

UNITED STATES OF AMERICA
BEFORE THE NUCLEAR REGULATORY COMMISSION

POINT BEACH NUCLEAR PLANT UNIT 1
DOCKET NO. 50-266

RESPONSE OF PETITIONER WISCONSIN'S ENVIRONMENTAL DECADE
TO NOVEMBER 23, 1979 LETTER OF APPLICANT WISCONSIN ELECTRIC POWER COMPANY

(Steam Generator Tube Degradation Matter)

This filing is respectfully submitted by Petitioner Wisconsin's Environmental Decade, Inc. (hereinafter referred to as "Decade"), in response to the letter of Applicant Wisconsin Electric Power Company (hereinafter referred to as "Wisconsin Electric") dated November 23, 1979, in the matter of steam generator tube degradation at Point Beach Nuclear Plant Unit 1 (hereinafter referred to as "Point Beach 1"), in accordance with the schedule established for such filings.

The response is supplemental to the earlier Petition of Wisconsin's Environmental Decade, Inc., dated November 14, 1979, in the above-referenced docket, and the Petition should be read in conjunction with this response.

I. INTRODUCTION

Simply put, notwithstanding an undisputedly serious safety problem at Point Beach 1, Wisconsin Electric is requesting to reopen the plant (which is presently down for refueling) and resolve these concerns at some later date. We, on the other hand, urge the Nuclear Regulatory Commission (hereinafter referred to as the "Commission") to require that the concerns be resolved first, before the unit is returned to service.

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Although the seriousness of the underlying circumstances are not in dispute, there is a difference of opinion as to the extent to which the safety of the plant is compromised by those circumstances. And, in the very abbreviated investigation that has occurred to date without a written record, it will be impossible for the Commission to definitively resolve that difference of opinion so as to be confident that the plant will operate safely if it is brought back to criticality prior to correcting the problem.

We will, in the second portion of the argument of this response summarize the reasons why we believe that the only prudent course is to conclude that, on the basis of the existing information available, safe operation cannot be assured in the event of a steam line break resulting from external causes. But, before doing that, in the first portion of the argument, we will provide a readily understandable basis for weighing the competing concerns that significantly reduces the need for any kind of conclusive confidence in choosing between the competing statements of the magnitude of the safety risks--and, at the same time militates for keeping the plant down until the problem is rectified.

II. ARGUMENT

- A. ANY ECONOMIC GAIN FROM CONTINUED OPERATION PRIOR TO CORRECTING THE PROBLEM IS SO SMALL AS TO BE OUTWEIGHED BY ANY ESTIMATE OF THE RISKS FROM DOING SO.

No one disputes that the rate of tube degradation at Point Beach 1 is the worst of any other commercial reactor in the country. In response to a question during the November 20, 1979, meeting with Commission staff, Mr. Burstein for the utility answered as follows, according to our notes:

"Q Is the rate of degradation at Point Beach 1 greater in 1979 than any other nuclear plant?"

"A To my knowledge, it is."

From this, no one disputes that in the near future some kind of drastic remedy along the lines of generator replacement will have to be implemented. In prepared testimony submitted by Wisconsin Electric to the Public Service Commission of Wisconsin ("Wisconsin Commission") in its docket 6630-UI-2, Mr. Frieling states as follows:

"Q Do you believe that repair or replacement of the steam generators in Units 1 and 2 will eventually be necessary and, if so, when?

"A Based upon our recent experience with Unit 1 steam generators, we expect that replacement is a distinct possibility and may be highly probable, Unit 2 steam generators have experienced only minor numbers of plugged tubes and have no indication of the intergranular corrosion in the tubesheet crevice which has been observed in Unit 1. Thus, replacement of Unit 2 steam generators is not being considered at this time. Should Unit 2 experience show patterns of tube degradation warranting repair or replacement, consideration would, of course, be given to these programs.

It is reasonable to expect that more Unit 1 tubes will have to be plugged. The schedule for replacement of the Unit 1 steam generators is determined primarily by the time to procure new lower sections of steam generators which is in the order of two or three years. Thus, the most likely time for beginning the replacement outage is the fall of 1981." (See: Id., at 23.)

Thus, it should be clear that there is no question before the Commission of whether drastic corrective measures should be taken. By the licensee's own testimony, the only question is when this ought to be done.

And therefore, the real issue for the Commission is whether, in view of the safety questions that have been raised, continued operation prior to generator replacement (or other appropriate corrective action) should be permitted solely for the cost savings to the utility from running its own base load plant for one and one-half years instead of relying upon replacement power in that short period of time.

Although we would dispute the relevance of cost considerations to the decision here, let us, nonetheless, briefly examine this matter of cost savings because it obviates the necessity of unraveling the safety controversy.

At the outset, we would reiterate the fact previously established that there are ample supplies of energy in the region eliminating any possible concern about power shortages were Point Beach 1 not to reopen until the problem is solved. (See: Petition, paragraph nos. 26-39). This fact has not been denied by the utility whatsoever, Cost, not availability, is at issue.

As to cost, without access to more detailed information from the utility, a precise calculation is impossible, but a "ball-park" estimate is ascertainable from publicly available documents. In summary as shown below, the actual cost of shutdown is not significant.

Wisconsin Electric considers the fuel cost from Point Beach in 1980 to be approximately 5.1 mills per kilowatt-hour. (See: Supplemental Information of Wisconsin Electric, Re Advance Plan Proceeding, PSCW Docket 05-EP-2, at Vol. 1, Table 3.61) From the record of the prior Wisconsin Commission advance plant proceeding, we would estimate that this cost understates the actual cost of waste disposal by at least 1 mill per kilowatt hour, bringing the actual fuel cost to 6.1 mills per kilowatt-hour. (See: Re Advance Plan Proceeding, PSCW, Docket 05-EP-1, at Tr. 13,019).

But, even this fuel cost is predicated upon maintaining a very high capacity factor of 85% on an annual basis, and the cost will be increased with lower capacity factors. The utility is now projecting reduced operating levels as generation at 33% of capacity when operating (see: Wisconsin Electric November 23, 1979, letter, at Enclosure 4, Table 1), and an 8% increase in the forced outage rate (see: Wisconsin Electric Prepared Testimony of David K. Porter, et al, Re Point Beach Investigation, PSCW Docket 6630-UI-2, at Attachment Q27) in the period prior to generator replacement. Combined with normal scheduled outages and partial forced outages, this implies an annual capacity factor of in the lower 60% range. (See: Supplemental Information, op. cit., at Vol. 1, Table 3.61)

If the plant is producing less energy than otherwise anticipated (and thus

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burning less of the enriched uranium in the core), at the time of refueling when one region is replaced, less of the nuclear fuel will have been consumed. It will have to be discarded unused, at a significant increase in cost. This is the concept referred to as burn-up rates. Unfortunately, it cannot readily be avoided by delaying refueling because new assemblies are ordered in advance based upon normal, not abnormal, operation, and the carrying charges on new fuel sitting waiting on site for a postponed refueling are prohibitive. (See: PSCW Docket 05-EP-1, op. cit., at Tr. 3,133.)

Burn-up rates at Point Beach 1 in the past (before the exacerbation of tube degradation when capacity factors over 85% were common) approximated 33,000 MWD_T. (See: PSCW Docket 05-EP-1, op. cit., at Tr. 3,132, 4524, and 4582). However, the industry wide average (which has a life time capacity factor of approximately 60%) has been only 21,000 MWD_T. (See: Id., at 3,132.) It appears reasonable to use the industry wide average as a proxy for Point Beach 1 operating at 60% capacity factor. This would imply an additional 4 mills per kilowatt-hour (See: PSCW Docket 05-EP-1, op. cit., at Exhibit 186), raising the total fuel cost to 10.1 mills per kilowatt-hour.

The reduced operational level when on line will also reduce the efficiency which the burned uranium is converted to electricity because the facility is only designed for optimal efficiency at full output. This concept is called heat rate. An approximate drop of 100 Btu/kWh can be expected at 83% operation. (See: Supplemental Information, op. cit., at Vol. 1 Table 3.61) This converts to one-tenth of a mill. Although no concrete numbers exist, it is probably reasonable to expect that operation and maintenance costs will also significantly increase, which combined with the decline in heat rate may total 1 mill, raising the final tally to 11.1 mills per kilowatt-hour.

In order to calculate any cost savings from continued operation of the plant, to the average price of replacement power to fill in for the unit's output should

it be shut down. A reasonable proxy for the cost of replacement power until more information is received might be the most expensive coal unit in the system, which is the Valley Plant with a fuel cost of 18.4 mills per kilowatt-hour. (See: Supplemental Information, op. cit., at Vol. 1, Table 3.61) The differential fuel cost for replacement power, then, would be 7.3 mills per kilowatt-hour, which, multiplied by the 2.6 GWH which the utility proposes to produce from Point Beach 1 at reduced levels of 60% capacity factor, is \$19.1 million. The discounted value for the first half of the second year of replacement power before shutting down to replace the generator would be \$8.5 million, for a total incremental cost of keeping the plant down until repairs are accomplished for one and one-half years of \$27.6 million. This relates to the approximately \$1.1 billion in revenues that the Company projects collecting during the period, or 2½% of the total picture. (See: Re Wisconsin Electric Power Company, PSCW Docket, 6630-ER-10, at Exhibit JPC-1.)

All this, however, is just the beginning of a complete analysis. For, in order to continue operating until the generator is replaced, Wisconsin Electric has acknowledged that it will have to significantly modify the design basis for the plant. (See: Wisconsin Electric, November 23, 1979, at Enclosures 4 and 5.) Whenever the operational parameters deviate significantly from the plant's design basis, there are necessarily going to be unintended, adverse side effects. There are undoubtedly going to be increased costs for keeping Point Beach in operation, in both the short and long term, beyond those normally experienced, and apart from those described above.

Illustrative examples for which there is no record support as yet are the change in pressure and temperature in the primary system which may cause more moisture in the steam, and corrosion in the secondary side of the plant, especially in the turbines. Frequent shutting down and reopening, as is proposed to check for tube degradation more frequently, will exacerbate stress on the plant, such as in the feedwater nozzle. Operation with frequent primary to secondary leakage

will require more frequent blowdowns and large amounts of radioactive boiler water to dispose of.

Whatever the actual incremental replacement cost for shut down, as opposed to reduced operation, until generator repair--whether it is the \$27.6 million we suggest or even double that amount--the economic costs resulting from these side effects could easily wipe out any savings from continued operation.

To conclude this segment, it is clear that there is no issue of whether a major overhaul in the generator will be required in the very near future. The only question is whether the plant should be permitted to continue operating at reduced levels until then, and whether the safety risks attendant upon continued operation outweigh the extremely slight economicies, if there are any, from doing so.

B. THERE ARE SIGNIFICANT SAFETY CONCERNS ATTENDANT UPON CONTINUED OPERATION.

Before getting into the meat of the safety issue, any person concerned with potential risks from continued operation must confront the repeated assurances by the vendor and licensee. Based upon the following brief chronology, we would submit that Westinghouse and Wisconsin Electric have an insufficient basis to conclude that continued operation "would not compromise public health and safety."

1965. At the time of initial licensing, Mr. Burstein for the utility has acknowledged: "No, I did not anticipate that (the tube thinning and denting problems) would develop. * * *. (See: PSCW Docket 05-EP-1, op. cit., at Tr. 3,796.)

1970. At the time commercial operation commenced, Westinghouse recommended a phosphate chemistry in the secondary water to control corrosion and prevent boiler scale. (See: Letter, op. cit., at E1-1).

1972. Upon experiencing primary-to-secondary leakage and tube thinning, phosphate concentrations were initially increased based upon Westinghouse's recommendation. (See: Id.)

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1973. Finally, Westinghouse recognized that the phosphate treatment, originally intended to control corrosion, was a prime candidate as the cause of accelerating tube degradation and recommended changing to an all-volatile treatment. (See: Id., at E1-2)

1974. Wisconsin Electric concluded that the change to AVT could be accomplished on-line without shutting down in order to save money, only to later find that the intended phosphate removal was not accomplished. (See: Id.)

1975. Excessive continuation of tube degradation, including a major tube rupture in February 1975 involving a primary-to-secondary leakage of 125 gpm, were traced to residual phosphates that would have been removed had the changeover to AVT been done by shutting the plant down, accompanied by a soak and lancing before restarting. (Note: This was brought out during the November 20, 1979, Meeting between Commission staff, ourselves and Westinghouse.)

1979. Mr. Burstein informs a legislative investigative committee in May that the progression of tube degradation is "minimal, if not completely arrested." (See: Statement of Sol Burstein Before Wisconsin Senate Subcommittee on Utilities, dated May 1, 1979, at 4.)

1979. Three months later in August major tube degradation occurs with 99 tubes requiring plugging. (See: Letter, op. cit., at Enclosure 2, Viewgraph 1.)

1979. Two months later in October major tube degradation continues with 142 tubes requiring plugging. (See: Id.)

Not only does this kind of abysmal track record cast a cloud over the validity of their claims at any point in time, it, in conjunction with matters discussed below, raises the distinct impression that the licensee and vendor are seeing the world through rose-colored glasses. It appears that at every turn, when several possible explanations for a problem exist, they automatically choose the one with the least adverse implications, without any assessment of the relative probabilities

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attached to each of the possible choices. WE, as well as the Commission, have long relied upon their judgment being exercised with the proper degree of caution necessary to operate a nuclear reactor. This reliance is no longer appropriate. It is in this light that the safety questions must be considered.

One of the major postulated accidents arising from tube degradation is the question of steam binding reducing reflood rates to unacceptable levels following rupture of degraded tubes in the course of a loss of coolant accident. This is the position of the American Physical Society which led them to consider the degradation to be a "serious problem." (See: Petition, paragraph no. 23.) Of course, there may exist other possible scenarios leading to a core melt due to tube degradation that have not yet been postulated.

The Commission staff has stated:

"Tests have shown that dented tubes with small through-wall cracks near the support plate have adequate margins against tube burst or collapse under normal operation, transients, and postulated accidents. Severe S(tress) C(orrosion) C(racking) could, however, reduce the margins to an unacceptable level." (See: Eisenhut, et al., Summary of Operating Experience with Recirculating Steam Generators, NUREG-0523, January 1979, at 33.

As previously indicated in the Petition and in this response, the rate of stress corrosion at Point Beach 1 is the worst of any reactor in the country. (See: Petition, at paragraph nos. 8 to 9).

Wisconsin Electric has submitted a revised ECCS analysis using 18% of the tubes plugged instead of 10%. (See: Wisconsin Electric November 19, 1979, letter to H. Denton.) However, it appears from the document that the postulated double-ended pipe break occurrence is premised upon no new tubes rupturing during the LOCA, and is limited to consideration of such things as adequate removal of residual heat from the core with 18% of the tubes plugged and not carrying water.

During the November 20, 1979, meeting, Mr. Burstein was asked whether he accepted the validity of the American Physical Society's concerns for tube degradation above the tube sheet. He responded: "I don't know." (Note: This is taken from our notes of the meeting.)

Wisconsin Electric's justification for arguing that there is no safety concern is primarily based upon the recent experience of tube degradation at Point Beach being located below the tube sheet where the constraining effect of the sheet may retard leakage. (See: Wisconsin Electric November 23, 1979, Letter, at 7.) Other secondary defenses relate to purported improvements in identifying incipient failures, characteristics of rupture, and reassuring results of stress tests above the tube sheet. (See: Id., at 5-7.)

Unfortunately, insufficient time and the absence of a written record makes a complete response to the utility's assurances impossible. Even a brief evaluation, however, indicates that the assurances are not adequate to be confident of safety with continued operation.

As indicated above, the licensee's track record concerning tube degradation has been extremely poor and leads to the conclusion that it is groping in the dark.

Specifically, as it relates to the primary justification that the tube degradation is within the tube sheet, we pointed out previously that a significant proportion of the crevice stress corrosion is occurring at or near the top surface of the tube sheet with sufficiently large cracks to extend above the constraining tube sheet. (See: Petition, at paragraph no. 20) A break below the tube sheet but within .15 inches of the top may result in the tube being pulled out during a steam line break. (See: Letter, op. cit., at Enclosure 3, Viewgraph no. 22).

Moreover, the very measures intended to enable continued operation at reduced levels to occur may be responsible for shifting the tube degradation above the tube sheet. At the November 20, 1979, Meeting, Wisconsin Electric stated in response to a question that the height of the sludge at the bottom of the steam generator is presently "increasing from 6 to 8 inches." (Note: This is taken from our notes of the November 20, 1979, meeting.) Inasmuch as the continued accumulation of sludge

follows conversion from phosphate to AVT and other corrective measures, it would appear that the additional sludge is being caused by hideout return. Continued and frequent shutting down and reopening to check for tube degradation will tend to increase that hideout return, and also, sludge accumulation at the bottom of the generator but above the tube sheet. A past record of poor condenser water leakage control, combined with the termination of the phosphate treatment which removes many of the solids and which is part of the justification for continued operation, may lead to increased corrosive agents in the accumulating sludge.

In essence, the past unpredictable nature of tube degradation at the plant and the possible unintended adverse side effects from new measures intended to minimize other elements of the corrosion equation can lead to no confidence that future corrosion will be confined to the tube sheet.

As to the improvements in tube testing, here, too, the new pallatives to enable continued operation may make such promises impossible to achieve, and, indeed, may result in a decrease in the quality of predicting tube failures. Time does not permit a detailed recitation, but suffice it to say that the past history of defect identification has been plagued by mistaken plugging of the wrong tubes and significant failure of eddy current tests to produce accurate results. Improvements based upon an assumption of using more experienced personnel ignore the fact that all of the increased inspection of the steam generator is going to use up the maximum radiation dose of all the experienced workers. Obviously, greater reliance is going to have to fall upon less well trained employees as the best people burn out. This may be expected to result in less predictive quality for incipient failures.

As to the assertion that cracks at Point Beach 1 are characterized by a slow leak before complete rupture, that claim is belied by the February 1975 tube failure in which a sudden 125 gpm primary-to-secondary leak rate suddenly erupted.

As to the reassurances from the stress tests for the portion of the tube above the tube sheet, this is based upon a test of just three tubes using static tests

in the laboratory that have no necessary correlation with the dynamic stresses that will occur in the generator. These tests also have no application to the extent that future tube degradation moves or extends above the tube sheet.

III. CONCLUSION

For the foregoing reasons, we respectfully urge the Commission to commence an adjudicatory hearing to investigate the safety problems resultant from the severe steam generator tube degradation problems currently experienced at Point Beach 1, and to order the utility to continue not to reopen the plant until resolution of the safety problem occurs.

Dated this 26th day of November, 1979, at Madison, Wisconsin.

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