November 27, 1990

Docket No. 50-293

Mr. Ralph G. Bird
Senior Vice President - Nuclear
Boston Edison Company
Pilgrim Nuclear Power Station
RFD #1 Rocky Hill Road
Plymouth, Massachusetts 02360

Dear Mr. Bird:

SUBJECT: ISSUANCE OF ENVIRONMENTAL ASSESSMENT - PILGRIM NUCLEAR POWER STATION

Enclosed for your information and use is a copy of an Environmental Assessment relating to your request for a license amendment to extend the expiration date of Facility Operating License No. DPR-35 from August 26, 2008 to June 9, 2012.

The original of the Environmental Assessment has been forwarded to the Office of the Federal Register for publication.

Sincerely,

Original signed by

Ronald Eaton, Senior Project Manager
Project Directorate I-3
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Enclosure:
As stated

cc: See next page

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Enclosure

7590-01

ENVIRONMENTAL ASSESSMENT
BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATING TO THE CHANGE IN EXPIRATION DATE OF
FACILITY OPERATING LICENSE NO. DPR-35
BOSTON EDISON COMPANY
FOR THE
PILGRIM NUCLEAR POWER STATION
DOCKET NO. 50-293

INTRODUCTION

The Pilgrim Nuclear Power Station (PNPS or the plant) is currently licensed for operation for 40 years commencing with the issuance of the construction permit. The license expires on August 26, 2008. By letter dated February 28, 1986, and as supplemented on July 13, 1989, Boston Edison Company (BECo or the licensee) requested that the license expiration date for the plant be extended to June 8, 2012 or 40 years after the date of the issuance of the "low-power" operating license. The currently effective Facility Operating License (DPR-35) was issued on June 1, 1972 and authorizes operation at full power, not to exceed 1998 megawatts thermal.

NEED FOR THE PROPOSED ACTION

The granting of this request would allow the licensee to operate the plant for approximately 3 years and 9 months beyond the current license expiration date, thus recapturing the construction period. This extension would also permit the plant to operate for the full 40-year design basis lifetime, consistent with previously stated Commission policy (Memorandum dated August 16, 1982, from William J. Dircks, Executive Director for Operations,

to the Commissioners) and as evidenced by the issuance of over 30 similar extensions to other licensees.

ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION

The anticipated impact of the plant on the environment was evaluated in the Staff's Final Environmental Statement (FES) for PNPS dated May 10, 1972, and in the FES for Pilgrim Unit 2, dated September 1974. Since that time its impact on the environment has been observed and recorded. In order to arrive at a finding on the acceptability of the plant's impact on the environment the following considerations will be evaluated in this assessment:

1. Radiological Impacts of the Hypothetical Design Basis Accident
2. Radiological Impacts of Annual Releases
3. Environmental Impact of Uranium Fuel Cycle
4. Non-Radiological Impacts
5. Plant Modifications
6. Conclusion on Environmental Impacts.

Each of these considerations is sequentially discussed below:

1. Radiological Impacts of the Hypothetical Design Basis Accident (DBA)

The offsite exposure from releases due to postulated accidents has been analyzed by the licensee in the PNPS Final Safety Analysis Report (FSAR). The results of these analyses were within the bounds of 10 CFR Part 100 and thus acceptable. This type of analysis is a function of four parameters: (1) the types of accidents postulated, (2) the radioactivity release calculated for each accident, (3) the assumed meteorological conditions, and (4) population distribution versus distance from the plant. The staff has concluded that neither the types of accidents nor the calculated radioactivity releases will change through the proposed amendment term. Furthermore, the site meteorology

as defined in the FSAR is essentially a constant and consideration herein is therefore unwarranted. Thus, the one parameter that is dependent on the proposed license amendment is the population size and distribution, as it could vary with time. A 1988 study projected population changes through the year 2012. There are no significant land-use changes expected during the amendment term that could affect offsite dose calculations. The results of the 1988 study and those of the other studies are presented in Enclosure 1, Projected Permanent Populations of Towns within the Pilgrim Station EPZ derived from KLD Associates letter of October 2, 1990.

None of the projected changes in population between the years 2008 and 2012, the added term of the proposed license amendment, will significantly impact any accident analysis previously calculated. Furthermore, the current exclusion area boundary, low population zone and nearest population center distance are not likely to be significantly changed through the amendment term from those originally and currently used by the PNPS. Accordingly, we conclude that the proposed license amendment will not significantly change previous conclusions on the potential environmental effects of offsite releases from postulated accidents.

The staff stated in their proposed no significant hazards consideration determination (51 FR 15393) dated April 23, 1986, that the change in expiration date to June 8, 2012 is consistent with current NRC policy and the originally engineered design life of the plant, i.e., 40-years of operation. Due to design conservatism, maintenance and surveillance programs, inspection programs and the Plant Technical Specifications, the proposed additional 3 years and 9 months of operation will have no significant impact on safety. That is,

regardless of the age of the facility, the above mentioned programs and Technical Specifications ensure that components, systems and structures will be refurbished or replaced to maintain their requisite safety function.

2. Radiological Impacts of Annual Releases

a. Onsite Doses

The PNPS occupational (onsite) exposure trend and comparative magnitude with the industry's average boiling water reactor (BWR) site, based on average annual exposures in terms of person-rem per 5-year period, is taken from the licensee's February 28, 1986 letter. The data in regards to both total dose and average dose per worker, indicate that the licensee has implemented a successful program under 10 CFR 50, Appendix I "As Low as Reasonably Achievable" (ALARA) guidelines. Given the licensee's continued implementation of its improved ALARA program and their excellent performance as noted in the interim Systematic Assessment of Licensee Performance (SALP) report dated October 4, 1990, we conclude that their projected exposures of about 350 person-rem, cumulative, will serve as an upper limit in future years of normal operation, i.e., non-reload years and years without major maintenance such as fuel pool modifications. During the proposed amendment term, it is assumed that the PNPS will operate with an approximately 24-month-long fuel cycle. This would result in a maximum of two refueling outages during the proposed amendment term using projected exposures of 550 and 150 person-rem for years with and without typical refueling outages. PNPS estimates an average exposure of 350 person-rem per year during the requested extension period. The expected exposures for the plant are in accordance with 10 CFR 20 and Regulatory Guide 8.8.

b. Offsite Doses

Appendix I guidelines on ALARA were briefly discussed above in regard to on-site doses; however, these guidelines also apply to releases that could cause offsite doses. In addition, routine releases to the environment are governed by 10 CFR 20.1(c), which states that such releases should be as low as reasonably achievable. Appendix I is more explicit in that it establishes radioactive design/dose objectives for liquid and gaseous offsite releases including iodine/particulate radionuclides.

Based on the continued operation of the plant's existing liquid and gaseous radwaste systems, we conclude that the anticipated offsite doses during the period covered by the proposed license amendment would remain a fraction of 10 CFR 50, Appendix I limits.

The staff concludes that the releases from the plant, both onsite and offsite, have remained within the bounds of the FES and have complied with the applicable portions of 10 CFR 20 and 50 as discussed above. As a consequence, we would expect releases during the proposed license extension period to remain within these bounds.

3. Environmental Impact of the Uranium Fuel Cycle

The PNPS reactor contains 580 fuel assemblies. The Final Environmental Statement (FES) for PNPS, dated May 1972, assumed that one-quarter of these fuel assemblies would be replaced during annual refueling outages. No estimate of the total number of fuel assemblies to be used during the 40-year operating plant life was made in the FES. However, an estimate can be made. If one quarter of the fuel was expected to be replaced every year for 40 years,

the total number of fuel assemblies replaced would be 5800 (580 fuel assemblies, divided by 4, times 40 years, equals 5800 assemblies replaced during the 40-year operating life of PNPS).

However, due to a combination of improved fuel designs and extended outages, actual fuel cycle lengths at PNPS have varied from approximately 20 months to 46 months. This has reduced the demand for fissile uranium. In the future, PNPS will be utilizing a 24-month cycle which will again reduce the need for additional fuel relative to the initial FES. Thus, the 40-year fuel use assumed in the FES, has been reduced by the use of improved fuel design and longer operating cycles. The total number of fuel assemblies to be used and stored if the amendment request is granted is now estimated to be approximately 4000. This is a reduction of 1800 fuel assemblies over the 40-year life of PNPS, including the additional 3 years, 9 months operating time requested.

The environmental impacts, both radiological and non-radiological, attributable to transportation of fuel and waste to and from plant sites, with respect to normal conditions of transport and possible accidents in transport have been assessed in several generic environmental impact statements. These assessments represent the contribution of such transportation to annual environmental costs including dose per reactor year to exposed transportation workers and to the general public. These annual environmental costs, which are displayed in Table S-4 of the Commission's regulations, 10 CFR Part 51.52, would not be changed by the extended period of operation.

Based on the above, the staff concludes that there are no significant changes in the environmental impact related to the uranium fuel cycle due to the proposed extended operation of PNPS.

4. 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 at 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 two fish per 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 productively 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 continuously injected at a rate not to exceed 0.25 ppm maximum daily average 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).

Protection of Historic Properties (36 CFR Part 800)

In accordance with the requirements of 36 CFR Part 800 "Protection of Historic Properties," Boston Edison reviewed the "State Register of Historic Places/1988," published by the Massachusetts Historic Commission, for the current listings of historic sites surrounding Pilgrim Nuclear Power Station (PNPS). Representatives of the Pilgrim Society, the Plymouth Historical Commission, the Massachusetts Historical Commission, the Plymouth Chamber of Commerce, and the U.S. Department of the Interior were contacted regarding information about the sites and to assure us the listings are complete.

The State Register lists 131 historic sites located in Plymouth in an area generally contiguous to Plymouth Rock, which is approximately 4-1/2 miles from Pilgrim Station. They are mostly in designated historic districts containing multiple, individually owned and occupied houses. Others are individual sites or houses, the most notable being Plymouth Rock, Cole's Hill Burial Ground, and the National Monument to the Forefathers. It should be noted that with the

exception of three sites; Cole's Hill, the Old County Courthouse, and Plymouth Rock, all Plymouth locations listed in the State Register were designated as historic sites after Pilgrim began operation.

Since December 1972, when Pilgrim started commercial operation, there is no known evidence of deterioration of any of these historic sites due to the operation of Pilgrim Station.

A similar assessment regarding protection of historical sites was noted in the FES issued by the AEC for Pilgrim Unit 2 dated September 1974. Section 2.3 "Historic Significance" states:

> According to the Massachusetts Historical Commission State Survey Director, none of the nearby historic sites will be impacted by construction of Unit 2. The staff agrees that no areas valued for their natural significance will be affected by the construction or operation of Unit 2 or the related transmission line corridor. The Conservative Commission of the Town of Plymouth agrees with this view.

In addition, the Pilgrim Unit 2 Environmental Report, Amendment 6, dated September 1976 provides the following in Section 2.3.1 "Review and Consultations:

> The Pilgrim Station site has been considered in accordance with the National Historical Preservation Act. In this regard, on April 25, 1968, Harold L. Price, Director of Regulation, AEC, requested George B. Hartzog, Jr., Director, National Park Service, to obtain comments from the Advisory Council on Historical preservation relative to the effects of Pilgrim Station on the general area of Plymouth Rock and Forefather's Faith Monument. In a letter dated May 20, 1968, Robert R. Garvey, Executive Secretary of the Advisory Council on Historical Preservation, considered the effect of the Pilgrim site upon these National Register properties. It was concluded that: "The probable effect upon these properties cannot be judged to be sufficiently adverse to warrant Council comment."

Using the aforementioned assessments and the 1986 criteria of 36 CFR 800.9: "Criteria of effect and adverse effect," it is concluded that operation of Pilgrim Nuclear Power Station for the requested 3 year and 9-1/2 months license extension will cause no adverse effect or induce any detrimental impact on the historic sites located in Plymouth.

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 Technical Specification 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.

5. Plant Modifications

Many modifications and design changes have taken place at the plant since original construction. Those that involve an unreviewed safety question or require a change to the Technical Specifications are submitted to the NRC for prior review and approval. This review includes a determination of the environmental effects of the proposed change. As provided by our regulations, other changes may be implemented by the licensee without prior NRC approval. The licensee must first perform a safety evaluation for any such changes, subject to NRC inspection and audit. The licensee also submits such changes to the staff in an Annual Report, which is reviewed by the staff. A complete detailed description of all the changes including a summary of the safety evaluation is included in the annual update of the Final Safety Analysis Report (FSAR). The staff reviews the FSAR updates to verify that the changes did not require prior NRC review and approval. In general, these changes improve plant reliability and do not adversely impact the environment. While it is recognized that the requested license extension will possibly result in further routine

design changes and modifications similar in nature to those already conducted, it is not anticipated that these would have any adverse impact on the environment.

6. Conclusion on Environmental Impacts

Based on the above, we conclude that the proposed extension will not have any significant impact on the environment.

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 3 years, 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.

ALTERNATIVE USE OF RESOURCES

This action does not involve the use of resources not previously considered in the FES in relation to the operation of the plant.

AGENCIES AND PERSONS CONSULTED

The Commission made a proposed determination that the amendment involves no significant hazards consideration which was published in the Federal Register (51 FR 15393) on April 23, 1986.

BASIS AND CONCLUSION FOR NOT PREPARING AN ENVIRONMENTAL IMPACT STATEMENT

The conclusions of the May 1972 and September 1974 (Unit 2) Final Environmental Statements remain valid and operation of the plant has demonstrated that its impact on the environment has been within the bounds predicted by the FES. The staff has reviewed the proposed license amendment relative to the requirements set forth in 10 CFR 51. Based on this assessment, the staff concludes that there are no significant radiological or non-radiological impacts associated with the proposed action and that the issuance of the proposed license amendment will have no significant impact on the quality of the human environment. Therefore, pursuant to 10 CFR 51.31, an environmental impact statement need not be prepared for this action.

Dated at Rockville, Maryland, this 20th day of November 1990.

FOR THE NUCLEAR REGULATORY COMMISSION

Curtis J. Cowgill III, Acting Director
Project Directorate I-3
Division of Reactor Projects - I/II

ENCLOSURE 1

PROJECTED PERMANENT POPULATIONS OF TOWNS
WITHIN THE PILGRIM STATION EPZ

	1995 MISER Proj.	2000 KLD Proj.	2005 KLD Proj.	2010 KLD Proj.	2012 KLD Proj.
Plymouth	47,980	53,234	59,063	65,531	68,178
Kingston	10,746	12,825	15,380	18,355	19,700
Carver	8,152	9,359	10,693	12,157	12,773
Duxbury	16,212	18,076	20,253	22,581	23,539
Marshfield	2,053	2,266	2,514	2,776	2,883
Total within EPZ:	85,143	95,760	107,903	121,400	127,073

Notes:

1. The projected populations for 1995 were calculated by the Massachusetts Institute for Social and Economic Research (MISER) of the University of Massachusetts at Amherst.

2. Projections to later years were estimated by extending the trends of annual growth rates into the future.

3. Roy Williams of MISER indicated that MISER is currently extending their population projections into the 21st century.

4. The entire towns of Plymouth, Kingston and Duxbury lie within the Pilgrim EPZ. It is estimated that 58 percent of the population in Carver, and 8 percent of the Marshfield population reside within the EPZ. The above figures are those <u>within</u> the EPZ.