	24.00	38.00	36.00	28.00	36.00	36.00
19	102	501	250	306.67	306.67	1.28	1.28	2.03E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00						
20	109	501	250	210.29	400.35	0.33	2.45	9.58E-06	0.00E+00	1.28E-08	0.00E+00	0.00E+00	0.00E+00	1.25E-08	0.00E+00	0.00E+00	0.00	0.00	118.00	120.00	120.00	118.00	120.00	120.00
21	110	501	250	172.06	174.03	0.14	0.21	3.42E-06	0.00E+00	6.84E-04	3.43E-05	1.20E-03	0.00E+00	2.49E-05	0.00E+00	2.30E-06	0.04	0.01	30.00	36.00	34.00	30.00	34.00	34.00
22	111	501	250	230.64	231.16	0.24	0.24	4.16E-07	0.00E+00	2.32E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00	42.00	44.00	44.00			
23	112	501	250	210.29	534.57	0.33	2.47	1.25E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00						
24	113	501	250	210.29	516.24	0.33	2.48	5.07E-05	0.00E+00	7.57E-09	0.00E+00	0.00E+00	0.00E+00	7.36E-09	0.00E+00	0.00E+00	0.00	0.00	120.00	120.00	120.00	120.00	120.00	120.00
25	114	501	250	330.65	542.86	0.56	1.80	1.25E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00						
26	115	501	250	330.65	547.58	0.56	1.84	5.07E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00						
27	116	501	250	187.58	187.58	0.18	0.21	2.60E-07	0.00E+00	1.70E-05	0.00E+00	9.40E-07	0.00E+00	2.25E-07	0.00E+00	0.00E+00	0.00	0.00	30.00	34.00	34.00	32.00	34.00	34.00
28	117	501	250	221.70	250.40	0.19	0.25	5.38E-07	0.00E+00	1.50E-05	0.00E+00	4.85E-07	0.00E+00	8.99E-08	0.00E+00	0.00E+00	0.00	0.00	30.00	34.00	34.00	32.00	34.00	34.00
29	119	501	250	187.29	205.36	0.13	0.22	4.41E-07	0.00E+00	3.55E-05	0.00E+00	9.19E-06	0.00E+00	1.43E-06	0.00E+00	0.00E+00	0.00	0.00	50.00	56.00	54.00	50.00	56.00	54.00
30	120	501	250	79.74	79.74	0.20	1.85	4.22E-08	0.00E+00	3.42E-06	0.00E+00	0.00E+00	0.00E+00	3.03E-06	0.00E+00	0.00E+00	0.00	0.00	42.00	70.00	68.00	42.00	70.00	68.00
31	121	501	250	94.36	286.61	0.24	0.52	2.28E-05	0.00E+00	1.71E-07	0.00E+00	0.00E+00	0.00E+00	1.42E-10	0.00E+00	0.00E+00	0.00	0.00	24.00	32.00	28.00	28.00	28.00	28.00
32	122	501	250	94.36	282.77	0.24	0.48	7.57E-06	0.00E+00	2.26E-04	0.00E+00	1.04E-04	0.00E+00	2.26E-04	0.00E+00	1.04E-04	0.03	0.39	24.00	128.00	122.00	26.00	128.00	122.00
33	123	501	250	199.97	426.08	0.44	0.75	2.28E-05	0.00E+00	1.71E-07	0.00E+00	0.00E+00	0.00E+00	1.42E-10	0.00E+00	0.00E+00	0.00	0.00	24.00	32.00	28.00	28.00	28.00	28.00
34	124	501	250	192.79	418.40	0.44	0.70	7.57E-06	0.00E+00	9.06E-05	0.00E+00	3.80E-05	0.00E+00	9.03E-05	0.00E+00	3.79E-05	0.01	0.10	24.00	70.00	68.00	24.00	70.00	68.00
35	125	501	250	72.93	72.93	0.15	0.21	4.61E-08	0.00E+00	4.57E-05	0.00E+00	2.09E-05	0.00E+00	1.87E-06	0.00E+00	0.00E+00	0.00	0.00	38.00	48.00	46.00	44.00	46.00	46.00
36	126	501	250	225.68	225.68	0.22	0.27	8.41E-08	0.00E+00	1.29E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00	40.00	46.00	46.00			
37	127	501	250	387.47	464.87	0.74	0.82	1.25E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00						

38	141	501	250	72.49	72.64	0.19	0.21	1.06E-04	0.00E+00	3.13E-04	1.03E-13	3.19E-04	0.00E+00	1.10E-05	0.00E+00	1.06E-08	0.52	0.23	64.00	88.00	88.00	70.00	88.00	82.00
39	142	501	250	114.92	114.92	0.21	0.22	1.06E-04	0.00E+00	1.24E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00	88.00	94.00	94.00			
40	145	501	250	283.41	283.41	0.33	0.33	1.34E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00						
41	146	501	250	96.02	96.02	0.40	0.42	4.23E-05	0.00E+00	1.17E-05	0.00E+00	3.34E-08	0.00E+00	1.43E-06	0.00E+00	0.00E+00	0.01	0.02	28.00	38.00	36.00	30.00	36.00	36.00
42	147	501	250	150.12	165.34	0.22	0.24	3.63E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00						
43	148	501	250	158.44	158.44	0.41	0.42	4.23E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00						
44	149	501	250	330.65	436.33	0.56	2.43	9.58E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00						
45	154	501	250	78.99	116.15	0.17	0.21	1.34E-04	0.00E+00	6.63E-05	0.00E+00	3.58E-05	0.00E+00	4.85E-06	0.00E+00	0.00E+00	0.15	0.15	18.00	32.00	30.00	22.00	30.00	30.00
46	156	501	250	74.50	111.79	0.02	0.03	7.03E-06	3.20E-01	5.81E-01	5.74E-01	8.65E-01	2.57E-03	5.01E-02	2.53E-02	1.82E-01	82.15	87.81	2.00	8.00	6.00	4.00	6.00	6.00
47	160	501	250	78.12	113.28	0.13	0.14	1.82E-05	8.34E-04	1.36E-02	7.04E-03	4.37E-02	0.00E+00	7.39E-04	9.86E-06	1.30E-03	5.21	2.69	22.00	34.00	30.00	24.00	32.00	30.00
48	164	501	250	74.44	112.55	0.08	0.09	2.12E-05	6.84E-04	1.33E-02	6.26E-03	4.30E-02	0.00E+00	5.88E-04	1.91E-06	8.69E-04	5.55	2.88	12.00	20.00	16.00	12.00	18.00	16.00
49	165	501	250	92.67	139.99	0.26	2.43	1.76E-06	0.00E+00	2.26E-04	0.00E+00	8.98E-05	0.00E+00	2.25E-04	0.00E+00	8.70E-05	0.01	0.08	24.00	128.00	122.00	26.00	128.00	122.00
50	168	501	250	175.79	175.79	0.45	2.43	1.76E-06	0.00E+00	8.91E-05	0.00E+00	3.54E-05	0.00E+00	8.87E-05	0.00E+00	3.54E-05	0.00	0.03	24.00	70.00	68.00	24.00	70.00	68.00
51	169	501	250	92.62	92.62	0.40	0.40	7.33E-06	0.00E+00	1.57E-04	1.22E-08	1.34E-04	0.00E+00	1.43E-05	0.00E+00	2.87E-08	0.02	0.02	24.00	38.00	36.00	28.00	38.00	36.00
52	170	501	250	87.74	87.75	0.31	0.24	6.28E-06	0.00E+00	1.38E-07	0.00E+00	0.00E+00	0.00E+00	8.80E-12	0.00E+00	0.00E+00	0.00	0.00	24.00	32.00	28.00	28.00	28.00	28.00
53	171	501	250	279.77	279.77	0.47	0.47	7.33E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00						
54	172	501	250	90.32	115.00	0.14	0.19	1.06E-04	3.90E-05	3.57E-03	1.06E-03	6.35E-03	0.00E+00	2.39E-04	6.40E-10	2.68E-04	6.31	5.58	46.00	58.00	54.00	48.00	58.00	54.00

Table E11 - Transient report for Palisades at 32 EFPY(12 dominant transients)

Plant Name:	EFPY:	WPS:	Ductile Tearing	Through-Wall Cracking Criteria
Palisades	32 (12 trans)	on	on	0.900

Transient Count	Transient Sequence Number	# of Time	Final Time	Min Temp	Final Temp	Min Press	Final Press	Mean Initiating Frequency	5% CPI	Mean CPI	Median CPI	95% CPI	5% CPF	Mean CPF	Median CPF	95% CPF	% total freq of crack initiation	% total freq of thru-wall cracking	First Crack Initiation Time	Last Crack Initiation Time	Most Crack Init Occur Time	First Failure Time	Last Failure Time	Most Failures Occur Time
			(min)	(°F)	(°F)	(ksi)	(ksi)	(events/yr)	Percentiles								(%)	(%)	(min)	(min)	(min)	(min)	(min)	(min)
1	19	501	250	301.87	301.87	1.212	2.499	2.29E-03	0.00E+00	1.56E-10	0.00E+00	0.00E+00	0.00E+00	9.22E-11	0.00E+00	0.00E+00	0.00	0.00	88.00	90.00	89.50	88.00	90.00	89.50
2	40	501	250	94.38	132.07	0.16	0.018	3.22E-05	0.00E+00	9.93E-04	1.29E-05	1.91E-03	0.00E+00	3.85E-06	0.00E+00	4.17E-06	54.49	3.51	5.50	9.50	5.50	5.50	9.50	5.50
3	52	501	250	304.66	304.78	1.101	2.33	6.37E-04	0.00E+00	6.61E-10	0.00E+00	0.00E+00	0.00E+00	3.57E-10	0.00E+00	0.00E+00	0.00	0.01	90.50	95.00	95.00	90.50	95.00	95.00
4	54	501	250	219.14	227.69	0.508	2.084	4.26E-06	0.00E+00	4.59E-05	0.00E+00	1.21E-05	0.00E+00	1.47E-05	0.00E+00	4.02E-06	0.22	0.66	5.50	130.00	12.00	5.50	130.00	14.50
5	55	501	250	327.68	370.42	1.192	2.475	2.74E-03	0.00E+00	2.91E-09	0.00E+00	0.00E+00	0.00E+00	1.89E-09	0.00E+00	0.00E+00	0.03	0.18	75.50	79.50	79.50	75.50	79.50	78.50
6	58	501	250	136.18	172.91	0.117	0.22	2.66E-04	0.00E+00	8.60E-05	0.00E+00	7.33E-05	0.00E+00	1.78E-05	0.00E+00	1.17E-05	26.96	50.25	21.00	45.00	45.00	21.00	45.00	45.00
7	59	501	250	171.61	172.3	0.118	0.222	2.09E-04	0.00E+00	8.15E-07	0.00E+00	0.00E+00	0.00E+00	2.59E-08	0.00E+00	0.00E+00	0.23	0.06	41.50	45.00	45.00	41.50	45.00	44.50
8	60	501	250	172.71	179.54	0.335	0.456	2.09E-04	0.00E+00	3.39E-06	0.00E+00	0.00E+00	0.00E+00	1.74E-07	0.00E+00	0.00E+00	0.73	0.32	37.50	54.00	54.00	38.50	47.50	47.00
9	62	501	250	94.72	210.62	0.042	0.043	7.07E-06	0.00E+00	9.42E-04	1.21E-05	1.79E-03	0.00E+00	3.10E-05	3.00E-09	3.52E-05	8.98	2.81	5.50	12.50	12.00	5.50	12.50	12.00
10	63	501	250	91.74	223.87	0.075	0.076	6.06E-06	0.00E+00	3.02E-04	2.55E-08	4.22E-04	0.00E+00	1.81E-05	0.00E+00	1.82E-05	2.23	1.45	15.50	25.00	25.00	15.50	25.00	25.00
11	64	501	250	121.43	126.16	0.064	0.064	7.07E-06	0.00E+00	2.37E-04	3.41E-12	3.49E-04	0.00E+00	9.39E-06	0.00E+00	8.27E-06	1.90	0.62	25.50	33.00	31.50	25.50	33.00	31.50
12	65	501	250	199.34	316.23	0.694	2.523	1.24E-04	0.00E+00	2.91E-05	0.00E+00	2.10E-06	0.00E+00	2.86E-05	0.00E+00	2.07E-06	4.21	40.14	109.50	114.50	114.50	109.50	114.50	114.50

Table E12 - Transient report for Palisades at 60 EFPY (30 transients)

Plant Name:	EFPY:	WPS:	Ductile Tearing		Through-Wall Cracking Criteria																			
Palisades	60 (30 trans)	on	on		0.900																			
Transient Count	Transient Sequence Number	# of Time	Final Time	Min Temp	Final Temp	Min Press	Final Press	Mean Initiating Frequency	5% CPI	Mean CPI	Median CPI	95% CPI	5% CPF	Mean CPF	Median CPF	95% CPF	% total freq of crack initiation	% total freq of thru-wall cracking	First Crack Initiation Time	Last Crack Initiation Time	Most Crack Init Occur Time	First Failure Time	Last Failure Time	Most Failures Occur Time
			(min)	(°F)	(°F)	(ksi)	(ksi)	(events/yr)	Percentiles								(%)	(%)	(min)	(min)	(min)	(min)	(min)	(min)
1	2	501	250	326.14	326.14	0.87	0.96	2.66E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00						
2	16	501	250	352.88	536.24	0.90	2.39	1.23E-04	0.00E+00	5.68E-13	0.00E+00	0.00E+00	0.00E+00	5.70E-14	0.00E+00	0.00E+00	0.00	0.00	29	30	30	29	30	30
3	18	501	250	338.46	340.56	1.09	2.15	4.71E-03	0.00E+00	4.43E-09	0.00E+00	0.00E+00	0.00E+00	3.15E-09	0.00E+00	0.00E+00	0.34	1.32	195	197	197	195	197	197
4	19	501	250	301.87	301.87	1.21	2.50	2.29E-03	0.00E+00	2.00E-07	0.00E+00	0.00E+00	0.00E+00	1.47E-07	0.00E+00	0.00E+00	0.08	0.33	41	134	89	83	134	89
5	22	501	250	251.21	251.21	1.90	2.07	6.67E-05	0.00E+00	5.68E-12	0.00E+00	0.00E+00	0.00E+00	1.66E-12	0.00E+00	0.00E+00	0.00	0.00	105	110	110	105	110	110
6	24	501	250	316.07	317.07	0.87	2.06	2.43E-06	0.00E+00	1.51E-07	0.00E+00	0.00E+00	0.00E+00	1.07E-08	0.00E+00	0.00E+00	0.00	0.00	5	9	7	5	9	8
7	26	501	250	316.07	535.62	0.87	2.39	5.69E-04	0.00E+00	1.51E-07	0.00E+00	0.00E+00	0.00E+00	1.10E-08	0.00E+00	0.00E+00	0.05	0.02	5	9	7	5	9	8
8	27	501	250	230.65	230.65	0.85	2.37	3.65E-05	0.00E+00	5.89E-06	0.00E+00	0.00E+00	0.00E+00	1.69E-06	0.00E+00	0.00E+00	0.11	0.18	5	234	13	6	234	14
9	29	501	250	224.21	230.97	0.78	2.49	4.20E-08	0.00E+00	1.01E-07	0.00E+00	0.00E+00	0.00E+00	7.30E-08	0.00E+00	0.00E+00	0.00	0.00	5	201	197	5	201	197
10	31	501	250	183.37	183.37	0.17	0.17	1.29E-05	0.00E+00	5.74E-06	0.00E+00	0.00E+00	0.00E+00	1.45E-06	0.00E+00	0.00E+00	0.05	0.08	57	78	77	57	77	77
11	32	501	250	280.35	524.62	0.30	2.25	1.08E-06	0.00E+00	1.91E-07	0.00E+00	0.00E+00	0.00E+00	1.52E-07	0.00E+00	0.00E+00	0.00	0.00	79	83	81	79	83	81
12	34	501	250	219.59	220.74	0.76	1.23	1.48E-05	0.00E+00	7.47E-07	0.00E+00	0.00E+00	0.00E+00	1.09E-07	0.00E+00	0.00E+00	0.01	0.00	5	17	9	5	17	16

13	40	501	250	94.38	132.07	0.16	0.02	3.22E-05	3.92E-12	2.31E-03	1.63E-04	4.70E-03	0.00E+00	1.15E-04	2.51E-06	2.05E-04	49.78	14.48	3	10	5	3	10	5
14	42	501	250	294.77	296.04	0.20	0.21	7.67E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00						
15	48	501	250	172.65	293.27	0.22	2.47	1.25E-04	0.00E+00	2.02E-04	1.30E-08	1.72E-04	0.00E+00	2.00E-04	1.29E-08	1.70E-04	0.08	0.44	61	115	110	61	115	110
16	49	501	250	307.36	446.72	0.78	2.43	1.00E-05	0.00E+00	3.15E-08	0.00E+00	0.00E+00	0.00E+00	3.84E-09	0.00E+00	0.00E+00	0.00	0.00	5	13	11	5	13	11
17	50	501	250	166.89	166.89	0.78	2.42	5.81E-07	0.00E+00	1.31E-05	0.00E+00	7.08E-15	0.00E+00	4.35E-06	0.00E+00	0.00E+00	0.00	0.01	5	250	13	5	250	13
18	51	501	250	215.94	232.57	0.39	2.24	7.51E-08	0.00E+00	7.62E-05	0.00E+00	3.45E-05	0.00E+00	3.59E-05	0.00E+00	1.89E-05	0.00	0.01	4	75	14	4	75	14
19	52	501	250	304.66	304.78	1.10	2.33	6.37E-04	0.00E+00	1.88E-07	0.00E+00	0.00E+00	0.00E+00	1.26E-07	0.00E+00	0.00E+00	0.07	0.27	83	142	95	83	142	95
20	53	501	250	319.89	523.83	0.28	2.56	1.09E-03	0.00E+00	1.29E-07	0.00E+00	0.00E+00	0.00E+00	1.01E-07	0.00E+00	0.00E+00	0.07	0.27	104	107	106	104	107	106
21	54	501	250	219.14	227.69	0.51	2.08	4.26E-06	0.00E+00	1.43E-04	0.00E+00	1.20E-04	0.00E+00	7.12E-05	0.00E+00	6.57E-05	0.37	1.06	4	136	12	4	136	14
22	55	501	250	327.68	370.42	1.19	2.48	2.74E-03	0.00E+00	4.93E-07	0.00E+00	0.00E+00	0.00E+00	3.89E-07	0.00E+00	0.00E+00	0.45	2.01	30	80	77	30	80	77
23	58	501	250	136.18	172.91	0.12	0.22	2.66E-04	0.00E+00	1.99E-04	4.04E-08	2.36E-04	0.00E+00	6.00E-05	0.00E+00	6.70E-05	27.37	46.11	19	46	45	19	46	45
24	59	501	250	171.61	172.30	0.12	0.22	2.09E-04	0.00E+00	4.27E-06	0.00E+00	0.00E+00	0.00E+00	3.21E-07	0.00E+00	0.00E+00	0.54	0.21	23	47	45	23	47	45
25	60	501	250	172.71	179.54	0.34	0.46	2.09E-04	0.00E+00	1.22E-05	0.00E+00	1.84E-07	0.00E+00	1.29E-06	0.00E+00	8.04E-10	1.50	1.11	32	54	47	32	47	46
26	61	501	250	230.40	253.08	0.16	0.16	2.09E-04	0.00E+00	2.03E-07	0.00E+00	0.00E+00	0.00E+00	6.54E-09	0.00E+00	0.00E+00	0.02	0.00	34	44	42	34	44	42
27	62	501	250	94.72	210.62	0.04	0.04	7.07E-06	3.58E-10	2.15E-03	1.57E-04	4.37E-03	0.00E+00	2.05E-04	4.69E-06	3.92E-04	9.71	5.27	5	13	12	5	13	12
28	63	501	250	91.74	223.87	0.08	0.08	6.06E-06	0.00E+00	7.67E-04	1.26E-05	1.26E-03	0.00E+00	1.20E-04	4.38E-07	1.86E-04	2.57	2.24	13	26	25	13	26	25
29	64	501	250	121.43	126.16	0.06	0.06	7.07E-06	0.00E+00	5.71E-04	3.49E-06	1.01E-03	0.00E+00	7.66E-05	6.55E-08	1.19E-04	2.74	2.06	25	33	32	25	33	32
30	65	501	250	199.34	316.23	0.69	2.52	1.24E-04	0.00E+00	5.92E-05	0.00E+00	1.41E-05	0.00E+00	5.85E-05	0.00E+00	1.39E-05	4.11	22.51	44	119	114	44	119	114

Table E13 - Transient report for Palisades at 60 EFPY(12 dominant transients)

Plant Name:	EFPY:	WPS:	Ductile Tearing		Through-Wall Cracking Criteria																					
Palisades	60 (12 trans)	on	on		0.900																					
Transient Count	Transient Sequence Number	# of Time	Final Time	Min Temp	Final Temp	Min Press	Final Press	Mean Initiating Frequency	5% CPI	Mean CPI	Median CPI	95% CPI	5% CPF	Mean CPF	Median CPF	95% CPF	% total freq of crack initiation	% total freq of thru-wall cracking	First Crack Initiation Time	Last Crack Initiation Time	Most Crack Init Occur Time	First Failure Time	Last Failure Time	Most Failures Occur Time
			(min)	(°F)	(°F)	(ksi)	(ksi)	(events/yr)	Percentiles								(%)	(%)	(min)	(min)	(min)	(min)	(min)	(min)
1	19	501	250	301.87	301.87	1.212	2.499	2.29E-03	0.00E+00	2.07E-07	0.00E+00	0.00E+00	0.00E+00	1.35E-07	0.00E+00	0.00E+00	0.44	1.77	41.00	129.50	129.50	83.50	129.50	129.50
2	40	501	250	94.38	132.07	0.16	0.018	3.22E-05	1.96E-10	2.39E-03	1.75E-04	4.70E-03	0.00E+00	3.75E-05	5.24E-07	6.01E-05	45.40	3.67	2.50	9.50	5.50	2.50	10.00	5.50
3	52	501	250	304.66	304.78	1.101	2.33	6.37E-04	0.00E+00	2.19E-07	0.00E+00	0.00E+00	0.00E+00	1.36E-07	0.00E+00	0.00E+00	0.03	0.13	84.00	95.50	90.50	84.00	95.50	90.50
4	54	501	250	219.14	227.69	0.508	2.084	4.26E-06	0.00E+00	1.59E-04	0.00E+00	1.19E-04	0.00E+00	6.54E-05	0.00E+00	5.24E-05	0.35	0.85	5.50	130.00	12.00	5.50	130.00	14.00
5	55	501	250	327.68	370.42	1.192	2.475	2.74E-03	0.00E+00	5.72E-07	0.00E+00	0.00E+00	0.00E+00	4.14E-07	0.00E+00	0.00E+00	0.45	1.74	29.50	79.50	77.00	29.50	80.00	77.00
6	58	501	250	136.18	172.91	0.117	0.22	2.66E-04	0.00E+00	2.14E-04	5.68E-08	2.36E-04	0.00E+00	6.61E-05	1.00E-12	6.73E-05	31.62	57.35	20.50	45.50	45.00	20.50	45.50	45.00
7	59	501	250	171.61	172.3	0.118	0.222	2.09E-04	0.00E+00	5.42E-06	0.00E+00	0.00E+00	0.00E+00	3.53E-07	0.00E+00	0.00E+00	0.64	0.22	22.00	47.00	44.50	22.00	47.00	45.00
8	60	501	250	172.71	179.54	0.335	0.456	2.09E-04	0.00E+00	1.40E-05	0.00E+00	1.51E-07	0.00E+00	1.56E-06	0.00E+00	6.45E-10	1.65	1.09	31.00	54.50	47.00	31.50	47.50	47.00
9	62	501	250	94.72	210.62	0.042	0.043	7.07E-06	8.83E-10	2.18E-03	1.55E-04	4.25E-03	0.00E+00	1.80E-04	3.26E-06	2.98E-04	9.20	4.51	5.50	12.50	12.00	5.50	12.50	12.00
10	63	501	250	91.74	223.87	0.075	0.076	6.06E-06	0.00E+00	7.63E-04	1.17E-05	1.20E-03	0.00E+00	8.85E-05	2.41E-07	1.28E-04	3.02	2.16	15.50	26.00	25.00	15.50	26.50	25.00
11	64	501	250	121.43	126.16	0.064	0.064	7.07E-06	0.00E+00	5.92E-04	3.48E-06	9.80E-04	0.00E+00	5.56E-05	3.96E-08	7.69E-05	2.89	1.40	25.50	33.00	31.50	25.50	33.00	31.50
12	65	501	250	199.34	316.23	0.694	2.523	1.24E-04	0.00E+00	6.84E-05	0.00E+00	1.89E-05	0.00E+00	6.76E-05	0.00E+00	1.86E-05	4.32	25.12	43.00	118.50	114.50	43.50	118.50	114.50

Table E14 - Transient report for Palisades at 200 EFPY (12 dominant transients)

Plant Name:	EFPY:	WPS:	Ductile Tearing		Through-Wall Cracking Criteria	
Palisades	200 (12 trans)	on	on		0.900	

Transient Count	Transient Sequence Number	# of Time	Final Time (min)	Min Temp (°F)	Final Temp (°F)	Min Press (ksi)	Final Press (ksi)	Mean Initiating Frequency (events/yr)	5% CPI	Mean CPI	Median CPI	95% CPI	5% CPF	Mean CPF	Median CPF	95% CPF	% total freq of crack initiation (%)	% total freq of thru-wall cracking (%)	First Crack Initiation Time (min)	Last Crack Initiation Time (min)	Most Crack Init Occur Time (min)	First Failure Time (min)	Last Failure Time (min)	Most Failures Occur Time (min)
									Percentiles															
1	19	501	250	301.87	301.87	1.212	2.499	2.29E-03	0.00E+00	7.89E-06	0.00E+00	0.00E+00	0.00E+00	7.02E-06	0.00E+00	0.00E+00	3.74	10.78	20.5	129.5	84.5	20.5	129.5	84.5
2	40	501	250	94.38	132.07	0.16	0.018	3.22E-05	3.22E-04	1.32E-02	4.83E-03	4.83E-02	5.05E-06	6.48E-04	1.62E-04	1.17E-03	43.60	6.26	5.5	9.5	5.5	5.5	9.5	5.5
3	52	501	250	304.66	304.78	1.101	2.33	6.37E-04	0.00E+00	8.59E-06	0.00E+00	0.00E+00	0.00E+00	7.70E-06	0.00E+00	0.00E+00	1.68	5.05	20.5	139.5	88.5	20.5	139.5	88.5
4	54	501	250	219.14	227.69	0.508	2.084	4.26E-06	0.00E+00	1.03E-03	1.36E-05	1.65E-03	0.00E+00	6.43E-04	8.70E-06	1.06E-03	0.51	1.09	5.5	130	12	5.5	130	12
5	55	501	250	327.68	370.42	1.192	2.475	2.74E-03	0.00E+00	1.74E-05	0.00E+00	0.00E+00	0.00E+00	1.57E-05	0.00E+00	0.00E+00	6.74	18.57	15.5	80	76	15.5	80	76
6	58	501	250	136.18	172.91	0.117	0.22	2.66E-04	7.40E-10	1.09E-03	7.74E-05	1.61E-03	0.00E+00	4.65E-04	1.70E-05	6.48E-04	23.86	32.70	20.5	45	45	20.5	45	45
7	59	501	250	171.61	172.3	0.118	0.222	2.09E-04	0.00E+00	3.72E-05	0.00E+00	2.38E-06	0.00E+00	8.88E-06	0.00E+00	2.47E-07	0.66	0.62	20.5	45	42	20.5	45	44.5
8	60	501	250	172.71	179.54	0.335	0.456	2.09E-04	0.00E+00	1.22E-04	0.00E+00	6.89E-05	0.00E+00	2.97E-05	0.00E+00	8.63E-06	2.28	1.80	25.5	54.5	54	25.5	54	45.5
9	62	501	250	94.72	210.62	0.042	0.043	7.07E-06	2.38E-04	1.15E-02	4.18E-03	4.10E-02	1.11E-05	2.42E-03	5.31E-04	4.71E-03	7.79	5.19	5.5	13	12	5.5	13	12
10	63	501	250	91.74	223.87	0.075	0.076	6.06E-06	1.21E-05	4.17E-03	8.56E-04	7.11E-03	1.00E-07	1.09E-03	1.35E-04	1.79E-03	2.43	1.85	15.5	25	19	15.5	25	25
11	64	501	250	121.43	126.16	0.064	0.064	7.07E-06	3.49E-06	3.21E-03	6.04E-04	5.76E-03	1.79E-08	7.78E-04	6.90E-05	1.42E-03	2.22	1.71	25.5	33.5	31.5	25.5	33.5	31.5
12	65	501	250	199.34	316.23	0.694	2.523	1.24E-04	0.00E+00	4.35E-04	1.90E-07	3.05E-04	0.00E+00	4.33E-04	1.90E-07	3.03E-04	4.50	14.39	20.5	118.5	114.5	20.5	118.5	114.5

Table E15 - Transient report for Palisades at 500 EFPY (30 base case transients)

Plant Name:	EFPY:	WPS:	Ductile Tearing	Through-Wall Cracking Criteria
Palisades	500 (30 trans)	on	on	0.900

Transient Count	Transient Sequence Number	# of Time	Final Time	Min Temp	Final Temp	Min Press	Final Press	Mean Initiating Frequency	5% CPI	Mean CPI	Median CPI	95% CPI	5% CPF	Mean CPF	Median CPF	95% CPF	% total freq of crack initiation	% total freq of thru-wall cracking	First Crack Initiation Time	Last Crack Initiation Time	Most Crack Init Occur Time	First Failure Time	Last Failure Time	Most Failures Occur Time
			(min)	(°F)	(°F)	(ksi)	(ksi)	(events/yr)	Percentiles								(%)	(%)	(min)	(min)	(min)	(min)	(min)	(min)
1	2	501	250	326.14	326.14	0.865	0.956	2.66E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00						
2	16	501	250	352.88	536.24	0.897	2.394	1.23E-04	0.00E+00	2.10E-07	0.00E+00	0.00E+00	0.00E+00	9.88E-08	0.00E+00	0.00E+00	0.00	0.00	13	31	30	13	31	30
3	18	501	250	338.46	340.56	1.085	2.15	4.71E-03	0.00E+00	7.18E-08	0.00E+00	0.00E+00	0.00E+00	6.44E-08	0.00E+00	0.00E+00	0.01	0.01	28	197	196	28	197	196
4	19	501	250	301.87	301.87	1.212	2.499	2.29E-03	0.00E+00	8.00E-06	0.00E+00	0.00E+00	0.00E+00	7.37E-06	0.00E+00	0.00E+00	0.55	1.34	18	134	89	18	134	89
5	22	501	250	251.21	251.21	1.904	2.065	6.67E-05	0.00E+00	3.16E-07	0.00E+00	0.00E+00	0.00E+00	2.28E-07	0.00E+00	0.00E+00	0.00	0.00	54	111	109	54	111	109
6	24	501	250	316.07	317.07	0.867	2.064	2.43E-06	0.00E+00	2.27E-05	0.00E+00	5.76E-06	0.00E+00	1.07E-05	0.00E+00	2.21E-06	0.00	0.01	4	9	7	4	9	7
7	26	501	250	316.07	535.62	0.867	2.393	5.69E-04	0.00E+00	2.27E-05	0.00E+00	5.76E-06	0.00E+00	1.07E-05	0.00E+00	2.21E-06	0.25	0.33	4	9	7	4	9	7
8	27	501	250	230.65	230.65	0.848	2.372	3.65E-05	0.00E+00	3.32E-04	3.30E-07	5.09E-04	0.00E+00	2.31E-04	5.17E-08	3.61E-04	0.23	0.44	4	234	12	4	234	12
9	29	501	250	224.21	230.97	0.776	2.486	4.20E-08	0.00E+00	9.53E-06	0.00E+00	1.33E-07	0.00E+00	6.01E-06	0.00E+00	8.30E-08	0.00	0.00	4	213	10	4	213	10
10	31	501	250	183.37	183.37	0.173	0.173	1.29E-05	0.00E+00	2.21E-04	1.99E-08	2.38E-04	0.00E+00	1.06E-04	0.00E+00	6.31E-05	0.06	0.07	49	78	77	48	78	76
11	32	501	250	280.35	524.62	0.301	2.253	1.08E-06	0.00E+00	7.65E-06	0.00E+00	0.00E+00	0.00E+00	7.18E-06	0.00E+00	0.00E+00	0.00	0.00	40	83	79	40	83	79
12	34	501	250	219.59	220.74	0.759	1.226	1.48E-05	0.00E+00	5.84E-05	0.00E+00	3.78E-05	0.00E+00	3.38E-05	0.00E+00	1.97E-05	0.02	0.03	4	17	9	4	17	9

13	40	501	250	94.38	132.07	0.16	0.018	3.22E-05	1.23E-02	7.36E-02	5.14E-02	2.02E-01	1.31E-03	2.11E-02	1.06E-02	7.32E-02	51.27	41.43	2	10	5	2	10	5
14	42	501	250	294.77	296.04	0.204	0.208	7.67E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00						
15	48	501	250	172.65	293.27	0.22	2.474	1.25E-04	2.16E-06	2.55E-03	1.70E-04	3.91E-03	2.15E-06	2.55E-03	1.70E-04	3.90E-03	0.03	0.09	21	115	110	21	115	110
16	49	501	250	307.36	446.72	0.776	2.429	1.00E-05	0.00E+00	7.77E-06	0.00E+00	3.24E-08	0.00E+00	4.24E-06	0.00E+00	1.82E-08	0.00	0.00	4	92	10	4	92	10
17	50	501	250	166.89	166.89	0.783	2.42	5.81E-07	0.00E+00	6.52E-04	1.21E-05	1.16E-03	0.00E+00	4.72E-04	4.53E-06	8.47E-04	0.01	0.01	4	250	12	4	250	12
18	51	501	250	215.94	232.57	0.387	2.241	7.51E-08	9.86E-07	2.71E-03	4.64E-04	4.98E-03	1.08E-07	2.06E-03	3.08E-04	3.87E-03	0.01	0.01	3	75	14	3	75	14
19	52	501	250	304.66	304.78	1.101	2.33	6.37E-04	0.00E+00	9.34E-06	0.00E+00	0.00E+00	0.00E+00	8.58E-06	0.00E+00	0.00E+00	0.09	0.23	18	142	91	18	142	91
20	53	501	250	319.89	523.83	0.278	2.56	1.09E-03	0.00E+00	4.86E-06	0.00E+00	0.00E+00	0.00E+00	4.63E-06	0.00E+00	0.00E+00	0.10	0.26	104	107	106	104	107	106
21	54	501	250	219.14	227.69	0.508	2.084	4.26E-06	1.59E-05	4.77E-03	1.18E-03	8.69E-03	5.16E-06	3.71E-03	8.04E-04	7.02E-03	0.49	1.07	3	136	12	3	136	12
22	55	501	250	327.68	370.42	1.192	2.475	2.74E-03	0.00E+00	2.07E-05	0.00E+00	2.79E-07	0.00E+00	1.97E-05	0.00E+00	2.70E-07	1.24	3.33	14	80	77	14	80	77
23	58	501	250	136.18	172.91	0.117	0.22	2.66E-04	8.55E-05	4.89E-03	1.34E-03	9.15E-03	1.69E-06	2.02E-03	3.55E-04	3.40E-03	23.88	27.06	16	46	45	16	46	45
24	59	501	250	171.61	172.3	0.118	0.222	2.09E-04	0.00E+00	1.99E-04	5.40E-08	2.03E-04	0.00E+00	6.04E-05	0.00E+00	3.37E-05	0.73	0.56	19	47	45	19	47	45
25	60	501	250	172.71	179.54	0.335	0.456	2.09E-04	0.00E+00	7.18E-04	3.06E-05	1.21E-03	0.00E+00	1.73E-04	4.60E-07	1.84E-04	3.05	1.84	26	55	54	26	54	46
26	61	501	250	230.4	253.08	0.157	0.164	2.09E-04	0.00E+00	1.60E-05	0.00E+00	4.79E-07	0.00E+00	4.30E-06	0.00E+00	4.92E-08	0.07	0.05	25	44	42	25	44	42
27	62	501	250	94.72	210.62	0.042	0.043	7.07E-06	9.20E-03	6.18E-02	4.20E-02	1.74E-01	1.16E-03	2.13E-02	1.08E-02	7.28E-02	9.77	9.33	5	13	12	5	13	12
28	63	501	250	91.74	223.87	0.075	0.076	6.06E-06	1.83E-03	2.19E-02	1.14E-02	7.11E-02	1.48E-04	8.03E-03	2.97E-03	1.43E-02	3.01	2.96	12	26	19	12	26	19
29	64	501	250	121.43	126.16	0.064	0.064	7.07E-06	1.04E-03	1.73E-02	8.84E-03	5.56E-02	6.42E-05	6.32E-03	2.16E-03	2.23E-02	2.87	3.24	24	34	32	24	33	32
30	65	501	250	199.34	316.23	0.694	2.523	1.24E-04	0.00E+00	1.01E-03	1.16E-05	1.29E-03	0.00E+00	1.01E-03	1.15E-05	1.29E-03	2.28	6.28	24	119	114	24	119	114

Appendix F – Discussion regarding definition of embrittlement metric RT_{NDT}*

Table 1 uses the embrittlement metric RT_{NDT}* and references this appendix for a discussion regarding its definition. There is a detailed discussion regarding the definition of RT_{NDT}* in reference F1. For completeness, an excerpt from that discussion is included here as follows:

In 10CFR50.61 [F2] an embrittlement metric called RT_{PTS} is adopted. The RT_{PTS} embrittlement metric suggests that the embrittlement of the RPV, and by implication its TWCF, is controlled by the following factors:

1. The material (be it an axial weld, circumferential weld, plate, or forging) having the highest transition temperature.

2. The peak neutron fluence in any particular weld, plate, or forging.

However, as shown by the results obtained in the PTS Re-evaluation analyses, the dominant contributors to PTS-induced RPV failure are not necessarily those materials with the highest transition temperature, nor are the dominant contributors necessarily subjected to a uniform fluence (let alone the highest fluence for that material). The observation that axial flaws in welds are the dominant (85% to 90%, or greater) contributors to the TWCF suggest that an improved embrittlement metric that more directly addresses factors affecting the likelihood and consequences of PTS-induced RPV failure can be defined. Such a metric should have the following characteristics:

1. It should reflect the embrittlement level of the most irradiation sensitive material in the vessel that can have weld fusion line axial flaws associated with it. Therefore, the embrittlement characteristics of axial welds and plates should be of primary importance in constructing the embrittlement metric.

2. It should reflect the maximum fluence that can occur on the fusion line of an axial weld.

3. It should reflect the total length of weld fusion line in the active core region. Thus, both the length of the active core and the number of axial welds in the active core region need to be considered.

The following embrittlement metric, which accounts for all of these considerations, is therefore proposed:

$$RT_{NDT}{*} \equiv W_{P-F-CW} \cdot RT_{P-F-CW} + W_{P-AW} \cdot RT_{P-AW}$$

where

$W_{P\text{-}F\text{-}CW}$ is the plate / forging / circumferential weld weighting factor. It has a value of $0.033 \cdot n_{circ}$, where n_{circ} is the number of circumferential welds in the vessel.

$W_{P\text{-}AW}$ is the plate / axial weld weighting factor. It has a value of $(1 - W_{P\text{-}F\text{-}CW})$.

$RT_{P\text{-}F\text{-}CW}$ is the reference temperature for the plate / forging / circumferential weld. It is defined as follows:

$$RT_{P-F-CW} \equiv MAX\left[\left(RT_{NDT(u)}^{P-F} + \Delta T_{30}^{P-F}\left(f_{\max}^{CW}\right)\right), \left(RT_{NDT(u)}^{CW} + \Delta T_{30}^{CW}\left(f_{\max}^{CW}\right)\right)\right]$$

$RT_{NDT(u)}^{P\text{-}F}$ is the unirradiated RT_{NDT} of the plate or forging on either side of the circumferential weld having the highest irradiated RT_{NDT} of all circumferential welds in the vessel.

$RT_{NDT(u)}^{CW}$ is the unirradiated RT_{NDT} of the circumferential weld.

$DT_{30}^{P\text{-}F}(f_{max}^{CW})$ is the Charpy irradiation shift values calculated using the Cu, Ni, and P appropriate to the plate of forging, and the maximum fluence that occurs along the circumferential weld fusion line (f_{max}^{CW}).

$DT_{30}^{CW}(f_{max}^{CW})$ is the Charpy irradiation shift values calculated using the Cu, Ni, and P appropriate to the circumferential weld, and the maximum fluence that occurs along the circumferential weld fusion line (f_{max}^{CW}).

$RT_{P\text{-}AW}$ is the reference temperature for the plate / axial weld. It is defined as follows:

$$RT_{P-AW} \equiv \frac{\sum_{i=1}^{n}\left\{L_i \cdot MAX\left[\left(RT_{NDT(u)}^{P} + \Delta T_{30}^{P}\left(f_{\max}^{AW}\right)\right), \left(RT_{NDT(u)}^{AW} + \Delta T_{30}^{AW}\left(f_{\max}^{AW}\right)\right)\right]\right\}}{\sum_{i=1}^{n} L_i}$$

n is the total number of axial weld fusion lines in the vessel,

i denotes a particular axial weld fusion line,

L_i is the total length of an axial weld fusion line measured from a position extending from 1-ft. above the top to 1-ft. below the bottom of the active core,

$RT_{NDT(u)}^{P}$ is the unirradiated RT_{NDT} of the plate on either side of the axial weld fusion line,

$RT_{NDT(u)}^{AW}$ is the unirradiated RT_{NDT} of the axial weld.

$DT_{30}^{P}(f_{max}^{AW})$ is the Charpy irradiation shift values calculated using the Cu, Ni, and P appropriate to the plate, and the maximum fluence that occurs along the axial weld fusion line (f_{max}^{AW}).

$DT_{30}^{AW}(f_{max}^{AW})$ is the Charpy irradiation shift values calculated using the Cu, Ni, and P appropriate to the axial weld, and the maximum fluence that occurs along the particular axial weld fusion line (f_{max}^{AW}).

While the explanation of RT_{NDT}* is somewhat lengthy, RT_{NDT}* is simply a weighted average that accounts for the combined effects of material composition, unirradiated fracture toughness transition temperature, flaw density, flaw location, flaw orientation, and irradiation damage in the region of the vessel where PTS challenging flaws reside. The weighting factors employed make RT_{NDT}* depend mostly (90% or more) on the embrittlement characteristics of materials associated with axial flaws. However, there is a minor contribution (10% or less) from the embrittlement characteristics of materials associated with circumferential flaws.

Appendix F references

F1. Mark Kirk, et al., Technical Basis for Revision of the Pressurized Thermal Shock (PTS) Screening Criteria in the PTS Rule (10CFR50.61), draft NUREG.

F2. U.S. Nuclear Regulatory Policy Issue, 1982, NRC Staff Evaluation of Pressurized Thermal Shock, SECY 82-465.