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50-439 Bellefonte Nuclear Plant, Unit 2, Tennessee Valley Au 05000439
AUTH.NAME AUTHOR AFFILIATION
MILLS,L.M. Tennessee Valley Authority
RECIP.NAME RECIPIENT AFFILIATION
ADENSAM,E. Licensing Branch 4

SUBJECT: Forwards responses to Questions 320.1 & 320.2 in NRC 820903 ltr re production cost analysis & total operating costs.

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TENNESSEE VALLEY AUTHORITY
CHATTANOOGA, TENNESSEE 37401
400 Chestnut Street Tower II

November 3, 1982

Director of Nuclear Reactor Regulation
Attention: Ms. E. Adensam, Chief
Licensing Branch No. 4
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Ms. Adensam:

In the Matter of the Application of	)	Docket Nos. 50-438
Tennessee Valley Authority	)	50-439

In reply to your September 3, 1982 letter to H. G. Parris transmitting questions on the Bellefonte Nuclear Plant, we have the enclosed responses to questions 320.1 and 320.2.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

L. M. Mills, Manager
Nuclear Licensing

Enclosure (20)
cc: U.S. Nuclear Regulatory Commission
Region II
Attn: Mr. James P. O'Reilly, Regional Administrator
101 Marietta Street, Suite 3100
Atlanta, Georgia 30303

B001

ENCLOSURE

320.1 Question:

Provide the following:

A production cost analysis which shows the difference in system production costs associated with the availability vs. unavailability of the proposed nuclear addition. Note, the resulting cost differential should be limited solely to the variable or incremental costs associated with generating electricity from the proposed nuclear addition and the sources of replacement energy. If, in your analysis, other factors influence the cost differential, explain in detail.

a. The analysis should provide results on an annual basis covering the period from initial operation of the first unit through five full years of operation of the last unit.

b. Where more than one utility shares ownership in the proposed nuclear addition or where the proposed facility is centrally dispatched as part of an interconnected pool, the results of the analysis may be aggregated for all participating systems.

c. The analysis should assume electrical energy requirements grow at (1) the system's latest official forecasted growth rate, and (2) zero growth from the latest actual annual energy requirement.

d. All underlying assumptions should be explicitly identified and explained.

e. For each year (and for each growth rate scenario) the following results should be clearly stated: (1) system production costs with the proposed nuclear addition available as scheduled: (2) system production costs without the proposed nuclear addition available; (3) the capacity factor assumed for the nuclear addition; (4) the average fuel cost and variable O & M for the nuclear addition and the sources of replacement energy (by fuel type) - both expressed in mills per kWh; and (5) the proportion of replacement energy assumed to be provided by coal, oil, gas, etc. (The base year for all costs should be identified.)

Response:

Based on current commercial operating dates, Bellefonte unit 1 is assumed to come online in 1986 and unit 2 in 1987. Base cases for the July 1982 high, medium, and low

load forecasts have been produced while the sensitivity cases (or impact cases) for the three forecasts have been produced by setting the forced outage rates for Bellefonte to 100 percent. The differences in the two sets of cases are then used to determine the operating cost impacts of not having Bellefonte in operation. The NRC request for growth rates of 'latest official forecasted rate and zero growth' have been approximated and re-represented herein by the TVA range of forecasts from 1982-2010 which include 2.9-percent growth on the high, 1.9-percent on the medium, and 0.4-percent on the low load forecasts.

Table 320.1-1 shows expected total operating costs for the generating system. The impact of operating without Bellefonte produces additional annual system operating cost (in current dollars) of from $120 million to $1,775 million for the high forecast; $115 million to $581 million for the medium forecast; and $113 million to $492 million for the low forecast over the period 1986-1993. Based on the Bellefonte generation lost (table 320.1-2), the additional costs to TVA range from 23-137 mills per kWh for the high growth case, 22-45 mills per kWh for the medium growth case, and 22-38 mills per kWh for the low growth case, as indicated in table 320.1-3.

Table 320.1-4 shows the sources of replacement energy for Bellefonte either by coal or other generation. Coal generation makes up the major portion of the replacement energy. However, as noted, the upper limit of the coal system is around 80 billion kWh per year. Therefore, more expensive generation may have to serve demands above 80 billion kWh. The 'other' category includes combusion turbine generation, economy exchange, emergency purchases, etc.

The operating level of the nuclear units assumed here, including Bellefonte, are based on industry-wide unit operation. Graphs 320.1-1 and 320.1-2 show nuclear unit performance or maturity curves for boiling water reactor (BWR) and pressurized water reactor (PWR) units, respectively. BWRs should be fully matured in around six years and have an annual capacity factor of 64 percent, including refueling. PWRs, such as Bellefonte, mature similarly and reach a mature annual capacity factor of 61 percent, including refueling.

Table 320.1-1

Expected Total Operating Costs
for Generating System
(Millions of Dollars)

	HIGH LOAD FORECAST			MEDIUM LOAD FORECAST			LOW LOAD FORECAST		
FY	Base	Without Hellefonte	Additional Cost w/o Bellefonte	Base	Withont Bellefonte	Additional Cost w/o Bellefonte	Base	Without Bellefonte	Additional Cost w/o Bellefonte
1986	3277	3397	120	3053	3168	115	2806	2919	113
1987	3908	4190	282	3602	3867	265	3274	3530	256
1988	4596	4945	349	4189	4500	311	3763	4060	297
1989	5179	5606	427	4661	5017	356	4132	4468	336
1990	5869	6388	519	5213	5619	406	4565	4939	374
1991	6625	7381	756	5783	6242	459	5008	5420	412
1992	7465	8664	1199	6397	6914	517	5478	5929	451
1993	8484	10259	1775	7121	7702	581	6028	6520	492

Table 320.1-2

Expected Operation of Bellefonte 1 and 2

FY	Generation Millions of kWh	Capacity Factor %	Fuel Costs $/MWh
1986	5181	48.8[1]	16.4
1987	10946	51.5[2]	15.5
1988	11852	55.8	14.8
1989	12371	58.2	13.4
1990	12629	59.4	14.6
1991	12824	60.3	17.1
1992	12954	61.0	19.5
1993	12954	61.0	20.7

Notes: 1. One unit at 1213
2. Two units at 1213 through 1993

TABLE 320.1-3

Replacement Energy and Additional Operating Costs
for Losing Bellefonte Generation

FY	Additional Operating Cost (M$)	Bellefonte Energy GWh	Bellefonte Operating Cost $/MWh	Additional Cost w/o Bellefonte $/MWh	Average Costs of Energy that Replace Bellefonte $/MWh
			High Load Forecast		
1986	120	5181	16.4	23.2	39.6
1987	282	10946	15.5	25.8	41.3
1988	349	11852	14.8	29.4	44.2
1989	427	12371	13.4	34.5	47.9
1990	519	12629	14.6	41.1	55.7
1991	756	12824	17.1	59.0	76.1
1992	1199	12954	19.5	92.6	112.1
1993	1775	12954	20.7	137.0	157.7
			Medium Load Forecast		
1986	115	5181	16.4	22.2	38.6
1987	265	10946	15.5	24.2	39.7
1988	311	11852	14.8	26.2	41.0
1989	356	12371	13.4	28.8	42.2
1990	406	12629	14.6	32.1	46.7
1991	459	12824	17.1	35.8	52.9
1992	517	12954	19.5	39.9	59.4
1993	581	12954	20.7	44.9	65.6
			Low Load Forecast		
1986	113	5181	16.4	21.8	38.2
1987	256	10946	15.5	23.4	38.9
1988	297	11852	14.8	25.1	39.9
1989	336	12371	13.4	27.2	40.6
1990	374	12629	14.6	29.6	44.2
1991	412	12824	17.1	32.1	49.2
1992	451	12954	19.5	34.8	54.3
1993	492	12954	20.7	38.0	58.7

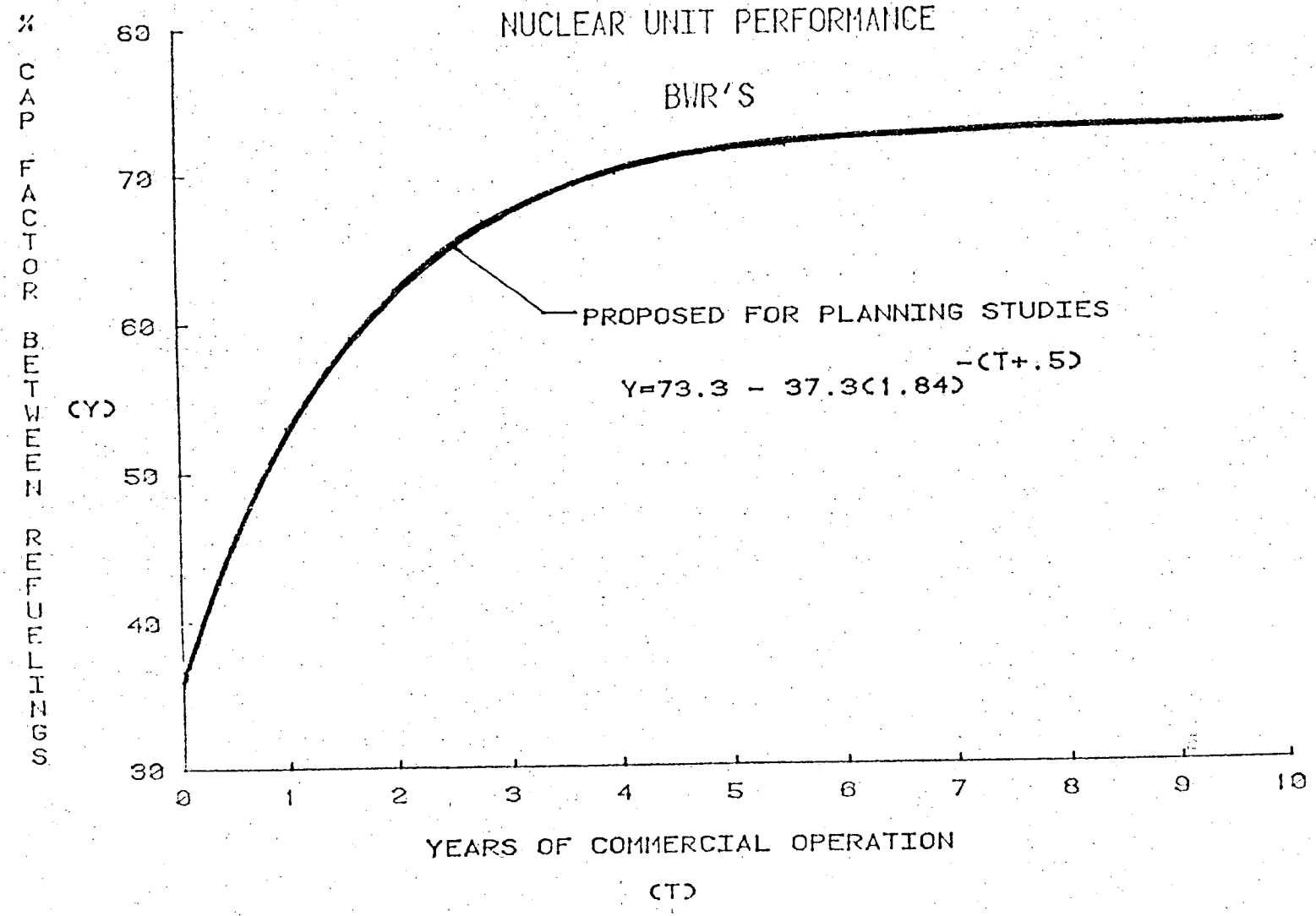
Table 320.1-4

Source of Replacement Energy for Bellefonte
(Billions of kWh)

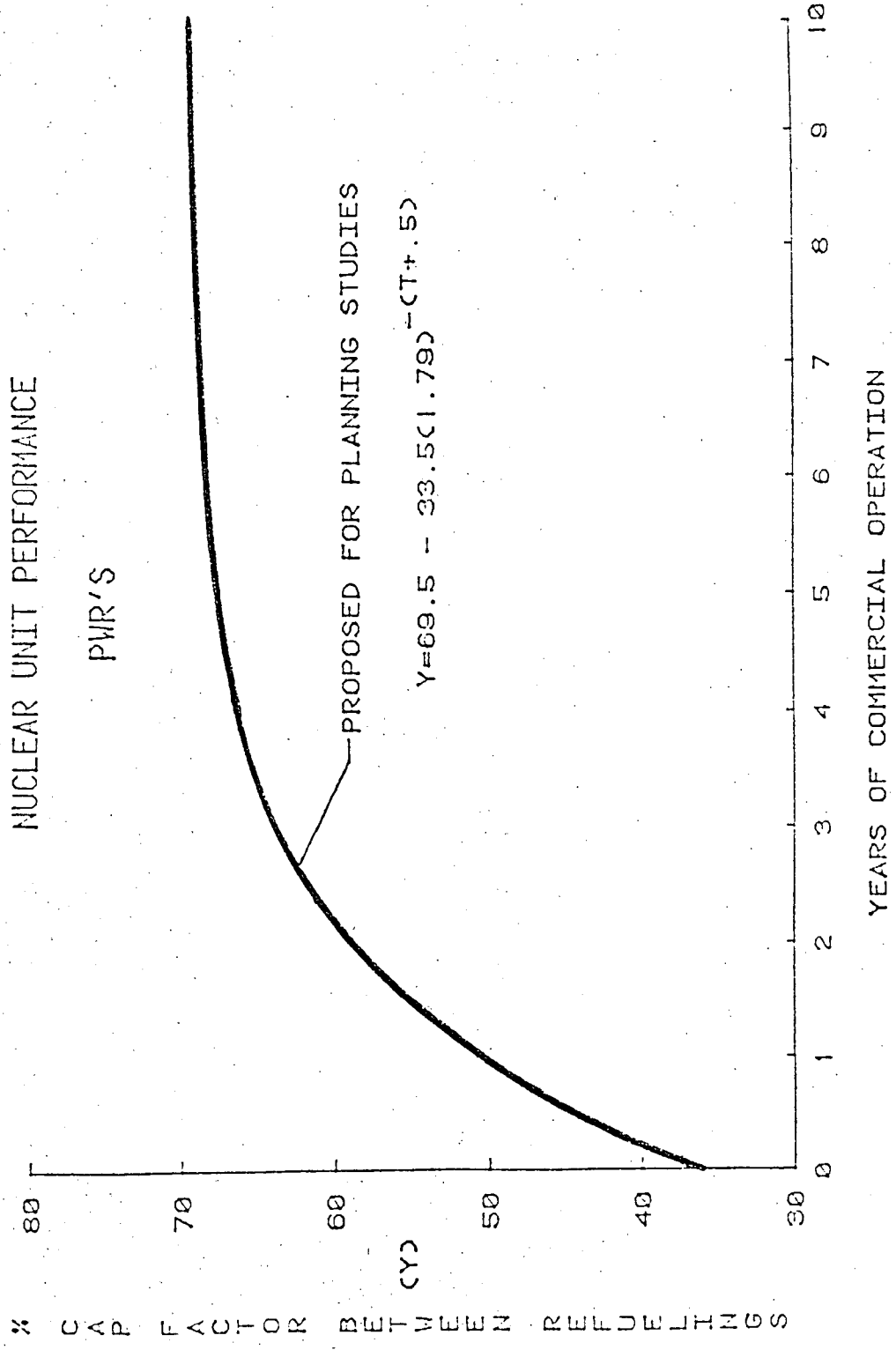
	High Load Forecast		Medium Load Forecast		Low Load Forecast	
FY	Coal	Other	Coal	Other	Coal	Other
1986	5.2	0	5.2	0	5.2	0
1987	10.9*	0	10.9	0	10.9	0
1988	11.7*	0.2	11.8	0.1	11.8	0.1
1989	12.2*	0.2	12.3	0.1	12.3	0.1
1990	12.4*	0.2	12.6	0	12.6	0
1991	12.0*	0.8	12.8	0	12.8	0
1992	10.8*	2.2	12.9	0.1	12.9	0.1
1993	9.1*	3.9	12.8	0.2	12.9	0.1

*This approaches the historical upper limit of coal capability and some of this shortage may be served by more expensive generation sources.

Graph 320.1-1


NUCLEAR UNIT PERFORMANCE
BWR'S
% CAP FACTOR BETWEEN REFUELINGS
(Y)
80
70
60
50
40
30
0
1
2
3
4
5
6
7
8
9
10
YEARS OF COMMERCIAL OPERATION
(T)
PROPOSED FOR PLANNING STUDIES
Y=73.3 - 37.3(1.84)^-(T+.5)

Graph 320.1-2


NUCLEAR UNIT PERFORMANCE
PWR'S
PROPOSED FOR PLANNING STUDIES
Y=69.5 - 33.5(1.79)^-(T+.5)
% CAP FACTOR BETWEEN REFUELINGS (Y)
80
70
60
50
40
30
0
1
2
3
4
5
6
7
8
9
10
YEARS OF COMMERCIAL OPERATION (T)

320.2 Question:

Provide 30-year levelized fuel and O & M costs (fixed and variable). Provide escalation, discount rates and all other variables assumed in calculating these costs.

Response:

Table 320.2-1 shows the levelized operating cost of Bellefonte units 1 and 2 in fuel, O&M, and total costs along with the implicit escalators that apply to Bellefonte fuel and O&M estimates. Please refer to the response to Question 320.1 for additional information concerning these calculations.

TABLE 320.2-1

Levelized Operating Cost of Bellefonte Units 1 and 2
30-year period

	Fuel $/MWh	O&M $/MWh	Total $/MWh
BLN 1	24.0	28.1	52.1
BLN 2	25.9	31.4	57.3

Fuel escalation rate 1986-2010 = 9.3%
O&M escalation rate 1986-2010 = 9.8%
Discount rate = 15.0%