

Environmental Review

Pilgrim Station
Forty Year Plant Life Extension

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1.0 INTRODUCTION

The currently-licensed term for Pilgrim Station is forty (40) years commencing with the issuance of the construction permit on August 26, 1968. The plant was originally engineered and designed for an operating life of forty (40) years. Issuance of the operating license from the date of issuance of the construction permit restricts the operating life of the plant to a period of thirty-six (36) years, two and one-half (2 1/2) months. This request endeavors to add the three (3) years, nine and one-half (9 1/2) months to the operating license by extending the expiration date of the operating license to June 8, 2012.

The information provided in this Attachment has been prepared to facilitate expedient NRC analysis and concurrence with this request.

2.0 RADIOLOGICAL IMPACTS

Boston Edison has obtained topical data from other utilities who have already made submittals to extend their license issuance dates for a full forty (40) year period. This material was examined in order to provide commensurate documentation in order to eliminate the request for additional informational material, and to assist NRC in the preparation of an environmental assessment.

2.1 Occupational Exposures

An analysis of man-rem exposures for the years 1979-1984, from records provided to the NRC, has enabled us to project exposures for the years 2008-2012.

2.1.1 Current Experience

Factual data was taken from annual Reg. Guide 1.16 reports to establish man-rem exposures by station occupational activities. Although other utilities provided data based on man-rem by major project, i.e., analysis of Radiation Work Permits, the Pilgrim system has only compiled this data for 1984 and 1985. The data for this report was compiled from occupational category dosimeter readings based on Radiation Work Permit information. Table 2.1.1 and Figure 2.1.1 provide yearly totals by occupational category of man-rem exposures at Pilgrim Station from 1979 to 1984.

Table 2.1.1

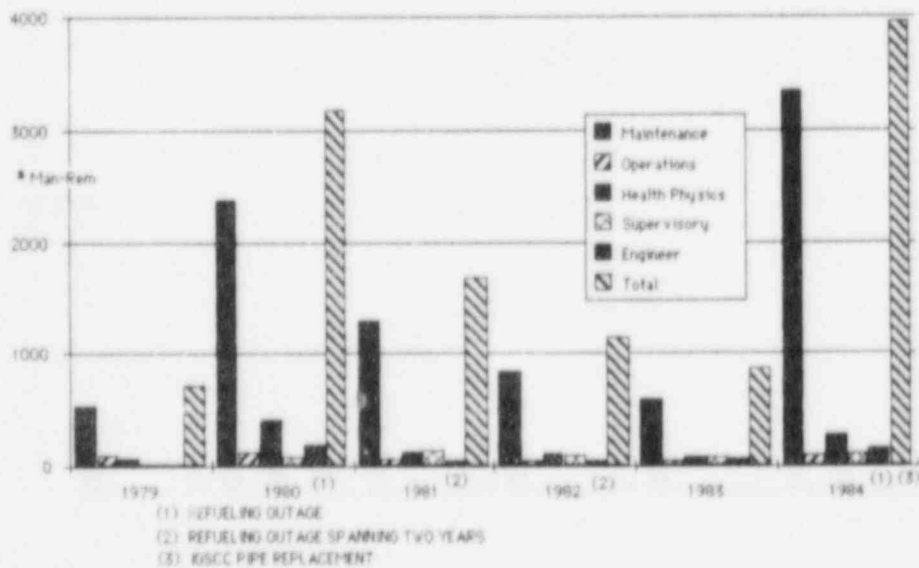
ACTUAL ANNUAL MAN-REM EXPOSURE
 PILGRIM STATION - OCCUPATIONAL CATEGORY
 1979 - 1984

Year	Maintenance	Operations	Health Physics	Supervisory	Engineer	Totals
1979	530.118	89.353	64.686	22.605	17.268	724.03
1980	2,378.750	130.810	406.050	73.980	186.540	3,176.130
1981	1,294.460	65.410	128.945	140.865	52.350	1,682.030
1982	837.185	52.815	105.255	95.100	48.285	1,138.640
1983	598.810	48.515	75.280	83.685	66.755	873.045
1984	3,343.510	94.150	270.980	108.620	149.130	3,966.390

A compilation of the same data in a bar-chart clearly portrays the heaviest exposures to be in the maintenance area.

Figure 2.1.1

ACTUAL ANNUAL MAN-REM EXPOSURE
 PILGRIM STATION - OCCUPATIONAL CATEGORY
 1979 - 1984



2.1.2 Projections for Additional Years

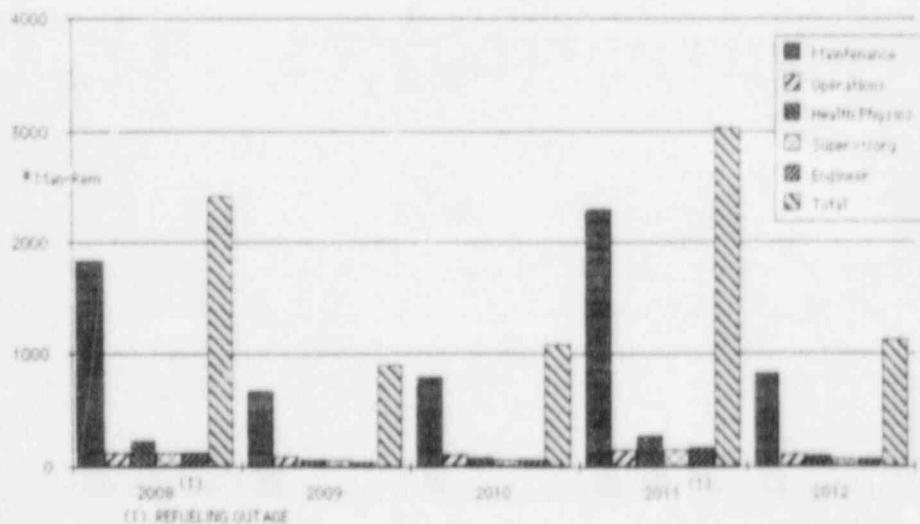
Man-rem exposure for the years 2008-2012 are projections based on the factual data obtained from TLD readings obtained and documented from 1979-1984 by occupational category. Estimations are not provided for plant decommissioning, since decommissioning is a one-time source of exposure which would not be appreciably affected by the proposed additional years of plant operation. Table 2.1.2 and Figure 2.1.2 provide yearly totals by occupational category of projected man-rem exposures at Pilgrim Station from 2008-2012.

Table 2.1.2
**PROJECTED ANNUAL MAN-REM EXPOSURE
 PILGRIM STATION - OCCUPATIONAL CATEGORY
 2008 - 2012**

Year	Maintenance	Operations	Health Physics	Supervisory	Engineer	Totals
2008	1,837	114	217	123	125	2,416
2009	660	80	64	50	42	896
2010	794	96	77	60	51	1,078
2011	2,296	142	271	155	156	3,020
2012	825	100	81	63	51	1,120

A compilation of the same data in a bar-chart also portrays the heaviest projected exposures to be in the maintenance area.

Figure 2.1.2
**PROJECTED ANNUAL MAN-REM EXPOSURE
 PILGRIM STATION - OCCUPATIONAL CATEGORY
 2008 - 2012**



These projections are at best conjectural in nature. Events may occur in the intervening years which would significantly change these estimates. There are other uncertainties which have not been included in the additional years' projections. On the negative side, additional required modifications to plant, i.e., hydrogen water chemistry, etc., may increase the projected man-rem exposure rates for the additional years. On the positive side, advances in technology and science, i.e., more extensive use of robotics, etc., may balance the potential increased exposures endemic to additional required modifications.

2.1.3 ALARA Program

The ALARA program at Pilgrim Nuclear Power Station (PNPS) was extensively upgraded in 1985. The controlling document for the PNPS ALARA program, Nuclear Operations Procedure 83RC1, was revised to formally establish an ALARA Committee to assist personnel working at PNPS with maintaining radiation exposures As Low As Reasonably Achievable. Membership of the Committee includes a department representative from each of the plant disciplines. The functions of this Committee include the setting of department exposure budgets, which are approved by the Vice President-Nuclear Operations, and the review of high exposure (greater than 25 man-rem) tasks at PNPS.

The ALARA group, under the direction of the Environmental and Radiological Health and Safety Group Leader (ERHSGL) has the responsibility for reviewing and approving all Radiation Work Permits issued for work at PNPS. The level of management review required is dependent upon the pre-job, man-rem estimate for the task. The review criteria is:

Less than 5 man-rem requires review and approval by an ALARA Engineer.
Greater than or equal to 5 and less than 10 man-rem requires review and approval by the Senior ALARA Engineer. Greater than or equal to 10 and less than 25 man-rem requires review and approval by the ERHSGL.
Greater than or equal to 25 man-rem requires ALARA Committee review and approval.

The review by the ALARA group is to stress the need for pre-planning of work and the application of engineering controls in an effort to maintain exposures ALARA. Checklists are used as part of the review process and are required for work with man-rem estimates greater than 5 rem. The ALARA group is also involved in the Plant Design Change Review cycle so that exposure reduction techniques can be implemented in the design of new plant systems and components. An ALARA manual for design engineers is being developed for the Boston Edison Company Engineering Department to increase the level of ALARA awareness in the design process.

The ALARA group has membership on the station's Decontamination/Housekeeping Committee which is developing decon criteria for the plant to aid in the minimizing of internal exposures to workers at PNPS.

New ALARA training programs are being developed for all plant personnel from crafts to management. It is intended that even the contractor personnel working at PNPS be scheduled to attend these 8-12 hour training sessions.

These training programs will stress the need for proper pre-planning of tasks and assist the worker with selection of alternative methods for maintaining task exposures ALARA. The application of engineering controls will be discussed, as well as past plant experiences, so that personnel can better understand the ALARA philosophy that exposure reduction is everyone's concern.

An ALARA Suggestion Program has been established to solicit worker input into the activities of the ALARA program. This program includes feedback to the workers on the results of the ALARA review of their suggestions so that they are aware of the ALARA process.

It is planned that the ALARA upgrading in 1985 will continue to expand on through the final years of operation. The ALARA group is already more involved with the planning of outage work and design of new plant systems. The ALARA group will review the routine as well as the non-routine work at PNPS and will be investigating state-of-the-industry technology for application to work at PNPS.

2.2 Population Estimates

The Boston Edison Environmental Report of September, 1970, provided an estimated resident population distribution for the years 1965 and 2015. In 1980, these figures were updated in Amendment 40 of the Pilgrim 2 Preliminary Safety Analysis Report. The data obtained at that time was based on estimates which included 1975 state census data, Health Service Administration projections, and data specific to towns within the 10 mile radius of the plant and was utilized to provide 1980 permanent population projections.

In 1981, a study was completed by HMM Associates of Waltham which updated the population distribution around Pilgrim. The distribution of the permanent resident population for 1980, within 10 miles of the site, and within the Emergency Planning Zone (EPZ) was determined using 1980 Census data, the most recent Geological Survey Maps, and results of a limited field survey performed by HMM. In addition, projected populations for the year 1990 were obtained for towns within the EPZ from the towns, the Commonwealth of Massachusetts, and area planning councils. The difference between 1980 and 1990 town population totals was allocated to large areas based on a comparison of the 1970 and 1980 Census data. First, the future growth was assigned in a manner which reflected growth during the past decade. The growth assigned to broad areas was next allocated to the various sectors based on the 1980 Census data and on the USGS maps for the study area.¹

¹ H.M.M. Associates, Inc., An Update of Population Distribution Around the Pilgrim Site, Waltham, MA., July 31, 1981

An analysis of projections for 1980, and the updated estimates for the same year, based on more factual 1980 Census data, reveals that the 1980 updated estimates were 6.4% less than the projections. Based on these figures, the permanent population estimated within the EPZ in 2012 will be 65,687. This is less than the 72,980 projected in 1965, when adjusted to an accumulative total in 2012, and should not be a factor in our request to extend our license for the full forty (40) year period. There are numerous variables, however, which could skew this projection. Expansion of a major industry into the Plymouth area, with numerous job opportunities, would change this projection significantly.

3.0 NON-RADIOLOGICAL IMPACTS

For 15 years (1970-1985) environmental programs and monitoring have been conducted at the Pilgrim Station site. These non-radiological studies and their results are documented in various reports issued to the Nuclear Regulatory Commission (NRC), Environmental Protection Agency (EPA) and Massachusetts Division of Water Pollution Control (DWPC). They include: Applicant's Environmental Report (September 1970), Final Environmental Statement (FES, September 1974), 316 Demonstration (July 1975), Supplemental Assessment in Support of the 316 Demonstration (September 1977), Marine Ecology Studies Final Report (July 1978), and Marine Ecology Semi-Annual Reports Nos. 1-25 (1972-1984).

The FES of 1974 is directed at the construction and operation of Pilgrim Station Unit 2. Its environmental impact statements include both Unit 1 and Unit 2 assessments, although Unit 2 construction was cancelled in 1981. Therefore, the FES of 1974 is conservative on the high side for assessing only Unit 1 non-radiological environmental impacts. Assessment of non-radiological impacts was based on different factors depending on the type of impact, including fixed life-of-plant, plant design considerations, renewable resource loss or loss/degradation of habitat. Impacts on the terrestrial ecology of the 517 acre tract of land were determined to be acceptable (FES, 2-14). The reports cited above following the 1974 FES, covering the period from 1975 to 1984, provide a great deal of additional data generally supporting the earlier impact assessments of the FES.

Entrainment and impingement losses have been assessed as small compared to the standing crops of susceptible organisms in the Station vicinity (FES, pp. 5-26 through 5-30). Thermal and chemical discharge impacts on marine biota have been documented, but on a spatial and population basis were acceptable as not causing significant harm (FES, pp. 5-35 through 5-40). The intake structure has been reviewed for causing impingement and entrapment impacts (FES, p. 5-26) but the mean impingement rate of approximately 2 fish/hour is low, despite periodic instances of high impingement events for selected species. The use of chlorine in biofouling control was considered (FES, p. 5-40) and judged to have a negligible impact on the Cape Cod Bay ecosystem at a discharge concentration of 0.1 ppm.

Impacts on two very important commercial fisheries, the Irish moss and lobster fisheries, have been analyzed (FES, p. 5-39). Both of these commercial fisheries have been sampled for several years utilizing reference and

surveillance station methodology, as well as inplant sampling for lobster larvae and Irish moss spores. Data taken during operational years have shown no consistent decline in productivity directly attributable to Station operation.

Two large gas bubble disease mortalities of Atlantic menhaden occurred in 1973 (FES, pp. 5-36 through 5-38) and 1975 in the Station discharge canal and vicinity. Both of these incidents, and a few other occasions when gas bubble disease symptoms were noted in selected species, were not considered to be of significant harm to the respective fishes' population. No additional mortalities due to gas bubble disease have been observed at Pilgrim Station from 1976 to 1985.

The NRC concluded in the FES (p. 10-1) that Pilgrim Station (including Unit 2) would not significantly impact the productivity of Cape Cod Bay regarding aquatic biological resources because of the Bay's recuperative capacity. This conclusion was based on NRC analyses of intake velocity, larval entrainment, fish impingement, chlorination and exposure time to elevated temperatures as detailed in the FES of 1974. Losses of biota associated with these impacts were determined not to be irreversible or irretrievable resource commitments.

The latest (1983-1988) Pilgrim Station National Pollutant Discharge Elimination System (NPDES) Permit (#MA0003557) recognizes (Section I.A.1.i.) compliance of the circulating water intake system design with Section 316 of the Clean Water Act. Sections I.A.7.b. and d. require that the permittee conduct monitoring to determine continued compliance of thermal discharge, entrainment, and impingement effects. Based on this monitoring, the Station has been found to meet thermal impact requirements, and to have relatively low entrainment and impingement losses compared to other comparable power plants. Maintenance of these conformances is assured through an annually-reviewed environmental monitoring and surveillance program regulated via the Station NPDES Permit by the USEPA and Mass. DWPC.

The Station uses sodium hypochlorite for macrofouling and microfouling control in salt water circulation systems. The NPDES Permit allows chlorine to be discharged to Cape Cod Bay at a maximum concentration of 0.1 ppm total residual. This discharge concentration is consistent with that evaluated in the FES (p. 5-40) to be adverse only to those organisms confined within the circulating water system (CWS) and salt service water system (SSWS). In 1983, the Pilgrim Station NPDES Permit was modified to allow for hypochlorite to be injected at a rate not to exceed 0.25 ppm maximum daily average continuously in the SSWS. It was determined that due to a dilution factor by the CWS of approximately 30:1, the concentration of total residual chlorine to be discharged to Cape Cod Bay would still not exceed the permissible limit of 0.1 ppm total residual chlorine.

Environmental protection and mitigation measures required by the Station's NPDES Permit in regard to intake and thermal discharge effects include: (1) Returning all live aquatic organisms trapped on intake screens to ambient temperature water, far enough away to avoid reimpingement (Section I.A.1.j.); (2) Reducing large intake impingement and thermal-related mortalities by requiring monitoring for and notification of substantial events and, for each

event, requiring a written report to include a discussion of precautions to be taken to avoid similar impingement or thermal mortality events (Section I.A.7.a.); and (3) Maintaining a barrier net in the distal end of the discharge canal to prevent fish entry on a year-round basis (Section I.A.2.f.).

The above is a summary of potential and real non-radiological, environmental impacts that have been reviewed and addressed by Boston Edison Company, NRC, USEPA and Mass. DWPC. The reviews have been of the various impact statements and environmental reports submitted to the regulators by Boston Edison between 1970 and 1985. The impacts have been addressed in NRC Tech. Spec. and NPDES (EPA) Permit conditions, and mitigative actions by Boston Edison. In conclusion, the requested legal plant life expectancy extension of 3 years 9 1/2 months will not alter the validity of previous findings and assessments, or pose any additional significant biological resource impacts.

4.0 ALTERNATIVE TO THE PROPOSED ACTION

The alternative to the issuance of the proposed license extension would be the cessation of Pilgrim Station's operation on August 26, 2008. This would result in a large loss of capacity which would necessitate the replacement of equivalent electric power resources. The most viable option would be the purchase of additional capacity from other utilities, or extensive pre-planning before-the-fact, and construction of equivalent or additional generating capability.

Even considering significant changes in the economics of either option, operation of Pilgrim Station for an additional three (3) years, nine and one-half (9 1/2) months would only require incremental yearly costs. These costs would be substantially less than the purchase of replacement power or the installation of new electrical generating capacity. Furthermore, the overall cost per year of the facility would decrease, since the large capital outlay would be averaged over a greater number of years.

5.0 CONCLUSION

Pilgrim Station was originally designed for an operating life of forty (40) years, and safety margins were considered and incorporated into the original forty (40) year design. The original plant design considered forty (40) years of operation at a capacity factor of eighty (80) percent. Pilgrim's cumulative capacity factor, from plant inception, is less than this figure, so the conservative operating criteria will not be compromised.

The NRC has been issuing licenses to new plants to commence from the issuance date of the operating license, and has recently initiated a policy of granting full forty (40) year licenses to older plants.

Issuance of a full forty (40) year license to Pilgrim Station will lessen the need to install additional baseload capacity to meet the growing needs of the New England region. Its cost-effective power supply will decrease the dependency on power production from fossil units which rely an expensive, imported oil for electrical generation. In summary, the cost/benefit advantage of Pilgrim Station, compared to alternative electrical power generating capacity, improves with the extended plant lifetime.

Bibliography

H.M.M. Associates. An Update of Population Around the Pilgrim Site.
Waltham, 1981.