

Reliability Study Update

Auxiliary Feedwater

1987–2005

This report presents a performance evaluation of the auxiliary feedwater (AFW) system at 69 operating United States commercial pressurized-water reactors (PWRs). The evaluation is based on the operating experience from fiscal year 1987 through 2005, from 74 PWRs, as reported in Licensee Event Reports (LERs). This is the latest update to NUREG/CR-5500 Volume 1, updating data, availability and reliability estimates, trends, and figures.

This report calculates two basic models for the AFW system. The first model, failure to start (FTS), models the AFW system start and injection. The second model, 8-hour mission, models the AFW system start, injection, and pump run for 8 hours. See the AFW Fault Tree Description document for more detail.

The AFW system has been categorized into eleven groups. The AFW design classes were categorized first by number of steam generators (SG), then by number of pump trains, and finally by number of motor (M), turbine (T), and diesel (D) trains. [Table 1](#) summarizes those groups. Information that is more detailed can be found in [Section 5](#).

Table 1. AFW design class summary.

	Design Class	Reference Plant	Number of Plants in Study	Number of Operating Plants
1	1M, 1T, 2SG	Crystal River 3	8	8
2	1M, 2T, 2SG	Calvert Cliffs 1	2	2
3	2T, 2SG	Davis-Besse	1	1
4	2M, 1T, 2SG	St. Lucie 1	17	16
5	2M, 1T, 3SG	Farley 1	12	11
6	3T, 3SG	Turkey Point 3	2	2
7	1M, 1D, 4SG	Braidwood 1	4	4
8	1M, 1T, 4SG	Seabrook	1	1
9	2T, 4SG	Haddam Neck	1	-
10	2M, 1T, 4SG	Salem 1	24	22
11	3M, 1T, 4SG	South Texas 1	2	2

1 LATEST VALUES AND TRENDS

1.1 Industry-Wide Unavailability and Unreliability

The industry-wide unreliability and unavailability of the AFW system has been calculated from the operating experience for an 8-hour mission and for the failure to start (FTS) and are shown in [Table 2](#). The estimates are based on failures that occurred during unplanned demands, cyclic, and quarterly surveillance tests.

Table 2. AFW Industry values.

Model	Lower (5%)	Mean	Upper (95%)
Failure-to-Start (Unavailability)	9.17E-06	2.63E-04	9.93E-04
8-hour Mission (Unreliability)	1.23E-05	7.34E-04	2.84E-03

1.2 Fail to Start Model Results

The unavailability of the AFW system for each design class has been calculated from the operating experience for the failure to start (FTS) mission. A waterfall plot is shown in [Figure 1](#) and the data table is shown in [Table 3](#).

Unavailability's for currently operating plants have been calculated for the FTS model. The estimates of AFW system unavailability using operating experience from LERs and fault tree analyses are plotted in [Figure 2](#) (FTS model) and the data table is shown in [Table 4](#).

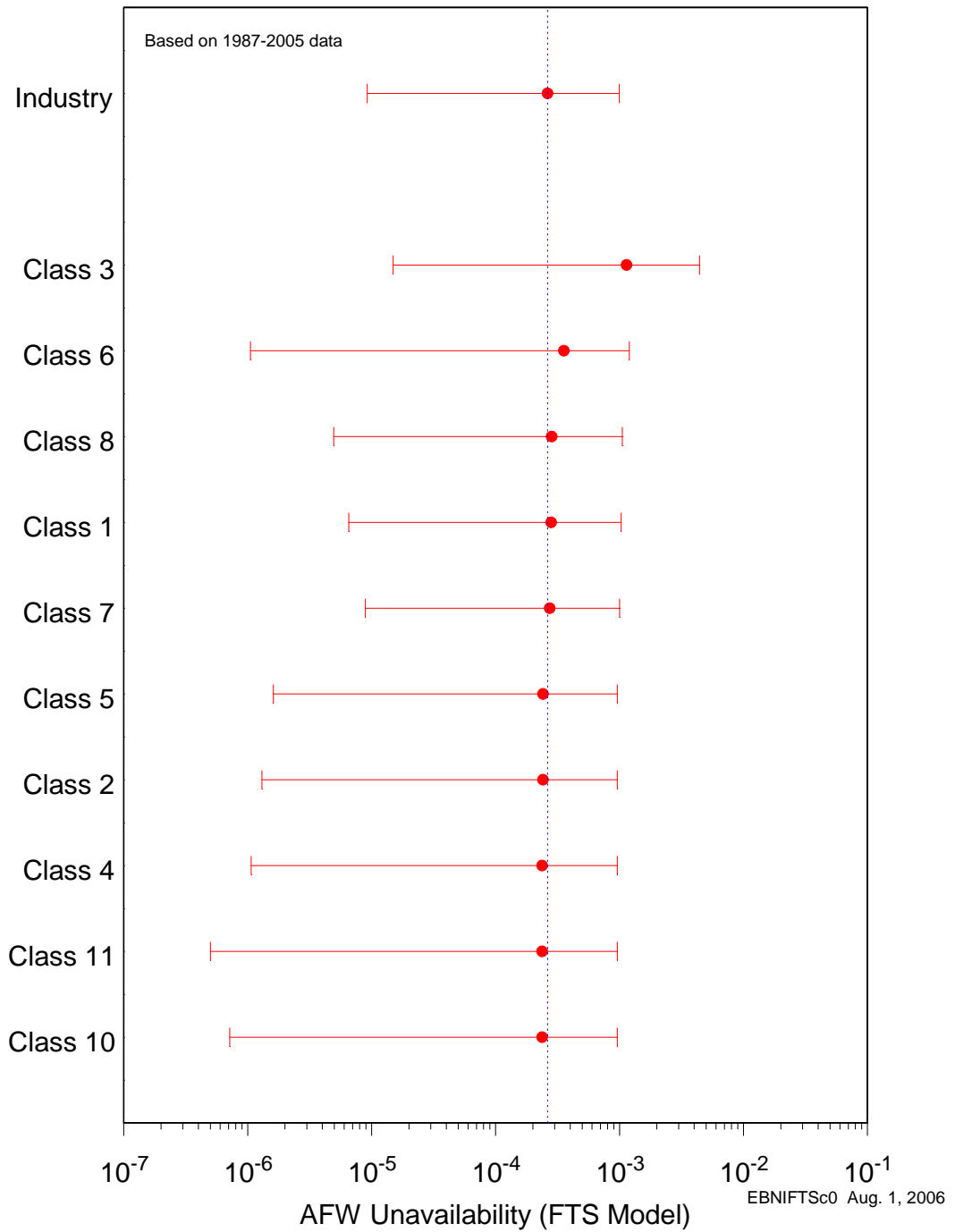


Figure 1. AFW design class unavailability (FTS model).

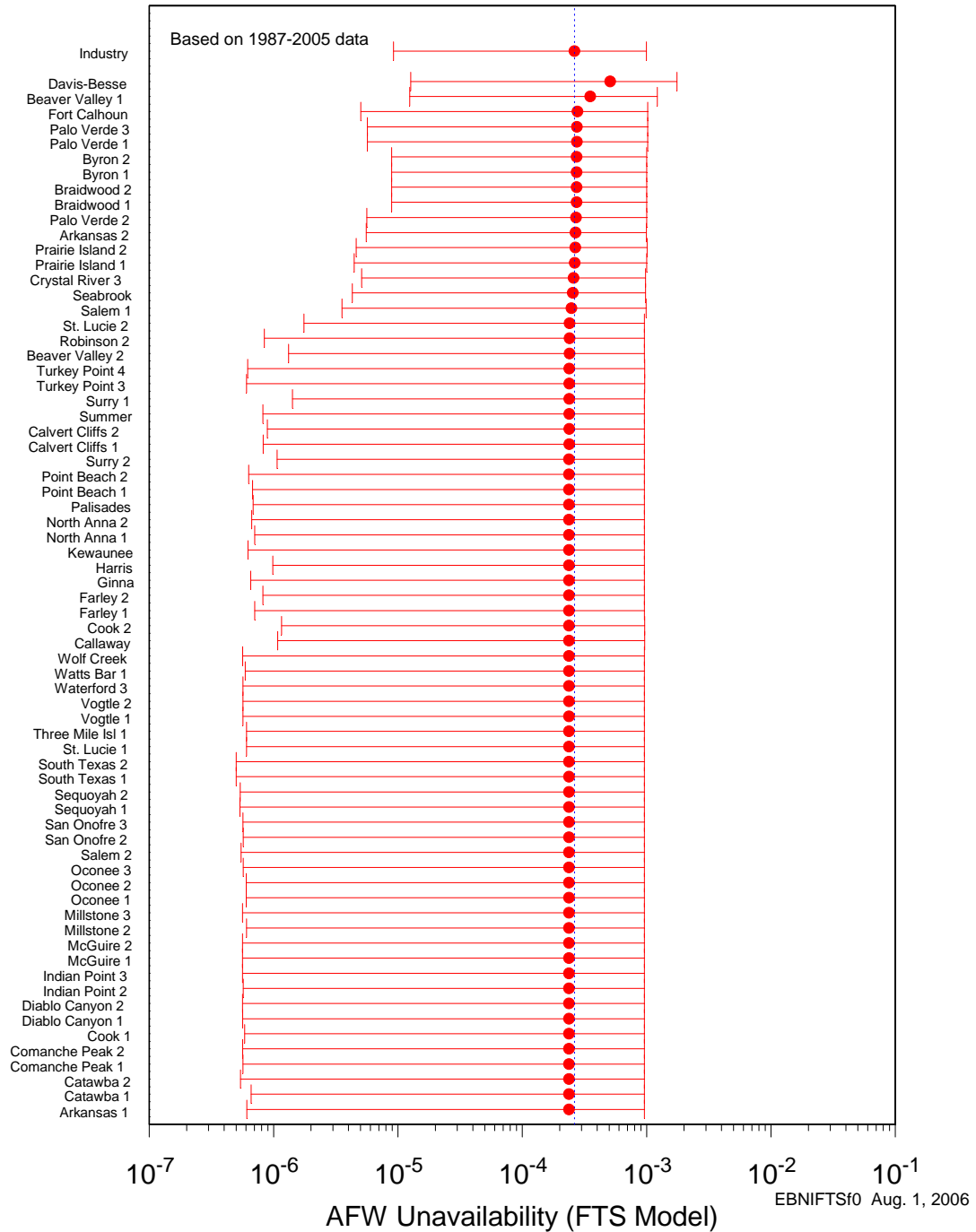


Figure 2. Plant-specific estimates of AFW system unavailability for FTS model.

Table 3. AFW unavailability (start only model) by design class.

Plant	Lower (5%)	Mean	Upper (95%)
Industry	9.17E-06	2.63E-04	9.93E-04
Class 3	1.49E-05	1.14E-03	4.42E-03
Class 6	1.05E-06	3.56E-04	1.20E-03
Class 8	4.96E-06	2.84E-04	1.05E-03
Class 1	6.55E-06	2.81E-04	1.03E-03
Class 7	8.88E-06	2.74E-04	1.00E-03
Class 2	1.30E-06	2.41E-04	9.60E-04
Class 5	1.61E-06	2.41E-04	9.62E-04
Class 4	1.07E-06	2.38E-04	9.58E-04
Class 10	7.15E-07	2.37E-04	9.62E-04
Class 11	5.01E-07	2.37E-04	9.60E-04

Table 4. AFW plant unavailability FTS model.

Plant	Lower (5%)	Mean	Upper (95%)
Industry	9.17E-06	2.63E-04	9.93E-04
Davis-Besse	1.27E-05	5.10E-04	1.75E-03
Beaver Valley 1	1.24E-05	3.53E-04	1.22E-03
Fort Calhoun	5.03E-06	2.78E-04	1.02E-03
Palo Verde 1	5.67E-06	2.75E-04	1.02E-03
Palo Verde 3	5.67E-06	2.75E-04	1.02E-03
Braidwood 1	8.88E-06	2.74E-04	1.00E-03
Braidwood 2	8.88E-06	2.74E-04	1.00E-03
Byron 1	8.88E-06	2.74E-04	1.00E-03
Byron 2	8.88E-06	2.74E-04	1.00E-03
Palo Verde 2	5.63E-06	2.71E-04	9.98E-04
Arkansas 2	5.57E-06	2.68E-04	9.95E-04
Prairie Island 2	4.60E-06	2.67E-04	1.01E-03
Prairie Island 1	4.45E-06	2.64E-04	1.00E-03
Crystal River 3	5.11E-06	2.59E-04	9.82E-04
Seabrook	4.30E-06	2.55E-04	9.80E-04
Salem 1	3.54E-06	2.49E-04	9.90E-04
Beaver Valley 2	1.32E-06	2.40E-04	9.59E-04
Robinson 2	8.43E-07	2.40E-04	9.62E-04
St. Lucie 2	1.75E-06	2.40E-04	9.59E-04
Calvert Cliffs 1	8.24E-07	2.39E-04	9.60E-04
Calvert Cliffs 2	8.92E-07	2.39E-04	9.60E-04
Summer	8.19E-07	2.39E-04	9.59E-04
Surry 1	1.42E-06	2.39E-04	9.59E-04
Turkey Point 3	6.07E-07	2.39E-04	9.65E-04
Turkey Point 4	6.18E-07	2.39E-04	9.65E-04
Callaway	1.08E-06	2.38E-04	9.63E-04

Plant	Lower (5%)	Mean	Upper (95%)
Cook 2	1.16E-06	2.38E-04	9.63E-04
Farley 1	7.07E-07	2.38E-04	9.58E-04
Farley 2	8.19E-07	2.38E-04	9.59E-04
Ginna	6.54E-07	2.38E-04	9.59E-04
Harris	9.85E-07	2.38E-04	9.59E-04
Kewaunee	6.22E-07	2.38E-04	9.59E-04
North Anna 1	7.07E-07	2.38E-04	9.58E-04
North Anna 2	6.68E-07	2.38E-04	9.58E-04
Palisades	6.83E-07	2.38E-04	9.59E-04
Point Beach 1	6.79E-07	2.38E-04	9.58E-04
Point Beach 2	6.31E-07	2.38E-04	9.59E-04
Surry 2	1.07E-06	2.38E-04	9.59E-04
Arkansas 1	6.09E-07	2.37E-04	9.59E-04
Catawba 1	6.59E-07	2.37E-04	9.62E-04
Catawba 2	5.43E-07	2.37E-04	9.58E-04
Comanche Peak 1	5.66E-07	2.37E-04	9.58E-04
Comanche Peak 2	5.65E-07	2.37E-04	9.58E-04
Cook 1	5.84E-07	2.37E-04	9.58E-04
Diablo Canyon 1	5.65E-07	2.37E-04	9.58E-04
Diablo Canyon 2	5.61E-07	2.37E-04	9.58E-04
Indian Point 2	5.70E-07	2.37E-04	9.58E-04
Indian Point 3	5.62E-07	2.37E-04	9.58E-04
McGuire 1	5.63E-07	2.37E-04	9.58E-04
McGuire 2	5.62E-07	2.37E-04	9.58E-04
Millstone 2	6.05E-07	2.37E-04	9.58E-04
Millstone 3	5.62E-07	2.37E-04	9.58E-04
Oconee 1	6.03E-07	2.37E-04	9.58E-04
Oconee 2	6.03E-07	2.37E-04	9.58E-04
Oconee 3	5.70E-07	2.37E-04	9.58E-04
Salem 2	5.47E-07	2.37E-04	9.58E-04
San Onofre 2	5.70E-07	2.37E-04	9.58E-04
San Onofre 3	5.67E-07	2.37E-04	9.58E-04
Sequoyah 1	5.37E-07	2.37E-04	9.58E-04
Sequoyah 2	5.38E-07	2.37E-04	9.58E-04
South Texas 1	5.01E-07	2.37E-04	9.60E-04
South Texas 2	5.01E-07	2.37E-04	9.60E-04
St. Lucie 1	6.05E-07	2.37E-04	9.59E-04
Three Mile Isl 1	6.06E-07	2.37E-04	9.58E-04
Vogtle 1	5.66E-07	2.37E-04	9.58E-04
Vogtle 2	5.66E-07	2.37E-04	9.58E-04
Waterford 3	5.66E-07	2.37E-04	9.58E-04
Watts Bar 1	5.90E-07	2.37E-04	9.59E-04
Wolf Creek	5.65E-07	2.37E-04	9.58E-04

Figure 3 displays the trend by fiscal year of the AFW system FTS unavailability calculated from the 1987–2005 experience. Table 10 shows the data points for Figure 3. The trend is not statistically significant.¹

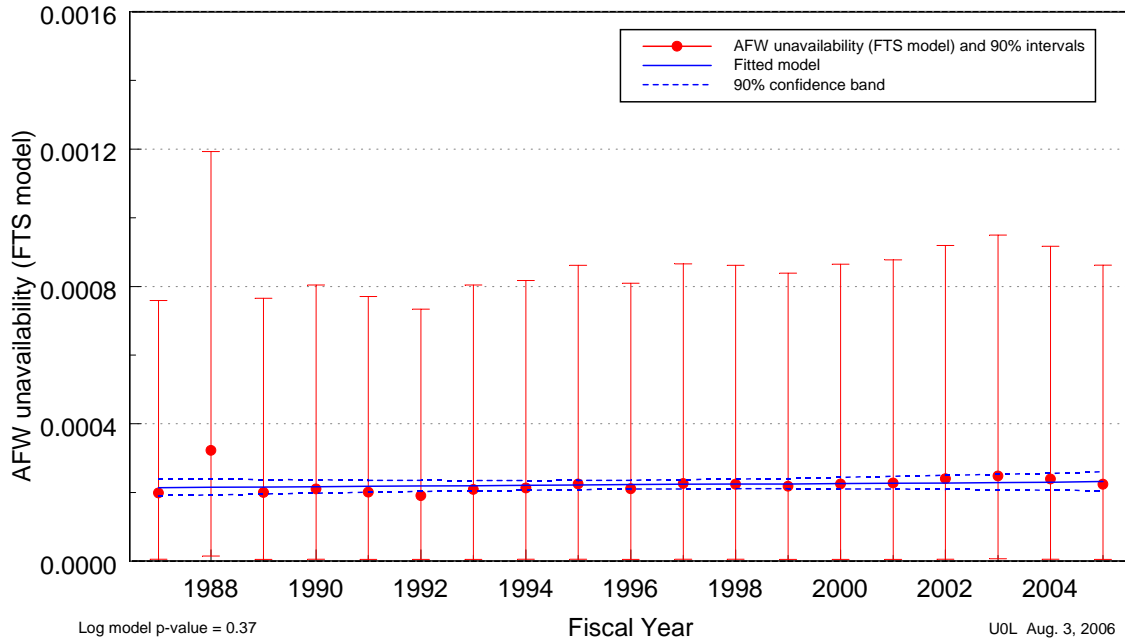


Figure 3. Trend of AFW system unavailability (FTS model), as a function of fiscal year.

1.3 Fail to Operate for 8-Hour Model

The unreliability of the AFW system for each design class has been calculated from the operating experience for the 8-hour mission. Waterfall plots are shown in Figure 4 and the data table is shown in Table 5.

Individual plant unreliability, for currently operating plants, has been calculated for the 8-hour mission. The estimates of AFW system unreliability using operating experience from LERs and fault tree analyses are plotted in Figure 5 (8-hour mission) and the data table is shown in Table 6.

¹ Statistically significant is defined in terms of the ‘p-value.’ A p-value is a probability indicating whether to accept or reject the null hypothesis that there is no trend in the data. P-values of less than or equal to 0.05 indicate that we are 95% confident that there is a trend in the data (reject the null hypothesis of no trend.) By convention, we use the "Michelin Guide" scale: p-value < 0.05 (statistically significant), p-value < 0.01 (highly statistically significant); p-value < 0.001 (extremely statistically significant).

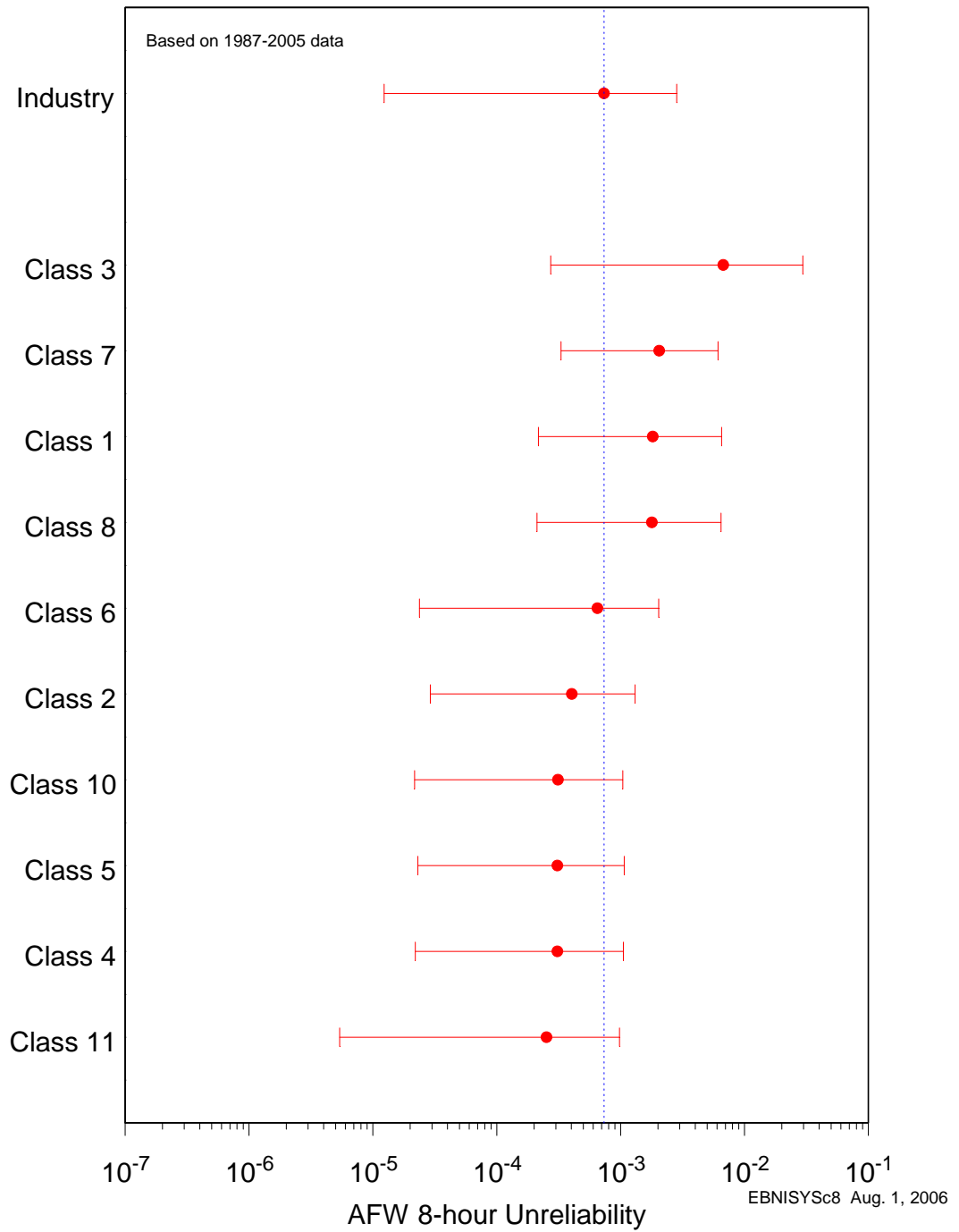


Figure 4. AFW design class unreliability (8-hour model).

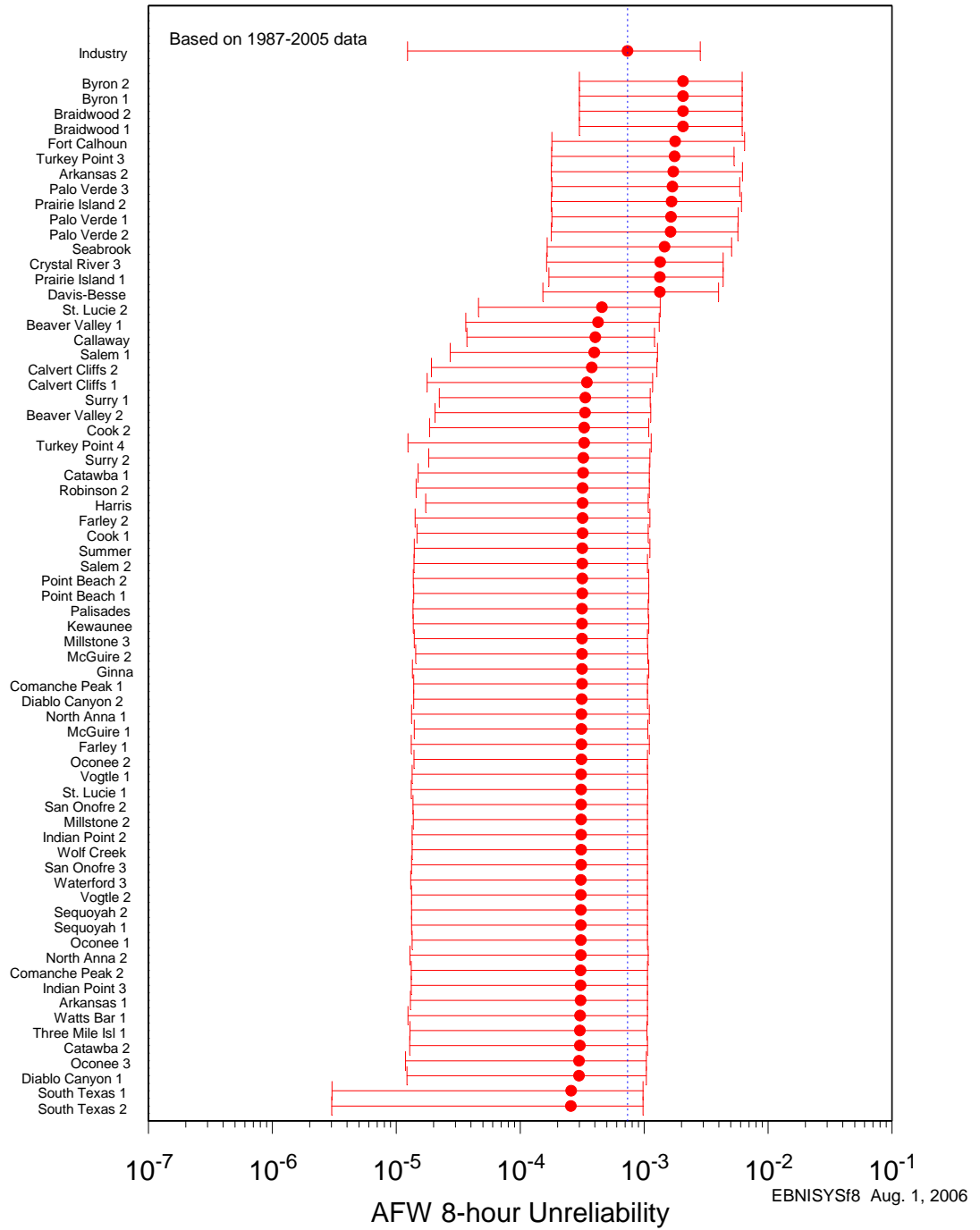


Figure 5. Plant-specific estimates of AFW system unreliability for an 8-hour mission.

Table 5. AFW unreliability (8-hour model) by design class.

Plant	Lower (5%)	Mean	Upper (95%)
Industry	1.23E-05	7.34E-04	2.84E-03
Class 3	2.72E-04	6.73E-03	2.95E-02
Class 7	3.30E-04	2.05E-03	6.11E-03
Class 1	2.17E-04	1.82E-03	6.53E-03
Class 8	2.11E-04	1.79E-03	6.47E-03
Class 6	2.37E-05	6.52E-04	2.03E-03
Class 2	2.91E-05	4.04E-04	1.31E-03
Class 10	2.17E-05	3.13E-04	1.04E-03
Class 4	2.20E-05	3.09E-04	1.05E-03
Class 5	2.30E-05	3.09E-04	1.07E-03
Class 11	5.40E-06	2.53E-04	9.78E-04

Plant	Lower (5%)	Mean	Upper (95%)
Cook 1	1.47E-05	3.18E-04	1.08E-03
Farley 2	1.42E-05	3.18E-04	1.11E-03
Harris	1.73E-05	3.18E-04	1.08E-03
Robinson 2	1.45E-05	3.18E-04	1.10E-03
Point Beach 1	1.38E-05	3.17E-04	1.09E-03
Point Beach 2	1.37E-05	3.17E-04	1.09E-03
Salem 2	1.39E-05	3.17E-04	1.06E-03
Summer	1.40E-05	3.17E-04	1.11E-03
Kewaunee	1.37E-05	3.16E-04	1.09E-03
Palisades	1.36E-05	3.16E-04	1.08E-03
Comanche Peak 1	1.38E-05	3.15E-04	1.06E-03
Ginna	1.35E-05	3.15E-04	1.09E-03
McGuire 2	1.43E-05	3.15E-04	1.07E-03
Millstone 3	1.40E-05	3.15E-04	1.06E-03
Diablo Canyon 2	1.38E-05	3.14E-04	1.06E-03
Farley 1	1.32E-05	3.13E-04	1.10E-03
McGuire 1	1.40E-05	3.13E-04	1.07E-03
North Anna 1	1.33E-05	3.13E-04	1.10E-03
Oconee 2	1.39E-05	3.12E-04	1.06E-03
Indian Point 2	1.34E-05	3.11E-04	1.06E-03
Millstone 2	1.37E-05	3.11E-04	1.06E-03
San Onofre 2	1.36E-05	3.11E-04	1.06E-03
St. Lucie 1	1.32E-05	3.11E-04	1.07E-03
Vogtle 1	1.34E-05	3.11E-04	1.06E-03
San Onofre 3	1.33E-05	3.10E-04	1.06E-03
Wolf Creek	1.34E-05	3.10E-04	1.06E-03
North Anna 2	1.29E-05	3.09E-04	1.08E-03
Oconee 1	1.34E-05	3.09E-04	1.06E-03
Sequoyah 1	1.33E-05	3.09E-04	1.06E-03
Sequoyah 2	1.33E-05	3.09E-04	1.06E-03
Vogtle 2	1.33E-05	3.09E-04	1.06E-03
Waterford 3	1.31E-05	3.09E-04	1.06E-03
Comanche Peak 2	1.32E-05	3.08E-04	1.06E-03
Arkansas 1	1.30E-05	3.07E-04	1.06E-03
Indian Point 3	1.32E-05	3.07E-04	1.06E-03
Watts Bar 1	1.24E-05	3.04E-04	1.06E-03
Catawba 2	1.28E-05	3.03E-04	1.06E-03
Three Mile Isl 1	1.29E-05	3.03E-04	1.05E-03
Diablo Canyon 1	1.22E-05	2.98E-04	1.04E-03
Oconee 3	1.19E-05	2.98E-04	1.04E-03
South Texas 1	3.03E-06	2.57E-04	9.80E-04
South Texas 2	3.01E-06	2.56E-04	9.80E-04

Table 6. AFW plant unreliability data.

Plant	Lower (5%)	Mean	Upper (95%)
Industry	1.23E-05	7.34E-04	2.84E-03
Braidwood 1	3.00E-04	2.06E-03	6.18E-03
Braidwood 2	3.00E-04	2.06E-03	6.18E-03
Byron 1	3.00E-04	2.06E-03	6.18E-03
Byron 2	3.00E-04	2.06E-03	6.18E-03
Fort Calhoun	1.80E-04	1.78E-03	6.48E-03
Turkey Point 3	1.79E-04	1.76E-03	5.31E-03
Arkansas 2	1.78E-04	1.72E-03	6.20E-03
Palo Verde 3	1.80E-04	1.69E-03	5.92E-03
Prairie Island 2	1.78E-04	1.67E-03	6.08E-03
Palo Verde 1	1.80E-04	1.65E-03	5.72E-03
Palo Verde 2	1.78E-04	1.63E-03	5.69E-03
Seabrook	1.65E-04	1.46E-03	5.08E-03
Crystal River 3	1.63E-04	1.35E-03	4.34E-03
Davis-Besse	1.52E-04	1.34E-03	3.98E-03
Prairie Island 1	1.70E-04	1.34E-03	4.33E-03
St. Lucie 2	4.60E-05	4.57E-04	1.35E-03
Beaver Valley 1	3.64E-05	4.25E-04	1.32E-03
Callaway	3.70E-05	4.05E-04	1.21E-03
Salem 1	2.73E-05	3.97E-04	1.28E-03
Calvert Cliffs 2	1.92E-05	3.79E-04	1.27E-03
Calvert Cliffs 1	1.77E-05	3.46E-04	1.17E-03
Surry 1	2.23E-05	3.35E-04	1.12E-03
Beaver Valley 2	2.05E-05	3.34E-04	1.13E-03
Cook 2	1.85E-05	3.29E-04	1.09E-03
Turkey Point 4	1.24E-05	3.28E-04	1.14E-03
Surry 2	1.83E-05	3.23E-04	1.11E-03
Catawba 1	1.50E-05	3.22E-04	1.10E-03

A statistically significant increasing trend within the industry estimates of AFW system unreliability (8-hour mission) on a per fiscal year basis was identified. Figure 6 displays the trend by fiscal year of the AFW system unreliability calculated from the 1987–2005 experience. Table 11 shows the data points for Figure 6.

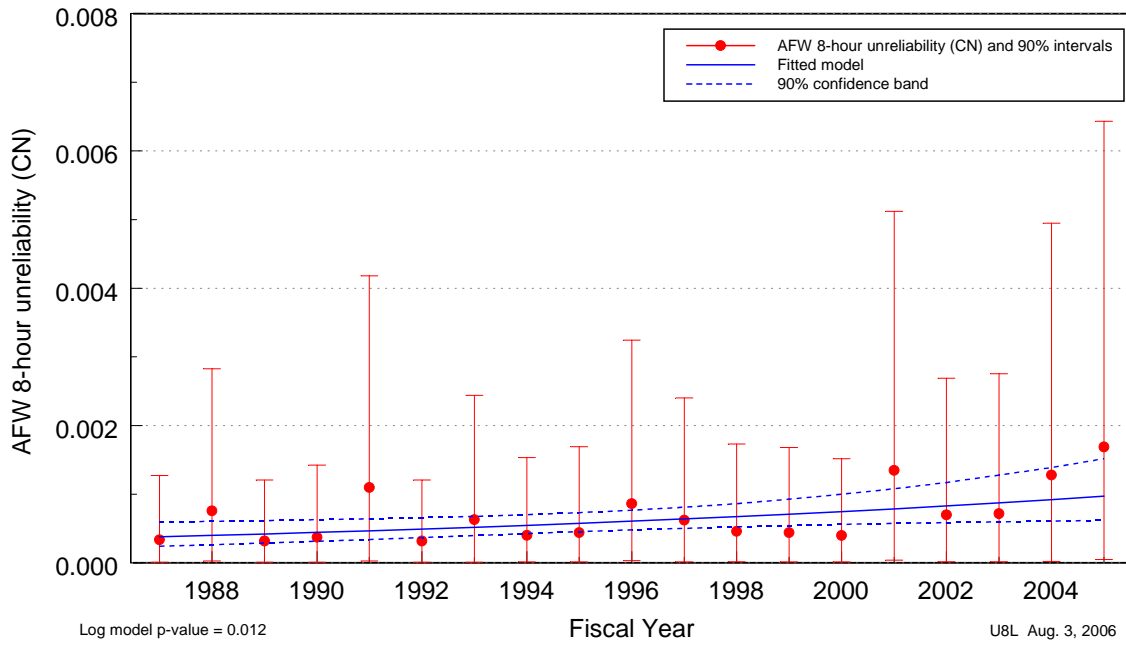


Figure 6. Trend of AFW system unreliability (8-hour mission), as a function of fiscal year.

2 DATA TRENDS

2.1 Unplanned Demand Trend

Trends were identified in the frequency of AFW unplanned demands (Figure 7). When modeled as a function of fiscal year, the unplanned demand frequency exhibited an extremely statistically significant decreasing trend. Table 12 shows the LERs that are represented in the figure. The noticeable increase in AFW unplanned demands in FY-2003 through FY-2005 is related to the significant increase in scrams and ECCS actuations in FY-2003 to FY-2005 compared to recent history.

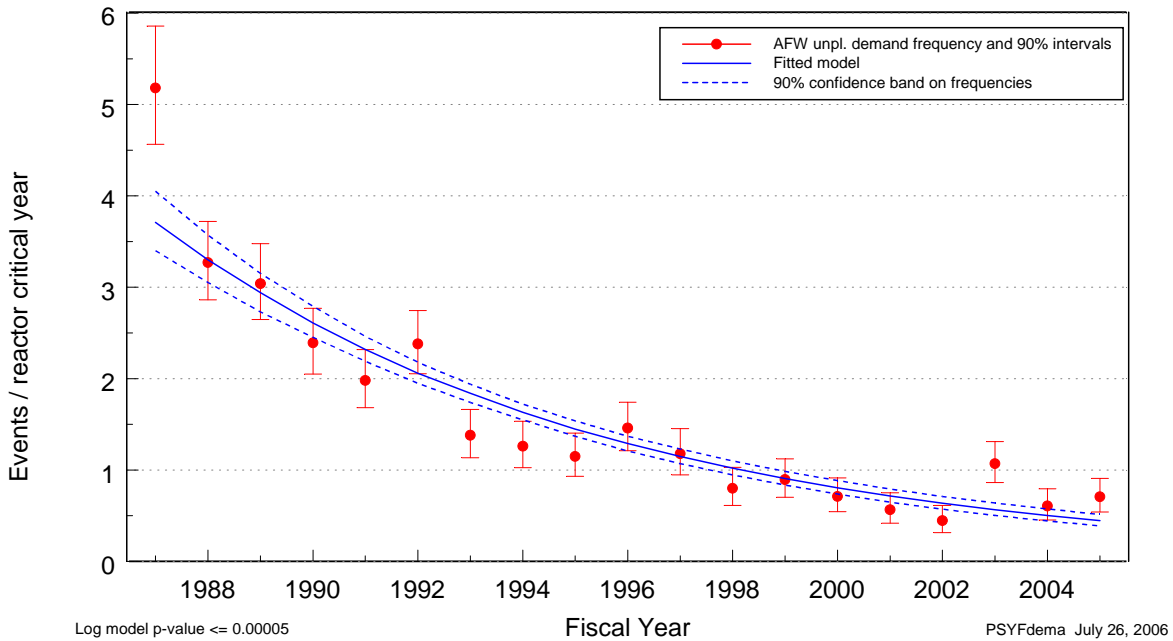


Figure 7. Frequency (events per reactor critical year) of unplanned demands, as a function of fiscal year.

2.2 Failure Trend

The frequency of all failures (unplanned demands, surveillance tests, inspections, etc.) resulting in train unavailability identified in the experience was analyzed to determine trends. When modeled as a function of fiscal year, an extremely statistically significant decreasing trend was identified. The fitted frequency is plotted against fiscal year in Figure 8. Trends for AFW failures are plotted without regard to method of detection (the trend excludes maintenance out of service and support system failures). Table 13 shows the LERs that are represented in the figure.

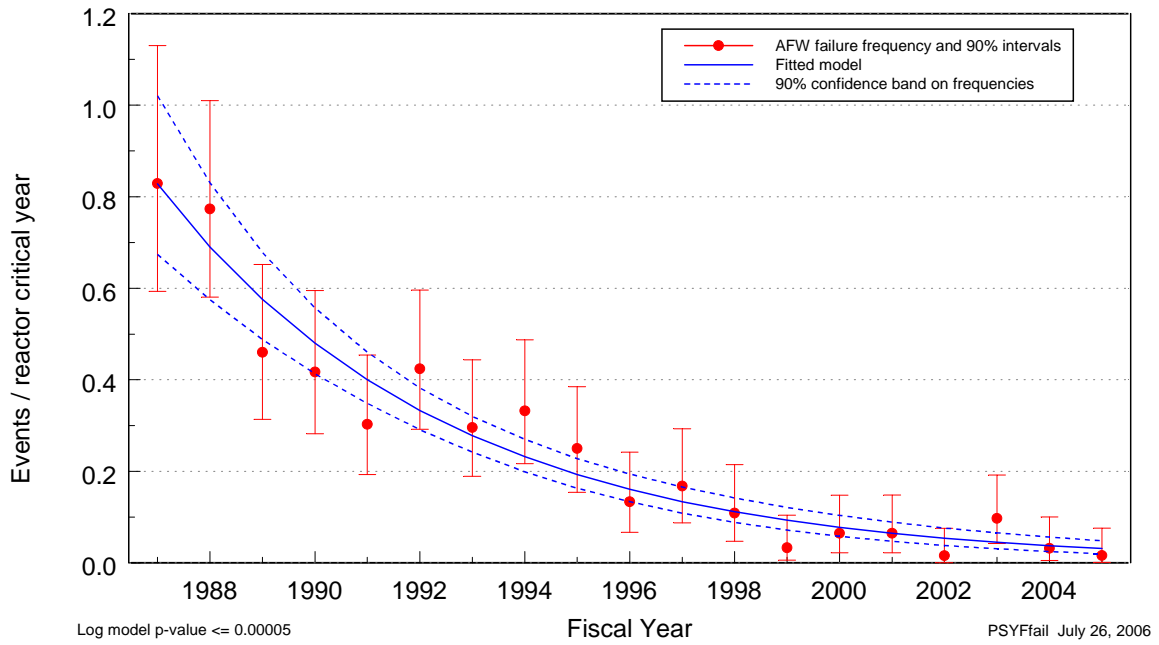


Figure 8. Frequency (events per reactor critical year) of failures, as a function of fiscal year.

3 MAJOR CONTRIBUTORS TO SYSTEM UNRELIABILITY AND UNAVAILABILITY

3.1 Segment Failure Contribution to Design Class Models

The segment failure contribution has been calculated by adding up the components of each cut-set for each design class fault tree model.

3.1.1 Fail to Start Model

Figure 9 through Figure 19 show the distributions of segment failures for the FTS model.

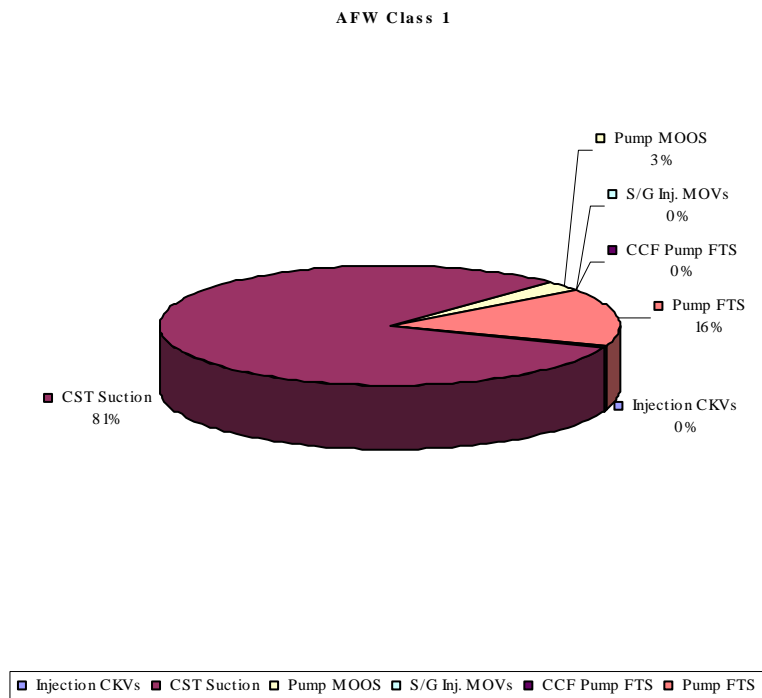


Figure 9. Segment failure distribution, FTS model Design Class 1.

AFW Class 2

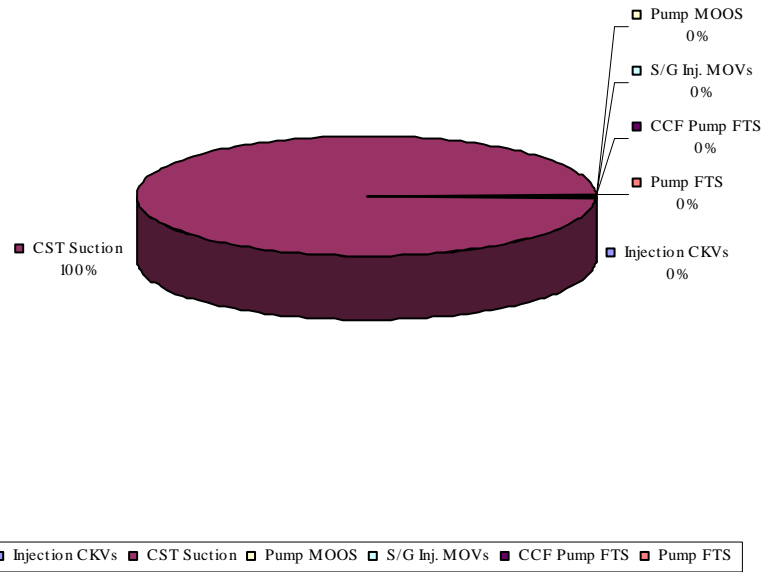


Figure 10. Segment failure distribution, FTS model Design Class 2.

AFW Class 3

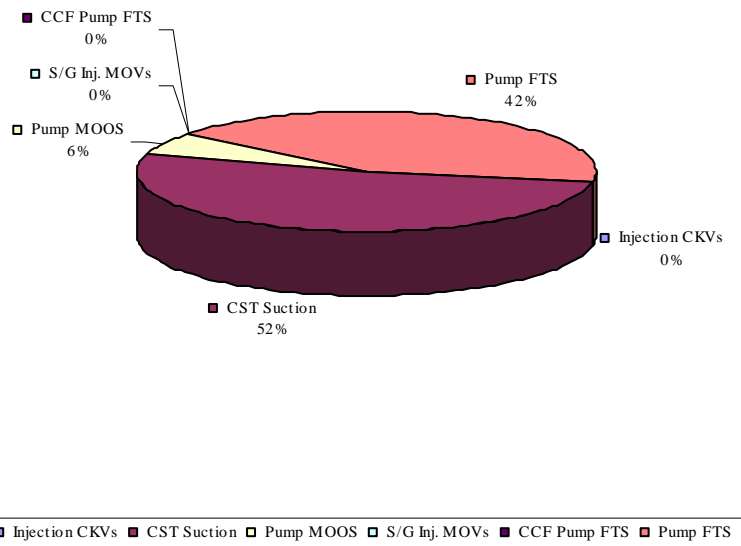


Figure 11. Segment failure distribution, FTS model Design Class 3.

AFW Class 4

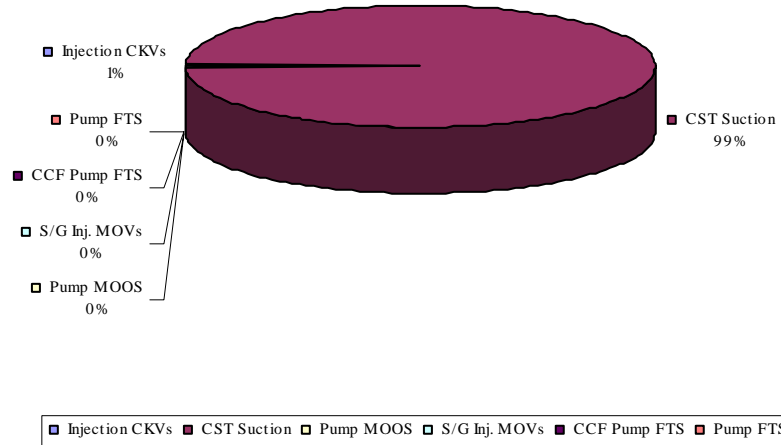


Figure 12. Segment failure distribution, FTS model Design Class 4.

AFW Class 5

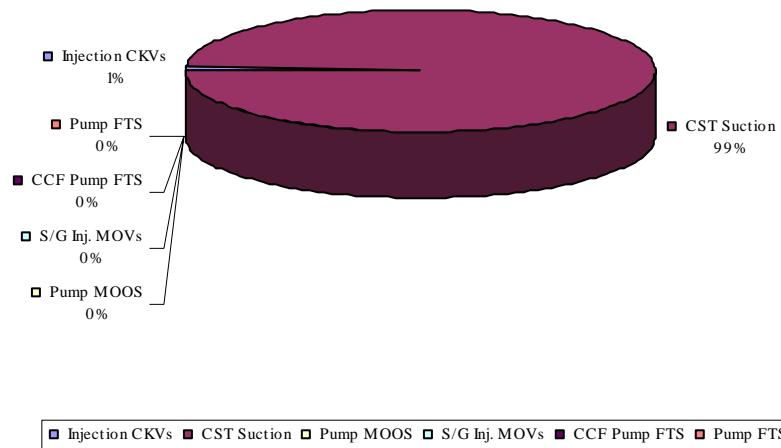


Figure 13. Segment failure distribution, FTS model Design Class 5.

AFW Class 6

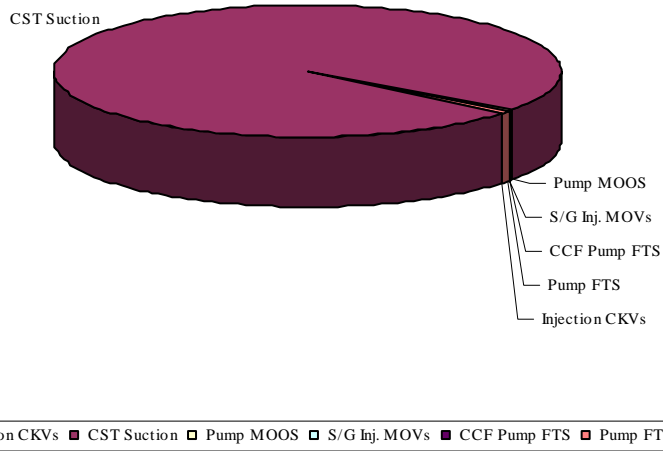


Figure 14. Segment failure distribution, FTS model Design Class 6.

AFW Class 7

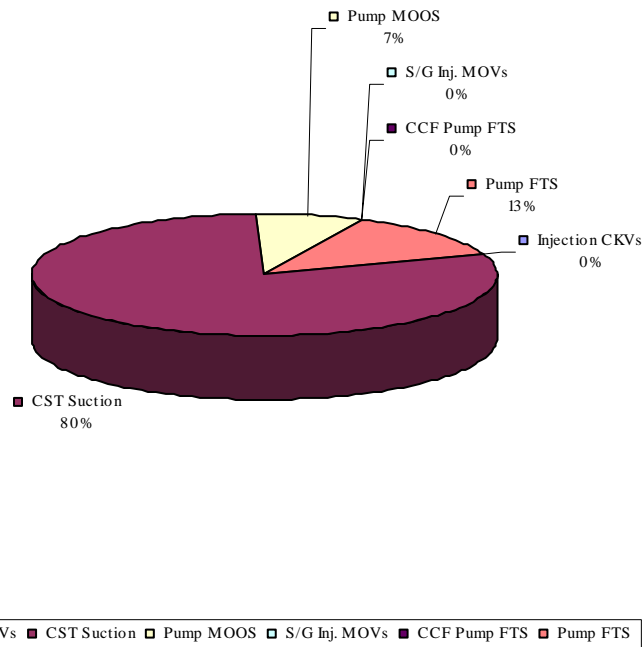


Figure 15. Segment failure distribution, FTS model Design Class 7.

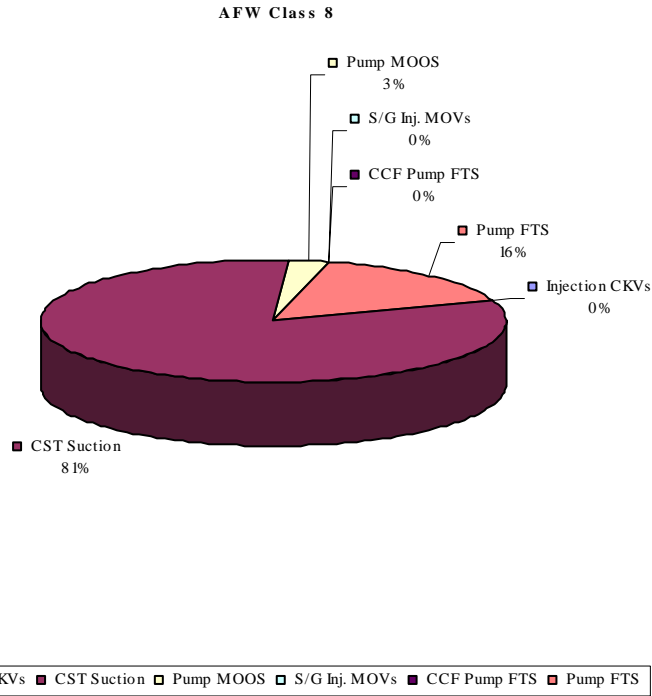


Figure 16. Segment failure distribution, FTS model Design Class 8.

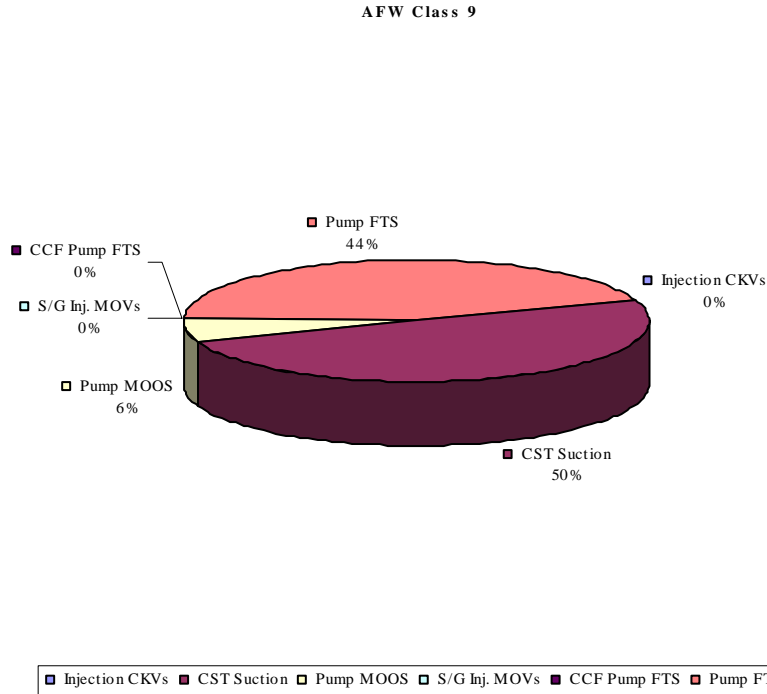


Figure 17. Segment failure distribution, FTS model Design Class 9.

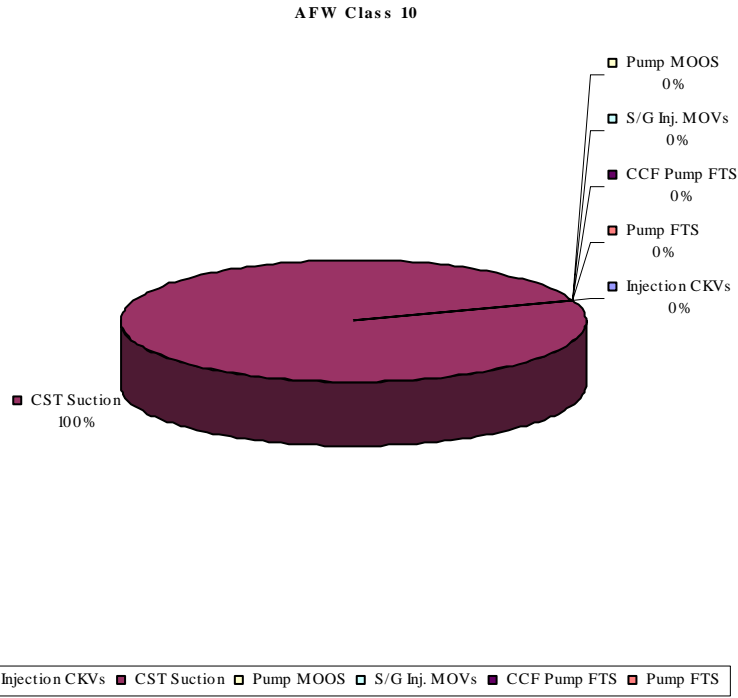


Figure 18. Segment failure distribution, FTS model Design Class 10.

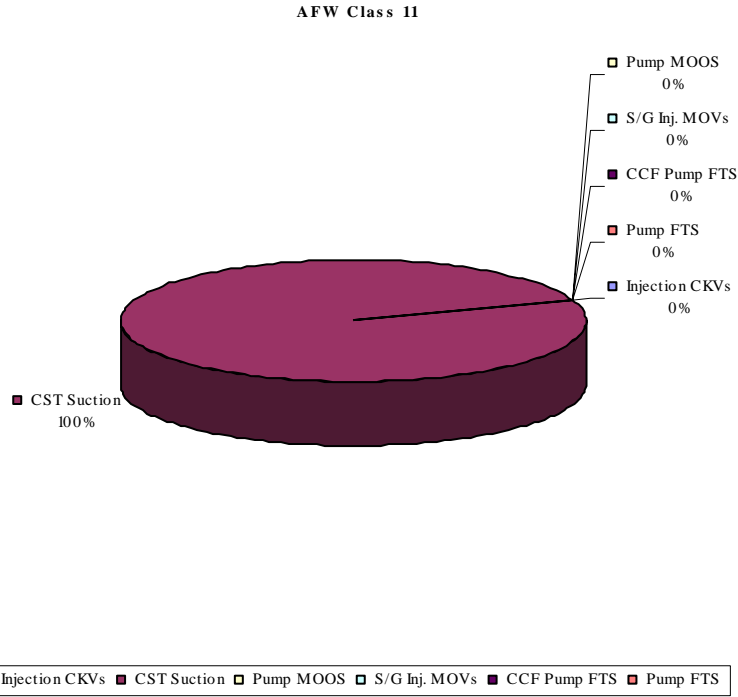


Figure 19. Segment failure distribution, FTS model Design Class 11.

3.1.2 Fail to Operate for 8 –hour Model

Figure 20 through Figure 30 show the distributions of segment failures for the 8-hour model.

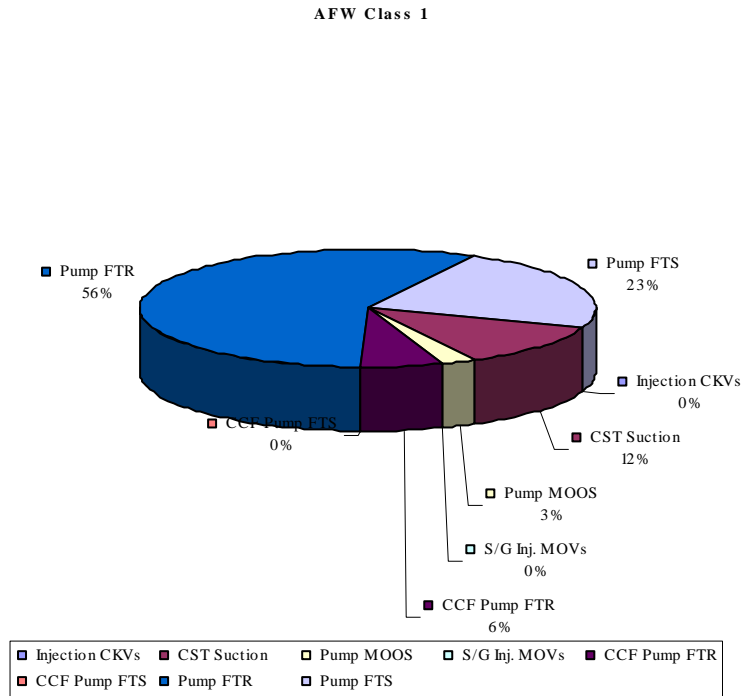


Figure 20. Segment failure distribution, 8-hour mission Design Class 1.

AFW Class 2

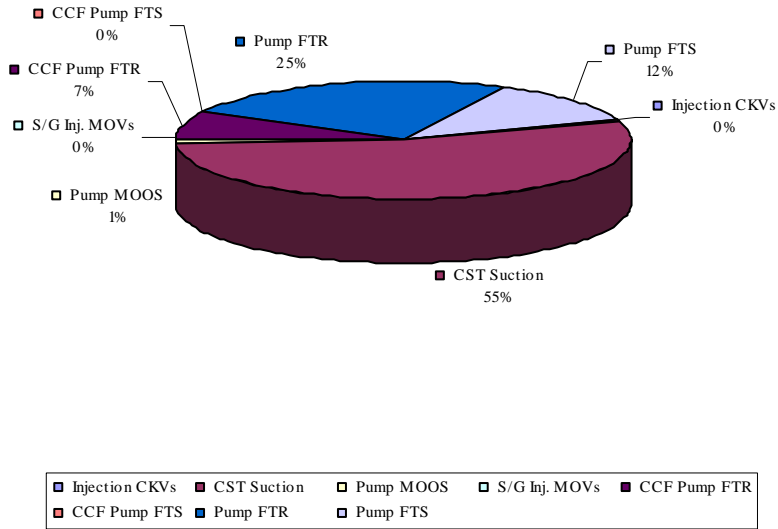


Figure 21. Segment failure distribution, 8-hour mission Design Class 2.

AFW Class 3

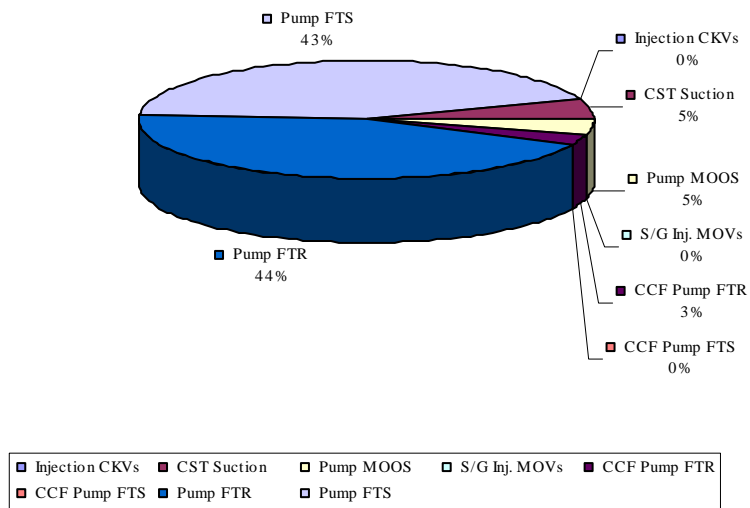


Figure 22. Segment failure distribution, 8-hour mission Design Class 3.

AFW Class 4

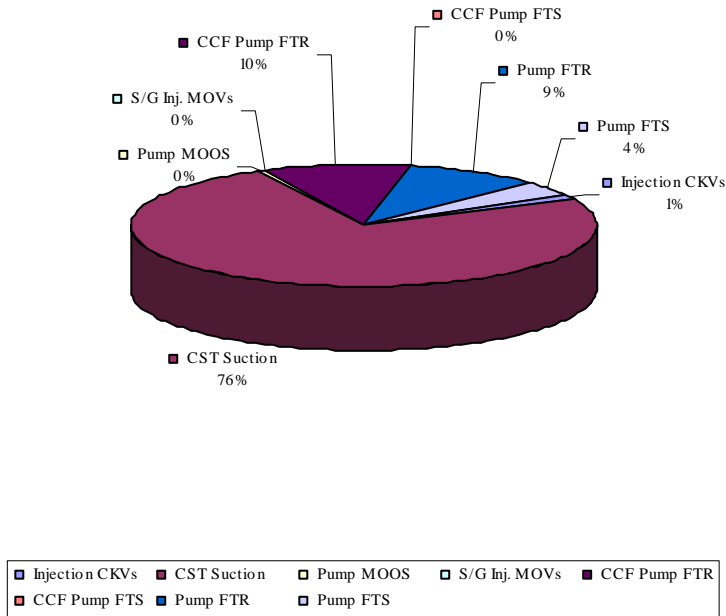


Figure 23. Segment failure distribution, 8-hour mission Design Class 4.

AFW Class 5

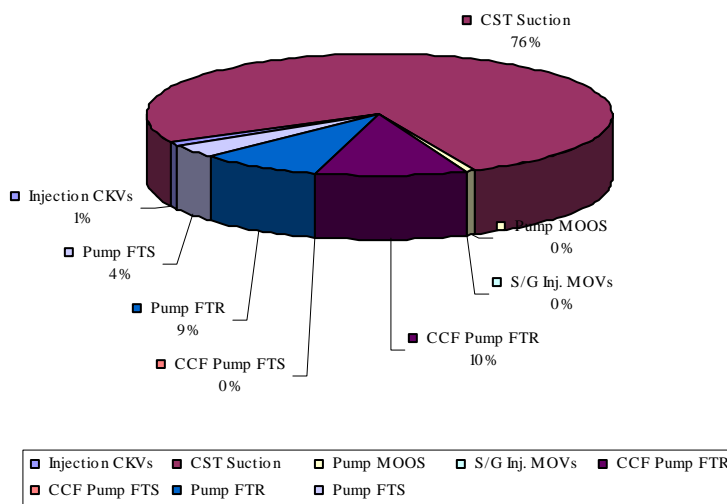


Figure 24. Segment failure distribution, 8-hour mission Design Class 5.

AFW Class 6

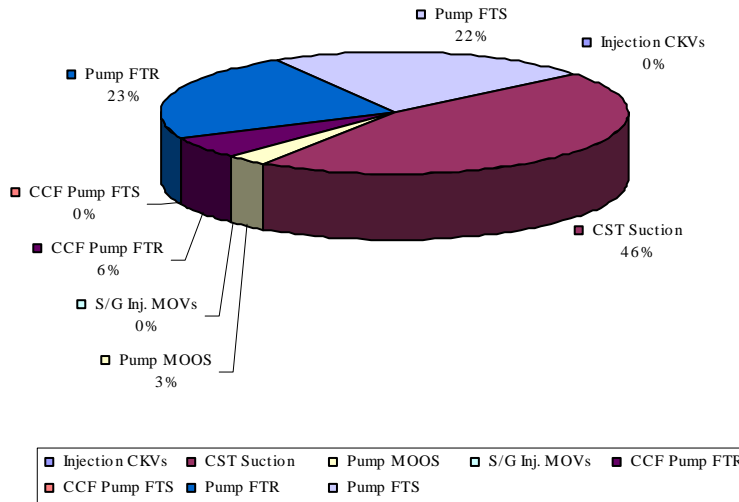


Figure 25. Segment failure distribution, 8-hour mission Design Class 6.

AFW Class 7

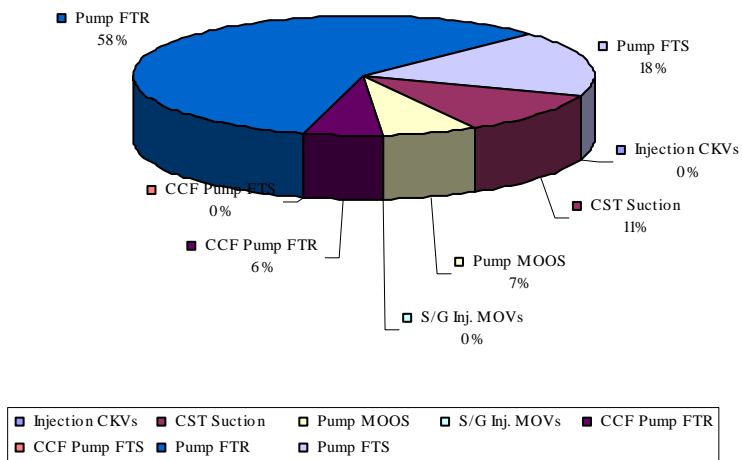


Figure 26. Segment failure distribution, 8-hour mission Design Class 7.

AFW Class 8

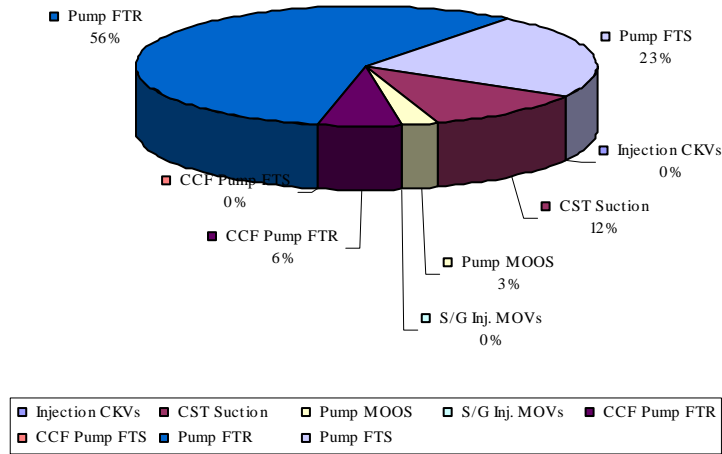


Figure 27. Segment failure distribution, 8-hour mission Design Class 8.

AFW Class 9

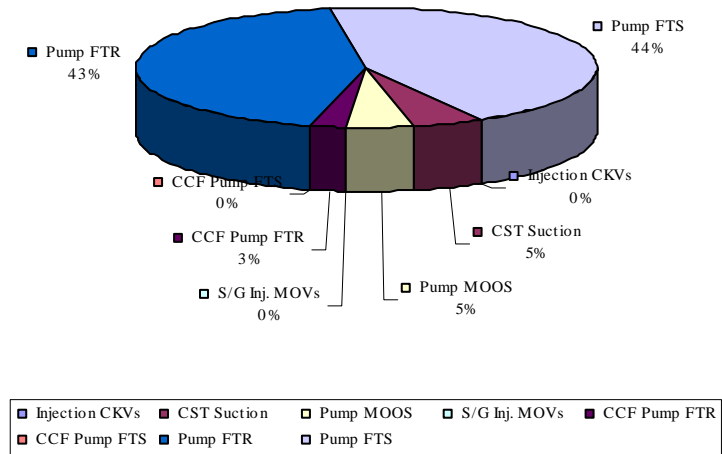


Figure 28. Segment failure distribution, 8-hour mission Design Class 9.

AFW Class 10

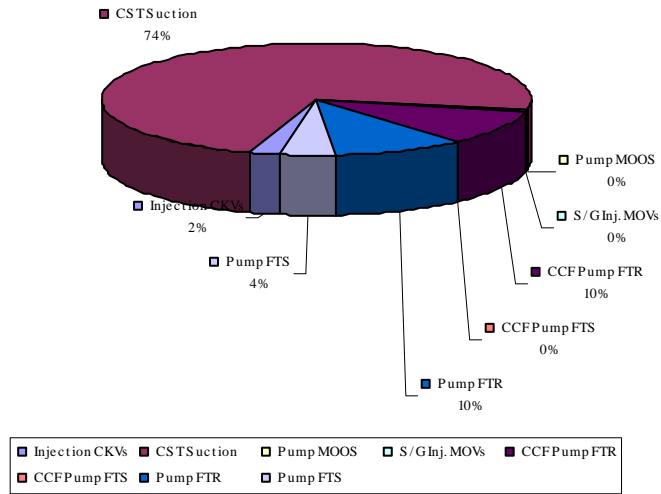


Figure 29. Segment failure distribution, 8-hour mission Design Class 10.

AFW Class 11

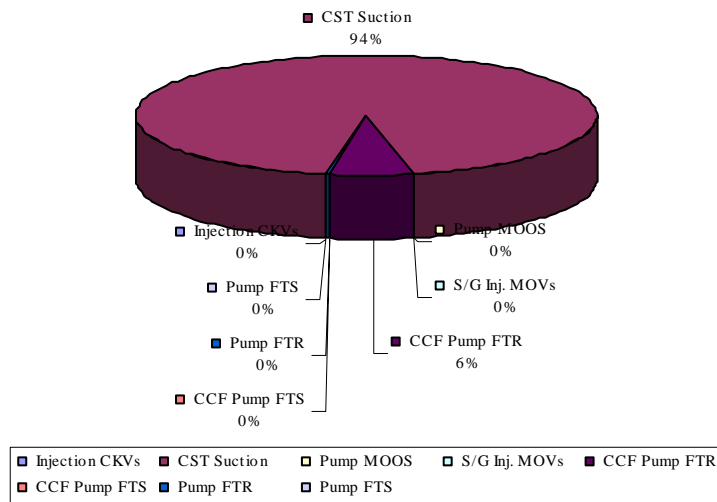


Figure 30. Segment failure distribution, 8-hour mission Design Class 11.

3.2 Failure Cause and Discovery Method Summary

The raw failure data were sliced to show the distribution of the failure causes and the discovery methods by the affected segment.

3.2.1 Leading Segment Failures.

The turbine-driven pump (34%) and the motor-driven pump (21%) were the leading segment failures identified in the database. See [Table 7](#).

3.2.2 Leading Discovery Methods

Periodic surveillance (33%) and unplanned demand (38%) were the leading methods of discovery. See [Table 7](#).

3.2.3 Leading Causes of Failure.

Forty percent of the failures in the AFW system observed in the experience were attributed to hardware-related problems. Personnel errors caused 20% of all AFW system failures. However, most of these failures were immediately identified and either recovered or were recoverable, meaning that the failures were of the nature where plant personnel were able to respond to the failures immediately after they occurred. See [Table 9](#).

Table 7. Comparison of failed segment with the method of discovery.²

Segments	Actual/ unplanned demand	Alarm/ indicator	Inspection/ review	Maintenance on system	Other (not counted) surveillance test	Periodic surveillance on system	Post- maintenance testing	Total	Percent
Common feed control segment	5		2			10		17	7%
Diesel-driven pump	1		1					2	1%
Instrumentation and control			6			1		7	3%
Motor-driven pump	21		10	2	1	15		49	21%
Motor-driven pump feed segment	25	2	15			3		45	19%
Pump suction	1		1					2	1%
Steam generator feed segment	3							3	1%
Turbine-driven pump	32		7	2		36	3	80	34%
Turbine-driven pump feed segment	1		7			4		12	5%
Turbine-driven pump steam supply	1		8			9		18	8%
Total	90	2	57	4	1	78	3	235	100%
Percent	38%	1%	24%	2%	0%	33%	1%	100%	

² The discovery method is the activity that is ongoing at the time of the failure.

Table 8. Discovery method description.

Discovery Method	Description	Used in the Failure Calculations
Actual/unplanned demand	The demand for the system was ESF, inadvertent. If the demand was inadvertent, the demand should mimic an ESF demand.	✓
Design review	Because of a design review, a deficiency was noted in the system.	
Periodic surveillance on subject system	Normally scheduled surveillance. These surveillances are to satisfy scheduled Technical Specification requirements.	✓
Maintenance on subject system	The failed condition was discovered during maintenance on the system. These include latent failures as well as maintenance-induced failures.	
Inspection/review	The failure was discovered during operator duties such as walk downs, inspections, etc.	
Alarm/indicator	The failure was evidenced by an alarm or by other indications.	
I&C functional test	The failure was discovered during testing of the instrumentation and control system for the subject system or another system.	
Post-maintenance testing	Failed condition was discovered during post-maintenance testing. The technical specification surveillance tests can be used for this testing, but cannot be counted.	
Unscheduled TS required surveillance	Failed condition was discovered during technical specification required testing. Tests are performed to show system operability per the technical specifications and are not scheduled. The technical specification surveillance tests can be used for this testing, but cannot be counted.	
Other (not counted) surveillance test	All others discovered by testing.	

Table 9. Comparison of failed segment and failure cause.³

Segments	Design	Environ- ment	Gas- Binding	Hardware	Mainten- ance	Personnel	Procedure	Support System	Water Accumu- lation	Total	Percent
Common feed control segment	1			14		2				17	7%
Diesel-driven pump				1		1				2	1%
Instrumentation and control				3	2		2			7	3%
Motor-driven pump	8		1	16	5	11	7	1		49	21%
Motor-driven pump feed segment	4	4		17	6	14				45	19%
Pump suction				1			1			2	1%
Steam generator feed segment				3						3	1%
Turbine-driven pump	6			35	13	9	9		8	80	34%
Turbine-driven pump feed segment				1	5	5	1			12	5%
Turbine-driven pump steam supply	4			4	2	6	1		1	18	8%
Total	23	4	1	95	33	48	21	1	9	235	100%
Percent	10%	2%	0%	40%	14%	20%	9%	0%	4%	100%	

- Contamination–The failure was the result of foreign material affecting the component.
- Design–The failure was the result of a flawed design.
- Hardware–The failure was the result of some aspect of the equipment. Typically, this is used for normal wear of the component.
- Personnel–The failure was the result of personnel error, by either commission or omission.
- Procedure–The failure was the result of an incorrect procedure.
- Gas Binding–The failure was the result of gases coming out of solution in the pump suction. This cause is used only in the AFW and HPI studies.

³ The cause of the failure is assigned to a broadly defined cause classification. The cause classifications are design, environment, hardware (e.g., aging, wear, manufacturing defects), personnel, and procedure. The cause classification assigned is based on the immediate cause of the failure and not the root cause. Generally, root cause is only determined through a detailed investigation and analysis of the failure. Specifically, the mechanism that actually resulted in the failure of the segment or component is captured as the cause.

- Environment–The failure was the result of the environment; room cooling and contaminated water are two examples.
- Support System–The failure was the result of a support system failure. These events do not count for the failure probability. Support systems include electricity and air.
- Water Accumulation–The failure was due to water accumulation in the turbine-driven pump steam.

4 DATA TABLES

4.1 Data Tables for Unreliability and Unavailability Trends

Table 10. Plot data table for AFW system unavailability, FTS model, Figure 3.

FY	Plot Trend Error Bar Points			Regression Curve Data Points		
	Lower (5%)	Mean	Upper (95%)	Lower (5%)	Mean	Upper (95%)
1987	5.96E-06	1.99E-04	7.59E-04	1.91E-04	2.14E-04	2.40E-04
1988	1.44E-05	3.23E-04	1.19E-03	1.93E-04	2.15E-04	2.39E-04
1989	5.59E-06	2.00E-04	7.66E-04	1.96E-04	2.16E-04	2.38E-04
1990	5.70E-06	2.10E-04	8.03E-04	1.98E-04	2.17E-04	2.37E-04
1991	5.28E-06	2.01E-04	7.71E-04	2.01E-04	2.18E-04	2.36E-04
1992	5.02E-06	1.91E-04	7.34E-04	2.03E-04	2.19E-04	2.36E-04
1993	5.38E-06	2.09E-04	8.04E-04	2.05E-04	2.20E-04	2.35E-04
1994	5.45E-06	2.13E-04	8.16E-04	2.07E-04	2.21E-04	2.35E-04
1995	6.00E-06	2.25E-04	8.61E-04	2.08E-04	2.22E-04	2.36E-04
1996	5.66E-06	2.11E-04	8.10E-04	2.10E-04	2.23E-04	2.36E-04
1997	6.31E-06	2.26E-04	8.66E-04	2.10E-04	2.24E-04	2.38E-04
1998	5.52E-06	2.24E-04	8.60E-04	2.11E-04	2.25E-04	2.39E-04
1999	5.41E-06	2.18E-04	8.39E-04	2.11E-04	2.25E-04	2.41E-04
2000	5.72E-06	2.25E-04	8.65E-04	2.10E-04	2.26E-04	2.44E-04
2001	5.79E-06	2.28E-04	8.77E-04	2.10E-04	2.27E-04	2.47E-04
2002	6.50E-06	2.40E-04	9.19E-04	2.09E-04	2.28E-04	2.50E-04
2003	6.82E-06	2.48E-04	9.50E-04	2.08E-04	2.29E-04	2.53E-04
2004	6.37E-06	2.39E-04	9.17E-04	2.07E-04	2.30E-04	2.56E-04
2005	5.54E-06	2.24E-04	8.62E-04	2.06E-04	2.32E-04	2.60E-04

Table 11. Plot data table for AFW system unreliability, 8-hour mission, Figure 6.

FY	Plot Trend Error Bar Points			Regression Curve Data Points		
	Lower (5%)	Mean	Upper (95%)	Lower (5%)	Mean	Upper (95%)
1987	1.15E-05	3.36E-04	1.27E-03	2.43E-04	3.81E-04	5.96E-04
1988	2.96E-05	7.56E-04	2.83E-03	2.65E-04	4.01E-04	6.06E-04
1989	1.09E-05	3.19E-04	1.21E-03	2.89E-04	4.22E-04	6.17E-04
1990	1.18E-05	3.75E-04	1.42E-03	3.15E-04	4.45E-04	6.29E-04
1991	3.58E-05	1.10E-03	4.19E-03	3.42E-04	4.69E-04	6.43E-04
1992	1.03E-05	3.18E-04	1.21E-03	3.70E-04	4.94E-04	6.59E-04
1993	1.13E-05	6.31E-04	2.44E-03	3.99E-04	5.20E-04	6.78E-04
1994	1.21E-05	4.03E-04	1.53E-03	4.27E-04	5.48E-04	7.02E-04
1995	1.33E-05	4.43E-04	1.69E-03	4.55E-04	5.77E-04	7.31E-04
1996	3.24E-05	8.64E-04	3.24E-03	4.81E-04	6.08E-04	7.67E-04
1997	1.46E-05	6.25E-04	2.41E-03	5.05E-04	6.40E-04	8.11E-04
1998	1.75E-05	4.62E-04	1.73E-03	5.26E-04	6.74E-04	8.64E-04
1999	1.25E-05	4.41E-04	1.68E-03	5.45E-04	7.10E-04	9.27E-04
2000	1.24E-05	4.00E-04	1.52E-03	5.61E-04	7.48E-04	9.99E-04
2001	4.52E-05	1.35E-03	5.12E-03	5.75E-04	7.88E-04	1.08E-03
2002	1.87E-05	7.01E-04	2.69E-03	5.88E-04	8.30E-04	1.17E-03
2003	1.75E-05	7.16E-04	2.75E-03	5.99E-04	8.75E-04	1.28E-03
2004	1.86E-05	1.28E-03	4.95E-03	6.10E-04	9.21E-04	1.39E-03
2005	5.34E-05	1.69E-03	6.43E-03	6.20E-04	9.71E-04	1.52E-03

4.2 Data Tables for Failure and Demand Trends

Table 12. LER listing for demand trend, Figure 7.

FY	Plant Name	LER	Event Date
1987	Arkansas 1	3131987002	5/17/1987
1987	Arkansas 1	3131987003	8/8/1987
1987	Arkansas 1	3131987004	8/15/1987
1987	Arkansas 1	3131987005	8/25/1987
1988	Arkansas 1	3131988003	2/17/1988
1989	Arkansas 1	3131989002	1/20/1989
1989	Arkansas 1	3131989020	5/30/1989
1990	Arkansas 1	3131989041	12/21/1989
1990	Arkansas 1	3131989048	12/28/1989
1991	Arkansas 1	3131991003	4/21/1991
1991	Arkansas 1	3131991005	5/21/1991
1992	Arkansas 1	3131992003	4/24/1992
1994	Arkansas 1	3131994002	4/11/1994
1995	Arkansas 1	3131995004	4/3/1995
1996	Arkansas 1	3131996005	5/19/1996
1996	Arkansas 1	3131996007	9/12/1996
1997	Arkansas 1	3131997003	7/8/1997
1998	Arkansas 1	3131998004	9/23/1998
1999	Arkansas 1	3131998005	12/25/1998
1999	Arkansas 1	3131999003	9/11/1999
2003	Arkansas 1	3132003001	8/29/2003
1987	Arkansas 2	3681987007	9/9/1987
1988	Arkansas 2	3681987008	11/14/1987
1988	Arkansas 2	3681988011	8/1/1988
1989	Arkansas 2	3681988020	12/1/1988
1989	Arkansas 2	3681989006	4/18/1989
1990	Arkansas 2	3681989024	12/31/1989
1990	Arkansas 2	3681990019	8/21/1990
1990	Arkansas 2	3681990020	9/28/1990
1991	Arkansas 2	3681991005	2/1/1991
1998	Arkansas 2	3681998002	5/20/1998
1987	Beaver Valley 1	3341987002	2/7/1987
1987	Beaver Valley 1	3341987013	6/9/1987
1988	Beaver Valley 1	3341988007	6/7/1988
1988	Beaver Valley 1	3341988008	6/9/1988
1988	Beaver Valley 1	3341988009	6/11/1988
1989	Beaver Valley 1	3341989001	1/17/1989
1989	Beaver Valley 1	3341989002	2/13/1989
1989	Beaver Valley 1	3341989007	5/18/1989
1990	Beaver Valley 1	3341990007	3/30/1990
1991	Beaver Valley 1	3341991022	7/20/1991
1991	Beaver Valley 1	3341991023	7/27/1991
1992	Beaver Valley 1	3341991029	11/6/1991
1993	Beaver Valley 1	3341992009	10/9/1992
1994	Beaver Valley 1	3341993013	10/12/1993
1994	Beaver Valley 1	3341994005	6/1/1994
1994	Beaver Valley 1	3341994008	7/19/1994
1996	Beaver Valley 1	3341996003	3/22/1996
1996	Beaver Valley 1	3341996007	5/6/1996
1996	Beaver Valley 1	3341996008	5/31/1996
1997	Beaver Valley 1	3341997005	3/19/1997
1997	Beaver Valley 1	3341997025	8/7/1997
1999	Beaver Valley 1	3341999001	1/23/1999
1999	Beaver Valley 1	3341999010	9/6/1999
2000	Beaver Valley 1	3342000006	7/5/2000
2003	Beaver Valley 1	3342002002	11/11/2002
2003	Beaver Valley 1	3342003001	2/24/2003
2004	Beaver Valley 1	3342004901	9/10/2004
1987	Beaver Valley 2	4121987005	7/17/1987
1987	Beaver Valley 2	4121987014	8/15/1987
1987	Beaver Valley 2	4121987015	8/15/1987
1987	Beaver Valley 2	4121987017	8/16/1987
1987	Beaver Valley 2	4121987019	8/25/1987
1987	Beaver Valley 2	4121987020	9/9/1987
1987	Beaver Valley 2	4121987023	9/28/1987
1987	Beaver Valley 2	4121987024	9/29/1987
1987	Beaver Valley 2	4121987025	9/30/1987
1988	Beaver Valley 2	4121987026	10/8/1987
1988	Beaver Valley 2	4121987028	10/14/1987
1988	Beaver Valley 2	4121987030	10/16/1987
1988	Beaver Valley 2	4121987032	10/24/1987
1988	Beaver Valley 2	4121987034	10/29/1987
1988	Beaver Valley 2	4121987035	11/10/1987
1988	Beaver Valley 2	4121987036	11/17/1987
1988	Beaver Valley 2	4121988002	1/27/1988
1988	Beaver Valley 2	4121988007	4/4/1988
1988	Beaver Valley 2	4121988009	7/27/1988
1988	Beaver Valley 2	4121988011	8/23/1988
1988	Beaver Valley 2	4121988013	9/20/1988
1989	Beaver Valley 2	4121989003	2/12/1989
1989	Beaver Valley 2	4121989015	5/14/1989
1989	Beaver Valley 2	4121989019	6/22/1989
1989	Beaver Valley 2	4121989020	6/22/1989
1990	Beaver Valley 2	4121990008	7/2/1990
1992	Beaver Valley 2	4121991005	11/26/1991
1992	Beaver Valley 2	4121992007	5/5/1992
1992	Beaver Valley 2	4121992009	6/5/1992
1993	Beaver Valley 2	4121993002	1/30/1993
1995	Beaver Valley 2	4121995006	8/13/1995
2000	Beaver Valley 2	4122000001	9/23/2000
2001	Beaver Valley 2	4122001001	3/17/2001
2004	Beaver Valley 2	4122003003	10/14/2003
1987	Braidwood 1	4561987046	9/10/1987
1988	Braidwood 1	4561987060	12/6/1987
1988	Braidwood 1	4561988016	8/11/1988
1989	Braidwood 1	4561988022	10/16/1988
1989	Braidwood 1	4561988023	10/17/1988
1989	Braidwood 1	4561988025	11/15/1988
1989	Braidwood 1	4561989004	3/6/1989
1990	Braidwood 1	4561990001	1/12/1990
1990	Braidwood 1	4561990008	6/8/1990
1991	Braidwood 1	4561990021	12/1/1990
1991	Braidwood 1	4561990023	12/30/1990
1992	Braidwood 1	4561991012	11/6/1991
1993	Braidwood 1	4561993001	1/7/1993
1994	Braidwood 1	4561994012	8/11/1994
1995	Braidwood 1	4561995004	4/9/1995
1988	Braidwood 2	4571988012	6/20/1988
1988	Braidwood 2	4571988013	6/21/1988
1988	Braidwood 2	4571988014	6/22/1988

FY	Plant Name	LER	Event Date
1988	Braidwood 2	4571988016	6/24/1988
1988	Braidwood 2	4571988018	7/2/1988
1988	Braidwood 2	4571988019	7/24/1988
1988	Braidwood 2	4571988020	9/4/1988
1989	Braidwood 2	4571988028	11/17/1988
1989	Braidwood 2	4571988029	10/25/1988
1989	Braidwood 2	4571988031	11/5/1988
1989	Braidwood 2	4571989002	5/11/1989
1989	Braidwood 2	4571989004	9/7/1989
1989	Braidwood 2	4571989004	9/7/1989
1990	Braidwood 2	4571990010	6/9/1990
1991	Braidwood 2	4571991003	8/1/1991
1992	Braidwood 2	4571991006	12/1/1991
1992	Braidwood 2	4571992001	2/25/1992
1992	Braidwood 2	4571992002	3/15/1992
1992	Braidwood 2	4571992006	9/10/1992
1993	Braidwood 2	4571992007	11/14/1992
1994	Braidwood 2	4571993007	10/3/1993
1994	Braidwood 2	4571994003	4/5/1994
1994	Braidwood 2	4571994005	8/2/1994
1996	Braidwood 2	4571996005	5/6/1996
1999	Braidwood 2	4571999001	4/14/1999
2000	Braidwood 2	4572000002	4/15/2000
2001	Braidwood 2	4572001001	5/19/2001
2004	Braidwood 2	4572003004	12/3/2003
2005	Braidwood 2	4572004002	12/22/2004
2005	Braidwood 2	4572005002	3/28/2005
1987	Byron 1	4541987018	8/11/1987
1987	Byron 1	4541987019	8/12/1987
1988	Byron 1	4541988002	4/18/1988
1988	Byron 1	4541988004	7/16/1988
1988	Byron 1	4541988005	8/4/1988
1989	Byron 1	4541989002	1/31/1989
1990	Byron 1	4541990006	5/3/1990
1990	Byron 1	4541990011	8/19/1990
1991	Byron 1	4541990014	12/3/1990
1992	Byron 1	4541992001	1/29/1992
1996	Byron 1	4541996011	7/2/1996
1999	Byron 1	4541999003	5/13/1999
2003	Byron 1	4542002003	11/7/2002
1987	Byron 2	4551987005	3/31/1987
1987	Byron 2	4551987006	4/27/1987
1987	Byron 2	4551987007	5/4/1987
1987	Byron 2	4551987009	6/29/1987
1987	Byron 2	4551987011	7/25/1987
1988	Byron 2	4551987018	10/1/1987
1988	Byron 2	4551988004	5/6/1988
1988	Byron 2	4551988006	6/2/1988
1988	Byron 2	4551988008	7/14/1988
1988	Byron 2	4551988009	7/15/1988
1989	Byron 2	4551988012	12/15/1988
1990	Byron 2	4551990001	1/18/1990
1991	Byron 2	4551990010	12/20/1990
1992	Byron 2	4551991005	11/7/1991
1992	Byron 2	4551992003	6/10/1992
1993	Byron 2	4551993003	5/11/1993
1994	Byron 2	4551994003	9/24/1994
1998	Byron 2	4551997003	10/10/1997
2000	Byron 2	4552000001	1/13/2000
2000	Byron 2	4552000002	7/26/2000
2001	Byron 2	4552001002	6/26/2001
1988	Callaway	4831987032	11/8/1987

FY	Plant Name	LER	Event Date
1988	Callaway	4831988001	1/4/1988
1988	Callaway	4831988004	2/13/1988
1988	Callaway	4831988005	4/17/1988
1988	Callaway	4831988006	4/21/1988
1988	Callaway	4831988007	5/2/1988
1988	Callaway	4831988010	9/3/1988
1989	Callaway	4831988015	11/16/1988
1989	Callaway	4831989003	3/31/1989
1989	Callaway	4831989005	5/18/1989
1989	Callaway	4831989006	5/29/1989
1989	Callaway	4831989008	6/23/1989
1990	Callaway	4831990005	5/1/1990
1990	Callaway	4831990007	6/11/1990
1991	Callaway	4831990015	11/19/1990
1991	Callaway	4831990016	11/24/1990
1991	Callaway	4831990017	12/30/1990
1992	Callaway	4831991006	11/5/1991
1992	Callaway	4831992002	1/22/1992
1992	Callaway	4831992003	1/23/1992
1992	Callaway	4831992004	3/20/1992
1992	Callaway	4831992006	5/15/1992
1992	Callaway	4831992007	5/23/1992
1992	Callaway	4831992010	9/20/1992
1995	Callaway	4831995004	6/8/1995
1995	Callaway	4831995005	8/16/1995
1992	Callaway	4831995006	4/10/1992
1996	Callaway	4831996001	4/2/1996
1997	Callaway	4831996003	10/12/1996
1997	Callaway	4831996005	11/11/1996
1997	Callaway	4831996006	12/5/1996
1999	Callaway	4831999003	8/11/1999
1999	Callaway	4831999006	8/13/1999
2000	Callaway	4831999008	11/26/1999
2001	Callaway	4832001003	3/9/2001
2001	Callaway	4832001005	9/17/2001
2002	Callaway	4832002001	12/3/2001
2003	Callaway	4832002014	12/14/2002
2004	Callaway	4832004002	1/27/2004
2004	Callaway	4832004003	2/3/2004
2004	Callaway	4832004005	2/15/2004
2005	Callaway	4832005001	1/19/2005
2005	Callaway	4832005003	3/29/2005
1987	Calvert Cliffs 1	3171987003	1/27/1987
1987	Calvert Cliffs 1	3171987012	7/23/1987
1988	Calvert Cliffs 1	3171987015	11/11/1987
1988	Calvert Cliffs 1	3171988009	8/24/1988
1989	Calvert Cliffs 1	3171988012	11/14/1988
1992	Calvert Cliffs 1	3171991003	10/1/1991
1993	Calvert Cliffs 1	3171992008	11/24/1992
1994	Calvert Cliffs 1	3171994001	1/24/1994
1994	Calvert Cliffs 1	3171994006	6/16/1994
1994	Calvert Cliffs 1	3171994007	7/19/1994
1995	Calvert Cliffs 1	3171995002	6/16/1995
1996	Calvert Cliffs 1	3171995006	11/16/1995
1999	Calvert Cliffs 1	3171999006	9/22/1999
2000	Calvert Cliffs 1	3172000005	9/10/2000
2004	Calvert Cliffs 1	3172004001	3/20/2004
1987	Calvert Cliffs 2	3181987002	2/28/1987
1987	Calvert Cliffs 2	3181987006	9/7/1987
1988	Calvert Cliffs 2	3181987008	11/22/1987
1988	Calvert Cliffs 2	3181987009	12/21/1987

FY	Plant Name	LER	Event Date
1988	Calvert Cliffs 2	3181988002	1/22/1988
1988	Calvert Cliffs 2	3181988004	4/27/1988
1992	Calvert Cliffs 2	3181992001	1/2/1992
1992	Calvert Cliffs 2	3181992003	6/24/1992
1992	Calvert Cliffs 2	3181992005	8/1/1992
1992	Calvert Cliffs 2	3181992006	8/17/1992
1992	Calvert Cliffs 2	3181992007	9/29/1992
1994	Calvert Cliffs 2	3181994001	1/12/1994
1995	Calvert Cliffs 2	3181995002	1/13/1995
1995	Calvert Cliffs 2	3181995003	1/15/1995
1996	Calvert Cliffs 2	3181996001	2/27/1996
1997	Calvert Cliffs 2	3181996005	11/17/1996
1987	Catawba 1	4131987006	1/31/1987
1987	Catawba 1	4131987013	3/16/1987
1987	Catawba 1	4131987015	4/9/1987
1987	Catawba 1	4131987026	7/6/1987
1987	Catawba 1	4131987028	7/11/1987
1987	Catawba 1	4131987029	7/13/1987
1987	Catawba 1	4131987034	8/23/1987
1988	Catawba 1	4131988007	1/23/1988
1989	Catawba 1	4131989003	2/6/1989
1989	Catawba 1	4131989008	3/5/1989
1989	Catawba 1	4131989017	6/26/1989
1989	Catawba 1	4131989022	8/24/1989
1991	Catawba 1	4131991013	6/20/1991
1991	Catawba 1	4131991015	7/10/1991
1991	Catawba 1	4131991018	9/6/1991
1991	Catawba 1	4131991019	9/11/1991
1992	Catawba 1	4131991021	10/2/1991
1992	Catawba 1	4131992008	7/12/1992
1993	Catawba 1	4131993006	6/12/1993
1993	Catawba 1	4131993008	7/19/1993
1994	Catawba 1	4131994001	1/11/1994
1996	Catawba 1	4131996005	6/13/1996
2000	Catawba 1	4132000001	2/13/2000
2003	Catawba 1	4132003001	2/4/2003
2003	Catawba 1	4132003005	8/29/2003
1987	Catawba 2	4141987002	1/28/1987
1987	Catawba 2	4141987003	1/30/1987
1987	Catawba 2	4141987007	2/24/1987
1987	Catawba 2	4141987010	3/23/1987
1987	Catawba 2	4141987011	3/24/1987
1987	Catawba 2	4141987013	3/25/1987
1987	Catawba 2	4141987018	5/6/1987
1987	Catawba 2	4141987019	5/8/1987
1987	Catawba 2	4141987021	7/27/1987
1987	Catawba 2	4141987022	7/28/1987
1987	Catawba 2	4141987024	8/7/1987
1987	Catawba 2	4141987025	9/3/1987
1987	Catawba 2	4141987027	9/15/1987
1988	Catawba 2	4141987029	11/3/1987
1988	Catawba 2	4141988007	2/22/1988
1988	Catawba 2	4141988012	3/9/1988
1988	Catawba 2	4141988014	3/17/1988
1988	Catawba 2	4141988017	4/24/1988
1988	Catawba 2	4141988019	5/27/1988
1988	Catawba 2	4141988020	5/28/1988
1988	Catawba 2	4141988021	6/3/1988
1988	Catawba 2	4141988022	6/6/1988
1988	Catawba 2	4141988023	6/20/1988
1988	Catawba 2	4141988025	6/26/1988

FY	Plant Name	LER	Event Date
1988	Catawba 2	4141988028	9/29/1988
1989	Catawba 2	4141988031	11/23/1988
1989	Catawba 2	4141988032	11/24/1988
1989	Catawba 2	4141989001	1/12/1989
1989	Catawba 2	4141989002	1/21/1989
1989	Catawba 2	4141989003	2/21/1989
1989	Catawba 2	4141989004	2/21/1989
1989	Catawba 2	4141989015	6/9/1989
1991	Catawba 2	4141990013	10/7/1990
1991	Catawba 2	4141991006	4/16/1991
1991	Catawba 2	4141991008	5/29/1991
1992	Catawba 2	4141991012	10/17/1991
1992	Catawba 2	4141992001	1/15/1992
1993	Catawba 2	4141992006	12/14/1992
1993	Catawba 2	4141993003	9/25/1993
1994	Catawba 2	4141994003	7/10/1994
1994	Catawba 2	4141994005	8/30/1994
1994	Catawba 2	4141994006	9/13/1994
1995	Catawba 2	4141994007	10/18/1994
1995	Catawba 2	4141995001	2/21/1995
1995	Catawba 2	4141995004	4/27/1995
1995	Catawba 2	4141995005	5/1/1995
1996	Catawba 2	4141996001	2/6/1996
1997	Catawba 2	4141997006	8/17/1997
1998	Catawba 2	4141998004	9/6/1998
2000	Catawba 2	4141999006	12/30/1999
2000	Catawba 2	4142000003	6/5/2000
2002	Catawba 2	4142001003	12/7/2001
2005	Catawba 2	4142004002	10/28/2004
1990	Comanche Peak 1	4451990004	3/12/1990
1990	Comanche Peak 1	4451990009	4/21/1990
1990	Comanche Peak 1	4451990013	5/9/1990
1990	Comanche Peak 1	4451990017	5/27/1990
1990	Comanche Peak 1	4451990020	7/26/1990
1990	Comanche Peak 1	4451990021	7/30/1990
1990	Comanche Peak 1	4451990023	8/8/1990
1990	Comanche Peak 1	4451990025	8/25/1990
1990	Comanche Peak 1	4451990027	9/7/1990
1990	Comanche Peak 1	4451990028	9/8/1990
1990	Comanche Peak 1	4451990029	9/10/1990
1990	Comanche Peak 1	4451990030	9/15/1990
1991	Comanche Peak 1	4451991002	1/23/1991
1991	Comanche Peak 1	4451991004	2/10/1991
1991	Comanche Peak 1	4451991008	3/17/1991
1991	Comanche Peak 1	4451991019	6/9/1991
1991	Comanche Peak 1	4451991020	7/13/1991
1991	Comanche Peak 1	4451991021	7/28/1991
1991	Comanche Peak 1	4451991022	9/4/1991
1992	Comanche Peak 1	4451991023	10/3/1991
1992	Comanche Peak 1	4451992001	1/8/1992
1992	Comanche Peak 1	4451992009	5/8/1992
1992	Comanche Peak 1	4451992014	6/11/1992
1992	Comanche Peak 1	4451992016	6/23/1992
1992	Comanche Peak 1	4451992020	7/20/1992
1993	Comanche Peak 1	4451992022	10/12/1992
1993	Comanche Peak 1	4451993001	1/18/1993
1993	Comanche Peak 1	4451993002	1/24/1993
1993	Comanche Peak 1	4451993007	6/26/1993
1995	Comanche Peak 1	4451995002	6/5/1995
1995	Comanche Peak 1	4451995003	6/11/1995
1991	Comanche Peak 1	4451995007	4/13/1991

FY	Plant Name	LER	Event Date
1996	Comanche Peak 1	4451996001	1/17/1996
1996	Comanche Peak 1	4451996002	1/22/1996
1996	Comanche Peak 1	4451996003	2/4/1996
1996	Comanche Peak 1	4451996007	8/9/1996
1998	Comanche Peak 1	4451997009	10/27/1997
2003	Comanche Peak 1	4452003002	3/16/2003
2003	Comanche Peak 1	4452003003	5/15/2003
2003	Comanche Peak 2	4452003003	5/15/2003
1993	Comanche Peak 2	4461993003	5/4/1993
1994	Comanche Peak 2	4461993008	10/1/1993
1994	Comanche Peak 2	4461993011	11/17/1993
1994	Comanche Peak 2	4461994003	3/5/1994
1994	Comanche Peak 2	4461994010	6/27/1994
1994	Comanche Peak 2	4461994012	8/15/1994
1996	Comanche Peak 2	4461995004	12/5/1995
1996	Comanche Peak 2	4461996003	2/23/1996
1996	Comanche Peak 2	4461996005	5/5/1996
1996	Comanche Peak 2	4461996006	9/18/1996
1997	Comanche Peak 2	4461996007	10/18/1996
1997	Comanche Peak 2	4461997001	4/15/1997
1998	Comanche Peak 2	4461997002	10/25/1997
1998	Comanche Peak 2	4461998002	3/8/1998
1999	Comanche Peak 2	4461999002	1/3/1999
1999	Comanche Peak 2	4461999004	5/22/1999
2000	Comanche Peak 2	4462000002	1/7/2000
2001	Comanche Peak 2	4462001001	7/18/2001
2002	Comanche Peak 2	4462002001	6/6/2002
2003	Comanche Peak 2	4462003001	7/9/2003
2003	Comanche Peak 2	4462003002	7/25/2003
2004	Comanche Peak 2	4462003005	12/22/2003
2005	Comanche Peak 2	4462004002	10/19/2004
2005	Comanche Peak 2	4462005002	2/23/2005
1987	Cook 1	3151987008	6/4/1987
1988	Cook 1	3151987021	10/13/1987
1988	Cook 1	3151988001	1/13/1988
1989	Cook 1	3151988011	10/19/1988
1989	Cook 1	3151988013	11/23/1988
1989	Cook 1	3151989001	1/16/1989
1989	Cook 1	3151989003	3/18/1989
1991	Cook 1	3151991004	5/12/1991
1995	Cook 1	3151995003	7/14/1995
1996	Cook 1	3151996002	3/17/1996
1997	Cook 1	3151997025	9/23/1997
2002	Cook 1	3152002005	6/14/2002
2003	Cook 1	3152003001	1/15/2003
2005	Cook 1	3152005001	4/26/2005
1987	Cook 2	3161987004	6/1/1987
1987	Cook 2	3161987005	6/2/1987
1987	Cook 2	3161987007	7/14/1987
1987	Cook 2	3161987008	7/22/1987
1989	Cook 2	3161989014	8/14/1989
1990	Cook 2	3161990004	6/11/1990
1991	Cook 2	3161990012	12/12/1990
1991	Cook 2	3161990013	12/15/1990
1991	Cook 2	3161991004	3/13/1991
1991	Cook 2	3161991006	8/1/1991
1992	Cook 2	3161991010	11/15/1991
1993	Cook 2	3161993007	8/2/1993
1994	Cook 2	3161994001	2/21/1994
1994	Cook 2	3161994005	8/15/1994
1995	Cook 2	3161994008	12/11/1994

FY	Plant Name	LER	Event Date
1995	Cook 2	3161995002	2/23/1995
1995	Cook 2	3161995004	8/26/1995
1995	Cook 2	3161995005	8/29/1995
1996	Cook 2	3161996005	5/8/1996
1997	Cook 2	3161997001	3/11/1997
2002	Cook 2	3162002004	1/19/2002
2002	Cook 2	3162002005	5/12/2002
2002	Cook 2	3162002006	7/22/2002
2003	Cook 2	3162003002	2/5/2003
2004	Cook 2	3162004001	3/29/2004
2004	Cook 2	3162004002	4/8/2004
1988	Crystal River 3	3021988001	1/9/1988
1988	Crystal River 3	3021988002	1/7/1988
1988	Crystal River 3	3021988006	2/28/1988
1989	Crystal River 3	3021988024	10/28/1988
1989	Crystal River 3	3021989003	1/15/1989
1989	Crystal River 3	3021989022	6/14/1989
1989	Crystal River 3	3021989023	6/16/1989
1989	Crystal River 3	3021989025	6/29/1989
1991	Crystal River 3	3021990016	10/10/1990
1991	Crystal River 3	3021991003	4/20/1991
1992	Crystal River 3	3021991014	11/25/1991
1992	Crystal River 3	3021991016	11/25/1991
1992	Crystal River 3	3021991018	12/8/1991
1992	Crystal River 3	3021992001	3/27/1992
1992	Crystal River 3	3021992015	7/17/1992
1993	Crystal River 3	3021992027	12/29/1992
1993	Crystal River 3	3021993009	9/18/1993
1996	Crystal River 3	3021996017	5/31/1996
1998	Crystal River 3	3021998003	2/11/1998
2000	Crystal River 3	3021999004	10/1/1999
2002	Crystal River 3	3022001005	10/24/2001
2004	Crystal River 3	3022003005	11/5/2003
2004	Crystal River 3	3022004001	3/24/2004
2004	Crystal River 3	3022004003	9/6/2004
2004	Crystal River 3	3022004901	9/8/2004
1987	Davis-Besse	3461987006	3/13/1987
1987	Davis-Besse	3461987011	9/6/1987
1992	Davis-Besse	3461991008	12/10/1991
1994	Davis-Besse	3461993005	10/8/1993
1998	Davis-Besse	3461998006	6/24/1998
1999	Davis-Besse	3461998011	10/14/1998
1987	Diablo Canyon 1	2751987004	3/15/1987
1987	Diablo Canyon 1	2751987006	5/11/1987
1988	Diablo Canyon 1	2751987023	12/13/1987
1988	Diablo Canyon 1	2751987024	12/13/1987
1988	Diablo Canyon 1	2751988002	1/8/1988
1988	Diablo Canyon 1	2751988025	8/30/1988
1990	Diablo Canyon 1	2751989009	10/6/1989
1990	Diablo Canyon 1	2751989015	12/14/1989
1990	Diablo Canyon 1	2751990002	2/20/1990
1990	Diablo Canyon 1	2751990005	6/14/1990
1991	Diablo Canyon 1	2751990014	12/5/1990
1991	Diablo Canyon 1	2751990017	12/24/1990
1991	Diablo Canyon 1	2751991002	2/1/1991
1991	Diablo Canyon 1	2751991007	4/23/1991
1991	Diablo Canyon 1	2751991009	5/17/1991
1992	Diablo Canyon 1	2751992002	3/6/1992
1992	Diablo Canyon 1	2751992004	4/25/1992
1994	Diablo Canyon 1	2751993011	12/26/1993
1995	Diablo Canyon 1	2751994020	12/14/1994

FY	Plant Name	LER	Event Date
1995	Diablo Canyon 1	2751995009	9/6/1995
1996	Diablo Canyon 1	2751995015	11/28/1995
1996	Diablo Canyon 1	2751995017	12/13/1995
1996	Diablo Canyon 1	2751996008	6/10/1996
1996	Diablo Canyon 1	2751996012	8/10/1996
1997	Diablo Canyon 1	2751996017	11/22/1996
1999	Diablo Canyon 1	2751999006	9/22/1999
1999	Diablo Canyon 1	2751999008	9/23/1999
2000	Diablo Canyon 1	2751999009	10/28/1999
2000	Diablo Canyon 1	2752000004	5/15/2000
2001	Diablo Canyon 1	2752000012	11/20/2000
2002	Diablo Canyon 1	2752002004	6/3/2002
1987	Diablo Canyon 2	3231987003	3/21/1987
1987	Diablo Canyon 2	3231987004	4/3/1987
1987	Diablo Canyon 2	3231987013	7/1/1987
1987	Diablo Canyon 2	3231987016	7/14/1987
1988	Diablo Canyon 2	3231987024	11/7/1987
1988	Diablo Canyon 2	3231988002	3/3/1988
1988	Diablo Canyon 2	3231988008	7/17/1988
1989	Diablo Canyon 2	3231989005	4/16/1989
1989	Diablo Canyon 2	3231989007	7/16/1989
1989	Diablo Canyon 2	3231989008	8/28/1989
1990	Diablo Canyon 2	3231989010	10/27/1989
1993	Diablo Canyon 2	3231993001	1/30/1993
1995	Diablo Canyon 2	3231994012	12/19/1994
1995	Diablo Canyon 2	3231995002	9/23/1995
1997	Diablo Canyon 2	3231997002	3/29/1997
1997	Diablo Canyon 2	3231997003	7/2/1997
1998	Diablo Canyon 2	3231997005	10/24/1997
1999	Diablo Canyon 2	3231998005	12/1/1998
2002	Diablo Canyon 2	3232002002	2/9/2002
2003	Diablo Canyon 2	3232002004	11/8/2002
2003	Diablo Canyon 2	3232003006	4/8/2003
1987	Farley 1	3481987002	1/8/1987
1987	Farley 1	3481987003	1/9/1987
1987	Farley 1	3481987004	1/22/1987
1987	Farley 1	3481987010	5/14/1987
1989	Farley 1	3481988021	10/21/1988
1990	Farley 1	3481989006	11/12/1989
1990	Farley 1	3481989007	11/12/1989
1990	Farley 1	3481990005	7/20/1990
1991	Farley 1	3481991006	5/24/1991
1991	Farley 1	3481991007	6/29/1991
1991	Farley 1	3481991008	8/2/1991
1991	Farley 1	3481991009	8/19/1991
1992	Farley 1	3481991010	10/3/1991
1993	Farley 1	3481992008	12/13/1992
1995	Farley 1	3481995001	1/13/1995
1995	Farley 1	3481995005	6/11/1995
1996	Farley 1	3481995010	11/5/1995
1996	Farley 1	3481996003	6/2/1996
1998	Farley 1	3481998004	9/9/1998
1999	Farley 1	3481999002	5/27/1999
2000	Farley 1	3482000002	3/4/2000
2000	Farley 1	3482000006	5/28/2000
2003	Farley 1	3482002002	10/15/2002
2003	Farley 1	3482003003	5/2/2003
2005	Farley 1	3482004002	11/5/2004
1987	Farley 2	3641987001	2/28/1987
1988	Farley 2	3641987009	12/3/1987
1989	Farley 2	3641989007	5/22/1989

FY	Plant Name	LER	Event Date
1989	Farley 2	3641989008	5/27/1989
1989	Farley 2	3641989010	9/20/1989
1990	Farley 2	3641989012	10/18/1989
1990	Farley 2	3641989015	11/18/1989
1990	Farley 2	3641990001	5/12/1990
1991	Farley 2	3641991001	4/1/1991
1991	Farley 2	3641991002	4/9/1991
1991	Farley 2	3641991004	4/20/1991
1991	Farley 2	3641991005	8/6/1991
1992	Farley 2	3641992001	1/22/1992
1992	Farley 2	3641992002	3/6/1992
1992	Farley 2	3641992005	5/12/1992
1992	Farley 2	3641992006	5/15/1992
1992	Farley 2	3641992007	5/25/1992
1992	Farley 2	3641992008	5/26/1992
1993	Farley 2	3641992010	10/20/1992
1994	Farley 2	3641993004	12/2/1993
1994	Farley 2	3641994001	8/5/1994
1995	Farley 2	3641994003	12/18/1994
1995	Farley 2	3641994004	1/13/1995
1995	Farley 2	3641995005	6/1/1995
1995	Farley 2	3641995007	6/25/1995
1996	Farley 2	3641995008	11/28/1995
1999	Farley 2	3641998007	11/16/1998
1991	Fort Calhoun	2851990026	11/19/1990
1992	Fort Calhoun	2851992023	7/3/1992
1993	Fort Calhoun	2851993011	6/24/1993
1994	Fort Calhoun	2851993018	12/6/1993
1994	Fort Calhoun	2851994001	2/11/1994
1988	GINNA	2441988003	3/10/1988
1988	GINNA	2441988005	6/1/1988
1988	GINNA	2441988006	7/16/1988
1989	GINNA	2441989004	6/1/1989
1990	GINNA	2441990007	5/10/1990
1990	GINNA	2441990010	6/9/1990
1990	GINNA	2441990012	9/26/1990
1991	GINNA	2441990013	12/11/1990
1991	GINNA	2441990018	12/20/1990
1991	GINNA	2441990019	12/21/1990
1992	GINNA	2441992002	2/3/1992
1992	GINNA	2441992003	2/29/1992
1994	GINNA	2441993006	11/10/1993
1994	GINNA	2441994007	4/27/1994
1996	GINNA	2441996002	3/7/1996
1996	GINNA	2441996004	3/9/1996
1996	GINNA	2441996008	7/7/1996
1996	GINNA	2441996010	8/6/1996
1996	GINNA	2441996011	8/7/1996
1996	GINNA	2441996012	8/20/1996
1999	GINNA	2441999006	4/21/1999
1999	GINNA	2441999007	4/23/1999
1999	GINNA	2441999008	4/27/1999
2001	GINNA	2442000005	10/21/2000
2003	GINNA	2442003002	8/14/2003
2004	GINNA	2442003005	10/15/2003
2005	GINNA	2442005001	2/16/2005
1990	Haddam Neck	2131990018	9/3/1990
1994	Haddam Neck	2131994018	7/11/1994
1995	Haddam Neck	2131995016	7/27/1995
1987	HARRIS	4001987005	1/22/1987
1987	HARRIS	4001987008	2/27/1987

FY	Plant Name	LER	Event Date
1987	Harris	4001987012	3/11/1987
1987	Harris	4001987013	3/13/1987
1987	Harris	4001987017	3/31/1987
1987	Harris	4001987018	4/3/1987
1987	Harris	4001987019	4/12/1987
1987	Harris	4001987021	4/14/1987
1987	Harris	4001987024	4/21/1987
1987	Harris	4001987025	4/22/1987
1987	Harris	4001987026	4/24/1987
1987	Harris	4001987028	5/2/1987
1987	Harris	4001987031	5/24/1987
1987	Harris	4001987035	6/17/1987
1987	Harris	4001987037	6/21/1987
1987	Harris	4001987038	6/22/1987
1987	Harris	4001987041	8/4/1987
1987	Harris	4001987042	7/9/1987
1987	Harris	4001987046	7/22/1987
1987	Harris	4001987047	8/5/1987
1987	Harris	4001987049	9/25/1987
1987	Harris	4001987051	8/31/1987
1988	Harris	4001987062	11/7/1987
1988	Harris	4001987063	11/8/1987
1988	Harris	4001988007	3/9/1988
1988	Harris	4001988018	7/30/1988
1989	Harris	4001988028	10/14/1988
1989	Harris	4001988032	10/30/1988
1989	Harris	4001989001	1/16/1989
1989	Harris	4001989003	2/6/1989
1989	Harris	4001989004	2/7/1989
1989	Harris	4001989005	2/22/1989
1989	Harris	4001989006	3/14/1989
1990	Harris	4001989017	10/9/1989
1990	Harris	4001989021	12/27/1989
1991	Harris	4001991009	5/21/1991
1991	Harris	4001991010	6/3/1991
1991	Harris	4001991015	5/19/1991
1992	Harris	4001992007	7/12/1992
1992	Harris	4001992008	7/13/1992
1992	Harris	4001992009	7/15/1992
1992	Harris	4001992010	7/17/1992
1993	Harris	4001993007	5/23/1993
1996	Harris	4001995010	10/12/1995
1996	Harris	4001995011	11/5/1995
1996	Harris	4001996008	4/25/1996
1996	Harris	4001996018	9/3/1996
1997	Harris	4001997001	1/31/1997
1997	Harris	4001997016	6/8/1997
1997	Harris	4001997019	7/20/1997
1999	Harris	4001998007	10/23/1998
1999	Harris	4001999002	1/14/1999
1999	Harris	4001999004	3/12/1999
2000	Harris	4001999009	12/14/1999
2000	Harris	4002000005	6/20/2000
2002	Harris	4002002002	7/13/2002
2002	Harris	4002002003	8/15/2002
2003	Harris	4002003002	5/20/2003
2003	Harris	4002003003	6/14/2003
2003	Harris	4002003004	6/15/2003
2003	Harris	4002003005	8/17/2003
2004	Harris	4002004003	5/6/2004
2005	Harris	4002004006	11/7/2004

FY	Plant Name	LER	Event Date
2005	Harris	4002005002	5/1/2005
1989	Indian Point 2	2471988018	11/22/1988
1989	Indian Point 2	2471988019	11/26/1988
1989	Indian Point 2	2471989003	3/5/1989
1990	Indian Point 2	2471989013	12/13/1989
1991	Indian Point 2	2471991001	1/7/1991
1991	Indian Point 2	2471991013	7/25/1991
1992	Indian Point 2	2471992002	1/27/1992
1992	Indian Point 2	2471992007	4/13/1992
1992	Indian Point 2	2471992018	9/26/1992
1995	Indian Point 2	2471995001	1/19/1995
1995	Indian Point 2	2471995016	6/12/1995
1996	Indian Point 2	2471996003	3/5/1996
1996	Indian Point 2	2471996012	5/23/1996
1997	Indian Point 2	2471997001	1/16/1997
1997	Indian Point 2	2471997010	5/1/1997
1997	Indian Point 2	2471997018	7/26/1997
1999	Indian Point 2	2471999015	8/31/1999
2000	Indian Point 2	2472000001	2/15/2000
2001	Indian Point 2	2472001001	1/2/2001
2003	Indian Point 2	2472003004	8/3/2003
2003	Indian Point 2	2472003005	8/14/2003
2004	Indian Point 2	2472004002	9/24/2004
2005	Indian Point 2	2472004005	11/26/2004
1987	Indian Point 3	2861987001	1/31/1987
1988	Indian Point 3	2861987012	12/22/1987
1988	Indian Point 3	2861988001	2/1/1988
1988	Indian Point 3	2861988002	3/31/1988
1988	Indian Point 3	2861988005	6/12/1988
1989	Indian Point 3	2861988006	10/9/1988
1989	Indian Point 3	2861989001	2/4/1989
1990	Indian Point 3	2861989015	10/19/1989
1990	Indian Point 3	2861990004	6/29/1990
1991	Indian Point 3	2861991003	12/27/1990
1991	Indian Point 3	2861991004	3/20/1991
1991	Indian Point 3	2861991005	3/22/1991
1992	Indian Point 3	2861992013	9/3/1992
1992	Indian Point 3	2861992015	9/15/1992
1995	Indian Point 3	2861995012	7/6/1995
1995	Indian Point 3	2861995018	9/14/1995
1997	Indian Point 3	2861996015	10/9/1996
1997	Indian Point 3	2861997001	1/2/1997
1997	Indian Point 3	2861997023	9/9/1997
1997	Indian Point 3	2861997025	9/15/1997
1998	Indian Point 3	2861998003	5/28/1998
1998	Indian Point 3	2861998006	8/30/1998
1999	Indian Point 3	2861999003	3/9/1999
1999	Indian Point 3	2861999010	8/12/1999
2000	Indian Point 3	2862000003	4/19/2000
2000	Indian Point 3	2862000007	6/4/2000
2000	Indian Point 3	2862000008	6/9/2000
2003	Indian Point 3	2862002003	11/15/2002
2003	Indian Point 3	2862003001	1/13/2003
2003	Indian Point 3	2862003002	4/29/2003
2003	Indian Point 3	2862003003	6/22/2003
2003	Indian Point 3	2862003005	8/14/2003
2005	Indian Point 3	2862005002	5/6/2005
2005	Indian Point 3	2862005003	5/16/2005
2005	Indian Point 3	2862005004	6/10/2005
1987	Kewaunee	3051987005	4/3/1987
1987	Kewaunee	3051987008	6/26/1987

FY	Plant Name	LER	Event Date
1987	Kewaunee	3051987009	7/10/1987
1988	Kewaunee	3051988001	3/2/1988
1988	Kewaunee	3051988004	4/12/1988
1988	Kewaunee	3051988006	5/2/1988
1988	Kewaunee	3051988012	9/1/1988
1990	Kewaunee	3051989016	12/27/1989
1992	Kewaunee	3051991010	10/12/1991
1992	Kewaunee	3051992017	9/15/1992
1993	Kewaunee	3051993001	1/28/1993
1993	Kewaunee	3051993013	6/4/1993
1995	Kewaunee	3051995005	9/5/1995
1996	Kewaunee	3051996002	3/31/1996
1996	Kewaunee	3051996003	4/2/1996
1998	Kewaunee	3051998005	2/24/1998
1987	Maine Yankee	3091987006	6/27/1987
1988	Maine Yankee	3091988001	1/5/1988
1988	Maine Yankee	3091988006	8/13/1988
1989	Maine Yankee	3091989001	1/10/1989
1989	Maine Yankee	3091989003	4/5/1989
1991	Maine Yankee	3091991005	4/29/1991
1991	Maine Yankee	3091991006	5/30/1991
1992	Maine Yankee	3091991010	10/5/1991
1992	Maine Yankee	3091991012	11/22/1991
1992	Maine Yankee	3091992001	2/8/1992
1994	Maine Yankee	3091994008	5/18/1994
1995	Maine Yankee	3091995001	1/14/1995
1987	McGuire 1	3691987009	4/15/1987
1987	McGuire 1	3691987017	8/16/1987
1987	McGuire 1	3691987019	9/4/1987
1988	McGuire 1	3691987028	11/20/1987
1988	McGuire 1	3691987036	12/28/1987
1988	McGuire 1	3691988001	1/7/1988
1988	McGuire 1	3691988005	3/23/1988
1988	McGuire 1	3691988007	4/16/1988
1988	McGuire 1	3691988013	6/20/1988
1988	McGuire 1	3691988015	6/26/1988
1989	McGuire 1	3691988042	12/10/1988
1989	McGuire 1	3691989022	8/26/1989
1990	McGuire 1	3691990001	1/8/1990
1991	McGuire 1	3691990027	10/13/1990
1991	McGuire 1	3691990032	11/17/1990
1991	McGuire 1	3691991001	2/11/1991
1991	McGuire 1	3691991004	2/19/1991
1992	McGuire 1	3691992008	7/26/1992
1992	McGuire 1	3691992009	6/25/1992
1994	McGuire 1	3691994004	5/12/1994
1995	McGuire 1	3691995001	1/29/1995
1995	McGuire 1	3691995005	9/27/1995
1996	McGuire 1	3691995006	10/1/1995
1996	McGuire 1	3691996001	2/3/1996
1997	McGuire 1	3691996006	11/9/1996
1997	McGuire 1	3691997006	5/12/1997
1997	McGuire 1	3691997009	9/6/1997
1998	McGuire 1	3691998002	2/9/1998
2000	McGuire 1	3692000004	5/25/2000
2002	McGuire 1	3692002001	3/4/2002
1987	McGuire 2	3701987003	1/20/1987
1987	McGuire 2	3701987016	9/6/1987
1988	McGuire 2	3701987019	11/5/1987
1988	McGuire 2	3701987021	11/30/1987
1988	McGuire 2	3701988001	1/12/1988

FY	Plant Name	LER	Event Date
1988	McGuire 2	3701988008	7/31/1988
1989	McGuire 2	3701989001	3/3/1989
1989	McGuire 2	3701989002	3/14/1989
1989	McGuire 2	3701989003	4/6/1989
1991	McGuire 2	3701991007	7/12/1991
1991	McGuire 2	3701991010	9/25/1991
1992	McGuire 2	3701991011	10/4/1991
1992	McGuire 2	3701991012	11/8/1991
1992	McGuire 2	3701992004	3/21/1992
1992	McGuire 2	3701992006	4/9/1992
1992	McGuire 2	3701992007	5/20/1992
1992	McGuire 2	3701992009	8/5/1992
1992	McGuire 2	3701992010	8/24/1992
1993	McGuire 2	3701993001	2/22/1993
1993	McGuire 2	3701993002	3/9/1993
1994	McGuire 2	3701993008	12/27/1993
1996	McGuire 2	3701995004	12/16/1995
1996	McGuire 2	3701996003	5/22/1996
1997	McGuire 2	3701997001	5/27/1997
1997	McGuire 2	3701997002	7/11/1997
1998	McGuire 2	3701998001	2/22/1998
1999	McGuire 2	3701999003	6/16/1999
1999	McGuire 2	3701999004	7/15/1999
2001	McGuire 2	3702000001	10/10/2000
2001	McGuire 2	3702000002	11/15/2000
2001	McGuire 2	3702001001	7/18/2001
2002	McGuire 2	3702002002	8/22/2002
2005	McGuire 2	3702004901	10/19/2004
2005	McGuire 2	3702005001	3/2/2005
2005	McGuire 2	3702005901	4/9/2005
1987	Millstone 2	3361987009	9/2/1987
1988	Millstone 2	3361987012	11/16/1987
1992	Millstone 2	3361991012	11/6/1991
1993	Millstone 2	3361993012	5/24/1993
1993	Millstone 2	3361993019	8/12/1993
1995	Millstone 2	3361995002	8/8/1995
2000	Millstone 2	3362000001	1/27/2000
2000	Millstone 2	3362000003	2/11/2000
2001	Millstone 2	3362001003	4/29/2001
2002	Millstone 2	3362002002	4/19/2002
2003	Millstone 2	3362003002	3/7/2003
2004	Millstone 2	3362004001	3/6/2004
2004	Millstone 2	3362004002	3/15/2004
1987	Millstone 3	4231987001	1/13/1987
1987	Millstone 3	4231987008	3/7/1987
1987	Millstone 3	4231987020	4/12/1987
1987	Millstone 3	4231987021	4/12/1987
1987	Millstone 3	4231987025	5/7/1987
1987	Millstone 3	4231987026	5/14/1987
1987	Millstone 3	4231987027	6/5/1987
1987	Millstone 3	4231987031	6/14/1987
1987	Millstone 3	4231987034	9/23/1987
1988	Millstone 3	4231988009	2/10/1988
1989	Millstone 3	4231988023	10/5/1988
1989	Millstone 3	4231988024	10/22/1988
1989	Millstone 3	4231988028	12/29/1988
1989	Millstone 3	4231989008	5/6/1989
1989	Millstone 3	4231989009	5/11/1989
1990	Millstone 3	4231990005	1/18/1990
1990	Millstone 3	4231990009	3/9/1990
1990	Millstone 3	4231990011	3/30/1990

FY	Plant Name	LER	Event Date
1990	Millstone 3	4231990013	4/16/1990
1990	Millstone 3	4231990014	5/19/1990
1990	Millstone 3	4231990019	6/6/1990
1991	Millstone 3	4231990030	12/31/1990
1991	Millstone 3	4231991014	6/9/1991
1992	Millstone 3	4231992011	4/5/1992
1993	Millstone 3	4231992029	11/20/1992
1993	Millstone 3	4231993004	3/31/1993
1994	Millstone 3	4231994011	9/8/1994
1995	Millstone 3	4231995022	4/16/1995
1998	Millstone 3	4231998023	4/11/1998
1998	Millstone 3	4231998033	6/10/1998
1999	Millstone 3	4231998044	11/11/1998
1999	Millstone 3	4231998045	12/11/1998
2003	Millstone 3	4232003001	12/23/2002
2005	Millstone 3	4232005002	4/17/2005
2005	Millstone 3	4232005003	9/29/2005
1987	North Anna 1	3381987004	4/19/1987
1987	North Anna 1	3381987017	7/15/1987
1988	North Anna 1	3381987020	11/23/1987
1988	North Anna 1	3381988002	1/8/1988
1988	North Anna 1	3381988005	1/13/1988
1988	North Anna 1	3381988020	8/6/1988
1989	North Anna 1	3381989005	2/25/1989
1990	North Anna 1	3381989017	12/5/1989
1994	North Anna 1	3381994005	9/9/1994
1995	North Anna 1	3381995001	1/27/1995
1996	North Anna 1	3381996005	8/27/1996
1997	North Anna 1	3381996010	10/24/1996
2000	North Anna 1	3382000004	5/7/2000
2003	North Anna 1	3382003003	4/19/2003
2003	North Anna 1	3382003004	6/11/2003
1990	North Anna 2	3391990003	8/21/1990
1991	North Anna 2	3391990010	11/2/1990
1991	North Anna 2	3391991009	9/20/1991
1992	North Anna 2	3391992001	1/29/1992
1992	North Anna 2	3391992007	8/6/1992
1993	North Anna 2	3391993002	4/16/1993
1993	North Anna 2	3391993003	4/24/1993
1994	North Anna 2	3391994003	1/22/1994
1996	North Anna 2	3391995004	11/11/1995
1997	North Anna 2	3391996003	11/12/1996
1998	North Anna 2	3391998004	9/17/1998
2000	North Anna 2	3391999004	12/2/1999
2000	North Anna 2	3392000001	4/3/2000
2002	North Anna 2	3392001005	12/22/2001
2003	North Anna 2	3392003001	3/31/2003
2004	North Anna 2	3392004004	6/10/2004
2005	North Anna 2	3392005001	8/5/2005
1988	Oconee 1	2691988009	7/5/1988
1989	Oconee 1	2691989001	1/2/1989
1989	Oconee 1	2691989002	1/3/1989
1992	Oconee 1	2691991011	10/2/1991
1992	Oconee 1	2691992004	5/8/1992
1993	Oconee 1	2691992015	10/3/1992
1993	Oconee 1	2691993008	8/23/1993
1994	Oconee 1	2691993010	11/3/1993
1994	Oconee 1	2691994002	2/26/1994
1996	Oconee 1	2691996004	2/28/1996
1997	Oconee 1	2691997008	7/1/1997
1999	Oconee 1	2691999005	7/7/1999

FY	Plant Name	LER	Event Date
2001	Oconee 1	2692001002	9/12/2001
1987	Oconee 2	2701987004	4/20/1987
1989	Oconee 2	2701989004	4/3/1989
1990	Oconee 2	2701990001	9/13/1990
1993	Oconee 2	2701992004	10/19/1992
1993	Oconee 2	2701993001	4/29/1993
1994	Oconee 2	2701994002	4/6/1994
1995	Oconee 2	2701994005	12/8/1994
1999	Oconee 2	2701998007	11/3/1998
2004	Oconee 2	2702004901	3/20/2004
1991	Oconee 3	2871991007	7/3/1991
1992	Oconee 3	2871992001	1/14/1992
1992	Oconee 3	2871992003	6/24/1992
1993	Oconee 3	2871993001	1/26/1993
1994	Oconee 3	2871994002	8/10/1994
1996	Oconee 3	2871996001	3/16/1996
1987	Palisades	2551987009	3/25/1987
1987	Palisades	2551987024	7/14/1987
1987	Palisades	2551987027	8/23/1987
1989	Palisades	2551989020	8/4/1989
1990	Palisades	2551990001	1/9/1990
1990	Palisades	2551990002	2/28/1990
1991	Palisades	2551991012	7/3/1991
1992	Palisades	2551992034	7/1/1992
1992	Palisades	2551992035	7/24/1992
1992	Palisades	2551992037	8/14/1992
1992	Palisades	2551992038	8/25/1992
1993	Palisades	2551992039	10/30/1992
1995	Palisades	2551995010	8/15/1995
1998	Palisades	2551998010	7/21/1998
2000	Palisades	2552000003	4/4/2000
2003	Palisades	2552002002	12/1/2002
2004	Palisades	2552004001	8/31/2004
2005	Palisades	2552005001	1/9/2005
2005	Palisades	2552005005	9/1/2005
1987	Palo Verde 1	5281987003	1/10/1987
1988	Palo Verde 1	5281988024	8/27/1988
1990	Palo Verde 1	5281990008	6/20/1990
1991	Palo Verde 1	5281991009	9/14/1991
1992	Palo Verde 1	5281991010	10/27/1991
1992	Palo Verde 1	5281992007	5/6/1992
1995	Palo Verde 1	5281995008	5/30/1995
1998	Palo Verde 1	5281998002	2/22/1998
2004	Palo Verde 1	5282004006	6/14/2004
2004	Palo Verde 2	5282004006	6/14/2004
1987	Palo Verde 2	5291987008	7/22/1987
1987	Palo Verde 2	5291987010	6/4/1987
1988	Palo Verde 2	5291988006	7/26/1988
1989	Palo Verde 2	5291988014	11/16/1988
1989	Palo Verde 2	5291989001	1/3/1989
1989	Palo Verde 2	5291989003	2/16/1989
1992	Palo Verde 2	5291992001	1/9/1992
1992	Palo Verde 2	5291992002	3/23/1992
1993	Palo Verde 2	5291992006	11/13/1992
1993	Palo Verde 2	5291993001	3/14/1993
1994	Palo Verde 2	5291993004	11/1/1993
1995	Palo Verde 2	5291995005	7/17/1995
1996	Palo Verde 2	5291996001	1/21/1996
1997	Palo Verde 2	5291997005	9/23/1997
2000	Palo Verde 2	5292000001	8/26/2000
2005	Palo Verde 2	5292005901	4/29/2005

FY	Plant Name	LER	Event Date
2004	Palo Verde 3	5282004006	6/14/2004
1989	Palo Verde 3	5301989001	3/3/1989
1991	Palo Verde 3	5301991003	6/19/1991
1991	Palo Verde 3	5301991006	8/24/1991
1992	Palo Verde 3	5301991010	11/15/1991
1993	Palo Verde 3	5301993001	2/4/1993
1994	Palo Verde 3	5301994005	8/19/1994
1994	Palo Verde 3	5301994007	8/30/1994
1989	Point Beach 1	2661989006	5/5/1989
1991	Point Beach 1	2661991008	6/29/1991
1993	Point Beach 1	2661992008	10/5/1992
1995	Point Beach 1	2661995006	7/14/1995
1996	Point Beach 1	2661996001	4/5/1996
2000	Point Beach 1	2661999013	11/8/1999
2000	Point Beach 1	2662000001	1/21/2000
2001	Point Beach 1	2662000010	10/27/2000
2003	Point Beach 1	2662003002	7/15/2003
1987	Point Beach 2	3011987002	8/16/1987
1988	Point Beach 2	3011988001	4/7/1988
1989	Point Beach 2	3011989002	3/29/1989
1989	Point Beach 2	3011989004	8/20/1989
1992	Point Beach 2	3011991006	12/17/1991
1993	Point Beach 2	3011993002	3/28/1993
1996	Point Beach 2	3011996001	5/18/1996
2001	Point Beach 2	3012001002	6/27/2001
2003	Point Beach 2	3012003004	7/10/2003
2004	Point Beach 2	3012004002	5/5/2004
1989	Prairie Island 1	2821989010	7/21/1989
1989	Prairie Island 1	2821990017	5/22/1989
1993	Prairie Island 1	2821993005	2/18/1993
1996	Prairie Island 1	2821996012	6/30/1996
1997	Prairie Island 1	2821997008	6/2/1997
1998	Prairie Island 1	2821998008	6/5/1998
1999	Prairie Island 1	2821998016	10/29/1998
1999	Prairie Island 1	2821999001	1/5/1999
1999	Prairie Island 1	2821999002	1/8/1999
2001	Prairie Island 1	2822001004	8/1/2001
2001	Prairie Island 1	2822001005	8/3/2001
2003	Prairie Island 1	2822002002	11/15/2002
1989	Prairie Island 2	3061989002	5/26/1989
1990	Prairie Island 2	3061989004	12/21/1989
1990	Prairie Island 2	3061990001	3/8/1990
1990	Prairie Island 2	3061990003	3/16/1990
1991	Prairie Island 2	3061990012	12/29/1990
1992	Prairie Island 2	3061992001	2/19/1992
1994	Prairie Island 2	3061994002	7/21/1994
1996	Prairie Island 2	3061996001	3/19/1996
1996	Prairie Island 2	3061996002	4/18/1996
1997	Prairie Island 2	3061997003	5/17/1997
1987	Robinson 2	2611987018	6/15/1987
1987	Robinson 2	2611987020	7/16/1987
1988	Robinson 2	2611988001	1/19/1988
1988	Robinson 2	2611988010	5/2/1988
1989	Robinson 2	2611989005	3/22/1989
1989	Robinson 2	2611989006	3/30/1989
1990	Robinson 2	2611990002	1/17/1990
1990	Robinson 2	2611990007	5/17/1990
1991	Robinson 2	2611991011	8/30/1991
1992	Robinson 2	2611992017	8/22/1992
1994	Robinson 2	2611994006	4/3/1994
1994	Robinson 2	2611994016	8/2/1994

FY	Plant Name	LER	Event Date
1995	Robinson 2	2611995004	6/30/1995
1997	Robinson 2	2611996007	10/20/1996
1998	Robinson 2	2611997011	11/16/1997
1998	Robinson 2	2611998003	4/25/1998
1999	Robinson 2	2611998005	10/17/1998
2000	Robinson 2	2612000001	6/21/2000
1988	Salem 1	2721988009	3/30/1988
1989	Salem 1	2721989007	2/6/1989
1989	Salem 1	2721989027	6/19/1989
1990	Salem 1	2721990012	4/9/1990
1990	Salem 1	2721990030	9/10/1990
1991	Salem 1	2721991024	6/16/1991
1993	Salem 1	2721993013	7/19/1993
1994	Salem 1	2721994003	1/27/1994
1994	Salem 1	2721994005	2/10/1994
1994	Salem 1	2721994006	4/7/1994
1994	Salem 1	2721994009	6/10/1994
1991	Salem 1	2721994011	8/15/1991
1998	Salem 1	2721998006	2/21/1998
1999	Salem 1	2721999004	5/20/1999
2000	Salem 1	2722000001	1/6/2000
2000	Salem 1	2722000002	4/11/2000
2001	Salem 1	2722000005	12/8/2000
2003	Salem 1	2722002004	11/12/2002
2003	Salem 1	2722002005	10/10/2002
1988	Salem 2	3111988014	6/22/1988
1988	Salem 2	3111988017	8/31/1988
1989	Salem 2	3111988024	11/28/1988
1989	Salem 2	3111989003	2/5/1989
1989	Salem 2	3111989005	3/12/1989
1989	Salem 2	3111989008	4/11/1989
1990	Salem 2	3111990029	6/28/1990
1992	Salem 2	3111991017	11/9/1991
1992	Salem 2	3111992009	5/14/1992
1992	Salem 2	3111992014	9/3/1992
1993	Salem 2	3111993002	1/28/1993
1993	Salem 2	3111993005	3/16/1993
1993	Salem 2	3111993009	6/22/1993
1994	Salem 2	3111994003	1/27/1994
1994	Salem 2	3111994008	6/29/1994
1995	Salem 2	3111995004	6/7/1995
1998	Salem 2	3111997014	10/2/1997
2002	Salem 2	3112001008	12/31/2001
2003	Salem 2	3112003001	3/29/2003
2004	Salem 2	3112004008	9/9/2004
1987	San Onofre 2	3611987001	2/5/1987
1987	San Onofre 2	3611987004	3/28/1987
1988	San Onofre 2	3611987031	12/17/1987
1991	San Onofre 2	3611990016	12/6/1990
1991	San Onofre 2	3611991007	4/10/1991
1992	San Onofre 2	3611992008	4/24/1992
1992	San Onofre 2	3611992012	7/31/1992
2003	San Onofre 2	3612003001	2/1/2003
2004	San Onofre 2	3612004002	4/10/2004
2005	San Onofre 2	3612004004	11/19/2004
2005	San Onofre 2	3612005001	2/3/2005
1987	San Onofre 3	3621987011	6/21/1987
1988	San Onofre 3	3621987017	10/11/1987
1989	San Onofre 3	3621989001	1/6/1989
1989	San Onofre 3	3621989006	4/7/1989
1990	San Onofre 3	3621990002	2/23/1990

FY	Plant Name	LER	Event Date
1991	San Onofre 3	3621991001	3/15/1991
1992	San Onofre 3	3621992003	5/15/1992
1992	San Onofre 3	3621992004	7/20/1992
1993	San Onofre 3	3621993004	7/5/1993
1999	San Onofre 3	3621999003	5/13/1999
2002	San Onofre 3	3622002001	2/27/2002
2003	San Onofre 3	3622002003	10/16/2002
1990	Seabrook	4431990015	6/20/1990
1990	Seabrook	4431990018	7/5/1990
1990	Seabrook	4431990022	8/22/1990
1991	Seabrook	4431990025	11/9/1990
1991	Seabrook	4431991001	2/12/1991
1991	Seabrook	4431991002	3/30/1991
1991	Seabrook	4431991008	6/27/1991
1991	Seabrook	4431991009	7/4/1991
1992	Seabrook	4431992017	9/7/1992
1993	Seabrook	4431992024	11/27/1992
1993	Seabrook	4431992025	12/13/1992
1993	Seabrook	4431993003	1/14/1993
1993	Seabrook	4431993009	5/20/1993
1993	Seabrook	4431993012	7/27/1993
1993	Seabrook	4431993018	9/22/1993
1994	Seabrook	4431994001	1/25/1994
1996	Seabrook	4431996001	1/27/1996
1999	Seabrook	4431998014	12/22/1998
2000	Seabrook	4432000004	6/26/2000
2001	Seabrook	4432001002	3/5/2001
2004	Seabrook	4432003002	10/31/2003
2005	Seabrook	4432005002	2/22/2005
2005	Seabrook	4432005006	5/1/2005
1989	Sequoyah 1	3271988045	11/18/1988
1989	Sequoyah 1	3271988047	12/25/1988
1989	Sequoyah 1	3271989005	2/10/1989
1990	Sequoyah 1	3271989035	12/10/1989
1990	Sequoyah 1	3271990012	6/2/1990
1990	Sequoyah 1	3271990021	9/14/1990
1990	Sequoyah 1	3271990022	9/19/1990
1991	Sequoyah 1	3271990030	11/15/1990
1992	Sequoyah 1	3271992010	4/28/1992
1992	Sequoyah 1	3271992012	5/16/1992
1993	Sequoyah 1	3271992018	10/26/1992
1993	Sequoyah 1	3271992027	12/31/1992
1994	Sequoyah 1	3271994011	7/15/1994
1995	Sequoyah 1	3271994014	11/29/1994
1995	Sequoyah 1	3271995008	6/23/1995
1996	Sequoyah 1	3271996006	6/23/1996
1997	Sequoyah 1	3271996010	11/16/1996
1997	Sequoyah 1	3271997012	8/1/1997
1998	Sequoyah 1	3271998001	5/19/1998
1999	Sequoyah 1	3271998003	11/9/1998
2000	Sequoyah 1	3272000003	3/21/2000
2000	Sequoyah 1	3272000004	9/25/2000
2002	Sequoyah 1	3272002004	7/12/2002
2003	Sequoyah 1	3272003901	6/15/2003
2004	Sequoyah 1	3272004001	3/15/2004
2005	Sequoyah 1	3272005001	4/9/2005
1988	Sequoyah 2	3281988014	3/20/1988
1988	Sequoyah 2	3281988023	5/19/1988
1988	Sequoyah 2	3281988024	5/23/1988
1988	Sequoyah 2	3281988027	6/6/1988
1988	Sequoyah 2	3281988028	6/9/1988

FY	Plant Name	LER	Event Date
1989	Sequoyah 2	3281989005	4/19/1989
1989	Sequoyah 2	3281989008	7/10/1989
1990	Sequoyah 2	3281990008	4/10/1990
1991	Sequoyah 2	3281990017	11/23/1990
1991	Sequoyah 2	3281991001	1/3/1991
1992	Sequoyah 2	3281991006	11/7/1991
1992	Sequoyah 2	3281992001	2/10/1992
1992	Sequoyah 2	3281992008	6/27/1992
1992	Sequoyah 2	3281992011	8/21/1992
1992	Sequoyah 2	3281992012	9/4/1992
1993	Sequoyah 2	3281992015	12/8/1992
1995	Sequoyah 2	3281995001	1/5/1995
1995	Sequoyah 2	3281995002	4/28/1995
1995	Sequoyah 2	3281995003	5/31/1995
1996	Sequoyah 2	3281995007	12/21/1995
1996	Sequoyah 2	3281996001	4/18/1996
1997	Sequoyah 2	3281996005	10/11/1996
1997	Sequoyah 2	3281996006	12/6/1996
1997	Sequoyah 2	3281996007	12/7/1996
1998	Sequoyah 2	3281998001	8/27/1998
1999	Sequoyah 2	3281998002	10/16/1998
2000	Sequoyah 2	3282000001	1/18/2000
2001	Sequoyah 2	3282000004	11/17/2000
2003	Sequoyah 2	3282002004	12/26/2002
2003	Sequoyah 2	3282003004	3/10/2003
2003	Sequoyah 2	3282003005	4/12/2003
2005	Sequoyah 2	3282005001	2/23/2005
1988	South Texas 1	4981988022	2/28/1988
1988	South Texas 1	4981988045	7/19/1988
1988	South Texas 1	4981988048	8/16/1988
1988	South Texas 1	4981988049	8/26/1988
1989	South Texas 1	4981989001	1/3/1989
1989	South Texas 1	4981989015	7/4/1989
1990	South Texas 1	4981990005	3/29/1990
1990	South Texas 1	4981990006	7/30/1990
1990	South Texas 1	4981990014	6/20/1990
1990	South Texas 1	4981990015	6/28/1990
1990	South Texas 1	4981990016	7/2/1990
1990	South Texas 1	4981990020	7/16/1990
1990	South Texas 1	4981990023	9/29/1990
1991	South Texas 1	4981990025	11/24/1990
1991	South Texas 1	4981991012	4/12/1991
1992	South Texas 1	4981991021	10/10/1991
1992	South Texas 1	4981991022	10/14/1991
1992	South Texas 1	4981992003	3/14/1992
1994	South Texas 1	4981994009	2/28/1994
1994	South Texas 1	4981994015	9/20/1994
1995	South Texas 1	4981995001	1/24/1995
1995	South Texas 1	4981995009	8/29/1995
1996	South Texas 1	4981995013	12/18/1995
1998	South Texas 1	4981997012	11/10/1997
1999	South Texas 1	4981999004	5/16/1999
1999	South Texas 1	4981999006	6/27/1999
1999	South Texas 1	4981999008	9/12/1999
2001	South Texas 1	4982000007	12/16/2000
1989	South Texas 2	4991989009	4/5/1989
1989	South Texas 2	4991989011	4/10/1989
1989	South Texas 2	4991989013	4/15/1989
1989	South Texas 2	4991989016	6/2/1989
1989	South Texas 2	4991989017	7/13/1989
1989	South Texas 2	4991989019	8/23/1989

FY	Plant Name	LER	Event Date
1989	South Texas 2	4991989020	8/29/1989
1989	South Texas 2	4991989021	9/5/1989
1989	South Texas 2	4991989022	9/19/1989
1989	South Texas 2	4991989023	9/22/1989
1990	South Texas 2	4991989026	10/13/1989
1990	South Texas 2	4991990002	2/2/1990
1990	South Texas 2	4991990004	3/26/1990
1990	South Texas 2	4991990005	4/14/1990
1990	South Texas 2	4991990012	7/13/1990
1990	South Texas 2	4991990013	9/17/1990
1991	South Texas 2	4991991001	1/9/1991
1991	South Texas 2	4991991003	3/14/1991
1991	South Texas 2	4991991004	3/30/1991
1992	South Texas 2	4991991010	12/24/1991
1992	South Texas 2	4991992001	1/22/1992
1992	South Texas 2	4991992003	2/24/1992
1993	South Texas 2	4991992010	12/27/1992
1993	South Texas 2	4991993001	1/23/1993
1993	South Texas 2	4991993004	2/3/1993
1994	South Texas 2	4991994007	6/25/1994
1995	South Texas 2	4991995003	3/28/1995
1996	South Texas 2	4991995008	11/15/1995
1997	South Texas 2	4991997004	3/19/1997
1997	South Texas 2	4991997005	3/26/1997
1997	South Texas 2	4991997006	4/30/1997
1998	South Texas 2	4991997007	11/21/1997
1998	South Texas 2	4991998002	9/22/1998
1999	South Texas 2	4991999002	1/21/1999
1999	South Texas 2	4991999003	3/12/1999
2000	South Texas 2	4992000001	2/9/2000
2001	South Texas 2	4992001001	2/7/2001
2001	South Texas 2	4992001002	3/1/2001
2001	South Texas 2	4992001004	5/8/2001
2002	South Texas 2	4992002002	6/14/2002
2005	South Texas 2	4992005901	5/17/2005
1987	St. Lucie 1	3351987002	2/7/1987
1987	St. Lucie 1	3351987011	5/21/1987
1987	St. Lucie 1	3351987013	6/14/1987
1988	St. Lucie 1	3351987016	10/29/1987
1988	St. Lucie 1	3351987017	12/21/1987
1988	St. Lucie 1	3351988003	3/28/1988
1988	St. Lucie 1	3351988004	6/30/1988
1988	St. Lucie 1	3351988008	9/20/1988
1989	St. Lucie 1	3351989003	7/17/1989
1989	St. Lucie 1	3351989005	9/13/1989
1990	St. Lucie 1	3351990007	5/24/1990
1991	St. Lucie 1	3351991003	5/6/1991
1991	St. Lucie 1	3351991005	7/1/1991
1991	St. Lucie 1	3351991006	9/18/1991
1992	St. Lucie 1	3351992006	9/24/1992
1994	St. Lucie 1	3351994001	1/9/1994
1994	St. Lucie 1	3351994003	3/28/1994
1994	St. Lucie 1	3351994004	4/3/1994
1996	St. Lucie 1	3351995010	11/16/1995
1996	St. Lucie 1	3351996002	2/22/1996
1997	St. Lucie 1	3351997003	3/4/1997
1998	St. Lucie 1	3351998001	1/4/1998
1998	St. Lucie 1	3351998003	1/10/1998
1999	St. Lucie 1	3351999003	8/23/1999
2000	St. Lucie 1	3351999006	10/29/1999
2001	St. Lucie 1	3352001007	6/5/2001

FY	Plant Name	LER	Event Date
2003	St. Lucie 1	3352002002	10/24/2002
1987	St. Lucie 2	3891987001	3/3/1987
1987	St. Lucie 2	3891987002	3/5/1987
1987	St. Lucie 2	3891987003	4/9/1987
1987	St. Lucie 2	3891987004	4/22/1987
1988	St. Lucie 2	3891987007	11/25/1987
1989	St. Lucie 2	3891989007	9/23/1989
1990	St. Lucie 2	3891990001	1/14/1990
1992	St. Lucie 2	3891992004	7/8/1992
1992	St. Lucie 2	3891992005	7/10/1992
1992	St. Lucie 2	3891992006	8/10/1992
1995	St. Lucie 2	3891995002	2/21/1995
1996	St. Lucie 2	3891996001	1/5/1996
1996	St. Lucie 2	3891996002	6/6/1996
1998	St. Lucie 2	3891998006	9/18/1998
2003	St. Lucie 2	3892003001	4/1/2003
2003	St. Lucie 2	3892003003	6/11/2003
2004	St. Lucie 2	3892003006	12/20/2003
2005	St. Lucie 2	3892004004	12/25/2004
2005	St. Lucie 2	3892004005	12/27/2004
2005	St. Lucie 2	3892005003	8/11/2005
1987	Summer	3951987015	6/16/1987
1987	Summer	3951987021	9/2/1987
1988	Summer	3951987027	10/29/1987
1988	Summer	3951988002	2/16/1988
1988	Summer	3951988006	5/12/1988
1988	Summer	3951988007	6/1/1988
1988	Summer	3951988009	7/26/1988
1989	Summer	3951989011	5/28/1989
1989	Summer	3951989012	7/11/1989
1989	Summer	3951989015	8/25/1989
1990	Summer	3951989020	12/2/1989
1993	Summer	3951993001	1/12/1993
1997	Summer	3951997002	4/26/1997
1999	Summer	3951999008	5/18/1999
2002	Summer	3952002004	6/17/2002
2004	Summer	3952004001	3/30/2004
2005	Summer	3952004003	10/26/2004
1987	Surry 1	2801987024	9/20/1987
1988	Surry 1	2801988003	2/16/1988
1988	Surry 1	2801988029	8/15/1988
1990	Surry 1	2801990004	5/22/1990
1990	Surry 1	2801990006	7/1/1990
1992	Surry 1	2801992001	1/2/1992
1992	Surry 1	2801992007	5/7/1992
1993	Surry 1	2801993001	1/8/1993
1993	Surry 1	2801993002	2/9/1993
1994	Surry 1	2801994006	5/11/1994
1995	Surry 1	2801995001	1/8/1995
1995	Surry 1	2801995003	4/12/1995
1997	Surry 1	2801997003	2/19/1997
1998	Surry 1	2801998002	2/2/1998
1999	Surry 1	2801998013	11/22/1998
1999	Surry 1	2801998014	11/26/1998
2001	Surry 1	2802000004	10/24/2000
2003	Surry 1	2802002001	12/31/2002
2003	Surry 1	2802003001	1/14/2003
2003	Surry 1	2802003002	1/25/2003
2003	Surry 1	2802003004	9/18/2003
2003	Surry 1	2812003001	1/25/2003
2003	Surry 2	2802003004	9/18/2003

FY	Plant Name	LER	Event Date
1988	Surry 2	2811988004	3/27/1988
1988	Surry 2	2811988010	5/16/1988
1989	Surry 2	2811989010	9/19/1989
1990	Surry 2	2811990003	5/31/1990
1990	Surry 2	2811990004	8/27/1990
1992	Surry 2	2811991011	12/17/1991
1993	Surry 2	2811993002	6/23/1993
1993	Surry 2	2811993003	8/3/1993
1993	Surry 2	2811993004	8/23/1993
1993	Surry 2	2811993005	8/27/1993
1994	Surry 2	2811993006	11/15/1993
1995	Surry 2	2811995004	5/11/1995
1995	Surry 2	2811995005	5/21/1995
1995	Surry 2	2811995006	6/14/1995
1996	Surry 2	2811995007	11/7/1995
1996	Surry 2	2811996004	6/6/1996
1996	Surry 2	2811996005	8/3/1996
1997	Surry 2	2811996006	12/13/1996
1997	Surry 2	2811997001	2/18/1997
1998	Surry 2	2811997004	12/2/1997
1999	Surry 2	2811999003	7/5/1999
2003	Surry 2	2812002003	11/23/2002
2003	Surry 2	2812003001	1/25/2003
2004	Surry 2	2812004001	5/21/2004
1988	Three Mile Isl 1	2891988004	8/13/1988
1991	Three Mile Isl 1	2891991003	9/27/1991
1993	Three Mile Isl 1	2891993003	3/12/1993
1997	Three Mile Isl 1	2891997007	6/21/1997
1987	Turkey Point 3	2501987001	1/4/1987
1988	Turkey Point 3	2501988004	3/18/1988
1989	Turkey Point 3	2501989005	2/15/1989
1990	Turkey Point 3	2501989020	12/23/1989
1990	Turkey Point 3	2501990011	6/9/1990
1995	Turkey Point 3	2501994006	12/6/1994
1996	Turkey Point 3	2501995007	10/17/1995
1996	Turkey Point 3	2501996002	2/9/1996
1996	Turkey Point 3	2501996006	3/27/1996
1997	Turkey Point 3	2501997004	4/11/1997
1997	Turkey Point 3	2501997006	7/22/1997
1997	Turkey Point 3	2501997007	7/30/1997
1998	Turkey Point 3	2501998001	2/16/1998
2003	Turkey Point 3	2502003002	1/27/2003
2003	Turkey Point 3	2502003006	4/28/2003
2005	Turkey Point 3	2502004007	12/28/2004
1987	Turkey Point 4	2511987001	1/6/1987
1988	Turkey Point 4	2511988009	8/16/1988
1988	Turkey Point 4	2511988010	8/19/1988
1989	Turkey Point 4	2511989011	9/15/1989
1990	Turkey Point 4	2511990003	4/9/1990
1990	Turkey Point 4	2511990008	8/12/1990
1992	Turkey Point 4	2511991006	10/29/1991
1992	Turkey Point 4	2511992007	9/29/1992
1993	Turkey Point 4	2511993003	8/16/1993
1994	Turkey Point 4	2511994004	9/23/1994
1995	Turkey Point 4	2511994006	11/30/1994
2001	Turkey Point 4	2512000004	10/21/2000
2004	Turkey Point 4	2512004002	5/14/2004
2005	Turkey Point 4	2512004004	12/25/2004
2005	Turkey Point 4	2512005001	3/22/2005
2005	Turkey Point 4	2512005002	6/27/2005
1987	Vogtle 1	4241987009	3/26/1987

FY	Plant Name	LER	Event Date
1987	Vogtle 1	4241987010	3/24/1987
1987	Vogtle 1	4241987011	3/26/1987
1987	Vogtle 1	4241987012	4/5/1987
1987	Vogtle 1	4241987013	4/10/1987
1987	Vogtle 1	4241987014	4/11/1987
1987	Vogtle 1	4241987015	4/13/1987
1987	Vogtle 1	4241987018	5/4/1987
1987	Vogtle 1	4241987025	5/9/1987
1987	Vogtle 1	4241987026	5/10/1987
1987	Vogtle 1	4241987027	5/13/1987
1987	Vogtle 1	4241987029	5/24/1987
1987	Vogtle 1	4241987030	6/3/1987
1987	Vogtle 1	4241987033	6/7/1987
1987	Vogtle 1	4241987034	6/7/1987
1987	Vogtle 1	4241987035	6/14/1987
1987	Vogtle 1	4241987041	6/23/1987
1987	Vogtle 1	4241987047	7/22/1987
1987	Vogtle 1	4241987050	7/28/1987
1988	Vogtle 1	4241987063	11/5/1987
1988	Vogtle 1	4241987066	11/11/1987
1988	Vogtle 1	4241988001	1/17/1988
1988	Vogtle 1	4241988006	2/15/1988
1988	Vogtle 1	4241988008	4/7/1988
1988	Vogtle 1	4241988013	4/24/1988
1988	Vogtle 1	4241988022	7/14/1988
1988	Vogtle 1	4241988024	7/30/1988
1988	Vogtle 1	4241988025	7/31/1988
1989	Vogtle 1	4241988043	12/15/1988
1989	Vogtle 1	4241988044	12/17/1988
1989	Vogtle 1	4241989005	2/10/1989
1989	Vogtle 1	4241989012	5/9/1989
1989	Vogtle 1	4241989016	8/3/1989
1990	Vogtle 1	4241989018	10/2/1989
1990	Vogtle 1	4241990001	1/24/1990
1990	Vogtle 1	4241990011	4/25/1990
1990	Vogtle 1	4241990016	7/23/1990
1991	Vogtle 1	4241990023	12/18/1990
1992	Vogtle 1	4241992008	9/14/1992
1993	Vogtle 1	4241993008	5/3/1993
1993	Vogtle 1	4241993009	7/28/1993
1994	Vogtle 1	4241994002	3/11/1994
1995	Vogtle 1	4241995002	7/23/1995
1996	Vogtle 1	4241996006	5/25/1996
1997	Vogtle 1	4241996012	11/27/1996
1997	Vogtle 1	4241997005	8/4/1997
2000	Vogtle 1	4242000002	6/5/2000
2001	Vogtle 1	4242000004	12/9/2000
2002	Vogtle 1	4242002003	4/20/2002
2004	Vogtle 1	4242004001	3/27/2004
2005	Vogtle 1	4242005001	1/11/2005
2005	Vogtle 1	4242005003	4/29/2005
1989	Vogtle 2	4251989018	4/22/1989
1989	Vogtle 2	4251989019	5/2/1989
1989	Vogtle 2	4251989020	5/12/1989
1989	Vogtle 2	4251989021	5/22/1989
1989	Vogtle 2	4251989023	7/20/1989
1989	Vogtle 2	4251989024	7/26/1989
1990	Vogtle 2	4251989027	10/11/1989
1990	Vogtle 2	4251989029	11/5/1989
1990	Vogtle 2	4251989031	12/2/1989
1990	Vogtle 2	4251990002	3/20/1990

FY	Plant Name	LER	Event Date
1990	Vogtle 2	4251990007	5/6/1990
1990	Vogtle 2	4251990008	6/28/1990
1990	Vogtle 2	4251990009	6/30/1990
1991	Vogtle 2	4251991005	2/18/1991
1991	Vogtle 2	4251991006	2/23/1991
1991	Vogtle 2	4251991007	5/7/1991
1992	Vogtle 2	4251992002	3/9/1992
1992	Vogtle 2	4251992010	5/14/1992
1993	Vogtle 2	4251993004	6/28/1993
1993	Vogtle 2	4251993006	9/8/1993
1994	Vogtle 2	4251994001	1/7/1994
1994	Vogtle 2	4251994002	1/19/1994
1997	Vogtle 2	4251996006	10/14/1996
1997	Vogtle 2	4251996008	10/23/1996
1998	Vogtle 2	4251998003	5/9/1998
1998	Vogtle 2	4251998005	6/9/1998
1998	Vogtle 2	4251998007	8/24/1998
1998	Vogtle 2	4251998008	9/4/1998
1999	Vogtle 2	4251999001	3/21/1999
2001	Vogtle 2	4252001001	4/7/2001
2003	Vogtle 2	4252002002	11/13/2002
2005	Vogtle 2	4252004004	11/20/2004
1987	Waterford 3	3821987008	3/15/1987
1987	Waterford 3	3821987012	4/13/1987
1987	Waterford 3	3821987016	5/25/1987
1987	Waterford 3	3821987020	7/31/1987
1988	Waterford 3	3821987028	12/11/1987
1988	Waterford 3	3821988002	1/26/1988
1988	Waterford 3	3821988016	6/14/1988
1989	Waterford 3	3821988033	12/8/1988
1989	Waterford 3	3821989013	7/15/1989
1990	Waterford 3	3821989024	12/23/1989
1990	Waterford 3	3821990002	3/22/1990
1990	Waterford 3	3821990003	3/29/1990
1990	Waterford 3	3821990012	8/25/1990
1991	Waterford 3	3821991013	6/24/1991
1991	Waterford 3	3821991019	8/25/1991
1992	Waterford 3	3821991022	11/17/1991
1993	Waterford 3	3821993001	3/4/1993
1993	Waterford 3	3821993002	6/15/1993
1995	Waterford 3	3821995002	6/10/1995
1996	Waterford 3	3821996006	5/17/1996
1998	Waterford 3	3821998014	7/16/1998
2001	Waterford 3	3822001003	2/13/2001
2001	Waterford 3	3822002901	10/14/2000
1996	Watts Bar 1	3901996004	2/19/1996
1996	Watts Bar 1	3901996009	3/13/1996
1996	Watts Bar 1	3901996011	3/27/1996
1996	Watts Bar 1	3901996014	4/16/1996
1996	Watts Bar 1	3901996015	4/21/1996
1996	Watts Bar 1	3901996016	4/28/1996
1997	Watts Bar 1	3901997002	1/22/1997
1997	Watts Bar 1	3901997006	3/6/1997
1997	Watts Bar 1	3901997008	3/6/1997
1997	Watts Bar 1	3901997010	4/20/1997
1998	Watts Bar 1	3901997015	10/19/1997
1998	Watts Bar 1	3901998001	3/7/1998
2000	Watts Bar 1	3902000004	9/10/2000
2001	Watts Bar 1	3902000005	10/6/2000
2001	Watts Bar 1	3902001001	6/29/2001
2001	Watts Bar 1	3902001002	9/4/2001

FY	Plant Name	LER	Event Date
2002	Watts Bar 1	3902001004	12/19/2001
2002	Watts Bar 1	3902002003	7/13/2002
2002	Watts Bar 1	3902002004	9/21/2002
2002	Watts Bar 1	3902002005	9/27/2002
2003	Watts Bar 1	3902003001	3/10/2003
2003	Watts Bar 1	3902003003	8/25/2003
2004	Watts Bar 1	3902004001	1/18/2004
2004	Watts Bar 1	3902004002	9/19/2004
1987	Wolf Creek	4821987002	1/8/1987
1987	Wolf Creek	4821987004	1/20/1987
1987	Wolf Creek	4821987005	1/21/1987
1987	Wolf Creek	4821987017	4/23/1987
1987	Wolf Creek	4821987022	5/28/1987
1987	Wolf Creek	4821987027	6/29/1987
1987	Wolf Creek	4821987030	7/20/1987
1987	Wolf Creek	4821987037	9/12/1987
1987	Wolf Creek	4821987041	9/27/1987
1988	Wolf Creek	4821987051	12/26/1987
1989	Wolf Creek	4821989002	1/23/1989
1989	Wolf Creek	4821989004	2/2/1989
1989	Wolf Creek	4821989013	7/11/1989
1990	Wolf Creek	4821990001	2/6/1990
1990	Wolf Creek	4821990011	5/14/1990
1990	Wolf Creek	4821990012	5/17/1990
1990	Wolf Creek	4821990013	5/19/1990
1990	Wolf Creek	4821990014	6/13/1990
1991	Wolf Creek	4821990023	10/23/1990
1991	Wolf Creek	4821991006	5/12/1991
1992	Wolf Creek	4821992002	2/19/1992
1993	Wolf Creek	4821992016	11/10/1992
1994	Wolf Creek	4821994002	2/19/1994
1995	Wolf Creek	4821995001	3/8/1995
1996	Wolf Creek	4821995006	11/10/1995
1996	Wolf Creek	4821996001	1/30/1996
1996	Wolf Creek	4821996006	6/6/1996
1999	Wolf Creek	4821999005	5/12/1999
1999	Wolf Creek	4821999008	8/5/1999
2000	Wolf Creek	4822000003	9/4/2000
2002	Wolf Creek	4822002003	5/8/2002
2002	Wolf Creek	4822002005	9/9/2002
2003	Wolf Creek	4822003003	8/18/2003
2004	Wolf Creek	4822004002	2/13/2004
2005	Wolf Creek	4822004006	10/11/2004
1987	Zion 1	2951987005	2/27/1987
1988	Zion 1	2951988011	5/7/1988
1989	Zion 1	2951989009	6/20/1989
1990	Zion 1	2951990004	1/27/1990
1992	Zion 1	2951991016	11/7/1991
1994	Zion 1	2951994005	4/3/1994
1994	Zion 1	2951994010	7/2/1994
1996	Zion 1	2951996015	4/17/1996
1996	Zion 1	2951996021	8/18/1996
1989	Zion 2	3041988007	10/8/1988
1990	Zion 2	3041990001	1/18/1990
1990	Zion 2	3041990010	9/7/1990
1991	Zion 2	3041990013	11/11/1990

Table 13. LER listing for failure trend, Figure 8.

FY	Plant Name	LER	Event Date
1989	Arkansas 1	3131988021	11/26/1988
1992	Arkansas 1	3131992005	5/19/1992
1994	Arkansas 1	3131994001	1/31/1994
1995	Arkansas 1	3131995005	4/20/1995
1989	Arkansas 2	3681989006	4/18/1989
1991	Arkansas 2	3681990024	12/5/1990
1994	Arkansas 2	3681994002	4/22/1994
1997	Beaver Valley 1	3341997005	3/19/1997
1988	Beaver Valley 2	4121987035	11/10/1987
1989	Beaver Valley 2	4121989015	5/14/1989
1990	Beaver Valley 2	4121990008	7/2/1990
1994	Beaver Valley 2	4121993014	11/29/1993
1989	Braidwood 2	4571989002	5/11/1989
1990	Braidwood 2	4571989007	11/1/1989
1988	Byron 2	4551988004	5/6/1988
1988	Byron 2	4551988008	7/14/1988
1987	Callaway	4831987003	4/2/1987
1992	Callaway	4831992005	4/10/1992
2002	Callaway	4832002001	12/3/2001
2003	Callaway	4832002014	12/14/2002
2004	Callaway	4832004003	2/3/2004
1987	Calvert Cliffs 1	3171987012	7/23/1987
1993	Calvert Cliffs 1	3171992008	11/24/1992
2001	Calvert Cliffs 1	3172001001	5/16/2001
1989	Calvert Cliffs 2	3181989004	3/1/1989
1995	Calvert Cliffs 2	3181995002	1/13/1995
1998	Calvert Cliffs 2	3181998002	3/5/1998
1987	Catawba 1	4131987026	7/6/1987
1988	Catawba 1	4131988015	3/9/1988
1989	Catawba 1	4131989007	1/27/1989
1991	Catawba 1	4131991015	7/10/1991
1992	Catawba 1	4131992008	7/12/1992
1994	Catawba 1	4131993012	12/25/1993
1987	Catawba 2	4141987024	8/7/1987
1987	Catawba 2	4141987026	9/12/1987
1988	Catawba 2	4141987029	11/3/1987
1988	Catawba 2	4141988012	3/9/1988
1989	Catawba 2	4141989010	3/14/1989
1989	Catawba 2	4141989017	7/31/1989
1989	Catawba 2	4141989019	9/12/1989
1995	Catawba 2	4141994007	10/18/1994
1992	Comanche Peak 1	4451991029	12/4/1991
1995	Comanche Peak 1	4451995004	6/21/1995
1989	Cook 1	3151989001	1/16/1989
1990	Cook 2	3161989017	10/19/1989
1991	Cook 2	3161991004	3/13/1991
1991	Cook 2	3161991006	8/1/1991
1993	Cook 2	3161993007	8/2/1993
1995	Cook 2	3161995005	8/29/1995
1987	Crystal River 3	3021987002	2/21/1987
1987	Crystal River 3	3021987013	7/12/1987
1988	Crystal River 3	3021988002	1/7/1988
1989	Crystal River 3	3021989023	6/16/1989
1992	Crystal River 3	3021991013	11/19/1991
2000	Davis-Besse	3462000005	6/8/2000
1989	Diablo Canyon 2	3231988024	12/31/1988
1989	Diablo Canyon 2	3231989001	1/17/1989
2003	Diablo Canyon 2	3232003005	4/4/2003
1990	Farley 1	3481989007	11/12/1989

FY	Plant Name	LER	Event Date
1991	Farley 1	3481991005	5/18/1991
1994	Fort Calhoun	2851993019	12/9/1993
1991	GINNA	2441990013	12/11/1990
1990	Haddam Neck	2131990004	3/16/1990
1991	Haddam Neck	2131991005	3/4/1991
1987	Harris	4001987035	6/17/1987
1989	Harris	4001989001	1/16/1989
1990	Harris	4001989017	10/9/1989
1997	Harris	4001997015	6/2/1997
1997	Harris	4001997022	8/29/1997
1991	Indian Point 2	2471991001	1/7/1991
1992	Indian Point 2	2471992007	4/13/1992
1996	Indian Point 2	2471996003	3/5/1996
1987	Indian Point 3	2861987001	1/31/1987
1988	Indian Point 3	2861988002	3/31/1988
1993	Indian Point 3	2861993004	1/13/1993
1988	Kewaunee	3051988011	8/31/1988
1990	Kewaunee	3051990006	4/14/1990
1992	Kewaunee	3051992010	4/13/1992
1996	Kewaunee	3051996007	11/9/1995
1992	Maine Yankee	3091992006	4/11/1992
1994	Maine Yankee	3091993020	10/12/1993
1996	Maine Yankee	3091996012	6/12/1996
1988	McGuire 1	3691988021	8/17/1988
1989	McGuire 1	3691988045	12/10/1988
1993	McGuire 1	3691992011	12/10/1992
1991	McGuire 2	3701991004	4/22/1991
1988	Millstone 2	3361987012	11/16/1987
1994	Millstone 2	3361994001	1/18/1994
1988	Millstone 3	4231988016	4/25/1988
1989	Millstone 3	4231989009	5/11/1989
1990	Millstone 3	4231989026	10/23/1989
1994	Millstone 3	4231994011	9/8/1994
1995	Millstone 3	4231994014	11/21/1994
2005	Millstone 3	4232005002	4/17/2005
1988	North Anna 1	3381988002	1/8/1988
1992	North Anna 1	3381992008	3/19/1992
1993	North Anna 1	3381993014	4/11/1993
1987	North Anna 2	3391987005	6/1/1987
1993	North Anna 2	3391993002	4/16/1993
1994	North Anna 2	3391994001	1/5/1994
1989	Oconee 1	2691989001	1/2/1989
1992	Oconee 1	2691992004	5/8/1992
1994	Oconee 2	2701994001	2/8/1994
1991	Oconee 3	2871991007	7/3/1991
1993	Oconee 3	2871993001	1/26/1993
1995	Palisades	2551995006	6/29/1995
1988	Palo Verde 1	5281987025	11/27/1987
1988	Palo Verde 1	5281988013	3/25/1988
1987	Prairie Island 1	2821987007	5/16/1987
1991	Prairie Island 2	3061990011	10/9/1990
1987	Robinson 2	2611987018	6/15/1987
1992	Salem 1	2721992019	8/5/1992
2000	Salem 1	2722000001	1/6/2000
2003	Salem 1	2722003001	5/23/2003
1998	Salem 2	3111998012	7/25/1998
1989	San Onofre 2	3611989001	1/12/1989
1990	San Onofre 2	3611990012	8/26/1990
1991	San Onofre 2	3611991014	9/10/1991
1992	San Onofre 2	3611992007	2/22/1992
1996	San Onofre 3	3621996001	3/12/1996

FY	Plant Name	LER	Event Date
1990	Seabrook	4431990015	6/20/1990
1996	Seabrook	4431996003	5/21/1996
2001	Seabrook	4432001002	3/5/2001
1989	Sequoyah 1	3271989005	2/10/1989
1988	Sequoyah 2	3281988012	3/5/1988
1988	Sequoyah 2	3281988026	6/11/1988
1997	Sequoyah 2	3281996005	10/11/1996
1988	South Texas 1	4981988032	2/28/1988
1990	South Texas 1	4981990006	7/30/1990
1992	South Texas 1	4981992006	3/18/1992
1993	South Texas 1	4981993007	2/4/1993
1999	South Texas 1	4981999005	5/19/1999
2003	South Texas 1	4982003005	9/4/2003
1989	South Texas 2	4991989013	4/15/1989
1993	South Texas 2	4991993004	2/3/1993
1987	St. Lucie 2	3891987003	4/9/1987
1989	St. Lucie 2	3891989007	9/23/1989
1990	St. Lucie 2	3891990001	1/14/1990
1996	St. Lucie 2	3891996002	6/6/1996
2003	St. Lucie 2	3892003001	4/1/2003
2004	St. Lucie 2	3892003006	12/20/2003
2000	Summer	3952000006	9/21/2000
1995	Surry 1	2801995001	1/8/1995
2003	Surry 1	2802003002	1/25/2003
1988	Surry 2	2811988004	3/27/1988
1988	Surry 2	2811988010	5/16/1988
1997	Surry 2	2811997001	2/18/1997
1998	Surry 2	2811997004	12/2/1997
1999	Three Mile Isl 1	2891999004	5/10/1999
2001	Three Mile Isl 1	2892001001	1/6/2001
1996	Turkey Point 3	2501996002	2/9/1996
1997	Turkey Point 3	2501997007	7/30/1997
1998	Turkey Point 3	2501998001	2/16/1998
1987	Vogtle 1	4241987009	3/20/1987
1987	Vogtle 1	4241987020	4/30/1987
1987	Vogtle 1	4241987036	6/15/1987
1988	Vogtle 1	4241987062	10/28/1987
1988	Vogtle 1	4241988008	4/7/1988
1989	Vogtle 1	4241989005	2/10/1989
1992	Vogtle 1	4241992007	9/9/1992
1994	Vogtle 2	4251993007	10/19/1993
1987	Waterford 3	3821987020	7/31/1987
2001	Watts Bar 1	3902001002	9/4/2001
1987	Wolf Creek	4821987037	9/10/1987
1993	Wolf Creek	4821993010	5/8/1993
1996	Wolf Creek	4821996001	1/30/1996
1990	Zion 1	2951989025	12/18/1989
1990	Zion 1	2951990002	1/16/1990
1992	Zion 1	2951992014	9/9/1992
1992	Zion 1	2951992016	9/26/1992
1993	Zion 1	2951992020	10/21/1992
1994	Zion 1	2951994008	6/10/1994
1991	Zion 2	3041991003	6/8/1991
1994	Zion 2	3041994002	3/7/1994
1994	Zion 2	3041994004	4/7/1994

5 DESIGN CLASSES

The AFW systems analyzed can be grouped into 11 different design classes as shown in [Table 14](#). Each system typically consists of at least two independent divisions. The divisions consist of a number of different combinations of electric-motor-driven and/or turbine-driven pump trains. Electrical power, control, and instrumentation associated with each division are independent from one another. Typically, the electric-motor-driven pump trains make up one division and the turbine-driven pump train the other. Some plants have a diesel-driven pump in place of the turbine-driven pump, or a second turbine-driven pump in place of the electric-motor-driven pumps.

The AFW system is typically started automatically by the engineered safety features actuation system (ESFAS) or equivalent, depending on plant design and terminology. The ESFAS system automatic start signals include a predetermined low water level condition in one or more steam generators, a loss of the operating main feedwater pumps, a loss of electrical power on safety-related buses, and a safety injection signal. There are additional start signals, but these four are the most common. There is significant variation among the plants in how the system responds given a start signal. However, in most cases, a low-level condition in one steam generator starts only the electric-motor-driven pumps, while a low-level condition in two or more steam generators starts both the electric and turbine-driven pumps. For the plants that have two divisions consisting of one train per division (i.e., an electric-motor and turbine-driven pump train), most start signals start both pumps.

A typical AFW system is configured with two separate mechanical divisions. Each division has independent initiation and control functions, and is designed to feed all the steam generators at full capacity. One division may consist of two electric-motor-driven pumps, while the other division may have only one turbine-driven pump. Typically, in a four-steam generator plant, each electric-motor-driven pump train has the capacity to supply two steam generators, while the turbine-driven pump train can supply all four steam generators. In the two-division two-train plants, both pumps are aligned and rated to supply all the steam generators.

Feedwater flow to each steam generator is normally controlled by a flow control valve that will modulate either open or closed to maintain steam generator level. The flow control valve can be controlled either automatically or manually. A flow recirculation line is provided downstream of each pump discharge. The recirculation line allows for continuous flow back to the suction source to provide minimum flow protection for the pump. In addition, a test return line is provided downstream of each pump discharge to allow for either full or partial testing of the pumps. To limit the flow, as steam generator pressure lowers during a cool down, the system utilizes several different methods depending on plant design. Some plants use a current limiter that acts to increase downstream pump pressure thereby reducing motor amps, others use flow restricting orifices or pipe design configurations, and others use the flow control valve that modulates closed when a flow reduction signal is received.

The turbine for each turbine-driven pump is classified as an atmospheric discharge, non-condensing turbine. Typically, driving steam is supplied from the main steam lines upstream of the main steam isolation valves from at least two steam generators. (Design class 11 turbine steam supply is from one steam generator.) Each steam supply line to the turbine contains a normally closed fail-open air-operated steam isolation valve. Some plants have a dc-powered motor-operated valve. A bypass is provided around each of these isolation valves with a flow-restricting orifice and a normally-closed fail-open air-operated bypass isolation valve. The bypass provides a small, controlled rate of steam flow to the AFW turbine for warming the steam lines and turbine. Steam drain traps are provided in the low points of the steam line to drain condensate from the lines as condensate present in the steam lines could have an adverse affect on turbine reliability during an unplanned demand.

Each turbine is supplied with a hydraulic governor control valve, and a trip and throttle valve with motor reset capability. The turbine is brought up to speed by governor control upon being supplied with steam by opening the steam supply isolation valve(s). The governor then controls the turbine speed at the pump rated speed by modulating the governor control valve. The governor controlled turbine speed can be adjusted from the control room, the remote shutdown panel, or manually at the governor.

The turbine is stopped by remotely closing the trip throttle valve from the control room or the remote shutdown panel. The trip and throttle valve is automatically (electrically) tripped on turbine overspeed at 115% of rated speed. The electric overspeed trip can be reset from either the control room or remote shutdown panel. A mechanical overspeed trip also provides automatic overspeed protection at 125% of rated speed. The mechanical overspeed trip can only be reset at the trip and throttle valve.

Feedwater is supplied to both divisions through either a single condensate storage tank with separate suction supply lines or two storage tanks with redundant supply lines. Each tank typically will have its level maintained above the minimum volume needed to provide a net positive suction head to the pumps and allow for 6 hours of system operation. For extended operation of the system or as a backup for the storage tanks, an ensured source of water is provided from a service water system. The switchover to the ensured source can be accomplished by either an automatic re-alignment of the suction valves based on a sensed, low-suction pressure condition or manually by operator action depending on the plant design (typical alignment at most plants is by manual capability). This switchover is not included in the models.

For the purposes of this analysis, the AFW system was partitioned into several different segments. These segments are (1) suction, (2) turbine-driven pump, (3) turbine steam supply, (4) turbine-driven pump feed control, (5) electric-motor-driven pump, (6) electric-motor-driven pump feed control, (7) diesel-driven pump, (8) diesel-driven pump feed control, (9) common feed control, and (10) steam generator feed. These segments are described in more detail below:

1. The suction segment includes all piping and valves (including valve operators) from the condensate storage tank (or equivalent based on plant terminology) to the pump suction isolation.
2. The turbine-driven pump segment includes the turbine, trip and throttle valve, governor assembly with the associated controls, the turbine steam supply isolation just upstream of the trip throttle valve, and the valve operators. Also included with this segment are the pump and associated piping from and including the suction isolation up to and including the discharge isolation valve, and associated valve operators. The minimum flow and test recirculation line is included if the associated tap off is prior to the discharge isolation valve.
3. The turbine steam supply segment includes the associated piping, valves, and valve operators from the main steam line penetrations (but not including) to the turbine steam supply isolation valve. The instrument air supply and dc power to the solenoid-operated valves were excluded.
4. The turbine-driven pump feed control segment includes the piping and valves from the pump discharge isolation up to the steam generator for plants with only one AFW injection header per steam generator or plants where AFW has no connection with the main feedwater system. For plants with more than one injection header per steam generator or AFW connects with the main feedwater system, the turbine-driven pump feed control segment includes the pump discharge isolation valve and upstream piping up to the connection point for the alternate injection path or main feedwater system. Included with the segment are the

associated valves and valve operators, the flow control valve and the control logic, and the test recirculation line where applicable.

5. The electric-motor driven pump segment includes the motor and associated breaker at the power board (excluding the power board itself). Also included with this segment are the pump and associated piping from and including the suction isolation up to and including the discharge isolation valve, and associated valve operators. The minimum flow and test recirculation line is included if the associated tap off is prior to the discharge isolation valve.
6. The electric motor driven pump feed control segment includes the piping and valves from the pump discharge isolation up the steam generator for plants with only one AFW injection header per steam generator or plants where AFW has no connection with the main feedwater system. For plants with more than one injection header per steam generator or AFW connects with the main feedwater system, the electric-motor driven pump feed control segment includes the pump discharge isolation valve and upstream piping up to the connection point for the alternate injection path or main feedwater system. Included with the segment are the associated valves and valve operators, the flow control valve and the control logic, and the test recirculation line where applicable
7. The diesel-driven pump segment includes the diesel engine, the associated fuel oil including the day tank, diesel-cooling water back to the supply isolation and the governor, and the engine starting system. Also included with this segment are the pumps and associated piping from and including the suction isolation up to and including the discharge isolation valve, and associated valve operators. The minimum flow and test recirculation line is included if the associated tap off is prior to the discharge isolation valve.
8. The diesel-driven pump feed control segment includes the piping and valves from the pump discharge isolation up to the steam generator for plants with only one AFW injection header per steam generator or plants where AFW has no connection with the main feedwater system. For plants with more than one injection header per steam generator or AFW connects with the main feedwater system, the diesel-driven pump feed control segment includes the pump discharge isolation valve and upstream piping up to the connection point for the alternate injection path or main feedwater system. Included with the segment are the associated valves and valve operators, the flow control valve and the control logic, and the test recirculation line where applicable.
9. The common feed control segment applies to plants where the turbine/diesel and electric-motor-driven pumps discharge to a shared header with flow to the steam generator being regulated in the common header. This segment includes the piping and valves from (but not including) the pump discharge isolation up to the steam generator for plants with only one AFW injection header per steam generator or plants where AFW has no connections with the main feedwater system. For plants with more than one injection header per steam generator or AFW connects with the main feedwater system, the feed control segment includes the pump discharge isolation valve and upstream piping up to the connection point for the alternate injection path or main feedwater system. Included with this segment are the associated valves and valve operators, the flow control valve and the control logic, and the test recirculation line where applicable.
10. The steam generator feed segment includes the check valve(s) and associated piping downstream of the common or turbine/motor feed segments. This segment generally

includes the last check valves in the feedwater system piping that prevent short cycling of AFW flow to the main feedwater system.

The Instrumentation and Control subsystem includes the circuits for the system initiation, operation, and the containment isolation function of the AFW turbine steam lines. However, each of the component failures in these circuits were screened to ensure that the failed component identified in the circuit was dedicated to the AFW system. Instrumentation and Control failures are implicit in the segment boundaries. That is, the segment affected by this type of failure would be recorded as a segment failure caused by instrumentation and control.

Additional components that were considered part of the AFW system are the circuit breakers at the motor control centers (MCCs) (but not the MCCs themselves). Heating, ventilating, and air conditioning systems and room cooling associated with the AFW system were also included. Losses of a specific AFW room cooler are included, but not failures within the service water system.

5.1.1 Design Class 1

The AFW system configuration for Design Class 1 plants consists of one motor-driven and one turbine-driven train supplying two steam generators.

5.1.2 Design Class 2

The AFW system configuration for Design Class 2 plants consists of one motor-driven and two turbine-driven trains supplying two steam generators. Overall, the two plants assigned to this design class had an operational unreliability lower than the industry average. This design class consists of Calvert Cliffs Units 1 and 2.

5.1.3 Design Class 3

The AFW system configuration for Design Class 3 plants consists of two turbine-driven trains supplying two steam generators. Overall, there is only one plant (Davis-Besse) assigned to this design class.

5.1.4 Design Class 4

The AFW system configuration for Design Class 4 plants consists of two motor-driven pump trains and a turbine-driven train supplying two steam generators.

5.1.5 Design Class 5

The AFW system configuration for Design Class 5 plants consists of two motor-driven pump trains and a turbine-driven train supplying three steam generators.

5.1.6 Design Class 6

The AFW system configuration for Design Class 6 plants consists of only three turbine-driven trains supplying three steam generators. Turkey Point Units comprise this design class.

5.1.7 Design Class 7

The AFW system configuration for Design Class 7 plants consists of only one motor-driven train and a diesel-driven pump train supplying four steam generators. The Byron and Braidwood Units comprise this design class.

5.1.8 Design Class 8

The AFW system configuration for Design Class 8 plants consists of a turbine-driven train and motor-driven train supplying four steam generators. Seabrook is the only plant that comprises this design class.

5.1.9 Design Class 9

The AFW system configuration for Design Class 9 plants consists of two turbine-driven trains supplying four steam generators. Haddam Neck is the only plant that comprises this design class.

5.1.10 Design Class 10

The AFW system configuration for Design Class 10 plants consists of two motor-driven pump trains and a turbine-driven train supplying four steam generators.

5.1.11 Design Class 11

The AFW system configuration for Design Class 11 plants consists of one turbine-driven train and three motor-driven trains with each train supplying one of four steam generators. This design class is comprised of the two South Texas plants.

Table 14. Listing of the AFW design classes, PWRs associated with each design class, the number and type of AFW trains, the number of steam generators, and the success criterion (as stated in the IPEs).

AFW Design Class	Plant Name	Motor Trains	Turbine Trains	Diesel Trains	Total Pump Trains	Steam Generators	Success Criterion Reported in the IPE
1	Arkansas Nuclear One 2	1	1		2	2	1 of 2 trains to 1 of 2 SGs
1	Crystal River 3	1	1	1*	2	2	1 of 2 trains to 1 of 2 SGs. Crystal River 3, in 2002, added a diesel driven emergency feedwater pump to the system, functionally replacing the motor driven pump. The system now has 3 pumps - 1 TD, 1 DD, and 1 MD. The TDP and the DDP start automatically, whereas, now, the MDP is a manual start.
1	Fort Calhoun	1	1	1*	3	2	<u>1 of 2 trains or FW-54 (diesel-driven)</u> to 1 of 2 SGs; since diesel is non-safety and manual start—model as 1 of 2 trains with diesel as recovery train
1	Palo Verde 1, 2, & 3	2*	1		3	2	1 of 3 pumps to one (1 of 2) SGs; <u>one motor train (MD-N) is nonessential; so net is 1 of 2 trains</u>
1	Prairie Island 1 & 2	1	1		2	2	1 of 2 trains to 1 of 2 SGs
2	Calvert Cliffs 1 & 2	1	2		3	2	300 gpm to 1 (or 2) SGs -- <u>IPE models pumps as 1 of 4 (3 plus xtie) available</u>
3	Davis-Besse	1*	2		3	2	<u>1 of 3 trains</u> to at least 1 SG (1 of 2 SGs); the MDFP serves as the MDP train and as BU to turbines, needs to be manually started; treat the MD train as recovery if the auto turbines fail. Success is 1 of 2 safety trains to 1 of 2 SGs
4	Arkansas Nuclear One 1	1	1		2	2	1 of 2 trains to 1 of 2 SGs
4	Ginna	2	1		3	2	1 of 3 pumps to 1 of 2 SGs
4	Kewaunee	2	1		3	2	200 gpm to 1 of 2 SGs from 1 of 3 AFW pumps
4	Millstone 2	2	1		3	2	1 of 2 MDP or the steam-driven pump delivers flow to 1 of 2 SGs
4	Oconee 1, 2, & 3	2	1		3	2	1 of 3 trains to 1 of 2 SGs
4	Palisades	2	1		3	2	1 of 3 pumps to 1 of 2 SGs
4	Point Beach 1 & 2	2	1		3	2	The units have only one MDP but supplies a SG at each unit net effect is 2 MD trains; 1 of 3 trains to 1 of 2 SGs
4	San Onofre 1, 2 & 3	2	1		3	2	1 of 3 AFW pumps to 1 of 2 SGs
4	St. Lucie 1 & 2	2	1		3	2	1 of 3 AFW pumps to 1 of 2 SGs
4	Three Mile Island 1	2	1		3	2	1 of 3 pumps to 1 of 2 SGs
4	Waterford 3	2	1		3	2	Any pump (1 of 3 AFW) to 1 of 2 SGs
5	Beaver Valley 1 & 2	2	1		3	3	1 of 3 trains to 1 of 3 SGs
5	Farley 1 & 2	2	1		3	3	1 of 3 trains to 2 of 3 SGs
5	Harris 1	2	1		3	3	1 of 3 trains to 1 of 3 SGs
5	Maine Yankee ⁴	2	1		3	3	1 of 3 trains to 1 of 3 SGs (2 of 2 pumps with flow diversion)
5	North Anna 1 & 2	2	1		3	3	1 of 3 trains to 1 of 3 SGs

⁴ Decommissioned August 1997.

AFW Design Class	Plant Name	Motor Trains	Turbine Trains	Diesel Trains	Total Pump Trains	Steam Generators	Success Criterion Reported in the IPE
5	Robinson	2	1		3	3	1 of 3 pumps to 1 of 3 SGs
5	Summer 1	2	1		3	3	1 of 2 MDPs OR 1 TDP to 1 of 3 SGs
5	Surry 1 & 2	2	1		3	3	1 of 3 pumps to any one SG
6	Turkey Point 3 & 4		3		3	3	1 of 3 pumps to at least 1 of 3 SGs (375 gpm)
7	Braidwood 1 & 2	1		1	2	4	1 of 2 trains to 1 of 4 SGs
7	Byron 1 & 2	1		1	2	4	1 of 2 trains to 1 of 4 SGs
8	Seabrook	1	1		2	4	PRA states 1 of 2 pumps to 2 of 4 SGs
9	Haddam Neck ⁵		2		2	4	(1 of 2 AFW pumps to 3 of 4 SGs) OR (2 of 2 pumps to 2 of 4 SGs)
10	Callaway	2	1		3	4	1 of 3 trains delivering flow to at least 2 SGs
10	Catawba 1 & 2	2	1		3	4	1 of 3 trains to 2 SGs
10	Comanche Peak 1 & 2	2	1		3	4	At least 300 gpm (1 of 3 trains) to 1 of 4 SGs; also have a 860 gpm (2 of MDP to 1 of 4 SGs or 1 TDP flow to 2 SGs); full flow--3 of 3 pumps with MDPs to 1 SG and TDP to 2 SGs
10	Cook 1 & 2	2	1		3	4	450 gpm AFW flow (1 of 3 trains) to 2 of 4 SGs
10	Diablo Canyon 1 & 2	2	1		3	4	1 of 3 trains to 1 of 4 SGs
10	Indian Point 2	2	1		3	4	1 of 3 AFW pumps to 1 SG
10	Indian Point 3	2	1		3	4	1 of 3 trains injecting to 1 of 4 SGs
10	McGuire 1 & 2	2	1		3	4	1 of 3 trains to 2 of 4 SGs
10	Millstone 3	2	1		3	4	1 of 3 pumps to any 2 of 4 SGs
10	Salem 1 & 2	2	1		3	4	426 gpm flow (1 of 3 pumps) to 2 SGs (MDP 440 gpm; TDP 880 gpm)
10	Sequoyah 1 & 2	2	1		3	4	at least one pump (1 of 3) feeding 2 SGs
10	Vogtle 1 & 2	2	1		3	4	Flow to 2 of 4 SGs from 1 of 2 MDPs or 1 TDP
10	Watts Bar	2	1		3	4	1 of 3 trains to 2 of 4 SGs
10	Wolf Creek	2	1		3	4	1 of 3 trains to 2 of 4 SGs
10	Zion 1 & 2 ⁶	2	1		3	4	1 of 3 pumps to 4 of 4 SGs or 1 of 4 SGs w/o all power. Page 4-48 states 1 MDP supplying 2/4 SGs is enough to safely cool down plant to RHR temp.
11	South Texas 1 & 2	3	1		4	4	1 of 4 AFW trains to 1 of 4 SGs (pump flow to its respective SG) no xtie to other SGs modeled in PRA

Note: * denotes plants that used non-safety pump trains as part of the IPE success criteria.

⁵ Decommissioned August 1997.

⁶ Decommissioned February 2000.

