UNITED STATES OF AMERICA

BEFORE THE NUCLEAR REGULATORY COMMISSION

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

PETITION OF WISCONSIN'S ENVIRONMENTAL DECADE, INC.

I. INTRODUCTION

1. This Petition to the U. S. Nuclear Regulatory Commission (hereinafter referred to as the "Commission") by Wisconsin's Environmental Decade, Inc. (hereinafter referred to as the "Decade"), seeks immediate entry of an order to show cause and order enjoining Wisconsin Electric Power Company (hereinafter referred to as "Wisconsin Electric"), operating licensee of the Point Beach Nuclear Plant Unit 1 (hereinafter referred to as "Point Beach"), from re-opening said facility at the end of its present refueling cycle, to be temporarily effective pending further order determining that the limiting conditions for operation as pertain to steam generator tubes have been met and that the potential safety consequences of steam generator tube degradation have been reviewed and the applicable regulatory guides and technical specifications revised accordingly to protect the public health and safety.

II. THE PETITIONER

1434 122

2. Petitioner Decade is a non-stock, not-for-profit Wisconsin corporation organized under ch. 181 of the Wisconsin Statutes, with offices at 114 East Mifflin Street in Madison, Wisconsin 53703, for the primary purpose of protecting and

enhancing the quality of the human and natural environment, including protection against undue risks posed by power production facilities. The Decade has approximately 700 members residing within and outside the State of Wisconsin, including members residing in the immediate vicinity of Point Beach. The Decade has become increasingly concerned as to the continued operation of the facility in the face of mounting evidence that Wisconsin Electric is placing economic and political considerations before safety considerations in its decisions and judgments relating to the plant's tube degradation problem.

III. PERSON UPON WHOM SERVICE MAY BE MADE

3. The person upon whom service may be made is Ms. Kathleen M. Falk, General Counsel, Wisconsin's Environmental Decade, Inc., 114 East Mifflin Street in Madison, Wisconsin 53703.

IV. JURISDICTION

4. This Petition is brought before the Commission pursuant to 42 U.S.C. secs. 2233(d), 2236(a) and 2237, 10 C.F.R. secs. 2.204, 2.206(c)(1) and 50.36(c)(2) and the inherent supervisory authority of the Commission to oversee all aspects of the nuclear regulation and licensing process.

5. The Decade has made no prior request for a notice of violation or order to show cause to the Director of Inspection and Enforcement pursuant to 10 C.F.R. sec. 2.206 because: (1) the Staff of the Commission is already fully aware of the violations set forth below and has determined, meeting in informal session with the licensee and the reactor vendor Westinghouse Electric Corporation, to take no action(see: Memorandum of L. Smith to the File of the Public Service Commission of Wisconsin, dated November 7, 1979, at 3, which is attached hereto as Appendix A); (2) the time consumed in first processing a request to the Staff of the Commission before appealing to the Commission would preclude the availability of relief in view of the licensee's present stated intention to return the facility to service on November 17, 1979(see: Id., at 3); and (3) the Commission possesses

inherent authority, even in the absense of express regulatory procedures, to oversee the enforcement of its regulations, especially under circumstances as stated herein and below(see: In the Matter of U.S. Energy Research and Development Administration, CLI-76-13, In the Matter of Consumers Power Company, CLI-73-38, In the Matter of Public Service Company of New Hampshire, CLI-77-8, In the Matter of Consolidated Edison Company, CLI-75-8).

V. THE FACTS

A. Point Beach Tube Degradation

6. Point Beach has been observed to experience steam generator tube degradation due to caustic stress corrosion and denting since April, 1971. (See:Wisconsin Electric Current Report to the Securities & Exchange Commission, Form 8-K, dated October 25, 1979, at 2; Wisconsin Electric Steam Generator Operating History Questionaire to the Nuclear Regulatory Commission, dated August 18, 1978; and Eisenhut, et al., Summary of Operating Experience with Recirculating Steam Generators, Nuclear Regulatory Commission(NUREG-0523), January 1979, at 14.)

7. Wisconsin Electric has undertaken all known and accepted measures to minimize such corrosive effects in the steam generator tubes including changing from a phosphate to an all-volatile treatment, monitoring of condenser leakage and repairs as soon as practicable, a program for removal of accumulated corrosion and modifications to the steam generators to improve recirculation of water and removal of impurities. (See: Statement of S. Burstein on behalf of Wisconsin Electric before the Wisconsin Senate Subcommittee on Utilities, May 1, 1979, at 3 to 4; and Eisenhut, op. cit., at 46 to 47.)

8. The frequency distribution pattern of tube ruptures and tube defects

which have required tube plugging at Point Beach since commencing commercial operation in 1970 indicates a significant amount of corrosion occurring in the period 1971 to 1975, followed by a time of apparent subsidence in the period 1976 to 1978, returning to an even more significant level of corrosion and denting in 1979. Exhibit 1, which is attached hereto and incorporated herein by reference as if set forth in full, shows a tabulation of the number of tubes plugged by date of plugging.

9. The steam generator tube rupture that occurred on August 29, 1979, at Point Beach (see: Wisconsin Electric Licensee Event Report, No. 79-013/01T-0, dated August 31, 1979) followed by less than one month an inspection by eddy current testing of all tubes in the portion of the steam generator where corrosion is being experienced (see: Wisconsin Electric Licensee Event Report, No. 79-012/01T-0, dated August 15, 1979).

10. The 140 tubes that required plugging or removal during the October 15, 1979, refueling at Point Beach (see: Smith Memorandum, op. cit., at 4) followed by less than two months the aforementioned inspection of all tubes.

11. There are 3260 tubes in "A" Generator and another 3260 tubes in "B" Generator in Point Beach. (See: Operating History Questionaire, op. cit., at 1.)

12. The total number of steam generator tubes at Point Beach reported by Wisconsin Electric to be plugged to date in "A" Generator number 326, or exactly 10% of the total, and in "B" Generator, 316, or 9.69% of the total. (See: Smith Memorandum, op. cit., at 5; Current Report, op. cit., 3.)

13. The limiting condition for operation of Point Beach as it pertains to steam generator tubes is a maximum of 10% of the tubes plugged. (See: Letter from A. Schwencer, Chief Operating Reactors Branch 1 to S. Burstein, Executive

Vice-President Wisconsin Electric, NRC Docket Nos. 50-266/301, dated June 4, 1979.)

13m. Wisconsin Electric reported to the Commission Staff as follows in regard to the adequacy of present testing procedures for detecting defective steam generator tubes:

> " * * * Sample sections were taken (during the October 15, 1979, refueling) from one bad tube (89% indicated defect but not leaking) from the problem region, from one good tube (no eddy current indication) from the problem region, and from one good tube (no eddy current indication) from the good region around the periphery of the tube sheet.
>
> "Examination of all of the three removed tubes showed intergranular stress corrosion attack in the crevice region within the tube sheet (see attached figure). The major portion of the tubes above the tube sheet were reported to be in generally good condition. The type of corrosion is not unique or unexpected and is believed to be caustic assisted corrosion associated with the use of phosphate secondary water treatment and the buildup of sludge and corrosion products in this small crevice area between the tube and the tube sheet on the secondary side. Photomicrographs of the tube wall cross-section in this area show general corrosion deterioration in the outer surface with sharper circumferential stress corrosion cracks penetrating deeper through the wall cross-section. The most severe defect found in the section of bad tube which indicated an 89% defect on eddy current test showed a general intergranular corrosion cracking approximately 20 mils (.020 inches) deep and the deepest stress crack penetration of approximately another 20 mils. The total through wall penetration of the crack, therefore, was 40 mils or approximately 80% through the tube wall which has an original thickness of 50 mils. These specific measurements must be qualified somewhat in that this tube broke during the pulling operation required to remove it for testing. Also, considerable amount of pulling stress in tension was placed on the tube during removal and may have increased the crack depth from its actual undisturbed condition.
>
> "The second tube sample was from a tube which was indicated to be good (no eddy current indication) but located in the problem area. Again, examination showed generalized corrosion attack of the outside tube surface in the tube sheet crevice region. A photomicrograph of the tube wall cross-section showed general corrosive deterioration approximately 5 mils deep with the deepest of the stress corrosion cracks penetrating approximately an additional 20 mils deep for a total of 25 mils or 50% of the original tube wall thickness.
>
> "Sections of the third tube removed were from a good tube (no eddy current indication) from the peripheral region where no problems have been experienced. Examination also showed where no problems have been experienced. Examination also showed the same generalized corrosion attack of the outside surface throughout the tube sheet crevice region. The generalized corrosion deterioration was approximately 5 mils deep with the deepest stress crack extending approximately another 15 mils deep for a total through-wall penetration of 20 mils, or 40%." (See: Smith Memorandum, op. cit., at 6 to 8.)

This raises the clear implication that more tubes at Point Beach require plugging right now under the terms of Regulatory Guide 1.121 than are in fact presently plugged.

14. Point Beach is presently shut down for refueling and Wisconsin Electric intends to return the unit to service on or about November 17, 1979. (See: Smith Memorandum, op. cit., at 3.)

15. "A" Generator at Point Beach, in its shut-down state, is presently at its limiting condition for operation of its steam generator tubes, to the extent all tubes required to be plugged have in fact been plugged. (See: Paragraph nos. 11, 12, 13 and 13m, supra.) To the extent they have not, the unit is presently exceeding its limiting condition for operation of steam generator tubes.

16. If Point Beach is returned to service in its present condition, the experience of the recent past compels the conclusion that there will be tube ruptures and further degradation immediately, and continuing thereafter which will result in operation far exceeding its limiting condition for operation of its steam generator tubes. (See: Paragraph nos. 8, 9 and 10, supra.)

17. The experience of extensive tube degradation in late August and in October, 1979, shortly following the inspection of all tubes(see: Paragraph nos. 9 and 10, supra), raises the clear implication that the procedures for inspecting and plugging degraded tubes(see: Commission Regulatory Guide 1.121, Bases for Plugging Degraded PWR Steam Generator Tubes") are inadequate to provide the second stated basis of continued operation proposed by the Commission Staff "that the great majority of degraded tubes will be identified and removed from service before leakage develops(see: Eisenhut, op. cit., at 46).

18. The experience of extensive tube degradation in late August and in October, 1979, shortly following an inspection of all tubes, raises the additional clear implication that either or both the eddy current testing procedure is inadequate and/or the rate of degradation is significantly accelerating.

19. Point Beach's experience with tube degradation in 1979 in which approximately 250 tubes had to be plugged compared to 401 tubes over the prior

nine years, after the licensee had previously undertaken all known and accepted measures to minimize corrosive effects(see: Paragraph no. 7, supra), raises the clear implication that the "additional measures" for minimizing corrosion relied upon by the Commission Staff are inadequate to provide as the third stated basis of continued operation proposed by Staff that "the potential for tube degradation during operation is minimized"(see: Eisenhut, op. cit., at 46).

20. The tube rupture that occurred on February 26, 1975, at Point Beach was in the region of the tube plate, yet that did not serve to prevent the primary-to-secondary leakage from reaching a maximum rate of 125 gallons per minute. (See: Wisconsin Electric Operation Report No. 10, January 1, 1975 Through June 30, 1975, at 58; and Commission Report to the Congress on Abnormal Occurrences, June 1975, at A-1.) This raises the clear implication that reliance on "cracks" being "constrained by the support plates" is inadequate to provide the fourth stated basis of continued operation proposed by Commission Staff to prevent the situation from becoming "unstable during postulated accidents". (See: Eisenhut, op. cit., at 46.) Although more recent experience at the plant has indicated a tendency for corrosive effects to have moved to concentrate in the region of the tube sheet(see: Licensee Event Report of August 15, 1979, op. cit.), that locational shift was not predicted, and more importantly, much of that degradation in the area is occurring toward the very top of the sheet(see: Id.) An analysis of the August 15 Licensee Event Report, which is the only publicly available document providing complete locational data, indicates that in "A" Generator, 34.6% of the tube degradation found was within 2 inches of the top of the tube sheet and 15.4% of the defects were 2 or more inches in extent. In "B" Generator, 15.6% was within 2 inches of the top of the tube sheet and 28.9% were 2 or more inches in extent. (See: Id., at unnumbered attached exhibits.) This raises the additional clear implication that there is a significant probability that

impending tube failures at Point Beach will involve cracks extending above any constraining effect of the tube sheet some a proportion of the occurrences.

21. On October 25, 1979, the Public Service Commission of Wisconsin(hereinafter referred to as the "Wisconsin Commission") commenced an investigation to develop the pertinent facts relating to the financial, accounting and ratemaking effects of such steam generator tube degradation at Units 1 and 2 of the Point Beach Nuclear Plant. Hearings were scheduled therein for November 26 and 27, 1979 (See: Re Wisconsin Electric Power Company, PSCW Docket 6630-UI-2, Notice of Investigation and Hearing and Assessment of Costs, dated October 25, 1979.)

22. On October 31, 1979, the Milwaukee Journal published an editorial which stated in relevant part:

> "The announcement of Wisconsin Electric Power Company that it is considering spending $30 million to $40 million to alleviate problems with steam generator tubes at the Point Beach Nuclear Plant poses serious economic and safety questions. * * *
>
> "One big issue, which the utility should not be allowed to settle on its own, is whether Point Beach Unit 1 should be reopened after its current shutdown for refueling or kept out of service pending generator replacement. * * *
>
> " * * * *
>
> "The PSC has been reluctant to jump into the safety issues, since it may lack legal jurisdiction(nuclear plant safety being chiefly in the baliwick of the federal Nuclear Regulatory Commission). However, there seems to be no way to divorce the safety issue from nuclear plant economics, over which the PSC clearly does have jurisdiction.
>
> "So we hope the PSC examination will deal thoroughly with the safety questions as well. And if it does not, then certainly the NRC should, before Point Beach Unit 1 is returned to service." (See: "What Price Nuclear Safety?", Milwaukee Journal, October 31, 1979. Emphasis added.)

B. Steam Generator Tube Degradation Generally

23. The Lewis Committee of the American Physical Society reviewed the implications of, inter alia, steam generator tube degradation and, on the basis of that review, concluded in relevant part as follows:

1434 129

> "As a general observation, the LOCA derived energy sources are reasonably, or strongly, conservatively estimated. However the AC have excluded from consideration a heat source of potentially overwhelming importance to PWR--ruptured steam generator tubes. Based upon evidence of substantial tube corrosion problems with frequent associated leakage in

most PWR's * * *, it was the consensus of the group that steam generator tube failure during a severe LOCA could occur frequently. Moreover, it appears that rupture of a few tubes (on the order of one to ten) dumping secondary steam into the depressurized primary side of the reactor system could exacerbate steam binding problems and induce essentially uncoolable conditions in the course of a LOCA, for PWR's with ECCS of current design. * * *

" * * *

" * * *

"The second major problem with reflooding rate estimates is associated with the potential for steam generator tube leaks and ruptures. It has been stated that tube breaks with an area of only 0.003 ft. could reduce flooding rates of 17%. At the current low flooding rates predicted for PWR's, even a minor break of this sort might reduce the rates to values so low that the core would not be adequately cooled. Thus the potential for steam generator tube leakage appears to be a serious problem which was precluded from evaluation at the ECCS hearings. * * *" (See: Lewis, et al., "Report to the Americal Physical Society by the Study Group on Light-Water Reactor Safety," 47 Review of Modern Physics 1, Summer 1975, at App. 1, S85.)

24. The Commission Staff's statement of the issues as represented in the Eisenhut Report(see: Eisenhut, op. cit.) fails to either acknowledge or otherwise address the aforementioned "steam binding problems" that could "induce essentially uncoolable conditions in the course of a LOCA", as identified by the American Physical Society.

25. The Commission Staff's first and fifth stated bases for continued operation of plants with significant tube degradation, namely that "corrective action will be taken before any individual crack becomes unstable" and that "the radiological consequences of a (LOCA or MSLB) would not be severe", respectively, also does not take cognizance of the aforementioned findings of the American Physical Society. (See:Eisenhut, op. cit., at 46 to 47.)

C. Availability of Replacement Power for Point Beach

26. Point Beach has a design electric rating of 497 MW. (See: Commission Operating Units Status Report, September 1979.)

1434 130

27. Wisconsin Electric has reported that it has an actual useful capacity for Winter 1979 of 3892.0 MW. (See: MAIN Regional Reliability Council Coordinated Bulk Power Supply Program, April 1, 1979.)

28. Wisconsin Electric is part of a Wisconsin planning organization consisting of itself and three other Wisconsin electric utilities known as the Eastern Wisconsin Utilities(hereinafter referred to as "EWU"), which plan future additions to generating capacity together and which dispatch power, as approporiate, on a pool basis. (See: EWU 1978 Advance Plan to the Public Service Commission of Wisconsin, at iv.)

29. EWU has reported that it has an actual useful capacity for Winter 1979 of 7691.2 MW. (See: Supply Program, op. cit.)

30. EWU, in turn, is part of a larger regional planning organization known as the Mid-America Interpool Network(hereinafter referred to as "MAIN") with members in Illinois, Michigan and Wisconsin, to which the Company is interconnected through the transmission grid of the members over which power is exchanged. (See: Advance Plan, at 8-2.)

31. MAIN has reported that it will have a reserve capacity of 39.9% in Winter 1979, or 11,829MW above expected peak demands. (See: Supply Program, op. at p. 3A-2.)

32. Member utilities of MAIN are actively soliciting other utilities in the region to purchase power from their system due to the excess reserves being experienced. (See: Letter from H. Nexon, Senior Vice-President Commonwealth Edison to N. Ricci, Senior Vice-President Wisconsin Electric, dated January 4, 1979, a copy of which is hereto as Appendix B.)

33. Wisconsin Electric in March 1979 predicted a Winter 1979 peak demand of 3164 MW. (See: Advance Plan, op. cit., at Table 1.2.)

34. The Summer 1979 peak demand actually experienced by Wisconsin Electric was 10.7% less than was predicted in its aforementioned March 1979 forecast. (See:

Memorandum from L. Smith to File of Public Service Commission of Wisconsin, dated September 14, 1979, a copy of which is attached as Appendix C.) This raises the clear implication that the actual Winter 1979 demands for Wisconsin Electric will be significantly less than the aforementioned utility forecast indicates.

35. EWU in March 1979 predicted a Winter 1979 peak demand of 5841 MW. (See: Advance Plan, at Table 1.2.)

36. The Summer 1979 peak demand actually experienced by EWU was 6.0% less than was predicted in its aforementioned March 1979 forecast. (See:September 14 Smith Memorandum, op. cit.) This raises the clear implication that the actual Winter 1979 demands for EWU will be significantly less than the aforementioned utilities' forecast indicates.

37. Using the Wisconsin Electric March 1979 predicted Winter 1979 peak demand, the utility will have a 23.0% reserve margin with Point Beach in service and a 7.3% reserve margin with Point Beach out-of-service. (See: Paragraph nos. 26, 27 and 33, supra.)

38. Using the EWU March 1979 predicted Winter 1979 peak demand, the planning organization will have a 31.7% reserve margin with Point Beach in service and a 23.2% reserve margin with Point Beach out-of-service. (See: Paragraph nos. 26, 29 and 35, supra.)

39. The Wisconsin Commission has determined a reserve margin of 14% to 15% is adequate for planning purposes for EWU. (See: Re Advance Plan Proceeding, PSCW Docket 05-EP-1, Findings of Fact, Conclusions of Law and Order, August 17, 1978, at 29.)

VI. THE LAW

40. 10 C.F.R. secs. 2.201(c) and 2.202(f) state:

"When the Director, Office of Inspection and Enforcement, finds that the public health, safety, or interest so requires, or that the violation is willful, the notice of violation may be omitted and an order to show cause issued.

"When the Director of Nuclear Reactor Regulation, Director of Nuclear Material Safety and Safeguards, Director, Office of Inspection and Enforcement, as appropriate, finds that the public health, safety, or interest so requires or that the violation is willful, the order to show cause may provide, for stated reasons, that the proposed action be temporarily effective pending further order."

41. 10 C.F.R. sec. 50.36(c)(2) states in relevant part:

"Limiting conditions for operation are the lowest functional capability or performance levels of equip ment required for safe operation of the facility. When a limiting condition for operation of a nuclear reactor is not met, the licensee shall shut down the reactor or follow any remedial action permitted by the technical specifications until the condition can be met. * * *"

42. 10 C.F.R. ch. 50, app. A, subp. II, crit. 14, states:

"The reactor coolant pressure boundary shall be designed, fabricated, erected, and tested so as to have an extremely low probability of abnormal leakage, of rapidly propagating failure, and of gross rupture."

43. Regarding compliance with the foregoing regulations, the Atomic Safety and Licensing Appeal Board has stated in relevant part:

"Nor can they avoid compliance by arguing that, although an applicable regulation is not met, the public health and safety will still be protected. For, once a regulation is adopted, the standards it embodies represent the Commission's definition of what is required to protect the public health and safety." (See: In the Matter of Vermont Yankee Nuclear Power Corp., ALAB-138, RAI-73-7, 520, 528.)

VI CONTENTIONS

44. Resumed operation of Point Beach would be in violation of the limiting condition for operation of the facility. (See: Paragraph nos. 6 to 20, supra.)

45. Resumed operation of Point Beach would be a threat to the public health, safety and interest. (See: Paragraph no. 23, supra.)

1434 133

46. The Company intends to return Point Beach to service on or about November 17, 1979, notwithstanding the limiting condition and in willful violation of the Commission's regulations. (See: Paragraph no. 14, supra.)

47. Even if, arguendo, it were relevant to a question of safety, there exists more than ample sources of replacement power to substitute for any energy shortfall that might exist if Point Beach is keptout of service in the immediate future. (See: Paragraph nos. 26 to 39, supra.)

48. The Commission Staff's proposed basis for continued operation of nuclear reactors experiencing significant tube degradation are not supported by the facts. (See: Paragraph nos. 13m, 17, 18, 19, 20 and 25, supra.)

49. The Commission's existing regulations, technical guides and technical specifications pertaining to steam generator tubes are inadequate to protect the public health, safety and interest. (See: Paragraph nos. 6 to 20, and 23 to 25, supra.)

VIII. RELIEF

50. The Commission is respectfully requested to:

a. Immediately consider this Petition;

b. Find that resumed operation of Point Beach Nuclear Plant Unit 1 would be in violation of the limiting condition for operation of the facility;

c. Find that resumed operation of Point Beach Nuclear Plant Unit 1 would be a threat to the public health, safety and interest;

d. Issue to Wisconsin Electric Power Company an order to show cause with the aforesaid findings and a proposed order enjoining the company from resuming operation of Point Beach Nuclear Plant Unit 1;

e. Make the aforesaid proposed order temporarily effective pending further order;

1434 134

f. Commence an investigation and hearing on the safety implications of steam generator tube degradation taking cognizance of, inter alia, the previously cited conclusions of the American Physical Society, and, in order

to avoid duplication and to enable affected citizens (who cannot afford to travel to Washington) an opportunity to participate, conduct its hearings jointly with hearings presently scheduledby the Public Service Commission of Wisconsin in its docket 6630-UI-2 on the economic implications of steam generator tube degradation at Point Beach Nuclear Plant Units 1 and 2; and

g. Continue the aforesaid temporarily effective proposed order in effect until the foregoing investigation and hearing have been completed and the appropriate revisions to the regulations, guides and specifications made and implemented.

DATED at Madison, Wisconsin, this 14th day of November, 1979.

WISCONSIN'S ENVIRONMENTAL DECADE, INC.

By: Kathleen M. Falk
Kathleen M. Falk
General Counsel

P. O. Address:
114 East Mifflin Street
Madison, Wisconsin 53703
(608) 251-7020

CERTIFICATE OF SERVICE

I hereby certify that a true and correct copy of the foregoing Petition of Wisconsin's Environmental Decade, Inc., was this day served by depositing a copy in the first class mail upon Mr. Sol Burstein, Executive Vice-President, Wisconsin Electric Power Company, 231 W. Michigan Street, Milwaukee, Wisconsin 53202.

DATED at Madison, Wisconsin, this 14th day of November, 1979.

Kathleen M. Falk

Point Beach Nuclear Plant Unit 1
Docket 50-266
Petition of Wisconsin's Environmental Decade, Inc.

EXHIBIT 1

POINT BEACH NUCLEAR PLANT UNIT 1
Steam Generator Tube Plugging History

1979

Date	"A" Generator	"B" Generator	Total
10-72	101	92	193
4-74	1	1	2
2-75	59	98	157
8-75	6	4	10
10-77	11	4	15
10-78	7	4	11
3-79	8	1	9
8-79	52	45	97
8-79	1	1	2
10-79	75	65	140

Sources:
WEPCO Operating Reports Nos. 6, 8, 10 and 11.
WEPCO Licensee Event Reports No. 50-266/79-003 ff.
NRC I&E Inspection Reports No. 50-266/78-19 ff.
Atomic Energy Commission of Canada Ltd. No. 410.
PSCW Memorandum by L. Smith, dated November 7, 1979.

1434 136

Note:
The totals reflected on this exhibit are less than the totals presently reported for the number of tubes plugged as of this date, apparently due to the fact that not all plugging was reported in documents readily available to the public.

PUBLIC SERVICE COMMISSION OF WISCONSIN

DEPARTMENTAL CORRESPONDENCE

FILE NO.

November 7, 1979

Subject: Meeting Between Wisconsin Electric Power Company, Westinghouse Electric Corporation, and Nuclear Regulatory Commission Staff on the Steam Generator Problems at Unit 1 of the Point Beach Nuclear Generating Plant -- November 5, 1979

By: L. L. Smith

On November 5, 1979 I attended a meeting at the Nuclear Regulatory Commission's Bethesda's offices between representatives of Wisconsin Electric Power Company, Westinghouse Electric Corporation, and the NRC staff on the problem of steam generator tube degradation at Unit 1 of the Point Beach plant. A copy of the list of attendees is attached. In summary, the meeting consisted of the following presentations:

1. Wisconsin Electric Power Company reported on the general results of the steam generator tube inspections done during the current refueling outage and an update on the number of additional tubes requiring plugging and the accumulated total of plugged tubes in each of the two steam generators.

2. Westinghouse described the results of detailed physical examinations, metallurgical tests performed on three tube sections removed from steam generator "A" for the purpose of detailed analysis.

3. Westinghouse reported on the general results of its assessment of continued steam generator integrity in their present condition and presented results of verification analysis

that the various safety criteria involving steam generator tube integrity are still met.

4. Wisconsin Electric Power described a number of options under consideration for potential modifications to future operations to address this problem on a continuing basis.

Conclusions

1. Based primarily on the results of testing and reanalysis done by Westinghouse, it was concluded that the various steam generator parameters associated with tube integrity and performance still meet safety criteria and remain within limiting conditions for safe operation.

2. Based primarily on the review by Westinghouse and Wisconsin Electric of existing overall accident analyses, it was concluded that the safety analyses remain valid and are satisfied with the Unit 1 steam generators in their present condition, i.e., with approximately 10% of the tubes plugged. In other words, the original safety analyses done to satisfy NRC licensing requirements included an assumption of up to 10% of the steam generator tubes plugged and since no more than 10% will be plugged on completion of the current repairs, the existing analyses remain satisfied.

1434 138

3. Although there are a number of operational options under consideration to attempt to further arrest or mitigate continued tube degradation due to corrosion, it was agreed that upon completion of current plugging and other maintenance, Unit 1

can be safely started and operated at full power. The unit is presently scheduled to return to service on November 17 (previous schedule mentioned was November 10). No NRC action or approval is required.

4. It was my perception of the NRC staff's position that it is satisfied with the continued safe operation of Unit 1 in the near term. NRC staff at the meeting, however, expressed concern about the long-term outlook if the tube degradation experience continues. There are already NRC requirements covering the frequency of in-service inspections required based on sample testing of steam generator tubes in the current Point Beach Technical Specifications. Staff indicated that they would continue to watch this aspect of Point Beach operating experience closely in the future both from the specific standpoint of safe operation of Point Beach as well as the more generic steam generator tube problems in this and other similar plants.

The following are "minutes" prepared by me from my notes and recollections of the highlights of the more detailed discussions and follow the presentations outlined in the opening summary above. The meeting was chaired by Mr. Charles Trammell who is the NRC staff project manager from the Operating Reactors Branch who was assigned to the Point Beach Plant, and also by Mr. B. D. Liaw, who is NRC's staff expert on the steam generator corrosion problem. In effect, the meeting was conducted in a very open roundtable style with oral presentations and question

and answer exchanges. There were no formal or written presentations and I am not aware whether the NRC will prepare or distribute minutes of the meeting.

Wisconsin Electric Presentation on Current Status

Mr. Fay of the utility reported on the recent steam generator tube history from the August outage caused by a leaking tube which resulted in 100% inspection and plugging of 97 additional tubes. In preparation for the fall refueling outage, utility staff met with Westinghouse in September to plan strategy for tube inspections during the refueling outage scheduled for early October. At that time it was decided to do more than the required amount of inspection using the newly-developed multi-frequency eddy current technique. It was also decided at that time to remove sections from a few tubes in order to obtain specimens for further detailed physical examinations and metallurgical testing.

Mr. Frieling of the utility covered some of the earlier history of plant operations including the switch from phosphate to all volatile secondary water treatment at Unit 1 in September of 1974. The status of plugged tubes prior to the recent refueling outage from photo-verified counts was 251 tubes plugged in each of the two Unit 1 steam generators. For the October refueling outage, the utility originally scheduled 75 tubes for inspection by the multi-frequency eddy current method.

These were located in the area of the hot leg side where most of the problems have occurred previously. Out of the 75, 18 bad tubes were found; that is, the eddy current tests indicated defects greater than the 40% threshold where plugging would be required. Based on this failure rate (18 out of 75) it was decided to increase the sample inspected to 200 tubes, also concentrating in the region with the history of worst corrosion. Out of these 200 tubes, a total of 75 showed indications of defects in excess of the 40% threshold. As a result of this failure rate (75 out of 200) the inspection was increased to 100%, or all tubes were inspected. The results for steam generator "A" remained at 75 bad tubes which would be plugged. A similar procedure was followed with steam generator "B" and resulted in 65 additional tubes to be plugged. On completion of plugging operations, the accumulated totals will be 326 tubes plugged (exactly 10%) in steam generator "A" and 316 tubes plugged in steam generator "B".

The 75 additional tubes plugged in steam generator "A" as indicated above is really a combination of 73 defective tubes and two good tubes from which sections were removed for further analysis. Sections of three tubes were physically removed for further detailed examination and testing. Sample sections were taken from one bad tube (89% indicated defect but not leaking) from the problem region, from one good tube (no eddy current indication) from the problem region, and from one good tube

worsened by the pulling stress (between about 13,000 and 25,000 pounds) which was required to remove the sample sections from the tube sheet. It was indicated, for example, in one case where the section exhibited 10-13% elongation as a result of tensile stress from the pulling operation.

Westinghouse people described the nondestructive testing techniques used for tube inspection which for steam generator tubes is confined primarily to eddy current techniques using a probe into the interior of the tube from the bottom side of the tube sheet which is accessible through the lower plenum of the steam generator. A new multi-frequency eddy current technique has been developed which offers several advantages over the previously-used single-frequency method. Basically the new technique results in more definitive information and a potential for more positive identification of defects due to the collection of data at four different frequencies and the flexibility of comparing data at one or more of the frequencies in order to get better discrimination and cancel out noise or interference effects. During the August inspection at Point Beach, both methods were used to gain experience and make comparisons between the two although not all tubes were inspected by both techniques. During the 100% inspection in October, the multi-frequency technique was used. Because of the better detection results offered by the new multi-frequency eddy current method, the question was raised as to what extent of the bad tubes found during the October

(no eddy current indication) from the good region around the periphery of the tube sheet.

Examination of all of the three removed tubes showed intergranular stress corrosion attack in the crevice region within the tube sheet (see attached figure). The major portion of the tubes above the tube sheet were reported to be in generally good condition. The type of corrosion is not unique or unexpected and is believed to be caustic assisted corrosion associated with the use of phosphate secondary water treatment and the build-up of sludge and corrosion products in this small crevice area between the tube and the tube sheet on the secondary side. Photomicrographs of the tube wall cross-section in this area show general corrosion deterioration in the outer surface with sharper circumferential stress corrosion cracks penetrating deeper through the wall cross-section. The most severe defect found in the section of bad tube which indicated an 89% defect on eddy current test showed a general intergranular corrosion cracking approximately 20 mils (.020 inches) deep and the deepest stress crack penetration of approximately another 20 mils. The total through wall penetration of the crack, therefore, was 40 mils or approximately 80% through the tube wall which has an original thickness of 50 mils. These specific measurements must be qualified somewhat in that this tube broke during the pulling operation required to remove it for testing. Also, considerable amount of pulling stress in tension was placed on the tube during

removal and may have increased the crack depth from its actual undisturbed condition.

The second tube sample was from a tube which was indicated to be good (no eddy current indication) but located in the problem area. Again, examination showed generalized corrosion attack of the outside tube surface in the tube sheet crevice region. A photomicrograph of the tube wall cross-section showed general corrosive deterioration approximately 5 mils deep with the deepest of the stress corrosion cracks pentrating approximately an additional 20 mils deep for a total of 25 mils or 50% of the original tube wall thickness.

Sections of the third tube removed were from a good tube (no eddy current indication) from the peripheral region where no problems have been experienced. Examination also showed the same generalized corrosion attack of the outside surface throughout the tube sheet crevice region. The generalized corrosion deterioration was approximately 5 mils deep with the deepest stress crack extending approximately another 15 mils deep for a total through-wall penetration of 20 mils, or 40%.

Although the general corrosion exhibited by the last two good tubes was not unexpected, there was concern about the measured depth of crack penetration on these two tubes compared to the fact that the eddy current test indicated no recognizable defects. The examination results, however, as mentioned above are qualified by the fact that the severe tube cracks may have been

inspection were actually tubes with previously undetected defects which could now be identified by the better method as opposed to the identification of new or increasing defects caused by continued or accelerated corrosion since the last inspection. There is no real way to quantify this, however, Westinghouse estimated that of the original sample tested of 75 tubes where both inspection methods had been used, that about 2/3 of the tubes found to be bad (40% defect or greater) were identified because of better detection methods and 1/3 were the result of continued or accelerated corrosion since previous inspections. Also as mentioned above in the description of the tubes removed for detailed testing, there is still some concern about inspection sensitivity even with the newer method since two of the tubes which had shown no eddy current indications did have significant crack defects on detailed examination.

Westinghouse described further testing done on mechanical properties of the tube material removed and how remaining strength based on these tests indicated that the structural strength remained adequate, both for normal operations and under different assumed accidents. Since in the Point Beach situation all of the tube deterioration is confined to the tube sheet crevice region, the analysis concentrated on this area, however, data was also given for defects outside the tube sheet area. The fact that the deterioration is confined to the tube sheet area is a disadva..tage from the standpoint of attempts to arrest the corrosion but is an advantage with respect to the

safety performance as a result of tube failure or rupture since the leakage and any movement of the tube is constrained because it is rather tightly bound due to the accumulation of corrosion products and sludge in this crevice region. It was indicated that the limiting condition for failure inside the tube sheet was a minimum thickness of 5 mils or 10% (90% penetration of a circumferential crack) for the most severe condition. For tube rupture at normal operation or several other conditions it was indicated that all that was required is enough ductility in the remaining tube material to allow the tube to expand to contact to tube sheet. The results of tests on removed samples indicated that adequate ductility of the remaining material of the corroded tubes is maintained to meet the limiting condition. In the case of a full circumferential crack within the tube sheet, it was indicated that the resultant leakage will either be constrained if the failure is deep enough toward the bottom of the tube sheet or will blow out if it is near enough the top of the tube sheet such that the resultant leakage would be easily detectable. This has also generally been the pattern of tube leakage detection during operations at Point Beach where relatively small minor leakage was detected and monitored and if increasing at a significant rate or to a significant level action can be taken to shut down for repairs. Westinghouse detailed analysis and testing also indicated that the leak rate will progress to a level requiring plant shut-down prior to the crack or rupture reaching a critical length or size which would lead to a complete break failure. This was indicated

to be true even for defects or ruptures above the tube sheet.

There was a brief review and discussion concerning steam generator problems at other Westinghouse plants, particularly those with similar steam generator designs. Nearly all of the operating plants have some history of operations with the phosphate secondary water treatment although Point Beach used phosphate for some of the longest times because of the age of Unit 1. Even though there has been a number of steam generator tube problems at various reactors, Point Beach Unit 1 is experiencing the most severe corrosion problem in the tube sheet crevice region. Differences in the tube corrosion problem evidenced at the various plants are not fully explained or directly comparable. This is due in part to small variations in design and operations, different sizes of units, different water chemistry and other perhaps subtle but important differences or combinations of factors which are not known or not clearly identified. The two existing plants were steam generator replacements are being made or proposed (Surry and Turkey Point) are different in that the serious tube degradation has been caused by corrosion build-up and tube denting up in the tube support plate region rather than problems with tube sheet crevice corrosion such as Point Beach. Problems with condensor tube integrity are also involved in those two locations since they use sea water for condensor cooling and intrusion of chlorides into the secondary system accelerates corrosion. Westinghouse was asked to describe the design and

structural modifications taken on newer steam generators to eliminate or mitigate these problems. They believe that the newer designs have adequately addressed most of these problems, however, there is very little operating history with steam generators of the latest design.

Mr. Frieling of Wisconsin Electric described the normal and additional actions which will be taken prior to start-up of the unit. Besides the normal primary and secondary hydrostatic testing, they will perform a newly-developed and novel procedure in an attempt to flush out some of the sludge and corrosion product deposits from the tube sheet crevice. This is a modification of a similar attempt done initially at a Japanese plant. It was reported that the Japanese technique was successful in removal of some of these solids but the overall effect of whether corrosion will be significantly reduced is unknown until additional operating experience is accumulated. Very briefly, the method involves filling the secondary side with approximately 2 feet of water above the tube sheet, heating it up with primary pump and decay heat power to approximately 250^{0} F. under pressure and then quickly depressurizing the secondary side to initiate boiling in hopes that the boiling in the crevice area will lift out some of the deposited solids. This operation will take several days and it is one of the reasons for the later start-up target date.

Operating Options

Wisconsin Electric described several options under consideration in the basic effort to arrest corrosion or reduce the rate of corrosion and therefore extend tube life and reduce the failure rate.

The first option would be to operate at a primary pressure of 2,000 pounds. This is a reduction from normal primary pressure of 2,250 pounds. There is no reduction in power output, temperature, or efficiency of the unit. The primary benefit is a reduction in the mechanical stress that the tubes are subject to because of the pressure difference between the primary and secondary side of the steam generator. Normal secondary side pressure is 850 pounds; therefore, the differential pressure under normal conditions at full load is 1,400 pounds. With reduced primary pressure, the pressure differential would be reduced to 1,150 pounds.

The second option is to reduce the primary coolant temperature on the hot leg side of the steam generator. The benefit here is that testing and analysis to date indicate that the corrosion and corrosion rate is temperature-dependent. This is also evidenced by the fact that the severe corrosion is only on the hot leg side which operates at approximately 600° F. and there is very little corrosion on the cold leg side which operates at about 540° F. The specific transition temperature or temperature range between high and low corrosion rates is not known but the proposal would be to reduce power output of the unit to