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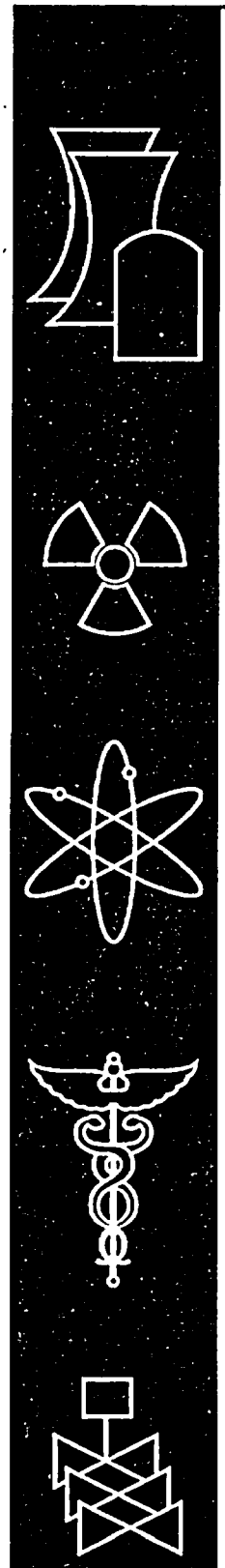

Generic Environmental Impact Statement for License Renewal of Nuclear Plants

Supplement 22

Regarding
Millstone Power Station, Units 2 and 3

Final Report

U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Washington, DC 20555-0001

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NUREG-1437
Supplement 22

Generic Environmental Impact Statement for License Renewal of Nuclear Plants

Supplement 22

Regarding
Millstone Power Station, Units 2 and 3

Final Report

Manuscript Completed: June 2005
Date Published: July 2005

Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Abstract

The U.S. Nuclear Regulatory Commission (NRC) considered the environmental impacts of renewing nuclear power plant operating licenses (OLs) for a 20-year period in its *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2, and codified the results in Title 10 of the Code of Federal Regulations (CFR) Part 51. In the GEIS (and its Addendum 1), the staff identifies 92 environmental issues and reaches generic conclusions related to environmental impacts for 69 of these issues that apply to all plants or to plants with specific design or site characteristics. Additional plant-specific review is required for the remaining 23 issues. These plant-specific reviews are to be included in a supplement to the GEIS.

This supplemental environmental impact statement (SEIS) has been prepared in response to applications submitted to the NRC by Dominion Nuclear Connecticut, Inc. (Dominion) to renew the OLs for Millstone Power Station, Units 2 and 3 (Millstone) for an additional 20 years under 10 CFR Part 54. This SEIS includes the NRC staff's analysis that considers and weighs the environmental impacts of the proposed action, the environmental impacts of alternatives to the proposed action, and mitigation measures available for reducing or avoiding adverse impacts. It also includes the staff's recommendation regarding the proposed action.

Regarding the 69 issues for which the GEIS reached generic conclusions, neither Dominion nor the staff has identified information that is both new and significant for any issue that applies to Millstone. In addition, the staff determined that information provided during the scoping process did not call into question the conclusions in the GEIS. Therefore, the staff concludes that the impacts of renewing the Millstone OLs will not be greater than impacts identified for these issues in the GEIS. For each of these issues, the staff's conclusion in the GEIS is that the impact would be of SMALL[(a)] significance (except for collective offsite radiological impacts from the fuel cycle and high-level waste and spent fuel, which were not assigned a single significance level).

Regarding the remaining 23 issues, those that apply to Millstone are addressed in this SEIS. The staff concludes that the significance of the potential environmental impacts of renewal of the OLs is SMALL for each applicable issue with two exceptions. For entrainment, the staff concludes that the impact is MODERATE, and the magnitude of impact for the chronic effects of electromagnetic fields is "uncertain." The staff also concludes that additional mitigation measures are not likely to be sufficiently beneficial as to be warranted. The staff determined that information provided during the scoping process did not identify any new issue that has a significant environmental impact.

(a) Environmental impacts are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.

Abstract

The NRC staff's recommendation is that the Commission determine that the adverse environmental impacts of license renewal for Millstone are not so great that preserving the option of license renewal for energy-planning decisionmakers would be unreasonable. This recommendation is based on (1) the analysis and findings in the GEIS; (2) the Environmental Report submitted by Dominion; (3) consultation with Federal, State, and local agencies; (4) the staff's own independent review; and (5) the staff's consideration of public comments.

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Executive Summary

By letter dated January 20, 2004, the Dominion Nuclear Connecticut, Inc. (Dominion) submitted applications to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating licenses (OLs) for Millstone Power Station, Units 2 and 3 for an additional 20-year period. If the OLs are renewed, State regulatory agencies and Dominion will ultimately decide whether the plant will continue to operate based on factors such as the need for power or other matters within the State's jurisdiction or the purview of the owners. If the OLs are not renewed, then the plants must be shut down at or before the expiration dates of the current OLs, which are July 31, 2015 for Unit 2 and November 25, 2025 for Unit 3.

The NRC has implemented Section 102 of the National Environmental Policy Act (NEPA) (42 United States Code [USC] 4321) in 10 CFR Part 51. In 10 CFR 51.20(b)(2), the Commission requires preparation of an environmental impact statement (EIS) or a supplement to an EIS for renewal of a reactor OL. In addition, 10 CFR 51.95(c) states that the EIS prepared at the OL renewal stage will be a supplement to the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2.[a]

Upon acceptance of the Dominion applications, the NRC began the environmental review process described in 10 CFR Part 51 by publishing a notice of intent to prepare an EIS and conduct scoping. The NRC staff visited the Millstone site in May 2004 and held public scoping meetings on May 18, 2004, in Waterford, Connecticut. In the preparation of this supplemental environmental impact statement (SEIS) for Millstone, the staff reviewed the Dominion Environmental Report (ER) and compared it to the GEIS, consulted with other agencies, conducted an independent review of the issues following the guidance set forth in NUREG-1555, Supplement 1, the *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal*, and considered the public comments received during the scoping process. The public comments received during the scoping process that were considered to be within the scope of the environmental review are provided in Appendix A, Part 1, of this SEIS.

A draft SEIS was published in December 2004. The staff held two public meetings in Waterford, Connecticut, in January 2005, to describe the preliminary results of the NRC environmental review, to answer questions, and to provide members of the public with information to assist them in formulating comments on this SEIS. When the comment period ended, the staff considered and dispositioned all of the comments received. These comments are addressed in Appendix A, Part 2 of this SEIS.

(a) The GEIS was originally issued in 1996. Addendum 1 to the GEIS was issued in 1999. Hereafter, all references to the "GEIS" include the GEIS and its Addendum 1.

This SEIS includes the NRC staff's analysis, which considers and weighs the environmental effects of the proposed action, the environmental impacts of alternatives to the proposed action, and mitigation measures for reducing or avoiding adverse effects. It also includes the staff's recommendation regarding the proposed action.

The Commission has adopted the following statement of purpose and need for license renewal from the GEIS:

> The purpose and need for the proposed action (renewal of an operating license) is to provide an option that allows for power generation capability beyond the term of a current nuclear power plant operating license to meet future system generating needs, as such needs may be determined by State, utility, and, where authorized, Federal (other than NRC) decisionmakers.

The evaluation criterion for the staff's environmental review, as defined in 10 CFR 51.95(c)(4) and the GEIS, is to determine

> . . . whether or not the adverse environmental impacts of license renewal are so great that preserving the option of license renewal for energy planning decisionmakers would be unreasonable.

Both the statement of purpose and need and the evaluation criterion implicitly acknowledge that there are factors, in addition to license renewal, that will ultimately determine whether an existing nuclear power plant continues to operate beyond the period of the current OL.

NRC regulations [10 CFR 51.95(c)(2)] contain the following statement regarding the content of SEISs prepared at the license renewal stage:

> The supplemental environmental impact statement for license renewal is not required to include discussion of need for power or the economic costs and economic benefits of the proposed action or of alternatives to the proposed action except insofar as such benefits and costs are either essential for a determination regarding the inclusion of an alternative in the range of alternatives considered or relevant to mitigation. In addition, the supplemental environmental impact statement prepared at the license renewal stage need not discuss other issues not related to the environmental effects of the proposed action and the alternatives, or any aspect of the storage of spent fuel for the facility within the scope of the generic determination in § 51.23(a) ["Temporary storage of spent fuel after cessation of reactor operation–generic determination of no significant environmental impact"] and in accordance with § 51.23(b).

The GEIS contains the results of a systematic evaluation of the consequences of renewing an OL and operating a nuclear power plant for an additional 20 years. It evaluates 92 environmental issues using the NRC's three-level standard of significance—SMALL, MODERATE, or LARGE—developed using the Council on Environmental Quality guidelines. The following definitions of the three significance levels are set forth in footnotes to Table B-1 of 10 CFR Part 51, Subpart A, Appendix B:

> SMALL - Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.
>
> MODERATE - Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.
>
> LARGE - Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

For 69 of the 92 issues considered in the GEIS, the analysis in the GEIS reached the following conclusions:

(1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics.

(2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal).

(3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are not likely to be sufficiently beneficial to warrant implementation.

These 69 issues were identified in the GEIS as Category 1 issues. In the absence of new and significant information, the staff relied on conclusions as amplified by supporting information in the GEIS for issues designated as Category 1 in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B.

Of the 23 issues that do not meet the criteria set forth above, 21 are classified as Category 2 issues requiring analysis in a plant-specific supplement to the GEIS. The remaining two issues, environmental justice and chronic effects of electromagnetic fields, were not categorized. Environmental justice was not evaluated on a generic basis and must be addressed in a

plant-specific supplement to the GEIS. Information on the chronic effects of electromagnetic fields was not conclusive at the time the GEIS was prepared.

This SEIS documents the staff's consideration of all 92 environmental issues identified in the GEIS. The staff considered the environmental impacts associated with alternatives to license renewal and compared the environmental impacts of license renewal and the alternatives. The alternatives to license renewal that were considered include the no-action alternative (not renewing the OLs for Millstone) and alternative methods of power generation. Based on projections made by the U.S. Department of Energy's Energy Information Administration, gas- and coal-fired generation appear to be the most likely power-generation alternatives if the power from Millstone is replaced. These alternatives are evaluated assuming that the replacement power generation plant is located at either the Millstone site or some other unspecified alternate location.

Dominion and the staff have established independent processes for identifying and evaluating the significance of any new information on the environmental impacts of license renewal. Neither Dominion nor the staff has identified information that is both new and significant related to Category 1 issues that would call into question the conclusions in the GEIS. Similarly, neither the scoping process nor the staff has identified any new issue applicable to Millstone, that has a significant environmental impact. These determinations included consideration of public comments. Therefore, the staff relies upon the conclusions of the GEIS for all of the Category 1 issues that are applicable to Millstone.

Dominion's license renewal applications present an analysis of the Category 2 issues. The staff has reviewed the Dominion analysis for each issue and has conducted an independent review of each issue. Six Category 2 issues are not applicable, because they are related to plant design features or site characteristics not found at Millstone. Four Category 2 issues are not discussed in this SEIS, because they are specifically related to refurbishment. Dominion has stated that its evaluation of structures and components, as required by 10 CFR 54.21, did not identify any major plant refurbishment activities or modifications as necessary to support the continued operation of Millstone for the license renewal period. In addition, any replacement of components or additional inspection activities are within the bounds of normal plant operation, and are not expected to affect the environment outside of the bounds of the plant operations evaluated in the U.S. Atomic Energy Commission's 1973 *Final Environmental Statement Related to the Continuation of Construction of Unit 2 and the Operation of Units 1 and 2, Millstone Nuclear Power Station* and in the NRC's 1984 *Final Environmental Statement related to operation of Millstone Nuclear Power Station, Unit No. 3.*

Eleven Category 2 issues related to operational impacts and postulated accidents during the renewal term, as well as environmental justice and chronic effects of electromagnetic fields, are discussed in detail in this SEIS. Five of the Category 2 issues and environmental justice apply

to both refurbishment and to operation during the renewal term and are only discussed in this SEIS in relation to operation during the renewal term. For 10 of the Category 2 issues and environmental justice, the staff concludes that the potential environmental effects would be of SMALL significance in the context of the standards set forth in the GEIS. For entrainment, the staff concludes that the potential environmental effects would be of MODERATE significance in the context of the standards set forth in the GEIS. In addition, the staff determined that appropriate Federal health agencies have not reached a consensus on the existence of chronic adverse effects from electromagnetic fields. Therefore, no further evaluation of this issue is required. For severe accident mitigation alternatives (SAMAs), the staff concludes that a reasonable, comprehensive effort was made to identify and evaluate SAMAs. Based on its review of the SAMAs for Millstone and the plant improvements already made, the staff concludes that one of the candidate SAMAs is cost-beneficial for Unit 2. One additional SAMA for each unit could be cost-beneficial if it can be implemented by severe accident management guidelines without hardware modifications. None of these SAMAs relate to adequately managing the effects of aging during the period of extended operation. Therefore, they need not be implemented as part of license renewal pursuant to 10 CFR Part 54.

If the Millstone operating licenses are not renewed and the units cease operation on or before the expiration of their current operating licenses, the adverse impacts of likely alternatives will not be smaller than those associated with continued operation of Millstone. The impacts may, in fact, be greater in some areas.

The recommendation of the NRC staff is that the Commission determine that the adverse environmental impacts of license renewal for Millstone are not so great that preserving the option of license renewal for energy planning decisionmakers would be unreasonable. This recommendation is based on (1) the analysis and findings in the GEIS; (2) the ER submitted by Dominion; (3) consultation with other Federal, State, and local agencies; (4) the staff's own independent review; and (5) the staff's consideration of public comments.

Abbreviations/Acronyms

°	degree(s)
µg	microgram(s)
µg/kg	microgram(s) per kilogram
µm	micrometers(s)
ac	acre(s)
AAGR	Annual Average Growth Rate
AC	alternating current electricity
ACC	averted cleanup and decontamination costs
AD	Anno Domini
ADAMS	Nuclear Regulatory Commission's Agencywide Documents Access and Management System
AE	assessment endpoint
AEC	U.S. Atomic Energy Commission
AFW	auxiliary feedwater
ALARA	as low as reasonably achievable
AOC	present value of averted offsite property damage costs
AOE	present value of averted occupational exposure costs
AOSC	present value of averted onsite costs
AOV	air-operated valve
APE	present value of averted public exposure
ATWS	anticipated transients without scram
BA	Biological Assessment
BC	Before Christ
Bq	becquerel(s)
Bq/L	bequerel(s) per liter
BTU	British thermal unit(s)
BTU/kWh	British thermal units per kilowatt-hour
cm	centimeter(s)
C	Celsius
CASE	Connecticut Academy of Science and Engineering
CCF	common cause failure
CCW	component cooling water
CDF	core damage frequency
CE	Combustion Engineering
CEOG	Combustion Engineering Owners Group
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations

Ci	curie(s)
CL&P	Connecticut Light and Power Company
COE	cost of enhancement
COOL	loss of cooling water to primary side components
CPUE	catch per unit effort
CTDEP	Connecticut Department of Environmental Protection
CTDPH	Connecticut Department of Public Health
CWA	Clean Water Act
DBA	design-basis accident
DC	direct current electricity
DOE	U.S. Department of Energy
Dominion	Dominion Nuclear Connecticut, Inc.
DSEIS	Draft Supplemental Environmental Impact Statement
DSM	demand-side management
DWST	demineralized water storage tank
EDG	emergency diesel generator
EIA	Energy Information Administration (of U.S. DOE)
EIS	environmental impact statement
ELF-EMF	extremely low frequency-electromagnetic field
EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
ER	Environmental Report
ESA	Endangered Species Act
ESF	Engineered safeguards feature
ESFRS	Engineered safeguards feature room service
ft	foot/feet
ft/s	foot/feet per second
ft^3	cubic foot/feet
ft^3/s	cubic foot/feet per second
F	Fahrenheit
FAA	Federal Aviation Administration
FES	Final Environmental Statement
FR	Federal Register
FSAR	Final Safety Analysis Report
FWS	U.S. Fish and Wildlife Service
g	acceleration due to the force of gravity (9.8 m/s^2)
gal	gallon(s)

gpd	gallon(s) per day
gpm	gallon(s) per minute
GEIS	Generic Environmental Impact Statement for License Renewal of Nuclear Plants, NUREG-1437
Gy	gray (joules per kilogram)
ha	hectare(s)
hr	hour(s)
HCLPF	high-confidence low-probability of failure
HEPA	high-efficiency particulate air (filter)
HLW	high-level radioactive waste
HPSI	high pressure safety injection
HRA	human reliability analysis
Hz	Hertz
in.	inch(es)
I	Interstate
ICRP	International Commission on Radiological Protection
IPE	Individual Plant Examination
IPEEE	Individual Plant Examination of External Events
ISLOCA	interfacing systems loss-of-coolant accident
J	joule(s)
kg	kilogram(s)
km	kilometer(s)
km/hr	kilometer(s) per hour
km/s	kilometer(s) per second
km^2	square kilometer(s)
kPa	kilopascal(s)
kV	kilovolt(s)
kWh	kilowatt hour(s)
lb	pound(s)
L	liter(s)
L/d	liter(s) per day
LIS	Long Island Sound
LOCA	loss-of-coolant accident
LOOP	loss of offsite power
LPSI	low pressure safety injection
LWR	light-water reactor

m	meter(s)
m/s	meter(s) per second
m/s^2	meter(s) per square second
m^3/s	cubic meter(s) per second
mA	milliampere(s)
mg/L	milligram(s) per liter
mGy	milligray
mi	mile(s)
mi^2	square mile(s)
mL	milliliter(s)
mm	millimeter(s)
mph	mile(s) per hour
mrad	millirad
mrem	millirem
mSv	millisievert
MACCS2	MELCOR Accident Consequence Code 2
ME	measurement endpoints
MG	motor generator
Millstone	Millstone Power Station, Units 2 and 3
MOV	motor-operated valve
MPS2	Millstone Power Station, Unit 2
MPS3	Millstone Power Station, Unit 3
MSIV	main steam isolation valve
MT	metric ton(s) (or tonne[s])
MTHM	metric ton(s) heavy metal
MT/y	metric ton(s) per year
MW	megawatt(s)
MW(e)	megawatt(s) electric
MW(t)	megawatt(s) thermal
MWh	megawatt hour(s)
NAS	National Academy of Sciences
NCI	National Cancer Institute
NEFSC	Northeast Fisheries Science Center
NEPA	National Environmental Policy Act of 1969
NESC	National Electric Safety Code
NHPA	National Historic Preservation Act
NIEHS	National Institute of Environmental Health Sciences
NMFS	National Marine Fisheries Service
NNECO	Northeast Nuclear Energy Company
NO_x	nitrogen oxide(s)

NOAA	National Oceanic and Atmospheric Adminstration
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NU	Northeast Utilities
NUSCO	Northeast Utilities Service Company
OL	operating license
pCi	picocurie(s)
pCi/L	picocurie(s) per liter
persons/km^2	persons per square kilometer
persons/mi^2	persons per square mile
ppb	parts per billion
ppm	parts per million
PDS	plant damage state
PORV	pilot-operated relief valve
PRA	Probabilistic Risk Assessment
psi	pound(s) per square inch
PWR	pressurized water reactor
rem	roentgen equivalent man
RAI	request for additional information
RBCCW	reactor building closed cooling water
RCP	reactor coolant pump
RCS	reactor coolant system
RCRA	Resource Conservation and Recovery Act
REMODCM	Radiological Effluent Monitoring and Offsite Dose Calculation Manual
REMP	radiological environmental monitoring program
ROW	right(s)-of-way
RPC	replacement power costs
RPS	reactor protection system
RWST	refueling water storage tank
s	second(s)
SARC	Stock Assessment Report Committee
SAMA	Severe Accident Mitigation Alternative
SAMG	severe accident management guideline(s)
SAR	Safety Analysis Report
SBO	station blackout
SCCOG	Southeastern Connecticut Council of Governments
SEER	Surveillance, Epidemiology, and End Result (report[s])

SEIS	Supplemental Environmental Impact Statement
SER	Safety Evaluation Report
SGTR	steam generator tube rupture
SMA	Seismic Margins Assessment
SNEMA	Southern New England Mid-Atlantic
SO_2	sulfur dioxide
SO_x	sulfur oxide(s)
SW	service water
Sv	sievert
UMDH	1,1-dimethylhydrazine
U.S.	United States
USACE	United States Army Corps of Engineers
USC	United States Code
USCB	U.S. Census Bureau
USDA	U.S. Department of Agriculture
USDOT	U.S. Department of Transportation
V	volt
WOG	Westinghouse Owners Group
yr	year

1.0 Introduction

Under the Nuclear Regulatory Commission's (NRC) environmental protection regulations in Title 10 of the Code of Federal Regulations (CFR) Part 51, which implement the National Environmental Policy Act of 1969 (NEPA), renewal of a nuclear power plant operating license (OL) requires the preparation of an environmental impact statement (EIS). In preparing the EIS, the NRC staff is required first to issue the statement in draft form for public comment, and then issue a final statement after considering public comments on the draft. To support the preparation of the EIS, the staff has prepared a *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996; 1999).[(a)] The GEIS is intended to (1) provide an understanding of the types and severity of environmental impacts that may occur as a result of license renewal of nuclear power plants under 10 CFR Part 54, (2) identify and assess the impacts that are expected to be generic to license renewal, and (3) support 10 CFR Part 51 to define the number and scope of issues that need to be addressed by the applicants in plant-by-plant renewal proceedings. Use of the GEIS guides the preparation of complete plant-specific information in support of the OL renewal process.

The Dominion Nuclear Connecticut, Inc. (Dominion) operates Millstone Power Station, Units 2 and 3 (Millstone) in Connecticut under OLs DPR-65 and NPF-49, which were issued by the NRC. These OLs will expire July 31, 2015 for Unit 2 and November 25, 2025 for Unit 3. On January 20, 2004, Dominion submitted applications to the NRC to renew the Millstone Power Station, Units 2 and 3 OLs for an additional 20 years under 10 CFR Part 54. Dominion is a *licensee* for the purposes of its current OLs and an *applicant* for the renewal of the OLs. Pursuant to 10 CFR 54.23 and 51.53(c), Dominion submitted an Environmental Report (ER) (Dominion 2004a) in which it analyzed the environmental impacts associated with the proposed license renewal action, considered alternatives to the proposed action, and evaluated mitigation measures for reducing adverse environmental impacts.

This report is the plant-specific supplement to the GEIS (the supplemental EIS [SEIS]) for the Dominion license renewal applications. This SEIS is a supplement to the GEIS because it relies, in part, on the findings of the GEIS. The staff will also prepare a separate safety evaluation report in accordance with 10 CFR Part 54.

(a) The GEIS was originally issued in 1996. Addendum 1 to the GEIS was issued in 1999. Hereafter, all references to the "GEIS" include the GEIS and its Addendum 1.

1.1 Report Contents

The following sections of this introduction (1) describe the background for the preparation of this SEIS, including the development of the GEIS and the process used by the staff to assess the environmental impacts associated with license renewal, (2) describe the proposed Federal action to renew the Millstone OLs, (3) discuss the purpose and need for the proposed action, and (4) present the status of Dominion's compliance with environmental quality standards and requirements that have been imposed by Federal, State, regional, and local agencies that are responsible for environmental protection.

The ensuing chapters of this SEIS closely parallel the contents and organization of the GEIS. Chapter 2 describes the site, power plant, and interactions of the plant with the environment. Chapters 3 and 4, respectively, discuss the potential environmental impacts of plant refurbishment and plant operation during the renewal term. Chapter 5 contains an evaluation of potential environmental impacts of plant accidents and includes consideration of severe accident mitigation alternatives. Chapter 6 discusses the uranium fuel cycle and solid-waste management. Chapter 7 discusses decommissioning, and Chapter 8 discusses alternatives to license renewal. Finally, Chapter 9 summarizes the findings of the preceding chapters and draws conclusions about the adverse impacts that cannot be avoided; the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity; and the irreversible or irretrievable commitment of resources. Chapter 9 also presents the staff's recommendation with respect to the proposed license renewal action.

Additional information is included in appendices. Appendix A contains public comments related to the environmental review for license renewal and staff responses to those comments. Appendices B through I, respectively, list the following:

- The preparers of the supplement
- The chronology of NRC staff environmental review correspondence related to this SEIS
- The organizations contacted during the development of this SEIS
- Dominion's compliance status in Table E-1 (this appendix also contains copies of consultation correspondence sent and received during the evaluation process)
- GEIS environmental issues that are not applicable to Millstone
- State-listed Threatened and Endangered Species

- Severe accident mitigation alternatives — Unit 2
- Severe accident mitigation alternatives — Unit 3

1.2 Background

Use of the GEIS, which examines the possible environmental impacts that could occur as a result of renewing individual nuclear power plant OLs under 10 CFR Part 54, and the established license renewal evaluation process supports the thorough evaluation of the impacts of renewal of OLs.

1.2.1 Generic Environmental Impact Statement

The NRC initiated a generic assessment of the environmental impacts associated with the license renewal term to improve the efficiency of the license renewal process by documenting the assessment results and codifying the results in the Commission's regulations. This assessment is provided in the GEIS, which serves as the principal reference for all nuclear power plant license renewal EISs.

The GEIS documents the results of the systematic approach that was taken to evaluate the environmental consequences of renewing the licenses of individual nuclear power plants and operating them for an additional 20 years. For each potential environmental issue, the GEIS (1) describes the activity that affects the environment, (2) identifies the population or resource that is affected, (3) assesses the nature and magnitude of the impact on the affected population or resource, (4) characterizes the significance of the effect for both beneficial and adverse impacts, (5) determines whether the results of the analysis apply to all plants, and (6) considers whether additional mitigation measures would be warranted for impacts that would have the same significance level for all plants.

The NRC's standard of significance for impacts was established using the Council on Environmental Quality terminology for "significantly" (40 CFR 1508.27, which requires consideration of both "context" and "intensity.") Using the Council on Environmental Quality terminology, the NRC established three significance levels—SMALL, MODERATE, and LARGE. The definitions of the three significance levels are set forth in the footnotes to Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, as follows:

> SMALL - Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.

MODERATE - Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.

LARGE - Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

The GEIS assigns a significance level to each environmental issue, assuming that ongoing mitigation measures would continue.

The GEIS includes a determination of whether the analysis of the environmental issue could be applied to all plants and whether additional mitigation measures would be warranted. Issues are assigned a Category 1 or a Category 2 designation. As set forth in the GEIS, **Category 1** issues are those that meet all of the following criteria:

(1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics.

(2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective off-site radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal).

(3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.

For issues that meet the three Category 1 criteria, no additional plant-specific analysis is required in this SEIS unless new and significant information is identified.

Category 2 issues are those that do not meet one or more of the criteria of Category 1, and therefore, additional plant-specific review for these issues is required.

In the GEIS, the staff assessed 92 environmental issues and determined that 69 qualified as Category 1 issues, 21 qualified as Category 2 issues, and 2 issues, environmental justice and chronic effects of electromagnetic fields, were not categorized. Environmental justice was not evaluated on a generic basis and must be addressed in a plant-specific supplement to the GEIS. Information on the chronic effects of electromagnetic fields was not conclusive at the time the GEIS was prepared.

Of the 92 issues, 11 are related only to refurbishment, 6 are related only to decommissioning, 67 apply only to operation during the renewal term, and 8 apply to both refurbishment and operation during the renewal term. A summary of the findings for all 92 issues in the GEIS is codified in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B.

1.2.2 License Renewal Evaluation Process

An applicant seeking to renew its OLs is required to submit an ER as part of its application. The license renewal evaluation process involves careful review of the applicant's ER and assurance that all new and potentially significant information not already addressed in or available during the GEIS evaluation is identified, reviewed, and assessed to verify the environmental impacts of the proposed license renewal.

In accordance with 10 CFR 51.53(c)(2) and (3), the ER submitted by the applicant must, among other things,

- provide an analysis of the Category 2 issues in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B in accordance with 10 CFR 51.53(c)(3)(ii); and
- discuss actions to mitigate any adverse impacts associated with the proposed action and environmental impacts of alternatives to the proposed action.

In accordance with 10 CFR 51.53(c)(2) and (3)(iii) and (iv), the ER does not need to

- consider the economic benefits and costs of the proposed action and alternatives to the proposed action except insofar as such benefits and costs are either (1) essential for making a determination regarding the inclusion of an alternative in the range of alternatives considered, or (2) relevant to mitigation;
- consider the need for power and other issues not related to the environmental effects of the proposed action and the alternatives;
- discuss any aspect of the storage of spent fuel within the scope of the generic determination in 10 CFR 51.23(a) in accordance with 10 CFR 51.23(b); or
- contain an analysis of any Category 1 issue unless there is new and significant information on a specific issue.

New and significant information is (1) information that identifies a significant environmental issue not covered in the GEIS and codified in Table B-1 of 10 CFR Part 51, Subpart A,

Appendix B, or (2) information that was not considered in the analyses summarized in the GEIS and that leads to an impact finding that is different from the finding presented in the GEIS and codified in 10 CFR Part 51.

In preparing to submit its applications to renew the Millstone OLs, Dominion developed a process to ensure that information not addressed in or available during the GEIS evaluation regarding the environmental impacts of license renewal for Millstone would be properly reviewed before submitting the ER and to ensure that such new and potentially significant information related to renewal of the licenses for Units 2 and 3 would be identified, reviewed, and assessed during the period of NRC review. Dominion reviewed the Category 1 issues that appear in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, to verify that the conclusions of the GEIS remained valid with respect to Millstone. This review was performed by personnel from Dominion and its support organization who were familiar with NEPA issues and the scientific disciplines involved in the preparation of a license renewal ER.

The NRC staff also has a process for identifying new and significant information. That process is described in detail in *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal*, NUREG-1555, Supplement 1 (NRC 2000a). The search for new information includes (1) review of an applicant's ER and the process for discovering and evaluating the significance of new information; (2) review of records of public comments; (3) review of environmental quality standards and regulations; (4) coordination with Federal, State, and local environmental protection and resource agencies; and (5) review of the technical literature. New information discovered by the staff is evaluated for significance using the criteria set forth in the GEIS. For Category 1 issues where new and significant information is identified, reconsideration of the conclusions for those issues is limited in scope to the assessment of the relevant new and significant information; the scope of the assessment does not include other facets of the issue that are not affected by the new information.

Chapters 3 through 7 discuss the environmental issues considered in the GEIS that are applicable to Millstone. In each chapter, at the beginning of the discussion of each set of issues, there is a table that identifies the issues to be addressed and lists the sections in the GEIS where the issue is discussed. Category 1 and Category 2 issues are listed in separate tables. For Category 1 issues for which there is no new and significant information, the table is followed by a set of short paragraphs that state the GEIS conclusion codified in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, followed by the staff's analysis and conclusion. For Category 2 issues, in addition to the list of GEIS sections where the issue is discussed, the tables list the subparagraph of 10 CFR 51.53(c)(3)(ii) that describes the analysis required and the SEIS sections where the analysis is presented. The SEIS sections that discuss the Category 2 issues are presented immediately following the table.

The NRC prepares an independent analysis of the environmental impacts of license renewal and compares these impacts with the environmental impacts of alternatives. The evaluation of the Dominion license renewal application began with publication of a notice of acceptance for docketing and opportunity for a hearing in the *Federal Register* (NRC 2004a) on March 12, 2004. The staff published a notice of intent to prepare an EIS and conduct scoping (NRC 2004b) on April 7, 2004. Two public scoping meetings were held on May 18, 2004, in Waterford, Connecticut. Comments received during the scoping period were summarized in the *Environmental Impact Statement Scoping Process: Summary Report – Millstone Power Station, Units 2 and 3, New London County, Connecticut* (NRC 2004c) dated August 27, 2004. Comments that are applicable to this environmental review are presented in Part 1 of Appendix A.

The staff followed the review guidance contained in NUREG-1555, Supplement 1, *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal* (NRC 2000). The staff and contractor retained to assist the staff visited the Millstone site on May 19 and 20, 2004, to gather information and to become familiar with the site and its environs. The staff also reviewed the comments received during scoping, and consulted with Federal, State, regional, and local agencies. A list of the organizations consulted is provided in Appendix D. Other documents related to Millstone were reviewed and are referenced.

On December 9, 2004, the NRC published the Notice of Availability of the draft SEIS in 69 FR 71437 (NRC 2004d). A 75-day comment period began on the date of publication of the U.S. Environmental Protection Agency Notice of Filing of the draft SEIS to allow members of the public to comment on the preliminary results of the NRC staff's review. During this comment period, two public meetings were held in Waterford, Connecticut, in January 2005. During these meetings, the staff described the preliminary results of the NRC environmental review and answered questions related to it to provide members of the public with information to assist them in formulating their comments. The comment period for the Millstone draft SEIS ended on March 2, 2005. Comments made during the 75-day comment period, including those made at the two public meetings, are presented in Part 2 of Appendix A of this SEIS. The NRC responses to those comments are also provided.

This SEIS presents the staff's analysis that considers and weighs the environmental impacts of the proposed renewal of the OLs for Millstone, the environmental impacts of alternatives to license renewal, and mitigation measures available for avoiding adverse environmental impacts. Chapter 9, "Summary and Conclusions," provides the NRC staff's recommendation to the Commission on whether or not the adverse environmental impacts of license renewal are so great that preserving the option of license renewal for energy-planning decisionmakers would be unreasonable.

1.3 The Proposed Federal Action

The proposed Federal action is renewal of the OLs for Millstone. The Millstone site is located in Waterford, Connecticut on the coast between the Niantic and Thames Rivers, approximately 64 kilometers (km) (40 miles [mi]) east of New Haven, 64 km (40 mi) southeast of Hartford, and 32 km (20 mi) west of Rhode Island. Unit 2 is a Combustion Engineering–designed pressurized-water reactor with a design power level of 2700 megawatts thermal (MW[t]) and a net power output of 870 megawatts electric (MW[e]). Unit 3 is a Westinghouse-designed pressurized-water reactor with a design power level of 3411 MW(t) and a net power output of 1154 MW(e). Plant cooling is provided by a once-through cooling-water system that is withdrawn from Niantic Bay and dissipates heat by discharge into Long Island Sound. Units 2 and 3 produce electricity to meet about 50 percent of the electrical use of Connecticut. The current OL for Unit 2 expires on July 31, 2015, and for Unit 3 on November 25, 2025. By letter dated January 20, 2004, Dominion submitted an application to the NRC (Dominion 2004b) to renew these OLs for an additional 20 years of operation (i.e., until July 31, 2035, for Unit 2 and November 25, 2045, for Unit 3).

1.4 The Purpose and Need for the Proposed Action

Although a licensee must have a renewed license to operate a reactor beyond the term of the existing OL, the possession of that license is just one of a number of conditions that must be met for the licensee to continue plant operation during the term of the renewed license. Once an OL is renewed, State regulatory agencies and the owners of the plant will ultimately decide whether the plant will continue to operate based on factors such as the need for power or other matters within the State's jurisdiction or the purview of the owners.

Thus, for license renewal reviews, the NRC has adopted the following definition of purpose and need (GEIS Section 1.3):

> The purpose and need for the proposed action (renewal of an operating license) is to provide an option that allows for power generation capability beyond the term of a current nuclear power plant operating license to meet future system generating needs, as such needs may be determined by State, utility, and where authorized, Federal (other than NRC) decisionmakers.

This definition of purpose and need reflects the Commission's recognition that, unless there are findings in the safety review required by the Atomic Energy Act of 1954 or findings in the NEPA environmental analysis that would lead the NRC to reject a license renewal application, the NRC does not have a role in the energy-planning decisions of State regulators and utility officials as to whether a particular nuclear power plant should continue to operate. From the

perspective of the licensee and the State regulatory authority, the purpose of renewing an OL is to maintain the availability of the nuclear plant to meet system energy requirements beyond the current term of the plant's license.

1.5 Compliance and Consultations

Dominion is required to hold certain Federal, State, and local environmental permits, as well as meet relevant Federal and State statutory requirements. In its ER, Dominion provided a list of the authorizations from Federal, State, and local authorities for current operations, as well as environmental approvals and consultations associated with Millstone license renewal. Authorizations and consultations relevant to the proposed OL renewal action are included in Appendix E.

The staff has reviewed the list and consulted with the appropriate Federal, State, and local agencies to identify any compliance or permit issues or significant environmental issues of concern to the reviewing agencies. These agencies did not identify any new and significant environmental issues. The ER states that Dominion is in compliance with applicable environmental standards and requirements for Millstone. The staff has not identified any environmental issues that are both new and significant.

1.6 References

10 CFR Part 51. Code of Federal Regulations, Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

10 CFR Part 54. Code of Federal Regulations, Title 10, *Energy*, Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

40 CFR Part 1508. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 1508, "Terminology and Index."

Atomic Energy Act of 1954. 42 United States Code (USC) 2011, et seq.

Dominion Nuclear Connecticut, Inc. (Dominion). 2004a. *Applicant's Environmental Report — Operating License Renewal Stage Millstone Power Station, Units 2 and 3.* Waterford, Connecticut.

Dominion Nuclear Connecticut, Inc. (Dominion). 2004b. *Applications for Renewed Operating Licenses, Millstone Power Station, Units 2 and 3.* Waterford, Connecticut.

National Environmental Policy Act of 1969 (NEPA), as amended. 42 USC 4321, et seq.

U.S. Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants.* NUREG-1437, Volumes 1 and 2, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Main Report, Section 6.3-Transportation, Table 9.1, Summary of findings on NEPA issues for license renewal of nuclear power plants,* Final Report. NUREG-1437, Volume 1, Addendum 1, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2000. *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Main Report, Supplement 1: Operating License Renewal.* NUREG-1555, Supplement 1, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2004a. "Notice of Acceptance for Docketing of the Application and Notice of Opportunity for a Hearing Regarding Renewal of License Nos. DPR-65 and NPF-49 for an Additional Twenty-Year Period." *Federal Register,* Vol. 69, No. 49, pp. 11897–11898. Washington, D.C. March 12, 2004.

U.S. Nuclear Regulatory Commission (NRC). 2004b. "Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process." *Federal Register,* Vol. 69, No. 67, pp. 18409–18410. Washington, D.C. April 7, 2004.

U.S. Nuclear Regulatory Commission (NRC). 2004c. *Environmental Impact Statement Scoping Process: Summary Report – Millstone Power Station, Units 2 and 3, New London County, Connecticut.* Washington, D.C. August 27, 2004. ADAMS Accession No. ML042400543.

U.S. Nuclear Regulatory Commission (NRC). 2004d. "Dominion Nuclear Connecticut, Inc., Millstone Power Station, Units 2 and 3; Notice of Availability of the Draft Supplement 22 to the Generic Environmental Impact Statement and Public Meeting for the License Renewal of Millstone Power Station, Units 2 and 3." *Federal Register,* Vol. 69, No. 236, pp. 71437–71438. Washington, D.C. December 9, 2004.

2.0 Description of Nuclear Power Plant and Site and Plant Interaction with the Environment

Millstone Power Station, Units 2 and 3 (Millstone) is located in Waterford, Connecticut, on Millstone Point, between the Niantic and Thames Rivers on Long Island Sound. The nearest large cities are New Haven, approximately 64 kilometers (km) (40 miles [mi]) to the west, and Hartford, approximately 64 km (40 mi) to the northwest. The site is situated on the edge of Long Island Sound and Niantic Bay and is approximately 32 km (20 mi) west of Rhode Island. At one time, there were three operating nuclear power plants at the Millstone site. Construction on Unit 1 began in 1966, on Unit 2 in 1970, and on Unit 3 in 1974. Unit 1 was a boiling-water reactor that began operations in November 1970 and was permanently shut down in 1995. The facility is in long-term storage awaiting decontamination and dismantlement as part of station decommissioning. Unit 1 is not part of these license renewal applications. Millstone Unit 2 is a two-loop, pressurized-water nuclear reactor with a calculated electrical output of approximately 870 megawatts electric (MW[e]); while Millstone Unit 3 is a four-loop, pressurized-water nuclear reactor with a calculated electrical output of approximately 1,154 MW(e) (Dominion Nuclear Connecticut Inc. [Dominion] 2004a). Unit 2 began operations in December 1975, while Unit 3 began operations in April 1986. Units 2 and 3 were shut down in late 1995, with Unit 3 returning to service in July 1998 and Unit 2 in May 1999. Millstone and its environs are described in Section 2.1, and the plant's interaction with the environment is presented in Section 2.2.

2.1 Plant and Site Description and Proposed Plant Operation During the Renewal Term

Prior to development as a power facility, Millstone Point was the site of a granite quarry that operated for approximately two centuries, until 1960. The granite from this quarry was used in the base of the Statue of Liberty, in Grand Central Terminal, in the United Nations building in New York City, and in the foundation of the U.S. Supreme Court building in Washington D.C. (Bachman 2000). The quarry, now flooded and connected to Long Island Sound, receives the cooling water discharge from Millstone. A small settlement with its own railroad station, post office and school provided for the employees and their families prior to World War I and the advent of the widespread use of concrete. In 1951, 46 hectares (ha) (114 acres [ac]) including the quarry was purchased for a coal-burning power plant, but this was instead built in Middletown, Connecticut. The site was later expanded to approximately 200 ha (500 ac) for use as a nuclear power plant (Bachman 2000). The topography consists of low rolling hills inland of the peninsular site. The maximum height above mean sea level within 4.8 km (3 mi) of the site is 76 meters (m) (250 feet [ft]). The area surrounding Millstone is a forested landscape of old New England towns and villages, interspersed with some agricultural land, industrial

facilities, and undeveloped areas. The region within 10 km (6 mi) of the site includes parts of the towns of Waterford, New London, Groton, East Lyme and Old Lyme. These towns are all contiguous. The most populous community within 16 km (10 mi) of the site is Groton. The largest cities within an 80-km (50-mi) radius are Hartford and New Haven, each with a population of about 123,000. Providence, Rhode Island lies just outside of the 80-km (50-mi) radius and has a population of about 174,000 (U.S. Census Bureau [USCB] 2000). Figures 2-1 and 2-2 show the location of Millstone in relationship to the major towns and cities within an 80-km (50-mi) and 10-km (6-mi) radius, respectively.

2.1.1 External Appearance and Setting

Millstone is sited on a peninsula that includes rocky beaches, coastal tidal marshes, and second-growth hardwood forests. Old stone cobble walls and fields from when the area was farmed overlie this landscape. Facility features at the 212-ha (525-ac) Millstone site include reactor buildings, auxiliary buildings, intake and discharge structures, turbine buildings, a radioactive waste facility, fuel handling buildings, switchyard and associated transmission lines, an environmental laboratory, and training facilities (Figure 2-3). Other site features include a natural area that is approximately 20 ha (50 ac) and recreational fields licensed to the town of Waterford that comprise approximately 12 ha (30 ac). In all, about 120 ha (300 ac) exist within the site that are not developed for the power station. The site is bisected by the Northeast Corridor rail line, which is owned by Amtrak. All development at Millstone, except the training facility, is situated south of this mostly below-grade rail line. An abandoned plant nursery adjoins both sides of the Millstone access road north of the tracks. The transmission lines that connect Millstone to the New England grid along with the switchyard equipment are owned and maintained by the Connecticut Light and Power Company (CL&P). The steel monopole transmission lines and rights-of-way (ROWs) corridor extend northward from the switchyard bordered by forested swaths and cross the Rope Ferry Road west of Gardiners Wood Road. The exclusion area coincides with the site property boundary. The nearest residences are single-family houses that are approximately 732 m (2400 ft) from the reactors.

The Millstone site is underlain by Monson gneiss and Westerly granite. Glacial soils, comprised of rock fragments from clay sized particles to boulders, cover the site. In some areas, fill from the quarry or the construction of Millstone overlies the glacial materials. One such pile is located west of Gardiners Wood Road near the recreational fields. This mound of excavated material, primarily associated with construction activities, occupies approximately 2.2 ha (5.5 ac) and is generally grass covered with some low shrubs. In the early 1980s, Northeast Utilities (NU), then the licensee, used the area to store material excavated during the construction of Millstone Power Station, Unit 3, along with miscellaneous construction debris including concrete and rebar which accounts for the majority of the material forming the mound. In 2000, in connection with the sale of Millstone to Dominion, NU characterized this area and

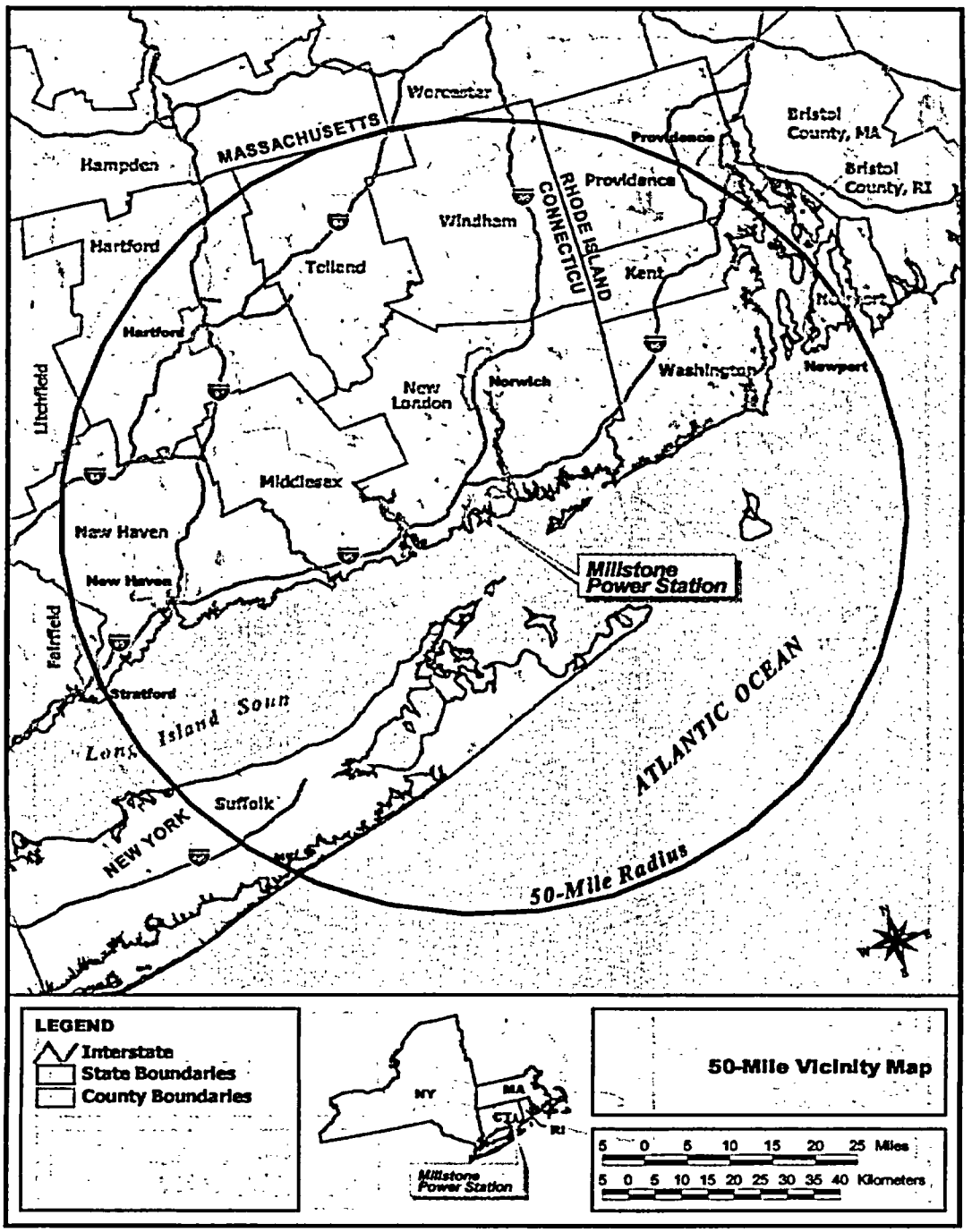

Figure 2-1. Location of Millstone, 80-km (50-mi) Region

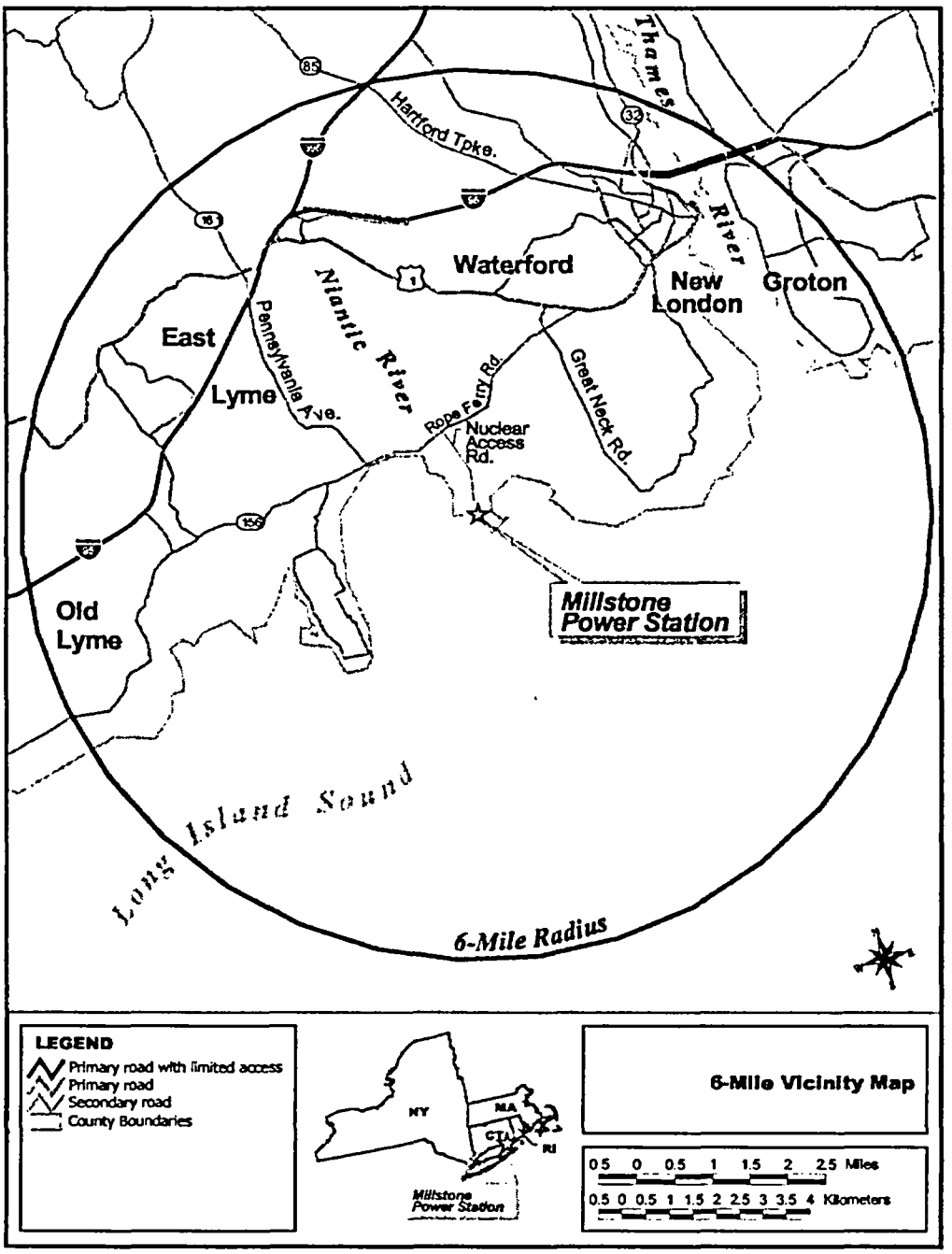

Figure 2-2. Location of Millstone, 10-km (6-mi) Region

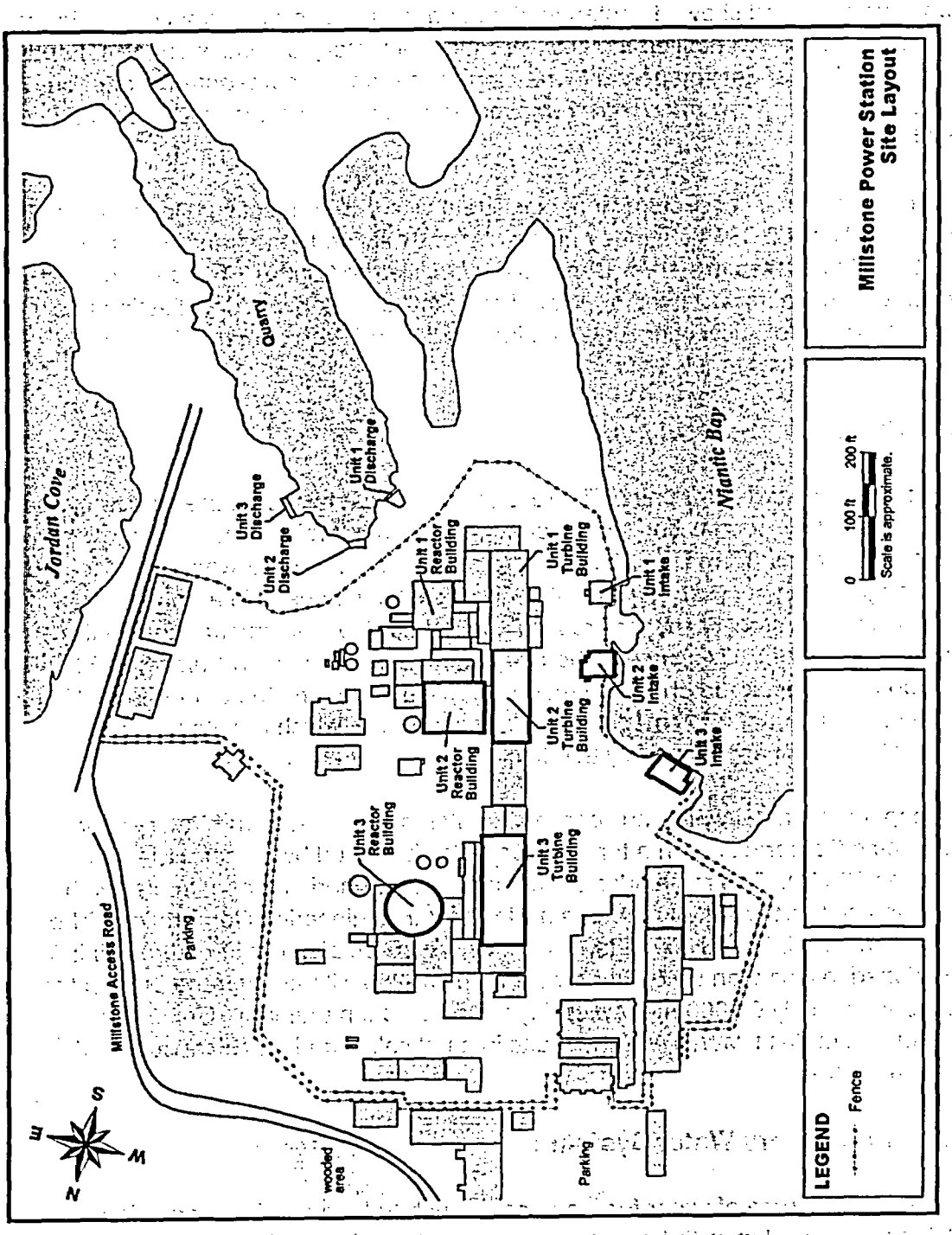

Figure 2-3. Millstone Site Layout

located two drums containing traces of radioactivity. No samples taken in areas outside of where the drums were located showed contamination, and the radioactivity levels of the drums were below reporting limits. NU notified the U.S. Nuclear Regulatory Commission (NRC) and the Connecticut Radiological Environmental Monitoring Office, and a representative of each organization toured the site. The drums were removed and shipped to a licensed low-level waste disposal facility.

Subsequent to the sale of Millstone, Dominion, consistent with the Connecticut Department of Environmental Protection (CTDEP) statutes and regulations relating to the transfer of the facility, has continued to assess this area (Connecticut Legislature 2003a). Tests of soil and ground-water samples have not detected a residual radioactive contamination. Testing has found some limited nonradiological chemical constituents that will require resolution under CTDEP remediation standards regulations.

2.1.2 Reactor Systems

Millstone has two operational reactor units (Figure 2-3). Unit 2 is a two-loop, pressurized-water nuclear reactor furnished by Combustion Engineering, Inc., with a turbine-generator furnished by General Electric Company (Dominion 2004a). The remainder of the unit was designed and constructed with engineering support from Bechtel. The reactor is housed in a double containment consisting of a steel-lined, prestressed concrete cylindrical structure inside the enclosure building. Unit 2 fuel is slightly enriched (less than 5 weight percent) uranium-235 with an average burnup for the peak rod of 62,000 megawatt days per metric ton of uranium. Unit 2 has a licensed thermal output of 2700 megawatts thermal (MW[t]), which results in a net calculated electrical output of approximately 870 MW(e).

Unit 3 is a four-loop, pressurized-water, nuclear reactor steam supply system furnished by Westinghouse Electric Corporation with a turbine-generator furnished by General Electric Company (Dominion 2004a). The remainder of the unit was designed and constructed with architect-engineering support provided by Stone and Webster Engineering Corporation. The reactor is in a steel-lined, reinforced concrete, subatmospheric containment structure. Unit 3 fuel is slightly enriched to less than 5 weight percent uranium-235 with an average burnup for the peak rod of approximately 60,000 megawatt days per metric ton uranium. Unit 3 has a licensed thermal output of 3411 MW(t), which results in a net calculated electrical output of approximately 1154 MW(e).

2.1.3 Cooling and Auxiliary Water Systems

Long Island Sound is the source of water for the once-through turbine condenser cooling systems at Millstone. The system withdraws salt water from Long Island Sound though intakes,

pumps the water through the condenser for cooling, and surface discharges heated water to Long Island Sound approximately 610 m (2000 ft) southeast of the withdrawal points (Dominion 2004a).

Millstone Point is located on the north shore of Long Island Sound. To the west of the site is Niantic Bay and to the east is Jordan Cove (Dominion 2004a). Intake structures for Units 2 and 3 are located on the eastern shore of Niantic Bay, which is fed by Long Island Sound. The structures consist of four reinforced-concrete bays for Unit 2 and six bays for Unit 3. When both Units 2 and 3 are operating at full power, the 10 pumps (one for each bay) pump a total of 92 cubic meters per second (m^3/s) (1.46 million gallons per minute [gpm]) into 2-m (7-ft) diameter conveyance pipes. Cooling water then moves through the condensers. After passing through each unit's condensers, cooling water is discharged to the former granite quarry. The heated discharge water then flows through two cuts excavated from the bedrock at the southern end of the quarry into Long Island Sound. Figure 2-3 shows the intake structures, quarry, and discharge points for the Millstone circulating water system.

The intake structures are designed to minimize the possibility of clogging or impingement of aquatic organisms. Before the intake water reaches the circulating water pumps, the water passes through trash racks consisting of 1-centimeter (cm) (3/8-inch [in.]) thick metal bars spaced horizontally on 5-cm (2-in.) centers. The water then flows through vertical traveling screens with 1-cm (3/8-in.) mesh that prevent debris and large organisms from entering the cooling system. A cutoff wall in front of the intake extends 2.7 m (9 ft) below the surface to prevent surface water debris and organisms from entering the intake. Maximum intake velocities at the coarse bar racks are 0.46 meters per second (m/s) (1.5 feet per second [ft/s]) for Unit 2 and 0.3 m/s (1 ft/s) for Unit 3. Unit 2 has always had 0.953-cm (0.375-in.) mesh continuous-belt traveling screens. Traveling screens associated with Unit 3 initially included 0.4763-cm (0.1875-in.) mesh screens or a combination of two mesh sizes (0.4763 cm [0.1875 in.] and 0.953 cm [0.375 in.]). Since 1992, traveling screens associated with Unit 3 have had a mesh size of 0.953 cm (0.375 in.).

At Unit 2, debris and organisms are washed off the traveling screens into a trough, using a spray-wash pressure of 85 pounds per square inch (psi) (586 kilopascals [kPa]). A fish-return sluiceway pipe was added to Unit 2 and became operational in July 2000 (Dominion 2001). The fish return system takes all impinged material from the Unit 2 screen-wash system and directs the material into the Sound, east between the Units 1 and 2 intake structures.

Unit 3 was constructed with a two-trough fish and trash return, designed as an integral part of the intake screen system. A low-pressure (10 psi [69 kPa]) spray is used to flush organisms off modified-lip baskets on the traveling screen panels into a lower fish sluiceway trough, which discharges into the Sound, eastward along the seawall on the west side of the intake structures.

Remaining material is washed off with pressure spray into an upper trough that empties into trash hoppers for offsite disposal.

Biocides are added to the intake water to prevent biofouling. Sodium hypochlorite is injected on a periodic basis, and the system is designed to maintain a chlorine concentration of 0.2 parts per million (ppm) (Dominion 2004a). Residual chlorine is monitored in the effluent water. Thermal backwashing is also performed to prevent mussels from fouling the intake structure pump bays.

Service water is also withdrawn inside the intake structures. This water is used in a variety of applications, including component cooling (e.g., pump bearings and spent fuel pool water) and as an emergency backup supply for some systems. During normal operations, approximately 3.4 m^3/s (54,000 gpm) of service water is withdrawn for both units.

Domestic-quality potable water, at a flow of about 1.3×10^6 liters per day (L/d) (3.3×10^5 gallons per day [gpd]), is purchased by Dominion from the city of New London for drinking, sanitary purposes, and industrial processes (other than cooling). In the past, Millstone withdrew groundwater from several wells onsite for sanitary purposes, but no longer does. Dominion maintains registrations for these wells. Sanitary waste from Millstone is discharged into the wastewater treatment system operated by the city of New London.

2.1.4 Radioactive Waste Management Systems and Effluent Control Systems

Millstone liquid, gaseous, and solid radioactive waste management systems collect and treat the radioactive materials that are produced as a by-product of plant operations. The Millstone processing systems are designed and operated to meet the dose design objectives of 10 Code of Federal Regulations (CFR) Part 50, Appendix I. Solid radioactive waste is packaged, stored onsite, and ultimately transported to a licensed treatment or disposal facility.

Radioactive material produced from fission of uranium-235 and neutron activation of metals in the reactor coolant system (RCS) is the primary source of liquid, gaseous, and solid waste. The radioactive fission products build up within the fuel. Most of these fission products are contained in the fuel pellets and sealed fuel rods, but small quantities escape from the fuel rods into the reactor coolant. Neutron activation of trace concentrations of metals entrained in reactor coolant such as zirconium, iron, and cobalt creates radioactive isotopes of these metals. Both fission and activation products in liquid and gaseous forms are continuously removed from reactor coolant and captured on several different types of filter media. Units 2 and 3 operate separate liquid and gaseous processing systems. Gaseous discharges for each unit are monitored separately before they are discharged to the stack or to other designated release points for each unit. All liquid discharges are directed to a canal which terminates in the old

quarry and the quarry discharges to Long Island Sound. All interconnections between Units 2 and 3 and Unit 1 were separated as described in *Millstone Power Station, 2002 Radioactive Effluent Release Report* (Dominion 2003b).

The radioactive-waste reduction facility is used for low-level radioactive solid waste processing and storage. Solid waste consists of spent fuel, contaminated equipment and components removed from service, dry active waste, solidified liquid waste, and spent filtration media. Spent fuel is removed from the reactor core and stored in each unit's spent fuel pool. Millstone has constructed a dry cask spent fuel storage facility. Dry active waste includes contaminated protective clothing, paper, rags, and other trash generated during operation and maintenance activities. Filter media include paper and glass fiber cartridge filters, resin beads or powder, and metallic filters. Class A, B, and C solid waste, as defined in 10 CFR Part 61, may be processed for volume reduction or is shipped to a licensed disposal facility. The State of Connecticut, a member of the Southeast Low Level Waste Compact, has access to the Barnwell, South Carolina disposal facility through the renewal period.

The Radiological Effluent Monitoring Offsite Dose Calculation Manual (REMODCM) provides the sampling and analysis requirements and the methods used for calculating the concentration of radioactive material in effluents and the estimated offsite doses (Dominion 2005). The REMODCM also provides guidelines for operating radioactive waste treatment systems and instrumentation in order that offsite doses are kept as low as reasonably achievable (ALARA). Each unit's specifications for the minimum number of operable effluent monitors, alarm set points, monitoring instrumentation surveillance requirements, and required actions if the required monitors are not in service are listed in the REMODCM. *Radioactive Effluent Release Reports* (Dominion 2002b; Dominion 2003b; Dominion 2004c) for 2001, 2002, and 2003 were reviewed. Data from the 2002 report were used to represent a typical year for capacity factors and operational events that impact the volume and activity of liquid, gaseous, and solid waste.

2.1.4.1 Liquid Waste Processing Systems and Effluent Controls

The liquid waste systems and effluent controls for Millstone Units 2 and 3 have the same general design and operation. There are two separate trains—one for normally tritiated, nonaerated, low-conductivity liquid waste associated with the primary coolant system and the other for all other aerated liquid wastes that are collected by the open drain systems. The primary liquid waste system contains higher radioactivity levels than are found in liquids collected from open drains. Processing of primary liquid waste occurs on a batch basis. The processing of the primary waste consists of filtration, degasification (when needed for shutdown) and ion exchange. Processed wastes are collected in monitor tanks, which are sampled prior to release. A radiation monitor in the discharge line records activity released and alarms if the activity level in the effluent exceeds predefined limits. A valve in the discharge line

is actuated on a high-level alarm to terminate the release to the circulating water discharge tunnel. Both Units 2 and 3 have continuous releases from steam generator blowdown and service water and from turbine building sump discharge pathways and batch releases from low-activity liquid waste tanks. Some of the low-activity liquid waste streams, such as turbine building floor drains and steam generator blowdown, are sampled, monitored, and discharged directly to the environment during normal operations. The waste-processing systems for aerated drains, equipment drains, and sumps, although different for each unit, provide for sampling, continuous monitoring, and where appropriate, automatic termination of releases (Dominion 2004d).

Each liquid waste pathway has specific sampling, analysis, monitoring points, alarms, and operational parameters listed in the REMODCM. The REMODCM prescribes the alarm / trip points, which are based on 20 percent of the radiological effluent control limit (Dominion 2005). The radioactivity released from each batch release or continuous release is recorded and reported annually to the NRC. During 2002, there were a total of 344 batch releases of liquid effluents and the volume of batched plus continuous releases was 3.34×10^7 liters (L) (8.82×10^6 gallons [gal]) for Unit 2 and 1.78×10^7 L (4.70×10^6 gal) for Unit 3. Total fission and activation products released were 2.99×10^9 becquerels (Bq) (0.0809 curies [Ci]) for Unit 2 and 5.51×10^9 Bq (0.149 Ci) for Unit 3. Total tritium activity released was 7.66×10^{12} Bq (207 Ci) from Unit 2 and 4.92×10^{13} Bq (1330 Ci) from Unit 3 (Dominion 2003b). These releases are typical of annual releases from Millstone and are not expected to increase during the renewal period. These releases result in doses to members of the public that are well below the dose design objectives of 10 CFR Part 50, Appendix I, as discussed in Section 2.2.7.

2.1.4.2 Gaseous Waste Processing Systems and Effluent Controls

The Millstone waste-processing systems are designed to meet 10 CFR Part 20 and 10 CFR Part 50, Appendix I. Unit 2 processes waste gases from the RCS by storage, decay, and particulate filtration. Unit 3 processes gases removed from the RCS through a series of filter banks designed to delay noble gases and capture radioiodine. Monitors record the concentration of particulate, iodine, and noble gases released. Sampling and analysis used to identify and quantify isotopes are described in the REMODCM (Dominion 2005).

In Unit 2, process waste gases from the RCS are compressed and collected in six tanks. The six tanks provide adequate storage capacity for a decay time of 90 days. The waste-gas decay tanks are sampled prior to release and discharged through a filter to the stack. The discharge pipe contains a radiation monitor and redundant isolation valves. A high-level alarm will automatically close an isolation valve to terminate the release. Both Air Ejector and Auxiliary Building roof vents are separate monitored release paths. Containment ventilation is processed through a HEPA (high efficiency particulate air) filter and a charcoal filter and monitored prior to

release in the stack. Auxiliary building, fuel building, and containment purge exhaust is processed through a HEPA filter and monitored prior to release at the enclosure building roof vent (Dominion 2004d).

For 2002, Unit 2 total fission and activation gas activity released was 4.74×10^{12} Bq (128 Ci), iodine-131 was 1.81×10^{8} Bq (4.90×10^{-3} Ci), particulates were 4.5×10^{5} Bq (1.22×10^{-5} Ci), and tritium was 1.15×10^{12} Bq (31.2 Ci) (Dominion 2003b). Historically, releases of noble gases and radioactive iodine from Unit 2 have been higher than from Unit 3 (Dominion 2003b).

Unit 3 has two separate systems for waste-gas collection and discharge. Process gas from the RCS and its support systems is passed through and filtered by charcoal bed adsorbers and HEPA filters. The charcoal adsorbers hold up noble gases long enough in comparison to their half-lives so that most of these radioisotopes are effectively removed by radioactive decay. Radioactive iodine is removed by the charcoal beds and a small quantity of noble gases are released to the stack. The process vents are designed to collect the low-activity aerated gas streams from drains, condenser air, containment vacuum system, and some of the relief valve discharges. Exhausts from the containment, fuel auxiliary, and waste-disposal buildings can be discharged directly to the reactor plant ventilation vent or processed through a HEPA / charcoal filter bank. Vents in the turbine building, steam generator blowdown tank, and safeguards building exhaust to the atmosphere during normal operations (Dominion 2004d).

For 2002, Unit 3 total fission and activation gas activity released was 9.07×10^{10} Bq (2.45 Ci), iodine-131 was 5.62×10^{4} Bq (1.52×10^{-6} Ci), particulates were 2.25×10^{6} Bq (6.08×10^{-5} Ci), and tritium was 1.75×10^{12} Bq (47.3 Ci) (Dominion 2003b). These releases from both units are typical of annual releases from Millstone and are not expected to increase during the renewal period. These releases result in doses to members of the public that are well below the dose design objectives of 10 CFR Part 50, Appendix I, as discussed in Section 2.2.7.

2.1.4.3 Solid Waste Processing

The radioactive solid waste systems are designed to collect, hold, process, dewater, solidify, package, and store waste until shipment off site. Volumes, activity levels, and number of shipments are reported in the *Radioactive Effluent Release Reports* (Dominion 2003b). Solid-waste containers, shipping casks, and methods of packaging meet applicable NRC and Department of Transportation regulations (10 CFR Part 61, 49 CFR Parts 171–178). Materials processed as solid waste include the following: concentrated boric acid, spent resin, spent filter cartridges, sludges, and miscellaneous dry active wastes. Contaminated structures, equipment, and components are processed for volume reduction or prepared for direct disposal at one of the licensed low-level waste disposal facilities. Spent resins and filter media contain the highest concentration of radioactive material and require special handling and solidification.

Dry active waste consisting of paper, personnel protective clothing, rags, mops, etc., is sorted and compacted. An offsite vendor may be used for further volume reduction (Dominion 2004d).

The condensate polishing facility processes spent condensate resin and is also used for storing mixed waste. Spent resins are generated from demineralizers in the radioactive waste systems, the chemical and volume control system, and the spent fuel pool clean-up system. The radioactive waste storage facility and the onsite storage containers are used to store liners that contain higher-activity waste such as dewatered resin and filters. The radioactive waste storage facility is also used for sorting, processing, loading, and shipping radioactive materials. Temporary waste storage containers are shielded to protect operating personnel (Dominion 2004d).

All radioactive waste is shipped to a licensed burial site in accordance with applicable NRC, U.S. Department of Transportation, and U.S. Environmental Protection Agency (EPA) regulations, including burial site regulation requirements. The quantities shipped off site for processing and burial are reported to the NRC in the *Annual Radioactive Effluent Release* (Dominion 2003b). In 2002, Millstone made a total of three low-level waste shipments, two mixed waste shipments, one low-level waste shipment of spent resin, and 14 shipments of water, dry active waste, contaminated equipment, or sludges. Unit 2 solid waste volume was 345 m^3 (1.22×10^4 ft^3) and the total activity was 1.30×10^{12} Bq (35.2 Ci) and Unit 3 solid waste volume was 243 m^3 (8580 ft^3) and 2.80×10^{12} Bq (75.6 Ci) (Dominion 2003b). These solid waste volumes and amounts of radioactive material are typical of annual waste shipments for both Millstone units and are not expected to increase during the renewal period.

2.1.5 Nonradioactive Waste Systems

Hazardous, nonradioactive waste is regulated under the Resource Conservation and Recovery Act (RCRA), administered by the CTDEP, which classifies Dominion as a large-quantity generator. Dominion operates under interim RCRA status (EPA ID # CTD00084518) while its permit application is being reviewed. Dominion currently is not considered to be a significant noncomplier (EPA 2004a; CTDEP 2004).

Millstone uses licensed commercial haulers for its solid and hazardous wastes. Common types of hazardous, nonradioactive waste generated at Millstone are aerosol cans, paint-related waste materials, and solvent rags.

2.1.6 Plant Operation and Maintenance

Routine maintenance performed on plant systems and components is necessary for safe and reliable operation of a nuclear plant. Maintenance activities conducted at Millstone include

inspection, testing, and surveillance to maintain the current licensing basis of the plant and to ensure compliance with environmental and public safety requirements. Certain activities can be performed while the reactor is operating. Others require that the plant be shut down. Dominion refuels Millstone on an 18-month schedule. Up to 700 to 800 additional contractor employees are employed for the approximately 30-day refueling outage (Dominion 2004a).

Millstone performed an aging management review and developed an integrated plant assessment for managing the impacts of aging on systems, structures, and components in accordance with 10 CFR Part 54. The aging management program is described in Section 3 of the Environmental Report (Dominion 2004a). The integrated plant assessment identified the programs and inspections that are managing the impacts of aging at Millstone. The integrated plant assessment did not identify any need for additional refurbishment or replacement activities. Dominion assumes that an additional five employees will be needed to perform all the necessary surveillance, monitoring, inspections, testing, trending, and record-keeping activities during the license renewal period.

2.1.7 Power Transmission System

Four 345-kilovolt (kV) transmission lines connect Millstone to the power grid (Table 2-1) (Dominion 2004a). The four lines share a common ROW for 14.5 km (9 mi) north to Hunts Brook Junction. At Hunts Brook Junction, two lines run north to the Card Street and Manchester substations, one line runs east to the Montville station, and one line runs west to the Southington substation (Figure 2-4). All Millstone lines share ROWs with lines from other sources and would be maintained regardless of continued Millstone operation status.

Table 2-1. Millstone Transmission ROWs

		Length		Width		Max Area[a]	
Substation	kV	km	(mi)	m	(ft)	ha	(ac)
Hunts Brook Junction	345	14.5	(9)	152	(500)	220	(545)
Montville	345	6.4	(4)	99	(325)	64	(158)
Card Street	345	32	(20)	91	(300)	294	(727)
Manchester	345	61	(38)	91	(300)	559	(1382)
Southington	345	71	(44)	76	(250)	539	(1333)

(a) Max area calculations use maximum ROW width estimates.

The 14.5-km (9-mi) common ROW leading out of Millstone to Hunts Brook Junction is approximately 152 m (500 ft) wide and covers a maximum of 220 ha (545 ac). The line from

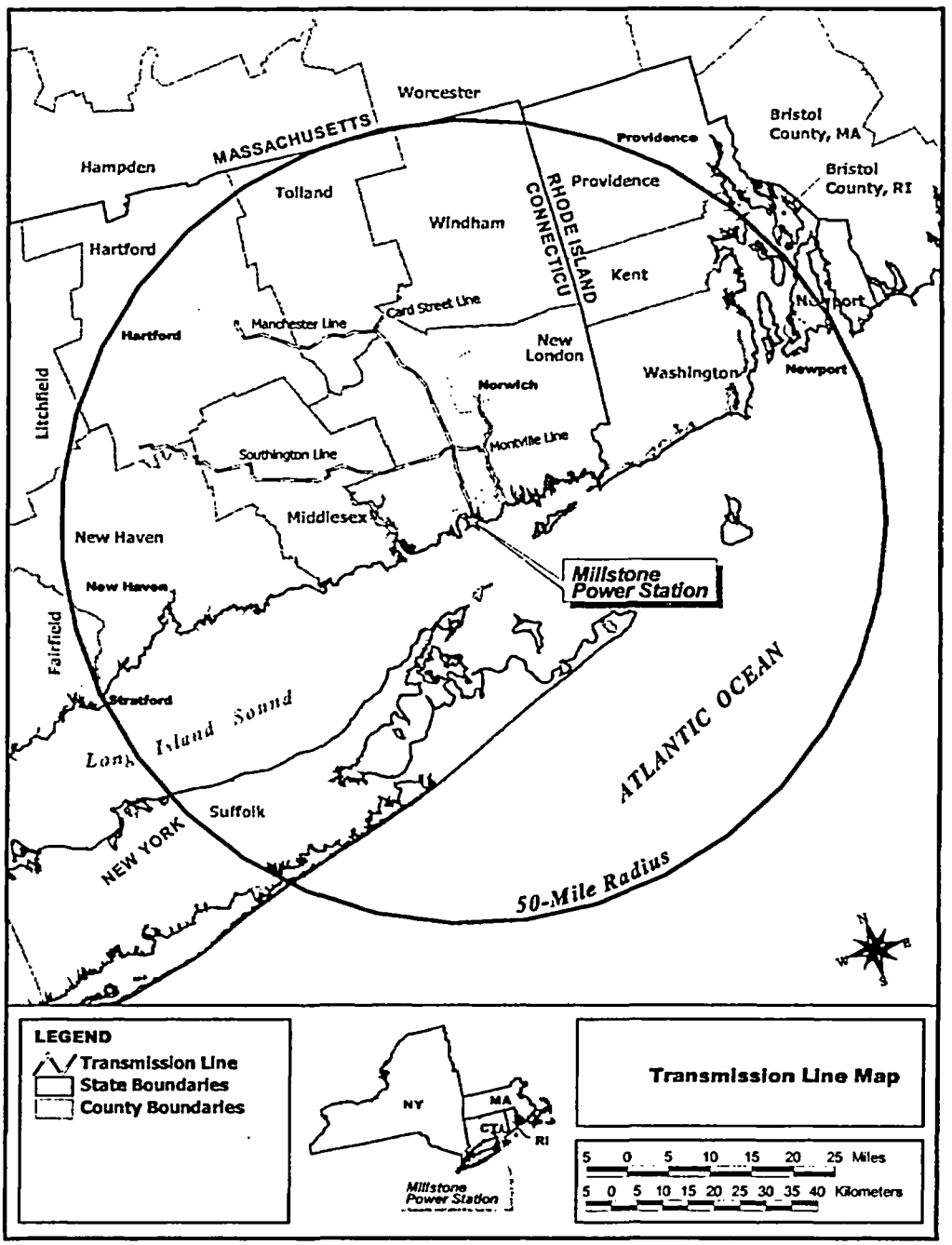

Figure 2-4. Millstone Transmission Lines

Hunts Brook Junction to the Montville station is approximately 6.4 km (4 mi) long and 99 m (325 ft) wide for a maximum area of 64 ha (158 ac). The line to the Card Street substation is approximately 32 km (20 mi) long and 91 m (300 ft) wide for a maximum area of 294 ha (727 ac). The Card Street line shares most of its length with the Manchester line. The line to the Manchester substation is approximately 61 km (38 mi) long and 91 m (300 ft) wide for a maximum area of 559 ha (1382 ac). The line to the Southington substation is approximately 71 km (44 mi) long and 76 m (250 ft) wide for a maximum area of 539 ha (1333 ac).

CL&P manages vegetation within the four transmission line ROWs with an approach it calls "two-zone maintenance" (NUSCO 2004). The area directly beneath the transmission lines and extending out 4.6 m (15 ft) in either direction is called the "wire zone." Most vegetation in the wire zone is kept short except for the occasional clusters of red cedar (*Juniperus virginiana*) that are maintained for nesting habitat. The area from the edge of the wire zone to the outside edge of the ROW is called the "side zone." The side zone acts as a transition between the low structure of the wire zone and the forest. The side zone is maintained as a multi-layered habitat with low-growing trees and shrubs.

Vegetation is managed through a combination of mowing, trimming, and herbicide treatments. All personnel applying herbicides are required to possess a valid applicator's license (NUSCO 2004). Wetlands and other water bodies are protected from herbicides by a 3-m (10-ft) border (NUSCO 2004). Mowing is conducted only between the months of November and April to minimize impacts to wet soils, nesting birds, and wildlife forage. CTDEP reviews all transmission line ROW management plans to ensure protection of threatened and endangered species. CL&P personnel work closely with crews to ensure that transmission line maintenance is implemented properly.

CL&P encourages collaboration with conservation groups to use transmission line ROWs for wildlife habitat improvement. CL&P has also developed a list of plant species and wildlife habitat types that it attempts to promote through its vegetation management actions (Ferrucci and Walicki 2002). Contractors are required to identify and target non-native, invasive plant species for eradication (Ferrucci and Walicki 2002).

2.2 Plant Interaction with the Environment

Sections 2.2.1 through 2.2.8 provide general descriptions of the environment near Millstone as background information. They also provide detailed descriptions when needed to support the analysis of potential environmental impacts of refurbishment and operation during the renewal term, as discussed in Chapters 3 and 4. Section 2.2.9 describes the historic and archaeological resources in the area, and Section 2.2.10 describes possible impacts associated with other Federal project activities.

2.2.1 Land Use

The Millstone site is approximately 212 ha (525 ac), including the developed area that is approximately 89 ha (220 ac). The lands at Millstone are designated as "public utility" on the 1996 *Existing Land Use* map for Waterford. They are within an industrial zone south of the Amtrak Northeast Corridor rail line, and are within an industrial park zoning district north of the rail lines. Waterford's *Future Land Use Plan* map calls out the Millstone site as an "electric generation facility." The plan specifies that this land use applies to "The area presently devoted to use by Millstone and associated facilities necessary for the generation and transmission of electricity." Also shown on the *Future Land Use Plan* map at Millstone are lands on the site designated for "natural resources." The plan notes that these are "areas that exhibit significant environmental constraints . . . and that represent the highest priorities for conservation. Use of these areas should be generally restricted or discouraged." These areas include wetlands and coastal resource areas. The entire shoreline of Millstone and of Waterford is considered a scenic area according to the Waterford Plan. The Coastal Boundary established by the 1982 Municipal Coastal Program (pursuant to Connecticut General Statutes Section 22a-94) encircles all of Millstone Point and includes offshore waters and lands within about 305 m (1000 ft) of the shore. Restoring freshwater wetlands at Millstone Point is encouraged by the plan. Adjacent land uses (existing and future) are shown for waterfront business development, residential, open space, and power transmission (Waterford 1998).

The current land uses on the land abutting the Millstone site are nearly exclusively single-family residential neighborhoods. A large undeveloped tract of forested private land that is also zoned for single-family residential uses abuts the site to the east of the recreation fields across Gardiners Wood Road. There is a small eighteenth century burial ground that abuts the site to the north and fronts Rope Ferry Road. A convalescent residential care center is located across from the main entrance to Millstone on the north side of Rope Ferry Road. The nearest commercial areas are found nearly 5 km (3 mi) away, where there are several small shopping centers and stand-alone retail establishments at Jordan Village, which is also the center for town government and the location of the high school. Maritime enterprises that cater to small fishing and pleasure craft are found at Mago Point about 1 km (0.6 mi) from Millstone.

Section 307(c)(3)(A) of the Coastal Zone Management Act [16 United States Code (USC) 1456(c)(3)(A)] requires that applicants for Federal licenses to conduct an activity in a coastal zone certify that the proposed activity is consistent with the enforceable policies of the State's coastal zone program. A copy of the certification is also to be provided to the State. The State is to notify the Federal agency whether the State concurs with or objects to the applicant's certification. This notification is to occur within 6 months of the State's receipt of certification. The Millstone plant is within Connecticut's coastal zone for purposes of the Act. Following submission of the Dominion certification of consistency, CTDEP waived a separate Federal

coastal consistency review. CTDEP has stated that it will evaluate consistency for the renewal of the OLs for Millstone in conjunction with the State's National Pollution Discharge and Elimination System (NPDES) permit review process (CTDEP 2004b). A copy of this letter is in Appendix E of this Supplemental Environmental Impact Statement (SEIS).

2.2.2 Water Use

Millstone receives water from the city of New London for potable and service uses at the plant. This freshwater is derived from the Lake Konomoc reservoir, located in Waterford and Montville on the mainland. Current plant usage averages approximately 1.3×10^6 L/day (3.3×10^5 gpd). The usage represents approximately 5.2 percent of the city of New London's daily capacity and 6 percent of the city's average daily use (Dominion 2004d). In the past, Millstone withdrew groundwater from three wells onsite for sanitary purposes, but no longer does so. However, registrations for these wells are maintained. Sanitary wastes generated at Millstone are discharged into the New London wastewater treatment facility.

Noncontact cooling water for Millstone Units 2 and 3 is withdrawn by Millstone from Long Island Sound. Additional minor amounts of ocean water may be used as emergency backup for fire protection and other systems. The water withdrawn from Long Island Sound represents about 3 percent of the mean tidal flow estimated for the Niantic Bay in the vicinity of Millstone (Dominion 2004d). The quantity of fresh water flow into Niantic Bay or Jordan Cove is not gauged (U.S. Geological Survey 2004), but is small relative to the estimated tidal exchange volumes. Dye tracer studies conducted in 1988 concluded that about 20 percent of the Niantic River discharge flow is withdrawn by Millstone during three-unit operation (Dominion 2004e). It is estimated that current two-unit operation results in the withdrawal of approximately 15 percent of Niantic River discharge. After passing through the condensers and service water system, most of the Millstone cooling water is returned to Long Island Sound.

The Millstone site has several shallow wells near it, the nearest being 0.5 km (0.33 mi) from the station proper (Dominion 2004d). None of these wells provide water for domestic purposes, but two shallow wells in the northern part of the site were used to irrigate ball fields and supply concession stands at the field. In 2001, the concession stands were connected to a municipal water supply, and one of the two wells was filled in and abandoned. The remaining well is pumped seasonally. Because of its shallow depth of 6.7 m (22 ft) and pump size, Dominion has estimated its pumping capacity to be much less than 379 L per minute (100 gpm) (Dominion 2004a).

The ground-water environment at Millstone is characterized by generally impermeable bedrock (gneiss and granite) overlain by glacial tills and soil of varying permeabilities (Dominion 2004d). There appears to be little movement of water through fractures in the bedrock because the

quarry did not fill with either fresh or salt water after its abandonment in 1960 (Dominion 2004d). A ground-water contour map of the site indicates that the ground-water table is highest in the northern part of the site and slopes gradually towards the shoreline (Dominion 2004d). Therefore, groundwater at the ball field area is hydraulically upgradient of the station proper.

2.2.3 Water Quality

In accordance with the Federal Water Pollution Control Act (also known as the Clean Water Act), the water quality of plant effluent discharges is regulated through the NPDES. CTDEP is the agency delegated by the EPA to issue discharge permits in Connecticut. Dominion holds an NPDES permit (CT0003263) for cooling system discharges and several other plant and storm water discharges. The NPDES permit sets limitations on water quality in effluent discharges and establishes specific monitoring requirements and the reporting frequency. The most recent NPDES permit, issued in 1992, remains in effect because a timely renewal application was filed by the licensee with CTDEP in 1997. Until the new permit is issued, Dominion will continue to operate under the requirements of the 1992 permit.

The current permit requires monitoring of discharges from the circulating cooling water system, house service boiler blowdown system, the high-conductivity water tank discharge system (including steam generator blowdown), and the radiation waste holdup and treatment system. Discharge limitations vary with location, and include flow, maximum discharge temperature, incremental temperature difference, chlorine, boric acid, oil and grease, suspended solids, pH, iron, copper, zinc, and chromium. Impacts to Long Island Sound are also considered in the permit, for parameters such as odor, coliform bacteria, and dissolved oxygen. There have been occasional instances when monitoring results have been above permit limits (e.g., total suspended solids). These instances have been reported in Millstone's monthly discharge monitoring reports to CTDEP. In addition to requiring chemical specific testing, the NPDES permit also requires testing of discharges for biological toxicity. The testing has shown no significant biological toxicity.

At full discharge flow, water temperatures increase approximately 9 to 14 degrees celsius (°C) (17 to 26 degrees fahrenheit [°F]) as the water crosses the condensers. The NPDES permit for Millstone limits the discharge temperatures to 40 °C (105 °F) and the maximum increases in temperature at the quarry cut to 18 °C (32 °F) above intake temperatures at full flow. The discharge is not allowed to increase the temperature of Long Island Sound beyond an 2438-m (8000-ft) radius mixing zone by more than an average of 2.2 °C (4 °F) or above 28 °C (83 °F). Monitoring data indicate that the thermal plume is warmest in the immediate vicinity of the quarry cuts and the surface-oriented plume from three-unit operation was shown to cool to less than 2.2 °C (4 °F) above ambient temperatures within approximately 1100 m (3610 ft) of the quarry (Dominion 2004e).

Total residual chlorine concentrations in the discharge at the quarry cut must not exceed 0.1 milligrams per liter (mg/L) (0.1 parts per million [ppm]), according to the NPDES permit. Detectable concentrations of free available chlorine may be present for no more than two hours per unit in any one day. Millstone is expected to remain in compliance with the permitted chlorine concentrations.

2.2.4 Air Quality

Millstone has a continental climate modified by marine influences. The northeastern U.S. climate is influenced heavily by the upper level westerlies that prevail at the earth's middle latitudes. Large-scale air masses and storm systems normally approach the area from southwesterly through northwesterly directions, particularly in the colder seasons when the jet stream steers storms along preferred storm tracks that cross New England. The influence of the ocean and Long Island Sound moderates the climate on more local scales. Temperatures along the coast tend to be less extreme than in inland areas, and the humidity tends to be higher. Warmer temperatures along the coast in winter can contribute to snowstorms changing to rain, resulting in proportionately lower observed snowfall totals and greater rain amounts as compared to inland areas. Differential heating of the ocean and land surfaces leads to localized, diurnal sea and land breezes, particularly in the warmer seasons. Proximity to the ocean sometimes contributes to two types of less frequent, but violent storms. Tropical storms or hurricanes can occasionally make their way up the Atlantic seaboard from the south and deliver strong winds and heavy rains to New England coastal locations in the summer and autumn months. Also, the relatively warm ocean waters off the east coast in winter can provide the energy for explosive growth of extratropical cyclones, many producing "northeasters" in New England, leading to strong winds and heavy precipitation. Because of Millstone's proximity to the ocean, the National Weather Service observing station at Bridgeport, Connecticut can be expected to experience a climate very similar to Millstone and can be used to represent long-term weather statistics at Millstone. Bridgeport is also located near the coast, approximately 97 km (60 mi) west of Millstone.

Climatological records from 1971 to 2000 at Bridgeport (National Oceanic and Atmospheric Administration [NOAA] 2003a) indicate that the normal daily maximum temperatures for the area range from 2.7 °C (36.9 °F) in January to 27.7 °C (81.9 °F) in July. Normal minimum temperatures range from -5.1 °C (22.9 °F) in January to 18.9 °C (66.0 °F) in July. The prevailing wind direction, based on a 15-year period of record (NOAA 2003), at Bridgeport for the months of November through January is from the west-northwest. The prevailing direction in February and March is from the northwest, while wind direction from April through October is mostly southwesterly.

Comparison of meteorological data collected at Millstone to data collected at Bridgeport during the years 1974 to1980 (Dominion 2004a) indicates that there are differences in the sea breeze characteristics between these two locations. Onshore flows at both sites tended to occur more frequently in the south-southwest to west direction than in the east-southeast to south direction. However, onshore winds from the east-southeast to south direction did occur more frequently at Millstone than at Bridgeport. Offshore flows from the west-northwest to north direction were recorded more frequently than winds from the north-northeast to east direction at both sites, with north-northeast to east winds occurring slightly more frequently at Bridgeport than at Millstone. In general, monthly average temperatures tended to be cooler at Millstone, particularly during the summer. Also, humidity tended to be lower at Millstone in the warmer months and was generally higher in the cooler months. This comparison is not rigorous and can only be used as a qualitative measure of relative difference between Millstone and the climate record at Bridgeport. The differences that exist in instrumentation type and height and frequency of observations, together with the short time frame of the comparisons (7 years) do not permit quantitative comparisons.

Precipitation in Connecticut is evenly distributed throughout the year and average annual snowfall is the lowest near the coast (Connecticut State Climate Center 2004). Normal annual precipitation at Bridgeport is 1120 millimeters (mm) (44.15 in.), with the lowest monthly mean of 74 mm (2.92 in.) in February, and the highest monthly mean of 105 mm (4.15 in.) in March (NOAA 2003a). Normal annual snowfall at Bridgeport is 64 mm (25.2 in.). Measurable snowfalls typically occur in the months of November through April.

Thunderstorms occur most often in the summer months with an average of 20.3 thunderstorms at Bridgeport, annually, based on a 40-year period of record (NOAA 2003a). The probability of a tornado striking the site is 1.28×10^{-4} per year, based on statistics from the years 1955 through 1983 (Ramsdell and Andrews 1986). During the years between 1900 and 2000, there were eight direct-hitting hurricanes on the coast of Connecticut. Three of these were considered major hurricanes (Jarrell et al. 2001). Category 3 and higher hurricanes are considered major hurricanes.

Wind energy potential along the coast of Connecticut is rated as wind Class 3 on a scale of 1 to 7 (Elliot et al. 1986). These ratings indicate that wind is potentially viable as an energy resource in this area.

Millstone is located in New London County, which is part of the Eastern Connecticut Intrastate Air Quality Control Region (40 CFR 81.183). The entire state of Connecticut has been designated as an attainment area for carbon monoxide, nitrogen dioxide, lead, and sulfur dioxide. New London County is also designated as in attainment for particulate matter with a

diameter of 10 micrometers (μm) or less. New London County has been designated as serious nonattainment for the EPA 1-hour ozone standard (40 CFR 81.307, CTDEP 2002a).

Diesel generators, boilers, and other activities and facilities associated with Millstone emit various nonradioactive air pollutants to the atmosphere. Air emissions from these sources are subject to Connecticut General Statutes, various sections of the Regulations of Connecticut State Agencies, Title 22a-174, (Connecticut Legislature 2003b), and various Federal regulations. Emissions from these sources are regulated under permit number 199-0038-TV, which was issued January 29, 2003, and expires January 29, 2008.

2.2.5 Aquatic Resources

Millstone is located at Millstone Point, a small peninsula situated on the north shore of Long Island Sound in Waterford, Connecticut. The plant is bordered on the west by Niantic Bay, on the east by Jordan Cove, and on the south by the Twotree Island Channel (Dominion 2004e) (Figure 2-5). The plant is located approximately 1.6 km (1 mi) southeast of the mouth of the Niantic River and approximately 5.6 km (3.5 mi) west of the Thames River. Cooling water intake structures are located in Niantic Bay and are situated approximately 4.6 to 7.6 m (15.1 to 24.9 ft) below mean sea level. Three separate intakes, one for each unit, are located along a 200-m (656-ft) stretch of shoreline on the western boundary of Millstone Point. The Unit 1 intake is no longer used because the unit has permanently ceased operation.

Dye studies conducted by the Massachusetts Institute of Technology in 1975 and 1976, prior to the operation of Unit 3, and again in 1988, suggested that about 20 percent of the water discharged from the Niantic River could be withdrawn by the Millstone cooling water system with three-unit operation and about 15 percent with only Units 2 and 3 operating (Lorda et al. 2000; Dimou and Adams 1989). Once-through cooling water is discharged into an abandoned granite quarry located approximately in the center of Millstone Point. Water then flows into Long Island Sound near the Twotree Island Channel (see Figure 2-5). The maximum allowed daily flow of the discharges is 1.0×10^{10} L/d (2.7×10^{9} gpd). The current NPDES permit limits the maximum temperature of the discharge points at the quarry cut to 40.6 °C (105 °F), with a maximum temperature increase of 17.8 °C (32 °F) above the intake water temperature under normal conditions.

2.2.5.1 General Water Body Characteristics

Long Island Sound is a large water body, comprising 3419 square kilometers (km^2) (1320 square miles [mi^2]), with 966 km (600 mi) of coastline. The drainage area associated with the water body is approximately 43,564 km^2 (16,820 mi^2). The average depth of the Sound

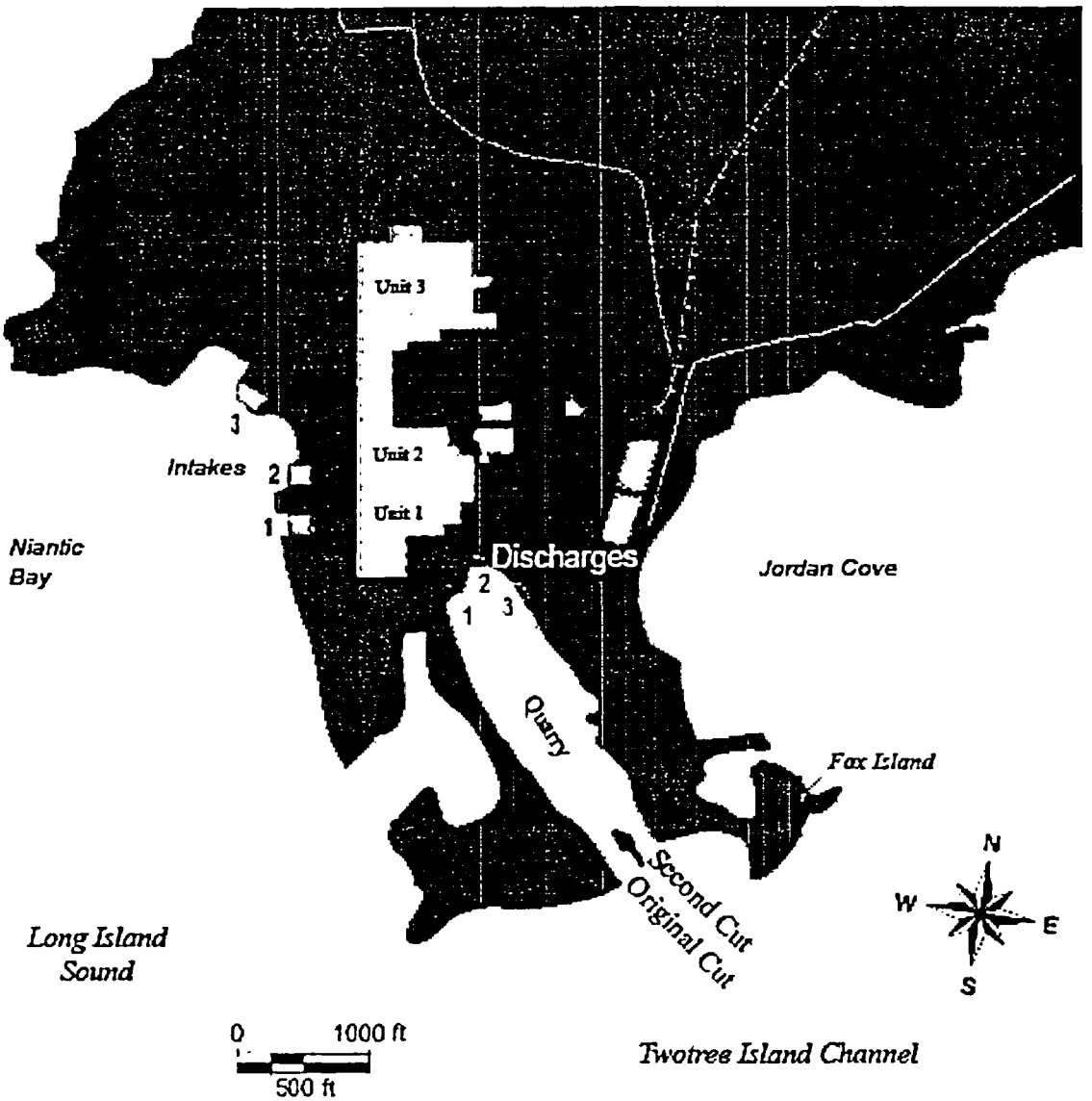

Figure 2-5. Millstone Point, Location of Millstone Cooling Water Intakes and Discharges

is 19 m (63 ft), and the approximate volume is 68 trillion L (18 trillion gal). It is estimated that 20 million people live within 80 km (50 mi) of the Sound (EPA 2004b).

Millstone Point is located on the eastern end of Long Island Sound, near the mouth of the Sound. This area of Long Island Sound has a salinity of approximately 26 to 30 parts per thousand. Salinity is influenced by the presence of three major rivers: the Thames, the

Housatonic, and the Connecticut. The Thames and Connecticut rivers flow into the Sound in the vicinity of the site. Ambient water temperature near Millstone cooling water intakes can range from 1.0 to 22.0 °C (33.8 to 71.6 °F) over the course of a year. Linear regression performed on regional daily and annual seawater temperatures over a 25-year period revealed a significant increase in water temperature of 1.55 °C (2.8 °F) based on daily means and 1.01 °C (1.8 °F) based on annual means (Keser et al. 2003). Millstone Point is situated approximately 5.6 km (3.5 mi) west of the Thames River, in an area that experiences strong tidal currents that influence the nearshore ecosystem, which includes rocky coastlines and boulder and gravel substrate beaches. The ecosystem supports a variety of fish, invertebrates, and marine plant life. The average tidal flow through Twotree Island Channel is approximately 3400 m^3/s (1.2×10^5 ft^3/s) with a maximum flow of about 8500 m^3/s (3.0×10^5 ft^3/s). This translates into current velocities of about 1.8 to 3.3 km/hr (1 to 1.8 knots), with slightly lower velocities near the plant. Weak currents predominate in both the Niantic River and Jordan Cove. Tidal fluctuation in this area is not severe, with mean and maximum ranges of 0.8 and 1.0 m (2.6 and 3.3 ft), respectively (Dominion 2004e).

EPA Region 1 identified Long Island Sound as "an estuary of national significance" and listed six problem areas of concern associated with water quality (EPA 2004c):

(1) Low dissolved oxygen (hypoxia)
(2) Toxic contamination
(3) Pathogen contamination
(4) Floatable debris
(5) Habitat degradation and loss, and living resource health associated with items 1 to 4
(6) Land use and development resulting in habitat loss and degradation of water quality

These environmental issues have resulted in a variety of long-term, integrated studies of Long Island Sound by both State and Federal agencies.

2.2.5.2 Chemical Contaminants Near Millstone

Specific chemical data associated with sediment, water, or biota near the Millstone study area were not available for review, but, in general, surficial sediment associated with the eastern portion of Long Island Sound exhibits lower levels of common contaminants (metals, polyaromatic hydrocarbons, polychlorinated biphenyls, pesticides) than western Long Island Sound. Recent U.S. Geological Survey data (Mecray et al. 2004) suggested that metal concentrations showed regional patterns of high concentrations in the western Sound, with relatively low concentrations associated with the eastern Sound in the vicinity of Millstone. Draft data provided by Battelle (1999) associated with surficial samples from the Thames River indicated that most metals were below NOAA effects-range-median (Long et al. 1998), and

organic constituents were at or near analytical detection limits with the exception of the polyaromatic hydrocarbon, perylene, which was detected at concentrations ranging from approximately 20 to 1200 micrograms per kilogram (μg/kg) (20 to 1200 parts per billion [ppb]) dry weight. It is suspected that the source of this compound is biogenic rather than anthropogenic.

A citizens' group conducted limited chemical and radiological monitoring of bottom sediments in the vicinity of Millstone and reported possible elevated levels of hydrazine and uranium in the bottom sediments of Jordon Cove (CTDEP 2002c). The chemical compound 1,1-dimethylhydrazine (UMDH) was reported as detected in two sediment samples at low levels. It was postulated that the UMDH might be due to hydrazine used at Millstone for corrosion control. CTDEP reviewed available information and concluded that the detections likely were false positives because of questionable quality of the analytical procedures, and it was unlikely that hydrazine could accumulate in bottom sediments because it degrades rapidly into water and nitrogen. In addition, the particular chemical form of hydrazine used at Millstone is different than UMDH. There are also industrial facilities in the area that commonly use hydrazine. CTDEP also concluded that the types and levels of uranium measured in sediments near Millstone reflected naturally occurring background levels (CTDEP 2003c). Neither concern was judged by CTDEP to be sufficiently credible to warrant further investigation.

2.2.5.3 Expected Changes or Modifications to Water Body Over Life of Plant

Dredging near cooling water intakes was required during plant construction in the 1970s and was permitted by the U.S. Army Corps of Engineers (USACE) under permit DACW33-71-C-0024 on February 6, 1970, for Unit 2, and under permit DACW33-75-C-0095 on June 10, 1975, for Unit 3. Dominion also informed USACE and the CTDEP on February 23, 1977, of its intent to maintain the existing 16.8-m (55-ft) wide quarry cut riprap and fish barrier structures associated with Units 1 and 2 and received permission from CTDEP to construct and maintain another 16.8-m (55-ft) wide quarry cut entering Jordan Cove on February 23, 1977, to support Unit 3 operation (Figure 2-3). If further maintenance dredging is required during the life of the plant, it is assumed Dominion would obtain the necessary permits from USACE and CTDEP.

Because the discharge of cooling water and other effluents associated with plant activities is permitted under the NPDES administered by the CTDEP, it is assumed future discharge during the life of the plant would be regulated under this system.

2.2.5.4 Important Fish and Shellfish Communities Near Millstone

A variety of commercially, recreationally, or environmentally important fish and shellfish live or spend a portion of their life cycle in the vicinity of Millstone and also commonly occur in Long

Island Sound. Many of these species live in the waters near Millstone, travel through the area during their seasonal migrations in and out of Long Island Sound, or pass close to the plant as they enter rivers adjacent to Millstone during their spawning seasons. Because of their proximity to Millstone, they may be susceptible to entrainment, impingement, or other lethal or sublethal effects associated with plant operations. To assess relative species abundance near Millstone operations, a variety of collection and enumeration methods have been employed, including subsampling cooling water discharge using plankton nets to determine ichthyoplankton (fish eggs and larvae) abundance, shore zone seines to capture small fish, and bottom trawls to capture larger, demersal fish (Dominion 2004e). In general, assessments of fish and shellfish have included sampling stations in direct proximity to the plant (e.g., within a radius of approximately 3.2 km [2 mi]). Sampling stations included locations near the Unit 2 and 3 cooling water discharge, in the Niantic River and Bay, and in Jordan Cove. Far-field reference sites were not included in the fish and shellfish monitoring programs, nor were sampling grids located at varying distances from the area of interest to identify environmental gradient effects. The exception to this were plume dynamic studies and assessments of intertidal ecosystems.

2.2.5.5 Population Trends Associated with Important Fish and Shellfish Species

The following is a summary of the general population trends associated with the species that are considered important commercially, recreationally, or ecologically.

- **American Lobster**

The American lobster (*Homarus americanus*, family Nephropidae) is common in western and eastern Long Island Sound, with a range extending from Canada to Cape Hatteras. Lobsters represent an important fishery in New England and the northern Atlantic coast of the U.S. Lobsters can live up to 70 years; 6-year old individuals weigh approximately 0.5 kilograms (kg) (1 pound [lb]). Populations of American lobster near Millstone have been estimated from field studies since 1978 based on lobster pot deployments in the vicinity of Millstone. Lobster populations in eastern Long Island Sound have shown significant fluctuations in abundance over the past two decades, and the recent collapse of the fishery in 2000 caused the U.S. Secretary of Commerce to declare a failure of the commercial lobster fishery in Long Island Sound in January 2001 (Dominion 2004e; Sea Grant 2004a). Since that time, the lobster fishery has attracted the attention of both State and Federal agencies, resulting in regional scientific symposia, Sea Grant research initiatives, and increased environmental sampling at both State and local levels (Sea Grant 2004a). At present, it is believed some of the decline observed in the fishery can be attributed to the combined effects of disease and parasitism, but it also appears that the controlling factors might be attributed to physiological and biological

stresses associated with the ecosystem change, including regional water temperature increases and the impacts of persistent environmental contaminants.

Populations associated with Millstone, expressed as the geometric mean catch-per-unit-effort, have been variable over the past two decades, but have not exhibited the significant population crash observed elsewhere in the fishery since 2002.

- **Winter Flounder**

The winter flounder (*Pseudopleuronectes americanus*, family Pleuronectidae) is the most common shoal water flounder occurring in southern New England. Adults are typically 30 to 38 cm (12 to 15 in.) and weigh between 0.5 and 0.9 kg (1 and 2 lbs). It is an important commercial and recreational resource in New England (Bigelow and Schroeder 1953; NOAA 1998). Winter flounder tend to return to their natal estuaries in the late fall and early winter to breed and gradually migrate offshore in the spring and summer months to avoid increasing water temperatures. Individual females can produce up to 2,500,000 eggs, but 500,000 eggs is an approximate average. Commercial harvest is generally accomplished with trawls. Winter flounder populations near Millstone and in Long Island Sound have shown an overall decrease over the past two decades (Figure 2-6).

The abundance of winter flounder peaked in the 1980s as a result of extraordinarily large year-classes produced during abnormally cold winters during the 1970s (Dominion 2004e). Comparison of abundance estimates from the Niantic River near Millstone with regional trends in Long Island Sound suggest similar regional decreases in abundance during concurrent reporting years (Figure 2-6) (Gottschall et al. 2003; NOAA 1998; MacLeod 2003; NOAA 2003b).

With regard to current winter flounder stock abundance, Northeast Fisheries Science Center (2003) stated that the Southern New England/Mid-Atlantic winter flounder stock complex, which includes Niantic River winter flounder, has been overfished and overfishing is continuing to occur. The current assessment provided a much more pessimistic evaluation of stock status than the previous assessment made in 1998. Recruitment to the Southern New England/Mid-Atlantic winter flounder stock has been below average since 1989, and indications are that the 2001 year-class is the smallest in 22 years.

A variety of environmental factors may be responsible for decreasing winter flounder abundances in the Niantic River. These factors include overfishing, entrainment of larvae by Millstone, increasing water temperatures in the region, increased predation, and habitat degradation associated with contaminant or nutrient inputs into the Niantic River estuary. Because winter flounder exhibit high fidelity to their natal stream, localized impacts to this

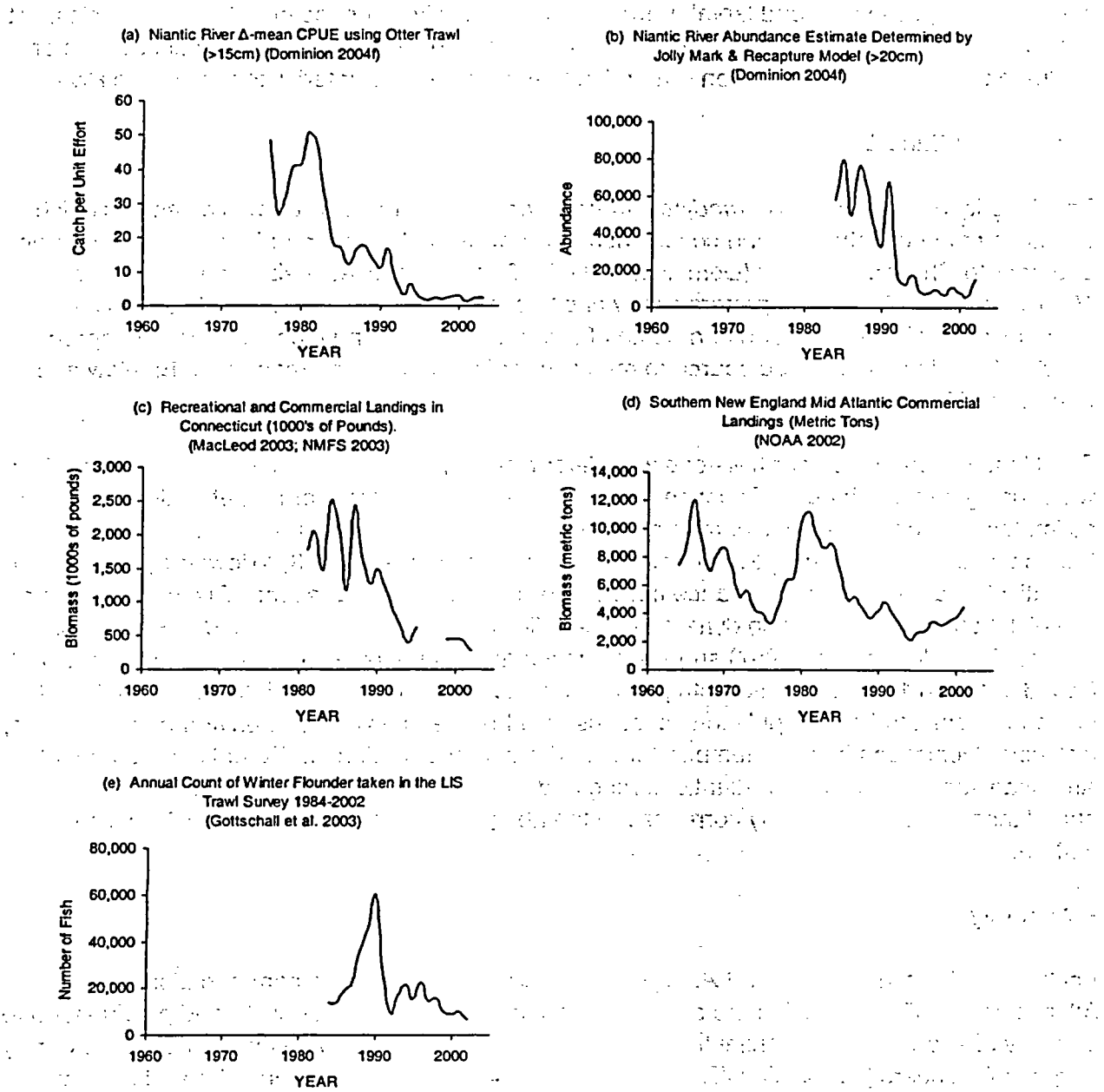

Figure 2-6. Comparison of Winter Flounder Population Trends in the Niantic River and the Region

species during spawning and larval growth can dramatically influence population dynamics. At present, it is not possible to quantify the importance of the various environmental stresses or evaluate their relative influence on winter flounder survival associated with the Niantic River.

- **American Sand Lance**

The American sand lance (*Ammodytes americanus*, family Ammodytidae) is a schooling fish that is common to estuaries and coastal nearshore waters. Its geographic range extends from Labrador to Chesapeake Bay (Dominion 2004e). This fish reaches a size of approximately 10 to 15 cm (4 to 6 in.), and prefers sandy habitats in shallow water and muddy bottoms in deeper water, where it burrows to a depth of several inches. Sand lance generally congregate in schools and provide a food source to many larger fish and marine mammals (Bigelow and Schroeder 1953).

Sand lance abundance near Millstone was determined by trawl, seine, and sampling of cooling water using fine-mesh nets. Because few fish were caught by trawl or net, abundance estimates are based on larval entrainment sampling of Millstone cooling water. The overall trends using this metric suggest a large population abundance in 1978, followed by a decline to a relatively stable but low abundance from approximately 1982 to present. Given the nature of fish distribution and population dynamics, it is difficult to assess regional trends. Population studies (Monteleone et al. 1987) suggest large variations in population densities in Long Island Sound between 1951 and 1983, with peak abundances occurring in the late 1970s as they did in the Millstone studies. Population variations may be due to a variety of environmental factors, including fluctuations in water temperatures and predator abundance. Potential predators of American sand lance include Atlantic herring and Atlantic mackerel. Regional sand lance abundance has been inversely correlated to the abundance of these predators (Dominion 2004e).

- **Anchovy**

Anchovies (*Anchoa mitchelli* and *A. hepsetus*, family Engaulidae) are common along the Atlantic coast. These species are an important component of the food web, and provide food to a variety of sport and commercial fishes (U.S. Fish and Wildlife Service and United States Army Corps of Engineers [FWS/USACE] 1989). The fish are generally silver in color and seldom exceed 8 cm (3 in.) in length. Although anchovies have historically been an important commercial fishery on the west coast, they are not considered an important commercial species in the mid-Atlantic region. They are, however, one of the most important species in the mid-Atlantic region as a primary forage item for many economically important predators and represent an important part of the regional food web (FWS/USACE 1989). Studies conducted by Morgan et al. (1995) suggest that bay anchovy (*A. mitchelli*) demonstrate little genetic

variation and no discernable stock structure, probably due to the enormous population size and movement and mixing of various stocks. Bay anchovy can spawn repeatedly during the summer, and evidence suggests that spawning is correlated with zooplankton abundance (Dominion 2004e).

Anchovy abundance in the vicinity of Millstone was estimated based on larval entrainment associated with plant cooling water (Dominion 2004e). Based on these evaluations, anchovy abundance reached its highest level in 1981, dropped dramatically between 1981 and 1982, and has gradually decreased since that time. Entrainment estimates at Millstone from 2000 to 2002 were the lowest levels recorded since the study was initiated. The data associated with the Dominion studies for this species exhibit a large variation in larval density, with large uncertainty associated with the abundance estimates (Dominion 2004e). Quantitative anchovy biomass data are not available for Long Island Sound or the Mid-Atlantic region, but a dramatic regional decline in the abundance of this species was noted in the Chesapeake Bay by Price (1999). Because actual abundance data associated with this reference are lacking, these data are considered to be a qualitative estimate of the status of the resource. Further evidence of regional anchovy decline is presented in Dominion (2004e) as a personal communication from Tim Lynch. Both qualitative assessments suggest the regional decline observed at Millstone is similar to regional trends.

- **Atlantic Menhaden**

The Atlantic menhaden (*Brevoortia tyrannus*, family Clupeidae) is a common inhabitant of coastal waters extending from Nova Scotia to southeastern Florida (Bigelow and Schroeder 1953). Adults average 30 to 38 cm (12 to 15 in.) in length and generally weigh 0.5 kg (1 lb) or less. Menhaden feed primarily on diatoms and small crustaceans, and they are an important part of the food web in the coastal system, serving as food for larger fishes. Menhaden exhibit a distinct annual cycle of movements that includes a southward movement in the fall and early winter, with overwintering observed in the Carolinas and southward. Spawning takes place at night and can occur during any month of the year. Most spawning takes place in the ocean where larval growth and development occur, but spawning has been reported to occur in Long Island Sound from late spring to early fall. Two distinct spawning periods, including a large event in summer and a smaller event in the fall, have been observed at Millstone (Dominion 2004e). Atlantic menhaden support the largest commercial fishery along the Atlantic coast. The species is primarily used for fish meal, oil, and emulsions (Dominion 2004e). The status of the fishery is considered to be healthy, with commercial harvests over the past seven years for the Atlantic seaboard ranging from approximately 259 $\times 10^3$ to over 300 $\times$ 10^3 metric tons (MT) (286 $\times$ 10^3 to 331 $\times$ 10^3 tons) (Beal et al. 1998).

Atlantic menhaden were collected sporadically by trawl or seine near Millstone over the past 20 years; thus reliable abundance estimates were not possible. Estimations of menhaden abundance based on larval entrainment suggest an overall increase in larvae from approximately 1987 to present, with the highest entrainment abundances recorded in 2002.

- **Silversides**

The silversides (*Menidia menidia* and *M. beryllina*, family Atherinidae) are small schooling fish common to bays, estuaries, and salt marshes of New England. Silversides are omnivorous, feeding primarily on copepods, juvenile mysids, small shrimp, amphipods, and the eggs of other fish. Silversides grow to a length of approximately 13 cm (5 in.). They are used as bait fish and are ecologically important as prey for larger fish, including bluefish (*Pomatomus saltatrix*), mackerel (*Scomber scombrus*), and striped bass (*Morone saxatilis*) (Bigelow and Schroeder 1953). Silversides mature during their first year of life and are believed to live only one or two years. Spawning occurs at water temperatures of 9 to 12 °C (48 to 54 °F) and generally occurs during the day at high tide on a semilunar cycle. Eggs are adhesive, and attach to available vegetation; larvae are planktonic and tend to remain in the spawning area (Dominion 2004e). Silverside abundance near Millstone was assessed by trawl and seine sampling. Abundances varied from year to year in the vicinity of the Millstone site without apparent long-term trend. Gottschall et al. (2003) observed similar fluctuations without trend throughout Long Island Sound.

- **Grubby**

Grubby (*Myoxocephalus aenaeus,* family Cottidae) is a demersal fish common to New England waters from the tide mark to a depth of approximately 30.5 m (100 ft). They are found on a variety of bottom types; they are most abundant among eelgrass. Grubby exhibit a high tolerance to both salinity and temperature changes (Bigelow and Schroeder 1953). Grubby feed primarily on annelid worms, shrimp, small crabs, and mollusks, and are of limited recreational and commercial value. Given the protective spines present on this species, it is unlikely that it represents an important prey item for higher-trophic-level predators. Grubby spawn throughout the winter and produce a demersal, adhesive egg that hatches in approximately 40 to 44 days (Dominion 2004e). Grubby populations at Millstone were assessed using trawls at three locations (Niantic River, Jordan Cove, and cooling water intake). Grubby populations have varied without apparent long-term trend in the vicinity of the Millstone site. Regional abundance data are not available.

- **Cunner**

The cunner (*Tautogolabrus adspersus*, family Labridae) is a coastal fish occurring from Newfoundland to Chesapeake Bay in shallow waters. Cunner are plentiful from just below the tideline downward, and often are associated with eelgrass, rocks, pilings, and mussel beds (Dominion 2004e). Cunner are omnivorous and feed exclusively within eelgrass, rock, piling, and mussel bed habitats. They have been known to feed on amphipods, shrimp, young lobsters and crabs, mollusks, hydroids, and polychaete worms (Bigelow and Schroeder 1953). Cunner tend to stay close to the bottom and are not known to school. Cunner are relatively small fish (15 to 25 cm [6 to 10 in.]) and currently have little recreational or commercial value. There is, however, a developing commercial interest in this species.

Cunner mature at approximately two years of age and spawn from late spring through early summer, and they produce buoyant, transparent eggs (Bigelow and Schroeder 1953). Dominion (2004e) cites evidence suggesting that settlement of metamorphosed larvae is not affected by habitat type or adult density, but that postsettlement survival, recruitment success, and subsequent adult densities were positively correlated with habitat complexity. Regional abundance data suggest that stocks have declined in Long Island Sound (Dominion 2004e). Abundance estimates using trawls have been conducted for 27 years near the Millstone intake and at Jordan Cove. Abundance of cunner eggs and larvae has varied considerably over the past two decades. Egg abundance has generally declined, but larval entrainment appears to vary without trend (Dominion 2004e). Trawl catch-per-unit-effort has fluctuated widely over the past two decades but has shown a general increase over the past three years (Dominion 2004e).

- **Tautog**

The tautog (*Tautoga onitis*, family Labridae) is common in the waters of New England, with a geographic range from New Brunswick to South Carolina. Tautog prefer rocky environments and are known to stay within a few miles of the coastline. Adults can reach a maximum length of about 1 m (3 ft), but are usually less than 0.6 m (2 ft) and weigh less than 4.5 kg (10 lb). When tautog are not feeding, they are known to gather in holes or clefts in rocks where they lie inert, on their sides, until tidal fluctuations initiate feeding behavior (Bigelow and Schroeder 1953). Tautog feed primarily on invertebrates, such as mollusks, mussels, and barnacles. Tautog are long-lived, with reported maximum ages for males and females of 34 and 27 years, respectively (Dominion 2004e). Tautog mature at 2 to 4 years of age, return to nearshore waters in spring prior to spawning, and appear to exhibit some spawning area site fidelity (Dominion 2004e).

Tautog abundance near Millstone was assessed through trawl surveys near the Millstone cooling water intakes in the Niantic River and at Jordan Cove. Abundances at these locations appeared to vary without trend, although increases appeared to be associated with sampling years 1999 to 2002. The recreational harvest for the state of Connecticut has varied considerably over time, with peak harvests of over one million fish occurring in 1987, 1989, and 1992 (Beal et al. 1998).

2.2.5.6 Other Important Aquatic Resources

Other important aquatic resources include eelgrass beds, rocky intertidal habitats, and benthic infaunal assemblages. These communities are an important component of the nearshore ecosystem associated with Millstone, and changes to these communities can directly affect the fish, shellfish, and bird communities they support.

- **Eelgrass**

Eelgrass (*Zostera marina*, family Potamogentomaceae) is one of the dominant seagrasses in coastal regions of the northern hemisphere and is found in eastern Long Island Sound near the Millstone facility. This seagrass is important because of its significant influence on nearshore environment. Eelgrass beds provide habitat and cover for many larval and juvenile forms of fish and invertebrates, support significant primary and secondary production, and serve as a food source for numerous waterfowl and planktonic grazers (Keser et al. 2003). Eelgrass beds in the vicinity of Millstone have been monitored for many years to evaluate population dynamics and to document population changes over time. Sampling locations included areas associated with thermal plume discharge (Jordan Cove, White Point) and reference locations associated with the Niantic River (Dominion 2004e). Studies near Millstone and in Long Island Sound have shown considerable variation in the extent of eelgrass beds at all locations, probably due to multiple environmental factors, including water body temperature fluctuations, eutrophication, sedimentation, turbidity, the presence of nuisance organisms (mussels and green algal blooms), and possible changes associated with nearshore hydrodynamics.

- **Rocky Intertidal Communities**

A rich and varied rocky intertidal habitat exists in the region surrounding Millstone, and includes marine algae, polychaeteous annelids, crustaceans, and molluscs. These organisms are important contributors to the structure and function of the nearshore ecosystem. Environmental studies conducted by Dominion have included sample collection sites at Fox Island, Millstone Point, White Point, and a reference location near Giant's Neck. Monitoring studies have included qualitative assessments of attached flora at each site, abundance estimates of rocky intertidal organisms, and growth and mortality studies on algal species of interest. Cooling

water discharge stations included a location close to the quarry cuts, and one location approximately 200 m (656 ft) southeast of the quarry cut. Millstone monitoring programs have been in effect since 1979 and are intended to provide (1) an environmental baseline of abundance of important species and (2) a means to detect change in community structure and function near the Millstone facility.

Algal studies have been conducted since 1979 and have identified over 140 species that occur or have occurred in the area during the study duration. Dominion scientists have focused on classes of organisms that represent the more common marine flora or fauna, including barnacles; the brown algae *Fucus* spp. and *Ascophyllum nodosum*; the red algae *Chondruscrispus* spp.; and the marine mussel *Mytilus edulis*.

- **Benthic Infauna**

Benthic infaunal communities near Millstone are consistent with soft bottom, nearshore environments associated with New England. These communities typically contain a diverse assemblage of species that collectively contribute to the stability of the nearshore food web. Subtidal communities in the vicinity of Millstone and at a reference site located near Giant's Neck have been sampled and studied since 1980. During the 2003 sampling, marine polychaetes were the most abundant taxa, followed by oligochaetes, arthropods, and molluscs (Dominion 2004e). The following infaunal taxa were selected as representative of sites affected by Millstone: oligochaetes; the polychaetes *Aricidea catherinae*, *Mediomastus ambiseta*, *Tharyx* spp., *Polycirrus eximius*, *Protodorvillea gaspeensis*, and *Parapionosyllis longicirrata;* and the bivalve mollusc *Nucula annulata* (Dominion 2004e). Monitoring studies have been helpful in detecting changes in benthic infauna community structure and in linking the observed changes to both natural and anthropogenic disturbances.

2.2.5.7 Threatened or Endangered Aquatic Species

Aquatic species that are Federally protected under the Endangered Species Act and listed by the FWS and/or NOAA Fisheries (also known as National Marine Fisheries Service [NMFS]) and that have the potential to occur in the vicinity of Millstone or along the transmission ROWs are presented in Table 2-2. Table 2-2 includes aquatic species listed by the state of Connecticut that are not listed Federally.

According to the Dominion Environmental Report (Dominion 2004a), endangered whale species pass south of Long Island during seasonal migrations and are occasionally observed in Long Island Sound. There have been no known observations of these species near the Millstone facility. Likewise, endangered or threatened sea turtle species have been observed in Long Island Sound and in the vicinity of Millstone; however, none have been impinged on the intake

screens and none have been collected during trawl studies. The endangered shortnose sturgeon (*Acipenser brevirostrum*), known from the Connecticut River, could enter Long Island Sound. None has been impinged on the intake screens and none has been collected during trawl studies. Life history information suggests that it is unlikely that shortnose sturgeon would be present in the vicinity of Millstone.

Table 2-2. Aquatic Species Listed as Endangered or Threatened by the State of Connecticut, the FWS, or NOAA Fisheries or that are Known to Occur or Potentially Occur Within Millstone Site or the Associated Transmission Line ROWs

Scientific Name	Common Name	Federal Status[a]	State Status[a,b]
	FISH		
Acipenser brevirostrum	shortnose sturgeon	Endangered	Endangered
Acipenser oxyrhinchus	Atlantic sturgeon		Threatened
	REPTILES		
Caretta caretta	loggerhead turtle	Endangered	Threatened
Chelonia mydas	green turtle	Threatened	Threatened
Dermochelys coriacea	leatherback turtle	Endangered	Endangered
Lepidochelys kempii	Kemp's ridley turtle	Endangered	Endangered
	MAMMALS		
Balaena glacialis	North Atlantic right whale	Endangered	Not listed
Balaenoptera physalus	finback whale	Endangered	Not listed
Megaptera novaengliae	humpback whale	Endangered	Not listed

(a) FWS 1999. Title 50, Wildlife and Fisheries, Part 17, Endangered and Threatened Wildlife and Plants, Subpart B Lists. U.S. Fish and Wildlife Service, December 21, 1999.
(b) CTDEP 2004 http://dep.state.ct.us/burnatr/wildlife/learn/esfact.htm (accessed April 27, 2004).

Shortnose Sturgeon (*Acipenser brevirostrum*)

The shortnose sturgeon is Federally listed as endangered throughout its range (FWS 2004). Two populations of shortnose sturgeon are present in the Connecticut River. One is landlocked in the upper part of the river between the Holyoke and Turners Dams in Massachusetts, and the other population is located in the lower Connecticut River between the Holyoke Dam and Long Island Sound. An estimated 1200 to 1500 shortnose sturgeon are found in freshwater and estuarine portions of the Connecticut River and are presumed to occasionally occur in adjacent areas of Long Island Sound (FWS 2001). No shortnose sturgeon have been impinged or captured in more than 30 years of sampling at Millstone (Dominion 2004a). The primary threats to this species are dam building, water pollution, and dredging (NatureServe 2004).

Atlantic Sturgeon (*Acipenser oxyrinchus*)

The Atlantic sturgeon is State-listed as threatened. Atlantic sturgeon are present in Long Island Sound, which may be an important feeding or resting area in transit to and from spawning areas (CTDEP 2004). Adult-sized sturgeon, up to 3.7 m [12 ft], are occasionally seen in the rivers of Connecticut. Declines in Atlantic sturgeon populations are the result of overfishing, loss of habitat, limited access to spawning areas, and water pollution (CTDEP 2004). The applicant reported that one Atlantic sturgeon specimen was captured and released alive during a trawl survey in 1980.

Loggerhead Turtle (*Caretta caretta)*

The loggerhead turtle is Federally listed as threatened throughout its range (FWS 2004). There are currently no critical habitats designated for this species, although NOAA Fisheries is currently working on a status review based on a 2002 petition to reclassify the Northern and Florida Panhandle subpopulations with endangered status and to designate critical habitat for both subpopulations (NOAA 2004a). The range for the Atlantic population of loggerheads extends from Newfoundland to Argentina, with primary nesting areas located in Florida, Georgia, and the Carolinas.

Green Turtle (*Chelonia mydas*)

The green turtle is Federally listed as endangered in the breeding colony populations in Florida and on the Pacific coast of Mexico and threatened for all other populations (FWS 2004). The western Atlantic population of green turtles ranges from Massachusetts south to the U.S. Virgin Islands and Puerto Rico, with important feeding grounds in Florida and primary nesting sites on the east coast of Florida, the U.S. Virgin Islands, and Puerto Rico (NOAA 2004b). There is critical habitat designated in Puerto Rico.

Leatherback Turtle (*Dermochelys coriacea*)

The leatherback turtle is Federally listed as endangered throughout its range (FWS 2004). The western Atlantic population of leatherback turtles ranges from Nova Scotia to Puerto Rico and the U.S. Virgin Islands. During the summer, leatherback turtles are typically found along the east coast of the U.S. from the Gulf of Maine to central Florida. Critical habitat designated in the area around the U.S. Virgin Islands, with nesting sites located from Georgia to the U.S. Virgin Islands (NOAA 2004c). The primary threats to the survival of leatherback turtles include habitat destruction, incidental catch in commercial fisheries, and harvest of eggs and mea (NOAA 2004c).

Kemp's Ridley Turtle (*Lepidochelys kempii*)

The Kemp's ridley turtle is Federally listed as endangered throughout its range (FWS 2004). This species is found primarily in coastal areas of the Gulf of Mexico and the northwestern Atlantic, with a major nesting beach on the northeastern coast of Mexico (NOAA 2004d). Habitat degradation, pollution, and ingestion of floating debris are among the most significant threats to Kemp's ridley (NOAA 2004d). No critical habitat has been designated for this species.

North Atlantic Right Whale (*Eubalaena glacialis*)

The North Atlantic right whale is Federally listed as endangered throughout its range (FWS 2004). With a population estimated at 291 individuals in 1998, the North Atlantic right whale is considered to be one of the most critically endangered populations of large whales in the world (NOAA 2002). According to NOAA Fisheries (2002), this population ranges from wintering and calving grounds in the coastal waters of the southeastern United States to summer feeding and breeding grounds in New England waters and northward. In 1994, NOAA Fisheries designated three critical habitats for the North Atlantic right whale: Cape Cod Bay/Massachusetts Bay, Great South Channel, and the Southeastern USA. At the present time, injuries and mortality caused by ship strikes are the primary source of human impacts to North Atlantic right whales, with some additional impacts from fishery entanglements. North Atlantic right whales have been sighted near Long Island Sound (NOAA 2002), but are not known to move into the shallow waters immediately offshore of the Millstone site (Dominion 2004e).

Finback Whale (*Balaenoptera physalus*)

The finback (fin) whale is Federally listed as endangered throughout its range (FWS 2004). According to NOAA Fisheries (2002), the current minimum population estimate from a 1999 survey for the western North Atlantic fin whale was 2362. Fin whales are found principally in waters from North Carolina north to Nova Scotia. New England waters provide an important feeding ground for this species. There are no critical habitats designated for the fin whale, although a recovery plan has been drafted. At the present time, injuries and mortality caused by ship strikes are the primary source of human impacts to fin whales. It is possible that fin whales could enter Long Island Sound, but they are not known to move into the shallow waters immediately offshore of the Millstone site (Dominion 2004e).

Humpback Whale (*Megaptera novaengliae*)

The humpback whale is Federally listed as endangered throughout its range (FWS 2004). According to NOAA Fisheries (2002), the overall abundance for the Gulf of Maine humpback whale stock was estimated in 1992/1993 at 11,570 individuals. Gulf of Maine humpback whales are found during the spring, summer, and fall over a range covering the eastern coast of the United States. New England waters are an important feeding ground for this species. A recovery plan for humpback whales is in effect. Injuries and mortality from fishery entanglements and ship strikes are the primary human impacts on humpback whales. Disturbance from whale watching traffic is also of concern, particularly in coastal New England waters. It is possible that humpback whales could enter Long Island Sound, but they are not known to move into the shallow waters immediately offshore of the Millstone site (Dominion 2004e). No critical habitat has been designated for this species.

2.2.6 Terrestrial Resources

The Millstone site supports flora and fauna common to the region. The Millstone site is located in the southern New England Coastal Plains and Hills of the Northeastern Coastal Zone ecoregion (EPA 2004). Presettlement vegetation would have consisted primarily of winter deciduous hardwood forests with some salt marsh and beach habitat types. Out of the approximately 212 ha (525 ac) that comprise the Millstone site, current land use includes approximately 89 ha (220 ac) of developed land, a 20-ha (50-ac) natural area, and a 12-ha (30-ac) ballpark licensed to the town of Waterford. Until 1960, the site was used as a granite quarry, in operation for some 200 years (Dominion 2004a).

2.2.6.1 Site Terrestrial Resources

The current terrestrial environment includes old field habitats dominated by eastern red cedar (*Juniperus virginiana*), scarlet oak (*Quercus coccinea*), black cherry (*Prunus serotina*), and blackberry (*Rubus* spp.) (Dominion 2004a). Common invasive exotics in this habitat include multiflora rose (*Rosa multiflora*) and Japanese honeysuckle (*Lonicera japonica*). Winter deciduous hardwood forest is the most common undisturbed habitat type and is dominated by various species of oak (*Quercus* spp.), pignut hickory (*Carya glabra*), black birch (*Betula lenta*), red maple (*Acer rubrum*), and American beech (*Fagus grandifolia*). Along the coast, beach and coastal marsh habitats are dominated by beach grass (*Ammopila breviligulata*), toadflax (*Linaria vulgaris*), evening primrose (*Oenothera biennis*), seaside goldenrod (*Solidago sempervirens*), salt meadow grass (*Spartina patens*), salt grass (*Distichlis spicata*), Bigelow's glasswort (*Salicornia bigelovii*), and smooth cordgrass (*Spartina alterniflora*). Ponds and wetlands in the eastern portion of the site are managed as a wildlife refuge.

Terrestrial habitats on the Millstone site support common wildlife species such as white-tailed deer (*Odocoileus virginianus*), gray squirrel (*Sciurus carolinensis*), cottontail rabbit (*Sylvilagus floridanus*), red fox (*Vulpes vulpes*), woodchuck (*Marmota monax*), and wild turkey (*Meleagris gallopavo*). Coastal marshes and the wildlife refuge on the site contain habitat that supports waterfowl such as mallard ducks (*Anas platyrhynchos*), wood ducks (*Aix sponsa*), Canada geese (*Branta canadensis*), common mergansers (*Mergus merganser*), black ducks (*Anas rubripes*), and multiple species of herons and egrets. Osprey (*Pandion haliaetus*) nest platforms have been maintained at Millstone for over 35 years, and 186 fledglings have been produced over this period (Dominion 2004a).

2.2.6.2 Threatened and Endangered Terrestrial Species

There are 16 species listed by FWS or the state of Connecticut that have either been observed on the site or have the potential to occur in the area or along transmission lines. An additional 342 State-listed species are reported to occur in counties traversed by transmission line ROWs. Table 2-3 shows terrestrial species that are listed by the FWS or the state of Connecticut and are known to have the potential to occur in the vicinity of the Millstone site or along the transmission ROWs. Additional State-listed species that have the potential to occur in Hartford, Middlesex, New London, or Tolland counties are listed in Appendix G.

Puritan Tiger Beetle (*Cicindela puritana*)

The Puritan tiger beetle (*Cicindela puritana*) is known from two disjunct populations, one along Chesapeake Bay in Maryland and one along the Connecticut River in northern Connecticut (CTDEP 2004c). Although this species is reported to occur in Middlesex County (FWS 2004), CTDEP maps clearly show the Connecticut population to be primarily along the Connecticut River in Hartford County (CTDEP 2004c). The Millstone ROW for the Manchester transmission line does not cross the Connecticut River in Hartford County. The Puritan tiger beetle is restricted to sandy habitats typically found along river banks. Habitat has been depleted through riverbank stabilization and flood control practices. There is no known habitat for this species near the Millstone site or associated transmission line ROWs. The Puritan tiger beetle is listed as threatened by the FWS and endangered by the state of Connecticut.

Sharp-shinned Hawk (*Accipiter striatus*)

The sharp-shinned hawk is a small accipiter found primarily in forested habitats. The sharp-shinned hawk is a relatively common fall migrant but has been listed as endangered because there is only a small breeding population in northern Connecticut (CTDEP 2004c). Population reduction is primarily a result of habitat degradation and past pesticide use. The sharp-shinned hawk is listed as endangered by the state of Connecticut.

Table 2-3. Terrestrial Species Listed as Endangered or Threatened by the State of Connecticut or the FWS and Proposed for Candidacy or that are Known to Occur or Potentially Occur Within Millstone Site or the Associated Transmission Line ROWs

Scientific Name	Common Name	Federal Status[a]	State Status[a,b]
	INSECTS		
Cicindela puritana	Puritan tiger beetle	Threatened	Endangered
	BIRDS		
Accipiter striatus	sharp-shinned hawk		Endangered
Ardea alba	great egret		Threatened
Charadrius melodus	piping plover	Threatened	Threatened
Circus cyaneus	northern harrier		Endangered
Egretta thula	snowy egret		Threatened
Falco peregrinus	peregrine falcon		Endangered
Haliaeetus leucocephalus	bald eagle	Threatened	Endangered
Icteria virens	yellow-breasted chat		Endangered
Pooecetes gramineus	vesper sparrow		Endangered
Podilymbus podiceps	pied-billed grebe		Endangered
Sterna antillarum	least tern		Threatened
Sterna dougallii	roseate tern	Endangered	Endangered
	MAMMALS		
Sylvilagus transitionalis	New England cottontail rabbit	Candidate	
	PLANTS		
Isotria medeoloides	small whorled pogonia	Threatened	Endangered
Scleria triglomerata	tall nut sedge		Endangered

(a) FWS 1999. Title 50, Wildlife and Fisheries, Part 17, Endangered and Threatened Wildlife and Plants, Subpart B Lists. U.S. Fish and Wildlife Service, December 21, 1999.
(b) CTDEP 2004c http://dep.state.ct.us/burnatr/wildlife/learn/esfact.htm (accessed April 27, 2004).

Great Egret (*Ardea albus*)

The great egret is a large white heron that can be found in a variety of fresh and saltwater habitats. Great egrets were very rare in Connecticut by the mid 1800s, primarily due to market hunting for their aigrettes (plumes), used in women's apparel (CTDEP 2004c). Coastal

development and disturbance of nesting colonies have hampered their recovery. The great egret is listed as threatened by the state of Connecticut.

Piping Plover (*Charadrius melodus*)

The piping plover is a shorebird that is found nesting in sandy beach habitats along seacoasts (CTDEP 2004c). Piping plovers nest from North Carolina north to Nova Scotia. Nesting generally occurs from March through July. Historically, these birds were killed for consumption, and the feathers used for adornment. Current threats include beach stabilization and development. The piping plover is listed as threatened by the FWS and the state of Connecticut. There have been no reported sightings of piping plover at the Millstone site. It is not likely that the necessary beach habitat for nesting is present in the vicinity of the site.

Northern Harrier (*Circus cyaneus*)

The northern harrier, or marsh hawk, is a relatively large bird of prey that prefers open marshland and meadows. Once recorded as common in Connecticut, it is now listed as endangered by the state of Connecticut. The population has been reduced by habitat degradation and past use of DDT (CTDEP 2004c). Northern harriers have been recorded at the Millstone site as an occasional migrant (Dominion 2004a).

Snowy Egret (*Egretta thula*)

The snowy egret is a medium-sized white heron that is found in habitats similar to the habitats where the larger great egret is found. Because of their showy plumes, snowy egrets were hunted even more extensively than the great egret, and the species was virtually extirpated from Connecticut by the late 1800s (CTDEP 2004c). Snowy egrets have been nesting in the State since 1961, but breeding populations remain low. The snowy egret is listed as threatened by the state of Connecticut.

Peregrine Falcon (*Falco peregrinus*)

The peregrine falcon has widespread distribution in open country from coastal areas to the mountains. Nesting peregrine falcons were relatively common in Connecticut though the early 1900s before egg collecting and later pesticide contamination nearly extirpated the species (CTDEP 2004c). The peregrine falcon is listed as endangered by the state of Connecticut.

Bald Eagle (*Haliaeetus leucocephalus*)

The bald eagle is a large raptor that is found along the coastline and around lakes and rivers. There are reported to be up to 100 bald eagles wintering along major rivers and reservoirs in Connecticut (CTDEP 2004c). There are no known nesting pairs of bald eagles near the Millstone site or along the transmission line ROWs. Individual bald eagles have been seen foraging in the area. Bald eagle populations have declined in the State due to loss of habitat, human disturbance, and pesticide contamination. The bald eagle is listed as threatened by the FWS and as endangered by the state of Connecticut.

Yellow-breasted Chat (*Icteria virens*)

The yellow-breasted chat is a songbird found in mid-successional shrubby habitats such as woodland edges, briar thickets, and old fields. Although once considered common in Connecticut, populations have declined due to the loss of farmlands and pastures (CTDEP 2004c). A few individuals were sighted in the Waterford area from 1986 to 1988 (CTDEP 2002b). The yellow-breasted chat is listed as endangered by the state of Connecticut.

Pied-billed Grebe (*Podilymbus podiceps*)

The pied-billed grebe is a small diving bird that is found in fresh and saltwater habitats. The species is declining throughout New England because of historically low numbers and wetland habitat loss. It has apparently never been common in Connecticut and has been recorded breeding in only two isolated locations in the State (CTDEP 2004c). It has been recorded at the Millstone site as an occasional migrant (Dominion 2004a). The pied-billed grebe is listed as endangered by the state of Connecticut.

Vesper Sparrow (*Pooecetes gramineus*)

The vesper sparrow is a songbird found in open areas such as old fields, meadows, agricultural areas, and, occasionally, beach habitats. Apparently common in the mid 1800s, numbers have dropped in the past century with the decline in agriculture and increase in residential and commercial development (CTDEP 2004c). The vesper sparrow has not been confirmed nesting in the state of Connecticut since 1984 and is listed as endangered by the state of Connecticut.

Least Tern (*Sterna antillarum*)

The least tern is a seabird that nests on beaches along coastlines, offshore islands, and large rivers. Similar to the roseate tern, least tern populations in Connecticut were decimated by market hunting by the early 1900s and continue to be impacted by shoreline development and

predators that are often associated with human development (CTDEP 2004c). The least tern is listed as threatened by the state of Connecticut.

Roseate Tern (*Sterna dougallii*)

The roseate tern is a seabird that is found almost exclusively on saltwater coastlines. Roseate terns nest in colonies on coastal beaches and offshore islands. Historically, tern populations in Connecticut have been impacted by unrestricted market hunting and more recently by the expansion of predatory great black-backed and herring gull populations throughout their range in the State (CTDEP 2004c). Roseate terns are listed as endangered by both the FWS and the state of Connecticut. Fox Island, a small promontory extending off Millstone Point into Long Island Sound, is known to be used by roseate terns during the fall migration period. Roseate terns are not known to nest in the vicinity of the Millstone site (Dominion 2004a).

New England Cottontail Rabbit (*Sylvilagus transitionalis*)

The New England cottontail rabbit is found in brushy habitats associated with edges of fields and forests, fence lines, and, probably, transmission line ROWs. Populations in Connecticut were considered abundant through the mid 1930s, but competition from introduced Eastern cottontail rabbits (*Sylvilagus floridanus*) and loss of agriculture-related habitat has led to the New England cottontail rabbit's status as a proposed candidate for Federal listing. Vegetation management techniques used on the Millstone site and associated transmission line ROWs maintain early successional habitat types the New England cottontail requires.

Small Whorled Pogonia (*Isotria medeoloides*)

The small whorled pogonia occurs in isolated populations throughout the eastern United States. In Connecticut, it is reported to occur in New London, Middlesex, Tolland, Hartford, and New Haven counties. New England populations of this orchid are found almost exclusively on acidic, well-drained fragipan (a subsurface impermiable layer) soils (NatureServe 2004). Common plant associates include red maple, eastern hemlock (*Tsuga canadensis*), paper birch (*Betula papyrifera*), northern red oak (*Quercus rubra*), eastern white pine (*Pinus strobus*), and American beech. Small whorled pogonia populations are found in second growth and mature forests. The major threats to this species are habitat destruction through development and logging. The small whorled pogonia is listed as threatened by the FWS and endangered by the state of Connecticut. Habitat for the small whorled pogonia may exist at the Millstone site or along associated transmission line ROWs.

Tall Nut Sedge (*Scleria triglomerata)*

The tall nut sedge or nut rush is a grass-like plant that favors wet habitats. A population of tall nut sedge has been found on the shared Card Street/Manchester transmission line ROW approximately 3.2 km (2 miles) north of the Hunts Brook Junction (Dominion 2004a; CTDEP 2002b). This species is listed as endangered by the state of Connecticut.

2.2.7 Radiological Impacts

Millstone conducts an annual Radiological Environmental Monitoring Program (REMP) in and around the Millstone site and publishes an *Annual Radiological Environmental Operating Report* (Dominion 2002a; Dominion 2003a; Dominion 2004b). Through this program, radiological impacts to employees, the public, and the environment are monitored, documented, and compared to the appropriate standards. The objectives of the REMP are the following:

- provide representative measurements of radiation levels and radioactive materials in the exposure pathways and of the radionuclides that have the highest potential for radiation exposures to members of the public; and
- supplement the radiological effluent monitoring program by verifying that the measurable concentrations of radioactive materials and levels of radiation are not higher than expected on the basis of effluent measurements and the modeling of the environmental exposure pathways.

Radiological releases are summarized in two Millstone reports: *Annual Radiological Environmental Operating Report* (Dominion 2003a) and *Radioactive Effluent Release Report* (Dominion 2003b). The limits for all radiological releases are specified in the Millstone REMODCM (Dominion 2005), and these limits are used to meet Federal standards and requirements. The REMP includes monitoring of the aquatic environment (fish, invertebrates, and shoreline sediment); atmospheric environment (airborne radioiodine, gross beta, and gamma); terrestrial environment (vegetation); and direct radiation. The *Annual Radiological Environmental Operating Report* found that:

No station effects were detected in terrestrial media. The predominant radioactivity, except for a few aquatic sample results, was that from outside sources, such as fallout from nuclear weapons tests and naturally occurring radionuclides. Monitoring of the aquatic environment in the area of the discharges indicated that presence of the following station related radionuclides: cobalt-60, cesium-137, silver-110m and tritium. Due to the decreasing trend in liquid effluent releases, a corresponding decrease is

observed in measured levels of radionuclides in the environment. Doses from the 2003 measured levels are well below those required by each unit's safety technical specifications. (Dominion 2004b).

Comparisons of zinc-65 and silver-110m discharges to uptakes in oysters in the quarry (on Dominion property) show a dependency between activity discharged and bioaccumulation in the oysters, as follows:

> The decreasing trend in effluent radioactive releases is apparent in both the curies released and the measured concentrations in oysters. (Dominion 2004b).

No measured radionuclides were observed in oysters beyond the station discharge area (outside the quarry).

Millstone's review of historical data on releases and the resultant dose calculations revealed that the calculated doses to maximally exposed individuals in the vicinity of Millstone were a small fraction of the limits specified in the Millstone REMODCM (Dominion 2005) to meet 10 CFR Part 50, Appendix I and EPA radiation standards in 40 CFR Part 190. For 2002, dose estimates were calculated based on actual liquid and gaseous effluent release data and conservative models to simulate the transport mechanisms. The results are described in the *Radioactive Effluent Release Reports* (Dominion 2003b). A second dose assessment method uses the actual measurements of the concentrations in various environmental media and dose consequences from the consumption of these foods (e.g., fish, shellfish), which are reported annually (Dominion 2003a). Dose estimates were performed by Millstone using the plant effluent release data, onsite meteorological data, and appropriate pathways identified in the REMODCM. An assessment of doses to the maximally exposed individual from gaseous and liquid effluents was performed by Millstone for locations representing the maximum dose. In all cases, doses were well below the limits as defined in the REMODCM (Dominion 2005). A breakdown of the calculated maximum dose to an individual located at the Millstone boundary from liquid and gaseous effluents released during 2002 is summarized as follows (Dominion 2003b):

- The critical organ dose due to the liquid effluents at the site discharge was 1.48×10^{-4} millisievert (mSv) (1.48×10^{-2} millirem [mrem]). This dose was about 0.15 percent of the 0.10 mSv (10 mrem) dose limit.

- The air dose due to noble gases in gaseous effluents was 1.89×10^{-4} milligray (mGy) (1.89×10^{-2} millirad [mrad]) or 0.189 percent of the 0.10 mGy (10 mrad) gamma dose limit and 6.91×10^{-4} mGy (6.91×10^{-2} mrad) beta or 0.346 percent of the 0.20 mGy (20 mrad) beta dose limit.

- The critical organ dose from gaseous effluents due to iodine-131, iodine-133, tritium, and particulates with half-lives greater than eight days was 2.99×10^{-4} mSv (2.99×10^{-2} mrem), which is 0.20 percent of the 0.15 mSv (15 mrem) dose limit.

The applicant does not anticipate any significant changes to the radioactive effluent releases or exposures from Millstone operations during the renewal period and, therefore, the impacts to the environment are not expected to change.

2.2.8 Socioeconomic Factors

The staff reviewed the Environmental Report (Dominion 2004a) and information obtained from meetings with local and regional agencies during a site visit to Waterford and the surrounding area from May 17 to 20, 2004. The following information describes the housing, public services, land use, demographics, and economy of the communities near Millstone.

2.2.8.1 Housing

Dominion employs a total nuclear-related permanent workforce of approximately 1550 to 1650 at Millstone. Of these, 1300 are Dominion employees and another 250 to 350 are long-term contractors. Approximately 73 percent of Millstone's employees live in New London County with about 140 employees living in Waterford, while another 200 live in Niantic and East Lyme. Another 12 percent reside in Middlesex County, and about 14 percent are distributed across 14 other counties in Connecticut, Massachusetts, and Rhode Island with numbers ranging from 1 to 60 employees per county. Less than 1 percent of the workforce resides outside of these three states. Table 2-4 summarizes the information for the permanent workforce. Given the predominance of regular employees living in New London and Middlesex counties, and the absence of the likelihood of significant socioeconomic impacts in other counties, the focus of this analysis is the town of Waterford and 20 other municipalities in New London County that form an area that is generally referred to as the Southeastern Connecticut Planning Region.

The Millstone reactors are on an 18-month refueling cycle. During refueling outages, site employment increases substantially above the 1550 to 1650 Dominion workforce by as many as 700 to 800 workers for a period of 28 to 30 days. Most of these temporary workers are assumed to live in the same geographic areas as the permanent Millstone staff. These numbers are within the GEIS range of 200 to 900 additional contractor workers per reactor outage.

Table 2-5 provides the number of housing units and housing unit vacancies for New London and Middlesex counties for 1990 and 2000, derived from U.S. Census Bureau information.

Table 2-4. Millstone Employee Residence Information by County

County	Number of Personnel	Percent of Total
New London	1205	73
Middlesex	198	12
Other Counties	231	14
Outside of CT, RI, and MA	16	1
TOTAL	**1650**	**100**

Source: Dominion 2004a

Table 2-5. Housing Units and Housing Units Vacant (Available) by County During 1990 and 2000

	1990	2000	Approximate Percentage Change
		NEW LONDON COUNTY	
Housing Units	104,461	110,674	5.9
Occupied Units	93,245	99,835	7.1
Vacant Units	11,216	10,839	(3.4)
		MIDDLESEX COUNTY	
Housing Units	61,593	67,285	9.2
Occupied Units	54,651	61,341	12.2
Vacant Units	6942	5944	(14.4)

Source: USCB 1990, 2000

New London County housing units numbered 110,674 and Middlesex County housing units numbered 67,285 in 2000. There were 10,839 vacant housing units in New London County and 5944 units in Middlesex County in 2000, corresponding to a rate of 9.8 percent and 8.8 percent, respectively. There were a total of 444 vacant housing units in Waterford in 2000, which equates to a vacancy rate of 5.6 percent. Approximately half of these vacancies are seasonal homes. The vacancy rate in Connecticut in 2000 was 6.1 percent. Two-thirds of the housing units in New London and Middlesex counties are owner occupied compared to nearly 95 percent of the housing units in Waterford (USCB 2000).

Housing has become more of a regional concern in southeastern Connecticut since 2000. Several interacting factors impact housing demand, supply, and affordability. There have been

fundamental shifts from a defense dependent economy to one dominated by gaming and tourism. There has been a reduction in the collective earning power of the employed labor force with the shift from manufacturing to service jobs and, consequently, there has been an increasing demand for affordable housing. The average median sales price for single-family homes within southeastern Connecticut increased by more than 50 percent between 2000 and 2003, and by 40 percent for condominiums. While the net increase in southeastern Connecticut population between 1990 and 2000 was just 1 percent, the population also grew older, households became smaller, single-family homes dominated housing starts, and vacancy rates declined. These housing issues are being addressed through cooperative efforts of the municipalities, tribal nations, the state of Connecticut, private nonprofits, major employers, and the housing industry (Southeastern Connecticut Council of Governments. [SCCOG] 2002).

According to Waterford's 1998 *Plan of Preservation, Conservation, and Development*, there is the theoretical potential for about 4000 additional housing units. The town had 7986 housing units in 2000 (USCB 2000) and could have 12,000 housing units when fully developed under existing zoning (Waterford 1998). The plan notes that Waterford is a suburban community consisting primarily of owner-occupied single-family dwellings on lots that range from 7500 ft^2 to 200,000 ft^2. Multiple-family dwellings are permitted with densities up to nine units per acre. The plan recommends that Waterford continue to provide for a diversity of housing types and encourage the availability of housing for a variety of age and income groups. The plan promotes modifying some residential zoning designations and regulations to accomplish these goals, while protecting natural resources and retaining the rural character cherished by residents. The pattern and pace of growth in Waterford is determined by the availability and location of suitable urban infrastructure. There are no current proposals to institute a moratorium on development in Waterford.

2.2.8.2 Public Services

Public services include water supply, education, and transportation.

- **Water Supply**

Table 2-6 displays public water supply information for the entire county of New London. Most of the Millstone employees reside in New London County, and this discussion of public water supply systems will focus on the three municipalities in New London County where the greatest number of employees live—Waterford, East Lyme / Niantic, and Colchester—and the city of New London, which supplies water to Waterford and provides potable water to Millstone. The city of New London obtains water from the Lake Konomoc reservoir located in Waterford and Montville. Millstone's 2000 to 2001 potable water usage averaged 125.7×10^4 L per day

(332.0 x 10^3 gpd). This usage represents approximately 5.2 percent of the city of New London's daily capacity and 6 percent of the city's average daily use.

State standards conclude that an adequate margin of safety exists when the safe yield is more than 125 percent of the average consumption, or average consumption is less than 80 percent of the safe yield. The Waterford water supply system may need to be expanded in the future because State standards indicate that there may not be an adequate margin of safety between average water consumption and the safe yield of the system. As a result, the city of New London is currently searching for additional supply sources for future consumption. An intermunicipal agreement with the city of New London provides that new Waterford customers may be denied service in times of water shortage (Waterford 1998).

Table 2-6. Major New London County Public Water Supplies and Capacities

Water Supplier	Water Source	Average Daily Use (MGD)[a]	Maximum Capacity (MGD)
Groton Water Department	surface water	9.31	12.6
Norwich Water Department	surface water	5.2	7.16
New London Water Division	surface water	5.5	6.4
East Lyme Water and Sewer Commission	groundwater	1.46	1.66
Waterford Water Pollution Control Authority	purchases water from New London Water Division	N/A	N/A
CT - American Water Co.—Mystic Valley Division	surface water and groundwater	1.56	1.5
Colchester Sewer and Water Commission	groundwater	0.48	0.74

Source: Dominion 2004a
(a) MGD—million gallons per day

A new water supply line was constructed in 2000 to supply a concession stand at the ball fields licensed by Millstone to Waterford. The stand had been supplied by a shallow low-yield well, which continues to be used to irrigate the ball fields on a seasonal basis.

Water availability may also be a more limiting factor for future growth in other New London County communities such as East Lyme and Colchester where Millstone workers prefer to reside. Aquifers provide the total current drinking water supply for East Lyme and will continue to do so for the foreseeable future. Although the town has the potential for developing new wells, the water supply is limited. Approximately 60 percent of the town is served by public water through the operation of seven wells located in four stratified drift aquifers. The

remaining 40 percent is served by private wells in bedrock aquifers. In 1998, the town implemented a moratorium on new water connections for subdivisions and commercial establishments. Peak daily demands are currently being met. However, estimated future demand may compel the town to seek other sources of water, and water conservation is strongly encouraged (Dominion 2004a).

The recently approved Thames Basin Regional Water Interconnection Project will provide alternative water supply sources for Waterford by interconnecting the Norwich, Groton, and the New London/Waterford systems. This project provides a degree of redundancy to the Waterford water system while mitigating pressure deficiencies that have been a concern for fire fighting in the Quaker Hill neighborhood. Piping water from Groton will provide a less costly solution than developing new sources while increasing the safe yield available for present and future demands (Waterford 2002).

The Colchester Sewer and Water Commission and the Public Works Department manage the public water system in Colchester. Public water is derived exclusively from public wells and service is essentially limited to the center of Colchester where the majority of the commercial and community facilities in town are located. The commission serves a population of approximately 4500. Colchester has adequate water supply sources to meet current demand. However, future water consumption is expected to increase and an eventual need for additional water supplies is projected. Several alternatives including additional ground-water options and/or an interconnection with the Norwich Water Department (which accesses the Deep River Reservoir in Colchester) are being explored. Presently, water conservation is encouraged (Dominion 2004a).

- **Education**

In 2000, 85.7 percent of the population of the southeastern Connecticut region who were 25 years or older had completed high school, while 25.3 percent were college graduates as compared to 31.4 percent for the State as a whole. In Waterford, in 2000, 86.8 percent of the population over 18 had completed high school, and 28.1 percent had finished college. All municipalities in the region recorded improvements in educational levels compared to previous years. Elementary and high school enrollments have experienced an increase since 1990, while preschool and college enrollments have decreased uniformly throughout the region. One plausible explanation for this situation is a pattern of in-migration by families with children in this age bracket (SCCOG 2003b).

The Waterford Public Schools project a budget of $34,398,900 for the 2004 / 2005 school year to operate five elementary, one middle, and one high school. Previous approved budgets for the town of Waterford show that funding for the Waterford Public Schools increased from $27,866,712 for 1997 to 1998 to $31,172,355 for 2001 to 2002. This increase reflects a

change from 48.9 percent of the total general fund to 52.2 percent following deregulation of Millstone. The Board of Education budget is projected to increase to $41,222,367 in 2013 representing 57.3 percent of the total budget for Waterford. Total enrollment in February 2004 was 3109 students of which 1361 were in elementary school, 776 in middle school, and 972 in high school. The total capacity of all the schools combined is 3324. Two of the elementary schools are now slightly exceeding their capacity, but portable classrooms are used in all the elementary schools to address this situation. There has been an increase in overall enrollment during the past five years from 2981 students in 1999 / 2000 to 3109 in 2004 / 2005. Elementary enrollments peaked at 1441 in 2000 / 2001, while the middle school and high school population has increased since then. Overall enrollment for 2006 / 2007 is projected to be 3091 (Waterford Public Schools 2004). Approximately 22.3 percent of the Waterford Public Schools budget is funded by revenues derived from Dominion operations at Millstone that are paid to the town of Waterford. This amounted to $7,373,494 in 2003.

The Waterford Public Schools were built between 1914 and 1958, initially, and have been remodeled and expanded over the decades many times. The seven schools comprise 557,221 square feet and 189 ac. The Board of Education is proceeding with plans to build or renovate-as-new three elementary schools. Waterford and New London have also received a $22 million grant from the State Department of Education to build an early childhood learning center for approximately 520 preschool and kindergarten aged children, half of whom will be from Waterford and half from New London. The building is to be located next to the Waterford High School. The project is scheduled to open in September 2005 (Waterford Public Schools 2004).

- **Transportation**

Waterford, New London County, and the southeastern Connecticut region have a well-developed transportation system. The area is served by an established roadway network of local, connector, arterial, and expressway routes. Rail lines operated by Amtrak provide local and long-distance high-speed train service connecting New London with Boston and New York. Intercity bus service is provided by Greyhound Lines with a stop in New London. Southeast Area Transit buses operate throughout New London County and provide local service into Waterford. The Groton / New London airport provides charter and commercial service. National air carriers serve Bradley International airport near Hartford and the T.F. Green airport in Providence, Rhode Island. Ferry service is offered from the consolidated intermodal New London terminal seasonally and year-round to several Long Island destinations; Martha's Vineyard, Massachusetts; and Block Island, Rhode Island. The mouth of the Thames River is one of New England's finest natural harbors and provides direct access to major transatlantic and coastal sea lanes.

Road access to Millstone is via the Millstone Access Road, an onsite two-lane paved road with a north-south orientation. When nearing Millstone, all employees must use State Route 156 (Rope Ferry Road), which is a two- to four-lane highway classified as an arterial road. State Route 156 intersects with U.S. 1 (Boston Post Road), which has an east-west orientation in Connecticut. Employees traveling from the towns of New London and Waterford are most likely to use U.S. 1 and State Route 156. Employees traveling from East Lyme and other communities to the west are most likely to use State Route 161 or U.S. 1, and State Route 156. State Route 161 serves as a major feeder to and from Interstate (I)-95 south. Waterford's main roadways are I-95 and I-395, U.S. 1, and State Routes 85, 156, 161 and 32. Most Millstone workers commute in their own vehicles or in organized van pools. Parking for all vehicles is provided at the site.

The major transportation issues in Waterford involve the roadway circulation system and enhancing other modes of transportation, such as pedestrian ways and bicycle paths. Overall, the community wants to address traffic needs while maintaining community character and minimizing environmental impacts. One of Waterford's major transportation challenges is to preserve the capacity of existing roadways and to maintain adequate traffic service levels given the historic and anticipated growth of traffic volumes, congestion, and accidents. Since only half the land area in Waterford has been developed, future traffic volumes could increase when new development occurs.

There are some transportation projects being conducted by State and local authorities that may improve transportation and that could impact Millstone. These include intersection improvements on U.S. 1, widening westbound Route 156 to two lanes in the vicinity of U.S. 1 to minimize traffic merging conflicts, and eventual widening of I-95. The open space plan for Waterford recommends using power transmission line ROWs (outside of the Millstone traverse) for multimodal trails (e.g., walking, bicycling).

In order to meet 10-year transportation goals, the *East Lyme Plan for Preservation, Conservation and Development* proposes a number of transportation improvements to alleviate congestion on the 219 km (136 miles) of roads in the town (Dominion 2004a). Thirty-two miles of the roads are State owned and maintained including the two major east-west routes (U.S. 1 and Route 156) and the major north-south corridor (Route 161). The proposed improvement projects having the greatest potential to impact Millstone include the upgrades of Routes 161 and 156.

The *Regional Transportation Plan for Southeastern Connecticut* contains a number of recommendations to address transportation concerns that could affect Waterford and Millstone (SCCOG 2003a). The plan notes that New London will continue to function as the region's primary transportation hub with its confluence of water, rail, and highway systems, and it cites Millstone as being the eleventh largest regional nonresidential traffic generator, and that it is

one of six high-security sites in southeastern Connecticut. The highest priority projects for southeastern Connecticut are the completion of Route 11 from Salem to I-95 and its intersection in Waterford, capacity improvements to I-95 from Branford to the Rhode Island state line, expansion of the regional bus system to address tourism and related employment demand, and improvements to Routes 2, 2A, and 32 to serve the casinos. These projects remain unfunded, except for transit improvements. Adequate public transportation for employment and other necessary travel was also identified as one of ten top priorities for southeastern Connecticut in 1999 (United Way of Southeastern Connecticut 1999).

The Connecticut Department of Transportation does not maintain level-of-service designations for the roads in the vicinity of Millstone (Dominion 2004a). Waterford strives to maintain a level-of-service standard of C or better for its roads, with exceptions made for certain commercial corridors provided that additional congestion occurs only on private driveways. Level-of-Service C means that vehicle traffic volumes are between 70 percent and 80 percent of the roadway capacity and that delays at traffic signals are between 15 and 20 seconds (Waterford 1998). In 2001, the segments of Route 156 passing by the Millstone access (at High Ridge Drive) had a volume to capacity ratio of 0.40 (SCCOG 2003a). A new traffic signal will be installed at the intersection of Route 156 and Gardiners Wood Road, and recent changes to the intersection of Route 156 at Route 213 (Great Neck Road) should mitigate the congestion experienced there at certain times of the day. Table 2-7 lists roadways in the vicinity of Millstone and the annual average number of vehicles per day, as determined by CTDEP.

2.2.8.3 Offsite Land Use

Millstone is located in the town of Waterford, a suburban community that consists primarily of owner-occupied single-family dwellings. Waterford was settled in the late 1600s and originally was part of New London. It incorporated in 1801. Waterford is one of 21 municipalities that comprise New London County. Land use in Connecticut is regulated by municipalities and each municipality is an independent government. There are no unincorporated lands in Connecticut, and counties do not have government functions such as regulation of land use. The Connecticut General Assembly recently passed legislation enabling cooperation among municipalities. Intergovernmental projects are encouraged by allowing municipalities to engage jointly in any function that they are authorized to carry out independently. Towns in New London County have made efforts to work together to address regional planning issues, such as those presented by the presence of large casinos, economic development, transportation, water supply and availability, and housing. The forum for addressing regional and intermunicipal issues is the SCCOG. It is likely that this approach to intergovernmental planning and cooperation will continue in the region where Millstone is located (Vincent 2004).

Table 2-7. Traffic Counts for Roads in the Vicinity of Millstone

	Roadway and Location	Annual Average Daily Traffic Volume[a]
(1)	Highway 156—Station Number 63 (just east of Millstone entrance near Gardiners Wood Road)	9600
(2)	Highway 156—Station Number 29 (west of Avery Road)	8900
(3)	Highway 156—Station Number 33 (east of Avery Road)	12,800
(4)	Highway 156—Station Number 44 (west of intersection with U.S.1)	14,700
(5)	Highway 156—Station Number 2190 (just west of Millstone entrance and west of High Ridge Road)	10,400
(6)	Highway 156—Station Number 2032 (west of River Street)	10,200
(7)	Highway 156—Station Number 25 (east of Highway 161)	10,300
(8)	Highway 156—Station Number 26 (west of Highway 161)	10,600
(9)	Highway 156—Station Number 27 (east of East Pattagansett Road)	9800
(10)	Highway 156—Station Number 18 (west of East Pattagansett Road)	9600
(11)	Highway 156—Station Number 33 (east of Rocky Neck Connector)	8900
(12)	Highway 161—Station Number 41 (northwest of Hope Street)	9300
(13)	Highway 161—Station Number 15 (north of Sleepy Hollow Road)	9900
(14)	Highway 161—Station Number 2010 (south of King Arthur Drive)	21,700
(15)	Highway 161—Station Number 8 (north of Boston Post Road)	11,900
(16)	Highway 161—Station Number 37 (north of Drabik Road)	6700
(17)	Highway 161—Station Number 38 (south of Walnut Hill Road)	5700
(18)	U.S. 1—Station Number 74 (east of Strosberg Road)	13,000
(19)	U.S. 1—Station Number 36 (west of Woodland Grove)	24,800
(20)	U.S. 1—Station Number 39 (southeast of Vivian Street)	25,200
(21)	U.S. 1—Station Number 35 (northwest of Vivian Street)	12,500
(22)	U.S. 1—Station Number 40 (northwest of Ellen Ward Road)	14,900
(23)	U.S. 1—Station Number 2051 (northwest of Cross Road)	9900
(24)	U.S. 1—Station Number 5034 (west of Oswegatchie Road)	9800

(a) Dominion 2004a

Section 8-23 of the Connecticut General Statutes requires each town planning commission to prepare and adopt a plan of conservation and development, and to amend, update, or readopt such plan at least every 10 years. The *Waterford Plan of Preservation, Conservation and Development* provides a vision for the future of a desired community structure, and includes a future land-use plan. The plan provides for a variety of land uses and ensures an adequate supply of land for residential, open space, and business uses. The plan also includes and designates the lands devoted for use by Millstone and associated facilities. The town also has regulations governing lot sizes and places restrictions on multifamily development densities.

The Atomic Energy Commission, predecessor to the NRC, noted that the general character of land use at the time of Millstone construction during the 1970s was scattered villages and homes except for the towns of Groton, New London, and Norwich. In the southeastern Connecticut planning region, 86 percent of the land area was classified as undeveloped. In 1990, developed uses accounted for 20.5 percent of the total land area, and, in 2000, the developed area was 25 percent.

In the decade between 1990 and 2000, development grew at a rate of about 22 percent, which is comparable to the 1980s. Suburban towns like Waterford accommodated most of this growth in developed lands. Residential uses have historically been the dominant component of developed uses and this trend continued during the 1990s. While there was population growth in southeastern Connecticut of about 1 percent, there was a 39 percent increase in land area consumed for residential development. Decreasing household size may be a contributing factor, but other public policies and preferences result in low-density residential development being the predominant land use in southeastern Connecticut. While intensive industrial and commercial uses increased in geographic area, these remained fairly constant as a percentage of the total developed lands between 1980 and 2000. Lands used for transportation, communication, and utilities comprise approximately 21 percent of all developed lands in 2000, and total land used for this increased since 1990; however as a relative percentage to total developed lands in 2000, these lands decreased by 4 percent. Lands used for open space and active recreation, including agricultural uses, account for approximately 19.5 percent of the land area at the regional level, which represents a slight increase from 1990. The most common use (about 68 percent) within this category is public-private preserves and the holdings of water utilities, while agricultural lands comprise about 19 percent of this category. Undeveloped land (mostly vacant forests, fields, wetlands or bodies of water) covered 55.5 percent of the lands of southeastern Connecticut in 2000, compared to 61 percent in 1990. This equates to 1 percent of the total land area of the region being developed every two years, which implies major changes to land use in the coming decades (SCCOG 2002). Table 2-8 provides a summary of land use in southeastern Connecticut.

There are 610 farms in New London County comprising 27,500 ha (67,924 ac) or an average of 45 ha (111 ac). In contrast, there are 288 farms in Middlesex County totaling 7560 ha

(18,682 ac) and averaging 26.3 ha (65 ac) (USDA 1997). Farms in New London County accounted for nearly 15 percent of all farms in the State, and they tended to be larger, on average, while the farms in Middlesex County were about half the size on average of those in New London County. The number of farms reported in Connecticut remained at 4200, between 2001 and 2003. The average size of a Connecticut farm was 34.8 ha (86 ac) (USDA 2004).

2.2.8.4 Visual Aesthetics and Noise

Prior to development as a power facility, Millstone Point was the site of a granite quarry that operated for approximately two centuries, until 1960. Current station facility features include reactor containment buildings, auxiliary buildings, intake and discharge structures, turbine buildings, a radioactive waste facility, fuel handling buildings, the electrical switchyard and associated transmission lines, an environmental laboratory, and training facilities.

Table 2-8. Land Use in Southeastern Connecticut

Land Use	km^2	mi^2	Percent of Total
Total Developed	361.2	139.5	24.9
Residential	222.0	85.7	15.3
Industrial	12.4	4.8	0.9
Commercial	15.0	5.8	1.0
Institutional	35.7	13.8	2.5
Transportation and Utilities	76.1	29.4	5.3
Open Space	191.7	74.0	13.2
Active Recreation	36.8	14.2	2.5
Agriculture	54.4	21.0	3.8
Native American	12.7	4.9	0.9
Undeveloped	295.6	305.4	54.6
Total	**656.8**	**559.5**	**100.0**

Source: SCCOG 2002.

The Millstone site maintains a low profile when viewed from locations further inland and upland in Waterford. It is plainly visible from the waters of Long Island Sound, from the shoreline of the Pleasure Beach neighborhood, and from across Niantic Bay. The 114-m (375-ft) tall red and white stack and a meteorological tower are the most visible features when passing by the site on Rope Ferry Road. Loud noises are occasionally heard in Waterford from Millstone, but noise is generally not an issue because the actual facilities are located within an exclusion and buffer zone on a peninsula that is distant from houses.

2.2.8.5 Demography

- **Resident Population within 80 km (50 mi)**

Population was estimated within an 80-km (50-mi) radius of Millstone. Four states and all or parts of 15 counties fall within this radius. The city of Hartford, and sections of the Hartford and the New London-Norwich Metropolitan statistical areas are also located within 80 km (50 mi) of Millstone. There are eight counties in Connecticut, four counties in Rhode Island, two counties in Massachusetts and one county in New York.

An estimated 2,868,207 people live within this area. This equates to a population density of 219 persons per square kilometer (persons/km^2) (567 persons per square mile [persons/mi^2]). Applying the GEIS proximity measures, Millstone is classified as Category 4 (greater than or equal to 73 persons/km^2 [190 persons/mi^2] within 50 miles). According to the GEIS sparseness and proximity matrix, Millstone's rank of sparseness, Category 4, and proximity, Category 4, result in the conclusion that Millstone is located in a high-population area (Dominion 2004a). Another estimate of population densities for 2000 (SCCOG 2003b) reports that there are 168 persons/km^2 (434 persons/mi^2) within the southeastern Connecticut planning region, which falls within the 80-km (50-mi) radius from Millstone, while Waterford has a density of 221 persons/km^2 (573 persons/mi^2), compared with New London where 1802 persons occupy each square kilometer (4667 persons/mi^2) (SCCOG 2003b). Table 2-9 shows population growth rates and projections for New London County and Connecticut from 1980 to 2040. Table 2-10 provides more detail about the population growth in the vicinity of Millstone between 1980 and 2000.

The Hartford Metropolitan Service Area is the 42nd largest Metropolitan Service Area in the United States with a population of 1,183,110 residents. The New London-Norwich Metropolitan Service Area, which contains New London County, has a total population of 293,566, making it the 134th largest Metropolitan Service Area in the United States. Since 1980, New London County has had an annual average growth rate of only 0.4 percent. From a regional perspective, the population of southeastern Connecticut continues to move from the urban to the suburban and rural areas. The Waterford population growth rate is the same as the county's, 0.4 percent. Groton and New London have lost population, while Colchester, East Lyme, Ledyard, and Montville have gained population. The southeastern Connecticut region as a whole grew by 2327 persons between 1990 and 2000. The natural increase (births minus deaths) for this period was 14,160 persons while 11,833 persons migrated out of the region. Waterford experienced a negative natural increase (more deaths than births), but there was a net in-migration that caused a total population gain. Waterford had a population of 19,152 in 2000, compared to 17,930 in 1990 (SCCOG 2003b).

Table 2-9. Population Growth and Trend in Connecticut and New London County 1980 to 2040

	Connecticut		New London County	
Year	Number	Percent	Number	Percent
1970	3,031,709	--	230,348	--
1980	3,107,576	0.25	238,409	0.35
1990	3,287,116	0.58	254,957	0.70
2000	3,405,565	0.36	259,088	0.16
2010	3,533,269	0.37	271,393	0.47
2020	3,663,379	0.37	281,669	0.38
2030	3,793,490	0.36	291,946	0.36
2040	3,923,601	0.34	302,223	0.35

Source: Dominion 2004a

Table 2-10. Population Growth in Vicinity of Millstone 1980 to 2000

Region	1980	1990	2000	AAGR[a] 1980–2000
Connecticut	3,107,580	3,287,116	3,405,565	0.5%
County				
New London County	238,410	254,957	259,088	0.4%
Town				
Colchester	7761	10,980	14,551	3.2%
East Lyme	13,870	15,340	18,118	1.3%
Groton	41,072	45,144	39,907	–0.1%
Ledyard	13,725	14,913	14,687	0.3%
Montville	16,455	16,673	18,546	0.6%
New London	28,843	28,540	25,671	–0.6%
Waterford	17,843	17,930	19,152	0.4%

Source: Dominion 2004a
(a) AAGR: Annual Average Growth Rate.

- **Transient Population**

The population within a 16-km (10-mi) radius of Millstone increases seasonally as a result of an influx of approximately 10,500 summer residents (Dominion 2004a). Similarly, the population of Eastern Suffolk County on Long Island increases by at least an additional 121,876 summer residents (Suffolk County Department of Planning 2005). Many of the beaches and recreation areas are popular regional and national tourist destinations, and during the summer months, they become sites inhabited by nonresidents, leading to a shift in population numbers. Some of these attractions are the Ocean Beach Park and boardwalk, Mystic Seaport and aquarium, the New London annual waterfront festival, evening summer concerts at Harkness State Park, and the Coast Guard Academy. Other area establishments such as the Crystal Mall in Waterford, and the two nearby casinos—Foxwoods and Mohegan Sun—attract thousands of daily visitors throughout the year.

- **Migrant Labor**

Migrant farm workers are individuals whose employment requires travel to tend or harvest agricultural crops. Migrant workers travel, and they can temporarily spend a significant amount of time in an area without being actual residents. Therefore, they may be unavailable for census takers to count. If this occurs, migrant workers will be underrepresented in U.S. Census Bureau minority and low-income population counts. Migrant workers are typically members of minority or low-income populations. While there are not significant numbers of migrant agricultural workers in New London County and the region, according to the United Way of Southeastern Connecticut, there are large numbers of low-paid, mostly Asian, service workers who live in the Norwich area and who are employed at the casinos. Many of these casino workers became unemployed in New York City after September 11, 2001, and came from New York City to take advantage of service jobs. They often occupy crowded households and share the same sleeping quarters.

2.2.8.6 Economy and Taxes

There have been structural changes to the economy of southeastern Connecticut during the past decade. The region has experienced a reduction of defense related and manufacturing employment and a boom in casino related development and employment that is altering the fundamental economics of southeastern Connecticut (SCCOG 1997).

The median household income for New London County was $50,646 in 1999 and lagged behind the State-wide median of $53,935 by 6.5 percent. However, the median household income gap between New London County and Connecticut was greater in 1989, when it lagged by 11 percent. Median household income in 1999 for towns in southeastern Connecticut ranged from a high of $58,750 in Salem to a low of $33,809 in New London. In Waterford, it

was $56,047. There were 15,349 persons (6.3 percent of the population) classified as living below the poverty threshold in 1999 in southeastern Connecticut. This represented an increase of 2.6 percent from 14,954 persons in 1989 and contrasts with the decade between 1979 and 1989 when the number of persons classified as living below the poverty level threshold dropped by 18.2 percent. In 1999, 789 people living in Waterford were classified as living below the poverty threshold, an absolute increase of 206 people since 1989. In contrast, the actual total number of families that are living below the poverty threshold decreased in southeastern Connecticut from 3116 in 1989 to 2943 in 1999. The greatest concentration of low-income population is in the three urban towns of Groton, New London, and Norwich, which account for approximately two-thirds of the region's poverty population (SCCOG 2003b).

The 2000 U.S. Census reported that southeastern Connecticut had a combined civilian and military workforce of 128,677, which represents a labor force participation rate of 68 percent. The southeastern Connecticut employed labor force is similar to that of the State as a whole, with a few exceptions. There is a lower proportion of workers in the finance, insurance, and real estate category, 4.1 percent in southeastern Connecticut compared to 9.8 percent in the State; and the proportion of arts, entertainment, recreation, accommodation, and food service workers was twice that of the State, 15.9 percent compared to 6.7 percent. Unemployment statistics from the 2000 census indicate that 5192 individuals, or 4.3 percent of the total civilian labor force 16 years and older in the region, were unemployed, compared to 5.9 percent in 1990. The town of New London had the highest unemployment rate at 7.4 percent, while 3.6 percent were unemployed in Waterford (SCCOG 2003b).

Casinos are now the largest employers in southeastern Connecticut, casino jobs having more than replaced in number the defense and manufacturing jobs lost during the 1990s. Defense and manufacturing still employ approximately 12,000 people in the New London labor market area, and more than 10,000 work at the U.S. Naval Submarine Base in Groton, and the pharmaceutical firm Pfizer had 6200 employees in 2000 (Southeastern Connecticut Enterprise Region Corporation 2000). Millstone is among the top ten corporate employers in the region and has a substantial economic impact on New London County. Table 2-11 lists major corporate employers in southeastern Connecticut.

Millstone's economic contribution between April 2001 and April 2002 was $515.2 million in New London County. The main contribution of Millstone was salaries. Direct and indirect compensation accounted for $118.3 million paid to employees residing in New London County during this period. In 2004, the average salary with benefits for a permanent employee at Millstone was $100,256, which was 50-percent higher than the average for New London County. In 2001, Millstone purchases in New London County were $34 million (Nuclear Energy Institute 2004).

Table 2-11. Major Employment Facilities in Southeastern Connecticut

Firm	Number of Employees
Foxwoods Resort Casino	11,500
U.S. Naval Submarine Base	10,119
Mohegan Sun Resort	10,000
Electric Boat	9000
Pfizer Pharmaceuticals	6200
Lawrence and Memorial Hospitals	2000
Millstone Power Station	**1650**
Backus Hospital	1500
U.S. Coast Guard Academy	1342
Connecticut College	900
Davis Standard—plastic extrusion equipment	650
Westerly Hospital	634
Computer Sciences Corporation	600
Franklin Mushroom Farms	595
Southern New England Telephone	528
Bess Eaton Donut Flour Company	405
S & S Worldwide—crafts, games, elderly aids	400
The Day Publishing Company—newspaper	395
Washington Trust	340
Mystic Seaport	330
Analysis and Technology—engineering and technical systems	325
Wyman-Gordon—casings	315
Ortronics—telecommunications	310
The Moore Company— fabrics	300
Sonalysts — sonar/film and audio studios	275

Source: Southeastern Connecticut Enterprise Region Corporation 2000: Area Survey of Employers April 2000 and May 2004

Millstone pays annual taxes to the towns of Waterford and East Lyme, both located in New London County. The majority of tax payments are made to Waterford ($13.5 million in 2002), but East Lyme receives a small tax payment for the plant's Information and Science Center ($5332 in 2002). Tax revenues fund Waterford's General Fund which supports programs such

as the Waterford Public Schools, the library, public works, public health programs, emergency management services, the police and fire departments, parks and recreation, planning and land use commissions, the retirement commission, and others (Dominion 2004a).

For the assessment years 1996 to 1999, Millstone taxes averaged $34.8 million per year and represented 64 to 69 percent of Waterford's total tax revenues. The State enacted legislation in 1998 restructuring the electric power industry. One result of the legislation was that Millstone tax payments would be assessed using fair market value instead of net book value methodologies. Millstone property tax payments dropped to $11.7 million in 2000, representing approximately 36 percent of Waterford's tax revenues. The State legislature passed a program called the Systems Benefit Charge, designed to reimburse affected towns such as Waterford for revenues lost by the change in assessment methodologies for electric power utilities. Eventually (as the program phases out after 2010), lost revenues will need to be recouped through millage rate increases and budget adjustments (Dominion 2004a). Table 2-12 compares Millstone's tax payments to Waterford's total tax revenues from 1996 to 2000.

Table 2-12. Millstone Tax Payments to Waterford 1996 to 2000

Year	Waterford Grand List Tax Revenues[a]	Tax Paid by Millstone Power Station	Percent of Waterford Tax Revenues
1996	$50,310,334	$34,768,749	69
1997	$50,436,903	$34,163,131	68
1998	$50,570,691	$33,495,022	66
1999	$52,548,808	$33,725,414	64
2000	$32,448,775[b]	$11,738,993	36

Source: Dominion 2004a.
(a) Taxes collected after adjustments (such as abatements, etc.). Grand List includes real estate, personal property, and motor vehicle taxes.
(b) Assessment year 2000 revenue does not include the State program reimbursement.

Waterford commissioned and completed a study to investigate budget and service delivery options in 2000. The *Town of Waterford Long Range Financial Management Plan* provides a toolkit with over 140 recommendations to assist the town of Waterford and the Waterford Public Schools to control and reduce costs using service delivery strategies and methods implemented through aggressive management of organizational performance (Waterford 2000a).

2.2.9 Historic and Archaeological Resources

This section discusses the cultural background and the known historic and archaeological resources at the Millstone site and in the surrounding area. This section draws on information

contained in the Environmental Report prepared by Dominion (Dominion 2004a), from archives and records stored at the Connecticut Historical Commission office in Hartford, as well as from published literature that treats the archaeology and history of Connecticut.

2.2.9.1 Cultural Background

The nearest established major cultural or historic park to Millstone is that of Ft. Trumbull State Park overlooking the Thames River about 8 km (5 mi) northeast of Millstone. Ft. Trumbull is the location of a series of coastal military forts dating back to the Revolutionary War.

As of May 2004, there are four Federally recognized Native American tribes in Connecticut and one in neighboring Rhode Island with possible historic ties to the general Millstone area. These include the Mohegan Tribe along the Thames River near Uncasville, approximately 14-km (9-mi) northeast of Millstone; the Mashantucket Pequot Tribal Nation in Ledyard, approximately 19-km (12-mi) north of Millstone; the Eastern Pequot Tribe in North Stonington, approximately 29-km (18-mi) northeast of Millstone; the Schaghticoke Tribal Nation in Kent, approximately 113-km (70-mi) northwest of Millstone; and the Narragansett Indian Tribe of Charlestown, Rhode Island, approximately 45-km (28-mi) east of Millstone. In addition to these Federally recognized tribes, there are several State-recognized tribes in Connecticut.

In the portions of the eastern coastline of Connecticut that are still largely undisturbed by historic and modern development, a rich heritage of prehistoric and early historic Native American resources and of historic Euroamerican resources is present (Van Dusen 1961; Keegan and Keegan 1999; Kerber 2002). Much of the information about Waterford is derived from Bachman (2000), while Millstone information is derived from a manuscript on the local quarrying industry (Reed 1994), and from a 1998 archaeological assessment survey of Waterford.

This area has an archaeological sequence that extends back at least 12,000 years before the present. The cultural history can be divided into four major periods: Paleoindian (10,000 before Christ [B.C.], and perhaps as early as 13,000 B.C., to around 7000 B.C.), Archaic (7000 to 700 B.C.), Woodland (700 B.C. to around Anno Domino [A.D.] 1650), and Historic (A.D. 1650 to the present). The Woodland period and the early portion of the Historic period are sometimes referred to as the Contact period.

During the Paleoindian period, the native peoples likely were organized into small mobile bands with a hunting and a fishing based economy. The Paleoindian climate was cooler than at present, with the presence of glaciers leading to much lower ocean levels. Thus, many of the archaeological sites along the coast dating from this time period would today be underwater, although a late Paleoindian site has been documented on Mashantucket Pequot tribal lands.

The Archaic period is typically divided into three components: Early, Middle, and Late Archaic, sometimes with a fourth component called Terminal Archaic. The greatest change came about during the Middle Archaic when ocean levels reached or even slightly exceeded current levels. Middle and Late Archaic archaeological sites typically exhibit greater evidence of sedentary economies, such as the presence of storage pits, extensive refuse middens, and large quantities of fire cracked rock. Habitation sites appear to have been divided into base camps used most of the year and smaller upland sites used during the fall.

In the Woodland period, Native American cultures reached their modern configurations, as noted at the time of initial European contact in the 1500s and 1600s. The increasing dependence on agriculture resulted in the development of increasingly complex trade networks and political systems and two major technological adaptions: use of ceramic containers and the bow and arrow. Woodland period archaeological sites are much more numerous throughout southern New England than are the earlier Archaic period sites. New England, for the most part, did not witness the complex Mississippian culture societies (e.g., Bense 1994) that developed immediately to the west and south of New England.

Prior to historic European contact, the ancestors of the modern southern New England Indians lived in a number of small distinct Algonquin-speaking Woodland culture societies. The Niantic occupied the area around Millstone. Around A.D. 1500, the Pequot, including the Mohegans, moved into eastern Connecticut, including the Millstone area, likely from the Hudson River Valley in New York, effectively dividing the Niantic into two bands, Eastern and Western Niantic. The Narragansett lived nearby in Rhode Island. In western Connecticut were the Mattabesic tribes, who spoke a dialect of Algonquin distinct from that of the Pequots, Mohegans, Niantics, and Narragansetts. The Pequot were aggressive and warlike and soon came to dominate much of Connecticut. The Algonquin word "quinnetukut" meant "on the long tidal river" in reference to the Connecticut River.

The Historic period for Connecticut can be roughly divided into eight subperiods: Contact (1614 to 1690), Colonial (1690 to 1764), Revolutionary War (1764 to 1783), Constitutional (1783 to 1850), Civil War Era (1850 to 1865), Reconstruction and Growth (1865 to 1917), World War I to World War II (1917 to 1945), and Modern (1945 to present).

The Historic period of Connecticut begins in 1614 with the exploration of the Connecticut River Valley by the Dutch explorer Adriaen Block. In 1633, the Dutch built a small fort in Hartford and the English founded the nearby city of Windsor. This marked the beginning of more than 100 years of population dislocation and cultural extirpation in Connecticut, ultimately resulting in amalgamations of native peoples previously distinct from one another and distributions that reflected the nature of European encroachment and economic systems, rather than the traditional patterns of the native populations.

In 1682, an amalgamation of Narragansetts and Eastern Niantics was allowed to settle and create the present Narragansett reservation in Charlestown, Rhode Island, and was given Federal recognition in 1983. An amalgamation of Mohegan Pequots together with the Western Niantics, lived variously in Connecticut and Wisconsin. In 1994, the surviving Mohegans were given Federal recognition. The Eastern Pequots were given Federal recognition in 2002. The Mattabesic tribes of western Connecticut were eventually largely amalgamated with the Mohegan, but a small surviving group composed of several Mattabesic tribes eventually became the Schaghticoke who received Federal recognition in 2004.

In the period between 1690 and 1764, all of the colonies, including Connecticut, witnessed growth as well as periodic boundary disputes with neighboring colonies. A population surge then occurred in Connecticut with the town of New London just east of Millstone increasing to a size of 5888 residents by 1774.

During the Revolutionary War, the British raided Danbury in 1777 and Greenwich in 1779, with major battles at Fort Trumbull and Fort Griswold. Connecticut primarily was involved by supplying troops and by provisioning the Continental Army during the Revolutionary War.

The period between 1790 and 1850 witnessed the dual processes of emigration from New England westward, and the growth of cotton and other manufacturing and banking industries in Connecticut. Connecticut once again became a provisioner during the Civil War, with the tiny port of Mystic being second only to Boston in terms of adding ships to the Federal Navy.

Between the Civil War and World War I, the communities around Millstone began to flourish and reached their modern configurations. During this period, Millstone served as a granite quarry for much of the construction in the surrounding cities.

In 1651, John Winthrop acquired more than 600 acres at Millstone Point. Winthrop did not live at the Millstone Point, but instead used the land for pasturage. He gave the land to his daughter and son-in-law in 1655, and it remained in the family until approximately 1723. The new owner, Peter Buor, began quarrying operations at about that time. In 1788, the quarry was purchased by Benajah Gardiner, and it remained in the Gardiner family until purchased in 1951 by Northeast Utilities, Dominion's predecessor to power generation operations at Millstone Point. The Millstone quarry was one of seven quarries that were developed in the Waterford area. It remained the largest and most active of the seven, and was the last to cease operations.

Groundbreaking for the power facility at Millstone began in December 1965, with construction on Unit 1 commencing in 1966, at Unit 2 in 1970, and at Unit 3 in 1974. Actual power generation at Unit 2 began in 1975. The old Millstone quarry, used for nearly two centuries, was opened to the ocean and converted into a cooling area for water discharge.

2.2.9.2 Historic and Archaeological Resources at and near Millstone

As of 2002, 181 properties in New London County were listed in the National Register of Historic Places, with 62 falling into a radius of 10 km (6 mi) of the Millstone facility (Dominion 2004a). None of these properties are on the Millstone site.

An archaeological records search was conducted through the use of the 1998 archaeological assessment survey for Waterford (Harper et al. 1998), and a general literature review was conducted at the Waterford Public Library. In addition, meetings were held with the Waterford town historian, Robert Nye, and with knowledgeable Millstone staff.

The earliest archaeological sites at Waterford date to the Late Archaic period, probably dating to around 4500 to 3700 years ago. Middle Woodland (around 2000 to 1200 years ago) and Late Woodland (around 1200 to 400 years ago) were the most commonly represented pre-European time periods.

There are two areas within the Millstone site known to have been the locale of pre-European Native American village habitations, both of which have been largely destroyed by historic farming and construction activities. One was situated a few hundred meters inland from Niantic Bay immediately north of the railroad bed that transects Millstone. The other site is located adjacent to Jordan Cove, with possibly intact deposits being preserved within the 20-ha (50-ac) wildlife refuge maintained by Dominion.

Among known Historic period resources at the Millstone site are a stone lined, slab covered, circular well and a small stone slab bridge spanning a brook. The well is of an unknown date, but the bridge is located at the point depicted on a 1868 map, where an old trail or road intersects the historic Gardiners Wood Road, in the vicinity of a depicted house. Both of these properties were added to the State files at the Connecticut Historic Commission in 1998. Also present but not formally documented in undeveloped portions of the Millstone site are a number of historic stone boundary walls, many of which are depicted on current maps of the Millstone site along with a second stone lined, slab covered well north of the railroad bed on the western side of the Millstone site. An unstudied homestead site is located in the northwest corner of the Millstone site, not far from a small historic cemetery. Tombstones in the cemetery range in date between 1794 and 1862.

The most important archaeological site at the Millstone site is the granite quarry itself. Quarrying operations likely began sometime shortly after 1723, with millstones being produced for local use, but some also being shipped as far as the West Indies. By 1776, on postal route maps of Benjamin Franklin, the area was already referred to as Millstone Point. By the mid 1830s, quarrying activities shifted from the manufacture of millstones to the use of blocks for major construction projects. During the next 20 years, Millstone quarry granite was used for

a number of coastal military forts including Adams, McAllister, Schuyler, Sumter, and Trumbull, along with the West Point Military Academy. By 1847, the Millstone quarry employed a workforce of 25 men and shipped some 30,000 tons of granite a year to cities such as New York, Philadelphia, and Charlestown. By the 1870s, the workforce had increased to more than 300 men. Millstone quarry granite was used for Mexico City's grand square, for Grand Central terminal, for the foundations of the Supreme Court building and the United Nations building, and for the base of the Statue of Liberty. Millstone quarry granite was also used for gravestones and for railroad construction.

In the late 1800s, a number of support facilities for the workers existed at the quarry, including offices, a boarding house, and a school. Virtually none of these facilities remain intact today, nor are their original locations well known. The wood framed school building still stands on the Millstone site, and although removed from its original location and moved at least twice, it serves as a reminder of earlier quarrying operations at Millstone Point. The quarrying operations appear to have lasted until 1963. As previously mentioned, the southern wall of the quarry pit was subsequently breached to let in waters from Long Island Sound in order to serve as a water discharge cooling pond for the Millstone nuclear plant operations.

As previously mentioned, the Mohegan Tribe, located along the Thames River near Uncasville, is the closest Federally recognized tribe to Millstone. Its reservation land is approximately 14 km (9 mi) northeast of the facility. The Mashantucket Pequot Tribal Nation in Ledyard is approximately 19 km (12 mi) north of Millstone; the Eastern Pequot Tribe in North Stonington is approximately 29 km (18 mi) northeast of Millstone; the Schaghticoke Tribal Nation in Kent is approximately 113 km (70 mi) northwest of Millstone; and the Narragansett Indian Tribe of Charlestown, Rhode Island, is approximately 45 km (28 mi) east of Millstone. With the possible exception of the Schaghticoke Tribal Nation, these tribes would all likely consider themselves culturally affiliated to the Millstone area.

2.2.10 Related Federal Project Activities and Consultations

The staff reviewed the possibility that activities of other Federal agencies might impact the renewal of the operating licenses for Millstone. Any such activities could result in cumulative environmental impacts and the possible need for the Federal agency to become a cooperating agency for the purpose of preparation of the SEIS.

There are several projects that have received or may receive Federal funding in the southeastern Connecticut planning region. A $2 billion upgrade to Amtrak's northeast corridor between Boston and New York City was completed recently to enable high-speed train travel. This rail line bisects the Millstone site but provides no access to or station within Waterford. The closest stop is in New London. Roadway improvements to connect Route 11 with I-95 in Waterford and to increase the capacity of I-95 in southeastern Connecticut would require

Federal funding, but these roadway projects remain unfunded despite their high priority in the regional transportation plan. The recently approved Thames Basin Regional Water Interconnection Project will provide alternative water supply sources for Waterford by interconnecting the Norwich, Groton, and the New London/Waterford systems. This project is to be partially funded with Federal matching dollars. The State pier and foreign trade zone in New London was also Federally funded. This multimodal facility is intended to serve freight and passengers, as well as fishing and marine research. Cruise ships are now stopping in New London.

The next proposed round of Defense Department base realignment and closures could affect southeastern Connecticut if the submarine base at Groton were to be reduced in size or closed. This could result in the closing of related industries and have a magnified negative impact on businesses and the economy of the region. A comprehensive economic development strategy is being prepared to analyze options and scenarios for southeastern Connecticut.

The disposition of the old Norwich State Hospital is a State project. The State and Preston town have agreed to terms of an agreement to allow Utopia Studios to build an entertainment complex on the190-ha (470-ac) site. While not a Federal project or action, the ultimate reuse of this site could affect the region by impacting housing, transportation, and economic development.

NRC is required under Section 102(a) of the National Environmental Policy Act of 1969 to consult with and obtain the comments of any Federal agency that has jurisdiction by law or special expertise with respect to any environmental impact involved. The staff has determined that there are no Federal projects or activities in the vicinity of Millstone that would result in cumulative impacts or would make it desirable for another Federal agency to become a cooperating agency for the purpose of preparing this SEIS.

2.3 References

10 CFR Part 20. Code of Federal Regulations, Title 10, *Energy*, Part 20, "Standards for Protection Against Radiation."

10 CFR Part 50. Code of Federal Regulations, Title 10, *Energy*, Part 50, "Domestic Licensing of Production and Utilization Facilities."

10 CFR Part 51. Code of Federal Regulations, Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

10 CFR Part 54. Code of Federal Regulations, Title 10, *Energy*, Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

10 CFR Part 61. Code of Federal Regulations, Title 10, *Energy*, Part 6, "Licensing Requirements for Land Disposal of Radioactive Waste."

10 CFR Part 71. Code of Federal Regulations, Title 10, *Energy*, Part 71, "Packaging and Transportation of Radioactive Material."

40 CFR Part 81. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 81, "Designation of Areas for Air Quality Planning Purposes."

40 CFR Part 190. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operations."

49 CFR Parts 171–178. Code of Federal Regulations, Title 49, *Transportation, Subtitle B–Other Regulations Relating to Transportation*, Chapter 1, "Research and Special Programs Administration."

Bachman, R. 2000. *An Illustrated History of the Town of Waterford*, Waterford, Connecticut.

Battelle. 1999. *Draft Final Data Report for Thames River Vibratory Core Sampling at Uncasville, CT.* Submitted to Department of the Army, U.S. Army Corps of Engineers, North, August 9, 2004. Atlantic Division, New England District. Contract No. DACW33-96-D-005, Deliver Order No. 29. July 1999.

Beal, R. E., J. C. Desfosse, J. D. Field, A. M. Schick, and T. L. Berger. 1998. *Atlantic States Marine Fisheries Commission (ASMFC), Special Report No. 66 of the Atlantic States Marine Fisheries Commission.* 1998 Annual Review of Interstate Fishery Management Plans.

Bense, J. A. 1994. *Archaeology of the Southeastern United States.* Academic Press, New York.

Bigelow, H. B. and W. C. Schroeder. 1953. "Fishes of the Gulf of Maine." *Fishery Bulletin 74 of the Fish and Wildlife Service* 53: (Contribution 592), Woods Hole Oceanographic Institute. United States Government Printing Office, Washington D.C.

Connecticut Department of Environmental Protection (CTDEP). 2002a. *Attainment and Non-Attainment of National Ambient Air Quality Standards in Connecticut.* August 16, 2002. Accessed at: http://dep.state.ct.us/air2/attain2.htm on May 6, 2004.

Connecticut Department of Environmental Protection (CTDEP). 2002b. Letter from Nancy Murray, Environmental and Geographic Information Center, to Anthony Johnson III, Northeast Utilities Service Company.

Connecticut Department of Environmental Protection (CTDEP). 2002c. Letter from Robert L. Smith, Water Management Bureau, to Scott M. Cullen, STAR Foundation.

Connecticut Department of Environmental Protection (CTDEP). 2004a. E-mail from L. K. Kostiuk, CTDEP, to B. Gallaher, Los Alamos National Laboratory. Subject: Millstone RCRA Status. (June 28, 2004).

Connecticut Department of Environmental Protection (CTDEP). 2004b. Letter from Office of Long Island Sound Programs to NRC Environmental Project Manager and Dominion Vice President and Chief Environmental Officer. Subject: Request to renew the operating license for Units 2 and 3 of the Millstone Power Station in Waterford Connecticut. (April 27, 2004).

Connecticut Department of Environmental Protection (CTDEP). 2004c. *Wildlife in Connecticut, Endangered and Threatened Species Series.* Accessed at: http://dep.state.ct.us/burnatr/wildlife/factshts on April 27, 2004.

Connecticut Legislature. 2003a. General Statutes of Connecticut. Title 22a, Environmental Protection, Chapter 445, "Hazardous Waste," Sec. 22a–134 through 22a-134e. (Commonly known as "the property transfer law"). Accessed at: http://search.cga.state.ct.us/dtsearch_pub_statutes.html on June 24, 2005.

Connecticut Legislature. 2003b. General Statutes of Connecticut. Title 22a, Environmental Protection, Chapter 446c, "Air Pollution Control," Sec. 22a–174. (Formerly Sec. 19-508). *Powers of the Commissioner. Regulations. Fees. Exemptions. General permits. Appeal of Commissioner's Action re: Permit Applications.* Accessed at: http://www.cga.state.ct.us/2003/ pub/Chap446c.htm#Sec22a-174j.htm on August 5, 2004.

Connecticut State Climate Center (CSSC). 2004. Overview *of Climate in Connecticut.* Narrated from Weather America 2001, Grey House Publishing, Lakeville, Connecticut. Accessed at: http://www.canr.uconn.edu/nrme/cscc/CTweatherstationintroduction/ CONNCTICUTINTRODUCTION.HTM on May 6, 2004.

Dimou, N. K. and E. E. Adams. 1989. *Application of a 2-D Particle Tracking Model to Simulate Entrainment of Winter Flounder Larvae at the Millstone Nuclear Power Station.* Energy Laboratory Report No. MIT-EL-89-002.

Dominion Nuclear Connecticut, Inc. (Dominion). 2001. *Millstone Power Station, Final Report,* "An Evaluation of Selected Cooling Water System Alternatives for Millstone Power Station." Waterford, Connecticut. August 31, 2001.

Dominion Nuclear Connecticut, Inc. (Dominion). 2002a. *Millstone Power Station, Annual Radiological Environmental Operating Report January 1, 2001 – December 31, 2001.* Waterford, Connecticut. April 30, 2002.

Dominion Nuclear Connecticut, Inc. (Dominion). 2002b. *Millstone Power Station, 2001 Radioactive Effluent Release Report.* Volume 1. Waterford, Connecticut. April 30, 2002.

Dominion Nuclear Connecticut, Inc. (Dominion). 2003a. *Millstone Power Station, Annual Radiological Environmental Operating Report January 1, 2002 – December 31, 2002.* Waterford, Connecticut. April 30, 2003.

Dominion Nuclear Connecticut, Inc. (Dominion). 2003b. *Millstone Power Station, 2002 Radioactive Effluent Release Report.* Volume 1. Waterford, Connecticut. April 28, 2003.

Dominion Nuclear Connecticut, Inc. (Dominion). 2004a. *Applicant's Environmental Report—Operating License Renewal Stage Millstone Power Station, Units 2 and 3.* Waterford, Connecticut. January 2004.

Dominion Nuclear Connecticut, Inc. (Dominion). 2004b. *Millstone Power Station, Annual Radiological Environmental Operating Report January 1, 2003 – December 31, 2003.* Waterford, Connecticut. April 30, 2004.

Dominion Nuclear Connecticut, Inc. (Dominion). 2004c. *Millstone Power Station, 2003 Radioactive Effluent Release Report.* Volume 1. Waterford, Connecticut. April 29, 2004.

Dominion Nuclear Connecticut, Inc. (Dominion). 2004d. *Applications for Renewed Operating Licenses, Millstone Power Station, Units 2 and 3.* Waterford, Connecticut, January 20, 2004.

Dominion Nuclear Connecticut, Inc. (Dominion). 2004e. *Annual Report 2003, Monitoring the Marine Environment of Long Island Sound at Millstone Power Station.* Waterford, Connecticut.

Dominion Nuclear Connecticut, Inc. (Dominion). 2005. *Millstone Power Station, 2004 Radioactive Effluent Release Report.* Volume 2, MP-22-REC-BAP-01, "Radiological Effluent Monitoring and Offsite Dose Calculation Manual (REMODCM)," Revision 024-02, effective date of revision - April 1, 2004. Waterford, Connecticut. April 30, 2005.

Elliot, D. L., C. G. Holladay, W. R. Barchet, H. P. Foote, and W. F. Sandusky. 1986. *Wind Energy Resource Atlas of the United States.* DOE/CH 10093-4, U.S. Department of Energy, Washington, D.C. Accessed at: http://rredc.nrel.gov/wind/pubs/atlas on May 6, 2004.

Ferrucci and Walicki. 2002. *Northeast Utilities Wildlife Habitat Management Plan for Right-of-Way Areas.*

Gottschall, K.F., D.J. Pacileo, and D.R. Molnar. 2003. *Job 2: Marine finfish survey. Part I: Long Island Sound trawl survey and Part II: esturarine seine survey.* Pages 41–149 in A Study of Marine Recreational Fisheries in Connecticut. Connecticut Department of Environmental Protection., Bureau of Natural Resources, Fisheries Division.

Harper, M. G., J. Martman-Brodur, B. Jones, and B. Clouette. 1998. *Report: Town-wide Archaeological Assessment Survey—Waterford.* Public Archaeology Survey Team, Inc. Manuscript in the possession of Robert Nye, Waterford Town Historian. Waterford, Connecticut.

Jarrell, J. D., M. Mayfield, E. N. Rappaport, and C. W. Landsea. 2001. *The Deadliest, Costliest, and Most Intense United States Hurricanes From 1900 to 2000 (and Other Frequently Requested Hurricane Facts).* NOAA Technical Memorandum NWS TPC-1, National Hurricane Center. Accessed at: http://www.aoml.noaa.gov/hrd/Landsea/deadly/ on May 6, 2004.

Keegan, W. F. and K. N. Keegan. 1999. *The Archaeology of Connecticut.* University Press of New England. Hanover, New Hampshire.

Kerber, J. E. 2002. *A Lasting Impression: Coastal, Lithic, and Ceramic Research in New England Archaeology.* Praeger. Westport, Connecticut.

Keser, M., J. T. Swenarton, J. M. Vozarik, and J. F. Foertch. 2003. "Decline in Eelgrass (Zostera marina L.) in Long Island Sound Near Millstone Point, Connecticut (USA) Unrelated to Thermal Input." *Journal of Sea Research* Vol. 49, pp: 11–26.

Long, E. R., L. J. Field, and D. D. MacDonald. 1998. "Predicting Toxicity in Marine Sediments with Numerical Sediment Quality Guidelines." *Environmental Toxicology and Chemistry* Vol. 17, No. 4, pp: 714–727.

Lorda, E., D. J. Danila, and J. D. Miller. 2000. "Application of a Population Dynamics Model to the Probabilistic Assessment of Cooling Water Intake Effects on Millstone Nuclear Power Station (Waterford, CT) on a nearby winter flounder spawning stock." *Environmental Science & Policy* Vol. 3, pp: S471–482.

MacLeod, R. E. 2003. *Job 1: Marine Angler Survey.* Pages 1–38 in A Study of Recreational Fisheries in Connecticut. Connecticut Department of Environmental Protection, Bureau of Natural Resources, Fisheries Division.

Mecray, E. L., M. R. Buchholtz ten Brink, and S. Shah. 2004. *Metal Distributions in the Surface Sediments of Long Island Sound.* U.S. Geological Survey (USGS), USGS OFR 00-304: Chapter 6. Accessed at: http://pubs.usgs.gov/of/of00-304/htmldocs/chap06/index.htm on August 28, 2004.

Monteleone, D. M., W. T. Peterson, and G. C. Williams. 1987. "Interannual Fluctuations in the Density of Sand Lance, *Ammodytes americanus*, Larvae in Long Island Sound, 1951–1983." *Estuaries* Vol. 10, No. 3, pp: 246–254.

National Environmental Policy Act of 1969 (NEPA), as amended. 42 USC 4321, et seq.

National Oceanic and Atmospheric Administration (NOAA) Fisheries. 1998. *Status of Fishery Resources off the Northeastern United States for 1998.* U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Region, Northeast Fisheries Science Center. Woods Hole, Massachusetts. September 1998.

National Oceanic and Atmospheric Administration (NOAA) Fisheries. 2002. *U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2002.* Accessed at: http://www.nmfs.noaa.gov/prot_res/PR2/Stock_Assessment_Program/sars.html#Overview on June 24, 2004.

National Oceanic and Atmospheric Administration (NOAA) Fisheries. 2003a. *Local Climatological Data, 2003, Annual Summary with Comparative Data—Bridgeport, CT.* U.S. National Oceanic and Atmospheric Administration, National Climatic Data Center. Asheville, NC.

National Oceanic and Atmospheric Administration (NOAA) Fisheries. 2003b. *Fisheries Statistics & Economics Division. Commercial Fishing Landings of Winter Flounder.* Accessed at: http://www.st.nmfs.gov/pls/webpls/mf_annual_landings.results on December 15, 2003.

National Oceanic and Atmospheric Administration (NOAA) Fisheries. 2004a. *Loggerhead Sea Turtles* (*Caretta caretta*). Accessed at: http://www.nmfs.noaa.gov/prot_res/species/turtles/loggerhead.html on June 24, 2004.

National Oceanic and Atmospheric Administration (NOAA) Fisheries. 2004b. *Green Sea Turtle* (*Chelonia mydas*). Accessed at: http://www.nmfs.noaa.gov/prot_res/species/turtles/green.html on June 24, 2004.

National Oceanic and Atmospheric Administration (NOAA) Fisheries. 2004c. *Leatherback Sea Turtle* (*Dermochelys coriacea*). Accessed at: http://www.nmfs.noaa.gov/prot_res/species/turtles/leatherback.html on June 24, 2004.

National Oceanic and Atmospheric Administration (NOAA) Fisheries. 2004d. *Kemp's Ridley Turtle (Lepidochelys kempii)*. Accessed at: http://www.nmfs.noaa.gov/prot_res/species/turtles/kemps.html on June 24, 2004.

NatureServe 2004. *NatureServe Explorer: an Online Encyclopedia of Life.* Version 3.1, NatureServe, Arlington, Virginia. Accessed at: http://www.natureserve.org on September 17, 2004.

Northeast Fisheries Science Center (NEFSC). 2003. B1. Southern New England/Mid-Atlantic (SNE/MA) winter flounder. Pages 139–220 in Report of the 36th Northeast Regional Stock Assessment Workshop (SAW): Stock Assessment Review Committee (SARC) consensus summary of assessments. NOAA Fisheries, Woods Hole, MA. Accessed at: http://www.nefsc.noaa.gov/nefsc/publications/crd/crd0306 on April 13, 2005.

Northeast Utilities Service Company (NUSCO). 2004. *Specifications for Rights-of-Way Vegetation Management.* Section III, Technical Requirements.

Nuclear Energy Institute (NEI). 2004. *Economic Benefits of Millstone Power Station.* Washington, DC.

Ramsdell, J. V. and G. L. Andrews. 1986. *Tornado Climatology of the Contiguous United States.* NUREG/CR 4461, U.S. Nuclear Regulatory Commission, Washington, DC.

Reed, W. A. III. 1994. *The Granite Industry of Waterford.* Report on file at the Waterford Public Library. Waterford, Connecticut.

Sea Grant 2004a. *Sea Grant's Long Island Sound Lobster Initiative. Sea Grant Program Response to Long Island Sound Mortality and Shell Disease, A Status Report.* Sea Grant New York. Accessed at: http://www.seagrant.sunysb.edu/LILobsters/Long Island SoundLI-ResearchResponse.pdf on August 28, 2004.

Southeastern Connecticut Council of Governments (SCCOG). 1997. *Regional Conservation and Development Policy Guide for Southeastern Connecticut.* Norwich, Connecticut.

Southeastern Connecticut Council of Governments (SCCOG). 2002. *Land Use - 2000 Southeastern Connecticut Region.* Norwich, Connecticut.

Southeastern Connecticut Council of Governments (SCCOG). 2003a. *Regional Transportation Plan for Southeastern Connecticut — FY 2003–2004.* Norwich, Connecticut.

Southeastern Connecticut Council of Governments (SCCOG). 2003b. *Social Indicators —2000.* Norwich, Connecticut.

Southeastern Connecticut Council of Governments (SCCOG). 2004. *Housing a Region in Transition - An Analysis of Housing Needs in Southeastern Connecticut, 2000–2005 Summary Report.* Norwich, Connecticut.

Southeastern Connecticut Enterprise Region Corporation. 2000. *Southeastern Connecticut Almanac—A Factbook of Business Resources for New London County, Connecticut and Western Rhode Island.* New London, Connecticut.

Suffolk County Department of Planning. 2005. *Saturation Population Analysis: Eastern Suffolk County.* Accessed at: http://www.co.suffolk.ny.us/Planning/SaturationPop.pdf on April 17, 2005.

United Way of Southeastern Connecticut. 1999. *Community Assessment.* Gales Ferry, Connecticut.

U.S. Census Bureau (USCB). 1990. *DP-5. Housing Characteristics: 1990, 1990 Summary Tape File (STF-3) - Sample data for New London and Middlesex Counties, Connecticut. Accessed at: http://factfinder.census.gov on June 21, 2004.*

U.S. Census Bureau (USCB). 2000. *Highlights from the Census 2000 Demographic Profiles for Waterford town, New London County and Middlesex County.* Accessed at: http://factfinder.census.gov on April 30, 2004.

U.S. Department of Agriculture (USDA). 1997. *1997 Census of Agriculture.* National Agricultural Statistics Service. Washington, D.C.

U.S. Department of Agriculture (USDA). 2004. *Farms and Land in Farms.* National Agricultural Statistics Service. Washington, D.C.

U.S. Environmental Protection Agency (EPA). 2004a. *Enforcement & Compliance History Online (ECHO).* Accessed at: http://www.epa.gov/echo/ on June 24, 2004.

U.S. Environmental Protection Agency (EPA). 2004b. *Long Island Sound: Facts, Figures, & Maps.* U.S. Environmental Protection Agency, Region 1: New England. Accessed at: http://www.epa.gov/region01/eco/lis/facts.html.

U.S. Environmental Protection Agency (EPA). 2004c. *Long Island Sound, An Estuary of National Significance.* U.S. Environmental Protection Agency, Region 1: New England. Accessed at: http://www.epa.gov/region01/eco/lis/ccmp.intro.html.

U.S. Fish and Wildlife Service (FWS) and United States Army Corps of Engineers (USACE). 1989. "Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic). Bay Anchovy." Biological Report 82 (11.97).

U.S. Fish and Wildlife Service (FWS). 1999. *Title 50 Wildlife and Fisheries, Part 17—Endangered and Threatened Wildlife and Plants, Subpart B—Lists.* U.S. Fish and Wildlife Service. December 21, 1999.

U.S. Fish and Wildlife Service (FWS). 2001. *Fish Facts - Shortnose Sturgeon.* Connecticut River Coordinator's Office website. Accessed at: http://www.fws.gov/r5crc/fish/zf_acbr.html. on June 24, 2004.

U.S. Fish and Wildlife Service (FWS). 2004. *Species Information, Threatened and Endangered Animals and Plants website.* Accessed at: http://endangered.fws.gov/wildlife.html. on August 2, 2004.

U.S. Geological Survey. 2004. *Real Time Data for Connecticut.* Accessed at: http://waterdata.usgs.gov/ct/nwis/rt on August 9, 2004.

Van Dusen, A. E. 1961. *Connecticut.* Random House. New York.

Vincent, J. 2004. *Inter-jurisdictional Planning Issues in Far Southeastern Connecticut,* Intergovernmental Affairs Newsletter. American Planning Association. Chicago, Illinois. March 2004.

Waterford. 1998. *Plan of Preservation, Conservation, and Development.* Adopted August 24, 1998.

Waterford. 2000a. *Town of Waterford Long Range Financial Management Plan,* 2000. Government Consulting Group, Inc. Waterford, Connecticut.

Waterford. 2000b. *A Survey of Waterford Residents on Taxes, Town Services, and Dealing with the Loss of Revenue from Millstone.* Center for Survey Research and Analysis, University of Connecticut. Waterford, Connecticut.

Waterford. 2002. *Thames Basin Regional Water Interconnection Project—Municipal Improvement Report to the Waterford Planning and Zoning Commission Pursuant to CGS 8-24.* Waterford, Connecticut.

Waterford. 2003. *Analysis of Impact of Collection Rate Changes Under De-Regulation.* Spread sheet provided by First Selectman Paul Eccard. Waterford, Connecticut.

Waterford Public Schools. 2004. Accessed at: http://www.waterfordschools.org on April 8, 2004.

3.0 Environmental Impacts of Refurbishment

Environmental issues associated with refurbishment activities are discussed in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996; 1999).[a] The GEIS includes a determination of whether the analysis of the environmental issues could be applied to all plants and whether additional mitigation measures would be warranted. Issues are then assigned a Category 1 or a Category 2 designation. As set forth in the GEIS, Category 1 issues are those that meet all of the following criteria:

(1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics.

(2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective off-site radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal).

(3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.

For issues that meet the three Category 1 criteria, no additional plant-specific analysis is required in this supplemental environmental impact statement (SEIS) unless new and significant information is identified.

Category 2 issues are those that do not meet one or more of the criteria for Category 1, and, therefore, additional plant-specific review of these issues is required.

License renewal actions may require refurbishment activities for the extended plant life. These actions may have an impact on the environment that requires evaluation, depending on the type of action and the plant-specific design. Environmental issues associated with refurbishment that were determined to be Category 1 issues are listed in Table 3-1.

Environmental issues related to refurbishment considered in the GEIS for which conclusions could not be reached for the above criteria for all plants, or for specific classes of plants, are Category 2 issues. These are listed in Table 3-2.

(a) *The GEIS was originally issued in 1996. Addendum 1 to the GEIS was issued in 1999.* Hereafter, all references to the "GEIS" include the GEIS and its Addendum 1.

Table 3-1. Category 1 Issues for Refurbishment Evaluation

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections
SURFACE-WATER QUALITY, HYDROLOGY, AND USE (FOR ALL PLANTS)	
Impacts of refurbishment on surface-water quality	3.4.1
Impacts of refurbishment on surface-water use	3.4.1
AQUATIC ECOLOGY (FOR ALL PLANTS)	
Refurbishment	3.5
GROUND-WATER USE AND QUALITY	
Impacts of refurbishment on ground-water use and quality	3.4.2
LAND USE	
Onsite land use	3.2
HUMAN HEALTH	
Radiation exposures to the public during refurbishment	3.8.1
Occupational radiation exposures during refurbishment	3.8.2
SOCIOECONOMICS	
Public services: public safety, social services, and tourism and recreation	3.7.4; 3.7.4.3; 3.7.4.4; 3.7.4.6
Aesthetic impacts (refurbishment)	3.7.8

Category 1 and Category 2 issues related to refurbishment that are not applicable to the Millstone Power Station, Units 2 and 3 (Millstone) because they are related to plant design features or site characteristics not found at Millstone are listed in Appendix F.

The potential environmental effects of refurbishment actions would be identified, and the analysis would be summarized within this section, if such actions were planned. Dominion Nuclear Connecticut, Inc. (Dominion) indicated that it performed its integrated plant assessment, the evaluation of structures and components pursuant to 10 Code of Federal Regulations (CFR) 54.21, to identify activities that are necessary to continue operation of Millstone during the requested 20-year period of extended operation. These activities include replacement of certain components as well as new inspection activities and are described in the License Renewal Applications (Dominion 2004a). In its Environmental Report for Millstone, Dominion stated that it "has not identified the need to undertake any major refurbishment of replacement actions to maintain the functionality of important systems, structures, and components during the Millstone license renewal period" (Dominion 2004b). Therefore, refurbishment is not considered in this supplemental environmental impact statement.

Table 3-2. Category 2 Issues for Refurbishment Evaluation

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections	10 CFR 51.53 (c)(3)(ii) Subparagraph
TERRESTRIAL RESOURCES		
Refurbishment impacts	3.6	E
THREATENED OR ENDANGERED SPECIES (FOR ALL PLANTS)		
Threatened or endangered species	3.9	E
AIR QUALITY		
Air quality during refurbishment (nonattainment and maintenance areas)	3.3	F
SOCIOECONOMICS		
Housing impacts	3.7.2	I
Public services: public utilities	3.7.4.5	I
Public services: education (refurbishment)	3.7.4.1	I
Offsite land use (refurbishment)	3.7.5	I
Public services, transportation	3.7.4.2	J
Historic and archaeological resources	3.7.7	K
ENVIRONMENTAL JUSTICE		
Environmental justice	Not addressed[a]	Not addressed[a]

(a) Guidance related to environmental justice was not in place at the time the GEIS and the associated revision to 10 CFR Part 51 were prepared. If an applicant plans to undertake refurbishment activities for license renewal, environmental justice must be addressed in the applicant's environmental report and the staff's environmental impact statement.

3.1 References

10 CFR Part 51. Code of Federal Regulations, Title 10, *Energy,* Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

10 CFR Part 54. Code of Federal Regulations, Title 10, *Energy,* Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

Dominion Nuclear Connecticut, Inc. (Dominion). 2004a. *Applications for Renewed Operating Licenses, Millstone Power Station, Units 2 and 3.* Waterford, Connecticut.

Dominion Nuclear Connecticut, Inc. (Dominion). 2004b. *Applicant's Environmental Report — Operating License Renewal Stage Millstone Power Station, Units 2 and 3.* Waterford, Connecticut.

U.S. Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants.* NUREG-1437, Volumes 1 and 2, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Main Report, Section 6.3 — Transportation, Table 9.1, Summary of findings on NEPA issues for license renewal of nuclear power plants, Final Report.* NUREG-1437, Volume 1, Addendum 1, Washington, D.C.

4.0 Environmental Impacts of Operation

Environmental issues associated with operation of a nuclear power plant during the renewal term are discussed in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (U.S. Nuclear Regulatory Commission [NRC] 1996; 1999).[a] The GEIS includes a determination of whether the analysis of the environmental issues could be applied to all plants and whether additional mitigation measures would be warranted. Issues are then assigned a Category 1 or a Category 2 designation. As set forth in the GEIS, Category 1 issues are those that meet all of the following criteria:

(1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics.

(2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal).

(3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.

For issues that meet the three Category 1 criteria, no additional plant-specific analysis is required unless new and significant information is identified.

Category 2 issues are those that do not meet one or more of the criteria for Category 1, and therefore, additional plant-specific review of these issues is required.

This chapter addresses the issues related to operation during the renewal term that are listed in Table B-1 of 10 Code of Federal Regulations (CFR) Part 51, Subpart A, Appendix B and are applicable to the Millstone Power Station, Units 2 and 3 (Millstone). Section 4.1 addresses issues applicable to the Millstone cooling system. Section 4.2 addresses issues related to transmission lines and onsite land use. Section 4.3 addresses the radiological impacts of normal operation, and Section 4.4 addresses issues related to the socioeconomic impacts of normal operation during the renewal term. Section 4.5 addresses issues related to ground-water use and quality, while Section 4.6 discusses the impacts of renewal term operations on threatened and endangered species. Section 4.7 addresses potential new information that was raised during the scoping period, and Section 4.8 discusses cumulative

(a) The GEIS was originally issued in 1996. Addendum 1 to the GEIS was issued in 1999. Hereafter, all references to the "GEIS" include the GEIS and its Addendum 1.

impacts. The results of the evaluation of environmental issues related to operation during the renewal term are summarized in Section 4.9. Finally, Section 4.10 lists the references for Chapter 4. Category 1 and Category 2 issues that are not applicable to Millstone because they are related to plant design features or site characteristics not found at Millstone are listed in Appendix F.

4.1 Cooling System

Category 1 issues in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, that are applicable to Millstone cooling system operation during the renewal term are listed in Table 4-1. Although

Table 4-1. Category 1 Issues Applicable to the Operation of the Millstone Cooling System During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections
SURFACE WATER QUALITY, HYDROLOGY, AND USE (FOR ALL PLANTS)	
Altered current patterns at intake and discharge structures	4.2.1.2.1
Altered salinity gradients	4.2.1.2.2
Scouring caused by discharged cooling water	4.2.1.2.3
Discharge of chlorine or other biocides	4.2.1.2.4
Discharge of sanitary wastes and minor chemical spills	4.2.1.2.4
Discharge of other metals in waste water	4.2.1.2.4
Water use conflicts (plants with once-through cooling systems)	4.2.1.3
AQUATIC ECOLOGY (FOR ALL PLANTS)	
Accumulation of contaminants in sediments or biota	4.2.1.2.4
Entrainment of phytoplankton and zooplankton	4.2.2.1.1
Cold shock	4.2.2.1.5
Thermal plume barrier to migrating fish	4.2.2.1.6
Distribution of aquatic organisms	4.2.2.1.6
Gas supersaturation (gas bubble disease)	4.2.2.1.8
Low dissolved oxygen in the discharge	4.2.2.1.9
Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses	4.2.2.1.10
Stimulation of nuisance organisms	4.2.2.1.11
HUMAN HEALTH	
Noise	4.3.7

the Dominion Nuclear Connecticut Inc. (Dominion) Environmental Report (ER) (Dominion 2004a) identified altered current patterns at intake and discharge structures (surface water) as a nonapplicable Category 1 issue, the staff determined that it is applicable. Dominion stated in its ER (Dominion 2004a) that it is not aware of any new and significant information associated with the renewal of the Millstone Power Station, Units 2 and 3 operating licenses (OLs). The staff has not identified any new and significant information during its independent review of the Dominion ER, the staff's site visit, the scoping process, its evaluation of other available information, and public comments on the draft supplemental environmental impact statement (SEIS). Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For all of the issues, the staff concluded in the GEIS that the impacts would be SMALL, and additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

A brief description of the staff's review and the GEIS conclusions, as codified in Table B-1, for each of these issues follows. (For each issue below, references to the Dominion ER are to Dominion 2004a.)

- Altered current patterns at intake and discharge structures. Based on information in the GEIS, the Commission found that

  > Altered current patterns have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.

  The staff has not identified any new and significant information during its independent review of the Dominion ER, the staff's site visit, the scoping process, its evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts from altered current patterns at intake and discharge structures during the renewal term beyond those discussed in the GEIS.

- Altered salinity gradients. Based on information in the GEIS, the Commission found that

  > Salinity gradients have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.

  The staff has not identified any new and significant information during its independent review of the Dominion ER, the staff's site visit, the scoping process, its evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff

concludes that there are no impacts from altered salinity gradients during the renewal term beyond those discussed in the GEIS.

- Scouring caused by discharged cooling water. Based on information in the GEIS, the Commission found that

  > Scouring has not been found to be a problem at most operating nuclear power plants and has caused only localized effects at a few plants. It is not expected to be a problem during the license renewal term.

The staff has not identified any new and significant information during its independent review of the Dominion ER, the staff's site visit, the scoping process, its review of monitoring programs, its evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there would be no impacts from scouring caused by discharged cooling water during the renewal term beyond those discussed in the GEIS.

- Discharge of chlorine or other biocides. Based on information in the GEIS, the Commission found that

  > Effects are not a concern among regulatory and resource agencies, and are not expected to be a problem during the license renewal term.

The staff has not identified any new and significant information during its independent review of the Dominion ER, the staff's site visit, the scoping process, its evaluation of other available information including the National Pollutant Discharge Elimination System (NPDES) permit for Millstone, discussion with the Connecticut Department of Environmental Protection (CTDEP), and public comments on the draft SEIS. Therefore, the staff concludes that there would be no impacts from discharge of chlorine or other biocides during the renewal term beyond those discussed in the GEIS.

- Discharge of sanitary wastes and minor chemical spills. Based on information in the GEIS, the Commission found that

  > Effects are readily controlled through NPDES permit and periodic modifications, if needed, and are not expected to be a problem during the license renewal term.

The staff has not identified any new and significant information during its independent review of the Dominion ER, the staff's site visit, the scoping process, its evaluation of other

available information including the NPDES permit for Millstone, discussion with the CTDEP, and public comments on the draft SEIS. Therefore, the staff concludes that there would be no impacts from discharge of sanitary wastes and minor chemical spills during the renewal term beyond those discussed in the GEIS.

- Discharge of other metals in waste water. Based on information in the GEIS, the Commission found that

  > These discharges have not been found to be a problem at operating nuclear power plants with cooling-tower-based heat dissipation systems and have been satisfactorily mitigated at other plants. They are not expected to be a problem during the license renewal term.

  The staff has not identified any new and significant information during its independent review of the Dominion ER, the staff's site visit, the scoping process, its evaluation of other available information including the NPDES permit for Millstone or discussion with the CTDEP, and public comments on the draft SEIS. Therefore, the staff concludes that there would be no impacts from discharge of other metals in waste water during the renewal term beyond those discussed in the GEIS.

- Water use conflicts (plants with once-through cooling systems). Based on information in the GEIS, the Commission found that

  > These conflicts have not been found to be a problem at operating nuclear power plants with once-through heat dissipation systems.

  The staff has not identified any new and significant information during its independent review of the Dominion ER, the staff's site visit, the scoping process, its evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there would be no impacts from water use conflicts for plants with once-through cooling systems during the renewal term beyond those discussed in the GEIS.

- Accumulation of contaminants in sediments or biota. Based on information in the GEIS, the Commission found that

  > Accumulation of contaminants has been a concern at a few nuclear power plants but has been satisfactorily mitigated by replacing copper alloy condenser tubes with those of another metal. It is not expected to be a problem during the license renewal term.

The staff has not identified any new and significant information during its independent review of the Dominion ER, the staff's site visit, the scoping process, its evaluation of available information, and public comments on the draft SEIS. Therefore, the staff concludes that there would be no impacts from accumulation of contaminants in sediments or biota during the renewal term beyond those discussed in the GEIS.

- Entrainment of phytoplankton and zooplankton. Based on information in the GEIS, the Commission found that

  > Entrainment of phytoplankton and zooplankton has not been found to be a problem at operating nuclear power plants and is not expected to be a problem during the license renewal term.

The staff has not identified any new and significant information during its independent review of the Dominion ER, the staff's site visit, the scoping process, its review of monitoring programs, its evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there would be no impacts from entrainment of phytoplankton and zooplankton during the renewal term beyond those discussed in the GEIS.

- Cold shock. Based on information in the GEIS, the Commission found that

  > Cold shock has been satisfactorily mitigated at operating nuclear plants with once-through cooling systems, has not endangered fish populations or been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds, and is not expected to be a problem during the license renewal term.

The staff has not identified any new and significant information during its independent review of the Dominion ER, the staff's site visit, the scoping process, its evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there would be no impacts from cold shock during the renewal term beyond those discussed in the GEIS.

- Thermal plume barrier to migrating fish. Based on information in the GEIS, the Commission found that

> Thermal plumes have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.

The staff has not identified any new and significant information during its independent review of the Dominion ER, the staff's site visit, the scoping process, its evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there would be no impacts from thermal plume barriers to migrating fish during the renewal term beyond those discussed in the GEIS.

- Distribution of aquatic organisms. Based on information in the GEIS, the Commission found that

  > Thermal discharge may have localized effects but is not expected to affect the larger geographical distribution of aquatic organisms.

  The staff has not identified any new and significant information during its independent review of the Dominion ER, the staff's site visit, the scoping process, its review of monitoring programs, its evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there would be no impacts on distribution of aquatic organisms during the renewal term beyond those discussed in the GEIS.

- Premature emergence of aquatic insects. Based on information in the GEIS, the Commission found that

  > Premature emergence has been found to be a localized effect at some operating nuclear power plants but has not been a problem and is not expected to be a problem during the license renewal term.

  The staff has not identified any new and significant information during its independent review of the Dominion ER, the staff's site visit, the scoping process, its evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there would be no impacts from premature emergence of aquatic insects during the renewal term beyond those discussed in the GEIS.

- Gas supersaturation (gas bubble disease). Based on information in the GEIS, the Commission found that

> Gas supersaturation was a concern at a small number of operating nuclear power plants with once-through cooling systems but has been satisfactorily mitigated. It has not been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds and is not expected to be a problem during the license renewal term.

In 1972, the applicant reported a fish kill of Atlantic menhaden that might be attributed to gas bubble disease that occurred in the quarry. It is also possible that the fish kill was the result of heat stress or a combination of heat stress and gas bubble disease. In response to the event, the licensee installed a fish barrier at the quarry entrance to Long Island Sound. The barrier is designed to prevent fish from swimming into the quarry. Since installation of the fish barriers, the licensee has not observed any gas bubble disease-related fish kills in the quarry.

The staff has not identified any new and significant information during its independent review of the Dominion ER, the staff's site visit, the scoping process, its evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there would be no impacts from gas supersaturation during the renewal term beyond those discussed in the GEIS.

- Low dissolved oxygen in the discharge. Based on information in the GEIS, the Commission found that

> Low dissolved oxygen has been a concern at one nuclear power plant with a once-through cooling system but has been effectively mitigated. It has not been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds and is not expected to be a problem during the license renewal term.

The staff has not identified any new and significant information during its independent review of the Dominion ER, the staff's site visit, the scoping process, its review of monitoring programs, its evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there would be no impacts from low dissolved oxygen during the renewal term beyond those discussed in the GEIS.

- Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses. Based on information in the GEIS, the Commission found that

> These types of losses have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.

The staff has not identified any new and significant information during its independent review of the Dominion ER, the staff's site visit, the scoping process, its evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there would be no impacts of losses from predation, parasitism, and disease among organisms exposed to sublethal stresses during the renewal term beyond those discussed in the GEIS.

- Stimulation of nuisance organisms. Based on information in the GEIS, the Commission found that

> Stimulation of nuisance organisms has been satisfactorily mitigated at the single nuclear power plant with a once-through cooling system where previously it was a problem. It has not been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds and is not expected to be a problem during the license renewal term.

The staff has not identified any new and significant information during its independent review of the Dominion ER, the staff's site visit, the scoping process, its evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there would be no impacts from stimulation of nuisance organisms during the renewal term beyond those discussed in the GEIS.

- Noise. Based on information in the GEIS, the Commission found that

> Noise has not been found to be a problem at operating plants and is not expected to be a problem at any plant during the license renewal term.

The staff has not identified any new and significant information during its independent review of the Dominion ER, the staff's site visit, the scoping process, its evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there would be no impacts from noise during the renewal term beyond those discussed in the GEIS.

The Category 2 issues related to cooling system operation during the renewal term and applicable to Millstone are discussed in the sections that follow and listed in Table 4-2.

Table 4-2. Category 2 Issues Applicable to the Operation of the Millstone Cooling System During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections	10 CFR 51.53(c)(3)(ii) Subparagraph	SEIS Section
AQUATIC ECOLOGY (FOR PLANTS WITH ONCE-THROUGH AND COOLING POND HEAT-DISSIPATION SYSTEMS)			
Entrainment of fish and shellfish in early life stages	4.2.2.1.2	B	4.1.1
Impingement of fish and shellfish	4.2.2.1.3	B	4.1.2
Heat shock	4.2.2.1.4	B	4.1.3

4.1.1 Entrainment of Fish and Shellfish in Early Life Stages

For power plants with once-through heat-dissipation systems, the entrainment into nuclear and power plant associated cooling-water systems of fish and shellfish in early life stages is considered a Category 2 issue, requiring a site-specific assessment before license renewal.

The staff independently reviewed the Millstone Units 2 and 3 ER, visited the site, and reviewed the applicant's NPDES permit. The staff also reviewed relevant scientific articles and agency documents from CTDEP and NOAA (National Oceanic and Atmospheric Administration) Fisheries (also known as National Marine Fisheries Service [NMFS]). The staff also interviewed agency staff from CTDEP and NOAA Fisheries and a faculty member at the University of Connecticut who has conducted research on entrainment at Millstone.

Section 316(b) of the Clean Water Act (CWA) requires that the location, design, construction, and capacity of cooling-water intake structures reflect the best technology available for minimizing adverse environmental impacts (33 United States Code [USC] 1326). Entrainment of fish and shellfish into the cooling-water system is a potential adverse environmental impact.

On July 9, 2004, the U.S. Environmental Protection Agency (EPA) published a final rule in the Federal Register (69 FR 41575) addressing cooling-water intake structures at existing power plants whose flow levels exceed a minimum threshold value of 189 million liters per day(L/d) (50 million gallons per day [gpd]). This rule is Phase II in EPA's development of 316(b) regulations establishing national requirements applicable, in existing facilities, to the location, design, construction, and capacity of cooling-water intake structures that exceed the threshold value for water withdrawals. The EPA requirements, which are implemented through NPDES permits, are designed to minimize the adverse environmental impacts associated with the continued use of the intake systems. Licensees will be required to demonstrate compliance with the Phase II performance standards in accordance with the provisions of the new rule.

Licensees may be required to alter the intake structure, redesign the cooling system, modify station operation, or take other mitigative measures as part of the NPDES permit renewal process. The new performance standards are designed to reduce entrainment losses due to plant operation. Any required site-specific mitigation would be expected to result in less impact from entrainment during the license renewal period.

As a condition of the NPDES permit issued in 1992, the CTDEP required Northeast Utilities Service Company (NUSCO) to conduct entrainment studies of winter flounder (*Pseudopleuronectes americanus*) and to submit a feasibility study on alternatives to reduce entrainment of larvae. The CTDEP approved the feasibility study, but required that NUSCO "... continue efforts to schedule refueling outages to coincide with the period of high winter flounder abundance at the intake..." and "continue to monitor Niantic River winter flounder population characteristics, in accordance with [the terms of the NPDES permit]" (CTDEP 1994).

NUSCO filed an NPDES permit renewal application in 1997. In 1999, the CTDEP notified Dominion that Millstone's once-through cooling might no longer represent the best technology available to minimize entrainment of aquatic eggs and larvae. Because of the possibility that Millstone was adversely impacting the local population of winter flounder, and the availability of new technologies to minimize entrainment, the CTDEP required that NUSCO submit "a new evaluation of all measures available to eliminate or minimize the use of once-through cooling water" prior to reissuance of the Millstone NPDES permit (CTDEP 1999). At the request of the CTDEP, the study scope included an assessment of winter flounder, tautog (*Tautoga onitis*), Atlantic menhaden (*Brevoortia tyrannus*), anchovies (*Anchoa* spp.), grubby (*Myoxocephalus aenaeus*), cunner (*Tautogolabrus adspersus*), and American sand lance (*Ammodytes americanus*). Dominion submitted the study (Dominion 2001a) to CTDEP in August 2001. Dominion's NPDES permit renewal application remains under review with the CTDEP. The 1992 NPDES permit and 316(b) determination remain in effect until the State acts on Dominion's NPDES permit renewal application.

4.1.1.1 Entrainment Monitoring

Entrainment of fish eggs and larvae through the Millstone cooling-water system has been monitored since 1976. During the most recent sampling periods, sampling frequency for eggs and larvae varied seasonally according to ichthyoplankton abundance, with day and night samples collected twice a week from June through August, once a week in September and February, and three times a week from March through May (Dominion 2002a; 2003a; 2004b). Only one daytime sample per week was collected during periods of low abundance (October through January). Samples were collected at the station discharges with a 1.0 × 3.6 meter (m) (3.3 × 11.8 feet [ft]) conical plankton net with 335-micrometer (μm) (0.013-inch [in.]) mesh