

ENVIRONMENTAL IMPACT APPRAISAL
BY THE OFFICE OF NUCLEAR REACTOR REGULATION
SUPPORTING AMENDMENT NO. TO OPERATING LICENSE NO. DPR-24
WISCONSIN ELECTRIC POWER COMPANY

DEMONSTRATION PROGRAM OF STEAM GENERATOR
REPAIR BY MEANS OF SLEEVING
POINT BEACH NUCLEAR PLANT UNIT 1
DOCKET NO. 50-266

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1.0 INTRODUCTION

Wisconsin Electric Power Company (WE) by letter application dated July 2, 1981, as modified by letter dated October 12, 1981 seeks a license amendment which would authorize WE to modify by sleeving, 12 steam generator tubes (six of which have degradation exceeding the plugging limit defined by Technical Specification 15.4.2.A.5(a)) at Point Beach Nuclear Plant Unit 1. This Environmental Impact Appraisal documents the results of the staff review and evaluation of the environmental and radiation exposure impact of the steam generator tube sleeving - demonstration project and interim operation of Unit 1 at power with 12 tubes sleeved (up to six of which have degradation exceeding the plugging limit) until final review of their overall steam generator tube sleeving program has been completed. Based on its review, the Staff finds that the proposed action will not significantly affect the quality of the human environment.

2.0 BACKGROUND

In the past Point Beach Nuclear Plant, Units 1 and 2 have experienced various corrosion problems in their steam generators. The problems include caustic intergranular attack of the tubes in the crevice region of the tubesheet and phosphate wastage on thinning above and usually within 2 inches of the top of the tubesheet. These problems have been more severe for Unit 1 than Unit 2 and resulted in the Commission issuing Orders for Modification of License for Unit 1 dated November 30, 1979 as modified by Orders dated January 3, 1980 and April 4, 1980. These orders imposed, among other things, more frequent eddy current inspections, more restrictive reactor coolant radioactivity levels, much more restrictive steam generator tube leakage rates and operation at reduced primary pressure for Unit 1.

In an effort to find an acceptable fix to the steam generator tube corrosion problem, WE has submitted an application dated July 2, 1981 for a license amendment involving Technical Specification changes which would allow them to repair degraded steam generator tubes by sleeving rather than plugging, which degradation of steam generator tubes had exceeded the plugging limit of 40% nominal wall thickness. In support of this requested change, the licensee has filed with the NRC staff for its review a Westinghouse Steam Generator Report containing technical information regarding tube sleeving of the Point Beach Unit 1 and 2 steam generators. WE modified its application of July 2, 1981 by letter dated October 12,

1981 to request interim operation of Unit 1 with 12 sleeved tubes (no more than six of which have indications of degradation beyond the plugging limit) as a demonstration program until final review of their overall tube sleeving program has been completed.

3.0 SCOPE OF WORK TO BE PERFORMED IN THE DEMONSTRATION PROGRAM

WE has described the scope of the steam generator tube sleeving-demonstration program to be conducted at Point Beach Nuclear Plant, Unit 1 to include the following major steps:

- (1) Demonstration of the capability to insert sleeves of two different designs in steam generator tubes with indications of tube degradation. Up to six of these tubes would have degradation in excess of the plugging limit and would include tubes which are presently plugged. The sleeve designs to be used are described in Section 3.2 of Westinghouse Report WCAP-9660 (Proprietary) dated September 28, 1981, and entitled, "Point Beach Steam Generator Sleeving Report for Wisconsin Electric Power Company" (Sleeving Report).
- (2) Demonstration and evaluation of the feasibility of explosive and mechanical tube plug removal using plug removal equipment described in Section 4.1 of the Sleeving Report.
- (3) Demonstration and evaluation of the tube preparation and sleeving processes and parameters described in Section 4 of the Sleeving Report.
- (4) Demonstration and evaluation of the tooling designs required for field installation of sleeves as described in Section 4 of the Sleeving Report.
- (5) Demonstration and evaluation of steam generator channel head decontamination equipment described in Section 8 of the Sleeving Report.

- (6) Demonstration and evaluation of non-destructive examination techniques described in Section 7 of the Sleeving Report.

4.0 Environmental Impacts Of The Demonstration Program

The Staff has reviewed the radiological and nonradiological environmental impacts of the Demonstration Program. The Staff has identified the radiological environmental impacts of occupational exposure and public radiation exposure as the only measurable environmental impacts of the demonstration program. These impacts are discussed in the following sections.

4.1 Radiological Assessment

4.1.1 Occupational Exposure

We have reviewed the work procedures and practices' that Wisconsin Electric Power Company (WE) will use during the steam generator tube sleeving-demonstration project. Based on this review, and through telephone conversations with the licensee, we feel that WE has taken adequate steps to assure that the occupational radiation exposures associated with the tube sleeving-demonstration project will be maintained as low as is reasonably achievable (ALARA) and to assure that the individual doses will be maintained within the requirements of 10 CFR Part 21, "Standards for Radiation Protection".

Wisconsin Electric Power Company (WE) has estimated that the steam generator tube sleeving-demonstration project for the Point Beach Nuclear Plant, Unit 1, will require the expenditure of between approximately 48 and 72 person-rems. The methods used

by WE to develop these collective occupational radiation exposure estimates for the steam generator sleeving-demonstration project are based on actual experience and testing. WE 1) determined the maintenance activities that will be involved in the sleeving program; 2) estimated the person-hours of work necessary to perform those activities; 3) determined the areas maintenance personnel must occupy to perform those activities and estimated the radiation dose rates in those areas; 4) multiplied the man-hours by the dose rate for each activity; and 5) summed the doses for all the activities. After reviewing the licensee's methods used to develop those dose estimates, we concluded that these estimates are reasonable. Prior to initiating the steam generator sleeving work, WE will use decontamination techniques in the steam generator channel head area to reduce dose rates. These techniques are expected to reduce the dose rates in the hot leg channel heads of the steam generators by a factor of approximately 2.5¹. Other ALARA measures implemented by WE during the steam generator sleeving-demonstration project include full size mockups for training workers, use of remote and semi-remote tooling whenever practicable, and routine air sampling, and contamination and radiation surveys. Measures such as these are recommended in Regulatory Guide 8.8, "Information Relevant to Ensuring That Occupational Radiation Exposures At Nuclear Power Stations Will Be As Low As Is Reasonably Achievable", in order to

minimize individual occupational radiation exposures and maintain the overall collective occupational radiation exposure as low as is reasonably achievable (ALARA). No individual will be allowed to exceed the dose limits imposed for workers by 10 CFR Part 20, which are established as dose limits appropriate to the health and safety of individuals.

To determine the relative environmental significance of the estimated maximum occupational dose of 60 person-rems, comparisons were made with 1) the doses expected from normal operation of nuclear plants, and 2) other non-nuclear risks.

Table 4.1 shows the occupational dose history for Point Beach Units 1 and 2^{2,3}. When there are more than one reactor unit at a plant site (as at Point Beach) the combined occupational dose for all reactor units (for example, Point Beach Units 1 and 2) can be reported^{2,3} instead of the doses for each separate unit. With the addition of 60 person-rems for the sleeving-demonstration project, the average annual dose for the 10 years of dose history at Units 1 and 2 (1970 through 1980) will be approximately 470 person-rems or an average of 235 person-rems per reactor unit. Occupational exposure estimates were not specifically considered in the Point Beach Units 1 & 2 FES⁴. However, in recent environmental statements for new pressurized water reactors (e.g., Summer FES), we have provided an estimate of 410 person-rems per reactor unit as

the average annual occupational dose.⁵ This estimate is based on reported data from power reactors that are operating with radiation protection programs in accordance with NRC guidance and regulations. A summary of these data is provided in Table 4.2.² These data show that 410 person-rems per reactor unit per year is roughly the average of the wide range of doses incurred at all pressurized water reactor units over the last several years. The amount of dose incurred at any single reactor unit in a year is highly dependent on the amount of major maintenance performed that year. Operating data from U.S. pressurized water reactors indicates that units requiring high levels of special maintenance work can average as much as 1300 person-rems per year over the life of the unit.⁶ Although the doses for these particular plants far exceeds the average of 410 person-rems for PWR's, these doses are included in the average and are considered normal deviations from the average, particularly since such maintenance contributes to effective and safe plant operation and since it is carried out with procedures that maintain exposures ALARA. As Table 4.2 shows, the 60 person-rems estimate for the sleeving-demonstration project is within the low end to the historical range of doses for a single unit in a year.

We calculate that 60 person-rems, the occupational dose estimate for the sleeving-demonstration project, corresponds to a risk of very

much less than one premature fatal cancer in the exposed work force population. We also calculate that 60 person-rems corresponds to a risk of less than 0.02 genetic effect to the ensuing five generations. These risks are based on risk estimators derived in the BEIR Report⁷ and WASH-1400⁸ from data for the population as a whole. New information in the BEIR III Report⁹ would lead to an even lower estimated risk for premature fatal cancers. These risks are incremental risks (risks in addition to the normal risks of fatal cancer and genetic effects as we all face continuously). For a population of 1000, these normal risks that are unrelated to Point Beach Nuclear Station would be expected to result in about 190 cancer deaths and about 60 genetic effects in the existing population (genetic effects are genetic diseases or malformations),^{7, 10} plus about 300 more genetic effects among their descendents.

To make the health risk associated with radiation dose more understandable, risk comparisons can be made with non-nuclear activities commonly participated in by many individuals. One rem of radiation is numerically comparable to a lifetime mortality risk of about 10^{-4} .⁷ Table 4.3 presents the equivalent risk of 10^{-4} for several common activities - risks which many people take routinely and consider to be insignificant.¹¹ The average dose to a worker for the sleeving-demonstration project will be roughly 0.6 rems. As Table 4.3 shows, the lifetime risk from radiation dose for the average sleeving-demonstration project work is smaller than the lifetime risk associated with many common activities.

Another perspective of an occupational risk comes from comparison of occupational mortality risks in the U.S. One such comparison is shown in Table 4.4. It indicates that radiation exposure in the work place, as experienced at an average radiation worker exposure rate, results in a relatively low occupational risk.

Some have criticized occupationally related cancer estimates as being overly conservative.¹² However, most experts feel the risk estimates in Table 4.4 relating to occupational exposure to low-LET radiation are also over-estimates. In our opinion, the comparisons just presented are reasonable ones. The risks of occupational exposures in the range of 0.5 rem per year to 5 rem per year do not significantly affect a typical worker's total risk of mortality.

In summary, the staff has drawn the following conclusions regarding occupational radiation dose. WE's estimate of 60 person-rem for the sleeving-demonstration project at Point Beach 1 is reasonable. This dose is at the low end of the normal range of annual occupational doses which have been observed in recent years at operating reactors. Although the doses resulting from the steam generator tube sleeving-demonstration project will increase the annual collective occupational dose average of Point Beach Units 1 and 2 combined to approximately 470 person-rems, this is still well below the 1300 person-rems per year annual average referenced in current Final Environmental Statements as being an upper bound dose average of PWR's experiencing high levels of special maintenance work. WE has taken appropriate steps to ensure that

occupational doses will be maintained within the limits of 10 CFR Part 20 and ALARA. The additional health risks due to these doses over normal risks are quite small, very much less than one percent of normal risk to the project work force as a whole. The risk to an average individual in the work force will be lower than risk incurred from participation in many commonplace activities. The individual risks associated with exposures involved in the sleeving-demonstration program will be controlled and limited so as not to exceed the limits set forth in 10 CFR Part 20 for occupational exposure. For the foregoing reasons, the Staff concludes that the environmental impact due to occupational exposure will not significantly effect the quality of the human environment.

4.1.2 Public Radiation Exposure

NRC Staff has estimated the amount of radioactivity which will be released in liquid and gaseous effluents as a result of the sleeving-demonstration project.¹ Those estimates are presented in Table 4.5. The estimates are based on information supplied by WE¹ to the NRC Staff concerning the method of decontamination and subsequent treatment of the decontamination solutions. Table 4.5 also presents effluent releases for 1979¹³ and 1980¹⁴ from Point Beach 1 and the FES⁴ annual average effluent release estimates.

WE will take several steps to minimize releases.¹ To minimize airborne releases the channel head decontamination process and the surface preparation process will be wet processes, entraining

removed material in water. The air from the channel head where the work is being performed will be exhausted through the opposite manway using a high efficiency particulate filter to control airborne concentrations during channel head work. Also, enclosure tents will be erected at selected locations inside containment to control contamination during process equipment maintenance. The water from the decontamination process and the surface preparation process will be treated by filters, an evaporator and a demineralizer to minimize liquid releases.

We have reviewed WE's estimates of effluent releases for the sleeving-demonstration project. Those estimates are based on estimating methods acceptable to the Staff and actual releases from similar operations at San Onofre Unit 1 and elsewhere. Based on our review, we conclude that WE's estimates are reasonable.

As Table 4.5 shows, the expected releases from the sleeving-demonstration project are small compared to both the FES estimates and Point Beach's actual annual releases. Therefore, on the basis of this comparison above, we conclude that the offsite environmental impact that may occur during the period of this procedure will be smaller than that which occurs during normal operation.

We have estimated the doses to individual members of the public as well as the population as a whole in the area surrounding Point

Beach Unit 1 based on the radioactive effluents which we estimated for the sleeving-demonstration project (summarized in Table 4.5) and on the calculational methods presented in Regulatory Guides 1.109,¹⁵ and 1.113.¹⁶ Using a liquid release source term of 1.44×10^{-4} Ci consisting primarily of Co-60 (Table 4.5) we calculated the maximum individual total body dose for an adult to be less than .01 mrem for the operations. This is equivalent to a dose of less than a small fraction of 1 percent of the limits of 40 CFR Part 190. The annual limits of 40 CFR Part 190 are 25 millirems to the total body or any organ except the thyroid and 75 millirems to the thyroid. The doses to the population of 819,000⁴ within 50 miles was estimated to be less than 6.2×10^{-3} person-rems to the total body from liquid effluents. The offsite population dose was calculated by multiplying the (offsite) maximum individual total body dose of 7.5×10^{-6} mrem (estimated for the liquid release of Co-60) with the projected population of 819,000⁴ for the year 1985 within 50 miles of Point Beach 1. We feel that this is a conservative estimate as the maximum individual dose estimate is overly conservative and it is very unlikely that an average individual offsite will receive such a dose. Every year the same population of about 819,000 will receive

a cumulative total body dose* of more than 81,900 person-rems from the natural background radiation (about 0.1 rem per year) in the vicinity of Point Beach 1.¹¹ Thus, the population total body dose from the sleeving-demonstration project is less than 7.6×10^{-6} percent of the annual dose due to natural background. On these bases, we conclude that the doses to individuals in unrestricted areas and to the population within 50 miles due to gaseous and liquid effluents from the sleeving-demonstration project will be environmentally significant. Since we expect no larger radioactive effluents from Point Beach 1 after the sleeving-demonstration (over presleeving operation), we conclude that the impact on biota other than man will also be no larger than the demonstration project.

In summary, the radioactive releases resulting from the sleeving-demonstration project will be less than those due to normal plant operation. These releases are also much less than the estimates presented in the FES. The doses due to these releases are small

* Our calculations (using the LADTAP Computer Program)¹⁷ for the maximum individual total body dose for an adult considered the following pathway consumption (1) of fish (21 kilogram per year) caught in the discharge area and (2) drinking water (730 liter per year) from the discharge area. A conservative dilution factor of w or no dilution was assumed for each of the above two pathways in our evaluation of radiological exposure due to the release of Co-60 from Point Beach 1 via liquid effluents which are expected to result from the sleeving-demonstration project. The LADTAP II program implements the radiological exposure¹⁵ described in U.S. NRC Regulatory Guide 1.109, Rev. 1 (Appendix a)¹⁵ for radioactivity releases in liquid effluent.

compared to the limits of 40 CFR Part 190 and to the annual dose from natural background radiation. Therefore, the radiological impact of the sleeving-demonstration project will not significantly affect the quality of the human environment.

4.1.3 RADIOLOGICAL ASSESSMENT CONCLUSIONS

Based on our review of the proposed steam generator sleeving-demonstration project, we have reached the following conclusions which are discussed in greater detail above.

- (1) The estimated range of 48 to 60 person-rems for the sleeving-demonstration project is on the low side of the expected range of doses incurred at light water power reactors in a year.
- (2) The risks to the workers involved in the sleeving-demonstration project from radiation exposure are no larger than the risks incurred by:
 - (a) workers in other industrial businesses, and
 - (b) most people, working or not, from commonplace activities such as driving a car.
- (3) WE has taken appropriate steps to ensure that occupational dose will be maintained as low as it reasonably achievable and within the limits of 10 CFR Part 20.
- (4) Offsite doses resulting from the sleeving-demonstration project will be,
 - (a) smaller than those incurred during normal operation of Point Beach 1, and
 - (b) negligible in comparison to the dose members of the public in the vicinity of Point Beach 1 receive from natural background radiation.

On the basis of the foregoing statements, the staff concludes that the proposed sleeving-demonstration project at the Point Beach

Nuclear Plant, Unit No. 1 will not significantly affect the quality of the human environment.

4.2 Nonradiological Assessment

We have reviewed the documents submitted by WF in support of its request to conduct the steam generator tube sleeving-demonstration program. We find that the proposed activities will occur within the plant on areas previously disturbed during site preparation and construction. These activities will not have appreciable offsite environmental effects. The licensee has not proposed any changes in effluents from the demineralizer waste systems or other waste streams as part of the demonstration program. We conclude that the activities as proposed will not result in any significant environmental impact.

5.0 BASIS AND CONCLUSION FOR NOT PREPARING AN ENVIRONMENTAL IMPACT STATEMENT

The NRC has reviewed the Demonstration Program relative to the requirements set forth in 10 CFR Part 51 of the Commission's regulations. The NRC has determined, based on this assessment, that this action will not significantly affect the quality of the human environment. Therefore, the Commission has determined that an Environmental Impact Statement need not be prepared, and that, pursuant to 10 CFR 51.5(c)(1), the issuance of a negative declaration to this effect is appropriate.

TABLE 4.1
 ANNUAL COLLECTIVE^{2, 3}
 OCCUPATIONAL DOSE AT POINT BEACH UNITS* 1, 2

<u>Year</u>	Collective Occupational Dose	
	<u>(person-rem)</u>	
1971	164	580
1973	588	295
1975	459	370
1977	429	320
1979	644	791 ³

* First commercial operation 12/70 (Unit 1), 10/72 (Unit 2)

TABLE 4.2

OCCUPATIONAL DOSE AT U.S. LIGHT WATER REACTORS²
(person-rem per reactor unit)

<u>Year</u>	<u>PWR Average</u>	<u>BWR Average</u>	<u>Low</u>	<u>High</u>
1969	165	195	42	298
1970	684	127	44	1639
1971	307	255	50	768
1972	464	286	61	1032
1973	783	380	85	5262
1974	331	507	71	1430
1975	318	701	2	2022
1976	460	549	58	2648
1977	396	828	87	3142
1978	429	604	48	1621
1979	510	733	30	2140

TABLE 4.3

LIFETIME MORTALITY RISKS
NUMERICALLY EQUIVALENT TO ONE REM¹⁸

<u>Type of Activity</u>	<u>Equivalent Risk to One Rem</u>
Smoking cigarettes	1 carton
Drinking wine	66 bottles
Automobile driving	6,600 miles
Commercial flying	33,000 miles
Canoeing	1.6 days*
Being a man aged 60	1.8 days

* Eight hours per day

TABLE 4.4

OCCUPATIONAL RISKS

Events per year per 100,000 workers)

	<u>Mining & Quarring</u>	<u>All U.S. Industries</u>	<u>Trade</u>	<u>Radiation Exposure</u>
Final Accidents ⁽¹⁾	63	14	6	1
Delayed Effects				
Actual	readily	Occasionally	not	not
Observable	Observable	Observable	Observable	
Estimated	?	Includes 115-219 lethal cancers ⁽²⁾	?	4-6 lethal cancers ⁽³⁾

(1) 1976 data, from "Accident Facts, 1977 Edison," National Safety Council.

(2) Estimates from "Toxic Chemicals and Public Protection, A Report to the President by the Toxic Substances Strategy Committee," Council on Environmental Quality, Government Printing Office, May 1980. Assumes 20-38% of all cancers are associated with occupation.

(3) Estimates from BEIR-II, 1980, assuming an average radiation worker exposure rate of 0.5 rem/hr; exposure at the limit, 5 rems/yr, would yield an estimate of from 37 to 63 lethal cancers per year per 100,000 workers.

TABLE 4.5

RADIOACTIVE EFFLUENTS FROM POINT BEACH 1

<u>Type of Radioactive Effluent</u>	<u>WE Estimates for Releases During Sleeving Demonstration (Ci)</u>	<u>Point Beach 1 1979 Releases (Ci)</u>	<u>Point Beach 1 1980 Releases (Ci)</u>	<u>FES⁽¹⁾ Estimates of Annual Average Releases (Ci/yr.)</u>
<u>Gaseous</u>				
Noble Gases	Negligible ^b	4.8(+2) ^c	3.2(+2)	5.0(+3)
Iodine + Particulates ^a	Negligible ^b	1.4(-2)	2.7(-3)	1.0(-1)
Tritium	Negligible ^b	4.0(+2)	3.3(+2)	<u> </u> ^d
<u>Liquid</u>				
Mixed fission and activation products	1.44 x 10 ⁻⁴	0.38	0.63	1.0(+1)
Tritium	Negligible ^b	4.5(+2)	3.8(+2)	1.0(+3)

^aRadioactive half lives 8 days or more.

^bBelow lower limits of detectability for plant instrumentation.

^c4.8(+2) means 4.8 x 10⁺².

^dNo estimate was given in FES, but FES stated that there would be low concentrations of tritium to the gaseous releases.

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16. Regulatory Guide 1.113, "Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I," U.S.N.R.C.
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