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Commercial U.S. Nuclear Reactors and Waste: The Current Status

A. M. Platt
J. V. Robinson

September 1980

Prepared for the U.S. Department of Energy
under Contract DE-AC06-76RLO 1830

Pacific Northwest Laboratory
Operated for the U.S. Department of Energy
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Pacific Northwest Laboratory
Richland, Washington 99352

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EXECUTIVE SUMMARY

Between March 1 and June 15, 1980, the declared[a] size of the commercial light waste reactor (LWR) nuclear power industry in the U.S. has decreased another 9 GWe.

For the presently declared size:

- The 165 declared reactors will peak at a capacity of 153 GWe in 2001 and will consume about 870,000 MTU as enrichment feed.
- The theoretical rate of enrichment requirements will peak at about 19,000,000 SWUs/yr in the year 2014.
- As few as two repositories each with capacity equivalent to 100,000 MTU would hold the waste.
- Predisposal storage reactor basins and AFRs (away-from-reactor basins) would peak at <85,000 MTU in the year 2020 if the two repositories were commissioned in the years 1997 and 2020.

It should be noted that the number of declared LWRs has dropped from 226 on December 31, 1974 to 165 as of this writing. The *oil equivalent* of the energy loss, assuming a 50% efficiency in use as in cars, is *17,000 million barrels*. This is *about 10 years of the current rate of U.S. consumption of OPEC oil*.

INTRODUCTION

In April of this year, PNL published the first (PNL-3317-1) in this series of reports intended to track implications to DOE's commercial nuclear waste

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(a) Power plants that either have operated, are operating, are being built, or have been announced.

management program due to the recent rapidly decreasing size of that industry. The present report, the second in the series, differs from the first in four ways:

1. Five boiling water reactors (BWRs)--Hartsville A1, A2, B1, B2, and Phipps Bend 2--and two pressurized water reactors (PWRs)--Cherokee 3 and Yellow Creek 2--have been withdrawn from the list of reactors previously announced as planned to be built and have been placed in the indefinite category.
2. Two reactors (Millstone 1 and 2) are now planned to be permanently shut down earlier than anticipated, thus decreasing slightly the integrated nuclear electric energy that will be produced.
3. Thirty-three other reactors in the declared category are now projected to be on-line later than previously anticipated.
4. The report format has been changed so that the tabular data and the associated graphs for the two power capacity scenarios are now brought together in such a way as to make the report easier to use and the scenarios easier to compare.

This report provides an executive overview of the LWR industry in the U.S. and its implications to the Department of Energy's (DOE) commercial waste management program. It summarizes the status of the LWR commercial reactors and spent fuel in the U.S. as of mid-CY-1980.

Two projections (scenarios) are made to the year 2060. One relates to the presently declared size of the industry and assumes that no new plants will be announced. The second relates to the situation if a resurgence in the industry were to occur, resulting in some additional plants being built. The analysis of this enhanced scenario illustrates the analytical capability used in producing this report.

This report is based on the status of the commercial nuclear power industry as of April 1, 1980[1] except that the power reactors cancelled between then and June 15, 1980, as reported in Nucleonics Week and other trade

publications, have been deleted from the two scenarios analyzed. Detailed information on the PWRs and BWRs excluded from, as well as those included in, the analyses is provided in the Appendix.

It should also be noted that only commercial LWR reactors are included. Reactors specifically excluded are: Hallam, EBR-2, Hanford N, Enrico Fermi-1, Fort St. Vrain, Peach Bottom-1, Carolina-Virginia Tube Reactor, and Piqua.

For convenience, all logistics for the fuel cycles are expressed in metric tons of uranium or heavy metal (MTU/MTHM). (The information in Tables 2 and 3 can be used to convert MTHM to volumes of waste generated in the various fuel cycle operations.)

METHODOLOGY

The information contained in this report is a very simple extrapolation of the past performance of existing U.S. light water reactors. The computer program used assumes that the announced future reactors will be operated similarly. More sophisticated computer codes[2,3] attempt to anticipate changes in fuel management for existing reactors as well as the operation of announced reactors on almost a batch-by-batch basis.

The program used in producing the results in this report is based on the logic that reactor fuel management in BWRs and PWRs has progressed to the point where it is very closely tied to the electrical energy produced. Thus the reactor startup and shutdown times establish the quantity and timing of fuel discharge. Hypothetical reactors can be added to the stream by defining their capacities and startup and shutdown times.

With fuel discharge cycles established, the timing and size of terminal storage needs are clearly projected for any given power capacity scenario. Utilizing the program, combinations of various power scenarios, fuel exposures, and repository construction schedules can be analyzed very rapidly.

POWER CAPACITY

Figure 1 shows cumulative power capacity of reactors in the U.S. whose status ranges from public announcement to those that have been or are now in commercial operation. This is the declared power scenario. Note that these reactors attain a peak generating capacity of 153 GWe at the turn of the century.

Reactor lifetimes are arbitrarily assumed to be 40 years unless contrary specific data are available.

ELECTRICAL ENERGY GENERATED

Figure 2 shows the cumulative electrical energy generated when 50, 60, or 70% of the installed capacity is used. The actual energy generated in the past (see squares in Figure 2) is also displayed. The actual energy curve closely matches the 60% capacity parameter.

FUEL DISCHARGED

The quantities of fuel that will be discharged by the nuclear power industry will be influenced primarily by the fraction of installed capacity used and by the exposure of the fuel. These two factors are combined in the exposure/on-line parameters[a] shown in Figure 3. This figure projects the cumulative fuel to be discharged by the nuclear capacity previously described. Actual fuel discharged through 1979 is only slightly (<7%) overestimated by the 15,000 MWED/T-OL parameter.[4] It is expected that future reactor operations

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(a) The burnup parameter, MWED/T-OL, will be unfamiliar to most readers. It is the electrical energy that would be generated by a metric ton of nuclear fuel if 100% of the available power capacity were used. For example,

$$31{,}500 \frac{\text{MWD(thermal)}}{\text{Ton}} \times \frac{1 \text{ electrical}}{3 \text{ thermal}} \times \frac{100\% \text{ available}}{70\% \text{ on line}} = 15{,}000 \text{ MWED/T-OL}$$

Dividing this parameter into the maximum possible energy production by installed nuclear capacity yields amount of fuel discharged.

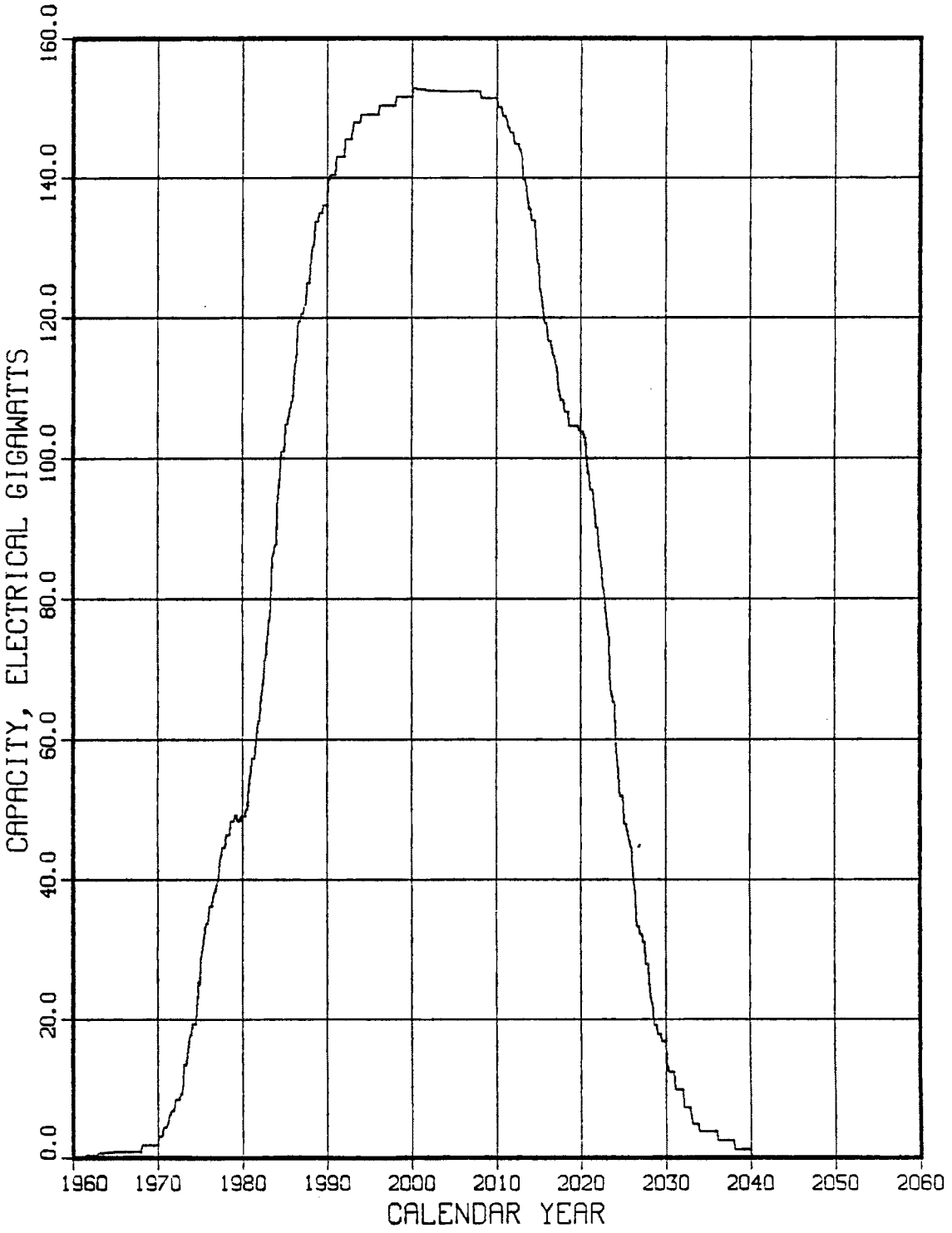

FIGURE 1. Declared U.S. Nuclear Power - Reactor Status 06/15/80

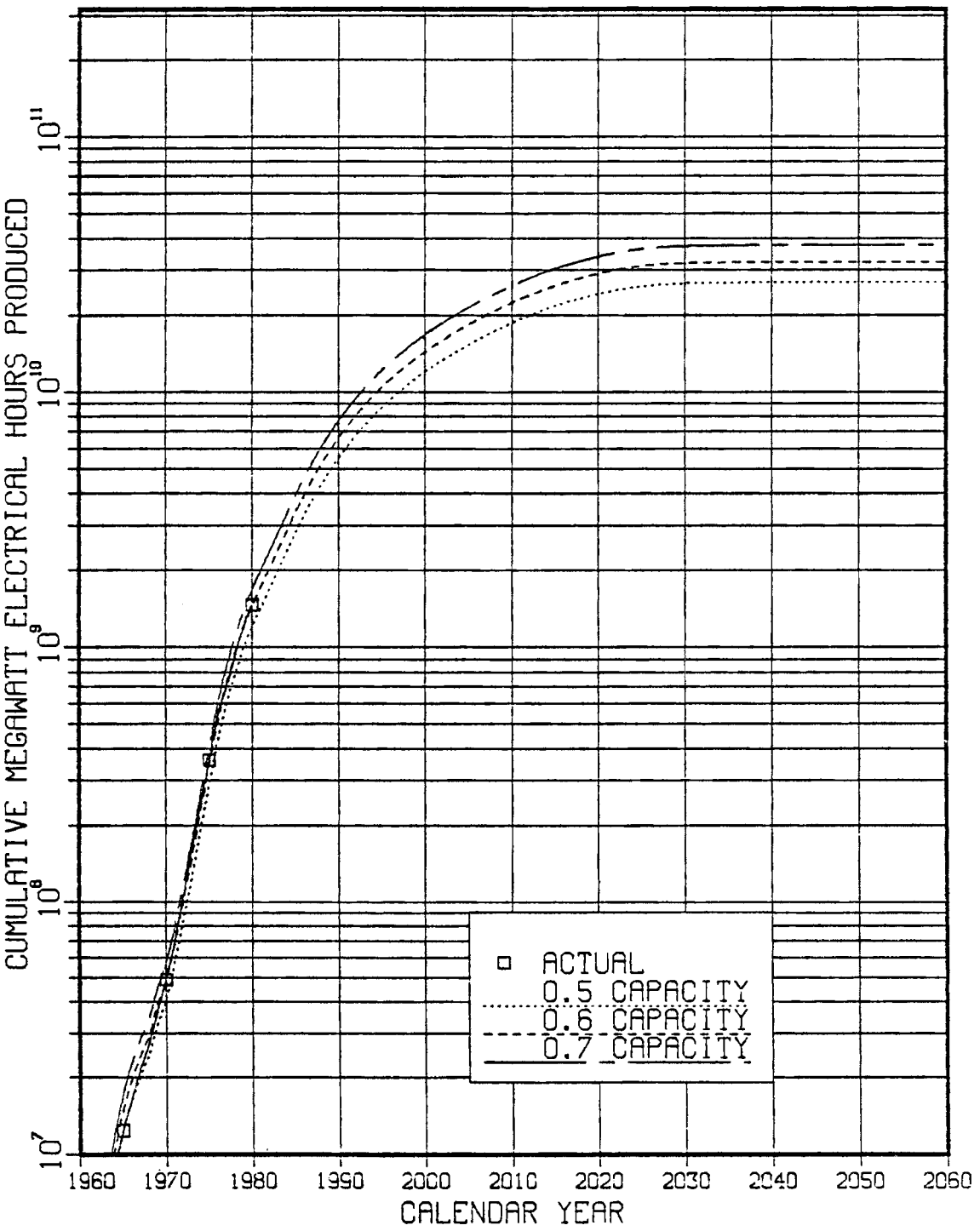

FIGURE 2. U.S. Nuclear Energy - Reactor Status 06/15/80

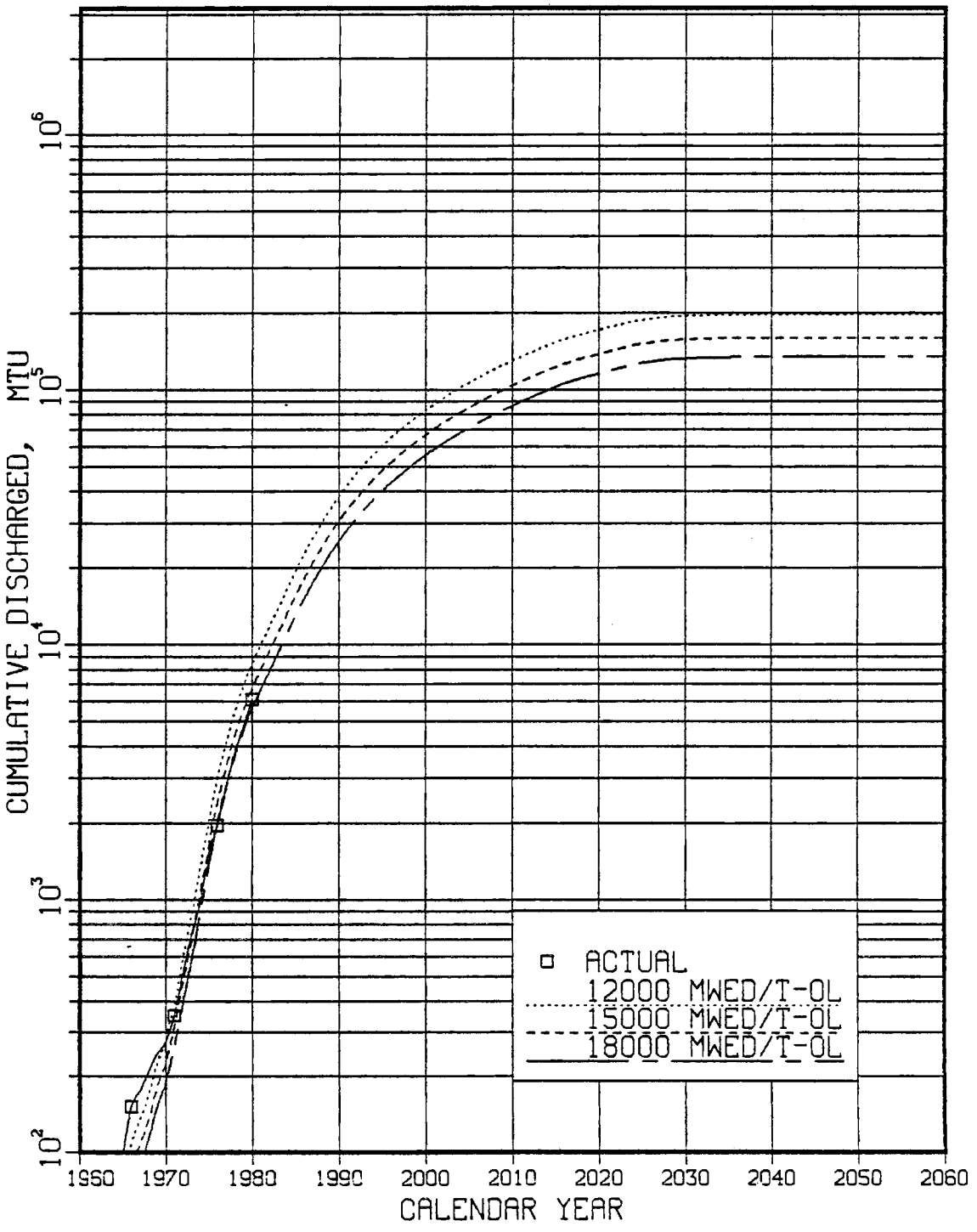

FIGURE 3. U.S. Discharged Fuel - Reactor Status 06/15/80

will be at higher exposures and capacity. Recent data indicate that fuel to be discharged in the future may better be estimated by the 18,000 MWED/T-OL parameter.

If waste packages were comprised of one element from the predominant PWRs or three elements from the BWRs, some 2000 packages would be generated from 1000 MTU.

DISPOSAL SCENARIO

No firm schedule has been established for the operation (loading rate, capacity) and startup of repositories for storage of waste from the commercial nuclear power industry. For this analysis, we assumed that the repositories would be built and operated according to the schedule shown in Table 1. You will note that the repositories begin operation in different years and each uses a lower loading rate in the first two years of operation than that used for the remaining years of its operation.

The cumulative amount of spent fuel disposed in these repositories is shown in Figure 4.

TABLE 1. Disposal Scenario--Declared Power Capacity

Repository Identification	Date[a] of Startup	Date of Shutdown or Changed Operation	Maximum Loading Rate, MTU/yr	Spent Fuel Loaded in Time Period, MTU	Capacity, MTU
Rep 1	1997.0	1998.0	1,000	1,000	98,000
	1998.0	1999.0	2,000	2,000	
	1999.0	2037.0	2,500	95,000	
Rep 2	2020.0	2021.0	1,000	1,000	75,500
	2021.0	2022.0	2,000	2,000	
		2051.0	2,500	72,500	

(a) Throughout tables herein, years or dates are expressed in decimal fashion; thus 1980 or 1980.0 is January 1 of 1980.

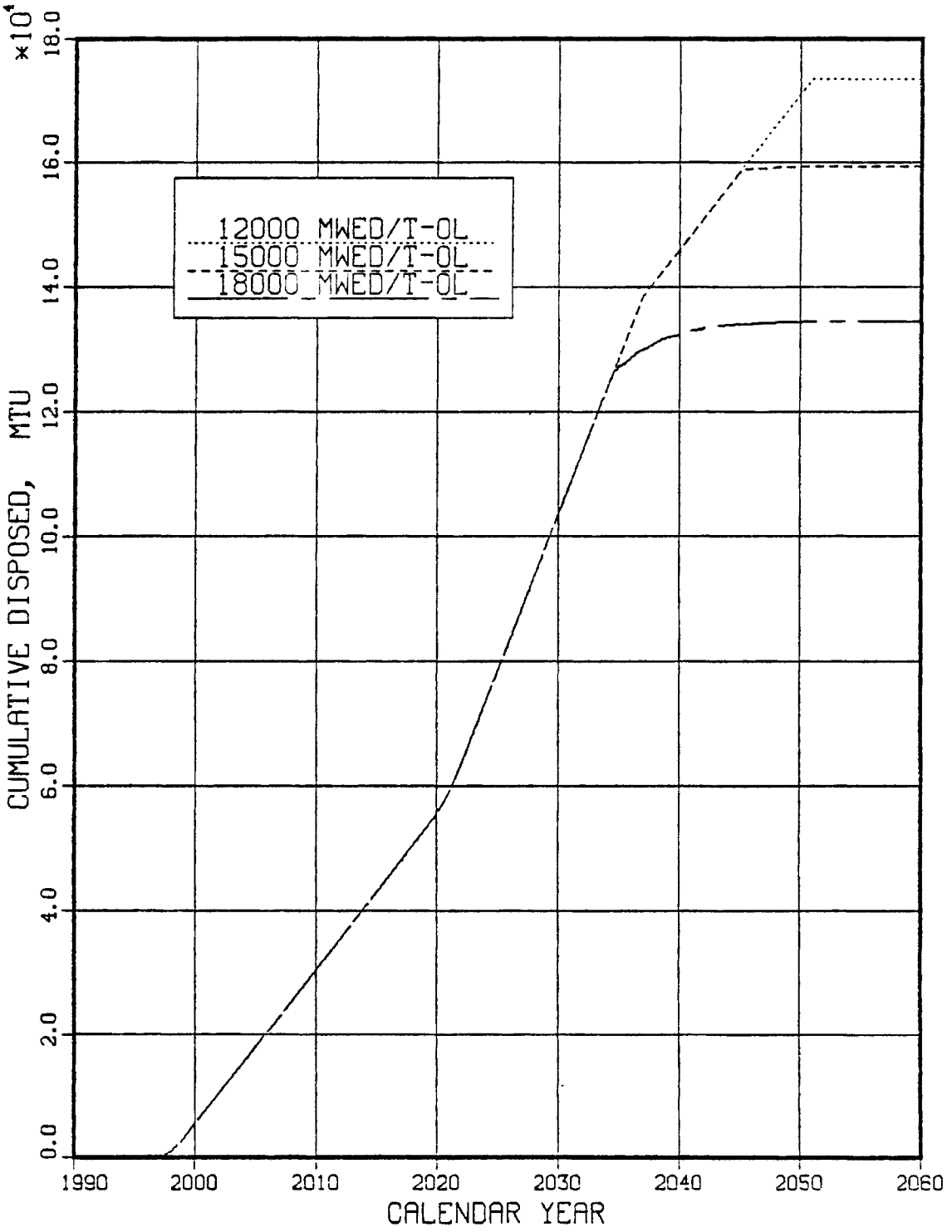

FIGURE 4. U.S. Fuel Disposed -
Reactor Status 06/15/80
Disposal Start 1997

FUEL AGE TO DISPOSAL

Significant quantities of spent fuel first became available in the U.S. in the mid-1960s. This 20-year-old material could be used to start operation of the repositories. After that, and based on the principle of oldest fuel to disposal first, the age of the youngest fuel going to disposal was determined and is shown in Figure 5 for the repository disposal scenario assumed.

PREDISPOSAL FUEL STORAGE

Predisposal storage will peak at about 82,000 MTHM (for the 15,000 MWED/T-OL parameter) in 2020. Quantities of fuel in predisposal storage at other times are shown in Figure 6. A one-time correction to fuel stored has been made (in 1973) for the 255 tons of commercial LWR fuel reprocessed by Nuclear Fuel Services, Inc., at West Valley, NY, in the period 1967 to 1971. No corrections have been made for the minute amounts of fuel consumed in R&D operations, e.g., the Nuclear Waste Vitrification Project conducted at PNL.

ENRICHMENT FEED

As a sidelight to these calculations, it was determined that some 817,000 MT of uranium feed to enrichment would be required for this scenario, with 0.2% tails and 3% product.

REPROCESSING AND OTHER WASTES

Table 2 shows the volume of TRU waste that would go to geologic disposal if the option to reprocess and recycle were elected rather than the once-through fuel cycle. Also LLW volumes for the recycle option are shown in Table 3.

DETAILED DATA FOR DECLARED POWER SCENARIO

The data (tabular and by year) from which Figures 1-6 were produces are given in Table 4.

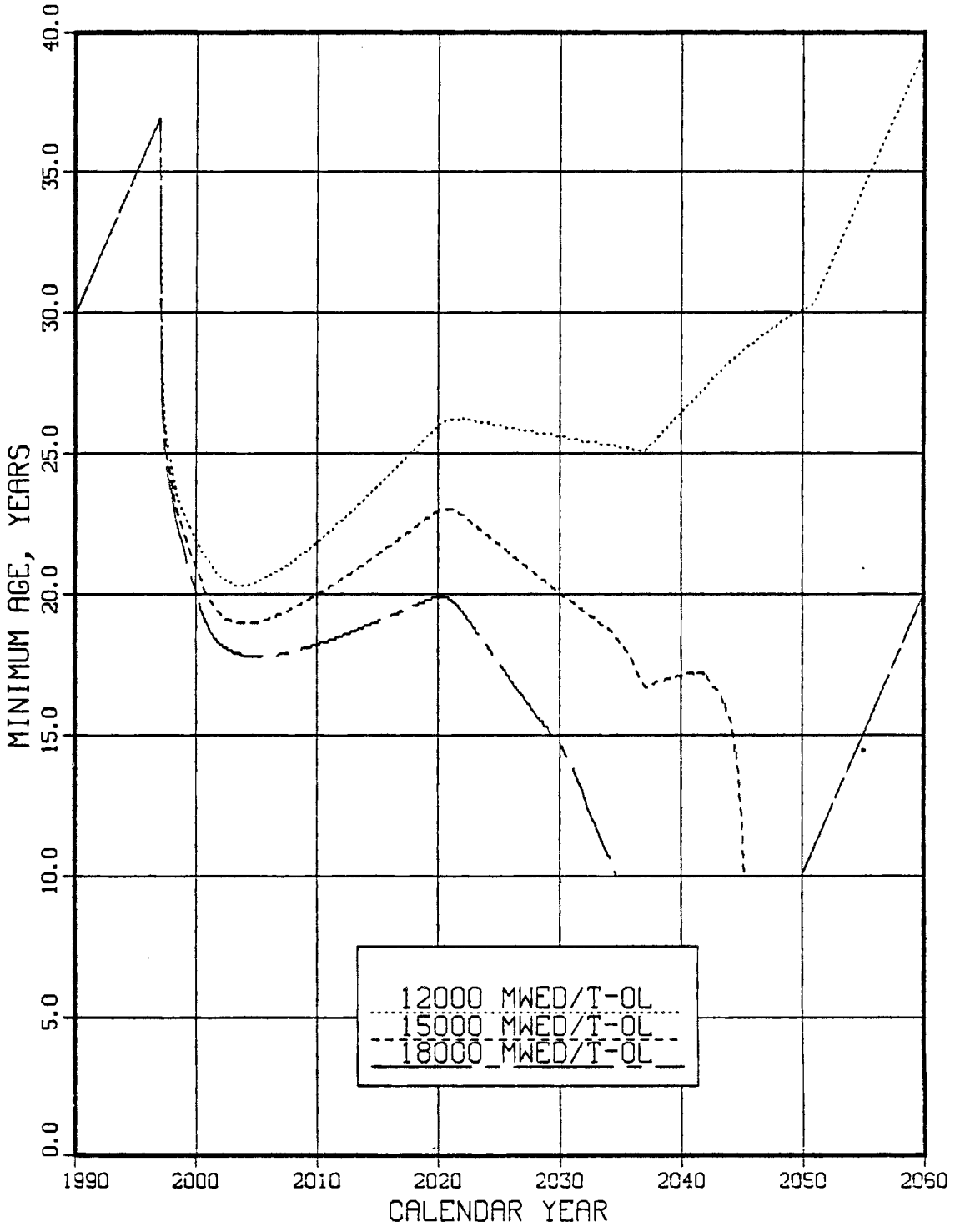

FIGURE 5. Minimum Age of Fuel Disposed - Reactor Status 06/15/80 Disposal Start 1997

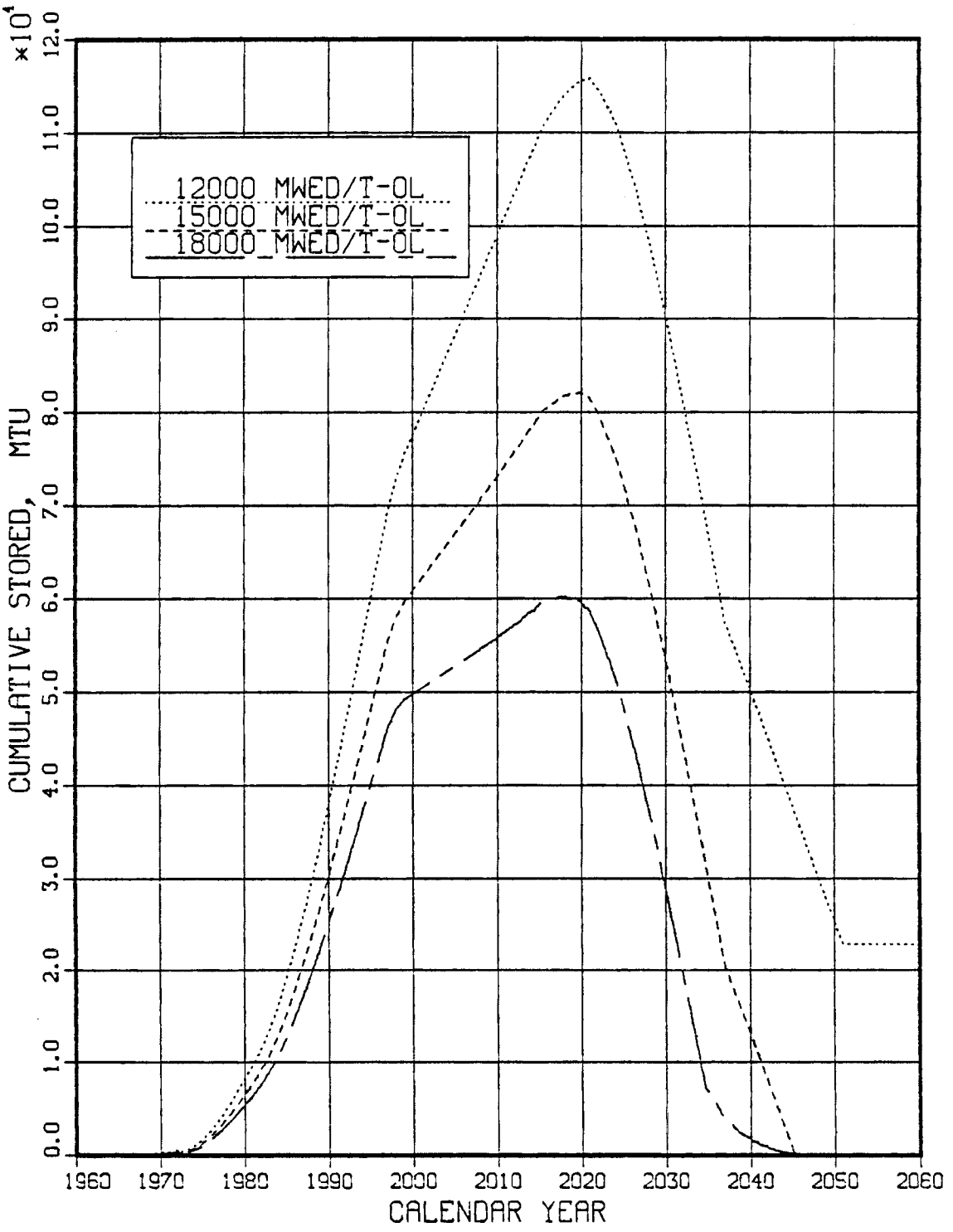

FIGURE 6. Fuel in Predisposal Storage - Reactor Status 06/15/80

TABLE 2. Projected Volumes of Transuranic Waste Disposed in Geologic Repository from the LWR-Recycle Fuel Cycle

	Volume, m^3/1000 MTHM	
Fuel reprocessing wastes		1600
Vitrified HLW	73	
Hulls and hardware	330	
Other TRU wastes	1200	
Mixed-oxide fuel refabrication wastes		320
		1900

Notes: Includes decommissioning wastes.
Fuel cycle characteristics are those described in Ref. 5.
Data for waste volumes were taken from Ref. 6.
Waste treatment assumptions include:

HLW:	vitrification
General trash:	incineration/cementation
Wet wastes:	cementation
Scrap:	direct packaging

TABLE 3. Projected Low-Level Waste Volumes from the LWR-Recycle Fuel Cycle

	Volume, m^3/1000 MTHM
Mill tailings	950,000
Refinery, conversion and enrichment wastes	680
Uranium fuel fabrication wastes	900
Reactor wastes	32,000
Fuel reprocessing plant LLW	630
Total	984,000

Notes: Includes decommissioning wastes.
Waste volume data were taken from Refs. 6 through 10.
Uranium mill tailings volume assumes an ore containing 0.2 wt% U with a 95% extraction efficiency.
Waste treatment assumptions include:

General trash:	compaction
Wet wastes:	cementation
Scrap:	direct packaging

TABLE 4. Declared Nuclear Power Industry

REACTOR STATUS 06/15/80

U S N U C L E A R P O W E R

	GWE		MWEH AT				MTU DISCHARGED AT MWED/T-OL			
DATE	ACTUAL	TOTAL	50 PER CENT	60 PER CENT	70 PER CENT	ACTUAL	12000	15000	18000	ACTUAL
1961.0	0.	0.	1.411+006 (a)	1.693+006	1.975+006	9.220+005	5.	4.	3.	0.
1962.0	0.	0.	2.934+006	3.520+006	4.107+006	2.750+006	15.	12.	10.	0.
1963.0	1.	1.	5.073+006	6.087+006	7.102+006	5.190+006	30.	24.	20.	51.
1964.0	1.	1.	8.507+006	1.021+007	1.191+007	8.840+006	54.	43.	36.	64.
1965.0	1.	1.	1.230+007	1.476+007	1.722+007	1.240+007	80.	64.	54.	96.
1966.0	1.	1.	1.626+007	1.951+007	2.277+007	1.640+007	108.	86.	72.	152.
1967.0	1.	1.	2.025+007	2.430+007	2.836+007	2.160+007	136.	109.	90.	175.
1968.0	1.	1.	2.420+007	2.903+007	3.387+007	2.710+007	167.	134.	112.	209.
1969.0	2.	2.	3.233+007	3.880+007	4.526+007	3.680+007	224.	180.	151.	247.
1970.0	2.	2.	4.050+007	4.860+007	5.669+007	4.900+007	281.	226.	189.	275.
1971.0	4.	4.	5.680+007	6.816+007	7.952+007	6.960+007	394.	316.	265.	351.
1972.0	8.	8.	8.472+007	1.017+008	1.186+008	1.070+008	588.	472.	394.	518.
1973.0	11.	11.	1.240+008	1.488+008	1.736+008	1.620+008	861.	690.	576.	731.
1974.0	18.	18.	1.919+008	2.303+008	2.687+008	2.440+008	1333.	1067.	890.	982.
1975.0	25.	25.	2.870+008	3.445+008	4.019+008	3.600+008	2015.	1617.	1352.	1534.
1976.0	35.	35.	4.269+008	5.123+008	5.977+008	5.390+008	2986.	2394.	2000.	1962.
1977.0	39.	39.	5.910+008	7.092+008	8.274+008	6.910+008	4130.	3310.	2764.	2743.
1978.0	45.	45.	7.808+008	9.370+008	1.093+009	9.220+008	5448.	4365.	3643.	3760.
1979.0	48.	48.	9.882+008	1.186+009	1.383+009	1.210+009	6888.	5517.	4602.	4802.
1980.0	49.	49.	1.202+009	1.443+009	1.683+009	1.470+009	8434.	6766.	5653.	6141.
1981.0	55.	55.	1.427+009	1.713+009	1.998+009		9998.	8017.	6696.	
1982.0	63.	63.	1.689+009	2.026+009	2.364+009		11813.	9469.	7906.	
1983.0	75.	75.	1.995+009	2.394+009	2.794+009		13943.	11173.	9326.	
1984.0	88.	88.	2.362+009	2.835+009	3.307+009		16492.	13212.	11025.	
1985.0	102.	102.	2.795+009	3.354+009	3.913+009		19497.	15616.	13028.	
1986.0	110.	110.	3.263+009	3.915+009	4.568+009		22745.	18214.	15194.	
1987.0	121.	121.	3.777+009	4.532+009	5.287+009		26314.	21069.	17573.	
1988.0	127.	127.	4.318+009	5.181+009	6.045+009		30071.	24075.	20078.	
1989.0	135.	135.	4.897+009	5.876+009	6.855+009		34091.	27291.	22758.	
1990.0	136.	136.	5.491+009	6.590+009	7.688+009		38220.	30594.	25510.	
1991.0	142.	142.	6.107+009	7.328+009	8.550+009		42495.	34014.	28360.	
1992.0	143.	143.	6.734+009	8.080+009	9.427+009		46849.	37496.	31262.	
1993.0	147.	147.	7.373+009	8.847+009	1.032+010		51285.	41047.	34221.	
1994.0	149.	149.	8.022+009	9.627+009	1.123+010		55795.	44654.	37227.	
1995.0	149.	149.	8.675+009	1.041+010	1.215+010		60332.	48284.	40252.	
1996.0	149.	149.	9.329+009	1.119+010	1.306+010		64870.	51914.	43277.	
1997.0	150.	150.	9.988+009	1.199+010	1.398+010		69446.	55575.	46328.	
1998.0	150.	150.	1.065+010	1.278+010	1.491+010		74022.	59236.	49378.	
1999.0	152.	152.	1.131+010	1.357+010	1.584+010		78637.	62928.	52455.	

(a) Throughout these tables and elsewhere in the text, the convention for depicting very large numbers is 1.411 + 006 = 1.411 x 10^6.

TABLE 4 (contd)

REACTOR STATUS 06/15/80

U S N U C L E A R P O W E R

DATE	GWE ACTUAL	GWE TOTAL	MWEH AT 50 PER CENT	MWEH AT 60 PER CENT	MWEH AT 70 PER CENT	MWEH AT ACTUAL	MTU DISCHARGED AT MWED/T-OL 12000	15000	18000	ACTUAL
2000.0	152.	152.	1.198+010	1.437+010	1.677+010		83252.	66620.	55532.	
2001.0	153.	153.	1.265+010	1.517+010	1.770+010		87914.	70354.	58646.	
2002.0	153.	153.	1.331+010	1.598+010	1.864+010		92573.	74082.	61754.	
2003.0	153.	153.	1.398+010	1.678+010	1.958+010		97216.	77796.	64849.	
2004.0	152.	152.	1.465+010	1.758+010	2.051+010		101863.	81513.	67948.	
2005.0	152.	152.	1.532+010	1.838+010	2.145+010		106502.	85226.	71042.	
2006.0	152.	152.	1.599+010	1.919+010	2.238+010		111142.	88938.	74135.	
2007.0	152.	152.	1.666+010	1.999+010	2.332+010		115783.	92650.	77229.	
2008.0	152.	152.	1.732+010	2.079+010	2.425+010		120491.	96430.	80390.	
2009.0	151.	151.	1.799+010	2.159+010	2.518+010		125100.	100118.	83463.	
2010.0	151.	151.	1.865+010	2.238+010	2.611+010		129798.	103893.	86624.	
2011.0	149.	149.	1.931+010	2.317+010	2.703+010		134468.	107653.	89776.	
2012.0	146.	146.	1.995+010	2.394+010	2.793+010		139173.	111464.	92991.	
2013.0	143.	143.	2.058+010	2.470+010	2.882+010		143906.	115318.	96259.	
2014.0	136.	136.	2.119+010	2.543+010	2.966+010		148486.	119060.	99442.	
2015.0	128.	128.	2.176+010	2.612+010	3.047+010		153125.	122897.	102746.	
2016.0	118.	118.	2.230+010	2.675+010	3.121+010		157324.	126360.	105717.	
2017.0	114.	114.	2.280+010	2.736+010	3.192+010		161089.	129422.	108310.	
2018.0	107.	107.	2.328+010	2.794+010	3.259+010		164851.	132516.	110960.	
2019.0	105.	105.	2.374+010	2.849+010	3.324+010		168199.	135221.	113236.	
2020.0	104.	104.	2.420+010	2.904+010	3.388+010		171427.	137815.	115406.	
2021.0	98.	98.	2.465+010	2.958+010	3.451+010		175070.	140839.	118019.	
2022.0	90.	90.	2.506+010	3.007+010	3.508+010		178416.	143617.	120418.	
2023.0	78.	78.	2.542+010	3.050+010	3.559+010		181738.	146434.	122899.	
2024.0	65.	65.	2.572+010	3.087+010	3.601+010		184919.	149195.	125378.	
2025.0	51.	51.	2.596+010	3.115+010	3.634+010		187358.	151304.	127268.	
2026.0	43.	43.	2.616+010	3.139+010	3.663+010		189224.	152889.	128666.	
2027.0	32.	32.	2.632+010	3.158+010	3.685+010		190898.	154346.	129977.	
2028.0	26.	26.	2.645+010	3.174+010	3.703+010		192309.	155578.	131090.	
2029.0	18.	18.	2.654+010	3.185+010	3.715+010		193387.	156528.	131956.	
2030.0	17.	17.	2.661+010	3.194+010	3.726+010		194215.	157252.	132609.	
2031.0	11.	11.	2.667+010	3.200+010	3.734+010		194823.	157784.	133091.	
2032.0	10.	10.	2.671+010	3.206+010	3.740+010		195295.	158195.	133462.	
2033.0	6.	6.	2.674+010	3.209+010	3.744+010		195669.	158526.	133764.	
2034.0	4.	4.	2.676+010	3.212+010	3.747+010		195888.	158716.	133935.	
2035.0	4.	4.	2.678+010	3.214+010	3.749+010		196005.	158810.	134013.	
2036.0	4.	4.	2.680+010	3.216+010	3.752+010		196207.	158988.	134176.	
2037.0	3.	3.	2.681+010	3.217+010	3.753+010		196285.	159051.	134228.	
2038.0	3.	3.	2.682+010	3.218+010	3.755+010		196448.	159198.	134365.	
2039.0	1.	1.	2.683+010	3.219+010	3.756+010		196487.	159230.	134391.	

TABLE 4 (contd)

REACTOR STATUS 06/15/80
U S NUCLEAR POWER

	GWE		MWEH AT				MTU DISCHARGED AT MWED/T-OL			
DATE	ACTUAL	TOTAL	50 PER CENT	60 PER CENT	70 PER CENT	ACTUAL	12000	15000	18000	ACTUAL
2040.0	1.	1.	2.683+010	3.220+010	3.756+010		196611.	159346.	134503.	
2041.0	0.	0.	2.683+010	3.220+010	3.756+010		196611.	159346.	134503.	
2042.0	0.	0.	2.683+010	3.220+010	3.756+010		196611.	159346.	134503.	
2043.0	0.	0.	2.683+010	3.220+010	3.756+010		196611.	159346.	134503.	
2044.0	0.	0.	2.683+010	3.220+010	3.756+010		196611.	159346.	134503.	
2045.0	0.	0.	2.683+010	3.220+010	3.756+010		196611.	159346.	134503.	
2046.0	0.	0.	2.683+010	3.220+010	3.756+010		196611.	159346.	134503.	
2047.0	0.	0.	2.683+010	3.220+010	3.756+010		196611.	159346.	134503.	
2048.0	0.	0.	2.683+010	3.220+010	3.756+010		196611.	159346.	134503.	
2049.0	0.	0.	2.683+010	3.220+010	3.756+010		196611.	159346.	134503.	
2050.0	0.	0.	2.683+010	3.220+010	3.756+010		196611.	159346.	134503.	
2051.0	0.	0.	2.683+010	3.220+010	3.756+010		196611.	159346.	134503.	
2052.0	0.	0.	2.683+010	3.220+010	3.756+010		196611.	159346.	134503.	
2053.0	0.	0.	2.683+010	3.220+010	3.756+010		196611.	159346.	134503.	
2054.0	0.	0.	2.683+010	3.220+010	3.756+010		196611.	159346.	134503.	
2055.0	0.	0.	2.683+010	3.220+010	3.756+010		196611.	159346.	134503.	
2056.0	0.	0.	2.683+010	3.220+010	3.756+010		196611.	159346.	134503.	
2057.0	0.	0.	2.683+010	3.220+010	3.756+010		196611.	159346.	134503.	
2058.0	0.	0.	2.683+010	3.220+010	3.756+010		196611.	159346.	134503.	
2059.0	0.	0.	2.683+010	3.220+010	3.756+010		196611.	159346.	134503.	
2060.0	0.	0.	2.683+010	3.220+010	3.756+010		196611.	159346.	134503.	

TABLE 4 (contd)

REACTOR STATUS 06/15/80

FUEL STATUS, MTU
15.000 MWED/T-OL SCENARIO

DATE	CUMULATIVE DISCHARGED	PREDISPOSAL STORAGE	TERMINAL STORAGE	FILL RATE MTU/YR	CAPACITY MTU/YR	MINIMUM AGE,YRS
1961.0	4.	4.	0.			.9
1962.0	12.	12.	0.			1.9
1963.0	24.	24.	0.			2.9
1964.0	43.	43.	0.			3.9
1965.0	64.	64.	0.			4.9
1966.0	86.	86.	0.			5.9
1967.0	108.	108.	0.			6.9
1968.0	134.	134.	0.			7.9
1969.0	180.	180.	0.			8.9
1970.0	226.	226.	0.			9.9
1971.0	316.	316.	0.			10.9
1972.0	472.	472.	0.			11.9
1973.0	690.	435.	0.			12.9
1974.0	1067.	813.	0.			13.9
1975.0	1617.	1363.	0.			14.9
1976.0	2394.	2140.	0.			15.9
1977.0	3310.	3056.	0.			16.9
1978.0	4365.	4110.	0.			17.9
1979.0	5517.	5262.	0.			18.9
1980.0	6766.	6511.	0.			19.9
1981.0	8017.	7762.	0.			20.9
1982.0	9469.	9214.	0.			21.9
1983.0	11173.	10918.	0.			22.9
1984.0	13212.	12958.	0.			23.9
1985.0	15616.	15361.	0.			24.9
1986.0	18214.	17960.	0.			25.9
1987.0	21069.	20815.	0.			26.9
1988.0	24075.	23820.	0.			27.9
1989.0	27291.	27036.	0.			28.9
1990.0	30594.	30340.	0.			29.9
1991.0	34014.	33759.	0.			30.9
1992.0	37496.	37242.	0.			31.9
1993.0	41047.	40792.	0.			32.9
1994.0	44654.	44400.	0.			33.9
1995.0	48284.	48030.	0.			34.9
1996.0	51914.	51660.	0.			35.9
1997.0	55575.	55320.	0.	1000.	1000.	36.9
1998.0	59236.	57981.	1000.	2000.	2000.	24.1
1999.0	62928.	59673.	3000.	2500.	2500.	22.3

TABLE 4 (contd)

REACTOR STATUS 06/15/00

FUEL STATUS, MTU
15,000 MWED/T-OL SCENARIO
****

DATE	CUMULATIVE DISCHARGED	PREDISPOSAL STORAGE	TERMINAL STORAGE	FILL RATE MTU/YR	CAPACITY MTU/YR	MINIMUM AGE,YRS
2000.0	66620.	60865.	5500.	2500.	2500.	21.0
2001.0	70354.	62100.	8000.	2500.	2500.	20.0
2002.0	74082.	63327.	10500.	2500.	2500.	19.3
2003.0	77796.	64542.	13000.	2500.	2500.	19.0
2004.0	81513.	65759.	15500.	2500.	2500.	19.0
2005.0	85226.	66971.	18000.	2500.	2500.	19.0
2006.0	88938.	68184.	20500.	2500.	2500.	19.1
2007.0	92650.	69396.	23000.	2500.	2500.	19.3
2008.0	96430.	70676.	25500.	2500.	2500.	19.5
2009.0	100118.	71864.	28000.	2500.	2500.	19.7
2010.0	103893.	73139.	30500.	2500.	2500.	20.0
2011.0	107653.	74398.	33000.	2500.	2500.	20.2
2012.0	111464.	75710.	35500.	2500.	2500.	20.5
2013.0	115318.	77063.	38000.	2500.	2500.	20.8
2014.0	119060.	78305.	40500.	2500.	2500.	21.1
2015.0	122897.	79643.	43000.	2500.	2500.	21.4
2016.0	126360.	80605.	45500.	2500.	2500.	21.7
2017.0	129422.	81168.	48000.	2500.	2500.	22.0
2018.0	132516.	81762.	50500.	2500.	2500.	22.3
2019.0	135221.	81967.	53000.	2500.	2500.	22.7
2020.0	137815.	82060.	55500.	3500.	3500.	23.0
2021.0	140839.	81585.	59000.	4500.	4500.	23.0
2022.0	143617.	79863.	63500.	5000.	5000.	22.8
2023.0	146434.	77680.	68500.	5000.	5000.	22.4
2024.0	149195.	75440.	73500.	5000.	5000.	22.1
2025.0	151304.	72550.	78500.	5000.	5000.	21.8
2026.0	152889.	69135.	83500.	5000.	5000.	21.4
2027.0	154346.	65591.	88500.	5000.	5000.	21.1
2028.0	155578.	61823.	93500.	5000.	5000.	20.7
2029.0	156528.	57774.	98500.	5000.	5000.	20.4
2030.0	157252.	53497.	103500.	5000.	5000.	20.0
2031.0	157784.	49029.	108500.	5000.	5000.	19.7
2032.0	158195.	44441.	113500.	5000.	5000.	19.4
2033.0	158526.	39772.	118500.	5000.	5000.	19.1
2034.0	158716.	34962.	123500.	5000.	5000.	18.8
2035.0	158810.	30055.	128500.	5000.	5000.	18.2
2036.0	158988.	25234.	133500.	5000.	5000.	17.6
2037.0	159051.	20296.	138500.	2500.	2500.	16.7
2038.0	159198.	17944.	141000.	2500.	2500.	16.9
2039.0	159230.	15475.	143500.	2500.	2500.	17.0

TABLE 4 (contd)

REACTOR STATUS 06/15/80

FUEL STATUS, MTU
15,000 MWED/T-OL SCENARIO

DATE	CUMULATIVE DISCHARGED	PREDISPOSAL STORAGE	TERMINAL STORAGE	FILL RATE MTU/YR	CAPACITY MTU/YR	MINIMUM AGE,YRS
2040.0	159346.	13092.	146000.	2500.	2500.	17.1
2041.0	159346.	10592.	148500.	2500.	2500.	17.2
2042.0	159346.	8092.	151000.	2500.	2500.	17.0
2043.0	159346.	5592.	153500.	2500.	2500.	16.6
2044.0	159346.	3092.	156000.	2500.	2500.	15.6
2045.0	159346.	592.	158500.	1125.	2500.	12.0
2046.0	159346.	103.	158988.	62.	2500.	10.0
2047.0	159346.	41.	159051.	62.	2500.	10.0
2048.0	159346.	0.	159198.	31.	2500.	10.0
2049.0	159346.	0.	159230.	31.	2500.	10.0
2050.0	159346.	0.	159346.		2500.	10.0
2051.0	159346.	0.	159346.			11.0

EXPANDED POWER-CAPACITY SCENARIO

For comparison, it was assumed that an additional 120 GWe will be added to the declared power scenario. We assumed the additional power would be added between 1997 and 2010 at a rate approximating that expected to be added between the years 1980 and 1990. This power scenario is shown in Figure 7.

For this expanded nuclear capacity, the loading schedule, shown in Table 5, for four repositories was assumed.

The energy produced, fuel discharged, fuel disposed, etc., for this power scenario are shown in Figures 7 to 12 and are on the same bases as for the declared power scenario previously described. The detailed data from which Figures 7 through 12 were produced are given in Table 6.

The two scenarios can be compared as shown in Table 7 to the year 2060 using the 15,000 MWED/T-OL and 60% capacity parameters.

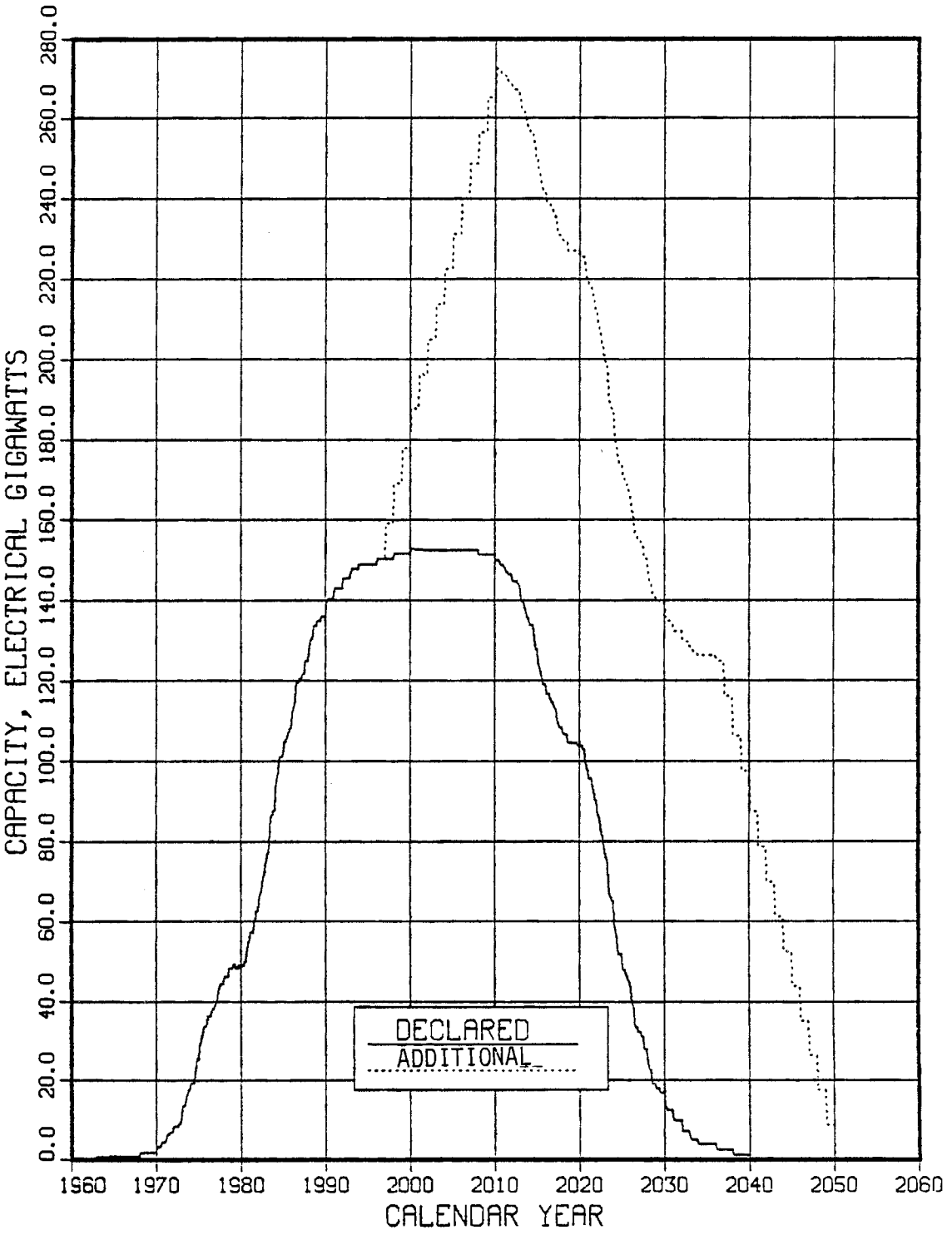

FIGURE 7. U.S. Nuclear Power - Expanded Scenario
Reactor Status 06/15/80

TABLE 5. Disposal Scenario--Expanded Power Capacity

Repository Identification	Date of Startup	Date of Shutdown	Maximum Loading Rate, MTU/yr	Repository Capacity, MTU
Rep 1	1997.0	2032.0	2,400	84,000
Rep 2	2004.0	2039.0	2,400	84,000
Rep 3	2023.0	2055.0	3,000	96,000
Rep 4	2032.0	2060.0	3,000	84,000

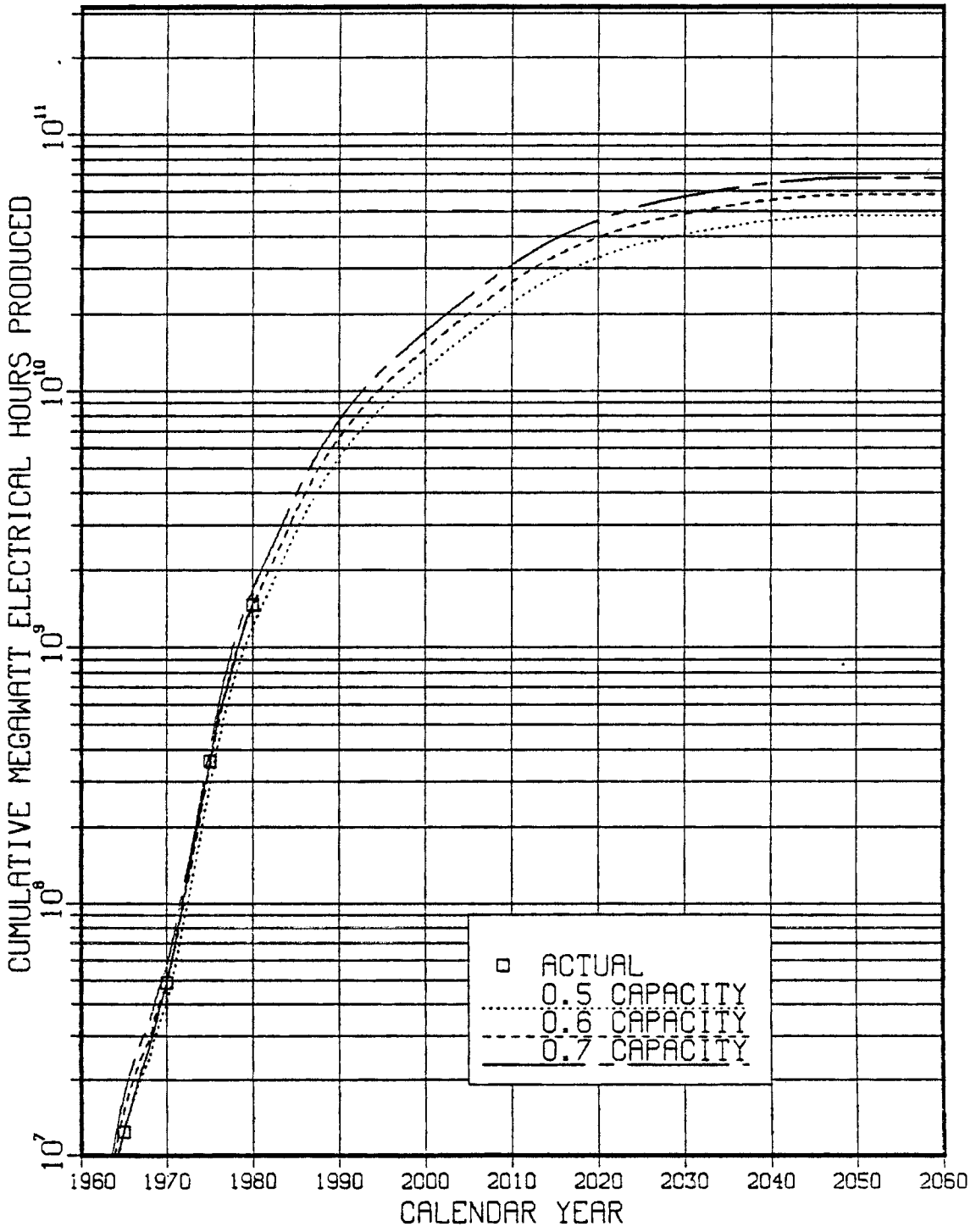

FIGURE 8. U.S. Nuclear Energy - Expanded Scenario
Reactor Status 06/15/80

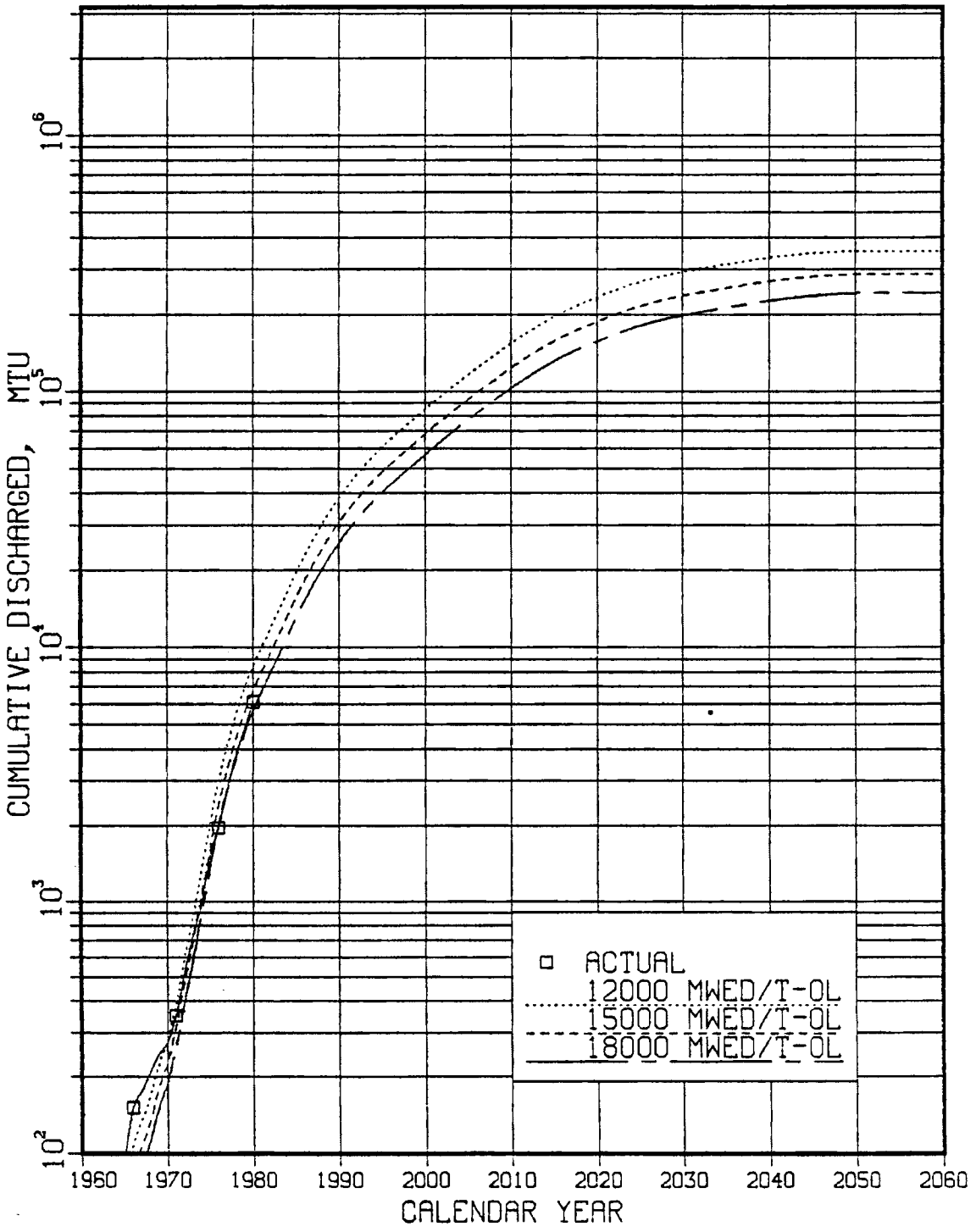

FIGURE 9. U.S. Discharged Fuel - Expanded Scenario
Reactor Status 06/15/80

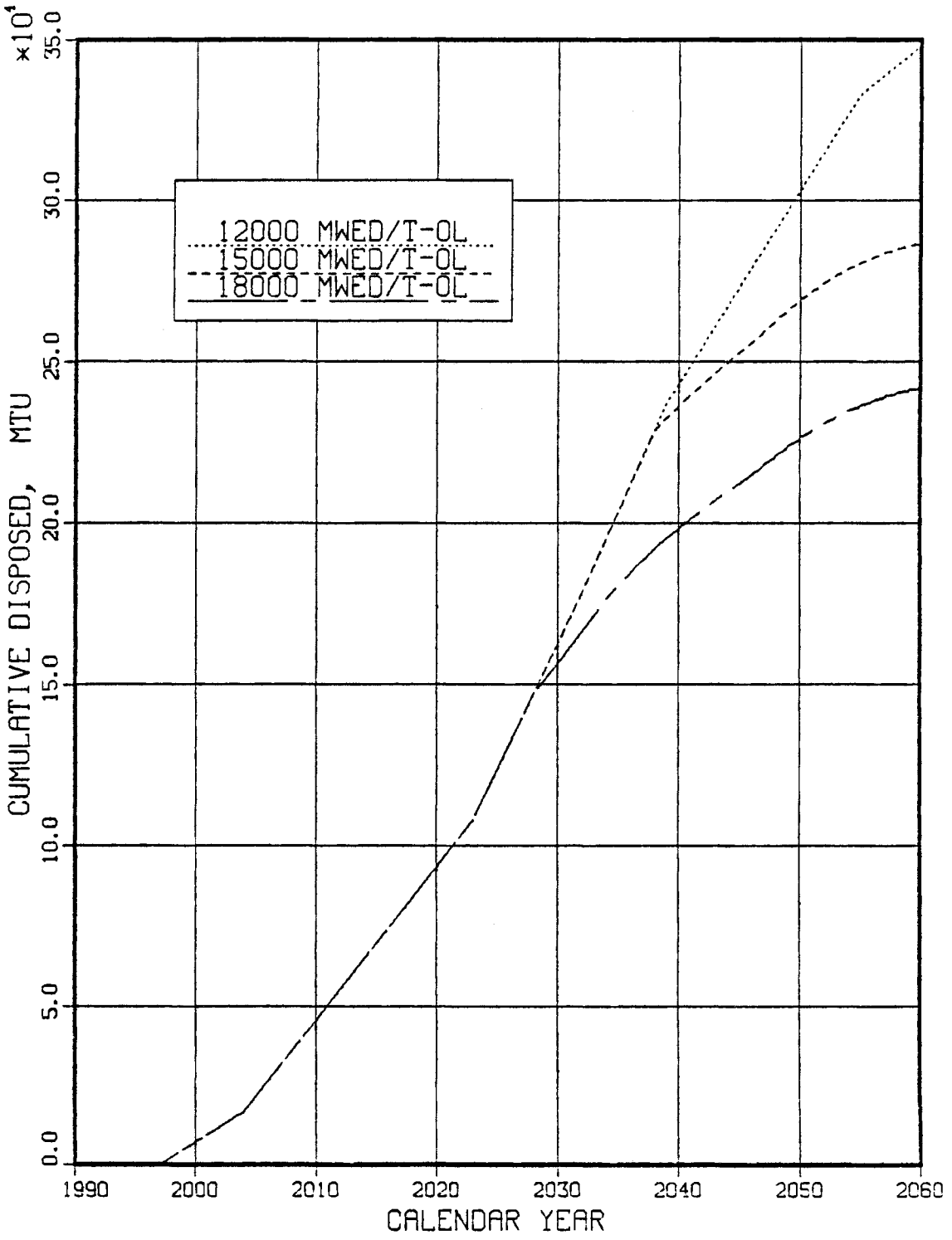

FIGURE 10. U.S. Fuel Disposed - Expanded Scenario
Reactor Status 06/15/80
Disposal Start 1997

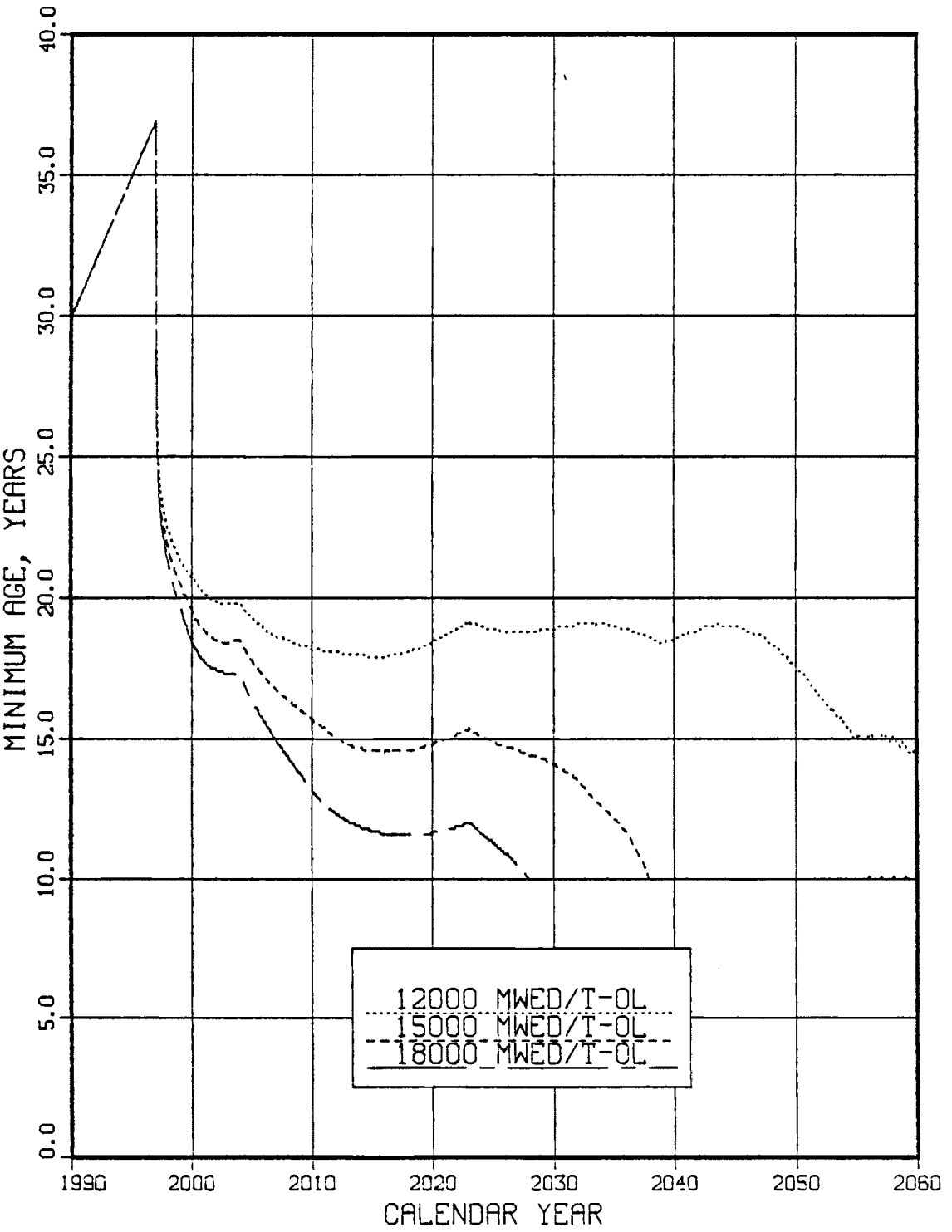

FIGURE 11. Minimum Age of Fuel Disposed - Expanded Scenario
Reactor Status 06/15/80
Disposal Start 1997

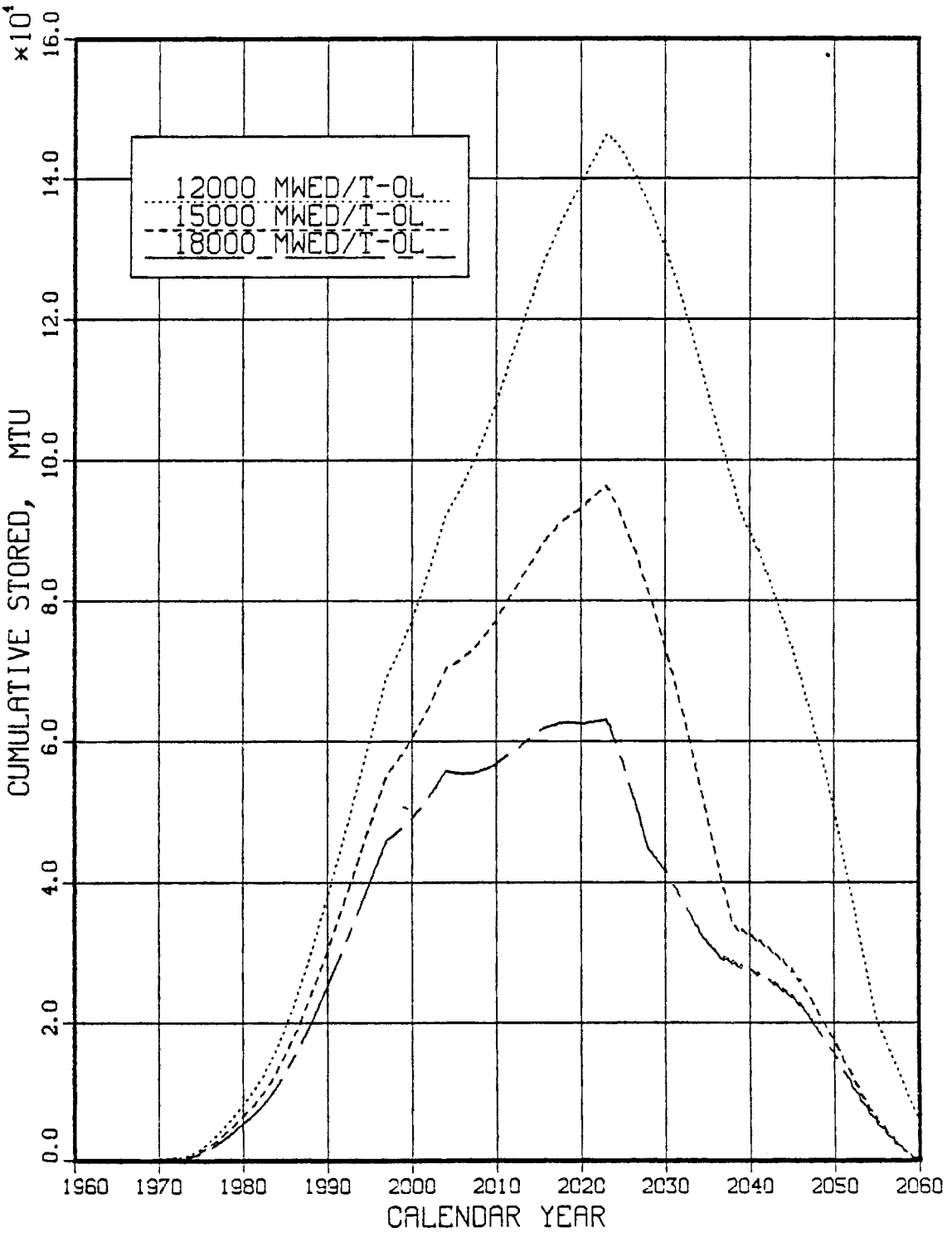

FIGURE 12. Fuel in Predisposal Storage - Expanded Scenario
Reactor Status 06/15/80

TABLE 6. Expanded Nuclear Power Industry

REACTOR STATUS 06/15/80

U S N U C L E A R P O W E R

	GWE		MWEH AT				MTU DISCHARGED AT MWED/T-OL			
DATE	ACTUAL	TOTAL	50 PER CENT	60 PER CENT	70 PER CENT	ACTUAL	12000	15000	18000	ACTUAL
1961.0	0.	0.	1.411+006	1.693+006	1.975+006	9.220+005	5.	4.	3.	0.
1962.0	0.	0.	2.934+006	3.520+006	4.107+006	2.750+006	15.	12.	10.	0.
1963.0	1.	1.	5.073+006	6.087+006	7.102+006	5.190+006	30.	24.	20.	51.
1964.0	1.	1.	8.507+006	1.021+007	1.191+007	8.840+006	54.	43.	36.	64.
1965.0	1.	1.	1.230+007	1.476+007	1.722+007	1.240+007	80.	64.	54.	96.
1966.0	1.	1.	1.626+007	1.951+007	2.277+007	1.640+007	108.	86.	72.	152.
1967.0	1.	1.	2.025+007	2.430+007	2.836+007	2.160+007	136.	108.	90.	175.
1968.0	1.	1.	2.420+007	2.903+007	3.387+007	2.710+007	167.	134.	112.	209.
1969.0	2.	2.	3.233+007	3.880+007	4.526+007	3.680+007	224.	180.	151.	247.
1970.0	2.	2.	4.050+007	4.860+007	5.669+007	4.900+007	281.	226.	189.	275.
1971.0	4.	4.	5.680+007	6.816+007	7.952+007	6.960+007	394.	316.	265.	351.
1972.0	8.	8.	8.472+007	1.017+008	1.186+008	1.070+008	588.	472.	394.	518.
1973.0	11.	11.	1.240+008	1.488+008	1.736+008	1.620+008	861.	690.	576.	731.
1974.0	18.	18.	1.919+008	2.303+008	2.687+008	2.440+008	1333.	1067.	890.	982.
1975.0	25.	25.	2.870+008	3.445+008	4.019+008	3.600+008	2015.	1617.	1352.	1534.
1976.0	35.	35.	4.269+008	5.123+008	5.977+008	5.390+008	2986.	2394.	2000.	1962.
1977.0	39.	39.	5.910+008	7.092+008	8.274+008	6.910+008	4130.	3310.	2764.	2743.
1978.0	45.	45.	7.808+008	9.370+008	1.093+009	9.220+008	5448.	4365.	3643.	3760.
1979.0	48.	48.	9.882+008	1.186+009	1.383+009	1.210+009	6888.	5517.	4602.	4802.
1980.0	49.	49.	1.202+009	1.443+009	1.683+009	1.470+009	8434.	6766.	5653.	6141.
1981.0	55.	55.	1.427+009	1.713+009	1.998+009		9998.	8017.	6696.	
1982.0	63.	63.	1.689+009	2.026+009	2.364+009		11813.	9469.	7906.	
1983.0	75.	75.	1.995+009	2.394+009	2.794+009		13943.	11173.	9326.	
1984.0	88.	88.	2.362+009	2.835+009	3.307+009		16492.	13212.	11025.	
1985.0	102.	102.	2.795+009	3.354+009	3.913+009		19497.	15616.	13028.	
1986.0	110.	110.	3.263+009	3.915+009	4.568+009		22745.	18214.	15194.	
1987.0	121.	121.	3.777+009	4.532+009	5.287+009		26314.	21069.	17573.	
1988.0	127.	127.	4.318+009	5.181+009	6.045+009		30071.	24075.	20078.	
1989.0	135.	135.	4.897+009	5.876+009	6.855+009		34091.	27291.	22758.	
1990.0	136.	136.	5.491+009	6.590+009	7.688+009		38220.	30594.	25510.	
1991.0	142.	142.	6.107+009	7.328+009	8.550+009		42495.	34014.	28360.	
1992.0	143.	143.	6.734+009	8.080+009	9.427+009		46848.	37496.	31262.	
1993.0	147.	147.	7.373+009	8.847+009	1.032+010		51285.	41047.	34221.	
1994.0	149.	149.	8.022+009	9.627+009	1.123+010		55795.	44654.	37227.	
1995.0	149.	149.	8.675+009	1.041+010	1.215+010		60332.	48284.	40252.	
1996.0	149.	149.	9.329+009	1.119+010	1.306+010		64870.	51914.	43277.	
1997.0	150.	150.	9.988+009	1.199+010	1.398+010		69446.	55575.	46328.	
1998.0	150.	159.	1.069+010	1.282+010	1.496+010		74288.	59449.	49556.	
1999.0	152.	169.	1.143+010	1.371+010	1.600+010		79436.	63567.	52988.	

TABLE 6 (contd)

REACTOR STATUS 06/15/80

U S N U C L E A R P O W E R

	G W E		M W E H AT				MTU DISCHARGED AT MWED/T-OL			
DATE	ACTUAL	TOTAL	50 PER CENT	60 PER CENT	70 PER CENT	ACTUAL	12000	15000	18000	ACTUAL
2000.0	152.	178.	1.221+010	1.465+010	1.709+010		84850.	67898.	56597.	
2001.0	153.	188.	1.303+010	1.563+010	1.824+010		90580.	72485.	60421.	
2002.0	153.	196.	1.389+010	1.667+010	1.945+010		96568.	77278.	64418.	
2003.0	153.	205.	1.479+010	1.775+010	2.070+010		102809.	82270.	68578.	
2004.0	152.	214.	1.573+010	1.887+010	2.202+010		109319.	87479.	72920.	
2005.0	152.	222.	1.670+010	2.004+010	2.338+010		116090.	92896.	77434.	
2006.0	152.	231.	1.771+010	2.126+010	2.480+010		123127.	98526.	82125.	
2007.0	152.	240.	1.877+010	2.252+010	2.627+010		130431.	104369.	86994.	
2008.0	152.	249.	1.986+010	2.383+010	2.780+010		138068.	110492.	92108.	
2009.0	151.	256.	2.098+010	2.518+010	2.937+010		145874.	116737.	97312.	
2010.0	151.	265.	2.214+010	2.657+010	3.100+010		154033.	123282.	102781.	
2011.0	149.	271.	2.333+010	2.800+010	3.267+010		162432.	130024.	108419.	
2012.0	146.	268.	2.452+010	2.942+010	3.432+010		170866.	136819.	114120.	
2013.0	143.	265.	2.568+010	3.082+010	3.596+010		179327.	143655.	119874.	
2014.0	136.	258.	2.683+010	3.219+010	3.756+010		187637.	150380.	125542.	
2015.0	128.	250.	2.794+010	3.353+010	3.911+010		196004.	157200.	131332.	
2016.0	118.	241.	2.901+010	3.481+010	4.061+010		203931.	163646.	136788.	
2017.0	114.	236.	3.005+010	3.606+010	4.207+010		211425.	169691.	141868.	
2018.0	107.	230.	3.107+010	3.728+010	4.349+010		218915.	175768.	147003.	
2019.0	105.	227.	3.207+010	3.848+010	4.489+010		225992.	181456.	151765.	
2020.0	104.	226.	3.306+010	3.967+010	4.629+010		232949.	187032.	156421.	
2021.0	98.	220.	3.404+010	4.085+010	4.766+010		240320.	193039.	161519.	
2022.0	90.	213.	3.499+010	4.199+010	4.898+010		247395.	198800.	166404.	
2023.0	78.	201.	3.589+010	4.307+010	5.024+010		254445.	204601.	171371.	
2024.0	65.	188.	3.673+010	4.407+010	5.142+010		261356.	210343.	176336.	
2025.0	51.	173.	3.750+010	4.500+010	5.250+010		267523.	215436.	180711.	
2026.0	43.	166.	3.824+010	4.589+010	5.354+010		273118.	220004.	184594.	
2027.0	32.	155.	3.894+010	4.672+010	5.451+010		278520.	224443.	188392.	
2028.0	26.	148.	3.960+010	4.752+010	5.544+010		283660.	228658.	191990.	
2029.0	18.	140.	4.023+010	4.828+010	5.632+010		288466.	232591.	195342.	
2030.0	17.	139.	4.084+010	4.901+010	5.718+010		293023.	236298.	198481.	
2031.0	11.	134.	4.143+010	4.972+010	5.801+010		297360.	239813.	201448.	
2032.0	10.	132.	4.201+010	5.042+010	5.882+010		301560.	243207.	204305.	
2033.0	6.	129.	4.258+010	5.110+010	5.962+010		305662.	246521.	207093.	
2034.0	4.	126.	4.314+010	5.177+010	6.040+010		309610.	249694.	209750.	
2035.0	4.	126.	4.369+010	5.243+010	6.117+010		313456.	252770.	212313.	
2036.0	4.	126.	4.425+010	5.310+010	6.195+010		317384.	255932.	214962.	
2037.0	3.	125.	4.480+010	5.376+010	6.271+010		321776.	259560.	218083.	
2038.0	3.	116.	4.531+010	5.437+010	6.343+010		325985.	263061.	221112.	
2039.0	1.	106.	4.577+010	5.493+010	6.408+010		329803.	266232.	223852.	

TABLE 6 (contd)

REACTOR STATUS 06/15/80

U S N U C L E A R P O W E R

DATE	GWE ACTUAL	GWE TOTAL	MWEH AT 50 PER CENT	MWEH AT 60 PER CENT	MWEH AT 70 PER CENT	MWEH AT ACTUAL	MTU DISCHARGED AT MWED/T-OL 12000	15000	18000	MTU DISCHARGED AT MWED/T-OL ACTUAL
2040.0	1.	98.	4.620+010	5.544+010	6.468+010		333440.	269276.	226500.	
2041.0	0.	88.	4.658+010	5.590+010	6.522+010		336687.	271990.	228858.	
2042.0	0.	79.	4.693+010	5.631+010	6.570+010		339667.	274491.	231040.	
2043.0	0.	70.	4.723+010	5.668+010	6.613+010		342381.	276779.	233043.	
2044.0	0.	61.	4.750+010	5.700+010	6.650+010		344829.	278853.	234870.	
2045.0	0.	52.	4.773+010	5.728+010	6.683+010		347010.	280715.	236518.	
2046.0	0.	44.	4.792+010	5.751+010	6.709+010		348925.	282364.	237989.	
2047.0	0.	35.	4.808+010	5.769+010	6.731+010		350574.	283799.	239283.	
2048.0	0.	26.	4.819+010	5.783+010	6.747+010		351956.	285022.	240399.	
2049.0	0.	17.	4.827+010	5.792+010	6.758+010		353072.	286031.	241337.	
2050.0	0.	9.	4.831+010	5.797+010	6.763+010		353922.	286827.	242098.	
2051.0	0.	0.	4.831+010	5.797+010	6.763+010		353922.	286827.	242098.	
2052.0	0.	0.	4.831+010	5.797+010	6.763+010		353922.	286827.	242098.	
2053.0	0.	0.	4.831+010	5.797+010	6.763+010		353922.	286827.	242098.	
2054.0	0.	0.	4.831+010	5.797+010	6.763+010		353922.	286827.	242098.	
2055.0	0.	0.	4.831+010	5.797+010	6.763+010		353922.	286827.	242098.	
2056.0	0.	0.	4.831+010	5.797+010	6.763+010		353922.	286827.	242098.	
2057.0	0.	0.	4.831+010	5.797+010	6.763+010		353922.	286827.	242098.	
2058.0	0.	0.	4.831+010	5.797+010	6.763+010		353922.	286827.	242098.	
2059.0	0.	0.	4.831+010	5.797+010	6.763+010		353922.	286827.	242098.	
2060.0	0.	0.	4.831+010	5.797+010	6.763+010		353922.	286827.	242098.	

TABLE 6 (contd)

REACTOR STATUS 06/15/80

FUEL STATUS, MTU
15,000 MWED/T-OL SCENARIO
****

DATE	CUMULATIVE DISCHARGED	PREDISPOSAL STORAGE	TERMINAL STORAGE	FILL RATE MTU/YR	CAPACITY MTU/YR	MINIMUM AGE,YRS
1961.0	4.	4.				.9
1962.0	12.	12.				1.9
1963.0	24.	24.				2.9
1964.0	43.	43.				3.9
1965.0	64.	64.				4.9
1966.0	86.	86.				5.9
1967.0	108.	108.				6.9
1968.0	134.	134.				7.9
1969.0	180.	180.				8.9
1970.0	226.	226.				9.9
1971.0	316.	316.				10.9
1972.0	472.	472.				11.9
1973.0	690.	435.				12.9
1974.0	1067.	813.				13.9
1975.0	1617.	1363.				14.9
1976.0	2394.	2140.				15.9
1977.0	3310.	3056.				16.9
1978.0	4365.	4110.				17.9
1979.0	5517.	5262.				18.9
1980.0	6766.	6511.				19.9
1981.0	8017.	7762.				20.9
1982.0	9469.	9214.				21.9
1983.0	11173.	10918.				22.9
1984.0	13212.	12958.				23.9
1985.0	15616.	15361.				24.9
1986.0	18214.	17960.				25.9
1987.0	21069.	20815.				26.9
1988.0	24075.	23820.				27.9
1989.0	27291.	27036.				28.9
1990.0	30594.	30340.				29.9
1991.0	34014.	33759.				30.9
1992.0	37496.	37242.				31.9
1993.0	41047.	40792.				32.9
1994.0	44654.	44400.				33.9
1995.0	48284.	48030.				34.9
1996.0	51914.	51660.				35.9
1997.0	55575.	55320.		2400.	2400.	36.9
1998.0	59449.	56794.	2400.	2400.	2400.	21.9
1999.0	63567.	58513.	4800.	2400.	2400.	20.6

TABLE 6 (contd)

REACTOR STATUS 06/15/80

FUEL STATUS, MTU
15,000 MWED/T-OL SCENARIO

DATE	CUMULATIVE DISCHARGED	PREDISPOSAL STORAGE	TERMINAL STORAGE	FILL RATE MTU/YR	CAPACITY MTU/YR	MINIMUM AGE,YRS
2000.0	67898.	60444.	7200.	2400.	2400.	19.6
2001.0	72485.	62630.	9600.	2400.	2400.	18.9
2002.0	77278.	65023.	12000.	2400.	2400.	18.5
2003.0	82270.	67616.	14400.	2400.	2400.	18.4
2004.0	87479.	70425.	16800.	4800.	4800.	18.5
2005.0	92896.	71042.	21600.	4800.	4800.	17.8
2006.0	98526.	71872.	26400.	4800.	4800.	17.2
2007.0	104369.	72915.	31200.	4800.	4800.	16.8
2008.0	110492.	74238.	36000.	4800.	4800.	16.4
2009.0	116737.	75682.	40800.	4800.	4800.	16.0
2010.0	123282.	77428.	45600.	4800.	4800.	15.7
2011.0	130024.	79370.	50400.	4800.	4800.	15.4
2012.0	136819.	81364.	55200.	4800.	4800.	15.1
2013.0	143655.	83401.	60000.	4800.	4800.	14.8
2014.0	150380.	85326.	64800.	4800.	4800.	14.7
2015.0	157200.	87346.	69600.	4800.	4800.	14.6
2016.0	163646.	88991.	74400.	4800.	4800.	14.5
2017.0	169691.	90236.	79200.	4800.	4800.	14.6
2018.0	175768.	91513.	84000.	4800.	4800.	14.6
2019.0	181456.	92401.	88800.	4800.	4800.	14.7
2020.0	187032.	93178.	93600.	4800.	4800.	14.8
2021.0	193039.	94385.	98400.	4800.	4800.	15.0
2022.0	198800.	95346.	103200.	4800.	4800.	15.2
2023.0	204601.	96346.	108000.	7800.	7800.	15.4
2024.0	210343.	94289.	115800.	7800.	7800.	15.1
2025.0	215436.	91582.	123600.	7800.	7800.	14.9
2026.0	220004.	88349.	131400.	7800.	7800.	14.8
2027.0	224443.	84989.	139200.	7800.	7800.	14.6
2028.0	228658.	81404.	147000.	7800.	7800.	14.4
2029.0	232591.	77537.	154800.	7800.	7800.	14.3
2030.0	236298.	73443.	162600.	7800.	7800.	14.1
2031.0	239813.	69159.	170400.	7800.	7800.	13.8
2032.0	243207.	64753.	178200.	8400.	8400.	13.5
2033.0	246521.	59667.	186600.	8400.	8400.	13.0
2034.0	249694.	54439.	195000.	8400.	8400.	12.6
2035.0	252770.	49116.	203400.	8400.	8400.	12.2
2036.0	255932.	43877.	211800.	8400.	8400.	11.7
2037.0	259560.	39106.	220200.	8400.	8400.	10.9
2038.0	263061.	34207.	228600.	4213.	8400.	10.0
2039.0	266232.	33387.	232591.	3418.	6000.	10.0

TABLE 6 (contd)

REACTOR STATUS 06/15/80

FUEL STATUS, MTU
15,000 MWED/T-OL SCENARIO
****

DATE	CUMULATIVE DISCHARGED	PREDISPOSAL STORAGE	TERMINAL STORAGE	FILL RATE MTU/YR	CAPACITY MTU/YR	MINIMUM AGE,YRS
2040.0	269276.	32724.	236298.	3500.	6000.	10.0
2041.0	271990.	31923.	239813.	3224.	6000.	10.0
2042.0	274491.	31029.	243207.	3161.	6000.	10.0
2043.0	276779.	30003.	246521.	3104.	6000.	10.0
2044.0	278853.	28905.	249694.	3076.	6000.	10.0
2045.0	280715.	27690.	252770.	3076.	6000.	10.0
2046.0	282364.	26177.	255932.	3045.	6000.	10.0
2047.0	283799.	24272.	259272.	3792.	6000.	10.0
2048.0	285022.	22058.	262709.	3761.	6000.	10.0
2049.0	286031.	19786.	265990.	3182.	6000.	10.0
2050.0	286827.	17603.	268970.	3151.	6000.	10.0
2051.0	286827.	14780.	271793.	2572.	6000.	10.0
2052.0	286827.	12257.	274316.	2288.	6000.	10.0
2053.0	286827.	9948.	276625.	2004.	6000.	10.0
2054.0	286827.	7852.	278721.	1720.	6000.	10.0
2055.0	286827.	5969.	280604.	1436.	3000.	10.0
2056.0	286827.	4599.	281974.	2152.	3000.	10.0
2057.0	286827.	3142.	283431.	1868.	3000.	10.0
2058.0	286827.	1899.	284674.	1584.	3000.	10.0
2059.0	286827.	868.	285705.	1300.	3000.	10.0
2060.0	286827.	50.	286523.	0.	0.	10.0

Table 7. Comparison of the Two Power Scenarios

	Declared Reactors	Declared Plus Additional Reactors
Peak capacity, GWe	153	273
Energy, MWEH	3.22 + 010	5.80 + 010
Fuel discharged, MTU	159,000	287,000
Maximum fuel in predisposal, MTU	82,000 (in 2020)	96,000 (in 2023)
Maximum total repository load rate, MTU/yr	5,000	8,400
Enrichment feed, MTU	872,000	1,570,000

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4. United States Nuclear Regulatory Commission, Operating Units Status Report, Data as of 10-31-79; Licensed Operating Reactors, Data for Decisions, NUREG-0020, Vol. 3, No. 11, November 1979.

5. United States Department of Energy, Draft Environmental Impact Statement: Management of Commercially Generated Radioactive Waste, DOE/EIS-0046-D, Volumes 1 and 2, April 1979.

6. United States Department of Energy, Technology for Commercial Radioactive Waste Management, DOE/ET-0028, Volumes 1 through 5, May 1979.

7. R. I. Smith, G. J. Konzek, and W. E. Kennedy, Jr., Technology, Safety, and Costs of Decommissioning a Reference Pressurized Water Reactor Power Station, NUREG/CR-0130, Vol. 2, Appendix G, June 1978.

8. United States Nuclear Regulatory Commission, Environmental Survey of the Reprocessing and Waste Management Portions of the LWR Fuel Cycle, A Task Force Report, NUREG-0116, October 1976.

9. International Nuclear Fuel Cycle Evaluation, Waste Arisings from Reactor and Post-Fission Activities in Selected Fuel Cycles, Report by Working Group 7, INFCE/DEP/WG.7/11, Vienna, August 1979.

10. International Nuclear Fuel Cycle Evaluation, Waste Management and Disposal for Selected Nuclear Fuel Cycles, Report by Working Group 7, INFCE/WG.7/26, Vienna, May 1979.

APPENDIX

DETAILED INFORMATION ON LWRs INCLUDED IN AND EXCLUDED FROM THE ANALYSES

TABLE A-1. U.S. LWR Commercial Reactors - PWR

ON-LINE/DOWN

PLANT NAME	LOCATION STATE	CAPACITY MWE	MANUFACTURER	DATE ON-LINE	DATE SHUT DOWN
ARKANSAS NUCLEAR 1	AR	850	BW	12/74	
ARKANSAS NUCLEAR 2	AR	912	CE	4/80	
BEAVER VALLEY 1	PA	852	W	10/76	
CALVERT CLIFFS 1	MD	845	CE	5/75	
CALVERT CLIFFS 2	MD	845	CE	4/77	
CONN YANKEE	CT	575	W	1/68	
DONALD C COOK 1	MI	1054	W	8/75	
DONALD C COOK 2	MI	1100	W	7/78	
CRYSTAL RIVER 3	FL	825	BW	3/77	
DAVIS BESSE 1	OH	906	BW	11/77	
JOSEPH M FARLEY 1	AL	829	W	12/77	
FORT CALHOUN 1	NB	457	CE	9/73	
ROBERT E GINNA	NY	470	W	7/70	
INDIAN POINT 1	NY	265	BW	10/62	10/74
INDIAN POINT 2	NY	873	W	8/73	
INDIAN POINT 3	NY	965	W	8/76	
KEWAUNEE	WI	535	W	6/74	
MAINE YANKEE	ME	825	CE	12/72	
MILLSTONE 2	CT	870	CE	12/75	/10
NORTH ANNA 1	VA	907	W	6/78	
OCONEE 1	SC	887	BW	7/73	
OCONEE 2	SC	887	BW	9/74	
OCONEE 3	SC	887	BW	12/74	
PALISADES	MI	805	CE	12/71	
POINT BEACH 1	WI	497	W	12/70	
POINT BEACH 2	WI	497	W	4/73	
PRAIRIE ISLAND 1	MN	530	W	12/73	
PRAIRIE ISLAND 2	MN	530	W	12/74	
RANCHO SECO	CA	918	BW	4/75	
ROBINSON 2	SC	700	W	3/71	
SALEM 1	NJ	1090	W	6/77	
SAN ONOFRE 1	CA	436	W	1/68	
ST LUCIE 1	FL	902	CE	12/76	
SURRY 1	VA	822	W	12/72	
SURRY 2	VA	822	W	5/73	
SHIPPINGPORT	PA	60	W	1/58	12/74
THREE MILE ISLE 1	PA	819	BW	9/74	
THREE MILE ISLE 2	PA	906	BW	12/78	4/79
TROJAN	OR	1130	W	5/76	
TURKEY POINT 3	FL	693	W	12/72	
TURKEY POINT 4	FL	693	W	9/73	
YANKEE ROWE	MA	175	W	7/61	
ZION 1	IL	1040	W	12/73	
ZION 2	IL	1040	W	9/74	

TABLE A-2. U.S. LWR Commercial Reactors - PWR

PROJECTED

PLANT NAME	LOCATION STATE	CAPACITY MWE	MANUFACTURER	PLANNED DATE ON-LINE
ALLENS CREEK 1	TX	1150	GE	11/87
BEAVER VALLEY 2	PA	833	W	5/86
BELLEFONTE 1	AL	1213	BW	9/83
BELLEFONTE 2	AL	1213	BW	6/84
BRAIDWOOD 1	IL	1120	W	0/85*
BRAIDWOOD 2	IL	1120	W	0/86*
BYRON 1	IL	1120	W	0/83*
BYRON 2	IL	1120	W	0/84*
CALLAWAY 1	MO	1120	W	10/82
CALLAWAY 2	MO	1120	W	0/88*
CARROLL 1	IL	1120	W	10/92
CARROLL 2	IL	1120	W	10/93
CATAWBA 1	SC	1145	W	3/84*
CATAWBA 2	SC	1145	W	9/85*
CHEROKEE 1	SC	1280	CE	1/90*
CHEROKEE 2	SC	1280	CE	1/92*
COMANCHE PEAK 1	TX	1111	W	12/81
COMANCHE PEAK 2	TX	1111	W	12/83
DIABLO CANYON 1	CA	1084	W	0/81*
DIABLO CANYON 2	CA	1106	W	0/81
JOSEPH M FARLEY 2	AL	829	W	9/80
MARBLE HILL 1	IN	1130	W	10/82
MARBLE HILL 2	IN	1130	W	1/84
MCGUIRE 1	NC	1180	W	8/80
MCGUIRE 2	NC	1180	W	9/82*
MIDLAND 1	MI	460	BW	0/85*
MIDLAND 2	MI	811	BW	12/83
MILLSTONE 3	CT	1156	W	5/86
NEW HAVEN 1	NY	1250	CE	12/92
NORTH ANNA 2	VA	907	W	8/80*
PALO VERDE 1	AZ	1270	CE	5/83
PALO VERDE 2	AZ	1270	CE	5/84
PALO VERDE 3	AZ	1270	CE	6/86
PEBBLE SPRINGS 1	OR	1260	BW	11/88
PEBBLE SPRINGS 2	OR	1260	BW	11/90
PERKINS 1	NC	1280	CE	1/96*
PERKINS 2	NC	1280	CE	1/98*
PERKINS 3	NC	1280	CE	1/ 0*
PILGRIM 2	MA	1150	CE	12/85
ST LUCIE 2	FL	810	CE	5/83
SALEM 2	NJ	1115	W	10/80
SAN ONOFRE 2	CA	1100	CE	12/81*
SAN ONOFRE 3	CA	1100	CE	1/83

TABLE A-2 (contd)

PROJECTED

PLANT NAME	LOCATION STATE	CAPACITY MWE	MANUFACTURER	PLANNED DATE ON-LINE
SEABROOK 1	NH	1200	W	4/83
SEABROOK 2	NH	1200	W	2/88*
SEQUOYAH 1	TN	1148	W	9/80*
SEQUOYAH 2	TN	1148	W	6/81
SHEARON HARRIS 1	NC	900	W	3/84
SHEARON HARRIS 2	NC	900	W	3/86
SHEARON HARRIS 3	NC	900	W	3/90
SHEARON HARRIS 4	NC	900	W	3/88
SO TEXAS PROJECT 1	TX	1250	W	2/84
SO TEXAS PROJECT 2	TX	1250	W	2/86
VANDALIA NUCLEAR	IA	1270	BW	12/90
VIRGIL C SUMMER 1	SC	900	W	8/81*
VOGTLE 1	GA	1110	W	11/84
VOGTLE 2	GA	1110	W	11/87
WPPSS 1	WA	1218	BW	12/83
WPPSS 3	WA	1242	CE	12/84
WPPSS 4	WA	1218	BW	6/87*
WPPSS 5	WA	1240	CE	6/87*
WOLF CREEK	KS	1150	W	4/83
WATERFORD 3	LA	1113	CE	2/82
WATTS BAR 1	TN	1177	W	9/81
WATTS BAR 2	TN	1177	W	6/82
YELLOW CREEK 1	MS	1285	CE	11/85

* Date is later than reported in PNL-3317-1.

TABLE A-3. U.S. LWR Commercial Reactors - PWR

CANCELLED

PLANT NAME	LOCATION STATE	CAPACITY MWE	MANUFACTURER	PLANNED DATE ON-LINE
ATLANTIC 1	NJ	1150	W	5/85
ATLANTIC 2	NJ	1150	W	5/87
1990 UNIT	NY	1150	W	5/90
1992 UNIT	NY	1150	W	5/92
BLUE HILLS 1	TX	918	C	0/89
BLUE HILLS 2	TX	918	CE	0/91
CAROLINA P-L 8	SC	1150	BW	3/87
CAROLINA P-L 9	NC	1150	BW	3/89
CAROLINA P-L 1	NC	1150	BW	3/91
DAVIS BESSE 2	OH	906	BW	12/88
DAVIS BESSE 3	OH	906	BW	12/90
ERIE 1	OH	1260	BW	4/86
ERIE 2	OH	1260	BW	4/88
FT CALHOUN 2	NB	1136	W	1/83
GREENE CO	NY	1191	BW	9/84
GREENWOOD 2	MI	1264	BW	9/90
GREENWOOD 3	MI	1200	BW	9/92
HAVEN NO. 2	WI	900	W	6/89
JAMESPORT 1	NY	1150	W	7/88
JAMESPORT 2	NY	1150	W	7/90
KOSHKONONG 1	WI	900	W	2/85
KOSHKONONG 2	WI	900	W	7/86
NEP 1	RI	1150	W	10/84
NEP 2	RI	1150	W	10/86
NEW HAVEN 2	NY	1250	CE	12/94
SEARS ISLE	ME	1150	W	0/91
SO DADE 1	FL	1100	W	0/91
SO DADE 2	FL	1100	W	0/91
STERLING	NY	1150	W	4/91
SUNDESERT 1	CA	974	W	4/84
SUNDESERT 2	CA	974	W	1/86
SURRY 3	VA	859	BW	4/86
SURRY 4	VA	859	BW	4/87
TYRONE 1	WI	1150	W	4/84

TABLE A-4. U.S. LWR Commercial Reactors - PWR

INDEFINITE

PLANT NAME	LOCATION STATE	CAPACITY MWE	MANUFACTURER	PLANNED DATE ON-LINE
CHEROKEE 3	SC	1280	CE	1/91
NORTH ANNA 4	VA	907	BW	4/87
NORTH ANNA 3	VA	907	BW	4/86
FORKED RIVER 1	NJ	1070	CE	12/83
YELLOW CREEK 2	MS	1285	CE	4/88

TABLE A-5. U.S. LWR Commercial Reactors - BWR

ON-LINE/DOWN

PLANT NAME	LOCATION STATE	CAPACITY MWE	MANUFACTURER	DATE ON-LINE	DATE SHUT DOWN
BIG ROCK POINT	MI	72	GE	3/63	
BONUS	PR	16	CE	6/65	06/68
BROWNS FERRY 1	AL	1065	GE	8/74	
BROWNS FERRY 2	AL	1065	GE	3/75	
BROWNS FERRY 3	AL	1065	GE	3/77	
BRUNSWICK 1	NC	821	GE	3/77	
BRUNSWICK 2	NC	821	GE	11/75	
COOPER	NB	778	GE	7/74	
DRESDEN 1	IL	200	GE	7/60	
DRESDEN 2	IL	794	GE	8/70	
DRESDEN 3	IL	794	GE	11/71	
DUANE ARNOLD	IA	538	GE	2/75	
FITZPATRICK	NY	821	GE	7/75	
EDWIN I HATCH 1	GA	786	GE	12/75	
EDWIN I HATCH 2	GA	784	GE	9/79	
HUMBOLDT BAY 3	CA	65	GE	8/63	7/76
LACROSSE	WI	50	AL	9/69	
MILLSTONE 1	CT	660	GE	3/71	/06
MONTICELLO	MN	545	GE	6/71	
NINE MILE PT 1	NY	620	GE	12/69	
OYSTER CREEK 1	NJ	650	GE	12/69	
PATHFINDER	SD	58	AC	6/64	10/67
PEACH BOTTOM 2	PA	1065	GE	7/74	
PEACH BOTTOM 3	PA	1065	GE	12/74	
PILGRIM 1	MA	655	GE	12/72	
QUAD CITIES 1	IL	789	GE	9/72	
QUAD CITIES 2	IL	789	GE	10/72	
VERMONT YANKEE	VT	514	GE	11/72	

TABLE A-6. U.S. LWR Commercial Reactors - BWR

PROJECTED

PLANT NAME	LOCATION STATE	CAPACITY MWE	MANUFACTURER	PLANNED DATE ON-LINE
BAILLY N 1	IN	644	GE	6/87
BLACK FOX 1	OK	1150	GE	7/85
BLACK FOX 2	OK	1150	GE	7/88
CLINTON 1	IL	933	GE	3/83*
CLINTON 2	IL	933	GE	6/88
FERMI 2	MI	1093	GE	3/82
GRAND GULF 1	MS	1250	GE	4/83*
GRAND GULF 2	MS	1250	GE	4/86*
HOPE CREEK 1	NJ	1067	GE	5/86*
HOPE CREEK 2	NJ	1067	GE	5/89*
LASALLE 1	IL	1078	GE	5/81
LASALLE 2	IL	1078	GE	5/82*
LIMERICK 1	PA	1055	GE	4/83*
LIMERICK 2	PA	1055	GE	4/85
NINE MILE POINT 2	NY	1099	GE	10/86
PERRY 1	OH	1205	GE	5/84
PERRY 2	OH	1205	GE	5/88
PHIPPS BEND 1	TN	1233	GE	3/87
RIVER BEND 1	LA	934	GE	4/84
RIVER BEND 2	LA	934	GE	0/90
SHOREHAM	NY	819	GE	3/83*
SKAGIT 1	WA	1277	GE	1/90
SKAGIT 2	WA	1277	GE	1/92
SUSQUEHANNA 1	PA	1050	GE	7/82*
SUSQUEHANNA 2	PA	1050	GE	7/83*
WPPSS-2	WA	1093	GE	9/81
ZIMMER 1	OH	810	GE	4/82*

* Date is later than reported in PNL-3317-1.

TABLE A-7. U.S. LWR Commercial Reactors - BWR

CANCELLED

PLANT NAME	LOCATION STATE	CAPACITY MWE	MANUFACTURER	PLANNED DATE ON-LINE
BARTON 1	AL	1159	GE	0/90
BARTON 2	AL	1159	GE	0/90
DOUGLAS PT 1	MD	1146	GE	3/87
DOUGLAS PT 2	MD	1146	GE	3/91
MONTAGUE 1	MA	1150	GE	4/88
MONTAGUE 2	MA	1150	GE	1/90
PACIFIC GAS/ELEC 1	CA	1200	GE	0/91
PACIFIC GAS/ELEC 2	CA	1200	GE	0/91
ZIMMER 2	OH	1170	GE	0/87

TABLE A-8. U.S. LWR Commercial Reactors - BWR

INDEFINITE

PLANT NAME	LOCATION STATE	CAPACITY MWE	MANUFACTURER	PLANNED DATE ON-LINE
HARTSVILLE A1	TN	1233	GE	7/86
HARTSVILLE A2	TN	1233	GE	7/87
HARTSVILLE B1	TN	1233	GE	6/89
HARTSVILLE B2	TN	1233	GE	6/90
PHIPPS BEND 2	TN	1233	GE	8/89

TABLE A-9. U.S. LWR Commercial Reactors
Announced as of 1-1-77
Since Cancelled

Project/Location	Owner	Capacity Net (MWe)	Public Annc'd
Fulton Generating Station Unit 1 (PA)	Philadelphia Electric Co.	1160	8/71
Fulton Generating Station Unit 2 (PA)	Philadelphia Electric Co.	1160	8/71
Summit Power Station Unit 1 (DE)	Delmarva Power & Light Co.	1200	12/76
San Joaquin Nuclear Project 1 (CA)	LA Dept. of Water, PG&E SCE, SDE&G, CDWR	1300	3/74
San Joaquin Nuclear Project 2 (CA)	LA Dept. of Water, PG&E SCE, SDE&G, CDWR	1300	3/74
San Joaquin Nuclear Project 3 (CA)	LA Dept. of Water, PG&E SCE, SDE&G, CDWR	1300	3/74
San Joaquin Nuclear Project 4 (CA)	LA Dept. of Water, PG&E SCE, SDE&G, CDWR	1300	3/74
Rancho Seco Nuclear Gen. Stat. No. 2 (CA)	Sacramento Municipal	1100	9/74
Nebraska Public Power (NB)	Nebraska Public Power	1100	1/75
Mid-Hudson East 1 (NY)	Empire State Power Resources	1300	4/75
Mid-Hudson East 2 (NY)	Empire State Power Resources	1300	4/75
Mid-Hudson West 1 (NY)	Empire State Power Resources	1300	4/75
Shoreham West 1 (NY)	Empire State Power Resources	1300	4/75
Shoreham West 2 (NY)	Empire State Power Resources	1300	4/75
St. Lawrence 1 (NY)	Empire State Power Resources	1300	4/75
St. Lawrence 2 (NY)	Empire State Power Resources	1300	4/75
Eastern Desert 1 (CA)	Southern California Edison Co.	1000	7/76
Eastern Desert 2 (CA)	Southern California Edison Co.	1000	7/76

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