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**ANALYSIS OF NUCLEAR POWER PLANT
COMPONENT FAILURES**

JANUARY 1984

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**Tennessee Valley Authority
Office of Power
Division of Energy Demonstrations and Technology**

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ANALYSIS OF NUCLEAR POWER PLANT COMPONENT FAILURES

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I. INTRODUCTION

The Nuclear Research Projects Branch of the Division of Energy Demonstrations and Technology has completed a two-part study which analyzes nuclear plant component failure. Part one of this study identifies the top 20 outage-causing components in the nuclear power plants and also includes an estimated power replacement cost for units out of service due to each outage-causing component. Part two of this study deals with an overall evaluation of EPRI's (Electric Power Research Institute) expenditures on nuclear related projects and/or reports addressing each outage-causing component. The data used to complete this research study was taken from the National Electric Reliability Council - Generating Availability Data System, 1980 (NERC-GADS); the EPRI Digest of Research in the Electric Utility Industry (Vol. 1, 1973-1980, Vol. 2 1981, Vol. 3 Indexes 1981); the 1982-83 EPRI Guide; and the EPRI 1982-1986 Research and Development Program plan.

NERC-GADS was requested to list the causes for nuclear and fossil unit outages or deratings with the highest hours per unit year at the beginning of the column. This listing is shown in Appendix B for the years 1972 to 1981.

II. EXECUTIVE SUMMARY

Much of EPRI's funding priorities during the 1970s were established at a time when utilities were planning for continued growth of nuclear power. LWRs had a significant economic advantage over fossil plants and it was expected that utilities would eventually be shifting to LMFBRs. As a result of these conditions, EPRI has spent a considerable amount of R&D money on long-range technology between 1973 and 1980.

By the early 1980s the utility situation had changed significantly. Interest rates had gone up tremendously; the capital cost for LWR plants had increased much more than had been anticipated; the regulatory and public attitudes toward nuclear power had become unpredictable; and many of the utilities found they had sufficient reserve power for the next 10 to 20 years without expanding the nuclear capacity.

As a result of these changes, many utility executives' concerns have apparently shifted from long-range research such as breeder reactor technology to present day concerns such as steam generator problems, BWR pipe cracking, unit availability, and avoidance of capital investment.

EPRI's R&D planning tracks the attitudes of the utility executives somewhat. They indicated in their 1982-1986 R&D program plan that they were shifting their priorities toward research with shorter term payoff. Their technology program, which deals mainly with advanced concepts, has been reduced 80 percent.

This study utilized the National Electric Reliability Council Generating Availability Data System (NERC-GADS) to determine the items that caused the utilities' loss of nuclear power. This data was used as a gross indicator of utility outage cost because it is readily available even though it does not include all associated costs (labor, materials,

etc.). A rough estimate of the power replacement cost was established for these items and compared with the money EPRI had spent (1973-1980) and plans to spend in the future (1982-1986) on R&D for these same items.

Figure 1 is a bar graph which shows the top 19 causes for nuclear units during the period studied (1971-1980). These outages have cost the utilities at least \$11 billion for power replacement. Also shown on this bar graph is an estimate of the money EPRI has spent on R&D for each of these problems between 1973 and 1980, and an estimate of the money EPRI plans to spend on these problems between 1982 and 1986.

The main contributor to nuclear plant unit outages over the period studied (1971-1980) has been refueling. EPRI allocated only a small amount of their R&D budget to help the utilities on this particular problem during the time period studied (1973-1980) and expects to increase the R&D budget in this area only a small amount in the future (1982-1986).

A considerable amount of EPRI's R&D projects were listed under code cause No. 200, "Reactor General," during the time period studied (1973-1980). This includes LMFBRs, HTGRs and other items, of which many may enhance only future reactor technology. Some of these items, however, may be a benefit to today's operating reactors. During the 1982-1986 time frame, EPRI plans to reduce emphasis on advanced concepts and concentrate more on R&D with shorter term payoff.

EPRI plans to increase funding in the nuclear safety and reactor fuel areas by a substantial amount during the 1982-1986 time period. This appears somewhat out of proportion with the need for R&D in this area based on the ranking and magnitude of the causes of nuclear plant outages.

In conclusion, it appears that some of the EPRI R&D may help the utilities on many of their nuclear plant present-day operating problems; but much of their R&D priorities during the period studied (1973-1980) have been directed towards future nuclear plants not yet in the construction stage or even planned for in the next 10 to 30 years. EPRI's future R&D priorities appear to be directed primarily toward NRC safety concerns, reactor fuel improvements, steam generators, reactor safety system values and piping and reactor general.

III. GUIDELINES FOR COMPARISON

The following general guidelines were used in matching the EPRI reports with the NERC-GADS outage or derating causes:

1. The EPRI reports were matched with the NERC-GADS outage causes when it was believed the report's subject dealt with the outage cause.
2. The subject of the EPRI report was generally matched with the NERC-GADS outage or derating cause.
3. Reports relating to nuclear plants in general were matched with the NERC-GADS code "Reactor General." This included reports with subjects relating to nuclear reactor plants, LMFBRs, HTGRs, fusion and general nuclear plant technology.
4. Some EPRI reports may be beneficial in reducing several outage or derating causes; but for the purpose of this study, each report is listed under only one outage cause or derating.
5. EPRI reports with subjects relating to safety are listed under the cause code, "Miscellaneous Capacity Factor Reductions Due to NRC Requirements." This includes reports relating to seismic, fault tree analysis, tornado missiles, fire protection, reactor core melt-down studies, loss of coolant analysis, probabilistic risk analysis, etc.
6. The NERC-GADS cause code numbers 203 and 209, "Reactor Coolant System Valves and Piping" and "Safety System Valves and Piping," were listed together because the EPRI reports benefiting one should benefit the other.

7. The cost estimates associated with the 1982-1986 EPRI programs were split between the various nuclear plant outage causes by best estimate after a review of the text in the EPRI 1982-1986 program plan. This is shown in Table 4.

IV. ANALYSIS OF TABLE 1

Each outage cause category on Table 1 is ranked according to the average hours per unit year or the average number of hours per year a unit is out of service due to a listed outage cause. The average hours per unit year is the combined total of the forced, maintenance, planned, and equivalent partial outages for the years studied (1971-1980). The power replacement cost was determined from the following equation:

$$\begin{aligned} & (\text{Price per MWH } (\$20.30)) (\text{Total No. of Unit Yrs } (421)) (\text{Avg MW/Units} \\ & \text{Studied } (639)) (\text{Avg Capacity Factor } (62.4) \text{ From } 1971-1980) (\text{Avg} \\ & \text{Outage Hrs per Unit Yr}) = \text{Power Replacement Cost for Units Studied} \end{aligned}$$

NOTE: Figures used for "Avg MW/Unit" and "Avg Capacity Factor From 1971-1980" were taken from Table 3.

The price per megawatt hour (\$20.30) is a rough estimate for the replacement power cost to provide some feel for the cost of outages or deratings. The total number of unit years (421) was taken from Table 5 in the National Electric Reliability Council Generating Availability Data System (NERC-GADS) "Ten Year Review 1971-1980 Component Cause Code Report."

The significance of the power replacement cost is that it illustrates what each outage cause has cost the utility industry from 1971-1980.

V. ANALYSIS OF TABLE 2 AND FIGURE 1

Table 2 and Figure 1 provide a close insight to the items that are causing nuclear plant outages and deratings. They identify the problems that are causing a loss of money to the utilities. By comparing the estimated replacement power cost due to certain outage causes with the EPRI expenditures, we can get an idea as to how well EPRI is addressing the utility problems.

It is noted that the EPRI R&D efforts may have resulted in a decrease in outage time for certain outage causes or may have eliminated the cause entirely; therefore, the EPRI R&D effort may show up on Table 2 as being unjustified. It is also noted that much of the R&D work EPRI has done may not eliminate or reduce the problems in the past but may eliminate or reduce the magnitude of future problems. The EPRI R&D effort may also be beneficial in increasing plant efficiency, reducing maintenance requirements, or increasing the overall plant performance. For these items and possibly other items not identified, Table 2 and Figure 1 would not provide the true value of the EPRI R&D efforts since Table 2 and Figure 1 use outage hours as the measure of R&D value.

Over the 10-year period studied (1971-1980), EPRI's high priority item has been "Reactor, General Code," cause code No. 200. This may be misleading due to the fact that many items relating to nuclear plants in general were matched with this code. It is important to note that in some cases EPRI's high priority items differ greatly with the NERC-GADS' outage contributors.

Refueling appears to be the leading contributor to outages or deratings for nuclear units in the United States; therefore, it is suggested

that further efforts be made to determine if the time required for refueling could be shortened by utilizing more R&D and/or technology transfer.

The steam turbine is the second highest cause for nuclear unit outages or deratings; therefore, it is suggested that greater emphasis be placed on research and development and possibly technology transfer to reduce the time required for turbine outages or to eliminate the causes of the outages.

Code cause Nos. 900-929, which include "Other, General Code," "Feed Water Heaters," "Feed Pumps," and various other balance of plant equipment as shown on Table 1, make up the third highest contributor to nuclear plant outages or deratings. Of these code causes, No. 900, "Other, General Code," contributes ten times as much outage or derating hours as the next highest contributor in this group. It is not known what problems are included in code cause No. 900. The above group of code causes are ranked thirteenth on EPRI's funding priority; therefore, it is suggested that an effort be made to determine what is actually causing the outages and deratings and then to determine if R&D or technology transfer could reduce or eliminate some of the problems.

Code cause Nos. 700, 701-716, and 799 include the main generator and its associated systems. This code cause group is the fourth main contributor to nuclear plant outages and deratings, but it has had a fairly low priority for EPRI's funding. It is recommended that problems with main generators and their support systems be investigated to determine if R&D and/or technology transfer could reduce or eliminate these problems.

Miscellaneous capacity factor reductions due to NRC requirements are the fifth greatest cause for nuclear plant outages or deratings. Table 2

indicates EPRI has ranked this item as the second highest funding priority. Figure 1 indicates EPRI plans to make nuclear safety their highest priority item.

Steam generators are the sixth greatest cause for nuclear plant outages or deratings. EPRI has ranked this item about fourth on their priority for funding. The priority for funding for this item seems to be satisfactory for now.

Item 7, "Condensers and Its Associated Equipment," is the seventh greatest cause for nuclear plant outages and deratings. This item is ranked eleventh on EPRI's priority for funding between 1973-1980. Figure 1 indicates EPRI plans to elevate this item on their R&D funding list.

Table 2 indicates the reactor, general code, as being the eighth greatest cause for nuclear plant outages or deratings. This item shows up as being ranked No. 1 on the EPRI funding list between 1973-1980. Table 2 and Figure 1 may be misleading on this item. For example, the EPRI R&D projects included in this item were projects that pertain to new nuclear plant types like LMFBRs, HTGRs, FUSION, etc.; so the benefit from EPRI's R&D efforts would not reduce present day outages significantly but would result in more reliable plants in the future. The EPRI R&D efforts listed under this item also included a broad range of items that may impact the nuclear plant in general but could not be listed under other items. This would make the EPRI R&D funding appear higher than it would be if it was funding only for R&D projects relating to the reactor. EPRI indicated in their 1982-1986 R&D program plan they would be decreasing funding by 80 percent for advanced concepts. A decrease in this area is also indicated in Figure 1.

Item 9, "Reactor Coolant Recirculating Pumps and Drives" is the ninth major contributor to nuclear plant outages and/or deratings. EPRI's R&D funding priority on this item appears sufficient on the basis of utility outage cost.

Item 10, "Reactor Coolant System Valves and Piping and Safety System Valves and Piping," is the tenth major contributor to nuclear plant outages and/or deratings. Table 2 and Figure 1 indicate this item has been and will be a high funding priority item for EPRI. EPRI's R&D funding priority on this item appears to be a little higher than is justified on the basis of utility outage cost as indicated in Table 2 and Figure 1.

Item 11, "Fuel Assembly Including Cladding Burnable Poison Rods and Shims," is the eleventh major contributor to nuclear plant outages and/or deratings. Table 2 and Figure 1 indicate this has been and will remain a high funding priority item for EPRI. EPRI's R&D funding priority on this item appears to be higher than is justified on the basis of utility outage cost as indicated in Table 2 and Figure 1.

Item 12, "Reactivity Limitation," is the twelfth greatest cause of nuclear unit deratings and/or outages as listed in the NERC-GADS report. Table 2 and Figure 1 indicate EPRI has not provided R&D funding for this item; however, funding for this item may have been covered by item 11, "Fuel Assembly Including Cladding, Burnable Poison Rods and Shims."

Item 13, "Maintenance Error," and Item 14, "Miscellaneous," are the thirteenth and fourteenth greatest contributors to nuclear unit outages or deratings. Table 2 and Figure 1 indicate these items received no R&D funding from EPRI in the past. It is suggested that EPRI investigate these items and determine if an R&D effort would be of value to the utilities.

Item 15, "Control Rods and Drives," is the fifteenth greatest contributor to nuclear unit outages and deratings. EPRI's R&D funding priority on this item appears to be reasonable on the basis of utility outage cost as indicated in Table 2 and Figure 1.

Item 16, "Reactor Internals," is the sixteenth greatest contributor to nuclear unit outages and deratings. EPRI's R&D funding priority on this item appears to be reasonable on the basis of utility outage cost as indicated in Table 2 and Figure 1. Figure 1 indicates no R&D funding in the future, but it is expected R&D in other areas will help on this item.

Item 17, "Reactor Protection - Instrument and Control," is the seventeenth greatest contributor to nuclear unit outages and deratings. Table 2 and Figure 1 indicate this item has been EPRI's eighth highest funding priority item in the past. Figure 1 indicates no funding for this item in the future (1982-1986).

Item 18, "Radioactive Discharge Levels to the Environment," is the eighteenth greatest contributor to nuclear unit outages and deratings. Table 2 indicates this item has been EPRI's twelfth highest funding priority item in the past. Figure 1 indicates EPRI plans to increase R&D funding for this item in the future (1982-1986). EPRI's R&D funding priority on this item appears a little higher than is justified on the basis of utility outage cost as indicated in Table 2 and Figure 1.

Item 19, "Reactor Vessel," is the nineteenth greatest contributor to nuclear unit outages and deratings. Table 2 indicates this item has been EPRI's seventh highest funding priority item in the past. Figure 1 indicates EPRI still plans to keep this item a high priority item in the future (1982-1986). EPRI's R&D funding priority on this item appears a little higher than is justified on the basis of utility outage cost as indicated in Table 2 and Figure 1.

VI. CONCLUSIONS

Table 2 and Figure 1 show the items that have caused 90 percent of the nuclear unit outages and/or deratings between 1971 and 1980 and indicate how much of a problem these items are by an estimate of power replacement cost when the units are out of service or derated. Table 2 and Figure 1 also show how much funding EPRI has provided on these specific items for R&D and technology transfer in the past and how much funding they are planning in the future (1982-1986) and, thereby, indicate their priorities.

Table 2 and Figure 1 indicate EPRI's R&D may help the utilities on only a small part of their nuclear unit outage problems. For example, refueling is the major cause for nuclear unit outages or deratings and the steam turbine is the second major cause for nuclear unit outages; however, these two items have been ranked fairly low on the EPRI priority list for R&D funding. Other items such as nuclear safety (NRC requirements), reactor general, reactor and safety valves and piping, and reactor fuel appear to be receiving more priority than is necessary as determined by analysis of nuclear unit outage causes.

Common sense also tells us that R&D may not always help in solving utilities' problems; however, it is felt that it is worth the effort for EPRI to re-evaluate their R&D priorities to better match R&D funding to actual operating problems.

FIGURE 1

REPLACEMENT POWER COST VS. EPRI R&D COST

Table 1

TOP 20 CAUSES OF FORCED, MAINTENANCE, PLANNED, AND EQUIVALENT PARTIAL OUTAGES
FOR NUCLEAR UNITS (421 UNIT YRS) FROM 1971-1980

			Avg Hrs Per	Power Replacement
			Unit Year	Cost for 421**
No.	Cause Code	Cause Description		Unit Yrs (Billion \$)
1	210	Refueling	912	\$ 3.11
2	600	Includes Codes: 620-632, 634-641, 648, 650	540	1.84
3	900	901-4, 907-10, 912-15, 918-23, 925-6, 928-9	277	0.94
4	700	Includes Codes: 701-716, 799	221	0.75
5	501, 506, 520, 523, 524, 526	Generators*	206	0.70
		Miscellaneous capacity factor reductions due to NRC requirements		
6	205	Steam Generators	205	0.70
7	800	Includes Codes: 801-2, 806-10, 814-15	180	0.61
8	200	Reactor	149	0.51
9	204	Reactor Coolant Recirculating Pumps and Drives	108	0.37
10	209	Fuel assembly including cladding, burnable poison rods and shims	75	0.26
11	208	Reactivity limitation	72	0.25
12	916	Maintenance error	60	0.20
13	299	Miscellaneous*	60	0.20
14	203	Reactor coolant system valves and piping	51	0.17
15	207	Control rods and drives	49	0.17
16	229	Safety system valves and piping	45	0.15
17	202	Reactor internals	42	0.14
18	261	Reactor protection - Instrument and control	21	0.07
19	251	Radioactive discharge levels to environment	19	0.06
20	201	Reactor vessel	19	0.06
Total of above			3311	\$11.29
Total not listed above			348	\$ 1.19

*May be additional capacity factor reductions due to regulatory agency requirements under codes 500-545.

**Based on an estimate of \$20.30 per MWh replacement cost.

Data taken from NERC-GADS (National Electric Reliability Council-Generating Availability Data System
Analysis and Reports for 1980)

Table 1 (Continued)

Cause Code	Cause Description	Avg Hrs Per Unit Year	Power Replacement
			Cost for 421** Unit Yrs (Million \$)
501	NRC order to investigate possible deficiency	7.76	\$26.5
506	NRC required modification or addition to plant (e.g., installation of fish protection equipment or cooling towers, etc.)	2.59	8.83
520	NRC order to investigate possible safety problem (e.g., BWR pipe crack)	73.28	250
523	Compliance with NRC technical specification and/or regulatory guides (e.g., periodic leak testing of containment vessel)	30.51	104
524	NRC required modification or addition to plant (e.g., design upgrade to meet seismic criteria or final ECCS acceptance criteria)	88.46	302
526	ALARA (as low as reasonably achievable) requirements (e.g., manpower radiation limitations, installation of shielding to reduce background radiation levels)	3.01	10.3
TOTALS		205.61	\$701
600	Turbine, general code	363.81	\$1241
620	Turning gear	0.82	2.8
621	Governors	2.83	9.65
622	Control, turbine and reheat stop valves	20.64	7.04
627	Shaft	1.85	6.31
628	Wheels or spindles	5.18	17.7
629	Buckets or blades	64.70	221
630	Vibration of turbine generating unit	28.24	96.3
631	Lube oil system and bearings	12.15	41.4
632	Turbine control	13.96	47.6
635	Shell leaks	1.10	3.75
636	Seal leaks	1.05	3.58
637	Cylinder outer	0.08	0.3
638	Cylinder inner	1.67	5.69
640	Gland rings	0.21	0.72
641	Diaphragm, unit and shroud type	0.08	0.3
648	Inspection	21.32	72.7
650	Differential expansion	0.01	0.03
TOTALS		539.7	\$1840

Table 1 (Continued)

Cause Code	Cause Description	Power Replacement	
		Avg Hrs Per Unit Year	Cost for 21** Unit Yrs (Million \$)
700	Generator	133.8	\$456
701	Lube oil system and bearings	0.98	3.34
702	Air cooling system	0.23	0.78
703	Hydrogen cooling system	5.08	17.3
704	Liquid cooling system	0.63	2.15
705	Seal oil system and seals	13.01	44.4
706	Stator windings, bushings, terminals	23.51	80.2
708	Rotor windings	4.63	15.8
709	Rotor collector rings	1.04	3.55
710	Brush rigging	0.15	0.51
711	Generator main leads	0.68	2.32
712	Exciter	10.40	35.5
713	Voltage regulator	1.16	3.96
714	Generator control	1.06	3.61
715	Inspection	19.38	66.1
716	Core monitor alarm	0.07	0.2
799	Miscellaneous	5.23	17.8
TOTALS		221.04	\$754
800	Condenser	124.28	\$424
801	Cleaning	9.71	33.1
802	Tube failure	26.15	89.2
806	Shell	0.13	0.44
807	Condenser control	0.90	3.1
808	Air leakage	4.95	16.9
809	Expansion joint	4.36	14.9
810	Inspection	5.33	18.2
814	Loss of vacuum	2.75	9.38
815	High condenser temperature	1.06	3.61
TOTALS		179.62	\$613

Table 1 (Continued)

Cause Code	Cause Description	Power Replacement	
		Avg Hrs Per Unit Year	Cost for 421** Unit Yrs (Million \$)
900	Other, general code	175.23	\$598
901	Feedwater heaters - Leaking	17.07	58.2
902	Feedwater heaters - Dirty	0.11	0.38
903	Main transformer	15.29	52.1
904	Switchgear	5.22	17.8
907	Water treatment system	4.44	15.1
908	Boiler water condition	2.38	8.1
909	Service water pumps	0.60	2.0
910	Computer	0.26	0.89
912	Cooling water limitation	10.05	34.3
913	Auxiliary generator	6.01	20.5
914	Auxiliary transformer	1.39	4.7
915	Operating error	12.34	42.1
918	Boiler feed pump drive - Electric motor	2.62	8.93
919	Boiler feed pump drive - Steam turbine	3.02	10.3
920	Boiler feed pump drive - Main shaft	0.13	0.44
921	Boiler feed pump drive - Other	0.46	1.6
922	Boiler feed pump	8.18	27.9
923	Fuel supply limitation	5.48	18.7
925	Starting system failure	0.31	1.1
928	Station service air	0.18	0.61
929	Feedwater valves	6.50	22.2
TOTALS		277.27	\$946

Table 2

TOP 19 CAUSES OF FORCED, MAINTENANCE, PLANNED AND EQUIVALENT PARTIAL OUTAGES
FOR NUCLEAR UNITS (421 UNIT YRS) FROM 1971-1980 WITH EPRI RANKING

No.	Cause Code	Cause Description	R A N K	A EPRI Research Expenditures (Thousand)	B Power Replacement Cost for 421 [^] Unit Yrs (Billion)	B/A
1	210	Refueling	16	\$ 63.5	\$3.11	49000
2	600	Includes Codes. 620-632, 634-641, 648, 650	6	14678.5	1.84	125
3	900	901-4, 907-10, 912-15, 918-23, 925-6, 928-9	13	1287.3	0.94	730
4	700	Includes Codes. 701-716, 799	10	3027.2	0.75	248
5	501, 506, 520, 523, 524, 526	Generators [*] , General Code Miscellaneous capacity factor reductions due to NRC requirements	2	47722.2	0.70	14.7
6	205	Steam Generators	4	30347.0	0.70	23
7	800	Includes Codes. 801-2, 806-10, 814-15	11	2322.3	0.61	263
8	200	Reactor, General Code	1	105091.4	0.51	4.9
9	204	Reactor Coolant Recirculating Pumps and Drives	9	4110.7	0.37	90
10	203	Reactor coolant system valves and piping				
	229	Safety system valves and piping	3	32297.7	0.32	9.9
11	209	Fuel assembly including cladding, burnable poison rods and shims	5	26231.0	0.26	9.9
12	208	Reactivity limitation		0	0.25	-
13	916	Maintenance error		0	0.20	-
14	299	Miscellaneous [*]		0	0.20	-
15	207	Control rods and drives	14	1235.0	0.17	138
16	202	Reactor internals	15	715.0	0.14	196
17	261	Reactor protection - Instrument and control	8	5152.6	0.07	13.6
18	251	Radioactive discharge levels to environment	12	2264.5	0.06	26.5
19	201	Reactor vessel	7	11189.2	0.06	5.4
		Total of above		287735.1	11.29	39.2
		Total not listed above		NOT KNOWN	1.19	-

May be additional capacity factor reductions due to regulatory agency requirements under codes 500-545
[^]Based on an estimate of \$20.30 per MWh replacement cost

Data taken from NERC-GADS (National Electric Reliability Council-Generating Availability Data System
 Analysis and Reports for 1980)

Table 3
CAPACITY FACTOR CHART

Capacity Factor	Year	Number Units	*Capacity MW _e (Net)	Average MW/Unit
62.4	1971	17	8113	477
62.4	1972	23	11294	491
62.4	1973	30	16844	561
57.2	1974	42	26855	639
66.5	1975	50	32828	656
63.5	1976	54	36010	666
64.4	1977	62	43993	709
67.2	1978	65	47004	723
60.5	1979	66	48145	729
57.6	1980	66	48727	738

Note: The capacity factor for 1971-1973 was based on estimates. The other numbers came from the NRC gray books.

*Based upon maximum dependable capacity (MDC); design electric rating used if MDC not determined.

Table 4

ELECTRIC POWER RESEARCH INSTITUTE SUMMARY OF PLANNED EXPENDITURES
FOR THE NUCLEAR POWER DIVISION FOR 1982-1986 AND OUTAGE CAUSE SPLIT

	EPRI Planned Expenditures (82-86) (\$ million)	Outage Cause Split* (\$ million)
Risk Assessment	67.2	
NRC Requirements		67.2
Reactor Performance	10.2	
Reactor Fuel		10.2
System and Component Analysis	17.8	
NRC Requirements		17.8
Software Integration and Validation	7.8	
Reactor Fuel		7.8
Applied Testing and Analysis	26.2	
Steam Generators		6.2
NRC Requirements		15.0
Reactor and Safety Valves and Piping		3.0
Other, General		2.0
Safety and Control Applications	10.2	
NRC Requirements		6.2
Reactor General		4.0
NSSS Testing and Analysis	6.7	
Steam Generators		1.0
Reactor Fuel		2.0
NRC Requirements		3.7
Steam Generator Technology	12.2	
Steam Generators		12.2
Nondestructive Examination	27.9	
NRC Requirements		10.9
Steam Generators		5.0
Condensers		5.0
Reactor and Safety System		
Valves and Piping		7.0
Structural Mechanics	21.0	
Reactor and Safety System		
Valves and Piping		10.0
Reactor Vessel		4.0
NRC Requirements		1.0
Reactor Coolant Pumps and Drives		3.0
Other, General		3.0

Table 4
(continued)

	EPRI Planned Expenditures (82-86) (\$ million)	Outage Cause Split* (\$ million)
Plant Materials	33.6	
Reactor Fuel		10.0
Reactor and Safety System		
Valves and Piping		13.0
NRC Requirements		10.6
Core Materials	30.9	
Reactor Fuel		30.9
External Fuel Cycle	16.9	
Radioactive Discharge to Environment		2.0
Reactor Fuel		14.9
Component Reliability	11.6	
Other, General		2.0
Steam Turbine		2.0
Steam Generators		2.0
Condensers		2.0
NRC Requirements		2.0
Refueling		1.0
Control Rods and Drives		0.6
Human Factors	5.5	
NRC Requirements		3.0
Other, General		2.5
Valves, Plant Outage and Improvements	9.7	
Refueling		5.0
NRC Requirements		3.0
Reactor and Safety System		
Valves and Piping		1.7
Chemical and Radiation Control	19.1	
NRC Requirements		6.1
Radioactive Discharge to Environment		6.0
Other, General Code		3.0
Steam Generators		1.0
Reactor and Safety System		
Valves and Piping		3.0
Emission Control and Monitoring	4.2	
Other, General Code		0.2
Radioactive Discharge to Environment		2.0
NRC Requirements		2.0

Table 4
(continued)

	EPRI Planned Expenditures (82-86) (\$ million)	Outage Cause Split* (\$ million)
Plant Monitoring and Diagnostics	4.6	
Steam Turbine		1.6
Reactor and Safety System		
Valves and Piping		1.0
Reactor Coolant Pumps and Drives		1.0
Radioactive Discharge to Environment		1.0
LMFBR	22.0	
Reactor General		22.0
Advanced Concepts and Designs	7.7	
Reactor General		7.7

*The EPRI R&D expenditures for the various programs were split between outage causes by best estimate from reviewing the text of the EPRI R&D program plan for 1982-1986.

VII. REFERENCES

1. Digest of Research in the Electric Utility Industry, Volume 1, 1973-1980, December 1981.
2. Digest of Research in the Electric Utility Industry, Volume 2, 1981-1982, December 1982.
3. Digest of Research in the Electric Utility Industry, Volume 3, Indexes, December 1982.
4. EPRI Guide - Winter 1982-1983.
5. National Electric Reliability Council Generating Availability Data System Analyses and Reports for 1980.
6. EPRI 1982-1986 Research and Development Program Plan, January 1982.

VIII. APPENDIX A
Summary of EPRI Nuclear Power Projects

CAUSE CODE 210

CAUSE DESCRIPTION: Refueling

NP #	RP #	Title	Total Cost (\$)
1080	TPS 78-790	Refueling outage water clarity improvement	49,237
340	TPS 76-634	Refueling radiation survey of Oconee 1 PWR reactor	14,301
		Grand Total	63,538

CAUSE CODE 600

CAUSE DESCRIPTION: Steam Turbine

INCLUDES CODES: 620-632, 634-641, 648, 650

NP #	RP #	Title	Total Cost (\$)
CS-2281	1648-3	Wear of steam turbine journal bearings at low operating speeds	97,360
CS-2367	1266-14	Acoustic emission monitoring for power steam turbines	154,216
744	502-2	Reliability of steam turbine rotors-nondestructive evaluation	1,560,250
BIG1F 2	700-1	Failure analysis and failure prevention in electrical systems	2,087,555
923	502-1	Reliability of steam turbine and generator rotors	1,518,320
2203	502-8	Advanced signal processing for turbine rotor bore waveforms	149,779
2404	1124-2	Turbine chemical monitoring	191,942
2391	1124-3	Turbine chemical monitoring	175,221
2397	1124-1	Turbine chemical monitoring - project management assistance	89,138
AF-445	TPS 76-641	Status of titanium blading for low pressure steam turbines	27,400
AF-903	TPS 77-746	Turbine cycle performance improvements achievable by last row titanium low pressure blades	50,000
CS-1967	912-1	Corrosion fatigue of steam turbine blading materials in operational environments	1,407,733
CS-2124	1408-1	Development of low pressure turbine coatings resistant of steam borne corrodents	1,225,825
1532	1398-1	Failure analysis--turbine disk	43,233
CS-1604	637-1	Detection of water induction-steam turbines	312,965
CS-1801-SY	1265-3	Failure cause analysis: turbine bearing systems	589,110

CAUSE CODE 600

CAUSE DESCRIPTION: Steam Turbine

INCLUDES CODES: 620-632, 634-641, 648, 650

NP #	RP #	Title	Total Cost (\$)
CS-1958	1409-1	Corrosion detector for steam and combustion turbines	519,323
CS-1990	1648-2	Assessment of rotor bearing analysis techniques	112,140
CS-2281	1648-3	Reduction of bearing losses in electric utilities	180,545
CS-2528	735-1	Condensation in steam turbines	842,863
EL-2614	TPS 81-794	Evaluation and study of turbine generator shaft parameters from subsynchronous resonance viewpoint	49,250
FP-799	TPS 77-721	Status of electroslog processings for production of large rotor forgings	35,000
AP-2536	1319-6	Putnam combined cycle plant reliability analysis	167,944
2237	1929-5	Proposal of the metal properties council on stress corrosion characterization of turbine rotor materials	417,406
2390	1124-4	Turbine chemical monitoring	196,892
2429	1398-5	Cracking of steam turbine discs	946,229
1026	700-4	Turbine related failure analysis	66,000
CS 2246	559-1	The elimination of impurity-induced embrittlement in steels	1,464,828
Grand Total			14,678,467

CAUSE CODE 205

CAUSE DESCRIPTION: Steam Generators

NP #	RP #	Title	Total Cost (\$)
HITCH	404-1	PWR secondary water chemistry study	1,965,149
636	TPS 77-709	Evaluation of eddy current inspection methods for PWR steam generator tubing	10,000
519	698-1	Evaluation of electromagnetic-acoustic concepts for inspection of steam generator tubing	74,445
723	TPS 77-723	Feasibility of using adaptive learning network concept for eddy current signal analysis	25,000
1088	1162-1	Visualization of flow regimes in steam generators	851,700
1219	620-29	Preliminary design/development of low pressure saturated steam generator	152,430
1244	1172-3	Optical technique for tube diametrical measurement	29,000
1351	1066-1	Steam generator code development	699,412
1391	RPS 129-1	Thermal-hydraulic evaluation of steam generators	178,227
1431	RPS 131-1	Thermal/hydraulic analysis of once-through steam generator	64,230
1479	RPS 169-1	Effect of out-of-plane denting loads on the structural integrity of steam generator internal	11,108
1546	RPS 130-1	Thermal-hydraulic analysis of steam generators	106,457
1576	684-1	Transient modeling of steam generator units in nuclear power plants	391,293
1607	RPS 122-1	Method of reducing carryover and reducing pressure drop through steam separator	64,089
1761	623-2	Neutralization of crevice acids relative to steam generator corrosion	1,385,188

CAUSE CODE 205

CAUSE DESCRIPTION: Steam Generators

NP #	RP #	Title	Total Cost (\$)
1687	502-1	Reliability of steam turbine and generator rotors	1,518,320
2270	RPS 132-2	Effect of changing the hydrazine injection at Carolina Power and Light, Robinson Plant	47,056
2294	RPS 189-1	Guide to the design of secondary systems and their components to minimize oxygen-induced corrosion	95,364
2295	TPS 81-777	PWR steam generator: cost benefit model development	45,900
2299	RPS 115-1	Improved multifrequency eddy current system	204,431
2310	1069-1	Development of an ac probe device to detect and measure corrosion in PWR steam generators	139,875
WS 80-136	WS 80-136	Workshop on cracking of alloy 600 U-bend tubes in steam generators, August 1980, Denver, Colorado	--
1416	963-1	Multidimensional 2-phase flow simulations for steam generator modeling	560,000
1785	RPS 126-1	Evaluation of NDE methods using a fixed site steam generator mock-up	244,663
1965	623-4	Evaluation of alternate steam generator materials and designs under varied water chemistry conditions	895,990
1999	1382-1	Factors affecting post-BNB operations for light water reactors	112,059
2448	RPS 104-2	Evaluation of the secondary system oxygen control in PWR power plants	100,000
2541	699-1	PWR steam side chemistry follow program	682,699
2547	494-1	Single- and multi-parameter blowdown heat transfer tests	1,781,649
2638	RPS 134-1	Steam generator crevice heat transfer hydrodynamic studies--Part 2	294,512

CAUSE CODE 205

CAUSE DESCRIPTION: Steam Generators

NP #	RP #	Title	Total Cost (\$)
2564	970-2	One-line monitoring and diagnostic systems for generators	178,979
WS 80-157	WS 80-157	Workshop on corrosion of Inconel 600 steam generator tubing in the tube sheet crevice	--
1772	684-1	Transient modeling of steam generator units in nuclear power plants	391,293
1785	RPS 126-1	Steam generator control chemistry	23,052
1787	704-1	Phase II water chemistry study of improved PWR steam generators and secondary systems	1,082,787
1789	RPS 128-1	Steam generator chemical cleaning: development and qualification of processes for current and new units	1,343,765
1794	RPS 136-1	Evaluation of steam generator tube #85-127 from Oconee 1-B	34,980
1829	RPS 127-1	Chemical cleaning of nuclear steam generators	1,105,533
1859	RPS 155-1	Visual inspection equipment for the secondary side of steam generators	37,178
1863	RPS 170-1	Extension of PWR secondary water chemistry evaluation	257,807
1875	RPS 140-1	Three Mile Island unit 2 steam generator data acquisition and analysis	393,099
1884	1170-1	Effects of heat treatment on passive behavior of Ni-Cr-Fe alloys in high-temperature water	154,962
2548	2079-1	Implications of recrystallization and HTGR helium effects on performance of FSV steam generators	62,797
2598	1731-1	Reflux boiling and natural circulation heat rejection tests	440,504
2610	RPS 133-1	Steam generator crevice heat transfer and hydrodynamic studies	209,567

CAUSE CODE 205

CAUSE DESCRIPTION: Steam Generators

NP #	RP #	Title	Total Cost (\$)
2648	1160-3	Fluid property and noncondensable gas effects on the reflux condensation heat transfer in a closed tube	48,780
2650	RPS 117-1	Hydrogen evolution monitoring as a measure on steam generator corrosion rate	256,498
2687	RPS 154-1	Tube cracking prediction in once-through steam generators	200,000
2711	RPS 145-1	Design guide for the prevention of erosion-corrosion, erosion-wear, and cavitation in PWR steam generator-- Part 2	56,474
2271	RPS 102-3	Prototype induced vibration analysis probe for measurement of steam generator tube/ support plate clearance	258,356
WS 80-157	WS 80-157	Workshop on corrosion of Inconel 600 steam generator tubing in the tube sheet crevice	--
2285	RPS 142-1	Evaluation of pulse-echo ultrasound for monitoring corrosion and denting in steam generator tubing	157,019
1941	RPS 119-1	Steam generator sludge pile boiler testing	325,392
1963	RPS 146-1	Diffusion and hideout in crevices	157,530
1965	634-4	Evaluation of alternate steam generator materials and designs under varied water chemistry conditions	895,990
2042	RPS 105-1	Develop radiography techniques to evaluate support plate integrity	317,362
2046	RPS 118-1	Single tube thermal and hydraulic tube support test	349,966
2082	RPS 136-2	Analysis of the 14th tube support plate debris at Oconee 1-B	72,313
2093	1708-1	Optimization of metallurgical variables to improve the corrosion resistance of Inconel 600	316,835

CAUSE CODE 205

CAUSE DESCRIPTION: Steam Generators

NP #	RP #	Title	Total Cost (\$)
2110	1541-1	Instrument development for measuring recirculating steam generator downcomer flow rates	172,663
2141	RPS 108-1	Develop and qualify NDE equipment and techniques to characterize steam generator tube dent size and shape	66,667
2146	RPS 176-1	Oconee 2 data vibration analysis	44,316
2316	1704-13	Steam generator development	727,384
1621	403-2	Multifrequency eddy current system for steam generator tubing inspection	374,555
758	403-1	Multifrequency eddy current system for steam generator tubing inspection	350,000
2298	967-2	Chemistry of corrosion-producing salts in LWR systems	10,501
1397	RPS 103-1	Evaluation of optical inspection of steam generator tubes	47,062
FANTEST	1649-5	Investigation of field test procedures for large fans	84,520
AF-158	235-1	Comparative study and evaluation of advanced cycle systems	379,450
1162	1121-1	Thermal-hydraulic analysis of U-tube steam generators	309,505
2331	311-4	Steam generator corrosion studies	53,600
1392	RPS 129-1	Thermal-hydraulic evaluation of steam generator	25,000
1419	RPS 102-1	Measurement of tube/tube support clearance via induced vibration analysis	39,765
1427	RPS 125-1	Magnetic flux leakage for measurement of crevice gap clearance and tube support plate inspection	358,176
1944	RPS 103-2	Improved prototype optical scanner for inspection of steam generator tubes	252,121

CAUSE CODE 205

CAUSE DESCRIPTION: Steam Generators

NP #	RP #	Title	Total Cost (\$)
2494	RPS 195-1	Inhibition of steam condensate corrosion of copper base alloys by hydrazine	12,500
2703	RPS 132-5	Monitoring of Salem unit 1 secondary plant oxygen and chloride control	4,173
1354	621-1	Optimization of metallurgical variables to improve the stress corrosion resistance of Inconel 600	235,993
959-1	959-1	Flecht separate effects and system effects test program (Flechtseaset)	4,939,989
		Grand Total	30,347,004

CAUSE CODES 501, 506, 520, 523,
524, 526

CAUSE DESCRIPTION: Miscellaneous Capacity
Factor Reductions Due to NRC Requirements

NP #	RP #	Title	Total Cost (\$)
2468	1323-1	Statistical methods for establishing safety systems margins	200,000
275	443-1	Separated flow model of 2-phase flow	108,863
1236	881-1	Two-phase flow analysis related to reactor safety	954,518
1237	1233-4	Value/impact analysis (VIA)	50,000
1306	1253-3	Proliferation resistant technology assessment	24,987
1759	1386-1	Development of optimum system configuration for standby emergency diesel generators	54,194
2354	1611-1	Development of a noninvasive PWR water level indicator	118,734
2468	1323-1	Statistical methods for establishing safety systems margins	200,000
2529	1810-3	Evaluation of value impact methodology	85,639
2646	961-1	Validation of real time software used in nuclear plant safety systems	262,407
WS-78-143	WS-78-143	EPRI workshop proceedings: basic 2-phase flow modeling in reactor safety and performance	--
617	827-2	Analysis support of dosimetry measurements in the reactor cavity of LWRs	29,953
1073	452-2	EPRI-Cinder modification and interfaces with EPRI-CELL and EPRI-CPM	29,597
1997	772-3	Dosimetry measurements of neutron and gamma ray fluxes in the cavities of LWRs	200,131
1193	TPS 77-745	Water as a means of cable fire protection and operational effects experience	47,343
1200	1165-1	Categorization of cable flammability	7,500
2631	1578-2	Diversion-resistant nuclear fuels processing	831,599

CAUSE CODES 501, 506, 520, 523,
524, 526

CAUSE DESCRIPTION: Miscellaneous Capacity
Factor Reductions Due to NRC Requirements

NP #	RP #	Title	Total Cost (\$)
128	301-1	CE/EPRI 2-phase pump performance program	2,823,030
135	598-1	Model pump tests and analysis for LOCA application	140,000
170	493-1	BASIA investigation of 2-phase pump performance	144,650
435	248-1	Study of reflood heat transfer during LOCA	621,566
895	688-1	Investigation of transition boiling	1,278,730
1277	1118-1	Zircaloy tube bundle thermal hydraulics at elevated temperature	378,852
1339	815-1	Hybrid analytical techniques for transient 2-phase thermal hydraulics	131,663
1486	1161-1	Temperature sensor fundamentals and technology confirmation	57,268
1692	1760-1	Heat transfer above the 2-phase mixture level under core uncover conditions	212,848
1999	1382-2	Factors affecting post-DNB operation for LWRs	90,000
2121	341-2	SUYAB/EPRI combined injection ECCS program	225,854
2192	1438-1	Critical flow data review and analysis	215,667
2344	1160-1	Basic investigation qualification of single channel countercurrent flooding models	119,000
2239	891-5	Safety parcel evaluation project	167,956
2522	813-1	Parametric study of critical heat flux data	296,716
169	444-1	Input-output analysis of energy, 1947-67	14,000
250	343-1	Evaluation of uranium-235 cross section shapes in the thermal energy range	93,900
356	453-1	Fission product data for thermal reactors	--

CAUSE CODES 501, 506, 520, 523,
524, 526

CAUSE DESCRIPTION: Miscellaneous Capacity
Factor Reductions Due to NRC Requirements

NP #	RP #	Title	Total Cost (\$)
1662	1380-2	Technical Staff analytical support	174,620
AP-1790	236-2	Safety studies of fusion-fission power reactors	96,000
114	341-1	SUNYAB/EPRI combined injection ECCS program	225,854
1090	1233-3	Probabilistic accident analysis-ATWS	56,000
2129	810-9	Approaches to nonlinear soil structure interaction design	19,650
AP-1642	474-2	Controlled thermonuclear device designed for transmutation of high-level wastes	72,400
631	613-1	Concentration of transuranics in commercial nuclear plant wastes	349,765
2334	TPS 80-756	Microwave technology in the treatment of radioactive waste	48,762
2335	1330-1	Radwaste evaporation pretreatment by ultrafiltration	113,070
2338	1557-2	Hydrocyclones for radwaste processing	61,969
2716	2062-1	Review of proposed dry storage systems	28,444
AP-1644	921-1	Background study of linear fusion devices for transmuting fission reactor wastes	225,000
1600	1557-1	Advanced low-level radwaste treatment systems	258,210
1921	1756-1	Requalification standard commentary report	49,433
143	50A 75-317	Evaluation of state of the art 2-velocity, 2-phase flow models and their applicability to nuclear reactor transient analysis	49,773
408	889-2	Development of a system transients simulator	50,000
1495	1117-2	Transient fuel behavior during hypothetical LWR accidents	29,976
1707	1385-1	PWR transient test at ANO-2	198,793

CAUSE CODES 501, 506, 520, 523,
524, 526

CAUSE DESCRIPTION: Miscellaneous Capacity
Factor Reductions Due to NRC Requirements

NP #	RP #	Title	Total Cost (\$)
159	347-1	CREARE/EPRI LWR safety research program	1,995,629
218	249-1	Zircaloy-steam oxidation kinetics	106,000
345	693-2	Hydrodynamic analysis of pressure suppression systems	530,779
441	693-1	Dynamic modeling of pressure suppression pools	1,278,730
908	1067-2	Analysis and testing of steam chugging in pressure suppression systems	400,951
2025-SY	1448-1	Quick response evaluation of critical inservice inspection issues	174,000
1167	1067-1	Analysis of steam chugging in pressure suppression systems	388,974
1747	TPS 80-721	Alternate containment state of the art review	67,505
EL 1960	1354-1	Human factors review of dispatch control centers	740,513
1118	501-3	Human factors review of nuclear power plant control board design approaches	96,462
2035	501-5	Survey and analysis of communications problems in nuclear power plants	55,769
2411	501-4	Human factors review of enhancement approaches for nuclear controls rooms	394,976
290	618-1	Documentation of utility experience with process computer in power plants	127,914
ER-278	236-1	Safety and environmental effects of central station fusion power	200,000
424	217-2	Fault tree evaluation and risk assessment of nuclear reactors	830,372
1891	1073-2	Wind tunnel measurements of dispersion turbulence in the wake of nuclear reactor plants	115,539

CAUSE CODES 501, 506, 520, 523,
524, 526

CAUSE DESCRIPTION: Miscellaneous Capacity
Factor Reductions Due to NRC Requirements

NP #	RP #	Title	Total Cost (\$)
1892	TSA 80-324	Analysis of extrapolated failure rates	14,700
1842	1119-1	Analysis of the Peach Bottom transient tests	51,890
ER-386	472-1	Fusion reactor first wall/blanket systems analysis	715,000
118	446-1	Instrumentation for measurements of 2-phase flow	18,250
189	351-1	Dynamic characteristics of nuclear reactor components	84,980
195	694-1	Reactor safety R & D planning and evaluation support	1,938,688
197	599-1	Multifluid flow analyses related to reactor safety	831,828
206	445-1	Analysis of standard problem No. 5	71,548
1684	891-3	Scoping and feasibility study for plant-wide disturbance analysis surveillance system	398,931
483	768-1	Methodology development for the statistical evaluation of safety-related engine	185,000
571	228-1	Fundamentals of scaling 2-phase fluid dynamics	69,226
604	405-1	Optimization of the design for environmental radiological surveillance systems for nuclear power plants	81,093
616	230-1	Decay heat from irradiated nuclear fuel for LOCA evaluation	328,962
800	496-1	Analytical evaluation of LWR integral tests	1,115,918
CAT	297-1	Application of probabilistic methodology to thermal reactor safety	217,000
COBRA	227-1	Transient analysis code for reactor safety studies	319,000

CAUSE CODES 501, 506, 520, 523,
524, 526

CAUSE DESCRIPTION: Miscellaneous Capacity
Factor Reductions Due to NRC Requirements

NP #	RP #	Title	Total Cost (\$)
G0-2	818-1	Development and application of advanced GO methodology for nuclear safety system assessment	219,254
1344	1377-3	Analysis of spray distribution in air and steam atmospheres	30,000
2239	891-5	Safety parcel evaluation project	167,956
2353	810-2	Soil-structure interaction	371,675
2577	1761-4	Reload safety analysis methodology	197,003
2646	961-1	Validation of real time software used in nuclear power plant safety systems	262,407
1091	810-3	Soil-structure interaction	143,000
1130	1233-1	Probabilistic reactor safety studies	2,514,416
1388	810-5	Soil-structure interaction	315,844
174	398-1	Evaluation of scale-model for seismic qualification of equipment	42,000
365	517-1	Development status and operational features of heavy water reactors	84,994
440	399-1	Full-scale tornado-missile impact test program	2,094,000
613	891-1	Online analysis of power plant disturbances	208,464
748	308-1	A bound for the impact forces of tornado missiles	41,203
749	767-1	Probabilistic reactor safety and risk analysis	1,113,973
768	616-1	Tornado missile risk analysis	145,432
865	615-1	Study of nonlinear effects of earthquake response using explicit numerical techniques	29,620
957	810-1	Soil-structure interaction	997,453

CAUSE CODES 501, 506, 520, 523,
524, 526

CAUSE DESCRIPTION: Miscellaneous Capacity
Factor Reductions Due to NRC Requirements

NP #	RP #	Title	Total Cost (\$)
988	TPS 77-750	Electric utility industry early alert report system (EARS)	47,748
EA-2311	1489-1	Expansion of cooling system data base to include environmental descriptors	354,932
984	1160-1	Basic investigation qualification of single channel countercurrent flooding models	119,000
926	709-1	Improvement of thermal benchmark analysis procedures	64,000
343	695-1	EPRI participation in comparative analysis of standard problems (CASP) program	599,311
928	958-1	Development of models for reactor transient effects	1,202,410
997	957-2	Determination of the number of fissions which occurred in a sample of 239PU	5,000
998	766-1	Measurement of beta and gamma fission product heat for 239PU	96,414
999	957-1	Cross section standardization for thermal power reactors	80,000
1350	695-3	Review of advanced analytical method developments	12,000
1373	695-3	RETRAN analysis	15,500
2140	1439-1	RETRAN analysis of the large x-trip blow- down experiment in the SGHWR	97,000
2188	1399-1	Development of an advanced methodology for LWR dosimetry applications	450,000
79-1-LD	1233-1	Probabilistic reactor safety studies	2,514,416
194	309-1	Methodology development for statistical evaluation of safety-related engineering analyses	84,022
962	1067-1	Analysis of steam chugging in pressure suppression systems	388,974

CAUSE CODES 501, 506, 520, 523,
524, 526

CAUSE DESCRIPTION: Miscellaneous Capacity
Factor Reductions Due to NRC Requirements

NP #	RP #	Title	Total Cost (\$)
1022	1117-1	Transient fuel behavior during hypothetical LWR accident	80,000
1217	393-1	Analytical and experimental study of reinforced concrete under impact loads	479,500
1224	1321-1	Feasibility study of the potential application of the endochronic theory	6,000
1734	601-1	Methodology for plastic fracture	595,000
1387	TPS 79-734	Earthquake-ground motion simulation study	5,000
1401	1065-1	Asymmetric (hydrodynamic) loads during a hypothetical LOCA	1,006,850
1505	964-2	Vibration tests at Indian Point 1	198,622
1505	964-3	Vibration tests at Indian Point 1	289,000
1505	964-4	Vibration tests at Indian Point 1	225,317
1505	964-6	Data acquisition for Indian Point 1 tests	441,362
2005	616-2	Tornado missile simulation and design methodology	177,267
2250	1065-3	Asymmetric (hydrodynamic) loads during hypothetical LOCA	204,369
2252	1627-2	Assessment and application of transient fuel behavior computer codes	16,790
280	217-1	Failure analysis and failure prevention in nuclear power systems	738,000
404	306-3	Radioactivity of recycle fuel: effect of fabrication on mixed oxide fuels	99,295
1378	971-1	Fuel rod mechanical performance modeling, Task 1	1,169,582
2626	2062-2	Study of safeguards and accountability of spent fuel in compacted form	14,848
1734	601-1	Methodology for plastic fracture	595,000
Grand Total			47,722,234

CAUSE CODE 700

CAUSE DESCRIPTION: Generators

INCLUDES CODES: 701-716, 799

NP #	RP #	Title	Total Cost (\$)
AESOPS 1	744-1	Frequency domain analysis of low frequency oscillations in large electric power systems	446,102
EL-577	429-1	Superconducting generator design	500,000
EL-541	798-1	Permanent magnetic fields in superconductor for S/C generators	45,000
EL-2043	1945-1	Application of inductions generators in power systems	90,775
EL-663	429-2	Superconducting generator design	251,627
EL-1980	1468-1	Component outage data analysis methods	307,411
EL-2195	1501-1	The development of a circuit breaker for large generators	269,341
EL-2679	1474-1	Fiber composite retaining rings for turbine driven generators	838,702
902	970-1	Determine electrical and mechanical online instrumentation monitoring needs for generators	278,245
Grand Total			3,027,203

CAUSE CODES 900-904, 907-910, 912-915,
918-923, 925, 926, 928, 929

CAUSE DESCRIPTION: Other, General Code

NP #	RP #	Title	Total Cost (\$)
CS-1445	1266-18	Design guidelines for feedwater pumps in large power generating units	39,203
2752	1934-1	BWR radiation control-plant demonstration	900,000
2129	1707-3	Threshold for radiation damage to electrical equipment	18,530
1571	1327-1	Basic causes of repetitive failures of nuclear and large fossil feedwater pumps	186,421
1759	1386-1	Development of optimum system configurations for standby emergency diesel generators	54,196
150	516-1	Future needs for dry cooling and significance to nuclear power plants	79,966
WS-78-133	WS-78-133	Feedwater heater workshop proceedings	9,000
		Grand Total	1,287,316

CAUSE CODE 800

CAUSE DESCRIPTION: Condensers

INCLUDES CODES: 801-2, 806-10, 814-15

NP #	RP #	Title	Total Cost (\$)
912	TPS 78-775	Location of condenser leaks at steam power plants	24,688
1467	TPS 79-729	Assessment of condenser leakage problems	35,000
1468	TPS 79-730	Corrosion and chemistry aspects of condenser leaks	43,456
CS-1629	733-1	Ozone dosage and contacting for condenser biofouling control	1,007,576
CS-1796	1132-1	Biofouling control practice and assessment	380,700
CS-2251	1689-1	Investigation on the admission of high energy fluids to steam surface condensers	44,383
CS-2378	1689-2	Survey of steam surface condenser and associated systems outages	98,734
FP-507	372-1	Structural design concepts for increased reliability and safety in power plant condensing system	78,957
2062	1778-1	Steam plant surface condenser leakage study update	147,782
CS-1554	902-1	Biofouling film development and destruction	79,832
EA-1082	1372-1	Study of selected alternatives to conventional chloridation practices for biofouling control	120,591
FP-432	321-1	Cooling tower study	14,210
2597	RPS 182-1	Condenser in leakage monitoring system development	246,424
		Grand Total	2,322,333

CAUSE CODE 204

CAUSE DESCRIPTION: Reactor Coolant
Recirculating Pumps and Drives

NP #	RP #	Title	Total Cost (\$)
1194	TPS 78-776	Primary coolant pump study	20,000
1447	893-1	Evaluation and test of improved fire-resistant fluid lubricant for water reactor coolant pump motors	684,806
2611	1556-1	Main coolant pump (MCP) shaft seal failure analysis	179,303
128	301-1	Two-phase pump performance program	2,823,030
474	598-1	One-third scale air-water pump program	140,000
170	493-1	Analytical models and experimental studies of centrifugal pump performance in 2-phase flow	144,625
174	398-1	Evaluation of scale-model for seismic qualification of equipment (with emphasis placed on pumps and valves)	42,000
351	TPS 76-635	BWR and PWR recirculating pump seal review	51,905
1656	TPS 79-774	High eff. electromagnetic pump	25,000
		Grand Total	4,110,669

CAUSE CODE 200

CAUSE DESCRIPTION: Reactor

NP #	RP #	Title	Total Cost (\$)
2507	1391-4	Anthropometric data base for power plant design	--
156	400-1	Technical evaluation of the thermal performance of gas-cooled fast breeder reactors	190,756
645-SY	620-22	Prototype large breeder reactor (PLBR) design studies	3,436,082
805	900-1	HTGR steam cycle technology	63,089
915	620-25	Critique of PLBR Phase A guidelines	405,350
1001	352-1	LMFBR systems analysis code development	192,762
1016-SY	620-26	Liquid metal fast breeder reactor plant design	2,270,000
1016-SY	620-27	Liquid metal fast breeder reactor plant design	210,000
1156	978-1	Evaluation of the potential of spectrum-shift control concept with uranium fuel	136,576
1265	620-28	Study of application of electromagnetic (EM) pump to 1,000 MW _e pool-type LMFBR	--
1292	900-3	GCFR evaluation support	48,695
1616	620-32	Conceptual design of a 1,000 MW _e heterogeneous oxide LMFBR	377,471
1656	TPS 79-774	High efficiency electromagnet pump	25,000
1887	1704-10	Locating failed fuel in LMFBRs	57,765
1972	1704-8	Consultation to LMFBR design assessment contractors	124,876
1985	1704-15	State of the art review of the sodium compatibility of proposed construction materials for the PLBR	16,500
2021	1704-4	Assessment of inspectability of LMFBR designs	455,069

CAUSE CODE 200		CAUSE DESCRIPTION: Reactor	
NP #	RP #	Title	Total Cost (\$)
2030	1704-2	Study of operability of PLBR designs	697,371
516	404-1	PWR secondary water chemistry study	1,965,149
PSMS	895-1	Power shape monitoring system, Task 3	1,268,555
PSMS	1442-1	BWR core power distribution analysis and control	1,155,474
214	130-1	Nuclear reactor core benchmark data	442,549
296	345-1	Columbia/EPRI core thermal-hydraulic research program	566,045
337	SOA 75-318	Review of in-core power distribution measurements--technical status and problems	27,900
425	492-1	Calculation of the deposition of gamma energy in typical LWR fuel assemblies during postulated LOCA and LOCA conditions	147,091
563	1020-1	Transient and stability tests at Peach Bottom 2 during cycle 2	262,017
672	492-2	Experimental fission product gamma ray deposition	83,542
971	1020-2	BWR core stability testing	206,000
1190-SR	620-1	Liquid metal fast breeder reactor plant design	3,000,000
1235	1178-1	Core performance benchmarking	123,324
1278	1120-1	Online nuclear power distribution	130,064
152	304-1	Study of radiation dosage to structural components in nuclear reactors	107,299
315	700-1	Failure analysis and failure prevention in electrical system	2,087,555
798	817-1	Water impact tests of BWR pressure suppression systems models	344,094
914	823-1	Development of an x-ray device for stress measurement	437,817

CAUSE CODE 200

CAUSE DESCRIPTION: Reactor

NP #	RP #	Title	Total Cost (\$)
1213	1249-1	Hot isostatic processing (HIP) of nuclear casting	97,000
1276	697-1	Theoretical and experimental analysis of stresses in reactor components	199,980
984	1160-1	Basic investigation qualification of single channel countercurrent flooding models	119,000
1382	959-1	Flecht separate effects and system effects test program (Flechtseaset)	4,939,989
1409	1380-1	Technical Staff analytical support	59,084
1522	1377-1	BWR refill and reflood thermal hydraulics	4,450,000
2370	956-1	Critical flow testing at Marviken, Sweden	700,000
2263	1784-2	BWR cobalt identification	65,771
2681	1784-3	Cobalt alloy replacement for PWR	96,699
2685	1784-1	Cobalt source identification	77,221
155	219-1	Radiation shielding information center	50,000
949	819-1	BWR radiation assessment and control	1,322,199
801	767-1	Probabilistic reactor safety and risk analysis	1,113,973
ER-469	268-1	Fission-fusion hybrid concept	100,000
1987	1704-17	Measurements of the coefficient of friction between 2/14 CR-IMO steel and alumina refractions	55,747
2598	1731-1	Reflux boiling and natural circulation heat rejection tests	440,504
COPHIN	125-3	Development of and improved lattice physics analysis capability	94,941
472	519-2	Documentation of operating data from light water power reactors for methods verification	48,971

CAUSE CODE 200		CAUSE DESCRIPTION: Reactor	
NP #	RP #	Title	Total Cost (\$)
511	130-3	Nuclear reactor core benchmark data	313,340
587	686-1	Defining document for a design/evaluation model for BWR power plants	43,307
2606	966-1	Properties of colloidal corrosion products and their effects on nuclear power plants	334,381
2752	1934-1	BWR radiation control-plant demonstration	900,000
1405	1397-1	Rhodium SPND sensitivity depletion measurements	169,530
1707	1385-1	PWR transient tests at ANO-2	198,793
1986	1704-16	Compatibility of refractory insulating materials with sodium	50,000
1919	1254-1	Analysis of the thorium-fueled core in Indian Point 1 reactor	108,753
2176	712-1	Conceptual core designs (based on LWBR) for a heavy water reactor	200,000
2354	1611-1	Development of a noninvasive PWR water level indicator	118,734
267	503-1	Sensor time response verification	69,502
495	274-1	Evaluation of radioiodine sources and other radionuclide effluents at nuclear power plants	1,201,860
571	228-1	Fundamentals of scaling 2-phase fluid dynamics	69,226
692	821-1	Evaluation of the effects of hydrogen addition in PWRs prior to refueling	126,788
757	341-1	SUNYAB/EPRI combined injection ECCS program	225,854
834	503-3	Sensor time response verification	168,463
858	825-2	Radiation control in the primary coolant loop of PWR plants	1,130,471

CAUSE CODE 200

CAUSE DESCRIPTION: Reactor

NP #	RP #	Title	Total Cost (\$)
1232	519-6	Documentation of operating data from light water power reactors methods verification	20,092
1382	959-1	Flecht separate effects and system effects test program (Flechtseaset)	4,939,989
2361	1938-2	Evaluation of relap-5 codes for analysis of LWR transients	196,874
613	613-1	Concentration of transuranics in commercial nuclear plant wastes	349,765
824	812-1	Analysis of fluid-structure interaction in BWR pressure suppression	286,639
827	519-2	Documentation of operating data from light water power reactors for methods verification	48,971
1856	965-3	Analysis of LOCA-induced fluid structure	562,000
1893	RPT 110-2	Low temperature solute segregation	76,777
1898	1751-1	Qualification of a critical heat flux model for BWR analysis	75,740
1920	1177-1	In-core fuel management for operational decisions and problems	39,610
1923	1754-1	Development of a BWR core flow analysis capability	94,019
2332	1570-2	Operation of EPRI nondestructive evaluation (NDE) center	11,832,479
2164	1754-3	Analysis of bypass flow distribution in a boiling water reactor	45,000
1344	1377-3	Analysis of spray distribution in air and steam atmospheres	30,000
1410	519-4	Documentation of operating data from light water power reactors for methods verification	26,327
1490	965-1	Analysis of LOCA-induced fluid/structure interaction	41,962

CAUSE CODE 200

CAUSE DESCRIPTION: Reactor

NP #	RP #	Title	Total Cost (\$)
1753	1387-1	Development and application of advanced statistical methods for online BWR stability analysis	66,000
1835	706-1	BWR oxygen control demonstration program	651,044
1842	119-1	Analysis of the Peach Bottom transient tests	51,890
2570	772-1	Dosimetry measurements of neutron and gamma ray fluxes in the reactor cavities of LWRs	229,689
1296	1242-1	Practical method of inelastic analysis for nuclear power plant components	50,000
1296	1242-2	Practical method of inelastic analysis for nuclear power plant components	49,999
1555	700-5	Structural and mechanical analysis methods	189,985
1686	1245-2	Technique to insert controlled and programmed flaws in heavy section weldments	164,221
1703	700-6	Cost-effective analysis of system modification: BWR 02 control	50,783
1971	1395-5	NDE techniques for residual stress measurement	17,380
2329	1331-1	Stellite replacement	592,460
2684	1567-1	Component wear measurements	92,000
1714	1704-1	Assessment of maintainability of LMFBR designs	414,835
2297	1388-1	Benchmark analysis of core bundle thermal-hydraulic experiments	438,356
1130	1233-1	Probabilistic reactor safety studies	2,514,416
1892	TSA 80-324	Analysis of extrapolated failure rates	14,700
1921	1756-1	Requalification standard commentary report	49,433
206	445-1	Analysis of standard problem No. 5	71,548

CAUSE CODE 200

CAUSE DESCRIPTION: Reactor

NP #	RP #	Title	Total Cost (\$)
1720	495-1	BWR full integral simulation test (FIST) program	3,842,669
169	444-1	Technical support for BDHT analysis	145,849
AP-2293	546-2	Fusion power reactor control analysis	359,850
CS/NP 2086	1163-1	Power plant performance modeling	885,118
ER-533	546-1	Fusion reactor control study	299,584
275	443-1	Separated flow model of 2-phase flow	108,863
333	TPS 76-643	A study of preoperational practices in nuclear power plants	48,340
1928	1381-1	Solution methods for simulation of nuclear power systems	185,771
2568	1448-1	Quick response evaluation of critical inservice inspection issues	174,000
454	887-1	Operational transients controlling parameters study	49,856
RETRAN-02	342-1	Reactor system analysis code development	1,196,819
RETRAN-02	889-1	Development of a system transients simulator	150,000
1012	1019-1	Alternative void fraction system development	367,857
1869	1119-2	Analysis of the Peach Bottom transient tests	66,546
985	975-4	Evaluation of sensitivity of reactor design and economics to nuclear data	135,000
1098	975-1	Nuclear data file development and standardization activities--ENDF/B-V development	577,674
2345	975-2	Nuclear data file development and standardization activities	232,000

CAUSE CODE 200		CAUSE DESCRIPTION: Reactor	
NP #	RP #	Title	Total Cost (\$)
180	392-1	Direct measurement of total fission product decay energy following shutdown	126,472
613	891-1	Online analysis of power plant disturbances	208,464
616	230-1	Decay heat from irradiated nuclear fuel for LOCA evaluation	328,962
846	897-1	A self-actuated shutdown system for a commercial size LMFBR	157,237
1033	828-1	Online concentration chemical decontamination	1,462,510
1684	891-3	Scoping and feasibility study for plant-wide disturbance analysis surveillance system	398,931
2577	1761-4	Reload safety analysis methodology	197,003
2531	1166-1	Corrosion and corrosion cracking of materials for water cooled reactors	2,211,968
1833	1128-1	Technical feasibility of low water volume fraction lattice reactor designs	18,397
P-2073	TPS 78-817	Lead time for advanced nuclear power technologies	94,301
COBRA	227-1	Transient analysis code for reactor safety studies	319,000
2032	518-1	Evaluation of finite element and flux expansion techniques for application to transient and depletion analysis	637,439
COPHIN	1252-3	Development of an improved lattice physics analysis capability	94,941
638	972-1	Monte Carlo analysis for validating fuel management codes	352,356
142	401-1	Development status and operational features on the high temperature gas reactor	164,000
454	887-1	Operational transients controlling parameters study	49,856

CAUSE CODE 200

CAUSE DESCRIPTION: Reactor

NP #	RP #	Title	Total Cost (\$)
2401	1384-2	Boiling water reactor void prediction models	599,126
STEALTH	307-1	Development of 1- and 2-dimensional Cotinuum mechanics codes for transient analysis	1,153,780
149	292-2	Transient critical heat flux	128,763
PHAMAS	1233-2	Phased mission analysis techniques for improved LWR availability and safety	85,000
785	248-1	Study of reflood heat transfer during LOCA	621,566
980	443-2	Separated flow model of 2-phase flow	470,678
2570	772-1	Dosimetry measurements of neutron and gamma ray fluxes in the reactor cavities of LWRs	229,689
2167	139-1	Development of a national data system for power plant	76,223
2360	1391-5	Data systems quantitative techniques	161,533
2384	1391-3	Decentralized data systems survey recommendations	118,023
2418	1253-6	Engineering aspects of LWR life extension	160,434
2589	1332-1	Mechanisms of environmental cracking in systems peculiar to the power generation industry	189,870
2676	1396-1	Test of job performance aids for power plants	317,288
WS 78-94	WS 78-94	Outage planning and maintenance management	40,620
WS 81-212	WS 81-212	Simulation methods for nuclear power systems	--
1014	620-21	Liquid metal fast breeder reactor plant design	1,570,000
1136	894-1	Limiting factor analysis of high availability nuclear plants	395,092

CAUSE CODE 200

CAUSE DESCRIPTION: Reactor

NP #	RP #	Title	Total Cost (\$)
1137	894-2	Limiting factor analysis of high availability nuclear plants	453,333
1138	894-3	Limiting factor analysis of high availability nuclear plants	412,095
1139	894-4	Limiting factor analysis of high availability nuclear plants	350,000
1334	SOA 78-412	Analytical methods for nuclear power plant availability improvement	30,096
1168	TPS 78-816	Plant decontamination methods review	58,682
1520	1391-1	Development of a national data system for power plants	76,223
1558	890-1	Assessment of class, i.e., equipment aging and qualification techniques--Part 2	197,947
2035	501-5	Survey and analysis of communications problems in nuclear power plants	55,769
EA-2153	1433-1	Decision framework for technology choice	249,898
438	705-1	Development and maintenance of a nuclear experience data base	337,539
543	826-1	Optimization of reliability data systems	194,369
646	620-20	Prototype large breeder reactor (PLBR) design studies	3,445,000
697	457-1	Comprehensive study of the operating and testing experience during the startup and initial operation at the Fort St. Vrain HTGR	148,000
1741	311-1	Corrosion programs to support reliability of nuclear power systems	1,769,000
2684	1567-1	Component wear measurements	92,000
493	TPS 76-662	Implementing availability engineering in electric power plants	24,999
514	TPS 76-665	Study of magnetic filter performance in light water reactor systems	--

CAUSE CODE 200

CAUSE DESCRIPTION: Reactor

NP #	RP #	Title	Total Cost (\$)
522	TPS 76-663	Survey on the generation, transport, and deposition of corrosion products in light water reactors	39,395
759-WS	WS 77-32	Workshop on implementation of availability engineering in the electric utility industry	14,088
836	TPS 77-722	Assessment of the feasibility of consolidating power plant data systems	43,283
1064	771-1	Analysis of reliability/availability data systems	390,136
1107	TPS 78-793	Study of semiautomatic welds crown contouring for improved inservice inspection	49,385
1191	771-4	Assessment of reliability/availability data systems	239,040
2168	1446-1	Power plant availability engineering program	124,387
2437	1704-14	Special concretes for LMFBR applications	24,000
2437	1704-19	Special concretes for LMFBR applications	56,000
2548	2079-1	Implications of recrystallization and HTGR helium effects on performance of FSV steam generators	62,797
2672	1704-11	Review of large LMFBR design-thermal stripping evaluation	293,682
1442	888-2	Two-phase flow analyses related to reactor safety	35,000
1771	1074-1	Studies of plutonium and uranium benchmark experiments	96,850
1917	958-1	Development of models for reactor transient effects	1,202,410
239	299-1	Numerical evaluation of stress intensity factors by global-local finite element method	169,646

CAUSE CODE 200		CAUSE DESCRIPTION: Reactor	
NP #	RP #	Title	Total Cost (\$)
1340	1707-2	Environmental qualification program, data base	423,142
132	450-1	Uranium recovery from sea water	80,000
334	506-3	Field ionization for isotope separation	101,844
500	456-2	Anisotropic deformation of zircaloy	320,000
717	455-1	EPRI/NASA cooperative project on stress corrosion cracking of zircalloys	100,000
1069	506-1	Isotope separation velocity-slip process	73,160
1501	559-1	The elimination of impurity-induced embrittlement in steels	1,464,828
1603	1563-1	BWR resin intrusion survey	74,162
1823	1072-1	Basic studies on the variabilities of fabrication related sensitization phenomena in stainless steels	250,000
2400	1167-1	High temperature behavior of chemical species which affect boiler performance	818,349
120	337-1	HTGR fracture toughness program	35,870
338	504-1	Evaluation of ultrasonic tomography for the mapping of stress fields in thick metal sections	340,690
373	232-3	Determining fracture properties of reactor vessel forging materials, weldments, and bolting materials	294,795
412	499-1	Nucleation and growth of microfractures	50,000
1407	504-2	Residual stress measurements in thick metal sections	367,722
1534	605-1	Evaluation of defect characterization by ultrasonic holography	390,311
1931	1237-1	Estimation techniques for elastic-plastic fracture	1,190,842

CAUSE CODE 200

CAUSE DESCRIPTION: Reactor

NP #	RP #	Title	Total Cost (\$)
1858	1570-3	Definition of Section XI Ultrasonic Test Techniques	289,407
1877	608-1	EPRI-National Bureau of Standards Cooperative Program on Acoustic Emission	756,600
2715	2055-7	Reconstituted charpy impact specimens	72,359
		Grand Total	105,091,349

CAUSE CODES 203, 229

CAUSE DESCRIPTION: Reactor Coolant System Valves
and Piping and Safety System Valves and Piping

NP #	RP #	Title	Total Cost (\$)
2261	RPT 118-9	Application of tearing modulus stability concepting on nuclear piping	99,750
2472	RPT 118-1	Growth and stability of stress corrosion cracks in large diameter BWR piping	756,525
EL-1246	565-1	Heat pipe cooled epoxy bushings	593,591
688	770-1	Development of adaptive techniques for pipe inspection	249,830
1414	1071-1	Explosive welding for fabrication and repair of nuclear mattering and components	59,843
1285	1122-1	Feasibility study of pipe welding using a homopolar generator	107,000
1835	1072-1	Basic studies on the variabilities of fabrication related sensitization phe- nomena in stainless steel	250,000
2347	RPT 118-2	Instability predictions for circumfer- entially cracked large-diameter type 304 stainless steel pipes under dynamic loading	973,613
ABAQUS-ND	964-5	Evaluation of pipe whip analysis capability	63,534
ABAQUS-ND	1324-3	Nonlinear finite element piping of Indian Point 1 tests	179,133
676-SR	TPS 75-620	A study to define areas of NDE research for inspection of stainless steel	50,000
891	892-1	BWR-NDE nozzle welding project	26,876
914	823-1	Development of an x-ray device stress measurement	437,817
964	1125-1	Application of nonlinear signal proces- sing to pipe and nozzle inspection	3,860,897
1003	TPS 77-724	Evaluation of mechanized pipe welding	24,659
1026	700-6	Cost-effective analysis of system modi- fication: BWR 02 control	50,783

CAUSE CODES 203, 229

CAUSE DESCRIPTION: Reactor Coolant System Valves
and Piping and Safety System Valves and Piping

NP #	RP #	Title	Total Cost (\$)
1163	1325-2	Preliminary assessment of the relationship between inspection internal and relative failure probability for larger diameter BWR piping	25,569
1208	1324-1	Evaluation of pipe whip analysis capability	27,676
1743	1174-1	Effects of weld parameters on residual stresses in BWR piping systems	275,000
1754	RPT 107-1	X-ray stress analyzer for 10-inch pipe	220,841
858	825-1	Radiation control in the primary coolant loop of PWR plant	1,130,471
1893	RPT 110-2	Low temperature solute segregation	76,777
1991	311-3	The influence of combined environmental effects on the stress corrosion cracking of welded stainless steel piping	239,687
2332	1570-2	Operation of EPRI nondestructive evaluation (NDE) center	11,832,479
2399	RPT 118-7	Analysis to predict the shapes of growing stress corrosion cracks in BWR piping welds	65,878
2406	1248-1	Environmental cracking margins for carbon steel piping	1,063,688
2426	RPT 101-2	Automated UT surface scanner design specification	125,979
2431	1237-2	Validation and implementation of the 2-criteria failure assessment procedure	115,782
2531	1166-1	Corrosion and corrosion cracking of materials for water cooled reactors	2,211,968
2568	1448-1	Quick response evaluation of critical inservice inspection issues	174,000
2709 CCM	1550-1	Nonlinear finite element dynamic computer code development	179,436
1714	1704-1	Assessment of maintainability of LMFBR designs	414,835

CAUSE CODES 203, 229

CAUSE DESCRIPTION: Reactor Coolant System Valves
and Piping and Safety System Valves and Piping

NP #	RP #	Title	Total Cost (\$)
1320	1324-2	Study of the state of the design for pipe whip	20,267
522	TPS 76-663	Survey on the generation, transport, and deposition of corrosion products in light water reactors	39,395
2606	966-1	BWR-NDE nozzle welding project	26,876
174	398-1	Evaluation of scale for seismic qualification of equipment	42,000
241	521-1	Assessment of industry valve problems	99,850
1313	1246-1	Acoustic monitoring for power plant valves	447,595
1473	894-5	Assessment of valve problems contributing to nuclear plant unavailability	27,436
2381	1389-1	Measurements and comparisons of generic BWR-MSIVs	282,586
2454	1243-1	Comparison of generic BWR-MSIV valve configurations	206,654
2560	1623-1	Valve packing improvement	139,010
186	218-1	Development of high temperature, biaial strain measurement device	80,000
192	585-1	Mechanical fracture predicting for sensitized stainless steel piping	110,000
761	687-1	Thermo-hydraulic forces associated with crack propagation in reactor piping	213,916
WS 80-155	WS 80-155	Environmental research in hydroelectric power	10,000
2503	1754-4	Critical flow correlation study	24,372
2457	1547-1	Impurity segregation in stainless steel	119,470
2641	2006-3	Environmental crack growth measurement techniques	179,900

CAUSE CODES 203, 229

CAUSE DESCRIPTION: Reactor Coolant System Valves
and Piping and Safety System Valves and Piping

NP #	RP #	Title	Total Cost (\$)
2524	706-1	BWR oxygen control demonstration programs	651,044
2453	825-2	Radiation control in the primary coolant loop of PWR plants	1,130,471
2709 CM	964-5	Nonlinear finite element piping code development in support of Indian Point 1 tests	179,133
436-SP	TPS 75-609	A program to evaluate current ultrasonic inspection practice for BWR piping welds	47,830
761	449-1	Corrosion studies of nuclear piping in BWR environments	1,066,000
1408	505-1	Development of a digital memory acoustic emission zone monitor/recorder for BWR pipe cracking	274,125
2529	1810-3	Evaluation of value impact methodology	85,639
648	275-1	Water entrainment in intercompartmental flows resulting from pipeline breaks	209,500
340	TPS 76-634	Refueling radiation survey of Oconee 1 PWR reactor	14,301
2329	133-1	Stellite replacement	592,460
213	610-1	Evaluation of x-ray tomography	36,769
304	232-4	Detection and determination of subcritical crack growth in ferritic materials	59,130
Grand Total			32,397,646

CAUSE CODE 209

CAUSE DESCRIPTION: Fuel Assembly Including Cladding,
Burnable Poison Rods, and Burnable Poison Shims

NP #	RP #	Title	Total Cost (\$)
409	509-1	Nuclear fuel performance evaluation	300,103
218	586-1	Joint EPRI/C-E power fuel performance evaluation program	2,481,749
340	TPS 76-634	Refueling radiation survey of Oconee 1 PWR reactor	14,301
359	515-1	Thorium based fuel cycles in pressurized water reactors	169,773
812	829-1	Determination and microscopic study of incipient defects in irradiated power reactor fuel rods	509,900
1055	300-1	Strategies for plutonium utilization in thermal power reactors	74,663
1254	1250-2	Zircaloy corrosion and crud deposition review	44,500
1472	1250-1	Uniform waterside corrosion of zircaloy clad fuel rods	1,497,627
1492	1229-1	Hydraulic investigation of a 4 x 6 rod bundle (B&W)	139,991
2354	TPS 80-756	Microwave technology in the treatment of radioactive waste	48,762
2392	1118-1	Zircaloy tube bundle thermal hydraulics at elevated temperatures	378,852
161	451-1	Preparation of heavy actinide cross section data for evaluated nuclear data file	21,008
163	346-1	Monte Carlo analysis of thermal fission cross section ratios and alpha experiments	60,000
167	512-1	Evaluation of uranium-235 cross section shapes in the thermal energy range	93,900
196	348-1	Clean critical experiment benchmarks for plutonium recycle in LWRs	375,000
209	247-1	Light water reactor benchmark data interpretation	81,294

CAUSE CODE 209

CAUSE DESCRIPTION: Fuel Assembly Including Cladding,
Burnable Poison Rods, and Burnable Poison Shims

NP #	RP #	Title	Total Cost (\$)
562	709-1	Improvement of thermal benchmark analysis procedures	64,000
2119	1758-1	Characterization of failures in stainless steel cladding	300,000
1657	514-1	Fast reactor blanket designs	245,000
214	130-1	Nuclear reactor core benchmark data	442,549
1974	TPS 79-708	Planning study on nuclear reactor control materials	71,500
1204	494-3	Evaluation of feedback between coolant heat transfer and cladding swelling	24,970
1663	1453-1	Feasibility of using gadolinium as a burnable poison in PWR cores	112,302
225	249-1	Zircaloy-steam oxidation kinetics	106,000
347	249-2	Zircaloy-steam oxidation kinetics	119,994
524	251-1	Zircaloy properties under simulated LOCA conditions	1,737,225
1296	971-3	Fuel rod mechanical performance modeling	19,961
2291	971-1	Fuel rod mechanical performance modeling, Task 1	1,169,582
2291	971-2	Fuel rod mechanical performance modeling, Task 3	1,025,507
332	820-1	Develop metallurgical methods for evaluation of performance characteristic for nuclear cladding metals	4,000
948	TSA 78-156	Evaluation of radiation source strengths	5,678
1197	767-4	Fuel cycle risk assessment	218,563
ARMP	118-1	Plutonium recycle methodology development	600,000
223	72-2	Use of plutonium fuel in water reactors	3,590,068

CAUSE CODE 209

CAUSE DESCRIPTION: Fuel Assembly Including Cladding,
Burnable Poison Rods, and Burnable Poison Shims

NP #	RP #	Title	Total Cost (\$)
240	497-1	Quad cities-1 plutonium recycle nuclear and fuel performance measurements	2,818,008
346	612-1	Cross section sensitivity analysis for thermal lattice parameters	45,000
222	353-1	Evaluation of temperature coefficients and the adequacy of inherent reactivity control characteristics for the 233U-thorium cycle HTGR	150,000
359	515-1	Thorium based fuel cycles in pressurized water reactors	169,773
931	620-24	Proliferation assessment methodology development	16,960
1919	1254-1	Analysis of the thorium-fueled core in Indian Point 1 reactor	108,753
556	708-1	Improvement of the ENDF/B nuclear data base for use in thermal reactor analysis	110,000
998	511-1	Uranium-238 resonance self-indication analysis and measurements	161,990
847	349-1	Plutonium usage in HTGRs and LWRs	36,000
1067	707-2	Evaluation of heavy actinide cross section data for evaluated nuclear data file	22,328
1248	975-3	Analysis of fuel cycle sensitivity calculations	413,949
1258	707-4	Determination of neutron multiplicities of fissile nuclei	169,419
1502	1074-1	Studies of plutonium and uranium benchmark experiments	96,850
1763	707-1	Evaluation of the thermal neutron cross sections of the fissile nuclei: 233U, 239PU, and 241PU	225,000
2278	1321-2	Analytical methods for transient fuel behavior	44,598

CAUSE CODE 209

CAUSE DESCRIPTION: Fuel Assembly Including Cladding,
Burnable Poison Rods, and Burnable Poison Shims

NP #	RP #	Title	Total Cost (\$)
2279	1627-4	Assessment and application of transient fuel behavior computer codes	15,905
146	TSA 75-21	Thermographic imaging of nuclear fuel rods	18,917
369	397-1	LWR fuel rod modeling code evaluation	276,707
637	396-1	Plutonia fuel study	1,100,000
854	TPS 77-744	Cost of fuel failure study	24,993
892	397-3	LWR fuel rod modeling code evaluation	175,000
982	456-2	Anisotropic deformation of zircaloy	320,000
1106	508-1	Cracking and healing behavior of UO2 as related to pellet-cladding mechanical interaction	640,500
1106	508-2	Statistical mechanics of uranium dioxide nuclear fuel	158,907
1155	1027-1	Characterization of irradiated zircaloys	599,383
1488	971-1	Fuel rod mechanical performance modeling, Task 1	1,169,582
1952	1702-4	Feasibility of using 2-dimensional gamma scanning to nondestructively characterize LWR fuel rods	35,000
1954	1702-2	Analysis of fission product migration and release experiments	68,329
1329	455-1	EPRI/NASA cooperative project on stress corrosion crack of zircaloys	841,236
2483	1943-1	Assessment of BWR channel lifetimes	49,562
Grand Total			26,230,971

CAUSE CODE 208

CAUSE DESCRIPTION: Reactivity Limitation

NP #	RP #	Title	Total Cost (\$)
		Grand Total	No Cost

CAUSE CODE 916

CAUSE DESCRIPTION: Maintenance Error

NP #	RP #	Title	Total Cost (\$)
		Grand Total	No Cost

CAUSE CODE 299

CAUSE DESCRIPTION: Miscellaneous

NP #	RP #	Title	Total Cost (\$)
		Grand Total	No Cost

CAUSE CODE 207

CAUSE DESCRIPTION: Control Rods and Drives

NP #	RP #	Title	Total Cost (\$)
1493	765-1	Subchannel thermal hydraulic experature program (STEP)	1,106,182
1497	1229-1	Temperature sensor fundamentals and technology confirmation	57,268
1974	TPS 79-708	Planning study on nuclear reactor control materials	71,500
		Grand Total	1,234,950

CAUSE CODE 202

CAUSE DESCRIPTION: Reactor Internals

NP #	RP #	Title	Total Cost (\$)
ER-582	472-1	Fusion reactor first wall/blanket system analysis	715,000
		Grand Total	715,000

CAUSE CODE 261

CAUSE DESCRIPTION: Reactor Protection-Instrument
and Control

NP #	RP #	Title	Total Cost (\$)
254	513-1	Remote multiplexing for nuclear power plant applications	124,253
1322	1173-1	Demonstration of application of fiber optic link plant multiplexed instrument/control computer system	205,256
1212	1379-1	Development of optical instrumentation for LWR safety	328,610
267	503-1	Sensor time response verification	69,502
893	503-3	Sensor time response verification	168,463
2336	606-1	Development of real time ultrasonic flow imaging devices	993,925
1577	895-12	Continuous fissions product monitoring	120,492
315	700-1	Failure analysis and failure prevention in electrical systems	2,087,555
2411	501-4	Human factors review of enhancement approaches for nuclear control rooms	394,976
1118	501-3	Human factors review of nuclear power plant control broad design approaches	96,462
290	618-1	Documentation of utility experience with process computer in power plants	127,914
309	501-1	Workshop on implementation of availability engineering in the electric utility industry	14,088
783	769-1	Performance measurement system for training simulators	250,000
1166	503-2	Sensor time response verification	171,078
Grand Total			5,152,574

CAUSE CODE 251	CAUSE DESCRIPTION: Radioactivity Discharge Levels to Environment
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NP #	RP #	Title	Total Cost (\$)
2726	1390-1	Containment integrated leak rate testing improvements	261,584
EA-2045	1059-1	Measurement of transuranium and other long-lived radionuclides in the environs of nuclear power plants	405,000
101	274-1	Evaluation of radioiodine sources and other radionuclide effluents at nuclear power plants	1,201,860
1380	1073-1	Determination of building effects on dispersion of effluent plumes from nuclear power plants	249,701
EL-2218	1764-1	Parallel multilevel state estimation	--
1271	962-1	Measurement of iodine partition coefficients in nuclear power plants	126,342
238	SOA 75-316	Lidar study of plume diffusion at Rancho Seco nuclear power station	20,000
		Grand Total	2,264,487

CAUSE CODE 201

CAUSE DESCRIPTION: Reactor Vessel

NP #	RP #	Title	Total Cost (\$)
261	498-1	Improved evaluation of nozzle corner cracking	193,100
891	892-1	BWR-NDE nozzle welding project	26,876
1311	1241-1	Feedwater nozzle instability analysis	58,517
1017	827-1	Analysis of dosimetry measurements in reactor cavity of light water reactors	307,815
933	886-1	Neutron embrittlement of reactor pressure vessel materials	642,076
1225	303-1	Crack arrest studies	629,391
2428	1240-1	Analysis of irradiated pressure vessel in material data	223,042
119	232-1	Fracture toughness data for ferritic nuclear pressure vessel materials	228,959
372	696-1	Fracture toughness statistical analysis	95,000
2336	606-1	Development of real time ultrasonic flow imaging devices	993,925
2336	1125-1	Application of nonlinear signal processing to pipe and nozzle inspection	3,860,897
122	232-3	Determining fracture properties of reactor vessel forging materials, weldments, and bolting materials	294,795
179	604-1	Field demonstration of Section XI Weld Repair	42,321
921	448-1	Acoustic emission and ultrasonic correlation examination of LaSalle II pressure vessel	58,490
1229	606-1	Development of real time ultrasonic flow imaging devices	993,925
1535	606-2	Development of real time ultrasonic flow imaging devices	772,981

CAUSE CODE 201

CAUSE DESCRIPTION: Reactor Vessel

NP #	RP #	Title	Total Cost (\$)
1398	1023-1	Small specimen fracture mechanics analysis	199,976
2493	1021-1	Thermal anneal of neutron embrittled reactor vessel materials	1,370,614
2720	1553-1	Evaluation of irradiation response of reactor pressure vessel materials	196,446
		Grand Total	11,189,146

IX. APPENDIX B

NERC - GADS Ranking of Outage Causes

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SR#83-94 T.B. JENKINS @ TVA, NUCLEAR UNITS

ALL SIZE RANGES PWR TYPE

1972-1981

COMPONENT OUTAGES BY AVERAGE HOURS PER UNIT YEAR
TOTAL NUMBER OF UNIT YEARS IS 288

17 TOTAL UNITS

FULL FORCED (UNPLANNED) OUTAGES				UNPLANNED DERATINGS				FORCED, MAINT, PLANNED & EQUIV DERATINGS			
CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG EQIV HRS PER UNIT YR	AVG EQIV HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE
205	0.85	173.71	203.36	629	0.14	22.48	157.90	210	0.71	882.83	1246.34
204	0.43	87.88	204.11	208	1.32	15.17	11.53	205	1.47	347.94	236.34
629	0.07	65.30	989.88	802	4.20	10.23	2.44	600	0.81	345.13	428.43
520	0.02	55.96	2302.25	901	0.74	8.65	11.75	900	1.23	221.61	180.29
299	0.25	33.52	132.26	299	1.62	0.39	5.19	200	2.10	162.58	77.26
706	0.02	31.30	1802.85	923	0.01	7.94	571.71	204	1.17	127.77	109.51
203	0.33	30.84	93.51	204	0.52	7.37	14.25	700	0.16	123.64	774.12
630	0.18	29.58	160.71	804	0.83	7.01	8.49	800	0.64	120.88	189.20
900	0.30	28.61	94.70	520	0.11	5.63	52.29	629	0.24	106.74	445.53
207	0.49	26.91	54.97	205	0.22	5.28	24.54	520	0.19	87.76	459.56
524	0.02	19.05	783.86	207	0.94	5.04	5.37	299	2.27	75.04	33.05
209	0.07	16.87	255.66	645	0.40	4.94	12.26	524	0.11	74.50	670.53
261	0.70	15.97	22.76	922	0.63	4.75	7.56	207	1.60	44.74	27.89
523	0.07	14.23	215.70	912	0.14	4.73	34.90	203	0.60	43.21	71.52
700	0.04	13.79	360.96	280	0.49	4.45	9.09	706	0.02	37.62	1805.71
600	0.07	12.90	176.98	200	1.44	3.66	2.54	200	0.96	35.23	36.76
229	0.10	11.67	120.03	919	0.31	3.60	11.52	209	0.98	34.83	35.44
201	0.02	10.91	448.99	699	0.67	3.50	5.20	630	0.38	31.69	82.98
915	0.46	10.89	23.75	209	0.49	3.33	6.80	523	0.66	31.62	47.93
631	0.13	10.40	83.22	523	0.16	2.99	18.34	229	0.22	27.26	122.65
501	0.01	10.13	972.93	905	0.40	2.30	5.82	208	1.83	25.96	14.19
929	0.24	8.89	37.09	918	0.03	2.14	68.60	901	0.96	25.44	26.55
802	0.14	8.63	63.73	900	0.48	2.06	4.28	802	4.65	24.85	5.34
800	0.02	7.79	373.72	912	1.25	2.03	1.63	645	2.03	19.58	9.65
632	0.45	7.33	16.11	509	0.69	1.81	2.61	261	1.04	17.78	17.12
206	0.06	6.83	109.32	999	0.23	1.63	7.24	202	0.09	16.50	190.11
262	0.14	6.49	46.76	801	0.68	1.58	2.32	699	0.09	15.88	17.93
622	0.31	6.39	20.44	221	0.03	1.41	40.75	262	0.41	14.85	35.95
904	0.16	5.85	35.88	803	0.55	1.25	2.26	922	0.86	14.38	16.76
242	0.03	5.61	179.49	908	0.17	1.22	7.15	206	0.15	14.07	96.46
624	0.00	5.11	1472.37	800	0.45	1.20	2.68	903	0.24	13.66	56.22
224	0.04	5.11	133.69	808	0.29	1.17	4.03	631	0.31	13.49	44.13
999	0.21	4.98	23.50	903	0.10	1.00	9.57	622	2.23	12.22	5.47
799	0.06	4.92	78.78	526	0.38	0.96	2.51	501	0.02	12.11	697.42
260	0.19	4.80	24.69	622	0.45	0.94	2.10	201	0.05	11.91	263.87
903	0.08	4.40	57.58	911	0.01	0.92	132.98	220	0.18	11.72	63.70
703	0.04	4.38	105.21	262	0.70	0.89	4.49	905	0.71	11.35	15.94
221	0.06	4.33	69.26	632	0.16	0.87	5.57	915	0.56	11.10	19.74
226	0.05	3.95	81.22	631	0.14	0.86	6.02	632	0.95	10.98	11.55
202	0.02	3.94	189.13	814	0.58	0.78	1.34	999	0.52	10.10	19.53

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SR#03-94 T.B. JENKINS @ TVA, NUCLEAR UNITS

ALL SIZE RANGES PWR TYPE

1972-1981

COMPONENT OUTAGES BY AVERAGE HOURS PER UNIT YEAR
TOTAL NUMBER OF UNIT YEARS IS 288

47 TOTAL UNITS

FULL FORCED (UNPLANNED) OUTAGES				UNPLANNED DERATINGS				FORCED, MAINT, PLANNED & EQUIV DERATINGS			
CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG EQUIV HRS PER UNIT YR	AVG EQUIV HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE
220	0.08	3.84	48.08	261	0.29	0.73	2.50	290	0.26	9.86	37.85
627	0.01	3.83	275.44	813	0.41	0.73	1.76	929	0.41	9.83	23.78
222	0.03	3.62	130.23	633	0.43	0.68	1.57	899	1.18	9.33	7.90
901	0.09	3.59	41.34	899	0.81	0.65	0.80	801	2.12	9.27	4.38
919	0.14	3.57	25.08	206	0.01	0.63	45.67	804	1.10	8.83	8.00
922	0.14	3.40	23.87	290	0.07	0.63	9.59	913	0.00	8.59	2474.48
905	0.22	3.28	14.99	253	0.04	0.59	14.07	500	0.04	8.49	203.75
643	0.07	3.05	43.89	260	0.68	0.56	0.82	263	0.23	8.19	35.22
263	0.15	2.99	19.58	630	0.12	0.52	4.41	923	0.01	7.94	571.71
270	0.03	2.89	104.09	815	0.32	0.46	1.44	815	0.32	7.90	24.74
200	0.05	2.84	62.95	621	0.12	0.44	3.64	221	0.11	7.80	72.48
712	0.08	2.84	37.18	643	0.14	0.43	3.07	812	1.27	7.67	6.02
916	0.27	2.73	10.10	600	0.21	0.42	1.97	643	0.24	7.66	32.44
628	0.00	2.55	735.22	647	0.11	0.39	3.40	242	0.05	7.65	146.90
225	0.03	2.54	91.56	646	0.02	0.38	21.94	912	0.17	7.60	43.75
265	0.24	2.52	10.67	921	0.05	0.38	8.34	620	0.03	7.58	242.43
699	0.13	2.46	19.66	907	0.09	0.36	4.18	919	0.48	7.43	15.40
522	0.01	2.32	334.21	220	0.07	0.35	5.09	703	0.13	7.32	55.51
506	0.00	2.25	648.57	203	0.19	0.30	1.58	260	0.93	6.89	7.43
621	0.10	2.18	22.38	904	0.06	0.25	3.99	640	0.06	6.84	109.36
228	0.04	2.15	51.54	929	0.13	0.24	1.83	505	0.33	6.56	20.10
264	0.09	2.01	21.48	225	0.08	0.23	2.98	715	0.02	6.54	376.51
809	0.01	1.70	162.87	628	0.02	0.22	9.05	810	0.15	6.36	41.62
918	0.02	1.50	61.74	915	0.10	0.22	2.09	799	0.11	6.26	54.67
803	0.05	1.49	28.70	202	0.03	0.21	6.68	904	0.23	6.22	26.76
504	0.01	1.41	203.52	229	0.08	0.21	2.69	224	0.06	6.06	96.89
713	0.10	1.33	13.69	816	0.13	0.19	1.46	264	0.14	5.80	40.71
208	0.02	1.32	63.34	500	0.02	0.18	8.77	902	0.04	5.35	140.20
240	0.01	1.20	115.45	228	0.08	0.18	2.19	624	0.00	5.11	1472.37
243	0.01	1.13	162.79	811	0.01	0.16	22.06	276	0.10	4.62	47.47
701	0.01	1.07	102.36	264	0.03	0.16	5.71	506	0.01	4.60	331.09
714	0.09	1.01	10.81	211	0.11	0.15	1.44	228	0.19	4.45	22.89
645	0.07	0.92	13.25	910	0.10	0.15	1.45	222	0.06	4.43	79.69
804	0.06	0.89	15.03	810	0.04	0.14	3.46	717	0.11	4.32	38.97
227	0.03	0.85	30.70	208	0.03	0.14	5.08	241	0.02	4.26	204.44
907	0.01	0.84	60.37	636	0.01	0.14	10.16	627	0.04	4.18	109.48
899	0.04	0.84	21.92	807	0.02	0.14	5.57	522	0.05	4.02	88.96
914	0.04	0.67	17.43	276	0.03	0.12	3.57	265	0.31	3.76	12.02
705	0.02	0.64	30.49	270	0.01	0.12	8.75	918	0.06	3.64	65.60
647	0.02	0.63	30.12	635	0.06	0.12	2.03	808	0.34	3.45	10.13

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SR#83-94 T.B. JENKINS & TVA, NUCLEAR UNITS

ALL SIZE RANGES PWR TYPE

1972-1981

COMPONENT OUTAGES BY AVERAGE HOURS PER UNIT YEAR
TOTAL NUMBER OF UNIT YEARS IS 288

47 TOTAL UNITS

FULL FORCED (UNPLANNED) OUTAGES				UNPLANNED DERATINGS				FORCED, MAINT, PLANNED & EQUIV DERATINGS			
CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG EQIV HRS PER UNIT YR	AVG EQIV HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE
711	0.02	0.50	28.97	713	0.02	0.11	5.18	809	0.02	3.22	132.68
814	0.04	0.48	12.59	544	0.02	0.09	5.05	621	0.25	3.11	12.42
704	0.01	0.47	44.69	642	0.03	0.09	2.74	636	0.03	3.10	89.40
642	0.03	0.43	12.37	703	0.07	0.08	1.14	270	0.05	3.02	66.81
280	0.01	0.42	39.87	705	0.00	0.08	22.58	803	0.68	2.88	4.25
241	0.01	0.41	59.50	265	0.06	0.08	1.27	225	0.13	2.84	21.53
808	0.03	0.33	10.67	263	0.05	0.07	1.60	547	0.32	2.79	8.65
636	0.01	0.27	25.81	252	0.01	0.07	4.83	916	0.31	2.78	9.08
702	0.00	0.26	76.15	711	0.00	0.06	17.01	211	0.14	2.69	19.34
708	0.00	0.26	75.87	799	0.04	0.05	1.32	908	0.25	2.37	9.46
644	0.00	0.24	68.08	504	0.01	0.05	7.22	647	0.17	2.29	13.20
813	0.01	0.22	21.09	542	0.02	0.05	2.84	509	0.70	1.84	2.63
505	0.01	0.19	28.01	627	0.02	0.05	2.35	240	0.02	1.71	70.18
816	0.01	0.19	26.73	914	0.01	0.05	6.89	504	0.02	1.49	71.52
908	0.02	0.16	9.40	224	0.01	0.04	3.20	713	0.12	1.44	12.19
810	0.01	0.16	11.41	902	0.03	0.04	1.46	526	0.42	1.32	3.11
635	0.02	0.16	8.97	505	0.02	0.04	1.92	814	0.62	1.26	2.03
710	0.00	0.14	38.98	227	0.04	0.04	0.95	816	0.23	1.24	5.41
807	0.02	0.13	7.35	805	0.05	0.04	0.67	907	0.11	1.20	11.19
648	0.01	0.13	18.03	222	0.01	0.03	2.38	705	0.03	1.16	37.24
715	0.00	0.12	33.63	809	0.01	0.03	4.75	243	0.01	1.13	162.79
637	0.01	0.12	16.62	712	0.01	0.03	3.14	649	0.01	1.09	104.60
542	0.01	0.11	7.57	644	0.01	0.03	4.12	701	0.02	1.09	62.65
921	0.01	0.10	14.82	648	0.01	0.02	2.27	714	0.14	1.05	7.78
910	0.01	0.09	13.29	701	0.01	0.02	3.09	227	0.09	1.04	11.94
649	0.00	0.08	24.25	714	0.04	0.02	0.52	813	0.56	1.01	1.82
801	0.00	0.08	24.00	242	0.01	0.02	2.48	914	0.06	0.94	15.12
500	0.00	0.08	23.25	817	0.01	0.02	1.18	711	0.03	0.94	33.74
805	0.01	0.07	9.74	251	0.00	0.01	4.25	911	0.01	0.92	132.98
253	0.00	0.06	16.03	522	0.01	0.01	1.33	635	0.10	0.77	7.94
620	0.00	0.05	15.42	210	0.00	0.01	3.98	633	0.43	0.68	1.57
928	0.01	0.04	4.27	500	0.01	0.01	1.95	909	0.01	0.65	93.20
912	0.01	0.04	5.23	704	0.01	0.01	1.91	253	0.05	0.64	14.22
509	0.00	0.03	8.00	612	0.00	0.01	3.18	642	0.08	0.61	7.28
925	0.00	0.02	5.00	240	0.01	0.01	1.31	921	0.07	0.53	7.69
716	0.00	0.02	4.77	715	0.00	0.01	2.54	704	0.02	0.48	27.58
612	0.00	0.01	3.93	649	0.00	0.01	2.25	708	0.03	0.40	12.95
290	0.00	0.01	2.68	806	0.01	0.01	1.09	644	0.03	0.39	12.35
244	0.00	0.00	1.17	916	0.03	0.01	0.24	646	0.02	0.38	15.81
x**	0.00	0.00	0.00	244	0.00	0.00	1.41	806	0.28	0.36	1.26

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NORTH AMERICAN ELECTRIC RELIABILITY COUNCIL
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SR#83-94 T.B. JENKINS @ TVA, NUCLEAR UNITS

ALL SIZE RANGES PWR TYPE

1972-1981

COMPONENT OUTAGES BY AVERAGE HOURS PER UNIT YEAR
TOTAL NUMBER OF UNIT YEARS IS 280

47 TOTAL UNITS

FULL FORCED (UNPLANNED) OUTAGES				UNPLANNED DERATINGS				FORCED, MAINT, PLANNED & EQUIV DERATINGS			
CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG EQIV HRS PER UNIT YR	AVG EQIV HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE
***	0.00	0.00	0.00	545	0.00	0.00	1.26	640	0.01	0.31	44.39
***	0.00	0.00	0.00	201	0.00	0.00	1.10	702	0.01	0.27	38.32
***	0.00	0.00	0.00	277	0.00	0.00	1.04	807	0.04	0.26	6.31
***	0.00	0.00	0.00	223	0.00	0.00	0.65	910	0.11	0.24	2.21
***	0.00	0.00	0.00	***	0.00	0.00	0.00	508	0.02	0.18	8.77
***	0.00	0.00	0.00	***	0.00	0.00	0.00	543	0.00	0.16	46.85
***	0.00	0.00	0.00	***	0.00	0.00	0.00	811	0.01	0.16	22.86
***	0.00	0.00	0.00	***	0.00	0.00	0.00	244	0.01	0.15	10.46
***	0.00	0.00	0.00	***	0.00	0.00	0.00	710	0.00	0.14	38.98
***	0.00	0.00	0.00	***	0.00	0.00	0.00	544	0.02	0.12	4.99
***	0.00	0.00	0.00	***	0.00	0.00	0.00	637	0.01	0.12	11.08
***	0.00	0.00	0.00	***	0.00	0.00	0.00	641	0.00	0.11	32.73
***	0.00	0.00	0.00	***	0.00	0.00	0.00	805	0.07	0.10	1.58
***	0.00	0.00	0.00	***	0.00	0.00	0.00	252	0.01	0.07	4.83
***	0.00	0.00	0.00	***	0.00	0.00	0.00	620	0.00	0.05	15.42
***	0.00	0.00	0.00	***	0.00	0.00	0.00	928	0.01	0.04	4.27
***	0.00	0.00	0.00	***	0.00	0.00	0.00	250	0.00	0.04	10.27
***	0.00	0.00	0.00	***	0.00	0.00	0.00	612	0.01	0.02	3.56
***	0.00	0.00	0.00	***	0.00	0.00	0.00	266	0.00	0.02	6.12
***	0.00	0.00	0.00	***	0.00	0.00	0.00	925	0.00	0.02	5.00
***	0.00	0.00	0.00	***	0.00	0.00	0.00	716	0.00	0.02	4.77
***	0.00	0.00	0.00	***	0.00	0.00	0.00	817	0.01	0.02	1.18
***	0.00	0.00	0.00	***	0.00	0.00	0.00	251	0.00	0.01	4.25
***	0.00	0.00	0.00	***	0.00	0.00	0.00	650	0.00	0.01	3.23
***	0.00	0.00	0.00	***	0.00	0.00	0.00	545	0.00	0.00	1.26
***	0.00	0.00	0.00	***	0.00	0.00	0.00	277	0.00	0.00	1.04
***	0.00	0.00	0.00	***	0.00	0.00	0.00	223	0.00	0.00	0.65
***	0.00	0.00	0.00	***	0.00	0.00	0.00	623	0.00	0.00	0.50

NORTH AMERICAN ELECTRIC RELIABILITY COUNCIL
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SR#83-94 T B. JENKINS @ TVA, NUCLEAR UNITS

ALL SIZE RANGES BWR TYPE

1972 1981

COMPONENT OUTAGES BY AVERAGE HOURS PER UNIT YEAR
TOTAL NUMBER OF UNIT YEARS IS 188

26 TOTAL UNITS

FULL FORCED (UNPLANNED) OUTAGES				UNPLANNED DERATINGS				FORCED, MAINT, PLANNED & EQUIV DERATINGS			
CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG EQIV HRS PER UNIT YR	AVG EQIV HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE
916	0.40	132.15	326.89	208	4.16	91.20	21.93	210	0.84	1074.63	1286.82
204	0.71	64.33	90.26	209	4.71	85.64	18.19	600	0.54	353.49	657.98
203	0.54	44.01	81.12	251	0.81	37.15	45.95	900	10.48	146.97	14.02
201	0.05	32.95	619.42	900	9.04	31.59	3.21	916	0.43	132.19	306.80
520	0.02	31.98	2003.96	202	0.16	31.44	190.68	700	0.19	130.72	682.67
903	0.10	27.47	271.82	204	1.80	25.29	14.03	208	5.73	118.80	20.72
263	0.21	26.88	129.56	299	4.82	18.32	3.80	204	2.86	114.86	40.14
229	0.43	26.85	62.33	205	0.19	15.79	84.82	524	0.09	111.14	1229.06
622	0.51	26.75	52.93	802	1.59	12.61	7.95	209	5.24	101.27	19.33
207	0.21	25.32	122.05	222	0.18	12.47	68.93	800	0.89	95.27	106.61
224	0.09	17.15	189.70	804	0.35	8.71	25.18	200	0.83	92.66	111.67
900	0.26	16.85	65.99	508	0.95	7.48	7.90	202	0.24	86.63	361.90
290	0.02	16.58	1039.03	224	0.07	5.60	75.15	203	1.23	83.67	68.09
210	0.03	15.62	587.47	901	0.46	5.33	11.66	648	0.14	75.69	527.03
261	0.41	15.61	37.61	922	0.58	5.20	8.98	229	0.77	58.12	75.35
632	0.70	14.98	21.33	509	0.61	5.14	8.48	715	0.02	57.00	3572.15
240	0.20	14.23	70.40	801	1.10	4.72	4.29	299	5.90	55.73	9.44
222	0.07	14.16	204.83	907	0.45	4.68	10.36	222	0.29	52.83	183.93
299	0.22	13.16	58.92	800	0.60	4.42	7.36	207	1.21	47.10	38.83
915	0.46	13.02	28.47	280	0.13	3.67	28.78	903	0.17	42.11	247.40
630	0.16	10.81	67.74	203	0.38	3.55	9.40	205	0.33	38.70	117.36
228	0.15	9.79	65.76	229	0.23	3.36	14.38	251	0.86	38.44	44.89
706	0.02	9.41	589.43	912	0.46	3.07	6.63	520	0.08	36.65	459.30
270	0.07	9.39	135.75	814	0.43	3.04	7.13	201	0.10	35.79	354.18
524	0.03	9.20	345.82	262	0.26	2.87	11.24	262	0.59	34.14	58.36
629	0.02	7.10	444.69	803	0.12	2.85	24.38	622	1.95	34.14	17.54
262	0.25	7.09	28.35	622	0.45	2.76	6.11	224	0.20	31.32	159.15
221	0.06	6.73	105.50	523	0.70	2.69	3.86	263	0.34	29.25	87.28
242	0.06	6.48	110.78	207	0.51	2.45	4.85	705	0.03	27.35	1028.37
811	0.12	6.03	51.51	200	0.34	2.33	6.95	802	1.87	24.78	13.27
265	0.07	5.37	72.17	911	0.01	2.33	437.66	240	0.34	20.78	62.00
205	0.10	5.16	51.02	226	0.30	2.30	7.73	523	1.29	20.15	15.59
645	0.30	4.55	15.27	252	0.27	2.27	8.54	290	0.31	20.04	63.86
802	0.07	4.34	62.82	526	0.34	2.16	6.45	261	0.64	18.44	28.88
999	0.14	4.29	30.99	628	0.01	1.98	372.68	901	0.66	18.05	27.14
504	0.02	4.22	264.66	815	0.69	1.93	2.80	632	1.38	18.01	13.02
708	0.02	4.09	256.04	699	0.44	1.68	3.80	712	0.10	17.01	168.35
808	0.09	3.89	42.97	811	0.18	1.53	8.46	811	0.35	13.21	38.20
814	0.11	3.27	30.77	807	0.20	1.47	7.27	915	0.48	13.05	26.95
907	0.04	3.24	87.11	261	0.17	1.46	8.56	241	0.05	12.62	263.70

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SR#83-94 T.B. JENKINS @ TVA, NUCLEAR UNITS

ALL SIZE RANGES BWR TYPE

1972-1981

COMPONENT OUTAGES BY AVERAGE HOURS PER UNIT YEAR
TOTAL NUMBER OF UNIT YEARS IS 188

76 TOTAL UNITS

FULL FORCED (UNPLANNED) OUTAGES				UNPLANNED DERATINGS				FORCED, MAINT, PLANNED & EQUIV DERATINGS			
CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG EQUIV HRS PER UNIT YR	AVG EQUIV HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE
220	0.10	2.97	30.99	808	0.06	1.33	20.89	228	0.27	12.59	46.39
712	0.04	2.92	78.43	220	0.15	1.33	8.95	630	0.25	12.26	49.04
799	0.05	2.75	57.43	816	0.20	1.23	6.06	804	0.39	10.55	27.16
904	0.05	2.69	50.59	250	0.08	1.15	14.46	708	0.03	10.24	384.93
260	0.15	2.68	17.98	621	0.05	1.10	20.64	801	2.19	9.98	4.55
631	0.07	2.64	35.43	632	0.54	1.08	1.99	221	0.14	9.93	71.77
264	0.07	2.52	33.86	899	0.19	0.93	5.01	270	0.11	9.47	84.77
901	0.06	2.49	42.56	504	0.01	0.93	87.36	706	0.02	9.41	589.43
200	0.05	2.46	51.31	643	0.03	0.85	26.66	242	0.10	8.26	86.30
914	0.03	2.03	63.54	645	0.27	0.81	3.00	907	0.53	8.08	15.19
899	0.06	1.99	31.16	602	0.01	0.79	149.40	508	0.96	7.58	7.91
241	0.02	1.92	120.15	908	0.10	0.68	7.06	922	0.67	7.32	10.92
922	0.06	1.87	29.36	544	0.01	0.58	54.62	629	0.02	7.10	444.69
521	0.02	1.85	116.13	905	0.07	0.52	7.00	803	0.18	6.87	39.11
804	0.04	1.80	48.25	212	0.01	0.48	89.54	526	0.85	6.61	7.82
620	0.01	1.75	328.62	799	0.12	0.43	3.51	252	0.35	6.43	18.33
202	0.01	1.75	328.52	812	0.09	0.42	4.89	814	0.53	6.31	11.86
699	0.09	1.70	18.83	263	0.10	0.39	4.12	265	0.11	6.19	55.44
929	0.05	1.56	32.51	210	0.04	0.37	9.87	808	0.16	6.18	37.47
621	0.10	1.44	15.03	542	0.09	0.36	4.20	504	0.03	6.16	193.08
635	0.02	1.43	67.19	260	0.09	0.36	4.18	645	0.60	5.94	9.88
803	0.02	1.42	89.23	221	0.03	0.35	10.90	509	0.62	5.89	9.47
226	0.03	1.40	52.82	910	0.15	0.33	2.17	699	0.68	5.26	7.79
523	0.02	1.34	63.12	805	0.09	0.33	3.83	220	0.30	4.99	16.24
805	0.03	1.30	49.06	600	0.07	0.32	4.66	809	0.02	4.82	302.12
252	0.04	1.26	33.86	809	0.01	0.32	59.89	914	0.04	4.71	110.66
522	0.01	1.20	112.65	920	0.01	0.29	54.58	280	0.27	4.69	17.64
800	0.07	1.09	15.71	647	0.03	0.29	9.10	260	0.28	4.58	16.57
208	0.02	1.05	65.87	902	0.21	0.28	1.33	627	0.01	4.42	831.82
643	0.03	1.02	31.81	240	0.07	0.26	3.83	643	0.09	4.40	48.67
911	0.01	0.85	80.31	700	0.04	0.26	6.21	999	0.18	4.40	24.32
600	0.04	0.83	22.19	703	0.01	0.22	20.62	226	0.37	4.18	11.39
250	0.01	0.82	154.60	228	0.09	0.21	2.46	522	0.07	3.99	57.74
509	0.01	0.74	62.57	704	0.02	0.19	8.77	631	0.11	3.99	35.70
227	0.02	0.70	44.08	227	0.02	0.17	10.35	912	0.47	3.89	8.31
925	0.05	0.66	13.77	909	0.02	0.16	7.44	638	0.01	3.75	352.21
642	0.03	0.65	24.28	630	0.04	0.15	3.58	223	0.01	3.63	340.92
908	0.02	0.64	29.98	929	0.05	0.15	2.74	899	0.29	3.56	12.15
928	0.02	0.61	38.12	633	0.01	0.13	12.59	929	0.13	3.51	26.41
905	0.03	0.58	21.76	211	0.01	0.13	12.26	506	0.01	3.23	608.02

NORTH AMERICAN ELECTRIC RELIABILITY COUNCIL
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SR#83-94 T.B. JENKINS @ TVA, NUCLEAR UNITS

ALL SIZE RANGES BWR TYPE

1977 1981

COMPONENT OUTAGES BY AVERAGE HOURS PER UNIT YEAR
TOTAL NUMBER OF UNIT YEARS IS 180

24 TOTAL UNITS

FULL FORCED (UNPLANNED) OUTAGES				UNPLANNED DERATINGS				FORCED, MAINT, PLANNED & EQUIV DERATINGS			
CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG EQUIV HRS PER UNIT YR	AVG EQUIV HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE
713	0.04	0.55	14.88	642	0.04	0.13	3.05	911	0.02	3.18	199.43
704	0.03	0.54	20.39	813	0.06	0.13	1.96	799	0.18	3.18	18.12
644	0.01	0.51	48.02	913	0.01	0.12	11.49	505	0.47	2.99	6.32
700	0.03	0.50	15.60	817	0.02	0.12	7.52	621	0.20	2.89	14.69
701	0.01	0.49	46.30	903	0.05	0.11	2.33	264	0.12	2.74	23.41
813	0.01	0.49	45.70	923	0.01	0.11	10.02	904	0.07	2.72	39.40
251	0.02	0.48	22.62	201	0.02	0.10	4.86	703	0.04	2.41	56.65
702	0.01	0.48	45.13	270	0.04	0.08	1.93	815	0.70	2.40	3.44
815	0.01	0.46	86.87	702	0.03	0.08	3.06	810	0.04	2.35	55.11
542	0.03	0.46	17.15	646	0.01	0.08	7.11	709	0.02	2.32	145.63
703	0.01	0.45	42.48	631	0.03	0.07	2.66	542	1.93	2.29	1.19
636	0.02	0.43	27.02	644	0.02	0.07	4.42	250	0.11	2.28	21.46
816	0.01	0.40	75.15	999	0.03	0.07	2.57	628	0.01	1.98	372.68
807	0.01	0.40	37.42	649	0.01	0.07	12.51	807	0.22	1.90	8.49
505	0.02	0.38	24.05	711	0.01	0.06	12.01	521	0.02	1.86	87.43
909	0.02	0.35	21.66	810	0.02	0.06	3.70	620	0.01	1.75	328.62
633	0.01	0.32	60.50	709	0.01	0.06	10.36	908	0.14	1.72	12.42
253	0.01	0.31	58.10	242	0.02	0.05	2.48	805	0.12	1.69	13.82
918	0.02	0.28	17.76	264	0.03	0.05	1.89	816	0.22	1.65	7.55
223	0.01	0.27	49.83	635	0.01	0.04	4.15	635	0.03	1.47	46.18
921	0.03	0.22	8.43	541	0.01	0.04	3.93	642	0.10	1.45	15.16
646	0.01	0.19	35.10	648	0.03	0.04	1.24	905	0.11	1.13	10.07
913	0.01	0.17	32.00	916	0.03	0.04	1.38	644	0.04	1.06	28.56
714	0.03	0.15	5.69	522	0.01	0.02	2.05	227	0.05	0.97	20.34
225	0.01	0.13	24.95	915	0.03	0.02	0.79	701	0.03	0.93	34.87
526	0.01	0.12	22.83	904	0.01	0.02	1.96	704	0.06	0.81	13.79
716	0.01	0.12	22.05	712	0.04	0.02	0.49	602	0.01	0.79	149.40
214	0.01	0.10	19.05	244	0.02	0.02	1.11	925	0.08	0.67	8.43
801	0.01	0.10	9.41	919	0.01	0.01	1.24	501	0.02	0.66	41.23
705	0.01	0.10	18.42	925	0.03	0.01	0.41	928	0.02	0.61	28.76
647	0.01	0.09	8.73	716	0.01	0.01	2.40	813	0.07	0.61	8.21
243	0.01	0.07	13.58	714	0.02	0.01	0.63	647	0.06	0.58	9.99
206	0.01	0.07	13.07	636	0.01	0.01	1.55	544	0.01	0.58	54.62
919	0.01	0.06	11.88	505	0.01	0.01	1.40	713	0.04	0.57	13.30
902	0.01	0.06	11.25	928	0.01	0.00	0.62	702	0.04	0.56	15.08
280	0.01	0.05	9.58	265	0.01	0.00	0.29	633	0.02	0.54	25.61
709	0.01	0.04	7.08	524	0.01	0.00	0.50	902	0.23	0.52	2.22
605	0.01	0.00	0.40	501	0.01	0.00	0.39	909	0.04	0.50	13.53
***	0.00	0.00	0.00	241	0.01	0.00	0.38	212	0.01	0.48	89.54
***	0.00	0.00	0.00	290	0.01	0.00	0.12	636	0.03	0.47	17.66

NORTH AMERICAN ELECTRIC RELIABILITY COUNCIL
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SR#B3-94 T.B. JENKINS @ TVA, NUCLEAR UNITS

ALL SIZE RANGES BWR TYPE

1972-1981

COMPONENT OUTAGES BY AVERAGE HOURS PER UNIT YEAR
TOTAL NUMBER OF UNIT YEARS IS 188

26 TOTAL UNITS

FULL FORCED (UNPLANNED) OUTAGES				UNPLANNED DERATINGS				FORCED, MAINT, PLANNED & EQUIV DERATINGS			
CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG EQUIV HRS PER UNIT YR	AVG EQUIV HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE
***	0.00	0.00	0.00	540	0.01	0.00	0.05	525	0.02	0.46	21.84
***	0.00	0.00	0.00	238	0.01	0.00	0.03	910	0.17	0.44	2.57
***	0.00	0.00	0.00	***	0.00	0.00	0.00	812	0.09	0.42	4.89
***	0.00	0.00	0.00	***	0.00	0.00	0.00	253	0.01	0.31	58.10
***	0.00	0.00	0.00	***	0.00	0.00	0.00	913	0.02	0.29	18.32
***	0.00	0.00	0.00	***	0.00	0.00	0.00	920	0.01	0.29	54.58
***	0.00	0.00	0.00	***	0.00	0.00	0.00	918	0.02	0.28	17.76
***	0.00	0.00	0.00	***	0.00	0.00	0.00	646	0.02	0.26	16.44
***	0.00	0.00	0.00	***	0.00	0.00	0.00	714	0.06	0.26	4.37
***	0.00	0.00	0.00	***	0.00	0.00	0.00	921	0.03	0.23	7.15
***	0.00	0.00	0.00	***	0.00	0.00	0.00	711	0.04	0.18	4.25
***	0.00	0.00	0.00	***	0.00	0.00	0.00	225	0.01	0.13	24.95
***	0.00	0.00	0.00	***	0.00	0.00	0.00	716	0.01	0.13	12.23
***	0.00	0.00	0.00	***	0.00	0.00	0.00	817	0.02	0.12	7.52
***	0.00	0.00	0.00	***	0.00	0.00	0.00	292	0.01	0.12	22.23
***	0.00	0.00	0.00	***	0.00	0.00	0.00	923	0.01	0.11	10.02
***	0.00	0.00	0.00	***	0.00	0.00	0.00	214	0.01	0.10	19.05
***	0.00	0.00	0.00	***	0.00	0.00	0.00	711	0.01	0.09	8.62
***	0.00	0.00	0.00	***	0.00	0.00	0.00	919	0.02	0.08	3.91
***	0.00	0.00	0.00	***	0.00	0.00	0.00	243	0.01	0.07	13.58
***	0.00	0.00	0.00	***	0.00	0.00	0.00	206	0.01	0.07	13.07
***	0.00	0.00	0.00	***	0.00	0.00	0.00	649	0.01	0.07	12.51
***	0.00	0.00	0.00	***	0.00	0.00	0.00	236	0.02	0.05	3.30
***	0.00	0.00	0.00	***	0.00	0.00	0.00	541	0.01	0.04	3.93
***	0.00	0.00	0.00	***	0.00	0.00	0.00	244	0.02	0.02	1.11
***	0.00	0.00	0.00	***	0.00	0.00	0.00	605	0.01	0.00	0.40
***	0.00	0.00	0.00	***	0.00	0.00	0.00	626	0.01	0.00	0.18
***	0.00	0.00	0.00	***	0.00	0.00	0.00	540	0.01	0.00	0.05
***	0.00	0.00	0.00	***	0.00	0.00	0.00	238	0.01	0.00	0.03

NORTH AMERICAN ELECTRIC RELIABILITY COUNCIL
COMPONENT SUMMARY REPORT 1981

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SR#83-94 T.B. JENKINS @ TVA, NUCLEAR UNITS

ALL SIZE RANGFS HTGR TYPE

1972-1981

COMPONENT OUTAGES BY AVERAGE HOURS PER UNIT YEAR
TOTAL NUMBER OF UNIT YEARS IS 3

1 TOTAL UNITS

FULL FORCED (UNPLANNED) OUTAGES				UNPLANNED DERATINGS				FORCED, MAINT, PLANNED & EQUIV DERATINGS			
CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG EQUIV HRS PER UNIT YR	AVG EQUIV HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE
261	6.67	411.62	61.74	523	52.67	153.25	2.91	210	0.33	1378.46	4135.38
205	2.33	349.25	149.68	908	5.33	30.51	5.72	505	1.00	1046.74	1046.74
504	0.67	263.07	394.61	280	0.33	9.24	27.71	203	0.33	422.47	1267.40
260	0.67	85.06	127.59	204	0.67	3.00	4.50	523	53.00	412.73	7.79
629	0.33	51.48	154.43	235	2.00	2.15	1.08	261	7.00	412.03	58.86
228	0.33	44.94	134.83	921	0.33	1.16	3.47	205	2.33	349.25	149.68
714	1.00	42.97	42.97	261	0.33	0.41	1.23	504	0.67	263.07	394.61
816	0.33	41.28	123.83	***	0.00	0.00	0.00	260	0.67	85.06	127.59
264	0.67	35.25	52.88	***	0.00	0.00	0.00	629	0.33	51.48	154.43
299	0.33	34.22	102.67	***	0.00	0.00	0.00	228	0.33	44.94	134.83
204	0.67	31.41	47.11	***	0.00	0.00	0.00	714	1.00	42.97	42.97
630	0.67	27.84	41.76	***	0.00	0.00	0.00	816	0.33	41.28	123.83
265	0.67	27.76	41.64	***	0.00	0.00	0.00	264	0.67	35.25	52.88
901	0.33	18.38	55.13	***	0.00	0.00	0.00	204	1.33	34.41	25.81
814	0.33	16.42	49.25	***	0.00	0.00	0.00	299	0.33	34.22	102.67
220	0.33	4.56	13.67	***	0.00	0.00	0.00	908	5.33	30.51	5.72
622	0.33	0.75	2.25	***	0.00	0.00	0.00	630	0.67	27.84	41.76
262	0.33	0.63	1.88	***	0.00	0.00	0.00	265	0.67	27.76	41.64
***	0.00	0.00	0.00	***	0.00	0.00	0.00	901	0.33	18.38	55.13
***	0.00	0.00	0.00	***	0.00	0.00	0.00	814	0.33	16.42	49.25
***	0.00	0.00	0.00	***	0.00	0.00	0.00	648	0.33	14.00	42.00
***	0.00	0.00	0.00	***	0.00	0.00	0.00	280	1.00	12.92	12.92
***	0.00	0.00	0.00	***	0.00	0.00	0.00	632	0.33	5.23	15.70
***	0.00	0.00	0.00	***	0.00	0.00	0.00	220	0.33	4.56	13.67
***	0.00	0.00	0.00	***	0.00	0.00	0.00	542	0.67	4.07	6.10
***	0.00	0.00	0.00	***	0.00	0.00	0.00	235	2.00	2.15	1.08
***	0.00	0.00	0.00	***	0.00	0.00	0.00	921	0.33	1.16	3.47
***	0.00	0.00	0.00	***	0.00	0.00	0.00	622	0.33	0.75	2.25
***	0.00	0.00	0.00	***	0.00	0.00	0.00	262	0.33	0.63	1.88

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SR#83-94 T.B. JENKINS @ TVA, NUCLEAR UNITS

ALL SIZE RANGES ALL TYPES

1972-1981

COMPONENT OUTAGES BY AVERAGE HOURS PER UNIT YEAR
TOTAL NUMBER OF UNIT YEARS IS 479

74 TOTAL UNITS

FULL FORCED (UNPLANNED) OUTAGES				UNPLANNED DERATINGS				FORCED, MAINT, PLANNED & EQUIV DERATINGS			
CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PFR UNIT YR	AVG DUR HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG EQIV HRS PFR UNIT YR	AVG EQIV HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE
205	0.57	108.65	191.34	208	2.42	44.92	18.53	210	0.76	961.21	1271.88
204	0.54	78.29	144.23	209	2.14	35.61	16.63	600	0.70	346.25	498.05
916	0.32	53.51	166.44	251	0.32	14.59	45.67	205	1.03	226.58	220.14
520	0.02	46.20	2212.76	204	1.02	14.38	14.06	900	4.85	190.92	39.33
629	0.05	42.37	882.44	900	4.15	13.64	3.29	200	1.59	134.12	84.31
203	0.41	35.82	87.09	629	0.09	13.52	157.90	700	0.17	125.65	733.97
207	0.38	26.12	69.51	202	0.08	12.47	149.28	204	1.83	122.12	66.62
299	0.24	25.54	105.45	299	2.86	12.24	4.27	800	0.73	110.07	149.78
900	0.28	23.81	84.49	802	3.15	11.10	3.53	524	0.10	80.42	864.31
706	0.02	22.51	1347.82	205	0.20	9.37	46.29	629	0.15	67.29	441.51
630	0.18	22.20	125.10	804	0.63	7.63	12.07	299	3.60	67.21	18.24
201	0.04	19.49	549.24	901	0.62	7.30	11.73	520	0.15	67.15	459.50
261	0.63	18.30	29.22	222	0.08	4.91	61.93	208	3.35	62.24	18.57
229	0.23	17.56	77.15	922	0.61	4.90	8.09	203	0.85	61.46	72.52
524	0.03	15.06	601.34	923	0.01	4.82	384.48	209	2.65	60.68	22.92
622	0.39	14.34	36.93	280	0.35	4.18	12.05	916	0.35	53.55	151.78
903	0.09	13.43	156.86	912	0.26	4.05	15.38	207	1.44	45.38	31.51
263	0.17	12.35	71.26	207	0.76	3.99	5.24	202	0.15	43.92	300.55
915	0.46	11.66	25.61	523	0.70	3.81	5.44	229	0.44	39.20	89.84
632	0.55	10.29	18.73	520	0.06	3.38	52.29	648	0.10	33.90	353.05
209	0.04	10.14	255.66	645	0.35	3.29	9.43	523	1.24	29.51	23.87
224	0.06	9.80	167.69	200	1.00	3.11	3.12	706	0.02	26.31	1400.28
523	0.05	9.08	189.17	509	0.66	3.11	4.74	715	0.02	26.30	1524.87
700	0.04	8.48	239.07	508	0.38	3.05	7.93	903	0.21	24.74	116.20
600	0.06	8.08	138.28	801	0.84	2.81	3.33	802	3.53	24.67	6.99
222	0.04	7.73	176.41	699	0.58	2.76	4.78	630	0.33	24.04	72.43
631	0.10	7.29	69.84	800	0.51	2.46	4.86	222	0.15	23.40	160.10
802	0.11	6.89	63.50	224	0.04	2.22	59.16	280	0.69	23.10	33.64
262	0.18	6.69	36.42	919	0.19	2.17	11.30	901	0.84	22.49	26.80
290	0.01	6.51	779.95	907	0.23	2.06	8.95	262	0.48	22.34	46.52
240	0.09	6.31	73.70	803	0.30	1.87	4.95	201	0.07	21.21	317.49
210	0.01	6.13	587.47	814	0.52	1.66	3.21	622	2.11	20.75	9.84
501	0.01	6.09	972.93	262	0.22	1.66	7.58	261	0.92	20.50	22.32
929	0.16	5.95	36.56	622	0.41	1.65	3.69	263	0.27	16.41	60.45
242	0.04	5.92	141.70	905	0.22	1.59	5.95	224	0.11	15.93	138.77
270	0.04	5.42	123.69	203	0.26	1.58	5.99	251	0.34	15.10	44.63
228	0.09	5.42	63.28	911	0.01	1.47	234.54	645	1.46	14.10	9.69
221	0.06	5.25	83.75	229	0.14	1.44	10.48	290	0.28	13.79	49.30
800	0.04	5.11	128.79	526	0.36	1.42	3.94	632	1.12	13.71	12.27
999	0.18	4.67	25.74	812	0.78	1.39	1.77	915	0.53	11.80	22.33

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SR#83-94 T.B. JENKINS @ TVA, NUCLEAR UNITS

ALL SIZE RANGES ALL TYPES

1972-1981

COMPONENT OUTAGES BY AVERAGE HOURS PER UNIT YEAR
TOTAL NUMBER OF UNIT YEARS IS 479

74 TOTAL UNITS

FULLY FORCED (UNPLANNED) OUTAGES				UNPLANNED DERATINGS				FORCED, MAINT, PLANNED & EQUIV DERATINGS			
CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG EQUIV HRS PER UNIT YR	AVG EQUIV HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE
904	0.12	4.58	38.46	918	0.02	1.29	68.60	505	0.39	11.67	30.06
260	0.18	4.47	24.90	808	0.20	1.23	6.13	699	0.80	11.61	14.56
504	0.01	4.15	284.32	908	0.17	1.19	6.86	922	0.78	11.52	14.79
206	0.04	4.14	104.26	815	0.46	1.03	2.24	705	0.03	11.43	391.22
799	0.06	4.04	71.66	261	0.24	1.01	4.15	631	0.23	9.67	42.51
265	0.18	3.80	21.66	999	0.15	1.01	6.90	801	2.13	9.49	4.45
220	0.09	3.50	39.93	221	0.03	0.99	29.55	804	0.82	9.45	11.58
901	0.08	3.25	42.08	226	0.14	0.98	7.10	712	0.11	9.28	87.14
624	0.00	3.07	1472.37	632	0.31	0.95	3.09	240	0.15	9.18	62.82
202	0.01	3.05	209.04	252	0.11	0.93	8.26	220	0.23	9.03	39.34
226	0.04	2.93	73.75	628	0.02	0.91	54.51	221	0.12	8.59	72.15
712	0.06	2.85	47.14	899	0.56	0.76	1.35	206	0.09	8.49	94.52
703	0.03	2.81	96.25	220	0.10	0.74	7.34	228	0.23	7.90	35.03
922	0.11	2.78	25.11	621	0.09	0.70	7.42	242	0.07	7.84	113.85
200	0.05	2.67	58.19	811	0.08	0.70	9.26	999	0.38	7.80	20.42
264	0.09	2.42	26.97	807	0.09	0.66	7.00	501	0.02	7.54	451.35
811	0.05	2.37	51.51	903	0.08	0.64	7.89	241	0.03	7.52	239.99
645	0.16	2.34	14.74	816	0.16	0.59	3.79	929	0.30	7.29	24.24
627	0.01	2.30	275.44	643	0.10	0.59	6.15	905	0.47	7.26	15.40
643	0.05	2.23	41.10	631	0.10	0.54	5.66	899	0.82	7.01	8.49
905	0.14	2.20	15.49	813	0.27	0.49	1.78	260	0.67	6.47	9.66
919	0.09	2.17	24.77	260	0.44	0.40	1.08	643	0.18	6.33	35.69
699	0.11	2.15	19.40	633	0.26	0.46	1.75	912	0.29	6.09	21.15
621	0.10	1.87	19.51	250	0.03	0.45	14.46	815	0.47	5.69	12.22
522	0.01	1.87	223.43	504	0.01	0.39	47.29	270	0.07	5.53	77.91
907	0.02	1.78	77.39	206	0.01	0.38	45.67	703	0.10	5.35	55.71
708	0.01	1.76	211.00	290	0.04	0.30	8.70	628	0.02	5.33	255.45
808	0.05	1.73	31.79	600	0.15	0.38	2.44	913	0.01	5.28	632.36
814	0.07	1.68	25.10	630	0.09	0.37	4.25	811	0.14	5.28	37.74
225	0.02	1.58	84.16	253	0.03	0.35	14.07	500	0.03	5.10	203.75
628	0.00	1.53	735.22	647	0.00	0.35	4.27	799	0.14	5.01	36.40
803	0.04	1.46	38.79	602	0.00	0.31	149.40	504	0.03	4.96	169.77
506	0.00	1.35	648.57	544	0.01	0.28	19.21	265	0.24	4.86	20.61
899	0.05	1.28	26.74	646	0.01	0.26	17.70	923	0.01	4.82	384.48
804	0.05	1.24	24.72	921	0.03	0.27	7.99	904	0.17	4.81	28.81
208	0.02	1.21	64.18	910	0.12	0.22	1.81	264	0.14	4.78	35.23
914	0.04	1.20	33.70	799	0.07	0.20	2.80	812	0.80	4.77	5.97
809	0.01	1.02	162.87	929	0.10	0.20	2.02	810	0.11	4.74	43.70
713	0.07	1.02	13.93	263	0.06	0.20	3.06	919	0.30	4.50	15.08
918	0.02	1.01	48.55	228	0.08	0.19	2.30	808	0.27	4.50	16.70

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SR183-74 T. B. JENKINS & TVA, NUCLEAR UNITS

ALL SIZE RANGES ALL TYPES

1972-1981

COMPONENT OUTAGES BY AVERAGE HOURS PER UNIT YEAR
TOTAL NUMBER OF UNIT YEARS IS 479

74 TOTAL UNITS

FULL FORCED (UNPLANNED) OUTAGES				UNPLANNED DERATINGS				FORCED, MAINT, PLANNED & SCHEDULED DERATINGS			
CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE
241	0.01	1.08	25.89	212	0.00	0.19	27.54	803	0.48	1.42	7.38
714	0.07	0.94	12.83	542	0.04	1.12	1.88	226	0.24	4.42	21.83
701	0.01	0.83	79.94	984	0.04	0.18	3.99	788	0.83	4.24	145.80
227	0.02	0.79	34.35	210	0.02	0.15	9.13	627	0.03	4.25	169.68
521	0.01	0.73	116.13	805	0.06	0.15	2.30	506	0.01	4.03	386.48
620	0.00	0.72	172.02	809	0.01	0.14	23.13	522	0.05	3.98	73.35
243	0.01	0.71	113.85	211	0.07	0.14	2.09	907	0.27	3.90	14.25
635	0.02	0.65	34.85	915	0.07	0.14	1.91	809	0.02	3.83	183.52
805	0.01	0.55	37.82	225	0.85	0.14	2.98	902	0.11	3.42	29.81
816	0.01	0.53	63.11	902	0.10	0.14	1.36	509	0.67	3.42	5.14
642	0.03	0.51	16.34	703	0.05	0.13	2.91	526	0.59	3.39	5.77
252	0.01	0.49	33.86	264	0.03	0.12	4.24	814	0.58	3.34	5.71
704	0.02	0.49	29.30	920	0.00	0.11	54.58	508	0.39	3.08	7.94
705	0.01	0.42	28.76	810	0.03	0.11	3.51	624	0.00	3.07	1472.37
647	0.02	0.41	24.77	240	0.03	0.11	3.49	621	0.23	3.00	13.19
908	0.02	0.35	18.55	270	0.03	0.11	4.20	542	0.96	2.60	2.72
702	0.01	0.35	55.47	700	0.02	0.10	6.21	252	0.15	2.57	17.56
644	0.01	0.34	54.71	642	0.04	0.10	2.89	914	0.05	2.42	44.51
911	0.00	0.34	88.31	635	0.04	0.09	4.25	918	0.04	2.30	58.05
636	0.01	0.33	26.41	227	0.03	0.09	2.83	908	0.24	2.29	9.61
813	0.01	0.32	38.93	636	0.01	0.09	8.44	636	0.03	2.85	65.48
250	0.00	0.32	154.60	708	0.02	0.08	5.08	911	0.01	1.80	172.85
509	0.01	0.31	49.04	704	0.01	0.08	6.48	225	0.08	1.76	21.62
711	0.01	0.30	28.97	713	0.01	0.06	5.18	211	0.10	1.69	16.83
280	0.01	0.27	32.30	909	0.01	0.06	7.44	816	0.23	1.65	7.32
925	0.02	0.27	12.89	711	0.00	0.06	14.51	647	0.13	1.61	12.62
505	0.01	0.27	25.63	817	0.01	0.06	3.90	638	0.00	1.47	352.21
928	0.01	0.27	21.19	913	0.00	0.05	11.49	223	0.01	1.42	227.49
542	0.02	0.24	12.89	705	0.00	0.05	22.58	713	0.09	1.09	12.40
807	0.01	0.23	15.94	265	0.04	0.05	1.13	635	0.07	1.04	14.69
251	0.01	0.19	22.62	644	0.01	0.04	4.30	701	0.02	1.02	48.76
815	0.00	0.18	86.87	201	0.01	0.04	4.11	227	0.07	1.01	14.16
253	0.00	0.15	37.07	702	0.01	0.03	3.06	714	0.11	1.00	9.07
921	0.01	0.15	10.25	242	0.01	0.03	2.48	642	0.09	0.93	10.66
909	0.01	0.14	21.66	649	0.00	0.03	7.38	250	0.04	0.92	20.92
633	0.00	0.13	60.50	648	0.02	0.03	1.58	709	0.01	0.91	145.63
223	0.00	0.10	49.83	627	0.01	0.03	2.35	807	0.11	0.90	8.01
810	0.01	0.10	11.41	914	0.00	0.03	6.89	813	0.36	0.85	2.34
801	0.01	0.09	14.27	505	0.01	0.03	1.84	521	0.01	0.73	87.43
710	0.00	0.08	38.98	712	0.02	0.03	1.28	805	0.09	0.73	8.28

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SR#83-94 T.B. JENKINS @ TVA, NUCLEAR UNITS

ALL SIZE RANGES ALL TYPES

1972-1981

COMPONENT OUTAGES BY AVERAGE HOURS PER UNIT YEAR
TOTAL NUMBER OF UNIT YEARS IS 479

74 TOTAL UNITS

FULL FORCED (UNPLANNED) OUTAGES				UNPLANNED DERATINGS				FORCED, MAINT, PLANNED & EQUIV DERATINGS			
CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG EQUIV HRS PER UNIT YR	AVG EQUIV HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE
648	0.00	0.08	18.03	709	0.00	0.02	10.36	620	0.00	0.72	172.02
646	0.00	0.07	35.10	916	0.03	0.02	0.65	243	0.01	0.71	113.05
715	0.00	0.07	33.63	522	0.01	0.02	1.62	649	0.01	0.68	81.64
637	0.00	0.07	16.62	541	0.00	0.02	3.93	644	0.03	0.65	19.45
913	0.00	0.07	32.00	714	0.03	0.02	0.54	633	0.27	0.62	2.32
716	0.00	0.06	13.41	235	0.01	0.01	1.00	704	0.03	0.60	18.10
910	0.00	0.06	13.29	701	0.00	0.01	3.09	711	0.02	0.60	28.71
649	0.00	0.05	24.25	244	0.01	0.01	1.19	909	0.02	0.59	31.23
500	0.00	0.05	23.25	500	0.00	0.01	1.95	253	0.03	0.51	17.36
526	0.00	0.05	22.83	612	0.00	0.01	3.18	921	0.06	0.42	7.41
214	0.00	0.04	19.05	715	0.00	0.01	2.54	702	0.02	0.38	20.24
902	0.00	0.02	11.25	925	0.01	0.01	0.41	646	0.02	0.33	16.00
912	0.00	0.02	5.23	716	0.00	0.01	2.40	910	0.13	0.32	2.40
709	0.00	0.01	7.08	806	0.00	0.00	1.09	602	0.00	0.31	149.40
612	0.00	0.01	3.93	545	0.00	0.00	1.26	544	0.02	0.30	16.02
244	0.00	0.00	1.17	277	0.00	0.00	1.04	925	0.03	0.27	8.21
605	0.00	0.00	0.40	928	0.00	0.00	0.69	920	0.01	0.27	18.26
***	0.00	0.00	0.00	223	0.00	0.00	0.65	806	0.17	0.22	1.26
***	0.00	0.00	0.00	524	0.00	0.00	0.50	212	0.00	0.19	89.54
***	0.00	0.00	0.00	501	0.00	0.00	0.39	640	0.00	0.19	44.39
***	0.00	0.00	0.00	241	0.00	0.00	0.38	525	0.01	0.18	21.84
***	0.00	0.00	0.00	540	0.00	0.00	0.05	920	0.00	0.11	54.58
***	0.00	0.00	0.00	238	0.00	0.00	0.03	543	0.00	0.10	46.85
***	0.00	0.00	0.00	***	0.00	0.00	0.00	244	0.01	0.09	6.45
***	0.00	0.00	0.00	***	0.00	0.00	0.00	710	0.00	0.08	38.98
***	0.00	0.00	0.00	***	0.00	0.00	0.00	637	0.01	0.07	11.08
***	0.00	0.00	0.00	***	0.00	0.00	0.00	641	0.00	0.07	32.73
***	0.00	0.00	0.00	***	0.00	0.00	0.00	716	0.01	0.06	9.74
***	0.00	0.00	0.00	***	0.00	0.00	0.00	817	0.01	0.06	3.90
***	0.00	0.00	0.00	***	0.00	0.00	0.00	292	0.00	0.05	22.23
***	0.00	0.00	0.00	***	0.00	0.00	0.00	214	0.00	0.04	19.05
***	0.00	0.00	0.00	***	0.00	0.00	0.00	236	0.01	0.02	3.30
***	0.00	0.00	0.00	***	0.00	0.00	0.00	541	0.00	0.02	3.93
***	0.00	0.00	0.00	***	0.00	0.00	0.00	612	0.00	0.01	3.56
***	0.00	0.00	0.00	***	0.00	0.00	0.00	235	0.01	0.01	1.08
***	0.00	0.00	0.00	***	0.00	0.00	0.00	266	0.00	0.01	6.12
***	0.00	0.00	0.00	***	0.00	0.00	0.00	650	0.00	0.01	3.23
***	0.00	0.00	0.00	***	0.00	0.00	0.00	545	0.00	0.00	1.26
***	0.00	0.00	0.00	***	0.00	0.00	0.00	277	0.00	0.00	1.04
***	0.00	0.00	0.00	***	0.00	0.00	0.00	623	0.00	0.00	0.50

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SR#83-94 T.B. JENKINS @ TVA, NUCLEAR UNITS

ALL SIZE RANGES ALL TYPES

1972-1981

COMPONENT OUTAGES BY AVERAGE HOURS PER UNIT YEAR
TOTAL NUMBER OF UNIT YEARS IS 479

74 TOTAL UNITS

FULL FORCED (UNPLANNED) OUTAGES				UNPLANNED DERATINGS				FORCED, MAINT, PLANNED & EQUIV DERATINGS			
CAUSE	AVG NO	AVG HRS	AVG DUR	CAUSE	AVG NO	AVG EDIV	AVG EDIV	CAUSE	AVG NO	AVG HRS	AVG DUR
CODE	OCC PER	PER	HRS PER	CODE	OCC PER	HRS PER	HRS PER	CODE	OCC PER	PER	HRS PER
	UNIT YR	UNIT YR	OUTAGE		UNIT YR	UNIT YR	OUTAGE		UNIT YR	UNIT YR	OUTAGE
***	0.00	0.00	0.00	***	0.00	0.00	0.00	605	0.00	0.00	0.40
***	0.00	0.00	0.00	***	0.00	0.00	0.00	626	0.00	0.00	0.18
***	0.00	0.00	0.00	***	0.00	0.00	0.00	540	0.00	0.00	0.05
***	0.00	0.00	0.00	***	0.00	0.00	0.00	238	0.00	0.00	0.03

NORTH AMERICAN ELECTRIC RELIABILITY COUNCIL
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SR#83-94 T.B. JENKINS @ TVA, FOSSIL UNITS, COAL PRIMARY, 450MW + ABOVE 1972-1981

COMPONENT OUTAGES BY AVERAGE HOURS PER UNIT YEAR
TOTAL NUMBER OF UNIT YEARS IS 1258

199 TOTAL UNITS

FULL FORCED (UNPLANNED) OUTAGES				UNPLANNED DERATINGS				FORCED, MAINT, PLANNED & EQUIV DERATINGS			
CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG EQUIV HRS PER UNIT YR	AVG EQUIV HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE
101	2.47	173.57	70.21	121	30.19	69.14	2.29	100	4.07	656.84	161.39
103	0.70	59.43	84.76	110	3.56	23.63	6.63	600	1.47	408.24	278.50
100	0.89	54.96	62.07	922	2.24	21.60	9.65	700	0.44	258.92	582.68
104	0.61	53.94	87.90	136	8.33	19.48	2.34	101	3.21	204.61	63.79
106	0.60	39.89	66.90	109	3.18	17.96	5.66	800	1.30	134.38	103.02
630	0.72	33.21	46.00	143	7.05	17.00	2.41	900	2.17	120.75	55.62
629	0.05	33.13	683.26	142	7.30	16.71	2.29	648	0.18	99.48	556.22
903	0.12	23.66	197.13	908	5.12	16.18	3.16	121	34.93	96.50	2.76
102	0.29	23.06	79.26	905	1.61	15.74	9.75	151	0.19	91.35	478.84
600	0.30	22.10	73.15	135	3.76	15.38	4.09	103	1.19	71.73	60.44
122	0.27	21.02	76.63	901	2.07	15.17	7.31	629	0.31	60.18	191.66
631	0.17	18.82	109.09	919	1.71	14.78	8.63	104	0.89	58.44	65.70
706	0.06	18.72	318.19	123	7.34	10.38	1.41	630	2.30	52.55	22.84
700	0.12	18.33	157.97	100	2.16	9.91	4.59	106	0.80	48.07	59.99
134	1.65	17.94	10.89	139	1.25	9.81	7.85	109	3.75	44.22	11.81
622	0.43	16.41	38.15	128	0.76	9.40	12.30	136	9.52	38.44	4.04
136	0.17	15.32	92.63	630	1.17	8.41	7.19	622	1.41	38.18	27.11
116	0.22	12.33	55.40	803	0.80	6.92	8.66	110	4.11	37.04	9.01
900	0.48	11.25	23.20	101	0.50	6.21	12.54	130	1.43	35.94	25.10
109	0.26	10.59	40.74	119	1.77	6.19	3.49	922	2.83	35.56	12.58
126	0.12	9.97	84.78	130	1.06	5.78	5.44	122	1.13	32.85	29.02
105	0.09	9.45	111.05	108	0.75	5.43	7.23	542	0.13	31.60	250.01
703	0.07	8.74	118.19	804	0.66	5.22	7.93	706	0.22	31.53	140.64
108	0.11	8.71	76.06	199	1.04	4.80	4.62	901	2.41	30.95	12.83
133	0.01	8.10	566.34	145	2.64	4.68	1.77	919	2.21	29.74	13.47
632	0.58	7.81	13.39	107	0.50	4.54	9.00	199	1.56	29.57	18.96
712	0.17	7.79	46.24	622	0.71	4.38	6.19	905	2.16	29.57	13.68
119	0.09	7.64	82.12	924	5.89	4.26	0.72	903	0.32	28.52	89.48
199	0.32	7.43	23.37	509	1.58	4.10	2.60	631	0.40	25.79	64.37
901	0.14	7.06	50.43	900	1.21	3.82	3.15	126	0.75	25.76	34.15
999	0.24	7.02	29.34	126	0.55	3.39	6.16	108	0.97	25.44	26.23
117	0.21	6.36	30.31	906	1.36	3.26	2.40	102	0.38	24.81	65.99
643	0.04	5.47	127.51	122	0.78	3.24	4.16	139	1.42	24.03	16.95
708	0.01	5.45	571.46	600	0.55	3.16	5.75	134	2.85	23.58	8.27
110	0.22	5.45	24.31	629	0.24	3.04	12.91	142	7.52	20.04	2.67
919	0.25	5.41	21.89	134	1.07	3.00	2.79	119	1.95	19.52	9.99
905	0.27	5.32	20.03	103	0.44	2.91	6.64	908	5.37	19.24	3.58
704	0.08	5.19	66.01	106	0.16	2.64	16.12	123	7.97	17.82	2.24
121	0.22	4.94	22.76	802	0.68	2.62	3.83	107	0.58	17.79	30.79
922	0.25	4.93	19.82	146	0.81	2.57	3.16	143	7.12	17.63	2.48

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COMPONENT OUTAGES BY AVERAGE HOURS PER UNIT YEAR
TOTAL NUMBER OF UNIT YEARS IS 1258

199 TOTAL UNITS

FULL FORCED (UNPLANNED) OUTAGES				UNPLANNED DERATINGS				FORCED, MAINT, PLANNED & EQUIV DERATINGS			
CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG EQUIV HRS PER UNIT YR	AVG EQUIV HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE
714	0.11	4.92	46.51	800	1.05	2.57	2.45	116	0.48	16.59	34.72
699	0.15	4.73	32.35	706	0.15	2.36	16.02	135	3.79	16.57	4.37
146	0.07	4.72	69.01	920	0.12	2.31	18.49	128	1.11	16.36	14.80
923	0.04	4.47	108.10	907	0.44	1.95	4.48	703	0.26	15.56	58.76
904	0.23	4.23	18.49	815	0.86	1.84	2.13	699	0.53	14.14	26.83
648	0.02	4.17	275.85	814	0.40	1.75	4.43	715	0.05	13.96	266.01
649	0.01	4.10	396.79	921	0.22	1.72	7.92	632	0.94	13.08	13.89
802	0.10	4.03	38.71	631	0.18	1.68	9.19	712	0.27	12.51	46.01
915	0.25	3.97	15.62	137	0.55	1.66	3.02	507	0.02	11.63	542.10
123	0.18	3.73	20.51	699	0.21	1.65	7.79	125	0.08	11.53	149.57
139	0.05	3.73	68.92	117	0.42	1.63	3.85	117	0.74	11.36	15.45
701	0.03	3.67	104.83	899	0.29	1.59	5.56	803	0.99	11.08	11.17
107	0.02	3.45	140.00	124	0.92	1.57	1.72	802	0.89	10.32	11.56
130	0.08	3.31	43.83	812	1.23	1.57	1.28	132	0.69	10.18	14.70
142	0.20	3.08	15.74	138	0.42	1.49	3.54	105	0.18	9.91	54.70
914	0.08	2.92	37.85	120	0.55	1.48	2.68	146	0.92	9.57	10.41
128	0.21	2.89	14.03	115	0.22	1.44	6.48	141	0.34	9.48	27.98
111	0.04	2.75	75.25	632	0.26	1.43	5.61	133	0.04	8.51	227.75
809	0.03	2.66	81.54	132	0.57	1.42	2.48	999	0.46	8.20	17.87
137	0.02	2.63	110.24	147	0.30	1.41	4.67	708	0.04	7.86	201.70
141	0.04	2.59	67.89	111	0.13	1.35	10.24	804	0.78	7.76	9.90
908	0.08	2.50	32.07	500	0.13	1.28	10.21	643	0.08	7.33	97.12
634	0.00	2.45	615.55	801	0.45	1.27	2.70	930	0.12	7.29	62.79
140	0.17	2.41	14.44	912	0.41	1.14	2.78	923	0.47	7.17	15.34
621	0.12	2.27	18.94	148	0.27	1.13	4.17	704	0.19	7.07	37.51
705	0.03	2.26	79.06	923	0.38	1.10	2.90	131	0.11	6.86	62.50
711	0.02	2.11	98.51	153	0.11	1.05	9.61	120	0.57	6.52	11.39
627	0.01	2.07	153.30	903	0.16	1.03	6.41	924	6.34	6.31	1.00
131	0.02	2.07	123.89	400	0.54	0.96	1.78	115	0.34	6.29	18.75
132	0.07	2.06	27.85	808	0.18	0.92	5.14	124	1.64	5.91	3.60
149	0.18	2.02	11.33	127	0.36	0.89	2.46	111	0.20	5.91	30.23
115	0.06	1.97	35.41	634	0.14	0.80	6.20	137	0.60	5.90	9.77
129	0.04	1.97	44.22	104	0.22	0.84	3.80	906	1.44	5.80	4.02
644	0.02	1.93	97.34	116	0.19	0.83	4.33	145	3.18	5.78	1.82
916	0.16	1.91	11.90	149	0.21	0.81	3.83	801	0.90	5.59	6.29
799	0.05	1.80	35.30	918	0.10	0.79	7.54	400	0.57	5.51	9.63
120	0.01	1.73	241.47	141	0.20	0.78	3.95	816	0.20	5.31	25.99
803	0.06	1.65	28.37	927	0.58	0.74	1.28	509	1.60	5.25	3.28
906	0.03	1.60	48.94	816	0.13	0.66	4.99	127	0.43	5.24	12.13
635	0.02	1.58	104.48	624	0.07	0.63	39.93	812	1.26	5.24	4.15

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NORTH AMERICAN ELECTRIC RELIABILITY COUNCIL
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SR483-94 T.B. JENKINS @ TVA, FOSSIL UNITS, COAL PRIMARY, 400MW+ ABOVE 1972-1981

COMPONENT OUTAGES BY AVERAGE HOURS PER UNIT YEAR
TOTAL NUMBER OF UNIT YEARS IS 1258

199 TOTAL UNITS

FULL FORCED (UNPLANNED) OUTAGES				UNPLANNED DERATINGS				FORCED, MAINT, PLANNED & EQUIV DERATINGS			
CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG EQIV HRS PER UNIT YR	AVG EQIV HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE
800	0.05	1.52	29.84	999	0.18	0.57	3.14	714	0.15	5.24	35.60
628	0.01	1.45	228.33	112	0.25	0.56	2.24	904	0.37	5.08	13.87
150	0.02	1.39	75.83	705	0.03	0.54	16.71	899	0.35	4.68	13.38
814	0.11	1.31	11.80	700	0.05	0.54	10.47	711	0.05	4.58	94.54
907	0.04	1.31	31.71	144	0.13	0.53	4.20	701	0.06	4.57	72.73
620	0.02	1.31	78.33	909	0.07	0.47	6.58	705	0.07	4.35	60.82
816	0.03	1.26	39.54	644	0.04	0.45	10.56	148	0.48	4.30	8.89
642	0.04	1.23	27.65	621	0.10	0.42	4.13	644	0.08	4.18	55.42
138	0.01	1.22	96.14	129	0.13	0.40	3.20	649	0.01	4.11	303.85
160	0.05	1.18	23.86	904	0.11	0.38	3.38	915	0.29	4.03	13.86
716	0.01	1.17	112.88	703	0.15	0.37	2.50	799	0.11	4.01	35.80
112	0.03	1.15	38.16	914	0.05	0.32	5.87	914	0.15	3.99	27.13
125	0.01	1.11	155.34	902	0.07	0.31	4.80	524	0.00	3.96	2492.96
127	0.03	1.02	40.05	131	0.05	0.30	6.39	634	0.15	3.93	26.57
899	0.03	0.99	30.37	929	0.13	0.30	2.39	149	0.42	3.90	9.18
636	0.01	0.97	87.58	712	0.05	0.28	5.19	627	0.03	3.84	150.95
715	0.01	0.97	121.57	133	0.02	0.23	11.31	907	0.50	3.79	7.54
147	0.01	0.96	67.20	807	0.23	0.23	1.02	621	0.28	3.74	13.55
713	0.07	0.94	12.66	105	0.09	0.22	2.44	902	0.09	3.63	42.64
151	0.01	0.88	85.51	125	0.02	0.20	9.51	138	0.52	3.56	6.85
929	0.04	0.74	19.84	704	0.09	0.20	2.29	809	0.06	3.45	56.30
707	0.00	0.70	293.87	925	0.01	0.20	31.45	814	0.52	3.17	6.13
804	0.03	0.70	21.45	930	0.05	0.19	3.73	500	0.13	3.11	23.56
135	0.01	0.64	44.71	810	0.05	0.18	3.75	920	0.16	3.08	18.71
124	0.01	0.64	80.28	102	0.06	0.17	2.95	112	0.33	3.08	9.44
924	0.05	0.63	12.74	648	0.05	0.15	2.94	160	0.15	2.98	20.18
912	0.02	0.62	33.96	701	0.02	0.14	6.81	147	0.33	2.82	8.62
152	0.18	0.62	3.39	805	0.09	0.13	1.47	144	0.19	2.73	14.01
812	0.02	0.60	36.24	403	0.08	0.13	1.62	921	0.28	2.65	9.59
910	0.05	0.59	11.46	813	0.05	0.12	2.66	927	0.64	2.56	3.98
808	0.04	0.58	15.55	711	0.02	0.12	4.86	129	0.18	2.56	14.26
930	0.01	0.57	71.68	650	0.02	0.12	4.78	624	0.02	2.56	123.67
153	0.03	0.49	13.99	113	0.09	0.11	1.20	929	0.18	2.43	13.15
921	0.03	0.46	14.98	628	0.01	0.10	8.22	628	0.03	2.16	69.74
400	0.02	0.44	26.47	702	0.05	0.10	2.06	916	0.22	2.03	9.13
801	0.01	0.41	36.47	160	0.08	0.10	1.17	810	0.08	2.02	24.67
709	0.01	0.39	30.84	505	0.05	0.10	1.84	815	0.91	1.92	2.12
144	0.05	0.38	7.68	503	0.01	0.09	7.22	707	0.01	1.91	133.20
118	0.00	0.36	89.97	114	0.02	0.09	5.60	912	0.45	1.79	3.98
114	0.01	0.36	44.84	715	0.01	0.08	5.67	808	0.22	1.78	7.91

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SR#83-94 T.B. JENKINS @ TVA, FOSSIL UNITS, COAL PRIMARY, 400MW & ABOVE 1972-1981

COMPONENT OUTAGES BY AVERAGE HOURS PER UNIT YEAR
TOTAL NUMBER OF UNIT YEARS IS 1258

199 TOTAL UNITS

FULL FORCED (UNPLANNED) OUTAGES				UNPLANNED DERATINGS				FORCED, MAINT, PLANNED & EQUIV DERATINGS			
CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PFR UNIT YR	AVG DUR HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG EQIV HRS PFR UNIT YR	AVG EQIV HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PFR UNIT YR	AVG DUR HRS PER OUTAGE
143	0.03	0.35	11.43	422	0.02	0.08	4.07	635	0.03	1.73	64.15
925	0.04	0.35	8.26	713	0.02	0.08	3.57	150	0.03	1.62	63.52
920	0.02	0.33	20.90	910	0.04	0.08	1.74	642	0.06	1.59	25.62
710	0.01	0.30	23.43	799	0.03	0.08	2.72	153	0.15	1.57	10.75
927	0.01	0.28	29.47	643	0.02	0.07	3.22	626	0.01	1.55	162.80
918	0.02	0.28	15.74	809	0.01	0.07	5.10	636	0.02	1.35	58.57
805	0.02	0.27	13.11	140	0.02	0.07	4.14	620	0.02	1.32	64.08
650	0.03	0.25	9.41	916	0.05	0.06	1.37	508	0.01	1.29	231.03
813	0.01	0.24	27.34	709	0.00	0.06	39.75	716	0.03	1.21	39.94
902	0.00	0.24	49.85	714	0.03	0.06	1.90	641	0.00	1.15	361.70
509	0.01	0.24	22.77	151	0.02	0.06	3.15	713	0.10	1.12	11.22
542	0.01	0.23	41.02	926	0.00	0.06	18.63	918	0.12	1.08	8.69
140	0.01	0.20	31.36	542	0.02	0.05	2.87	909	0.09	1.06	12.30
626	0.01	0.20	27.63	635	0.01	0.05	5.87	114	0.03	0.95	34.26
113	0.02	0.19	9.69	412	0.05	0.05	1.03	709	0.02	0.87	45.69
633	0.01	0.19	26.52	409	0.00	0.05	15.40	505	0.10	0.84	8.69
504	0.00	0.19	118.39	915	0.03	0.05	1.74	152	0.18	0.73	3.97
624	0.00	0.16	97.87	434	0.01	0.04	3.10	910	0.10	0.70	7.00
612	0.01	0.14	11.98	421	0.03	0.04	1.48	422	0.02	0.70	31.35
807	0.02	0.14	8.95	716	0.02	0.04	2.01	637	0.00	0.68	170.94
177	0.00	0.13	157.73	638	0.01	0.04	3.16	925	0.05	0.62	12.63
928	0.01	0.11	13.10	633	0.01	0.04	5.08	623	0.00	0.62	156.23
503	0.00	0.11	68.52	435	0.00	0.04	7.41	415	0.01	0.61	48.18
810	0.00	0.11	27.39	404	0.01	0.03	3.06	118	0.01	0.56	43.76
406	0.00	0.10	122.02	428	0.01	0.03	5.22	504	0.03	0.48	15.13
637	0.00	0.09	37.22	627	0.01	0.03	4.82	710	0.02	0.46	26.09
913	0.00	0.07	31.07	636	0.01	0.03	2.86	807	0.25	0.43	1.69
434	0.01	0.07	12.35	405	0.00	0.02	6.99	434	0.03	0.42	16.00
602	0.00	0.06	39.70	708	0.02	0.02	1.15	805	0.11	0.41	3.63
815	0.00	0.06	12.84	504	0.02	0.02	1.15	813	0.09	0.39	4.37
702	0.00	0.06	12.70	190	0.00	0.02	7.82	140	0.03	0.38	14.42
145	0.00	0.06	36.53	414	0.04	0.02	0.50	650	0.05	0.37	7.11
415	0.00	0.05	67.30	642	0.01	0.02	2.11	702	0.06	0.34	5.36
909	0.01	0.04	5.67	540	0.01	0.02	1.72	113	0.11	0.30	2.73
447	0.00	0.03	39.50	641	0.00	0.01	8.43	633	0.02	0.26	16.50
171	0.00	0.02	15.68	150	0.00	0.01	3.33	428	0.05	0.22	4.44
638	0.00	0.02	30.05	406	0.01	0.01	2.30	503	0.01	0.20	14.03
609	0.00	0.02	25.73	806	0.01	0.01	1.99	928	0.02	0.18	10.23
414	0.00	0.02	12.58	623	0.00	0.01	7.67	525	0.00	0.15	194.63
181	0.00	0.02	20.28	444	0.02	0.01	0.47	612	0.01	0.14	10.73

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NORTH AMERICAN ELECTRIC RELIABILITY COUNCIL
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SR#83-94 T.B. JENKINS @ TVA; FOSSIL UNITS, COAL PRIMARY, 400MW + ABOVE 1972-1981

COMPONENT OUTAGES BY AVERAGE HOURS PER UNIT YEAR
TOTAL NUMBER OF UNIT YEARS IS 1258

199 TOTAL UNITS

FULL FORCED (UNPLANNED) OUTAGES				UNPLANNED DERATINGS				FORCED, MAINT, PLANNED & EQUIV DERATINGS			
CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG EQUIV HRS PER UNIT YR	AVG EQUIV HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE
450	0.00	0.01	3.46	411	0.00	0.01	7.19	602	0.00	0.14	44.30
540	0.00	0.01	13.77	928	0.01	0.01	1.71	403	0.09	0.14	1.65
522	0.00	0.01	13.63	449	0.01	0.01	0.93	177	0.00	0.13	157.73
166	0.00	0.01	10.62	419	0.02	0.01	0.48	406	0.01	0.11	17.27
404	0.00	0.01	5.30	161	0.03	0.01	0.36	435	0.01	0.11	16.59
417	0.00	0.01	10.48	507	0.01	0.01	1.58	806	0.02	0.10	6.60
623	0.00	0.01	4.08	171	0.01	0.01	0.98	543	0.01	0.09	10.81
500	0.00	0.01	3.85	420	0.00	0.01	1.52	913	0.00	0.08	19.19
817	0.00	0.01	6.30	402	0.00	0.01	3.96	638	0.01	0.06	4.84
403	0.00	0.00	6.27	639	0.00	0.01	3.93	926	0.00	0.06	18.63
625	0.00	0.00	3.05	620	0.00	0.01	2.21	416	0.00	0.06	13.99
195	0.00	0.00	3.00	191	0.00	0.01	6.54	412	0.05	0.05	1.03
507	0.00	0.00	2.87	707	0.01	0.00	0.44	409	0.00	0.05	15.40
544	0.00	0.00	2.60	649	0.00	0.00	2.81	404	0.01	0.05	3.34
444	0.00	0.00	1.88	645	0.00	0.00	5.13	421	0.03	0.04	1.48
445	0.00	0.00	1.52	415	0.00	0.00	0.94	414	0.04	0.04	1.00
646	0.00	0.00	1.05	441	0.00	0.00	1.52	171	0.01	0.03	3.43
412	0.00	0.00	0.90	408	0.00	0.00	4.11	447	0.00	0.03	39.50
420	0.00	0.00	0.83	602	0.00	0.00	3.81	610	0.00	0.03	16.74
164	0.00	0.00	0.58	118	0.00	0.00	0.94	540	0.01	0.03	2.73
***	0.00	0.00	0.00	508	0.00	0.00	1.72	405	0.00	0.02	6.99
***	0.00	0.00	0.00	625	0.00	0.00	3.42	609	0.00	0.02	25.73
***	0.00	0.00	0.00	180	0.00	0.00	1.61	411	0.00	0.02	7.83
***	0.00	0.00	0.00	445	0.00	0.00	0.64	190	0.00	0.02	7.82
***	0.00	0.00	0.00	173	0.00	0.00	0.93	444	0.03	0.02	0.60
***	0.00	0.00	0.00	913	0.00	0.00	1.37	181	0.00	0.02	20.28
***	0.00	0.00	0.00	416	0.00	0.00	0.67	817	0.01	0.02	2.77
***	0.00	0.00	0.00	817	0.00	0.00	0.80	191	0.00	0.01	8.71
***	0.00	0.00	0.00	186	0.00	0.00	2.26	402	0.00	0.01	5.41
***	0.00	0.00	0.00	407	0.00	0.00	0.64	450	0.00	0.01	2.60
***	0.00	0.00	0.00	170	0.00	0.00	1.92	522	0.00	0.01	13.63
***	0.00	0.00	0.00	185	0.00	0.00	1.78	449	0.01	0.01	0.93
***	0.00	0.00	0.00	450	0.00	0.00	0.88	419	0.02	0.01	0.48
***	0.00	0.00	0.00	646	0.00	0.00	0.86	161	0.03	0.01	0.36
***	0.00	0.00	0.00	543	0.00	0.00	0.52	166	0.00	0.01	10.62
***	0.00	0.00	0.00	637	0.00	0.00	1.49	417	0.00	0.01	10.48
***	0.00	0.00	0.00	501	0.00	0.00	0.24	420	0.01	0.01	1.42
***	0.00	0.00	0.00	183	0.00	0.00	1.01	407	0.00	0.01	2.30
***	0.00	0.00	0.00	606	0.00	0.00	0.86	639	0.00	0.01	3.93
***	0.00	0.00	0.00	446	0.00	0.00	0.85	625	0.00	0.01	3.24

NORTH AMERICAN ELECTRIC RELIABILITY COUNCIL
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SR#83-94 T.B. JENKINS @ TVA, FOSSIL UNITS, COAL PRIMARY, 400MW + ABOVE 1972-1981

COMPONENT OUTAGES BY AVERAGE HOURS PER UNIT YEAR
TOTAL NUMBER OF UNIT YEARS IS 1258

199 TOTAL UNITS

FULL FORCED (UNPLANNED) OUTAGES				UNPLANNED DERATINGS				FORCED, MAINT, PLANNED & EQUIV DERATINGS			
CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG EQUIV HRS PER UNIT YR	AVG EQUIV HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE
***	0.00	0.00	0.00	437	0.00	0.00	0.40	646	0.00	0.00	1.34
***	0.00	0.00	0.00	424	0.00	0.00	0.74	645	0.00	0.00	5.13
***	0.00	0.00	0.00	710	0.00	0.00	0.23	445	0.00	0.00	0.78
***	0.00	0.00	0.00	510	0.00	0.00	0.56	441	0.00	0.00	1.52
***	0.00	0.00	0.00	423	0.00	0.00	0.16	408	0.00	0.00	4.11
***	0.00	0.00	0.00	610	0.00	0.00	0.30	418	0.00	0.00	3.35
***	0.00	0.00	0.00	401	0.00	0.00	0.07	180	0.00	0.00	1.61
***	0.00	0.00	0.00	605	0.00	0.00	0.10	195	0.00	0.00	3.00
***	0.00	0.00	0.00	152	0.00	0.00	0.06	173	0.00	0.00	0.93
***	0.00	0.00	0.00	442	0.00	0.00	0.05	446	0.00	0.00	0.88
***	0.00	0.00	0.00	***	0.00	0.00	0.00	544	0.00	0.00	2.60
***	0.00	0.00	0.00	***	0.00	0.00	0.00	811	0.00	0.00	2.47
***	0.00	0.00	0.00	***	0.00	0.00	0.00	448	0.00	0.00	2.28
***	0.00	0.00	0.00	***	0.00	0.00	0.00	186	0.00	0.00	2.26
***	0.00	0.00	0.00	***	0.00	0.00	0.00	178	0.00	0.00	2.18
***	0.00	0.00	0.00	***	0.00	0.00	0.00	170	0.00	0.00	1.92
***	0.00	0.00	0.00	***	0.00	0.00	0.00	185	0.00	0.00	1.78
***	0.00	0.00	0.00	***	0.00	0.00	0.00	506	0.00	0.00	1.26
***	0.00	0.00	0.00	***	0.00	0.00	0.00	501	0.00	0.00	0.24
***	0.00	0.00	0.00	***	0.00	0.00	0.00	183	0.00	0.00	1.01
***	0.00	0.00	0.00	***	0.00	0.00	0.00	606	0.00	0.00	0.86
***	0.00	0.00	0.00	***	0.00	0.00	0.00	437	0.00	0.00	0.40
***	0.00	0.00	0.00	***	0.00	0.00	0.00	424	0.00	0.00	0.74
***	0.00	0.00	0.00	***	0.00	0.00	0.00	164	0.00	0.00	0.58
***	0.00	0.00	0.00	***	0.00	0.00	0.00	510	0.00	0.00	0.56
***	0.00	0.00	0.00	***	0.00	0.00	0.00	423	0.00	0.00	0.16
***	0.00	0.00	0.00	***	0.00	0.00	0.00	401	0.00	0.00	0.07
***	0.00	0.00	0.00	***	0.00	0.00	0.00	640	0.00	0.00	0.10
***	0.00	0.00	0.00	***	0.00	0.00	0.00	605	0.00	0.00	0.10
***	0.00	0.00	0.00	***	0.00	0.00	0.00	442	0.00	0.00	0.05

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SR#83-94 T.B. JENKINS @ TVA, FOSSIL UNITS, ALL FUEL TYPES, ALL SIZES 1972-1981

COMPONENT OUTAGES BY AVERAGE HOURS PER UNIT YEAR
TOTAL NUMBER OF UNIT YEARS IS 9589

1,265 TOTAL UNITS

FULL FORCED (UNPLANNED) OUTAGES				UNPLANNED DERATINGS				FORCED, MAINT, PLANNED & EQUIV DERATINGS			
CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG EQUIV HRS PLR UNIT YR	AVG EQUIV HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE
101	1.61	96.45	60.08	121	8.40	26.79	3.19	100	1.99	487.78	245.57
103	1.07	60.16	56.10	901	1.32	17.94	13.59	600	0.76	366.51	482.29
104	0.43	26.13	60.69	109	1.37	13.70	9.97	700	0.33	219.22	671.61
106	0.53	23.70	44.57	922	0.97	11.39	11.69	800	0.56	143.56	256.72
630	0.32	20.57	64.85	110	1.06	10.45	9.89	101	2.13	122.76	57.77
100	0.38	19.23	50.90	905	0.67	8.87	13.29	900	1.08	122.20	113.18
629	0.02	14.57	731.31	143	2.25	7.70	3.42	151	0.18	74.02	411.47
102	0.17	13.24	76.30	908	2.08	7.56	3.64	103	1.44	72.47	50.27
631	0.11	13.22	120.50	142	2.76	7.42	2.69	648	0.10	68.64	654.88
708	0.01	11.46	1207.87	199	0.52	6.74	12.85	121	10.59	38.43	3.63
600	0.10	11.09	106.99	135	1.16	6.47	5.57	199	0.89	36.00	40.55
706	0.02	8.83	425.47	629	0.18	5.98	32.40	901	1.71	34.35	20.12
903	0.06	8.33	138.35	136	1.61	5.44	3.38	629	0.22	32.37	144.24
622	0.22	8.01	36.16	128	0.37	5.31	14.42	104	0.59	31.94	54.11
122	0.13	7.84	62.50	101	0.23	4.91	21.02	106	0.67	30.30	45.19
134	0.62	7.60	12.18	803	0.30	4.15	13.82	630	0.86	29.90	34.97
126	0.10	7.16	71.22	139	0.41	4.06	9.90	622	0.70	26.72	38.39
628	0.01	6.24	906.76	804	0.32	4.02	12.48	109	1.73	26.53	15.31
999	0.12	5.43	46.57	108	0.28	3.94	14.29	126	0.57	22.88	40.50
700	0.04	5.38	130.86	919	0.33	3.76	11.24	130	0.57	21.91	38.32
199	0.15	5.27	36.15	100	0.77	3.64	4.74	108	0.56	21.53	38.52
901	0.12	5.20	42.28	123	2.06	3.60	1.75	631	0.29	20.86	71.89
116	0.10	4.67	48.41	126	0.32	3.58	11.04	922	1.25	20.32	16.25
109	0.11	4.60	41.09	802	1.09	3.46	3.16	905	0.99	19.93	20.12
108	0.06	4.50	69.88	918	0.12	2.96	23.76	110	1.35	18.38	13.59
627	0.01	4.46	423.39	801	1.12	2.74	2.44	715	0.04	18.05	453.10
136	0.06	4.34	71.78	509	0.92	2.52	2.76	542	0.06	17.36	280.28
632	0.20	4.15	20.68	622	0.27	2.45	9.19	102	0.25	17.05	68.84
133	0.01	4.14	461.57	630	0.29	2.20	7.71	708	0.03	16.73	536.61
900	0.17	4.13	23.58	900	0.47	2.00	4.24	706	0.06	14.55	261.30
712	0.11	4.01	37.84	137	0.23	1.91	8.14	801	3.70	14.47	3.91
703	0.04	3.33	91.20	631	0.12	1.86	14.92	628	0.07	14.42	203.36
130	0.07	3.30	45.22	130	0.26	1.77	6.75	122	0.50	13.52	26.88
904	0.11	3.26	29.57	103	0.22	1.76	7.96	125	0.07	13.34	190.98
117	0.12	3.25	27.15	132	0.40	1.67	4.22	903	0.19	13.14	68.71
802	0.11	3.16	29.46	134	0.47	1.67	3.60	136	1.86	12.10	6.52
699	0.07	3.06	45.29	122	0.33	1.64	4.98	139	0.61	11.74	19.26
922	0.08	3.00	35.79	119	0.48	1.61	3.34	134	1.20	11.35	9.48
905	0.10	2.96	29.30	903	0.07	1.54	20.61	802	1.45	10.90	7.53
110	0.09	2.85	32.69	924	1.62	1.43	0.80	507	0.04	10.83	309.10

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COMPONENT OUTAGES BY AVERAGE HOURS PER UNIT YEAR
TOTAL NUMBER OF UNIT YEARS IS 9589

1,265 TOTAL UNITS

FULL FORCED (UNPLANNED) OUTAGES				UNPLANNED DERATINGS				FORCED, MAINT, PLANNED & EQUIV DERATINGS			
CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG EQUIV HRS PER UNIT YR	AVG EQUIV HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE
119	0.05	2.71	53.73	628	0.05	1.39	26.73	123	2.42	10.83	4.47
123	0.16	2.70	16.67	921	0.09	1.39	15.66	908	2.41	9.99	4.14
105	0.04	2.55	71.77	145	0.54	1.38	2.57	699	0.26	9.85	37.59
649	0.00	2.40	490.09	923	0.16	1.37	8.66	128	0.55	9.51	17.25
643	0.02	2.17	118.26	920	0.05	1.35	26.33	919	0.48	8.70	18.21
132	0.08	2.17	28.56	107	0.12	1.25	10.09	712	0.20	8.66	42.42
621	0.07	2.12	28.78	699	0.10	1.24	12.04	119	0.60	8.52	14.18
915	0.14	2.10	15.29	627	0.03	1.22	35.97	116	0.25	8.41	33.77
648	0.01	2.08	217.15	117	0.17	1.18	6.94	117	0.41	8.41	20.54
635	0.01	1.87	144.76	115	0.09	1.17	13.13	132	0.57	8.37	14.76
919	0.07	1.80	26.37	111	0.09	1.11	12.97	142	2.82	8.30	2.94
705	0.02	1.73	98.28	106	0.06	1.06	17.42	999	0.33	8.29	24.74
799	0.03	1.70	53.13	600	0.13	0.93	7.01	803	0.41	8.23	20.18
107	0.01	1.63	127.14	104	0.09	0.91	10.11	135	1.25	8.15	6.51
128	0.07	1.60	21.82	800	0.25	0.90	3.55	143	2.30	8.02	3.49
803	0.03	1.55	49.39	899	0.17	0.84	5.05	107	0.17	7.83	45.50
121	0.06	1.48	25.64	999	0.14	0.78	5.44	627	0.05	7.38	149.04
908	0.04	1.40	38.69	814	0.28	0.78	2.75	632	0.38	7.24	19.14
146	0.02	1.37	65.55	912	0.25	0.75	3.03	703	0.22	7.00	31.75
137	0.02	1.37	70.80	902	0.06	0.75	12.82	804	0.43	6.95	16.11
701	0.02	1.34	76.26	102	0.04	0.75	17.25	810	0.10	6.66	65.84
139	0.02	1.30	53.48	906	0.26	0.71	2.77	124	0.41	6.25	15.18
714	0.05	1.27	25.06	621	0.08	0.68	8.36	904	0.23	5.45	24.18
926	0.00	1.20	5756.29	634	0.05	0.67	12.73	621	0.23	5.20	23.10
923	0.02	1.16	63.93	138	0.12	0.65	5.25	133	0.02	4.69	287.98
711	0.01	1.16	98.18	815	0.23	0.65	2.77	141	0.17	4.44	26.88
916	0.06	1.13	18.82	116	0.08	0.63	8.06	137	0.27	4.42	16.27
800	0.03	1.05	36.31	141	0.08	0.61	7.59	918	0.16	4.10	25.81
151	0.01	1.02	142.15	112	0.09	0.61	6.63	812	0.23	4.01	17.74
914	0.04	1.01	27.68	146	0.18	0.57	3.16	643	0.05	3.65	77.06
141	0.02	0.99	62.33	907	0.12	0.54	4.69	509	0.94	3.63	3.85
636	0.01	0.99	80.01	140	0.05	0.53	10.21	115	0.16	3.61	21.93
644	0.01	0.93	80.35	812	0.21	0.50	2.43	114	0.06	3.53	61.96
704	0.02	0.93	44.77	624	0.01	0.47	64.17	131	0.08	3.53	42.96
809	0.01	0.90	68.14	120	0.11	0.46	4.21	400	0.12	3.47	29.98
112	0.02	0.89	45.34	904	0.05	0.46	8.34	899	0.33	3.44	10.49
713	0.04	0.89	20.48	114	0.03	0.45	16.59	799	0.07	3.31	48.13
114	0.02	0.88	52.98	632	0.08	0.42	5.44	923	0.19	3.30	17.05
709	0.01	0.87	60.55	808	0.07	0.39	5.73	111	0.14	3.17	22.44
111	0.01	0.85	58.82	706	0.02	0.38	15.60	105	0.06	3.02	50.13

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COMPONENT OUTAGES BY AVERAGE HOURS PER UNIT YEAR
TOTAL NUMBER OF UNIT YEARS IS 9589

1,265 TOTAL UNITS

FULL FORCED (UNPLANNED) OUTAGES				UNPLANNED DERATINGS				FORCED, MAINT, PLANNED & EQUIV DERATINGS			
CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG EQIV HRS PER UNIT YR	AVG EQIV HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE
142	0.05	0.81	15.90	147	0.07	0.32	4.48	146	0.22	3.01	13.78
115	0.02	0.79	34.63	813	0.05	0.32	5.94	120	0.13	2.96	23.10
131	0.01	0.77	56.71	914	0.02	0.30	15.40	705	0.04	2.94	75.16
149	0.06	0.75	11.85	816	0.06	0.29	4.65	635	0.02	2.94	131.06
148	0.04	0.75	20.19	500	0.03	0.29	10.68	624	0.01	2.86	276.60
138	0.01	0.75	67.66	153	0.03	0.27	7.89	920	0.09	2.60	29.97
125	0.00	0.72	146.99	712	0.02	0.26	11.79	649	0.01	2.59	381.40
634	0.00	0.66	571.96	124	0.13	0.26	1.98	500	0.06	2.57	45.87
801	0.03	0.65	18.55	400	0.09	0.24	2.58	701	0.03	2.55	73.51
150	0.01	0.65	44.88	703	0.14	0.23	1.66	816	0.14	2.55	18.01
637	0.00	0.63	468.19	127	0.09	0.23	2.42	112	0.15	2.48	17.01
509	0.01	0.63	54.05	131	0.02	0.23	9.26	915	0.18	2.34	13.28
707	0.00	0.62	597.19	929	0.05	0.23	4.69	127	0.13	2.33	17.99
620	0.01	0.62	52.52	636	0.01	0.22	25.26	929	0.09	2.25	24.62
899	0.03	0.62	24.12	641	0.00	0.21	113.54	711	0.02	2.23	96.42
624	0.00	0.59	402.57	148	0.06	0.21	3.61	930	0.05	2.20	43.47
639	0.00	0.59	935.72	927	0.15	0.20	1.32	709	0.03	2.16	68.25
642	0.02	0.57	24.40	105	0.02	0.19	8.73	921	0.13	2.15	17.08
814	0.06	0.56	9.07	807	0.07	0.19	2.71	636	0.03	2.11	70.17
144	0.03	0.55	17.32	650	0.04	0.18	4.62	138	0.16	2.10	13.48
413	0.00	0.54	466.73	505	0.02	0.17	7.75	707	0.01	2.09	303.75
804	0.02	0.53	26.96	113	0.03	0.17	5.73	914	0.07	2.07	28.25
120	0.00	0.52	155.97	149	0.06	0.17	3.06	924	1.76	2.05	1.16
912	0.02	0.52	32.34	643	0.02	0.17	10.42	144	0.07	2.04	27.60
907	0.01	0.48	32.44	144	0.03	0.16	6.05	912	0.35	1.83	5.17
921	0.02	0.47	29.55	909	0.02	0.16	9.30	634	0.06	1.75	31.37
129	0.02	0.47	27.16	648	0.01	0.13	10.67	809	0.03	1.71	53.63
641	0.00	0.46	399.77	708	0.01	0.13	9.01	714	0.08	1.70	22.22
929	0.02	0.45	21.73	403	0.04	0.13	3.40	145	0.64	1.64	2.56
147	0.01	0.44	59.07	150	0.01	0.13	23.19	644	0.03	1.63	56.30
816	0.01	0.44	31.95	129	0.03	0.12	3.93	902	0.07	1.61	21.54
906	0.01	0.44	51.03	635	0.00	0.12	35.96	148	0.12	1.57	13.57
812	0.00	0.41	86.50	449	0.01	0.12	17.38	907	0.15	1.57	10.72
920	0.01	0.40	31.10	705	0.01	0.12	10.04	906	0.28	1.52	5.36
918	0.01	0.39	39.76	925	0.01	0.11	10.45	814	0.35	1.44	4.13
715	0.00	0.36	94.04	700	0.02	0.11	5.84	149	0.13	1.34	10.08
124	0.01	0.35	50.33	805	0.02	0.11	4.67	150	0.03	1.32	49.93
930	0.01	0.32	41.56	711	0.01	0.11	15.47	642	0.05	1.27	27.53
400	0.01	0.30	40.72	644	0.01	0.10	12.36	704	0.05	1.27	26.24
650	0.02	0.30	17.49	799	0.01	0.09	7.42	926	0.00	1.21	829.84

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COMPONENT OUTAGES BY AVERAGE HOURS PER UNIT YEAR
TOTAL NUMBER OF UNIT YEARS IS 9589

1,265 TOTAL UNITS

FULL FORCED (UNPLANNED) OUTAGES				UNPLANNED DERATINGS				FORCED, MAINT, PLANNED & EQUIV DERATINGS			
CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG EQIV HRS PER UNIT YR	AVG EQIV HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE
127	0.01	0.30	39.71	930	0.02	0.09	4.87	916	0.09	1.21	13.84
710	0.01	0.29	30.34	160	0.03	0.09	3.23	813	0.08	1.20	14.91
808	0.02	0.28	17.18	428	0.01	0.08	5.66	147	0.09	1.15	13.39
540	0.00	0.28	333.32	810	0.03	0.08	2.75	113	0.04	1.15	26.93
135	0.01	0.28	25.56	404	0.01	0.08	10.43	641	0.00	1.13	286.25
160	0.02	0.27	16.86	915	0.03	0.07	2.29	713	0.06	1.09	18.04
805	0.02	0.27	17.30	151	0.01	0.07	11.66	620	0.02	1.09	53.74
633	0.01	0.22	32.27	704	0.02	0.06	2.95	623	0.01	1.04	160.80
602	0.00	0.21	187.12	707	0.00	0.06	16.57	140	0.06	1.01	15.51
500	0.01	0.20	17.37	133	0.01	0.06	8.83	413	0.00	0.95	239.78
623	0.00	0.18	64.61	507	0.01	0.06	4.15	808	0.10	0.94	9.62
140	0.00	0.17	41.48	809	0.01	0.05	7.01	129	0.05	0.81	15.50
702	0.00	0.16	104.11	125	0.01	0.05	8.02	637	0.00	0.77	274.85
716	0.00	0.16	109.00	642	0.01	0.05	8.93	805	0.05	0.77	16.55
910	0.02	0.16	9.82	625	0.00	0.05	39.91	639	0.00	0.77	524.23
638	0.00	0.16	149.00	716	0.00	0.05	14.84	815	0.25	0.76	3.00
913	0.00	0.15	46.43	421	0.01	0.05	9.42	508	0.01	0.74	86.87
924	0.01	0.15	12.60	409	0.00	0.04	12.57	540	0.01	0.74	115.76
813	0.01	0.15	21.47	806	0.02	0.04	1.60	505	0.05	0.72	15.59
143	0.01	0.13	12.98	420	0.00	0.04	7.50	153	0.05	0.71	15.27
925	0.02	0.12	7.72	701	0.01	0.03	4.34	160	0.05	0.68	13.07
409	0.00	0.12	58.21	715	0.00	0.03	11.04	927	0.17	0.66	3.95
807	0.01	0.11	9.24	910	0.02	0.03	2.08	710	0.02	0.66	29.31
507	0.00	0.11	82.45	422	0.00	0.03	6.89	650	0.06	0.54	9.00
505	0.00	0.11	106.96	405	0.01	0.03	5.25	524	0.00	0.52	2492.96
118	0.01	0.11	19.07	713	0.01	0.03	3.17	504	0.04	0.50	13.97
542	0.00	0.11	36.84	412	0.01	0.03	2.94	806	0.13	0.48	3.66
543	0.00	0.10	194.72	649	0.00	0.03	42.46	602	0.00	0.48	175.54
927	0.00	0.10	26.09	714	0.01	0.03	1.70	415	0.01	0.46	40.51
152	0.03	0.09	3.63	702	0.01	0.03	2.61	543	0.00	0.41	103.97
153	0.01	0.09	17.36	435	0.00	0.02	5.20	909	0.03	0.41	15.19
626	0.00	0.08	21.89	710	0.00	0.02	33.95	633	0.02	0.40	20.83
403	0.00	0.08	32.76	544	0.00	0.02	6.50	910	0.04	0.39	10.21
411	0.00	0.08	257.37	413	0.00	0.02	12.65	807	0.09	0.38	4.43
909	0.00	0.07	17.55	423	0.00	0.02	15.18	407	0.01	0.38	67.89
407	0.00	0.07	81.60	639	0.00	0.02	56.55	422	0.01	0.35	31.52
113	0.01	0.07	11.23	916	0.02	0.02	1.31	409	0.01	0.33	41.30
902	0.00	0.06	27.06	709	0.00	0.02	6.40	638	0.00	0.32	97.22
810	0.00	0.06	18.61	152	0.01	0.02	3.74	626	0.01	0.30	46.58
640	0.00	0.06	47.08	541	0.00	0.02	63.40	449	0.01	0.28	22.11

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SR#83-94 T.B. JENKINS @ TVA, FOSSIL UNITS, ALL FUEL TYPES, ALL SIZES 1972-1981

COMPONENT OUTAGES BY AVERAGE HOURS PER UNIT YEAR
TOTAL NUMBER OF UNIT YEARS IS 9589

1,265 TOTAL UNITS

FULLY FORCED (UNPLANNED) OUTAGES				UNPLANNED DERATINGS				FORCED, MAINT, PLANNED & EQUIV DERATINGS			
CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG EQUIV HRS PER UNIT YR	AVG EQUIV HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE
449	0.00	0.06	40.51	118	0.00	0.02	4.44	403	0.04	0.27	6.41
422	0.00	0.05	39.58	817	0.01	0.02	2.77	702	0.01	0.27	19.76
504	0.00	0.04	48.11	434	0.00	0.02	3.77	913	0.01	0.26	36.09
428	0.00	0.04	62.46	406	0.00	0.02	7.22	640	0.00	0.26	75.28
412	0.00	0.04	35.97	437	0.00	0.02	7.03	420	0.02	0.25	10.57
414	0.00	0.04	84.39	633	0.01	0.02	2.06	925	0.03	0.25	9.00
415	0.00	0.03	25.16	415	0.00	0.01	3.57	152	0.04	0.22	6.02
928	0.00	0.03	8.47	542	0.01	0.01	2.56	118	0.01	0.22	14.74
423	0.00	0.03	101.81	503	0.00	0.01	5.94	716	0.00	0.21	43.36
815	0.00	0.03	9.58	443	0.00	0.01	11.68	411	0.00	0.19	205.45
806	0.00	0.03	22.58	407	0.00	0.01	4.14	190	0.00	0.19	127.03
612	0.00	0.03	12.29	637	0.00	0.01	13.90	645	0.00	0.18	341.83
601	0.00	0.02	108.76	504	0.01	0.01	1.87	434	0.01	0.14	16.30
420	0.00	0.02	22.34	926	0.00	0.01	8.90	423	0.00	0.13	43.07
177	0.00	0.02	88.62	602	0.00	0.01	16.38	414	0.01	0.11	14.16
608	0.00	0.02	175.07	190	0.00	0.01	6.23	404	0.01	0.10	11.14
603	0.00	0.02	172.73	811	0.00	0.01	36.39	412	0.01	0.09	8.11
503	0.00	0.02	42.49	928	0.00	0.01	3.15	601	0.00	0.08	182.84
434	0.00	0.02	11.20	605	0.00	0.01	17.83	161	0.01	0.07	8.65
406	0.00	0.01	122.02	414	0.01	0.01	1.10	646	0.00	0.07	79.47
145	0.00	0.01	34.74	442	0.00	0.01	3.75	625	0.00	0.07	39.36
410	0.00	0.01	49.05	540	0.00	0.01	1.48	402	0.00	0.06	19.43
404	0.00	0.01	18.39	543	0.00	0.01	5.73	435	0.02	0.06	3.80
416	0.00	0.01	73.00	191	0.00	0.01	1.65	420	0.01	0.06	9.28
450	0.00	0.01	6.43	638	0.00	0.00	3.16	928	0.01	0.06	7.25
444	0.00	0.01	34.56	441	0.00	0.00	4.11	421	0.01	0.05	10.35
191	0.00	0.01	22.76	620	0.00	0.00	3.53	446	0.00	0.05	17.40
435	0.00	0.01	62.02	411	0.00	0.00	6.99	442	0.00	0.05	20.09
407	0.00	0.01	14.08	612	0.00	0.00	3.48	503	0.00	0.05	9.88
441	0.00	0.01	53.32	445	0.00	0.00	2.67	817	0.01	0.04	3.64
183	0.00	0.01	50.28	444	0.00	0.00	0.79	405	0.01	0.04	6.23
425	0.00	0.00	40.48	171	0.00	0.00	2.01	406	0.00	0.04	14.85
447	0.00	0.00	39.50	402	0.00	0.00	1.41	177	0.00	0.04	86.36
817	0.00	0.00	5.25	185	0.00	0.00	8.82	612	0.00	0.03	8.45
405	0.00	0.00	17.01	161	0.01	0.00	0.40	443	0.00	0.03	17.69
171	0.00	0.00	10.54	508	0.00	0.00	4.10	541	0.00	0.03	35.23
609	0.00	0.00	25.73	419	0.00	0.00	0.71	188	0.00	0.03	240.00
646	0.00	0.00	12.66	623	0.00	0.00	3.55	544	0.00	0.02	6.39
168	0.00	0.00	7.76	431	0.00	0.00	20.25	171	0.00	0.02	11.07
508	0.00	0.00	20.50	913	0.00	0.00	1.53	525	0.00	0.02	194.63

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COMPONENT OUTAGES BY AVERAGE HOURS PER UNIT YEAR
TOTAL NUMBER OF UNIT YEARS IS 9589

1,265 TOTAL UNITS

FULL FORCED (UNPLANNED) OUTAGES				UNPLANNED DERATINGS				FORCED, MAINT, PLANNED & EQUIV DERATINGS			
CAUSE	AVG NO	AVG HRS	AVG DUR	CAUSE	AVG NO	AVG EQIV	AVG EQIV	CAUSE	AVG NO	AVG HRS	AVG DUR
CODE	OCC PER	PER	HRS PER	CODE	OCC PER	HRS PER	HRS PER	CODE	OCC PER	PER	HRS PER
	UNIT YR	UNIT YR	OUTAGE		UNIT YR	UNIT YR	OUTAGE		UNIT YR	UNIT YR	OUTAGE
181	0.00	0.00	20.28	416	0.00	0.00	3.22	603	0.00	0.02	35.68
522	0.00	0.00	13.63	645	0.00	0.00	9.59	441	0.00	0.02	12.71
437	0.00	0.00	13.27	168	0.00	0.00	2.53	600	0.00	0.02	175.07
433	0.00	0.00	11.08	626	0.00	0.00	4.36	437	0.00	0.02	7.23
166	0.00	0.00	10.62	427	0.00	0.00	5.04	416	0.00	0.02	19.96
417	0.00	0.00	10.48	448	0.00	0.00	3.73	450	0.00	0.02	7.22
421	0.00	0.00	10.02	450	0.00	0.00	2.43	444	0.01	0.01	2.52
419	0.00	0.00	2.26	646	0.00	0.00	3.33	191	0.00	0.01	3.73
190	0.00	0.00	9.00	180	0.00	0.00	3.89	445	0.00	0.01	6.17
161	0.00	0.00	6.17	609	0.00	0.00	3.35	425	0.00	0.01	10.97
442	0.00	0.00	1.95	425	0.00	0.00	1.66	419	0.00	0.01	2.65
192	0.00	0.00	4.82	601	0.00	0.00	9.83	410	0.00	0.01	49.05
625	0.00	0.00	3.05	521	0.00	0.00	4.35	168	0.00	0.01	7.00
195	0.00	0.00	3.00	501	0.00	0.00	1.20	811	0.00	0.01	15.35
544	0.00	0.00	2.60	408	0.00	0.00	2.62	605	0.00	0.01	17.83
175	0.00	0.00	1.53	446	0.00	0.00	1.41	426	0.00	0.01	28.89
445	0.00	0.00	1.52	181	0.00	0.00	7.02	448	0.00	0.01	9.56
811	0.00	0.00	1.35	436	0.00	0.00	6.74	189	0.00	0.01	54.33
541	0.00	0.00	1.03	192	0.00	0.00	5.76	183	0.00	0.01	17.74
613	0.00	0.00	1.00	184	0.00	0.00	1.90	447	0.00	0.00	39.50
184	0.00	0.00	0.95	603	0.00	0.00	1.42	609	0.00	0.00	8.94
164	0.00	0.00	0.58	523	0.00	0.00	2.18	619	0.00	0.00	11.21
xxx	0.00	0.00	0.00	426	0.00	0.00	4.04	522	0.00	0.00	16.13
xxx	0.00	0.00	0.00	604	0.00	0.00	3.34	192	0.00	0.00	10.60
xxx	0.00	0.00	0.00	526	0.00	0.00	1.62	502	0.00	0.00	7.65
xxx	0.00	0.00	0.00	183	0.00	0.00	1.47	181	0.00	0.00	9.29
xxx	0.00	0.00	0.00	173	0.00	0.00	0.93	185	0.00	0.00	8.82
xxx	0.00	0.00	0.00	613	0.00	0.00	1.35	431	0.00	0.00	20.25
xxx	0.00	0.00	0.00	186	0.00	0.00	2.26	427	0.00	0.00	5.04
xxx	0.00	0.00	0.00	418	0.00	0.00	2.25	613	0.00	0.00	3.73
xxx	0.00	0.00	0.00	156	0.00	0.00	0.98	180	0.00	0.00	2.49
xxx	0.00	0.00	0.00	170	0.00	0.00	1.92	433	0.00	0.00	11.08
xxx	0.00	0.00	0.00	510	0.00	0.00	0.65	166	0.00	0.00	10.62
xxx	0.00	0.00	0.00	502	0.00	0.00	0.55	417	0.00	0.00	5.22
xxx	0.00	0.00	0.00	606	0.00	0.00	0.86	501	0.00	0.00	1.12
xxx	0.00	0.00	0.00	611	0.00	0.00	0.82	521	0.00	0.00	4.35
xxx	0.00	0.00	0.00	640	0.00	0.00	0.41	408	0.00	0.00	2.62
xxx	0.00	0.00	0.00	424	0.00	0.00	0.74	436	0.00	0.00	6.74
xxx	0.00	0.00	0.00	610	0.00	0.00	0.30	184	0.00	0.00	1.67
xxx	0.00	0.00	0.00	177	0.00	0.00	0.20	647	0.00	0.00	6.42

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COMPONENT OUTAGES BY AVERAGE HOURS PER UNIT YEAR
TOTAL NUMBER OF UNIT YEARS IS 9589

1,265 TOTAL UNITS

FULL FORCED (UNPLANNED) OUTAGES				UNPLANNED DERATINGS				FORCED, MAINT, PLANNED & EQUIV DERATINGS			
CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG EQUIV HRS PER UNIT YR	AVG EQUIV HRS PER OUTAGE	CAUSE CODE	AVG NO OCC PER UNIT YR	AVG HRS PER UNIT YR	AVG DUR HRS PER OUTAGE
***	0.00	0.00	0.00	401	0.00	0.00	0.07	418	0.00	0.00	2.80
***	0.00	0.00	0.00	163	0.00	0.00	0.06	162	0.00	0.00	2.57
***	0.00	0.00	0.00	417	0.00	0.00	0.05	523	0.00	0.00	1.68
***	0.00	0.00	0.00	***	0.00	0.00	0.00	604	0.00	0.00	3.34
***	0.00	0.00	0.00	***	0.00	0.00	0.00	526	0.00	0.00	1.62
***	0.00	0.00	0.00	***	0.00	0.00	0.00	195	0.00	0.00	3.00
***	0.00	0.00	0.00	***	0.00	0.00	0.00	173	0.00	0.00	0.93
***	0.00	0.00	0.00	***	0.00	0.00	0.00	186	0.00	0.00	2.26
***	0.00	0.00	0.00	***	0.00	0.00	0.00	156	0.00	0.00	0.73
***	0.00	0.00	0.00	***	0.00	0.00	0.00	178	0.00	0.00	2.18
***	0.00	0.00	0.00	***	0.00	0.00	0.00	170	0.00	0.00	1.92
***	0.00	0.00	0.00	***	0.00	0.00	0.00	175	0.00	0.00	1.53
***	0.00	0.00	0.00	***	0.00	0.00	0.00	510	0.00	0.00	0.69
***	0.00	0.00	0.00	***	0.00	0.00	0.00	506	0.00	0.00	1.26
***	0.00	0.00	0.00	***	0.00	0.00	0.00	606	0.00	0.00	0.86
***	0.00	0.00	0.00	***	0.00	0.00	0.00	611	0.00	0.00	0.82
***	0.00	0.00	0.00	***	0.00	0.00	0.00	424	0.00	0.00	0.74
***	0.00	0.00	0.00	***	0.00	0.00	0.00	164	0.00	0.00	0.58
***	0.00	0.00	0.00	***	0.00	0.00	0.00	401	0.00	0.00	0.07
***	0.00	0.00	0.00	***	0.00	0.00	0.00	163	0.00	0.00	0.06

Component Cause Code Listing

Boiler

- 100 Boiler General Code see codes 500-545 for additional classifications
- 101 Water Walls
- 102 Generating Tubes
- 103 Superheater
- 104 Reheater—First
- 105 Reheater—Second
- 106 Economizer
- 107 Air Preheater—Tubular
- 108 Air Preheater—Regenerative
- 109 Induced Draft Fans
- 110 Forced Draft Fans
- 111 Recirculating Fans
- 112 Desuperheaters and Attenuators
- 113 By-Pass Dampers
- 114 Furnace Refractories
- 115 Safety Valves
- 116 Steam Valves and Piping
- 117 Valves and Piping—Feedwater and Blowdown
- 118 Gage Glasses
- 119 Slag and Fly-Ash Disposal System
- 120 Stack
- 121 Pulverizers
- 122 Cyclones
- 123 Fuel Handling Equipment (gas, oil, coal, etc.)
- 124 Fireside Cleaning
- 125 Acid Cleaning
- 126 Boiler Casing Breaching and Ducts
- 127 Soot Blowers
- 128 Boiler Circulating Pumps
- 129 Air Compressors (sootblowing control and station air)
- 130 Precipitator—Electrical
- 131 Precipitator—Mechanical
- 132 Burners
- 133 Explosion
- 134 Boiler Controls
- 135 Stack Emission (also see code 507)
- 136 Furnace Slagging
- 137 Superheater Fouling
- 138 Reheater Fouling
- 139 Air Heater Fouling
- 140 Induced Draft Fan Fouling
- 141 Precipitator Fouling
- 142 Wet Coal

Boiler (Con't)

- 143 Poor Quality Fuel (low Btu) (also see code 502-503)
- 144 Drum Steam Scrubbers and Separators etc
- 145 Pulverizer Capacity Limited (due to wear but still in service)
- 146 Ashpit Trouble
- 147 Fly Ash Disposal Trouble (also see code 502-503)
- 148 Startup System (superheater or turbine by-pass system)
- 149 Light Off System (ignitors purging system etc.)
- 150 Headers
- 151 Inspection License Insurance (also see codes 500-545)
Use codes 400-450 for Flue Gas Scrubbers
- ~~152 Flue Gas Scrubbers (particulate only)~~
Use codes 400-450 for Flue Gas Scrubbers
- ~~153 Flue Gas Scrubbers (particulate and gas absorption)~~
Use codes 400-450 for Flue Gas Scrubbers
- *160 Auxiliary Boiler
- 199 Miscellaneous see codes 500-545 for additional classifications

Diesel Engine

- 100 Diesel Engine General Code see codes 500-545 for additional classifications
- 170 Drive Shaft and Bearings
- 171 Fuel System
- 172 Pistons
- 173 Cylinders
- 174 Cylinder Heads
- 175 Battery and Battery Charger System
- 176 Engine Starting System
- 177 Synchronizing System
- 178 Air Filter System
- 179 Turbo Charger
- 180 Governor
- 181 Lube Oil System
- 182 Engine Cooling System
- 183 Heater Elements
- 184 Control Power Transformer
- 185 Vibration
- 186 Intake Valves
- 187 Exhaust Valves
- 188 Hydraulic Lock (water in cylinder)
- 189 Engine Control System
- 190 Overhaul
- 199 Miscellaneous, see codes 500-545 for additional classifications

Nuclear Reactor

- 200 Reactor General Code see codes 500-545 for additional classification
- 201 Reactor Vessel
- 202 Reactor Internals Including Core Support and Control Rod Guide Structures
- 203 Reactor Coolant System Valves and Piping
- 204 Reactor Coolant Recirculating Pumps and Drives
- 205 Steam Generator (Reactor Coolant System)
- 206 Pressurizer
- 207 Control Rods and Drives
- 208 Reactivity Limitation
- 209 Fuel Assembly Including Cladding Burnable Poison Rods and Burnable Poison Shims
- 210 Refueling
- 211 Fuel Handling and Storage
- 220 Auxiliary or Standby Feedwater Supply System
- 221 Emergency Core Cooling System High Pressure (also see code 524)
- 222 Emergency Core Cooling System Low Pressure
- 223 Core and Containment Cooling Long term Post Accident
- 224 Residual Heat Removal System
- 225 Component Cooling System
- 226 Chemical Addition System—Reactor Coolant Quality Control
- 227 Chemical Addition System—Reactor Coolant Reactivity Control
- 228 Auxiliary System Valves and Piping
- 229 Safety System Valves and Piping
- 240 Reactor Containment
- 241 Reactor Containment Test
- 242 Reactor Containment Cooling and Ventilation—Normal
- 243 Reactor Containment Cooling and Gas Cleanup—Post Accident
- 244 Auxiliary Building Ventilation System
- 250 Plant Radiation Levels
- 251 Radioactivity Discharge Levels to Environment } Also see codes 520-527
- 252 Radioactive Waste Treatment System
- 253 Radioactive Waste Storage
- 260 Reactor Control (excluding protection)—Inst. and Control
- 261 Reactor Protection—Inst. and Control
- 262 Nuclear Instrumentation
- 263 Engineered Safeguards—Inst. and Control
- 264 Auxiliary Systems—Inst. and Control
- 265 Control and Instrument Power
- 270 Emergency Power System
- 280 Core Physics Test
- 290 Operator Training and License Testing (also see code 523)
- 299 Miscellaneous, see codes 500-545 for additional classifications

*New Code Addition (effective 1-1-76)

Component Cause Code Listing

Gas Turbine

- 300 Gas Turbine General Code see codes 500-545 for additional classifications
- 301 Inlet Air Ducts and Vanes
- 302 Compressor
- 303 Air Filters
- 304 Fuel Supply System
- 305 Ignition System
- 306 Combustion Chamber
- 307 Turbine (high pressure if more than one)
- 308 Low Pressure Turbine
- 309 Exhaust Chamber Hood and Vanes
- 310 Intercoolers
- 311 Regenerators
- 312 Reduction Gear
- 313 Load Shaft and Bearings
- 314 Compressor Shaft and Bearings for Two Shaft Machine
- 315 Cooling and Seal Air Systems and Seal
- 316 Cooling Water System
- 317 Lube Oil System
- 318 Heat Shields
- 319 Superheating Fan
- 320 Interstage Gas Passages
- 321 Expansion Joint
- 322 Starting Motor
- 323 Bearings and Coupling System
- 324 Turning Gear and Motor
- 325 Control and Instrumentation
- 326 Vibration
- 327 Overhaul
- *330 Engine Cleaning (carboblaster, etc)
- *331 Hot End Inspection
- *332 Boroscope
- *333 Fire Protection System
- *334 Fire in Unit
- *335 Engine Exchange
- *336 High Engine Exhaust Temperature
- *337 Engine Vibration
- 346 Exhaust Emission (also see code 502)
- 347 Noise (also see codes 540-545)
- 348 Inspection (also see code 542)
- 349 Miscellaneous see codes 500-545 for additional classification

Jet Engine

- 350 Jet Engine General Code see codes 500-545 for additional classifications
- 351 Air Inlet Vanes
- 352 Low Pressure Compressor
- 353 High Pressure Compressor
- 354 Fuel System
- 355 Ignition System
- 356 Combustors
- 357 Low Temperature Turbine
- 358 High Temperature Turbine
- 359 Inlet and Exhaust Cone
- 360 Anti-icing System
- 361 Fuel Nozzle Cooling Air System
- 362 Regenerator
- 363 Expansion Joints
- 364 Spalt Seals
- 365 Lube Oil System
- 366 Engine Shaft and Bearings
- 367 Engine Starting System
- 368 Control and Instrumentation
- 369 Auxiliary Drive System
- *370 Engine (carboblaster, etc)
- *371 Hot End Inspection
- *372 Boroscope
- *373 Fire Protection System
- *374 Fire in Unit
- *375 Engine Exchange
- *376 High Engine Exhaust Temperature
- *377 Engine Vibration
- 378 Overhaul
- 396 Exhaust Emission (also see code 502)
- 397 Noise (also see codes 540-545)
- 398 Inspection (also see code 542)
- 399 Miscellaneous see codes 500-545 for additional classifications

Flue Gas Scrubber System

- 400 Flue Gas Scrubber General Code see codes 500-545 for additional classifications
- 401 Operator Failure
- 402 Stacks
- 403 ID Fans
- 404 FD Fans
- 405 Fan Vibration
- 406 Fan Blades
- 407 Reheaters General

Flue Gas Scrubber System (Con't)

- 408 Reheater Vibration
- 409 Reheater Tube Leaks
- 410 Reheater Ducts
- 411 Thickeners
- 412 Piping
- 413 Tubes Corrosion Leaking
- 414 Spray Pumps
- 415 Duct System Baffles
- 416 Reactor Tank
- 417 Coupling Failure
- 418 Drain Pots
- 419 Strainer Pluggings
- 420 Recycle Pumps
- 421 Valve Failure
- 422 Precipitator
- 423 Spray Nozzle
- 424 Driver
- 425 Reagent Feed Lines
- 426 SO₂ Monitor
- 427 Disc Scrubber Thrust
- 428 Absorber Tower
- 429 Screw Conveyors
- 430 Bucket Elevators
- 431 Grinders & Crushers
- 432 Centrifuge Vacuum Filter
- 433 Weigh Feeders
- 434 Dampers
- 435 Demister
- 436 Demister Wash Piping Assembly
- 437 Agitators
- 438 Heat Tracer
- 439 Motors
- 440 Calciners
- 441 Recycle Tanks
- 442 Liquid Level Controls
- 443 Sludge Pond
- 444 Test Program (also see codes 500-510)
- 445 Instrumentation
- 446 Inspection (also see code 502)
- 447 External Causes (also see codes 500-545)
- 448 Chemical Unavailability
- 449 Other Mechanical
- 450 Other Electrical

Component Cause Code Listing

Safety and Environmental Requirements

*500 Safety and Environmental Requirements General Code

Non-Radiological Protection of Environment

- *501 NRC Order to Investigate Possible Deficiency
- *502 EPA Order to Investigate Possible Deficiency
- *503 Other Order to Investigate Possible Deficiency
- *504 Operating Utility Decision to Investigate Possible Deficiency
- *505 Required Inspection or Test e.g. Periodic Precipitator Scrubber etc Tests to Demonstrate Proper Acceptable Performance
- *506 NRC Required Modification or Addition to Plant e.g. Installation of Fish Protection Equipment or Cooling Towers etc
- *507 EPA Required Modification or Addition to Plant e.g. Installation of Cooling Towers Precipitators Scrubbers etc
- *508 Other Required Modification or Addition to Plant e.g. Installation of Cooling Tower Blowdown Treatment Equipment Required by State or Local Agencies
- *509 License or Operating Permit Restrictions e.g. SO₂ Concentration or Discharge Steam Temperature Limitation
- *510 Intervenor Action

Nuclear Safety Protection

- *520 NRC Order to Investigate Possible Safety Problem e.g. BWR Pipe Crack
- *521 Other Order to Investigate Possible Safety Problem e.g. State or Local Legislative Action
- *522 Operating Utility Decision to Investigate Possible Safety Problem e.g. BWR Torus Design Verification
- *523 Compliance with NRC Technical Specification and/or Regulatory Guides e.g. Periodic Leak Testing of Containment Vessel—ASME Boiler and Pressure Vessel Code Section II
- *524 NRC Required Modification or Addition to Plant e.g. Design Upgrade to Meet Current Seismic Criteria or Final ECCS Acceptance Criteria
- *525 Other Required Modification or Addition to Plant e.g. State or Local Legislation
- *526 ALARA (As Low As Reasonable Achievable) Requirement e.g. Manpower Radiation Limitations Installation of Shielding to Reduce Background Radiation Levels
- *527 Intervenor Actions

*New Code Addition (effective 1/1/76)

Industry Safety Protection

- *540 Operating Utility Decision to Investigate Possible Safety Problem e.g. Alleviation of Adverse Employee Working Conditions
- *541 Order to Investigate Possible Safety Problem
- *542 Required Inspection or Test e.g. Annual Boiler Inspection
- *543 Required Plant Modification or Addition e.g. Noise Abatement Equipment Installation
- *544 License Operating Permit Restrictions or Regulations
- *545 Intervenor Action

Expander Turbine

- 600 Expander Turbine General Code see codes 500-545 for additional classifications
- 601 Couplings
- 602 Shaft and Bearings
- 603 Blades
- 604 Discs and Spacers
- 605 Nozzles
- 606 Heat Shields
- 607 Exhaust Diffusers
- 608 Seal Oil System and Seals
- 609 Inner Casing
- 610 Outer Exhaust Casing
- 611 Lube Oil System
- 612 Control and Instrumentation
- 613 Evaporator
- 699 Miscellaneous see codes 500-545 for additional classifications

Steam Turbine

- 600 Turbine General Code see codes 500-545 for additional classification
- 620 Turning Gear
- 621 Governors
- 622 Control Turbine and Reheat Stop Valves
- 623 Shaft Packing
- 624 Nozzles and Nozzle Blocks
- 625 Nozzle Bolting (first stage)
- 626 Diaphragms
- 627 Shaft
- 628 Wheels or Spindles
- 629 Buckets or Blades
- 630 Vibration of Turbine Generator Unit
- 631 Lube Oil System & Bearings (except bearing vibration)
- 632 Turbine Control
- 633 Gland Steam Controller

Steam Turbine (con't)

- 634 Blade Fouling
- 635 Shell Leaks
- 636 Seal Leaks
- 637 Cylinder Outer
- 638 Cylinder Inner
- 639 Dummy Ring
- 640 Gland Rings
- 641 Diaphragm Unit and Shroud Type
- 642 Piping Steam Drain and Gland
- 643 Piping Steam Inlet and Reheat
- 644 Cross Over or Under Piping
- 645 Moisture Removal Equipment (nuclear plant)
- 646 Turbine Building Closed Cooling Water System (nuclear plant)
- 647 Steam Reheater (nuclear plant)
- 648 Inspection
- 649 Water Induction
- *650 Differential Expansion
- 699 Miscellaneous see codes 500-545 for additional classification

Hydro Turbine

- 600 Hydro Turbine General Code see codes 500-545 for additional classification
- 660 Shaft Packing
- 661 Shaft
- 662 Runner
- 663 Nozzle Assembly
- 664 Lube Oil System and Oil Lubricated Bearings
- 665 Water Lubricated Bearings
- 666 Vibration
- 667 Wicket Gate Assembly
- 668 Draft Tube
- 669 Spiral Case
- 670 Pressure Regulating Valve
- 671 Relief Valve
- 672 Spherical Valve or Shut off Valve
- 673 Spherical Valve or Shut off Valve Bypass Line and Valve
- 674 Governor
- 675 Turbine Controls
- 676 Upper Reservoir Dam and Dikes
- 677 Intake Channel or Flume (including trash racks)
- 678 Intake Tunnel
- 679 Lower Reservoir Dam and Dikes
- 680 Auxiliary Reservoir Dam and Dikes
- 681 Penstock (including valves or headgates)
- 682 Canal (including siphon radial gates and spills)
- 683 Tailrace

Component Cause Code Listing

Hydro Turbine (con't)

684 Dewatering and Rewatering Piping System
 685 Tailwater Depressing Equipment
 686 Runner Cavitation Damage
 687 Inspections
 699 Miscellaneous see codes 500-545 for additional classifications

Generator

700 Generator General Code see codes 500-545 for additional classification
 701 Lube Oil System and Bearings
 702 Air Cooling System
 703 Hydrogen Cooling System
 704 Liquid Cooling System
 705 Seal Oil System and Seals
 706 Stator Windings Bushings Terminals
 707 Stator Core Iron
 708 Rotor Windings
 709 Rotor Collector Rings
 710 Brush Riggings
 711 Generator Main Leads
 712 Exciter
 713 Voltage Regulator
 714 Generator Control
 715 Inspection
 716 Core Monitor Alarm
 799 Miscellaneous see codes 500-545 for additional classifications

Condenser

800 Condenser General Code see codes 500-545 for additional classification
 801 Cleaning
 802 Tube Failure
 803 Circulating Water Pumps
 804 Condensate Pumps
 805 Air Removal Pumps
 806 Shell
 807 Condenser Control
 808 Air Leakage
 809 Expansion Joint
 810 Inspection

Condenser (con't)

811 Off-gas System (nuclear plant)
 812 Cooling Towers
 813 Traveling Screens
 *814 Loss of Vacuum
 *815 High Condenser Temperature
 *816 Circulating Water System (screens piping etc)
 *817 Condensate Cooler
 899 Miscellaneous see codes 500-545 for additional classification

Other

900 Other General Code see codes 500-545 for additional classification
 901 Feedwater Heaters—Leaking
 902 Feedwater Heaters—Dirty
 903 Main Transformer
 904 Switchgear
 905 Boiler Feed Pumps General (see codes 918 to 922)
 906 Coal Conveying System
 907 Water Treatment System
 908 Boiler Water Condition
 909 Service Water Pumps
 910 Computer
 911 Radioactivity (nuclear plant) see codes 250 and 251
 912 Cooling Water Limitation
 913 Auxiliary Generator
 914 Auxiliary Transformer
 915 Operating Error
 916 Maintenance Error
 918 Boiler Feed Pump Drive—Electric Motor
 919 Boiler Feed Pump Drive—Steam Turbine
 920 Boiler Feed Pump Drive—Main Shaft
 921 Boiler Feed Pump Drive—Other
 922 Boiler Feed PUMP
 *923 Fuel Supply Limitation
 *924 Coal Pulverizer Feeders
 *925 Starting System Failure
 *926 Parts Unavailability
 *927 Coal Pipes
 *928 Station Service Air
 *929 Feedwater Valves
 *930 Precipitators
 999 External Cause (e.g. flood earthquake transmission line)

Equipment, Outage and Time Definitions

Equipment Definitions

1. **Component**—Part within a “major equipment” group, such as superheater tube, governor, boiler feed pump, control rods
2. **Major Equipment**—Major group of equipment within a unit, such as boiler, reactor, generator, steam turbine, condenser

3. Major Equipment Abbreviations Used Include—

Boiler	=	Steam Generator
Turbine	=	Turbine
Reactor	=	Steam Supply System—Nuclear
Cond	=	Condenser
Gen	=	Generator (Electncal)
Regul	=	Regulatory
Scrbbrs	=	SO ₂ Scrubbers
Gas Tur	=	Gas Turbine
Jet Eng	=	Jet Engine
Diesel	=	Diesel Engine
Other	=	Balance of Plant
Unit	=	Total Unit including all components

4. **Maximum Dependable Capacity (MDC)**—The dependable main unit capacity winter or summer, whichever is smaller

Outage Definitions

1. **Forced Outage**—The occurrence of a component failure or other condition which requires that the unit be removed from service immediately or up to and including the very next weekend
2. **Forced Partial Outage**—The occurrence of a component failure or other condition which requires that the load on the unit be reduced 2% or more immediately or up to and including the very next weekend
3. **Maintenance Outage**—The removal of a unit from service to perform work on specific components which could have been postponed past the very next weekend. This is work done to prevent a potential forced outage and which could not be postponed from season to season
4. **Outage Cause**—A component failure, preventive maintenance or other condition which requires that the unit or a component be taken out of service or run at reduced capacity
5. **Planned Outage**—The removal of a unit from service for inspection and/or general overhaul of one or more major equipment groups. This is work which is usually scheduled well in advance (e.g. annual boiler overhaul, five year turbine overhaul)
6. **Scheduled Partial Outage**—The occurrence of a component failure or other condition which requires that the load on the unit be reduced 2% or more but where this reduction could be postponed past the very next weekend

Time Definitions

1. **Equivalent Forced Outage Hours (EFOH)**—Forced Partial Outage Hours x Size of Reduction/MDC
2. **Equivalent Scheduled Outage Hours (ESOH)**— Scheduled Partial Outage Hours x Size of Reduction/MDC
3. **Forced Outage Hours (FOH)**—The time in hours during which a unit or major equipment was unavailable due to a Forced Outage
4. **Forced Partial Outage Hours (FPOH)**—The time in hours during which a unit or major equipment is unavailable for full load due to a Forced Partial Outage
5. **Maintenance Outage Hours (MOH)**—The time in hours during which a unit or major equipment is unavailable due to a Maintenance Outage
6. **Period Hours (PH)**—The clock hours in the period under consideration (Generally one year)
7. **Planned Outage Hours (POH)**—The time in hours during which a unit or major equipment is unavailable due to a Planned Outage
8. **Scheduled Partial Outage Hours (SPOH)**—The time in hours during which a unit or major equipment is unavailable for full load due to a Scheduled Partial Outage
9. **Unit Years (UY)**—This term is the common denominator used to normalize data from units of the same type with different lengths of service. The following example contains 20 UY of experience from 4 units

	TOTAL			
Unit	A	B	C	D
Years in Service	8	3	7	2
				4
				20

Equations*

1. Average Number of Occurrences Per Unit-Year

$$\frac{\text{AVG NO OCC PER UNIT-YR}}{\text{UNIT-YR}} = \frac{\text{NUMBER OF OUTAGE OCCURRENCES}}{\text{NUMBER OF UNIT-YEARS}}$$

2. Average Hours Per Unit-Year

$$\frac{\text{AVG HRS PER UNIT-YR}}{\text{UNIT-YR}} = \sum \frac{\text{OUTAGE HOURS FOR EACH OUTAGE TYPE}}{\text{NUMBER OF UNIT-YEARS}}$$

3. Average Duration in Hours Per Outage

$$\frac{\text{AVG DUR HRS PER OUTAGE}}{\text{OUTAGE}} = \sum \frac{\text{OUTAGE HOURS FOR EACH OUTAGE TYPE}}{\text{NUMBER OF OUTAGE OCCURRENCES}}$$

4. Average Equivalent Hours Per Unit-Year

Average Equivalent Hours Per Outage

Computed as shown in items 2 and 3 above except that outage hours are equivalent and computed on an individual unit and partial outage basis.

$$\frac{\text{EQUIVALENT OUTAGE HOURS}}{\text{OUTAGE HOURS}} = \sum \frac{\text{PARTIAL OUTAGE HOURS, X SIZE OF REDUCTION, (MW)}}{\text{MAXIMUM DEPENDABLE CAPACITY, (MW)}}$$

*Rounded to nearest hundredth. Entries of 0.00 signify that averaged values are less than 0.005.