Wisconsin Electric POWER COMPANY
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July 7, 1983

Mr. H. R. Denton, Director
Office of Nuclear Reactor Regulation
U. S. NUCLEAR REGULATORY COMMISSION
Washington, D. C. 20555

Attention: Mr. R. A. Clark, Chief
Operating Reactors Branch 3

Gentlemen:

DOCKET NO. 50-266
POINT BEACH NUCLEAR PLANT, UNIT 1
STEAM GENERATOR REPLACEMENT

Enclosure 1 to this letter provides responses to requests for further technical and economic information related to replacement of the steam generators in Point Beach Nuclear Plant, Unit 1, which were formally transmitted by your letter of July 6, 1983. These requests were discussed during a meeting with Messrs. Colburn, Fields, and Toalston in our offices on June 23, 1983.

In addition, we confirm that the following documents were provided to the NRC Staff during the June 23 meeting:

1. "Testimony of Richard A. Abdoo on Economic Analysis of Steam Generator Replacement at Point Beach Nuclear Plant, Unit 1" with attachments.

2. Environmental Screening prepared by the Staff of the Public Service Commission of Wisconsin dated March 24, 1981.

3. Letter dated January 25, 1982, Mr. C. W. Fay to Mr. H. R. Denton, "Sleeving Demonstration Program, Point Beach Nuclear Plant, Unit 1".

4. Letter dated June 4, 1982, Mr. N. A. Ricci to the Public Service Commission of Wisconsin, with the attached application to replace the Unit 1 steam generators.

5. Unit 1 Tube Plugging Histories and Plugging Maps.

6. Estimated Rates of Discharge of Significant Pollutants Fossil Plants from Wisconsin Electric's Advance Plan 3, submitted to the Public Service Commission of Wisconsin in September 1981.

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7. Point Beach, Units 1 and 2, 1981 and 1982 production costs from the December 1982 Wisconsin Electric Power Company Operating Report.

8. Morrison-Knudson, Company, Inc. Specification 3049-23301, "Temporary Steam Generator Storage Building, Westinghouse WQSN 2330, Point Beach Nuclear Generating Station, Wisconsin Electric Power Company", Revision 0.

9. Morrison-Knudson Drawing 545-001, Revision 1.

10. Morrison-Knudson Drawing 545-002, Revision 1.

The Staff has also requested a copy of a report dated June 8, 1983, "Present Status and Projected Future Progression of Steam Generator Tube Corrosion/ Degradation at Point Beach Unit No. 1, Wisconsin Electric Power Company, Two Creeks, Wisconsin", by James R. Myers, Ph. D., P.E., prepared for the Public Service Commission of Wisconsin. This report is enclosed as Enclosure 2.

Should you have questions concerning the enclosed information, please contact us as soon as possible.

Very truly yours,

C. W. Fay

C. W. Fay Vice President-Nuclear Power

Enclosures

Copies to NRC Resident Inspector
J. G. Keppler, Region III

WISCONSIN ELECTRIC POWER COMPANY RESPONSE
TO NRC STAFF REQUEST FOR ADDITIONAL INFORMATION
POINT BEACH UNIT 1 STEAM GENERATOR REPLACEMENT

QUESTION 1

Provide the labor, equipment, and operating costs and downtime for the proposed plan, including charges on Point Beach 1 nuclear fuel inventory, Point Beach 1 O&M costs, and replacement power costs during the downtime.

RESPONSE:

The capital cost of the replacement project is $54.5 million. This figure includes $12.5 million for the purchase of the new steam generators and construction of the temporary storage building and $42 million for steam generator installation. The projected expenditures are outlined on pages 2 and 3 of the attachments to the "Testimony of Richard A. Abdoo on Economic Analysis of Steam Generator Replacement at Point Beach Nuclear Plant, Unit 1". Replacement power costs are determined by our production cost model which calculates the additional costs of power due to operation of the higher cost sources of power both within and outside the Wisconsin Electric system to replace Unit 1 production. Replacement power for the six month outage will cost $25 million. Point Beach Unit 1 operating and maintenance costs are determined on a year-by-year basis as an output of the production cost model. Nuclear fuel inventory costs are included in the nuclear fuel cost input to the production cost model.

QUESTION 2

Justify in terms of costs and technical feasibility the proposed plan as compared to alternative steam generator repair plans including:

1. Replacement of the entire steam generators.
2. Retubing the steam generators in place.
3. Sleeving the steam generator tubes.

RESPONSE:

1. Replacement of the entire steam generators is not a reasonable alternative to the proposed method of steam generator repair due to space and handling limitations in the containment structure. The laydown area inside containment near the equipment hatch is insufficient for an entire steam generator and there is insufficient headroom to lift the entire steam generator inside containment. Thus, replacement of the entire steam generators would require cutting an access opening in the containment dome and use of special cranes outside containment to lift the steam generators into place.

   As discussed in Sections 2.0 and 3.0 of the Point Beach Nuclear Plant Unit 1 Steam Generator Repair Report ("Repair Report"), the replacement of the steam generator lower assemblies and refurbishment of the upper assemblies inside containment allows the use of the existing containment hatch and polar crane bridge with minimal impact on the containment structure and results in steam generators with the same design features as entirely new steam generators.

   For these reasons, cost analyses of the replacement of entire steam generators have not been performed.

2. Retubing of the existing steam generators in place would involve disassembly of the steam generators and cutting and removal of the tube bundle and associated internal components. The tube stubs would be removed from the tubesheet, the tubesheet would be refurbished, and new tubes would be inserted, expanded into the tubesheet, and welded. This procedure would be performed in a radioactive environment with very restricted access inside

the steam generator cubicles and would likely result in schedular costs and total radiation exposure which exceed the sleeving or replacement alternatives with substantial economic risk. Should the tubesheet be damaged during tube removal or be otherwise unsuitable for continued use, the unit would then remain shut down until replacement of steam generators could be accomplished. The uncertainties associated with the retubing alternative as compared to the greater assurance of the quality of the steam generator lower assemblies fabricated in the controlled environment of an industrial facility preclude retubing in place as a viable alternative.

3. A sleeving demonstration program was conducted on Unit 1 during the fall 1981 refueling outage and a full-scale sleeving program has been completed recently on Unit 2. Both these sleeving programs demonstrated the feasibility of sleeving as a steam generator repair technique. However, Unit 1 has experienced crevice corrosion to a much greater degree than has Unit 2 and Unit 1 has large numbers of explosively plugged tubes which would not be sleeved during a full-scale sleeving program.

For the purpose of comparison with the proposed steam generator replacement, a sleeving program encompassing a 2,500 tube region in the central portion of each steam generator was assumed to minimize the potential for forced outages due to accelerated rates of crevice corrosion during subsequent full-power operation. This program would sleeve only the hot leg side of the steam generators with recovery of mechanically plugged tubes within the sleeved region. This sleeving program also assumes that a qualification program for sleeves of shorter length than are presently approved by NRC for use at Point Beach, and NRC approval of these sleeves, can be completed in time for the sleeving outage. Since it is expected that crevice corrosion will continue to occur following sleeving, it was assumed that subsequent refueling outages would be extended by one week to accommodate the additional eddy current inspections and plugging of degraded steam generator tubes outside the sleeved region which would be required for the sleeved steam generators.

We believe that Public Service Commission of Wisconsin approval to sleeve, rather than replace, Unit 1 steam generators could not be obtained prior to the scheduled fall 1983 steam generator replacement outage. Thus, it is assumed that Unit 1 would be shut down in the fall 1983 for a normal refueling outage and returned to power at reduced temperature and power level until March 1984. In March 1984, the unit would be shut down for a sleeving outage of 18 weeks. Following this outage, the unit is conservatively assumed, for economic comparisons, to be capable of full-power operation through the year 2003.

The cost of the sleeving program during the 18-week sleeving outage is estimated to be $33.2 million in 1983 dollars exclusive of replacement power costs. The cost of additional eddy current inspection and tube repair during subsequent outages is estimated to be $200,000 per year in 1983 dollars exclusive of replacement power costs. In addition to these costs, and assuming a decision by Wisconsin Electric in July 1983 to sleeve rather than replace, a total of approximately $13.7 million for steam generator replacement engineering, planning, and site preparation and $12.5 million for replacement steam generators and the temporary steam generator storage building will have been expended or irretrievably committed. These costs are unrecoverable and are appropriately included in the cost of the sleeving alternative at this time. In addition, cancellation charges might be incurred due to termination of steam generator replacement engineering and site activities. These costs are not quantifiable at this time and no allowance has been made for cancellation costs in the sleeving alternative. These costs compare to the estimated cost of $54.5 million for steam generator replacement during a six-month outage beginning October 1, 1983. Both alternatives were compared using Wisconsin Electric's production costing model described in Mr. R. A. Abdoo's testimony before the Public Service Commission of Wisconsin. These evaluations are provided in Attachment 1 to this enclosure and show that the total discounted revenue requirements for the sleeving alternative are greater than those for the replacement alternative by about $30 million through the year 2003. Thus, sleeving has no economic advantage to the proposed replacement of steam generators in Unit 1.

Based upon experience gained during the Unit 2 full scale sleeving program and the Unit 1 sleeving demonstration program, it is estimated that approximately 2,500 man-rem would be expended to accomplish the Unit 1 sleeving program due to higher radiation levels in Unit 1 than Unit 2, the greater number of sleeves that would be installed in Unit 1, removal of mechanical plugs, and the need to decontaminate both the hot and cold legs of the Unit 1 steam generator channel heads. The additional exposure required for eddy current inspection and tube repair during subsequent outages is estimated to be in the order of 100 man-rem per year. These exposures for the sleeving alternative compare to 1,390 man-rem for the steam generator replacement alternative.

In addition to substantially higher estimated radiation exposures for the sleeving alternative, it has been conservatively assumed for the economic comparison that sleeving of Unit 1 will preclude the necessity of reduction in power level during the remaining life of the plant and that forced outages due to continued crevice corrosion will not occur. There is no assurance that crevice corrosion will not occur outside the sleeved region in Unit 1 in tubes which cannot be sleeved. Following the sleeving program, the equivalent tube plugging levels in Unit 1 steam generators would be in the order of 14 to 15 percent. Plugging of only 50 tubes per steam generator during subsequent outages due to continuing degradation would increase the plugging levels by about 1.5 percent per year. While detailed evaluations of unit capability with increasing numbers of tubes plugged have not been made, it is estimated that plugging levels in the order of 25 percent would result in reduction of the unit's capability. With increasing plugging levels during outages subsequent to sleeving, it is likely that reduction in unit capability would occur within ten years, and potentially within six to seven years, following sleeving of the steam generators. Replacement of the steam generators would then be necessary. Thus, considering the economics, personnel exposure, and likely unit reliability and capability penalties within the lifetime of the unit, sleeving is not a viable alternative to steam generator replacement for Unit 1.

QUESTION 3

Provide a present worth comparison of accumulated annual charges, including annual production costs over the life of the plant, for the following alternatives:

1. The proposed steam generator repair plan.
2. Replacement of Point Beach 1 by alternative sources, purchases and/or generation.
3. Steam generator repairs, such as initial resleeving and periodical plugging, coupled with reduced output as necessary.

Provide cost estimates and assumptions used for the cost comparisons such as cost additions (including cost of required new generation and transmission facilities), fixed charge rate, discount rate, inflation, nuclear fuel cost, purchase power cost, nuclear O&M cost, alternative fuel cost, alternative's O&M cost, and decommissioning costs.

RESPONSE:

Mr. Abdoo's testimony, prepared for the Public Service Commission of Wisconsin, provides the revenue requirements on a year-by-year basis or the accumulated future revenue requirements for a number of years discounted to the present for the proposed steam generator replacement plan as compared to the option of continued operation of Unit 1 as is. The period of the analysis is from 1983-2003. The differences in revenue requirements between the two options are provided on pages 8 and 10 of the attachment to Mr. Abdoo's testimony. The difference in discounted accumulated revenue requirements between the two options is provided on pages 9 and 11 of the attachment; estimated discount rates and inflation rates for the analysis are provided on page 4 of the attachment; nuclear and alternative fuel costs are provided on page 5 of the attachment; and production costs for nuclear and non-nuclear generated energy are provided on page 6 of the attachment.

The option of shutting Unit 1 down and replacing the power by alternative generation with decommissioning to be conducted in the future in conjunction with Unit 2 was also analyzed at the request of the NRC staff. The same production cost model was used to compare the replacement option with operating Unit 1 at reduced power for the Public Service Commission of Wisconsin. The results of this analysis indicate estimated costs in the order of $306 million through the year 1990 for the decommissioning alternative. This analysis is provided as Attachment 2 to this enclosure.

QUESTION 4

Discuss the other differences of the above three alternatives such as reserve capacity differences, transmission adequacy for power purchases, differences in pollution, nuclear waste disposal, and fossil fuel usage.

RESPONSE:

Returning Point Beach Unit 1 to full-power operation is estimated to preclude the need for additional generating capacity until 1998. If Unit 1 continues to be operated at the reduced output of 370 MW, it is estimated that additional generating capacity will be needed in 1997. If the generation of Unit 1 is lost, generating capacity will be needed in 1994. None of the alternatives would limit Wisconsin Electric's ability to import power from the south or west. Estimated rates of discharge of significant pollutants of fossil plants were used to approximate the differences in pollution for the various alternatives. As an example, by returning Unit 1 to full-power operation, an additional 900,000 MWH would be nuclear-generated resulting in approximately 8 additional spent fuel assemblies per year and the annual generation of 2,250 tons less NO_x, 22,500 tons less SO_2, 250 tons less particulates, and 34,000 tons less fly ash. If the full generating capacity of Unit 1 were replaced by alternative generating means, it is estimated that an additional 8,000 tons of NO_x, 80,000 tons of SO_2, 800 tons of particulates, and 120,000 tons of fly ash would be generated annually and approximately 32 fewer fuel assemblies would be discharged per year. According to the Public Service Commission of Wisconsin's Environmental Screening, it is estimated that 3,000 to 5,000 cubic feet of low-level waste would not be generated if Point Beach Unit 1 were shut down and its generating capacity were replaced by an alternative source. Based on the recent Unit 2 sleeving experience, it is estimated that 5,000 cubic feet of compacted and non-compacted low-level waste would be generated by the sleeving of the Unit 1 steam generators. The disposal cost of this waste is estimated to be $175,000. In the Repair Report, Section 3.3.6.2, it is estimated that a total of 26,800 cubic feet of non-compacted low level waste will be generated per steam generator by the replacement alternative. The disposal cost of this waste is estimated to be $300,000. Nuclear fuel costs, which are included in the production cost model as described in Mr. Abdoo's testimony, include the cost of spent fuel disposal.

QUESTION 5

Discuss alternative methods of disposal of the steam generators under the proposed alternative, and justify the method(s) selected.

RESPONSE:

Alternative methods of disposal have been considered in Section 3.4.3 of the Repair Report. These alternatives include long-term and short-term storage followed by intact shipment or dismantling followed by shipment. As stated in the Repair Report, disposal of the steam generator lower assemblies at an off-site facility is not an available alternative at the present time due to space limitations at existing disposal facilities. Table 3-2 of the Repair Report shows that, with the exception of immediate intact shipment, the long-term storage alternative with intact shipment at the time of plant decommissioning provides the lowest estimated occupational exposure. In addition, long-term storage maintains the options of intact shipment or dismantling and shipment at any time during the storage period should facilities become available. Thus, long-term storage is the preferred alternative based on radiation exposure estimates and the number of options available for ultimate disposal.

QUESTION 6

Describe the general features of the temporary steam generator storage building, including the following:

a. Type of structure, materials, and strength.
b. Seismic resistance capability.
c. Tornado missile resistance capability.
d. Tornado and high wind resistance capability.
e. Fire protection features.
f. Shine and skyshine gamma radiation shielding features.
g. Access control features.
h. Flood protection capability.

RESPONSE:

The temporary steam generator storage building location is shown on Figure 7-1 and is discussed in Section 3.4.4 of the Repair Report. The storage building is of reinforced concrete construction and is constructed in accordance with the Wisconsin State Building Code and seismic design requirements of the Uniform Building Code for Zone 1. Building walls, floors, and roof are at least 2 feet thick to reduce radiation from the stored steam generators to levels less than 2.5 millirem per hour at external surfaces of the building. Thus, direct radiation and skyshine are insignificant at the nearest site boundary. Based upon the design and construction of the building, there is reasonable assurance that tornadoes or tornado-generated missiles will not significantly affect the storage building or its contents.

As discussed in Section 3.4.4 of the Repair Report, the storage building is provided with closed sumps to collect any liquids which may be present in the building. In addition, the building vent is provided with a HEPA filter to allow filtration of air interchanges due to ambient temperature variations.

Site hydrology is discussed in Section 2.5 of the FSAR. The storage building grade is at elevation 29'-6" relative to Lake Michigan and there are no lakes or streams in the site area. Thus, there is no potential for flooding of the storage building or the adjacent area.

The storage building is located within a locked fenced area adjacent to the patrolled plant security area and access to the storage building area is restricted to authorized personnel. There are no exterior openings in the north half of the building in which the steam generators are stored. The only access to the stored steam generators is through locked doors in the south half and a locked door in the interior wall dividing the north and south halves of the building. Thus, there is no significant potential for unauthorized access to the storage building fenced area, the storage building, or the stored steam generator components.

The stored steam generator components and the storage building are non-combustible and there is no need for permanently installed fire detection or suppression systems. Should combustible material be stored in the building, fire protection equipment will be provided, as appropriate. However, even assuming a fire in the building, there is little potential for radioactive release from the stored steam generator components.

Details of the temporary storage building design and construction features are provided in Morrison-Knudson Company, Inc. Specification 3049-23301, "Temporary Steam Generator Storage Building, Westinghouse WQSN 2330, Point Beach Nuclear Generating Station, Wisconsin Electric Power Company", Revision 0; Morrison-Knudson Drawing 545-001, Revision 1; and Morrison-Knudson Drawing 545-002, Revision 1. These drawings and specifications have been provided to NRC Staff.

QUESTION 7

Discuss the effects of an external event such as tornado or earthquake on the stored steam generator. Include missile potential and radiological consequences, if any. Or alternatively, discuss questions 7a and 7b.

RESPONSE:

As discussed in the response to Question 7, the steam generator storage building is an engineered reinforced concrete structure which is designed to the Wisconsin State Building Code and to the seismic criteria of the Uniform Building Code for Zone 1. This building design provides a high degree of protection against seismic and tornado events. Thus, it is not expected that an earthquake or tornado event would significantly affect the storage building. The steam generators were designed originally to withstand the design basis earthquake without loss of integrity, would not become airborne during a tornado due to their weight and relatively small size, and are sealed as described in Section 3.4 of the Repair Report. Thus, even assuming the storage building could be damaged by a tornado or seismic event, no radioactive releases would be expected.

QUESTION 8

Discuss any provisons for treatment and monitoring of gaseous and liquid effluents from the steam generator storage building.

RESPONSE:

Stored components are sealed to prevent the release of radioactive materials to the building. As discussed in the response to Question 7 and Section 3.4.4 of the Repair Report, the storage building is provided with closed sumps for collection of any liquids which may accumulate and with a filtered vent to prevent releases of airborne radioactivity. Liquids, if any, will be processed in plant systems or released depending on the level of radioactivity. Thus, the potential for releases of radioactivity to the environment due to storage of the steam generator components is insignificant. However, to provide further assurance of stored component integrity, storage building radioactivity and radiation levels will be monitored at least quarterly.

QUESTION 9

Discuss and evaluate an appropriate diffusion and transport relative atmospheric concentration (χ/Q) at the exclusion area boundary point in closest proximity to contaminated steam generator sections stored in the temporary storage building.

RESPONSE:

Relative concentrations and meteorological data for the site are provided in Appendix I of the FSAR. As stated in Appendix I, there are onsite residences which may be occupied by plant personnel and their families. Therefore, for the purpose of estimating annual average doses to an individual nearest the storage building, it is suggested that the values given in Appendix I, Table I.4-3, for turbine building releases in the WNW sector be used.

QUESTION 10

Discuss any plans for coating the deposits of radioactive corrosion products to reduce near-zone doses.

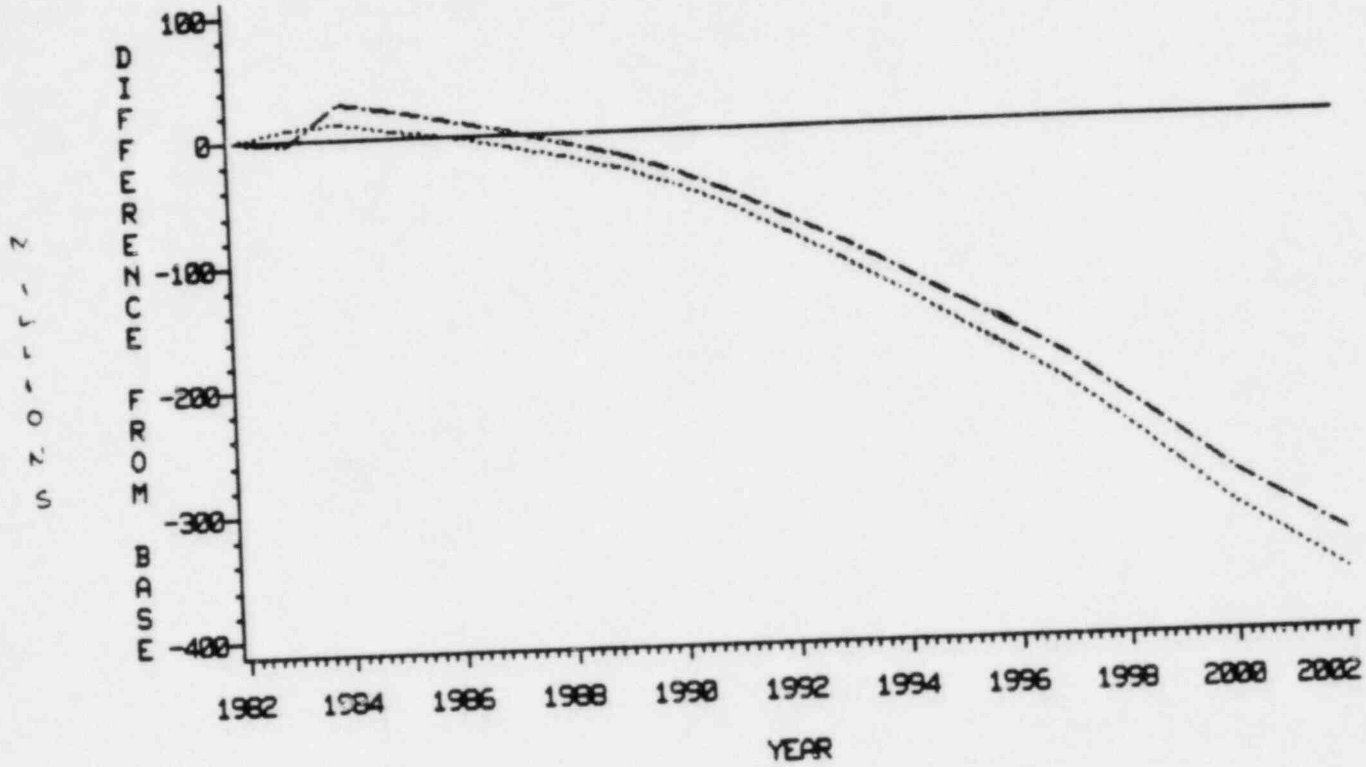
RESPONSE:

To be of any benefit, a coating would be required to improve the integrity of the already tightly adherent magnetite film and to provide significant shielding of the radiation from the corrosion product film such that external radiation levels are reduced. There are no easily applied coatings which provide significant shielding. The radioactive corrosion products in the steam generator components are essentially all contained in a tightly adherent magnetite film on internal primary side surfaces, as discussed in Sections 3.4.2 and 3.4.5 of the Repair Report. Since all openings in the steam generators are sealed prior to transport to the storage building, any coating of interior surfaces would require reopening the steam generators, removal of plugs from plugged tubes (13 to 14 percent of the total number of tubes), and resealing the steam generators in the storage building. Personnel exposures to perform these tasks would be expected to be high. Thus, there would be no benefit in coating steam generator surfaces.

For the above reasons, we have not considered attempts to coat surfaces of the stored steam generator components.

STEAM GENERATOR REPLACEMENT OR RESLEEVING

DIFFERENCE IN
DISCOUNTED ACCUMULATED REVENUE REQUIREMENTS



____ PRESENT OPERATION - NO REPLACEMENT

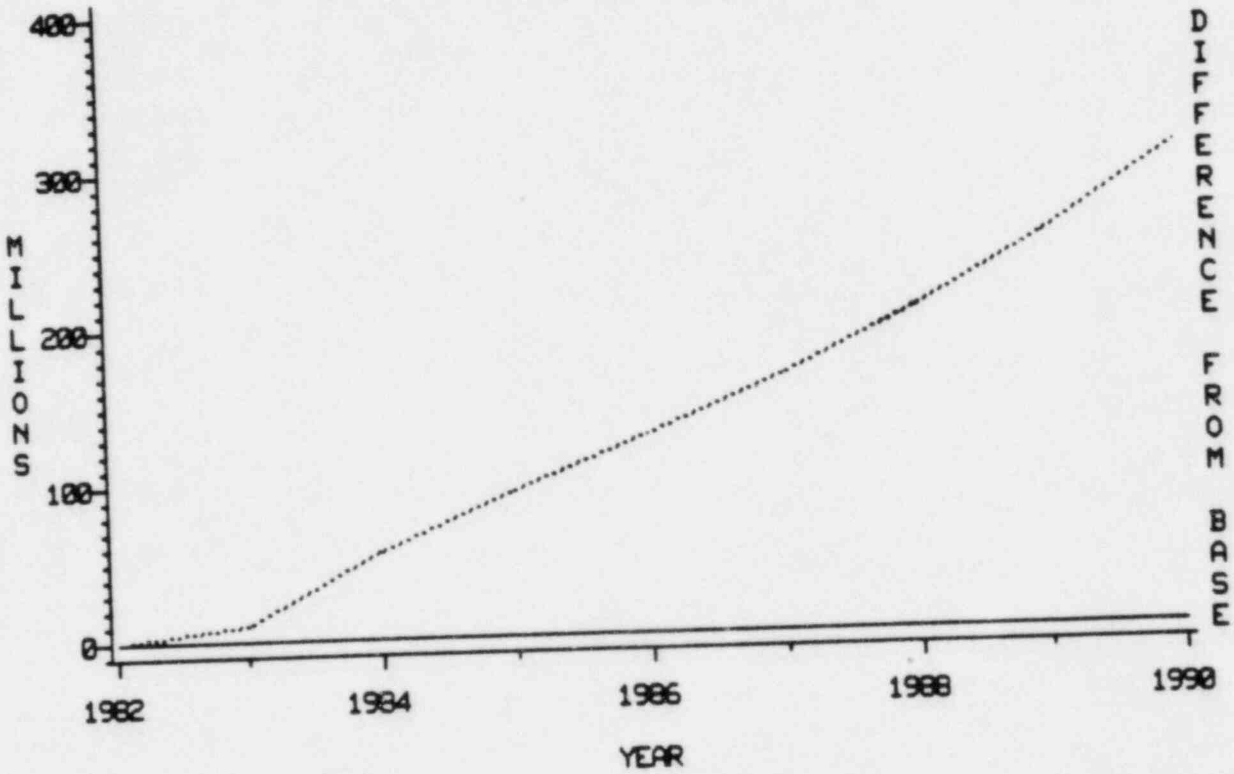
..... REPLACE STEAM GENERATORS 1983

_._ RESLEEVE ALL IN 1984 WITH INSPECTIONS

STEAM GENERATOR REPLACEMENT OR RESLEEVING
DIFFERENCE IN
DISCOUNTED ACCUMULATED REVENUE REQUIREMENTS

OBS	YEAR	PRESENT	REPLACE	DIFF	RESLEEVE	DIFF
1	1982	1201418	1201266	-0.15	1201277	-0.14
2	1983	2406869	2415937	9.07	2403063	-3.81
3	1984	3580387	3592071	11.68	3608917	28.53
4	1985	4714511	4720518	6.01	4735238	20.73
5	1986	5815152	5814755	-0.40	5827556	12.40
6	1987	6881550	6873098	-8.45	6885347	3.80
7	1988	7907780	7890015	-17.76	7901401	-6.38
8	1989	8900707	8871487	-29.22	8882480	-18.23
9	1990	9873349	9829823	-43.53	9840849	-32.50
10	1991	10838431	10776976	-61.45	10788644	-49.79
11	1992	11807982	11723874	-84.11	11736782	-71.20
12	1993	12762931	12655309	-107.62	12669748	-93.18
13	1994	13701506	13568488	-133.02	13584764	-116.74
14	1995	14624658	14466228	-158.43	14483948	-140.71
15	1996	15541250	15357074	-184.18	15376322	-164.93
16	1997	16450733	16239863	-210.87	16261108	-189.63
17	1998	17338075	17094626	-243.45	17117005	-221.07
18	1999	18244744	17967991	-276.75	17992698	-252.05
19	2000	19139248	18829225	-310.02	18855711	-283.54
20	2001	19996119	19658926	-337.19	19686875	-309.24
21	2002	20841135	20475679	-365.46	20505007	-336.13
22	2003	21666387	21276184	-390.20	21307224	-359.16

POINT BEACH STEAM GENERATOR REPLACEMENT
RETIRE POINT BEACH UNIT 1 EARLY (1/84)
DIFFERENCE IN
DISCOUNTED ACCUMULATED REVENUE REQUIREMENTS



______CASE 1 - PRESENT OPERATION - NO STEAM GENEARTOR
(BASE CASE) REPLACEMENT

......CASE 2 - RETIRE POINT BEACH UNIT 1 (1/84)

POINT BEACH STEAM GENERATOR REPLACEMENT
RETIRE POINT BEACH UNIT 1 EARLY (1/84)
DIFFERENCE IN
DISCOUNTED ACCUMULATED REVENUE REQUIREMENTS

OBS	YEAR	PRESENT	RETIRE	DIFF.(MILLIONS)
1	1982	1201418	1201266	-0.152
2	1983	2406869	2416438	9.569
3	1984	3580387	3635556	55.169
4	1985	4714511	4806998	92.487
5	1986	5815152	5941846	126.694
6	1987	6881550	7045048	163.498
7	1988	7907780	8111550	203.770
8	1989	8900707	9150517	249.810
9	1990	9873349	10179376	306.027