DOCKET NO. 4

APPLICATION OF THE MILLSTONE POINT COMPANY, ET AL FOR A CERTIFICATE OF ENVIRONMENTAL COMPATIBILITY AND PUBLIC NEED FOR AN ELECTRIC GENERATING FACILITY IDENTIFIED AS "MILLSTONE NUCLEAR POWER STATION, UNIT 3" LOCATED IN THE TOWN OF WATERFORD, CONNECTICUT	:	POWER FACILITY EVALUATION COUNCIL

FINDINGS

1. The Millstone Point Company and 26 New England utility companies, in accordance with the provisions of Section 16-501 of the 1971 Noncumulative Supplement to the General Statutes of Connecticut, applied to the Power Facility Evaluation Council on March 30, 1973 for a Certificate of Environmental Compatibility and Public Need for the construction of an electric generating facility in the Town of Waterford, Connecticut, which is identified as "Millstone Nuclear Power Station, Unit 3." The fee preseribed in Section 16-50v-1(b) of the Regulations of Connecticut State Agencies accompanied this application. (Applicants' Exhibit 1, Sections 1 and 6 and Appendix A; Transcript 9/24 p. 12)

2. Said application was filed by Northeast Utilities Service Company as agent for the applicants and was accompanied by proof of service of a copy of it by the applicants as required by Section 16-501(b) of the 1971 Supplement to the General Statutes of Connecticut. (Applicants' Exhibit 1, Section 1)

3. Affidavits of newspaper notice as required by statute and Section 16-501-1 of the Regulations of Connecticut State Agencies were also filed on March 30, 1973.

4. Pursuant to Section 16-50m of the 1971 Supplement to the General Statutes of Connecticut and Section 16-50j-21 of the Regulations of Connecticut State Agencies, the Power Facility Evaluation Council, after giving due notice thereof, held a public hearing on the application at the Waterford Public Library on September 24, 25, 26, 27 and 28 and October 1, 5, 15, 16 and 19, 1973. The hearing was open to the public. Council members Mortimer A. Gelston, Chairman, Richard O. Carey, Mrs. Woolsey S. Conover, Hendrik Eleveld,

James G. Horsfall, Benjamin P. Terry, Jeremiah Wadsworth and Commissioner Howard E. Hausman were present at sessions as indicated by the record. Richard Dowd attended as the designee of Commissioner Douglas M. Costle, and George Tower attended some sessions as the designee of Commissioner Hausman. (Hearing Transcripts)

5. The parties to the proceeding are the applicants; the persons entitled to receive a copy of the application under Section 16-501(b) of the 1971 Supplement to the General Statutes of Connecticut; Percy MacDonald and Spencer Williams, Selectmen of Waterford; Michael Jacobson of Fairfield; Those Interested in Defending the Environment ("TIDE"); Chester J. and Doris Dzialo of Middletown; and Peter Cooper of New Haven. (Transcript 9/24 pp. 4-5)

6. Several persons made a limited appearance pursuant to Section 16-50j-15 of the Regulations of Connecticut State Agencies for the purpose of filing statements in writing, which statements were made a part of the record. (Transcript 9/25 p. 44; 9/27 p. 178; 10/5 pp. 96, 165)

7. The Council retained S. E. Minor Company, consultants of Greenwich, Connecticut, who studied and made a report on the public need for and environmental impact of the proposed facility and possible alternatives, and other information the Council deemed necessary. (Council Exhibit 1; Transcript 9/28 p. 167)

8. After due notice to all parties, on Thursday, July 12, 1973, the Council and its consultants made an inspection of the proposed site for the facility at Millstone Point in the Town of Waterford and the two alternative sites for the proposed facility. (Council Exhibit 1, p. xx)

9. As proposed, Unit 3 would be a nuclear-fueled base load electric generating plant with a nominal net electrical capability estimated at 1150 megawatts ("MW"). (Applicants' Exhibit 1, p. iii and Section 9)

10. The proposed Unit 3 would utilize a pressurized-water type nuclear steam supply system (composed of a reactor, reactor coolant system and associated auxiliary systems) furnished by the Westinghouse

Electric Corporation and a turbine generator furnished by the General Electric Company. It would be similar in concept to the Connecticut Yankee Atomic Power Company generating plant on the Connecticut River in Haddam, Connecticut, Millstone Unit 2, the Maine Yankee Atomic Power Plant in Wiscasset, Maine and approximately 57 other nuclear plants presently in operation or under construction in the United States. (Applicants' Exhibit 1, p. iv and Section 9; Transcript 9/24 pp. 45, 46)

11. A nuclear generating unit, like proposed Unit 3, has three basic systems:

(a) A nuclear steam supply system, which consists of a closed system in which water under pressure is heated by the fission of uranium in the nuclear reactor. From the reactor, the pressurized heated water is piped to a heat exchanger where it generates steam and then returns to the reactor.

(b) The steam so provided is piped to a turbine generator where its energy is utilized to produce electricity. The spent steam from the turbine generator then passes through a water-cooled condenser where it returns to the liquid state and is pumped back to the heat exchanger where it is converted to steam again.

(c) A circulating water system, which is open-ended and the purpose of which is to provide cool water to condense the steam exhausted from the turbine generator. In this system cool water from Long Island Sound is pumped through pipes inside the condenser where it receives the heat from the condensing steam. It is then returned at a higher temperature to Long Island Sound. (Applicants' Exhibit 1, pp. 9-2 to 9-5; Exhibit 3; Transcript 9/24 pp. 46-48)

12. Auxiliary systems, in addition to the three basic systems, are needed for the purpose of controlling the quantity and quality of

the water in the nuclear supply system, for removal of residual heat from the system when the plant is shutdown, for emergency core cooling and for reactor control. (Transcript 9/24 p. 48)

13. The proposed Unit 3 would be constructed at Millstone Point in the Town of Waterford. The Millstone site is on the North Shore of Long Island Sound and on the east side of Niantic Bay, 3.2 miles west southwest of the Town limits of New London and about 40 miles southeast of Hartford, Connecticut. The site contains approximately 500 acres. A main line of the Penn Central railroad passes through the site about 1/2 mile north of the proposed location of Unit 3. This site is already the location of two other nuclear generating units. Unit 1 has a gross electrical capacity of 690 MW and is presently in operation. Unit 2 will have a gross electrical capacity of 865 MW and a net electrical capacity of 830 MW and is presently under construction with commercial operation scheduled for December of 1974. Unit 3 is expected to have a gross electrical capacity of 1209 MW and a net electrical capacity of 1156 MW. (Applicants' Exhibit 1, pp. vii, 9-1 and 15-1; Transcript 9/24 p. 43, 161; Exhibit 2)

14. The Applicant projects commercial operation of the proposed Unit 3 by May, 1979. (Transcript 9/24 pp. 35-36; Applicants' Exhibit 1, pp. iii and 9-1 and Section 14)

15. The Millstone Point Company is responsible for the operation of the Millstone Nuclear Power Station in Waterford, Connecticut. Northeast Utilities Service Company is an affiliate of the Millstone Point Company and is a service company supplying engineering, administrative and other services to the subsidiaries of Northeast Utilities, including The Millstone Point Company, the Connecticut Light and Power

Company, The Hartford Electric Light Company and Western Massachusetts Electric Company. (Transcript 9/24 p. 11)

16. The Millstone Point Company will have no ownership interest in the proposed facility but would act as agent for the owners and operate the facility on their behalf. (Transcript 9/24 p. 15)

17. Other than the Millstone Point Company, there are 26 applicants in this proceeding who are prospective owners of the proposed facility in varying percentages. (Applicants' Exhibit 1; Transcript 9/24 pp. 15-17, 21)

18. Connecticut Light and Power Company and Hartford Electric Light Company, which are public utilities operating in Connecticut, and Western Massachusetts Electric Company, which is a public utility operating in western portions of Massachusetts, are subsidiaries of the Northeast Utilities system. These three utilities would own a minimum of 72.3% and a maximum of 75% of Unit 3 and would take the same percentage of its output. (Transcript 9/24 p. 21; Applicants' Exhibit 1, p. iv, and Appendix A, p. A-1)

19. The remainder of Unit 3 would be owned by other New England utilities, including the Connecticut based United Illuminating Company which would own 3.68% of Unit 3. (Transcript 9/24 pp. 21-22; Applicants' Exhibit 1, p. iv and Appendix A, p. A-1)

20. Nine of the applicants are firmly committed to become owners of the proposed Unit 3. These applicants and the percentage of ownership which each would have if none of the other applicants becomes an owner are as follows:

The Connecticut Light and Power Company	39.750%
The Hartford Electric Light Company	21.000%
Western Massachusetts Electric Company	14.250%
New England Power Company	11.141%
The United Illuminating Company	3.685%
Public Service Company of New Hampshire	3.891%
Central Vermont Public Service Corporation	3.694%
Montaup Electric Company	2.372%
Fitchburg Gas & Electric Light Company	0.217%
Total	100.000%

(Applicants' Exhibit 1, Section 1 and Appendix A, p. A-1)

21. Certain of those firmly committed applicants have agreed to make small portions of their interest in the unit available, under specified conditions, to certain municipal systems in Massachusetts and certain systems in Vermont, all of which are also applicants in this proceeding. (Applicants' Exhibit 1, p. iv, Section 1 and Appendix A)

22. The companies of the Northeast Utilities system would have the responsibility for design, construction and operation of the proposed Millstone Unit 3. (Applicants' Exhibit 1, p. iv; Transcript 9/24 p. 18)

23. Stone & Webster Engineering Corporation of Boston, Massachusetts, is the architect-engineer responsible for the detailed design of the proposed Unit 3 and would be immediately responsible for supervision of actual construction. (Applicants' Exhibit 1, p. iv; Transcript 9/24 p. 41)

24. The proposed Millstone Unit 3 is one of a series of generating units scheduled to be installed in the late 1970s and early 1980s which have been designated "Pool-Planned Units" under the terms of the New England Power Pool Agreement dated as of September 1, 1971. These units include oil-fired units to be placed in operation in 1977 and 1978 in Massachusetts and Vermont and three nuclear units (Seabrook 1, Pilgrim 2 and Seabrook 2) to be placed in operation in Massachusetts and New Hampshire in 1979, 1980 and 1981. Ownership of each of these units is being shared by a number of New England Utilities. The Northeast Utilities system will share in the ownership of Pilgrim 2 and Seabrook 1 and 2. (Transcript 9/24 p. 18)

25. The Northeast Utilities service companies will have approximately a 25% interest in Seabrook Unit 1 and Pilgrim Unit 2, both nuclear units of the same size as the proposed Millstone Unit 3, which percentage is roughly equivalent to that which other New England electric systems would have in the proposed Millstone Unit 3. (Transcript 9/24 p. 21)

26. Planning for future electric generating capacity requirements must include a forecast of future total energy demands and peak loads. (Transcript 9/24 p. 77)

27. That portion of the Northeast Utilities system service area located in Massachusetts is relevant in evaluating the need for the facility as proposed. (Transcript 9/24 pp. 22, 23)

28. Influencing the growth of demand for electricity are factors such as population, per capita income, the number of households, saturation of electrical appliances, lifestyle, weather, growth of commercial and industrial activity, and other variables such as the cost and availability of electricity and other competing fuels. (Applicants' Exhibit 1, p. 10-3; Applicants' Exhibit 12; Transcript 9/25 pp. 147-157)

29. The applicants analyzed the growth expected on the Northeast Utilities system in different categories of electrical consumption. Estimates of net electrical energy requirements were prepared by totaling the requirements of all customers of each of the operating companies within the system plus an allowance for transmission and distribution losses and company use. Separate forecasts were made of the amounts of electrical energy expected to be consumed by each of the major customer classes; residential, commercial, industrial, street lighting, railroad and sales for resale. (Applicants' Exhibit 1, p. 10-3 and Appendix D; Exhibit 11, 12, 13; Transcript 9/24 pp. 89-96)

30. The forecast of electrical consumption for the residential class was determined by predicting the number of customers and the use per average customer. Important to the forecast was an analysis of demographic and historic customer data, and projected saturation of appliances. The forecast of future residential customers was based on independent studies of population trends and evaluation of the impact of increases in family forming age groups. (Transcript 9/25 pp. 131-132; Applicants' Exhibit 1, Appendix D, p. D-2; Applicants' Exhibits 31-37)

31. The average number of residential customers on the Northeast Utilities system will increase substantially. The 877,302 residential customers in 1973 may increase to as many as 1,013,100 in 1979 and 1,080,300 in 1982. (Applicants' Exhibit 1, Appendix D, p. D-2; Applicants' Exhibit 13)

32. Kilowatthour (kWh) use per average residential customer will also increase substantially. From 7,945 kWh in 1973 this use may increase to as much as 10,689 in 1979 and 12,086 in 1982. (Applicants' Exhibit 13)

33. There will be a significant increase in total kilowatt-hour use by residential customers. From 6,969.9 million kWh in 1973 this use could increase to as much as 10,828.7 million in 1979 and 13,056.5 million in 1982. (Applicants' Exhibits 11 and 13)

34. The applicants' forecast of estimated consumption by the commercial, industrial and street lighting customer classes was determined by summing estimates provided by Connecticut Light and Power Company, Hartford Electric Light Company and Western Massachusetts Electric Company for the years 1974 through 1978. The consumption estimates for 1979 through 1982 were based upon projections of the historic trend. (Transcript 9/24 p. 95; Applicants' Exhibit 11)

35. The estimated data in the forecast for sales for resale was calculated by adding individual projections of sales for resale to municipal utilities and small private systems. Railroad sales were estimated on the basis of data from the Penn Central Railroad, including an anticipated new load of approximately 40,000 kWh. (Transcript 9/24 pp. 95, 96; Transcript 9/27 pp. 43-47; Applicants' Exhibit 11)

36. The applicants' forecast is based on an average 7.6% annual compound rate of increase in total electric energy consumption for all customer classes (residential, commercial, industrial, street lighting, sales for resale and railroad). (Applicants' Exhibit 1, p. 10-4)

37. The generation of electricity required to meet the needs of customers on the Northeast Utilities system will increase substantially. From an estimated 20,610.6 million kilowatthours in 1973,

required generation may increase to as much as 32,271.8 million kWh in 1979 and 39,978.1 million kWh in 1982. (Applicants' Exhibit 11)

38. For planning purposes, in addition to system energy requirements, the winter and summer peak loads for which electrical generating capacity must be available are important points of reference. (Applicants' Exhibit 1, p. 10-1; Transcript 9/24 pp. 80-81)

39. During the period 1963 to 1972, the winter peak load of the Northeast Utilities system companies increased an average of 7.8% annually. (Applicants' Exhibit 1, p. 10-3)

40. The annual system peak on the Northeast Utilities system has historically occurred during the winter months but the summer peaks have been growing at a faster rate than the winter peaks. (Transcript 9/24 pp. 85-87, Applicants' Exhibit 5)

41. The summer peaks have been growing faster due to the increasing use of weather sensitive energy consumming devices, principally air-conditioning equipment. It is expected that by the late 1970's the summer peak may regularly exceed the previous winter peak. (Transcript 9/24 pp. 87, 97)

42. The summer and winter peaks have grown at the same rate over the past five years primarily because of the rapid growth in the use of electric energy for space heating. It is not expected that this rate of growth for space heating will continue and the summer load growth should continue while the winter load growth declines somewhat. (Applicants' Exhibit 5; Transcript 9/27 pp. 120, 121)

43. Through 1982, winter peaks will grow at an average annual compound rate of as much as 7.5% over the estimated 1973-74 winter peak, while summer peaks will increase at an average annual compound rate of as much as 8.1% over the estimated 1973 summer peak. (Transcript 9/24 p. 87; Transcript 9/27 p. 118; Applicants' Exhibit 1, p. 10-3; Exhibit 5)

44. The applicants' forecast shows an increase in the summer peak load on the Northeast Utilities system from an estimated 3520 megawatts ("MW") in 1973 to 5620 MW in 1979 to 7100 MW in 1982. The winter peak load is projected to increase from an estimated 3915 MW in 1973-74 to 6070 MW in 1979-80 to 7480 MW in 1982-83. (Applicants' Exhibit 5)

45. In 1969, the companies in the Northeast Utilities system discontinued direct sales promotion advertising and promotional builder-dealer allowances. The effect of this suspension has been taken into account in the applicants' studies of future demand. (Transcript 9/25 p. 132; Transcript 9/27 pp. 131, 140; Applicants' Exhibit 38, pp. 7-8; Exhibit 1, p. 8-1)

46. National Economic Research Associates, Inc., an economic consulting firm retained by the Northeast Utilities system, prepared in 1972 an independent forecast of future demand on the Northeast Utilities system which essentially agreed with the applicants' forecast as presented in this proceeding. (Transcript 9/24 pp. 99-100; Transcript 10/15 pp. 140-143; Applicants' Exhibit 38)

47. The consultants to the Council, the S. E. Minor Company, corroborated the applicants projection of the growth rate in demand for electricity. (Council Exhibit 1, pp. 1-1 to 1-4)

48. Generation planning by the companies of the Northeast Utilities system is carried out on a coordinated basis with other electric systems in New England, and has recently become formalized through creation of the New England Power Pool (NEPOOL). (Transcript 9/24 p. 105; Transcript 9/25 p. 65)

49. Northeast Utilities system planning involves the examination of the requirements of its own service area within the framework of New England wide planning. (Transcript 9/24 p. 105)

50. An 8 to 11 year lead time is required after a major generating facility is committed and before it can be placed in commercial operation for engineering, licensing and construction. (Transcript 9/24 p. 106)

51. The applicant is currently supporting long-term research into new concepts for the generation of electricity, new materials, new techniques and designs, alternate fuel supplies, and minimization

of environmental impact. (Transcript 9/24 pp. 106, 107; Exhibit 14)

52. Prior to the time a new generating unit must be committed, studies must be limited to a consideration of alternatives which are available or certain to be available in time to perform the required function. (Transcript 9/24 p. 108)

53. The proposed Unit 3 would be constructed as part of an overall generation expansion program by utilities participating in NEPOOL and by other New England utilities. (Applicants' Exhibit 1, pp. iv, 10-1)

54. Based on system costs of various currently available alternatives, Northeast Utilities studies and those made by NEPOOL indicate that the needs of the customers of the Northeast Utilities system and New England as a whole for increased amounts of electricity in the late 1970's and early 1980's can best be met by the installation of a number of large nuclear units. (Transcript 9/24 pp. 108, 109)

55. The overall reliability of an electric power supply system depends on the adequacy of the system's physical facilities and on the degree of integration and coordination of operation with adjacent power supply systems. (Transcript 9/24 p. 109)

56. Within New England this coordination is achieved through the New England Power Pool (NEPOOL), while at the multi-regional and national level it is accomplished by the Northeast Power Coordinating Council (NPCC) and the National Electric Reliability Council (NERC), Overall, the Federal Power Commission (FPC) exercises its regulatory authority and directly influences the reliability policies and standards developed by the industry. (Transcript 9/24 pp. 109, 110)

57. In addition to the anticipated load requirements, reliable operation of the bulk power system of New England requires the availability of adequate reserve generating capacity to meet an operating reserve requirement, to permit units to be taken out of service for scheduled maintenance, and to protect against possible extended unscheduled outages. (Applicants' Exhibit 1, p. 10-2; Transcript 9/24 pp. 110, 111)

58. Generation planning must also include consideration of energy losses which will be incurred in transmitting and distributing needed electricity and which normally approximate 9½% of the total electric energy consumption. Company use generally consumes another 1/2 of 1% of total consumption. (Transcript 9/24 p. 96)

59. Operating reserves protect against the sudden unexpected loss of generating equipment, the loss of scheduled power from outside the area and variations in the daily forecasted load. (Transcript 9/24 p. 110; Transcript 10/1 pp. 4-5, Applicants' Exhibit 1, p. 10-2)

60. The applicants are responsible for maintaining a reserve margin as required by the need for reliable electric service and in accordance with standards set by the Northeast Power Coordinating Council. (Applicants' Exhibit 1, p. 10-5 to 10-6)

61. Pooling arrangements such as NEPOOL allows systems to share reserve margin requirements. The pooling arrangement utilizes each system's generation resources, and capacity on other systems can be called upon in the event of an outage of a large unit. (Applicants' Exhibit 1, p. 10-6)

62. NEPOOL requires a reserve margin equivalent to 20-22% of peak load. In light of experience with the new large fossil and nuclear units coming into service the sufficiency of this margin is under consideration and Northeast Utilities has adopted an interim reserve margin for the 1979-1980 period equal to 23 percent of its winter peak load for planning purposes. (Applicants' Exhibit 1, p. 10-6; Transcript 9/24 pp. 112, 113; Transcript 9/28 p. 112)

63. Due to higher ambient air and cooling water temperatures in the summer months and the dependence of hydroelectric capacity on river flow, the Northeast Utilities system has a reduction in capacity from the winter period to the peak summer period amounting to 280 MW. As summer peaks increase, the applicants' capacity is becoming summer limited from an operation and planning standpoint. (Applicants' Exhibit 5; Transcript 9/24 pp. 119, 120)

64. Capacity additions currently planned for the Northeast Utilities system in 1979 and subsequent years include interests in the proposed Millstone Unit #3, Seabrook Unit I in New Hampshire, the Pilgrim #2 Nuclear Unit and some demonstration fuel cell units scheduled for 1980. If this schedule is maintained, Northeast Utilities system will have adequate capacity in 1979 and 1980. (Transcript 9/24 pp. 127-129; Applicants' Exhibit 16)

65. Without the installation of the proposed Unit 3 or equivalent capacity for operation in 1979, the reserve margin of generating capacity available would be insufficient to cover contingencies thus endangering the quality and reliability of service in Connecticut. Assuming other capacity as scheduled, this reserve margin could be as low as 13.4% in 1979, 12.0% in 1980 and 6.4% in 1981. These percentages would be equivalent to a deficiency in Northeast Utilities' capacity responsibility of 580 MW in 1979, 717.5 MW in 1980 and 1157.9 MW in 1981. (Transcript 9/24 pp. 132-133; Applicants' Exhibit 1, p. 10-6, Table 10-2; Applicants' Exhibit 17, Council Exhibit 1, pp. 1-6 to 1-10)

66. In the context of NEPOOL planning, additional generating capacity must be developed in Connecticut in the 1979 period to make up for the state's expected capacity deficit in the early 1980's. (Applicants' Exhibit 1, p. 16-1; Applicants' Exhibits 16 and 17; Transcript 9/24 pp. 133-135)

67. The operating reserve for NEPOOL is currently set at 1½ times the largest generating unit in New England. The operating reserve for all of New England is about 1,000 MW and the Northeast Utilities system share of that reserve is about 280 MW. (Transcript 9/28 pp. 109-111)

68. Daily loads on the applicants' systems are supplied by three types of generating capacity; base-load, intermediate and peaking. (Transcript 9/24 p. 118; Applicants' Exhibit 15)

69. Base load units, which supply the bottom part of the daily load curve, must be capable of sustained operation at full load. Because of their operating requirement of maintaining maximum output

almost continuously, the principal variable component of cost, i.e., the energy cost, which depends on efficiency of equipment and fuel cost, must be kept as low as practicable because energy cost represents a greater proportion of total costs of base load capacity than for equipment which is operated less. (Transcript 9/24 pp. 118, 121-122)

70. In order to achieve higher efficiency or use a lower cost fuel, it may be economic to spend extra amounts on base load units because such added costs can be spread over a large number of hours of operation. Thus base load units typically have a high investment per kilowatt of capacity together with a low cost per unit of energy output. (Transcript 9/24 p. 122)

71. Intermediate units, which supply the middle part of the daily load curve, should be capable of going through a daily starting and shutdown cycle without such operation causing excessive maintenance problems. Because of the portion of the load curve they supply, these units, which are sometimes referred to as cycling units, are operated fewer hours of the year. There is a lesser penalty associated with somewhat higher energy costs and a corollary incentive to incur a lower installed cost per kilowatt of capacity since there are fewer kilowatt hours over which the carrying costs of capital may be spread. (Transcript 9/24 pp. 118, 123)

72. Peaking units, which supply the top part of the daily load curve, must be capable of being brought on line quickly and be capable of rapid changes in load so that they may also function in the role of providing operating reserve. Similarly to the case of intermediate units, the lesser number of hours of operation required of peaking units results in lower installed cost and permits use of high cost fuels. On the Northeast Utilities system, peaking capacity is currently made up of gas turbines, a few old, high energy cost fossil steam units, a few small river hydroelectric units and pumped storage hydroelectric capacity. (Transcript 9/24 p. 124)

73. The expected intermediate and peak loads of the 1979-1980 period can be supplied by existing intermediate and peaking units, but the total projected needs of 1979 and beyond require the addition of a base-load unit. (Applicants' Exhibit 1, pp. 10-8, 10-10, Table 10-3)

74. In their evaluation the applicants studied the optimum mix of nuclear base-load expansion compared with other alternatives including the installation of gas turbines or combined cycle fossil fueled generating units, or a mix of the two. (Applicants' Exhibit 21; Transcript 9/24 pp. 146-151)

75. Compared to the case where the average amount of nuclear capacity equals approximately 55% of peak load, an all-gas turbine expansion as an alternative to the proposed base-load nuclear Unit 3 would, in present worth values and over the period 1979 to 1989, cost an additional $660 million; an all combined cycle expansion would cost $460 million more; and a mix of the two would cost an additional $390 million. (Transcript 9/24 pp. 150-151; Applicants' Exhibit 21)

76. Installation of peaking or intermediate capacity at the end of 1978 would be uneconomic and unresponsive to the projected system needs of the applicants. (Applicants' Exhibit 1, p. 10-11; Transcript 9/24 p. 136; Applicants' Exhibit 18)

77. While the installed cost per kilowatthour and the operating and maintenance expenses of a nuclear base-load plant would substantially exceed those costs and expenses for an oil-fired plant, the total annual cost of generating electricity from a nuclear plant would be lower than from a comparable oil-fired plant because of the higher fuel costs of the oil-fired plant as compared to the nuclear plant. (Applicants' Exhibit 1, p. 10-14, Amendment No. 1; Applicants' Exhibit 20)

78. The proposed Unit 3, with an installed cost of $565. per kilowatt and using a fuel cost of $.23 per million BTU with a capacity factor of 77% results in a cost of 16.5 mills for generating one kWh of electricity. A comparable oil-fired unit with an installed cost of $350 per kilowatt using an average fuel cost of $1.51 per million BTU and a similar 77% capacity factor results in a cost of 21.9 mills for generating one kWh of electricity. This 5.4 mills per kWh savings, for an 1150 MW nuclear unit, would be an annual cost advantage for the proposed Unit 3 of $41.9 million or $419 million over the first ten years of operation. (Applicants' Exhibit 1, pp. 10-14 to 10-15, Amendment No. 1; Applicants' Exhibit 20)

79. The system total cost of power is to a large extent a function of the total cost to supply the base energy portion of the load curve. Two choices of fuel, fossil fuels and uranium, are available for units which would have to operate to supply base load power in the time frame under consideration. For the 1980's, it is the fuel cost advantage that makes nuclear the economic choice for capacity additions. (Transcript 9/24 pp. 139-154; Applicants' Exhibits 20, 21; Council Exhibit 1, p. 1-11, 1-13)

80. Present indications are that there will be an adequate supply of nuclear fuel during the life of the proposed facility and its cost should retain its current advantage over fossil fuels. (Council Exhibit 1, p. 1-13; Applicants' Exhibits 41 through 49; Transcript 9/25 pp. 159-163; Transcript 9/26 pp. 92-95; Transcript 10/16 pp. 26-57; Transcript 10/19 pp. 4-13)

81. Nuclear fuel for the proposed facility is under contract by the applicant for the first loading and several reloads. In terms of reactor operation this amounts to a minimum of four years of operation at a relatively fixed fuel cost. (Transcript 9/25 pp. 160-163; Transcript 9/27 p. 67; Transcript 9/28 p. 142)

82. In addition, the applicants are currently evaluating bids for an additional six years' supply of fuel at prices consistent with their projections of nuclear fuel costs, which projections show a continuing advantage for nuclear fuel over oil. (Transcript 9/27 p. 68; Transcript 10/16 p. 43)

83. For financial planning purposes, the life of a nuclear power reactor such as the proposed Millstone Unit 3 is estimated at thirty (30) years. The design life of the reactor pressure vessel is specified to be forty (40) years at full rated power. (Transcript 10/16 p. 95)

84. In addition to cost, availability of oil also has to be considered. Historically, oil supply problems in New England have been acute. (Transcript 9/24 pp. 28-29; Council Exhibit 1, p. 1-12)

85. Because the fuel cost component of a nuclear generating unit is a comparatively small component, a percentage increase in the cost of nuclear fuel would have substantially less effect than a comparable percentage increase in the cost of oil. (Applicants' Exhibit 1, p. 10-15, Amendment No. 1)

86. Reasonable variations in cost factors in favor of an oil-fired plant do not alter the overall economic advantage of a new nuclear plant for 1979 over a new oil-fired plant. (Transcript 9/24 pp. 152-153; Applicants' Exhibit 56)

87. Assuming no significant design changes, delaying the completion of the proposed Millstone Unit 3 until 1981 would result in increased costs ranging from approximately 60 million to 110 million dollars. (Transcript 10/16 pp. 73, 74)

88. Total installed cost of the proposed Millstone Unit 3 is estimated by the applicants to be $540 million, not including $110 million in interest during construction. Carrying costs are estimated to be $91 million annually, fuel costs to be $17.8 million annually for the first ten years of operation, and operating

and maintenance costs to be \$19.4 million annually. The production cost for electricity from the proposed unit would approximate 1.65¢ per kilowatthour. (Applicants' Exhibit 1, pp. 13-1 to 13-2, Amendment No. 1; Transcript 9/24 pp. 58, 59)

89. Approximately 40% of engineering and 17% of design has been accomplished for the proposed facility. Construction is scheduled to start May 1, 1974, with commercial operation planned for May 1, 1979. (Transcript 9/24 pp. 60, 61)

90. The applicants' outstanding contracts, the design work and evaluations done to date and an allowance for contingencies and inflation factors is reflected in the estimate for the total installed cost of the proposed Unit 3. (Transcript 9/28 pp. 156-162)

91. The economics of the proposed Millstone Unit 3 would not depend on development of breeder reactors or the purchase of plutonium by the United States Government. (Transcript 10/16 pp. 26-56)

92. The proposed Millstone Unit 3 is scheduled to obtain an Atomic Energy Commission construction permit during 1974 and if it does so obtain one prior to August 1, 1977, it will be entitled to continued governmental indemnity under the existing provisions of the Price-Anderson Act (42 U.S.C. §2210 et seq.) even if that statute is not extended past its present expiration date of August 1, 1977. (Transcript 9/24 p. 33; Transcript 10/5 p. 65; Transcript 10/16 p. 23; Applicants' Exhibit 1, Figure 14-1; Applicants' Exhibit 40)

93. Importing needed electricity from neighboring generating systems, as an alternative to the installation of a nuclear base load generating unit in Connecticut in 1979 would be impractical since

power in the substantial amounts needed would not be available for sustained periods of time, and many miles of costly new transmission lines would be required. (Applicants' Exhibit 1, pp. 10-10 to 10-11; Transcript 9/24 p. 27)

94. Delaying the scheduled retirement of presently operating units, or reactivating older units, would also be impractical due to the small capacity of such units, the high maintenance and operating costs associated with such units and their relative inefficiency and lack of pollution control devices. (Applicants' Exhibit 1, p. 10-11)

95. The use of natural gas as an alternative fuel for a New England base load plant is precluded due to price and supply limitations. Even in areas close to natural gas fields new plants are now being designed as nuclear, oil or coal fired units. (Applicants' Exhibit 1 p. vi; Transcript 9/24 pp. 24, 25; Council Exhibit 1, p. 1-11)

96. Coal will once again become a viable alternative in the future as the development of stack gas desulphurization, coal gasification or liquefaction processes permit the meeting of current air quality regulations. (Transcript 9/24 pp. 25, 26; Council Exhibit 1, p. 1-11)

97. There is no assurance that coal meeting current Connecticut air quality standards will be available in New England at a reasonable price, or that reliable, economic desulphurization technology will be available to justify approval of a coal-fired alternative to meet the need for new base-load generation in the 1979-1980 period. (Applicants' Exhibit 1, pp. vi, 10-12; Transcript 9/24 pp. 25-26)

98. The applicant is currently supportung research into the development of new base load technologies such as magnetohydrodynamics, breeder reactors and fusion reactors for possible use

in post 1980 operations. (Transcript 9/24 p. 26; Applicants; Exhibit 14)

99. New technologies for the generation of base-load electricity, through the use of solar energy alternatives, are being developed and an offshore windpower system concept or a concept known as the ocean thermal gradient system may offer viable long term alternatives to present heat releasing combustion and fission processes. (Transcript 9/26 pp. 126-133, 134-152; TIDE Exhibits 1 to 10; Council Exhibit 1, p. 1-11)

100. An offshore windpower system would consist of a large number of floating windmill generator stations located at sea in the Gulf of Maine and over Nantucket Shoals. Electricity thus generated would be used to run electrolyzers and distillers to produce hydrogen, which would be transmitted by pipeline to reconversion stations, where it would be turned back into electricity. Such a windpower system would require a total capitalization of approximately $18.585 billion. (Transcript 9/26 pp. 129, 131)

101. An ocean thermal gradient system would utilize the temperature differences between the solar heated surface water of the Gulf Stream and the cold bottom water directly beneath it. The end product, hydrogen gas, would be sent 750 miles from the generating area off South Carolina to Hartford via a pipeline laid in the seabed and in the bottom of the Connecticut River, for use directly as fuel or as a source of electricity. (Transcript 9/26 pp. 145-147; Transcript 10/5 p. 185)

102. These windpower and ocean thermal gradient concepts are not, and under proposed research programs will not be, sufficiently developed and demonstrated for the applicants to rely on them as a substitute for the proposed Unit 3 in supplying the increased

needs for electricity in 1979. (Transcript 10/5 pp. 144-145, 146-147, 148-149, generally 149-204; TIDE Exhibit 8, p. 5, p. 8 Table 1, p. 9 Table 2, p. 10 Table 3; Council Exhibit 1, p. 1-11)

103. In the context of NEPOOL generating capacity planning, Connecticut was chosen by the applicants as the site for the 1979 unit because of the projected load deficit in Connecticut for the period 1979 and beyond. (Transcript 9/28 pp. 11-14; Applicants' Exhibit 1, Table 16-1)

104. In siting new generating units, the Northeast Utilities Service Company considers available sites in both Connecticut and Massachusetts. Its largest single operating plant is the 1,000 (MW) Northfield Mountain pumped storage plant in Massachusetts. (Transcript 9/24 p. 23)

105. The Millstone Point site for the proposed 1979 unit was chosen by the Northeast Utilities system after examination of numerous alternatives in Connecticut and in Western Massachusetts. (Applicants' Exhibit 1, pp. 16-2 to 16-5)

106. The site selection process for the proposed facility was influenced by the long lead time required for licensing, engineering and construction of nuclear plants. (Transcript 9/24 pp. 62-72; Council Exhibit 1, p. 2-1)

107. Thirteen sites were initially considered for the proposed unit, and all but three were eliminated due to insufficient land availability or population density in excess of Atomic Energy Commission guidelines. (Transcript 9/24 p. 62; Transcript 9/27 p. 30; Transcript 9/28 p. 128; Applicants' Exhibit 1, Section 16)

108. The Connecticut Yankee site at Haddam Neck on the Connecticut River (where the Connecticut Yankee nuclear power plant has been operating since 1967), the Maromas site on the Connecticut River near Middletown, and Millstone Point could meet

the requirements necessary to achieve an operating nuclear unit in 1979. (Applicants' Exhibit 1, Section 16; Transcript 9/24 pp. 63-64; Council Exhibit 1, p. 2-2)

109. Economic considerations indicate that a third unit at Millstone Point would have at least a $14 million cost advantage over a second unit at Connecticut Yankee and a $55 million cost advantage over a single unit at Maromas, assuming that cooling towers would be required at both river sites and that cooling towers would not be required at Millstone Point. (Applicants' Exhibit 1, p. 16-5; Transcript 9/24 p. 72; Transcript 9/25 pp. 136-138)

110. Geological, hydrological, meteorological and population characteristics for the alternative sites are favorable. Economics of construction and environmental characteristics taken as a whole led the applicants to select Millstone Point as the preferred site. (Transcript 9/24 p. 63)

111. The Millstone Point site has been in continuous industrial use for approximately two centuries, first as a quarry, more recently, for light industry and research, and now for power generation. (Applicants' Exhibit 1, p. 15-1)

112. Various environmental studies of the three sites, considering such factors as thermal effects, entrainment effects, intake structure design, cooling tower plume, radiological effects, plant and cooling tower noise, land use compatibility, visual impact, and the effect of necessary transmission lines, indicate that Millstone Point is the preferred choice from an environmental standpoint. (Transcript 9/24 pp. 62-73; Applicants' Exhibit 1, pp. 16-6 to 16-10; Council Exhibit 1, p. 2-1 to 2-12)

113. The Connecticut Yankee and Maromas sites are both located on the Connecticut River near the Towns of Haddam and Middletown, respectively. Locating the proposed facility at either of these locations would necessitate the use of cooling towers to meet water quality criteria. (Transcript 9/24 pp. 63, 64; Council Exhibit 1, p. 2-5, 2-9)

114. A cooling tower blowdown flow of approximately six thousand gallons per minute would constitute the only source of heated water

discharged from a new unit at either of these river locations. This flow would be less than 1/10 of 1% of the minimum average daily tidal flow. (Transcript 9/24 pp. 64, 65)

115. The circulating water system of the proposed Millstone Unit 3 would discharge to the quarry about nine hundred thousand gallons per minute of water heated approximately 18° above ambient. This would mix with approximately one million gallons per minute being discharged from Units 1 and 2 before the combined flow enters Long Island Sound. The average tidal flow in Twotree Island Channel of approximately fifty million gallons per minute would facilitate the mixing and cooling of this combined discharge. (Applicants' Exhibit 1 p. viii and Transcript 9/24 p. 65)

116. The operation of cooling towers at the Maromas or Connecticut Yankee sites would result in vapor plumes or fog. However, the fog formation at ground level would probably not be significant. (Transcript 9/24 p. 68)

117. Effects of entrainment on fish eggs, larvae and other small aquatic organisms would be the greatest at the Millstone site where the circulating water flow with all three units in operation would be about 1,900,000 gallons per minute. By way of contrast, the water volumes involved in makeup to cooling towers at Connecticut Yankee or Maromas would only be about 24,000 gallons per minute. The Millstone flow would, however, amount to less than four percent of the average tidal flow in Twotree Island Channel. (Transcript 9/24 p. 66)

118. Since two nuclear units are already located at Millstone Point, the proposed unit could be incorporated into the general development of the site. The visual impact of the proposed unit at Millstone would perhaps be the least of any of the sites under consideration because of the inability to adequately screen the cooling towers which would be necessary at Maromas or Connecticut Yankee. (Transcript 9/24 pp. 70-72; Council Exhibit 1, p. 2-4, 2-7, 3-2)

119. State and Federal concern over the aesthetic beauty of the Connecticut River Valley, and local zoning regulations with respect to the Maromas site indicate that locating the proposed facility at Millstone Point would be the most compatible with existing land uses in the three areas. (Transcript 9/24 pp. 68-70)

120. The major sources of noise which could create a problem beyond the boundaries of a nuclear plant site are the main power transformer, building ventilation fans, turbine noise transmitted through building vents and, as proposed, cooling towers at the Connecticut Yankee and Maromas sites. (Transcript 9/24 p. 68)

121. Since 1968, the Northeast Utilities system has been studying and monitoring the environmental impact of nuclear power plant operation on marine biota at Millstone Point. (Applicants' Exhibit 1, Section 18 and Appendix F; Exhibit 22; Transcript 9/24 pp. 165, 166)

122. The principal studies have covered the areas of aquatic ecology, hydrography and terrestrial ecology. At the time of the hearing, approximately twenty separate but interrelated studies were continuing primarily to determine the effect of the thermal plume on aquatic ecology. (Applicants' Exhibit 1 Section 15; Exhibit 22, 23; Transcript 9/24 pp. 168-170)

123. The addition of a third unit at Millstone Point would take advantage of the characteristics of the site and the knowledge of the site's terrestrial and aquatic environment that the applicants have gained through studies relating to the earlier units. (Applicants' Exhibit 1, p. 15-28)

124. The aquatic ecology studies have been and continue to be conducted by independent laboratories including the Clapp Laboratories

of the Battelle Memorial Institute, Woods Hole Oceanographic Institute, University of Rhode Island and Braincon. (Transcript 9/24 p. 171)

125. The aquatic ecology studies include an exposure panel study, intertidal rock shore surveys, oyster studies, studies of intertidal sand macrofauna, artificial lobster habitats, shore zone seining, gill netting, offshore trawl sampling, seawater trace metal analyses, tissue metal analyses, subtidal benthos surveys, a fish tagging survey, an ichthyoplankton study, entrainment studies and a mathematical biological model to assess long-term or subtle environmental effects. (Transcript 9/24 pp. 173-186; Applicants' Exhibit 22; Council Exhibit 1, p. 3-54, 3-55)

126. In addition, the applicants have conducted and are conducting hydrographic studies dealing with tidal circulation and thermal effects. (Transcript 9/24 pp. 186-187; Applicants' Exhibit 1 pp. 15-13 to 15-14)

127. Terrestrial ecology studies have included a floral survey, a survey of bird populations, a survey of reptile and amphibian populations and surveys of large and small mammals on the site. (Transcript 9/24 pp. 187-188)

128. Vegetation on Millstone Point consists of a mixed hardwood forest, open fields, a riparian community, brackish marshes, a transmission line corridor, a beach community and an abandoned nursery. Many birds, small mammals and amphibians have been observed on the site. (Applicants' Exhibit 1 Section 15; Transcript 9/24 p. 161-163)

129. The marine organisms in the vicinity of Millstone Point consists of benthos or bottom dwellers such as the lobster, plankton and nekton such as fin fish. Striped bass, blue fish, flounder, tautog, menhaden, herring and silverside are the most common fish found in the area. (Applicants' Exhibit 1 Section 15; Transcript 9/24 pp. 163-165)

130. The Millstone Nuclear Power Station, after completion of the proposed facility, would consist of an additional containment building to house the nuclear steam supply system, a turbine building, and a third intake structure. (Applicants' Exhibit 4; Transcript 9/24 p. 50)

131. The environmental impact of the proposed Millstone 3 would include effects both from construction and operation of an additional generating facility at Millstone Point. (Transcript 9/25 p. 4)

132. Since construction of the proposed Unit 3 would be limited to much of the same general area as was used for Units 1 and 2, the additional amount of vegetation removal or displacement of wildlife will not be material. Following the completion of the proposed Unit 3, the temporary laydown area would be restored. (Transcript 9/25 p. 6; Council Exhibit 1, p. 3-11, 3-12)

133. The installation of a pump house just to the north of the existing Unit 2 pump house would necessitate the permanent closing of about three-hundred feet of Bay Point Beach. This represents about thirty percent of the present beach front. (Transcript 9/25 p. 7)

134. In addition to the acreage required for Units 1 and 2 on the five hundred acre Millstone Point, the proposed facility would occupy about eight additional acres of land. Architectural plans have been formulated to make the proposed unit aesthetically compatible with the existing units. (Applicants' Exhibit 1 pp. iii, 18-1; Transcript 9/24 pp. 4, 5)

135. There has been major construction activity at the Millstone site since 1966. The construction of Units 1 and 2 resulted in clearing land at the site for parking, offices and laydown space. Shore areas were disturbed for construction of

the circulating water intake housing. (Applicants' Exhibit 1, p. 18-1)

136. Construction of the circulating water system for the proposed facility would require the building of an earthen cofferdam and the removal by dredging of approximately 40,000 cubic yards of material. (Applicants' Exhibit 1 p. 18-1 to 18-3; Transcript 9/25 p. 7, 8)

137. There will be a disruption of the benthic communities during this construction and dredging operation. (Applicants' Exhibit 1 p. 18-1 to 18-3; Transcript 9/25 pp. 7, 8)

138. There may be a recovery of these benthic communities disturbed during the construction and dredging operation. (Applicants' Exhibit 1 p. 18-1 to 18-3; Transcript 9/25 pp. 7, 8)

139. Proper transportation, storage and handling of construction chemicals would minimize the chances of their having any long-term adverse effect on the aquatic environment. (Applicants' Exhibit 1 pp. 18-1 to 18-3; Transcript 9/25 p. 9)

140. Connecticut regulations for the Abatement of Air Pollution would be followed during the construction phase of the proposed unit. (Applicants' Exhibit 1 p. 18-3; Transcript 9/25 p. 10)

141. Effects on air quality from construction equipment and dust are not expected to be significant. (Applicants' Exhibit 1, p. 18-3; Transcript 9/25 p. 10; Council Exhibit 1, p. 3-47)

142. No significant adverse effects from construction of the proposed Unit 3 at Millstone Point, on human activities, are anticipated that were not experienced by the construction of Units 1 and 2. (Transcript 9/25 pp. 10-12; Applicants' Exhibit 1, pp. 18-2 to 18-3)

143. Effects of the operation of the proposed Unit 3 on the aquatic environment would consist primarily of the impact of the circulating water system, including the heated water discharge, entrapment, entrainment and discharge of chemicals. (Applicants' Exhibit 1, p. 18-4; Transcript 9/25 pp. 12-13)

144. The heated circulated water from the proposed Unit 3 would be discharged into an abandoned quarry where it will combine with the heated discharges from Units 1 and 2 and flow into Long Island Sound in an area known as Twotree Island Channel. (Applicants' Exhibit 1, pp. 9-1 to 9-2, 17-3)

145. The total combined flow of the circulating water systems of all three units would be approximately 4,155 cubic feet per second with a maximum temperature increase at full load of about 20.6° F. This flow represents approximately 4% of the average tidal flow through Twotree Island Channel. (Applicants' Exhibit 1, p. 17-3; Transcript 9/25 p. 13; Council Exhibit 1, p. 3-28)

146. The thermal plume, or total area of heated water, would be continuously shifting in location and configuration in Twotree Island Channel due to the changing tidal currents and, to a lesser extent, the wind. (Transcript 9/25 p. 14)

147. The temperature of the heated water from Units 1, 2 and 3 will be reduced from approximately 21° F. above ambient temperature at the point of discharge from the quarry to 8° F. above ambient temperature within 900 feet from the quarry discharge point and to 4° F. above ambient temperature within 3000 feet. (Transcript 9/25 p. 14; Applicants' Exhibit 24)

148. The combined operation of Units 1, 2 and the proposed Unit 3 would extend the 4° isotherm approximately 1000 feet further into Twotree Island Channel than the Unit 1 operation alone. (Transcript 9/26 p. 39)

149. The average tidal flow in Twotree Island Channel is approximately 120,000 cubic feet per second. (Applicants' Exhibit 1, p. 17-3)

150. Ambient water temperature variations of at least two to three degrees occur from location to location at any particular instant of time. This variation in ambient water temperatures is a naturally occurring phenomenon and is caused by solar heating. (Transcript 9/25 p. 17)

151. Effects of the thermal plume on benthic (i.e., bottom dwelling) communities of marine flora and fauna would primarily be limited to the bottom areas immediately adjacent to the cut created to open the quarry to Long Island Sound and the areas in the inter-

tidal and upper subtidal zones in limited areas on either side of the cut, because the warmest portions of the plume are confined to the upper level of the water column. (Transcript 9/25 p. 17; Applicants' Exhibit 1, pp. 18-8 to 18-9; Council Exhibit 1, p. 3-62)

152. Effects on benthic communities which have been observed in the applicants' studies are an increase in the growth of a species of seaweed in a limited part of a nearby island and some temporary scouring in the immediate vicinity of the discharge at the quarry cut. (Transcript 9/25 pp. 17-19; Applicants' Exhibit 1 p. 18-9)

153. Bottom scouring caused by the jet turbulence of the discharge of water from Unit 1 was observed before installation of a fish barrier in 1972 in the discharge quarry cut. The fish barrier may have eliminated the scouring and the area has returned to its natural condition. (Transcript 9/25 pp. 18, 19; Transcript 9/26 pp. 17, 46-56; Transcript 9/28 p. 104)

154. Installation of a subsurface diffuser or predilution pumping to decrease the impact on the benthic community would be of questionable benefit in this instance. (Applicants' Exhibit 30; Transcript 9/28 p. 97; Comments, Department of Environmental Protection, p. 17)

155. Studies to date indicate that the thermal plume associated with the proposed facility would not create a barrier to the movement of marine organisms in the area nor would access to Jordan Cove and Niantic Bay be blocked. During all stages of the tide there would be adequate space for passage around or under the plume. (Applicants' Exhibit 1 p. 18-1; Exhibits 24, 25, 26; Transcript 9/25 pp. 12, 23)

156. The transient nature of the plume would minimize the chances of attracting fish during colder months and the resulting thermal shock if the heated discharge were turned off. (Applicants' Exhibit 1, p. 18-10; Transcript 9/25 p. 24; Transcript 9/27 p. 7)

157. The potential for all three units shutting down at the same time is minimal, further reducing the chances of cold shock stress. (Applicants' Exhibit 1, p. 18-10; Transcript 9/25 p. 24; Transcript 9/27 p. 7; Council Exhibit 1, pp. 3-39, 3-66)

158. In April and May of 1972, an estimated 20,000 to 30,000 menhaden died in the quarry. Elevated temperatures were a factor but the exact cause of mortality remains uncertain. To avoid a reoccurrence of such an event, a barrier has been erected to prevent the entry of adult fish into the quarry. (Transcript 9/25 p. 24; Council Exhibit 1, p. 3-6)

159. The possibility that the winds or tides could push the plume of heated discharge water into Jordan Cove for an extended period and cause eutrophication of the Jordan Cove area is negligible. (Transcript 9/28 pp. 75-80; Applicants' Exhibit 51)

160. A large number of juvenile menhaden and blue back herring were impinged on the intake screens of Unit 1 during the late summer and fall of 1971. Large schools reported in the area at that time and the presence of the Unit 2 cofferdam seem to have contributed to the incident. Changes incorporated into the intake structure of Unit 2 and the proposed Unit 3 are designed to prevent such mass impingement in the future. (Applicants' Exhibit 27; Transcript 9/25 p. 26; Transcript 9/28 pp. 43-57, 68-71; Transcript 10/16 pp. 66, 67)

161. In addition to a trash rack and mesh screens, the proposed Unit 3 intake structure design provides for lateral fish exit passages and fish pumps in order to minimize entrapment. Fish more than six inches in length should be able to avoid entrapment because intake velocities will not exceed one foot per second. (Applicants' Exhibit 1, pp. 9-5, 18-5; Exhibit 27; Transcript 9/25 p. 25; Transcript 9/26 p. 11)

162. The installation of a permanent floating boom which acts as a barrier for surface schooling fish would reduce the impingement of fish. (Transcript 9/26 p. 17; Transcript 9/28 p. 56)

163. The combined operation of Units 1, 2 and the proposed Unit 3 may entrap as many as 80,000 individual organisms per year, equivalent to 22,000 pounds of fish. (Transcript 9/25 p. 26)

164. In the years 1968 to 1971, the flounder catch ranged from 4 to 6 million pounds per year for the Connecticut and Rhode Island fisheries. Also in 1971, these fisheries reported a catch of 19 million pounds of menhaden. (Transcript 9/25 pp. 26, 163, 165)

165. The impact of entrainment on marine organisms passing through the circulating water system comes from changes in pressure and temperature, mechanical effects and chemicals added to the system. (Transcript 9/25 pp. 27-34)

166. The applicants have studied and are continuing their studies of phytoplankton and zooplankton entrainment. Ichthyoplankton is the segment of the plankton community most vulnerable to entrainment stress. (Applicants' Exhibit 1, p. 18-7)

167. Studies of Unit 1 phytoplankton entrainment showed that temperature and chlorination levels were the most significant mortality factors. Zooplankton mortality was associated more with mechanical stresses. (Transcript 9/25 p. 28)

168. Thirteen species of fish have been recorded as having eggs and larvae passing through the circulating water system of Unit 1 during entrainment studies. (Transcript 9/25 pp. 29-32; Transcript 9/26 p. 21)

169. Three species, menhaden, winter flounder and atlantic mackerel, have been collected in large enough numbers so that estimates of the potential Unit 3 impact can be made. (Transcript 9/25 pp. 29-32; Transcript 9/26 p. 21)

170. Assuming a one hundred percent mortality rate, the total weight of these fish effected by the proposed Unit 3 would be about 108,000 pounds per year. For Units 1, 2 and 3 combined, this figure would increase to 227,000 pounds. (Transcript 9/25 pp. 29-32; Transcript 9/26 p. 21)

171. Based on average prices paid to fisherman in New London County, as reported in statistics compiled by the State of Connecticut, the potential entrainment loss to the winter flounder, mackerel and menhaden fisheries would amount to a total of approximately $4,500 as a result of Unit 3 operation and approximately $9,400 for all three units. (Transcript 9/25 p. 33)

172. Chemical regeneration of the water treatment system will result in the discharge of sodium sulfate to the circulating water. In addition, chemicals such as boric acid and hydrozone could be discharged at trace level concentrations. (Transcript 9/25 pp. 34, 35; Council Exhibit 1 p. 3-45)

173. To lessen the entrainment effects of the proposed Unit 3, biofouling of the circulating water system would be controlled by means of a mechanical condenser tube cleaning system and thermal backwashing of the inlet circulating water pipe lines. (Applicants' Exhibit 1, p. 18-7)

174. Chlorine would only be used in the circulating water system if thermal backflushing proves inadequate. (Applicants' Exhibit 1, p. 18-7; Transcript 9/25 pp. 35, 36; Transcript 9/26 pp. 26, 27; Council Exhibit 1, p. 3-43)

175. The service water system which provides cooling for auxiliary systems would require chlorination to prevent biofouling by growth of marine organisms. However, the amount of chlorine used would be minimal and no chlorine storage facility would be needed for the proposed facility. (Transcript 9/25 pp. 52, 53)

176. During operation of the proposed Unit 3, various chemicals would be discharged into Long Island Sound via the circulating water flow. All chemicals discharged would be treated and monitored, prior to discharge, to maintain a safe level of discharge. (Applicants' Exhibit 1, p. 18-13; Transcript 9/28 p. 100)

177. After mixing with the circulating water flow, the chemical discharges would meet all applicable water quality criteria for Class SA coastal and marine waters pursuant to the Connecticut Water Quality Standards. (Applicants' Exhibit 1, p. 18-14; Transcript 9/25 pp. 41-43; Transcript 9/26 pp. 37-42)

178. The auxiliary fossil fuel burning equipment associated with the proposed unit would be installed and operated in conformance with the air quality regulations ultimately determined to be applicable to the equipment at the time permits would be required. (Council Exhibit 1, p. 3-46)

179. The proposed Unit 3 would not present a significant noise problem during either construction or operation. (Applicants' Exhibit 1, pp. 18-3, 18-14; Transcript 9/25 p. 36; Transcript 10/1 pp. 14-16)

180. The warmed effluent from the circulating water systems of Units 1 and 2 would not be a workable source of circulating water for the proposed Unit 3. Such a system would create excessive interdependence between the units resulting in significantly increased outfall temperatures, and decrease the efficiency of the proposed Unit 3. (Transcript 10/16 pp. 77-79)

181. There will be a satisfactory sanitary waste system for the Millstone Station with the addition of the proposed Unit 3. (Transcript 9/25 p. 36; Transcript 10/16 pp. 79, 80; Council Exhibit 1, p. 3-42)

182. The marine environmental effects of the proposed Unit 3 could be reduced through the use of cooling towers. The cost of these towers would be an additional $31,700,000. (Applicants' Exhibit 30; Transcript 9/28 pp. 86-88)

183. The costs and visibility of cooling towers outweigh any environmental benefits that would be gained by their use for Unit 3 at the Millstone Point site. (Transcript 9/28 pp. 86-88; Applicants' Exhibit 30)

184. The salt water chloride intrusion incident which occurred with Unit 1 in September of 1972 has cost about $16 million to date.

Similar condenser leaks would not cause salt water to enter the proposed Unit 3 reactor because this unit would utilize a pressurized water reactor and different material in the condenser tubes. (Transcript 9/25 pp. 139, 140; Transcript 10/16 pp. 74-77)

185. The 1938 hurricane was accompanied by winds between 115 and 140 miles an hour, recorded at Montague Point. The maximum still water level was between 9 and 10 feet above mean sea level. (Transcript 9/28 pp. 19, 20)

186. The grade elevation of the proposed facility is designed to be 24 feet above mean sea level and the intake structure is designed to withstand flooding to an elevation of 22 feet above mean sea level. (Transcript 9/24 p. 53; Transcript 9/28 pp. 18-20; Council Exhibit 1, p. 3-22)

187. The proposed facility is designed to withstand hurricane winds of from 115 to 140 miles per hour. (Transcript 9/24 p. 53; Transcript 9/28 pp. 18-20)

188. Earthquake resistance characteristics have been incorporated into the design of the proposed facility. (Applicants' Exhibit 1, p. 15-9, 15-10; Council Exhibit 1, p. 3-19 to 3-21)

189. The proposed Unit 3 would include design and safety features in accordance with regulations established by the Atomic Energy Commission. (Applicants' Exhibit 1, p. 17-4)

190. All aspects of the proposed Unit 3 having to do with radioactive emmissions and reactor safety must conform to Atomic Energy Commission requirements to qualify for licensing by that agency. (Transcript 9/24 pp. 31-35; Applicants' Exhibit 1, p. v)

191. The release of radioactive gases from the proposed Unit 3 must be in accordance with regulations of the United States Atomic Energy Commission. (Applicants' Exhibit 1, pp. 18-4 and 12-1; Transcript 9/25 pp. 121, 122)

192. Transportation and storage of fuel and wastes must conform to U. S. Department of Transportation and Atomic Energy Commission requirements. (Applicants' Exhibit 1, p. v; Transcript 9/24 pp. 31-34; Transcript 9/25 pp. 52-55; Transcript 9/26 p. 65)

193. Transportation of spent wastes from Millstone Point with

three units in operation would amount to 30 to 40 shipments a year. The shipments would be spaced throughout the year with a temporary storage time of from three to four months. (Transcript 9/28 pp. 135, 136)

194. The Atomic Energy Commission exercises its jurisdiction over matters of radiological health and safety with respect to nuclear power plants such as the proposed Unit 3 by its comprehensive program of regulation of the design, construction and operation of such plants. (Transcript 9/24 pp. 31-34; 10 Code of Federal Regulations, Parts 2, 20, 50, 100, 140)

195. The Atomic Energy Commission and the U. S. Department of Transportation exercise their jurisdiction over the shipment of nuclear fuel to and nuclear wastes from nuclear power plants such as the proposed Unit 3 through a comprehensive program of regulation of the design, construction and use of shipping containers therefor. (Atomic Energy Commission and U. S. Department of Transportation Memorandum of Understanding, 38 Fed. Reg. 8466-67 (1973); Applicants' Memorandum dated October 15, 1973 and regulations cited therein)

196. Motor vehicles used in the transportation of nuclear fuel and nuclear wastes are required to obey the highway laws of the State of Connecticut while operating in Connecticut. (49 Code of Federal Regulations §397.3)

197. Nuclear safety with respect to the proposed Unit 3 would be achieved by designing and building it in accordance with the "multiple barrier" and "defense-in-depth" concepts, with multiple and redundant safety features to mitigate the consequences of such accidents as may occur and to prevent the uncontrolled release of radioactive fission products from the facility. (Transcript 9/27 pp. 101-106; Transcript 10/15 pp. 156-163; Applicants' Exhibit 39 pp. 2-1 to 2-16)

198. The decommissioning of the proposed Unit 3 would be accomplished in accordance with all applicable standards and

procedures. (Transcript 9/25 pp. 95, 144-146)

199. Construction and operation of an additional unit at Millstone Point would appear to have little effect on recreational values in the vicinity. Sport fishing, pleasure boating, swimming and use of the sites athletic fields would not be significantly affected. (Transcript 9/24 pp. 55, 56)

200. The proposed Unit 3 would not have a significant adverse impact on recreation values, nearby parks, historic sites and forests. (Applicants' Exhibit 1 p. 15-7; Transcript 9/25 pp. 37-38)

201. The location and construction of Unit 3 at Millstone Point as proposed will conform to applicable state and local laws and regulations. (Transcript 9/24 pp. 54-55; Transcript 9/25 pp. 37-43; Applicants' Exhibit 1, pp. 19-1 to 19-3)

202. Public safety and health aspects of the proposed project will be the subject of additional consideration by other Federal, State and local regulatory agencies who must approve them. (Applicants' Exhibit 1, Section 19; Transcript 9/24 pp. 53-55)

203. Pursuant to §16-50j(f) of the 1971 Supplement to the General Statutes of Connecticut, the Public Utilities Commission of the State of Connecticut submitted a letter dated December 13, 1973, summarized as follows:

(a) Generation from the proposed facility will be needed by 1979.

(b) The fossil fuel shortage and other economic factors make nuclear generation the best option for New England.

(c) The proposed facility will cause less pollution than a comparable size fossil fuel plant.

(d) Adverse effects on aquatic life is minimal compared to the public interest in the availability of power at a reasonable cost.

204. Pursuant to said §16-50j(f) of the 1971 Supplement to the General Statutes of Connecticut, the State Health Department submitted a letter dated December 26, 1973, summarized as follows:

(a) There should be no great loss of productive or commercially valuable shellfish grounds caused by the construction of Unit 3.

(b) There are presently no commercial shellfish permits in the area of the proposed facility.

(c) If the proposed facility is constructed, it is expected that testing of shellfish for radiation would be required.

205. Pursuant to said §16-50j(f) of the 1971 Supplement to the General Statutes of Connecticut, the Council on Environmental Quality of the State of Connecticut submitted a letter dated January 4, 1974, summarized as follows:

(a) Additional structures associated with the proposed Unit 3 should not have a detrimental aesthetic effect over and above that related to the structures of Unit 1 and 2.

(b) The utilization of indicated design features should reduce the cumulative noise level of the three units.

(c) Additional information should be secured in order to more fully evaluate the impact of the proposed Unit 3 on marine ecology alone and in combination with Units 1 and 2.

206. Pursuant to said §16-50j(f) of the 1971 Supplement to the General Statutes of Connecticut, the Commerce Department of the State of Connecticut submitted a letter dated January 15, 1974, wherein it was requested that the subject certificate be granted in order to assure an adequate supply of electric power.

207. Pursuant to said §16-50j(f) of the 1971 Supplement to the General Statutes of Connecticut, the Department of Environmental Protection of the State of Connecticut submitted written comments dated January 11, 1974, summarized as follows:

(a) The proposed addition of 1150 MW of base load generation is necessary and reasonable.

(b) Nuclear and fossil fuel generation are the only choices available to the applicant in the time frame of these proceedings. However, less environmentally degrading forms of generation should be considered for the future.

(c) There is a moral obligation to consider nuclear safety aspects of the proposed facility.

(d) The possibility that cooling towers may be required at Millstone was not adequately developed.

(e) The Millstone site is appropriate for a third nuclear power plant.

(f) The applicant presented inadequate data regarding entrapment of organisms on the intake screens of the proposed facility.

(g) The applicant cannot assure the Council that the entrainment mortality rate from the combined operation of three units at Millstone Point will be insignificant.

(h) The Department of Environmental Protection has been examining alternative methods of condenser cooling.

(i) Inconsistencies exist with respect to information on thermal discharge which need explanation.

(j) The attractive effect of a larger plume with three units in operation needs additional discussion.

(k) The Council should not require the applicants to incorporate a mechanical predilution system for controlled temperature reduction.

(l) The Department of Environmental Protection cannot recommend a "best" cooling system alternative at this time.

(m) The construction and operation of the proposed facility will not create a significant air pollution concern other than releases of radioactive gases.

(n) State owned land will not be affected by the operation of the proposed facility.

(o) Failure of the proposed mechanical backwashing system with the ensuing chlorine disposal may pose a hazard to winter food for waterfowl.

(p) Cooling tower construction on the Millstone site would consume most of the wildlife sanctuary located there.

(q) The Department is interested in the results of shellfish studies being undertaken to detect the effects of radionuclide and trace metal discharge.

(r) An oil slick boom should be scheduled for Unit 3 intake.

(s) Semi-annual reports on transportation, storage and processing of radioactive materials should be required.

(t) The applicant should incorporate data sampled from the shellfish bed near the quarry discharge canal into its environmental monitoring program.